



Main Investigation Report

at

Rivermead Leisure Centre, Richfield Avenue, Reading, Berkshire RG1 8EQ

for

Reading Borough Council

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This is not a valid document for use in the design of the project unless it is titled Final in the document status box.

Current regulations and good practice were used in the preparation of this report. The recommendations given in this report must be reviewed by an appropriately qualified person at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

Commission

Reading Borough Council commissioned Soils Limited to undertake an intrusive ground investigation and produce a Main Investigation Report on land at Rivermead Leisure Centre, Richfield Avenue, Reading, Berkshire RG1 8EQ. The scope of the investigation was outlined in the Soils Limited quotation reference Q21577/rev102, dated 9th July 2019.

This document comprises the Main Investigation Report and incorporates the results, discussion and conclusions to this intrusive works.

This Main Investigation Report must be read in conjunction with the Preliminary Investigation Report undertaken on the above site by Soils Limited, Report ref: 17755/PIR, dated August 2019.

This report has been updated following a period of post-works soil gas and groundwater monitoring and supersedes all previous revisions.

Standards

The site works, soil descriptions and geotechnical testing was undertaken in accordance with the following standards:

- BS 5930:2015 and BS EN ISO 22476-2 2005+A1:2011
- BS 5930:2015 and BS EN ISO 22476-2&3:2005+A1:2011
- BS EN ISO 14688-1:2002+A1:2013
- BS EN ISO 14688-2:2004+A1:2013
- BS 10175:2011+A1:2013

The geotechnical laboratory testing was performed by GEO Site & Testing Services Ltd (GSTL) in accordance with the methods given in BS 1377:1990 Parts 1 to 8 and their UKAS accredited test methods.

For the preparation of this report, the relevant BS code of practice was adopted for the geotechnical laboratory testing technical specifications, in the absence of the relevant Eurocode specifications (ref: ISO TS 17892).

The chemical analyses were undertaken by DETS Environmental Limited in accordance with their UKAS and MCERTS accredited test methods or their documented in-house testing procedures. This investigation did not comprise an environmental audit of the site or its environs.

Trial hole is a generic term used to describe a method of direct investigation. The term trial pit, borehole or window sample borehole implies the specific technique used to produce a trial hole.

Revisions

This report has been revised to version V1.01 following the completion of twelve monitoring visits undertaken over the period of 25/07/2019 and 03/01/2019. The results of the monitoring have been presented in Section 6 and the Risk Assessment in Section 7.4 of this report.

Contents

Section 1	Introduction.....	1
1.1	Objective of Investigation.....	1
1.2	Location	1
1.3	Site Description.....	1
1.4	Proposed Development	1
1.5	Anticipated Geology.....	2
1.5.1	Made Ground.....	2
1.5.2	Alluvium	2
1.5.3	Langley Silt Member	2
1.5.4	Kempton Park Gravel Member.....	2
1.5.5	Seaford and Newhaven Chalk Formation	3
1.6	Limitations and Disclaimers	3
Section 2	Site Works.....	6
2.1	Proposed Project Works	6
2.1.1	Actual Project Works.....	6
2.2	Ground Conditions	7
2.3	Ground Conditions Encountered in Trial Holes	9
2.3.1	Made Ground and Topsoil	9
2.3.2	Kempton Park Gravel Member.....	9
2.3.3	Seaford and Newhaven Chalk Formation	10
2.4	Roots	11
2.5	Groundwater	12
Section 3	Discussion of Geotechnical In-Situ and Laboratory Testing	13
3.1	Standard Penetration Tests	13
3.2	Dynamic Probe Tests.....	13
3.3	Dynamic Cone Penetrometer Tests	14
3.4	Quick Unconsolidated Undrained Triaxial Compression Tests.....	14
3.5	Atterberg Limit Tests.....	14
3.6	Particle Size Distribution Tests	14
3.7	Saturation Moisture Content Tests.....	15
3.8	Sulphate and pH Tests	15
Section 4	Foundation Design	16

4.1	General	16
4.1.1	Made Ground and Topsoil	16
4.1.2	Kempton Park Gravel Member.....	16
4.1.3	Seaford and Newhaven Chalk Formation	17
4.1.4	Roots	18
4.1.5	Groundwater	18
4.2	Foundation Scheme General	18
4.2.1	Guidance on Shrinkable Soils	18
4.3	Foundation Scheme	19
4.3.1	Piled Foundations	19
4.3.2	Floor Slabs.....	20
4.4	Subsurface Concrete	20
4.5	Excavations	21
4.6	Pavements.....	21
Section 5 Determination of Chemical Analysis		23
5.1	Site Characterisation and Revised Conceptual Site Model	23
5.2	Soil Sampling.....	23
5.3	Determination of Chemical Analysis	24
Section 6 Soil Gas Monitoring.....		26
6.1	General	26
Section 7 Qualitative Risk Assessment.....		29
7.1	Assessment Criteria.....	29
7.2	Representative Contamination Criteria - Soil	29
7.2.1	Asbestos	30
7.3	Risk to Groundwater	30
7.4	Soil Gas Risk Assessment.....	31
7.5	Tier 1 Quantitative Risk Assessment	34
7.5.1	Soils.....	34
7.5.2	Groundwater	34
7.5.3	Soil Gas	35
7.6	Duty of Care.....	35
7.7	Excavated Material	35
7.8	Re-use of Excavated Material On-site	36

7.9	Imported Material	37
7.10	Discovery Strategy	37

List of Figures

Figure 1 – Site Location Map	40
Figure 2 – Aerial Photograph	41
Figure 3 – Trial Hole Plan	42

List of Tables

Table 2.1 Final Depth of Trial Holes	7
Table 2.2 Ground Conditions	8
Table 2.3 Final Depth of Made Ground	9
Table 2.4 Final Depth of Kempton Park Gravel Member	10
Table 2.5 Final Depth of Seaford and Newhaven Chalk Formation	11
Table 2.6 Depth of Root Penetration	11
Table 2.7 Groundwater Monitoring	12
Table 3.1 Sulphate Content	15
Table 4.1 Aggressive Chemical Environment Concrete Classification	21
Table 5.1 Sampling Strategy	23
Table 5.2 Chemical Analysis Specification	24
Table 6.4 Soil Gas Monitoring Results	26
Table 7.1 Summary of Chemical Analysis of Soils Sample Exceedance for Commercial Land-use Scenario	29
Table 7.2 Summary of Chemical Analysis of Soils Sample Exceedance for POS Park Land-use scenario	30
Table 7.3 Summary of Chemical Analysis for Groundwater and Leachate Samples Exceedances	30
Table 7.4 Hazardous Flow Rates	32
Table 7.5 Worst Case Hazardous Flow Rates	33
Table B.1.1 SPT "N" Blow Count Cohesive Classification	
Table B.1.2 SPT "N" Blow Count Granular Classification	
Table B.1.3 Interpretation of SPT "N" Blow Counts in Chalk	

Table B.2.1 Interpretation of SPT Tests

Table B.2.2 Interpretation of DPSH Blow Counts

Table B.2.3 Interpretation of QUU Tests

Table B.2.4 Interpretation of Atterberg Limit Tests

Table B.2.5 Interpretation of PSD Tests

Table B.2.6 Interpretation of SMC Tests

Table D.1.1 CSM Revised Post Testing

List of Appendices

Appendix A Field Work

Appendix A.1 Engineers Logs

Appendix B Geotechnical In-Situ and Laboratory Testing

Appendix B.1 Classification

Appendix B.2 Interpretation

Appendix B.3 Geotechnical In-Situ and Laboratory Results

Appendix C Foundation Design

Appendix C.1 Preliminary Pile Design

Appendix D Chemical Laboratory Testing

Appendix D.1 Conceptual Site Model

Appendix D.2 Chemical Laboratory Results

Appendix D.3 General Assessment Criteria

Appendix E Information Provided by the Client

Section I Introduction

I.1 Objective of Investigation

Soils Limited was commissioned by Reading Borough Council to undertake an intrusive ground investigation and to prepare a Main Investigation Report to supply the client and their designers with information regarding ground conditions, to assist in preparing a foundation scheme for development that was appropriate to the settings present on the site.

The investigation was to be undertaken to provide comment on appropriate foundation options for the proposed development. The investigation was to be made by means of in-situ testing and geotechnical laboratory testing undertaken on soil samples taken from the trial holes.

Soil samples were taken for chemical laboratory testing to enable recommendations for the safe redevelopment of the site and the protection of site workers, end-users and the public from any contamination identified as dictated by the Conceptual Site Model (CSM) in the Preliminary Investigation Report undertaken for the site by Soils Limited (Report ref: 17755/PIR, dated August 2019).

I.2 Location

The site was located at Rivermead Leisure Centre, Richfield Avenue, Reading, Berkshire RG1 8EQ and had an approximate O.S Land Ranger Grid Reference of SU 707 745.

The site location plan is given in Figure 1.

I.3 Site Description

The site comprised a one to two storey leisure centre complex with associated parking and public recreational play area. The site was relatively flat with a gentle slope down to the west and the northern part gently sloping down to the north towards the river. The surfacing was predominantly tarmac, areas of grass associated with the public play area. Occasional young to mature trees were noted onsite and along site boundaries. The site was bound by open land with the River Thames beyond to the north, commercial land to the east, industrial land to the south and open land to the west. The site was recorded to be situated on a historic landfill.

An aerial photograph has been included in Figure 2.

I.4 Proposed Development

The proposed development was to comprise construction of a new two storey leisure centre, constructed in the area of the existing carpark, and subsequent demolition of the existing complex once the new facility is operational. The proposed development was to

include areas of hard landscaping including access road, pavements and parking, and areas of soft landscaping to include planters and recreation grounds.

At the time of reporting, no proposed development plans were available. Site plans provided by the client are presented in Appendix E.

1.5 Anticipated Geology

The 1:50,000 BGS map showed the site to be located upon the bedrock Seaford and Newhaven Chalk Formation with overlying superficial deposits of the Langley Silt Member. Superficial deposits of Kempton Park Gravel Member, likely to underlie the Langley Silt Member, and Alluvium were recorded in proximity to the site. A historic landfill was recorded underlying the site, therefore significant depth of Made Ground is anticipated.

1.5.1 Made Ground

Made Ground comprises material that has been placed by man, or spread by man. It can comprise demolition material from former structures on the site or imported material placed to raise levels. Its composition can be very variable both laterally and with depth and may contain putrescible matter and voids.

1.5.2 Alluvium

Alluvium is the most recent river or estuarine deposit and generally comprises silty clays usually with an appreciable organic content. Lenses of sand and gravel are also commonly found, as are pockets of peat.

1.5.3 Langley Silt Member

The Langley Silt Member, which was formerly known as Brickearth, comprises a geologically recent deposit of brown structureless sandy clay of limited thickness that is usually associated with the underlying River Terrace Gravels. Its name is derived from its former use in the manufacture of bricks.

The name Brickearth has been applied to sandy superficially deposited soils of differing origins covering soliflucted deposits, stratified estuarine deposits and colluvial sediments.

The name Langley Silt Member has been applied to the deposits that are thought to be in their original position.

1.5.4 Kempton Park Gravel Member

The rivers of the south-east of England, including the River Thames and its tributaries, have been subject to at least three changes of level since Pleistocene times. One result has been the formation of a complex series of River Terrace Gravels. These terraces represent ancient floodplain deposits that became isolated as the river cut downwards to lower levels. The Kempton Park Gravel is found at an elevation below the current river level.

The composition of the Kempton Park Gravel varies greatly, depending on the source material available in the river's catchment. Deposits generally consist of sands and gravels of roughly bedded flint or chert gravels commonly in a matrix of silts and clays.

1.5.5 Seaford and Newhaven Chalk Formation

Seaford Chalk Formation can be described as firm white chalk with conspicuous semi-continuous nodular and tabular flint seams. Hardgrounds and thin marls are known from the lowest beds. Some flint nodules are large to very large.

The Newhaven Chalk Formation is a soft white friable microporous limestone composed of coccolith biomicrites with a varying proportion of larger shell fragments.

At various levels clay sized material occurs as marl seams and partings. Close to the surface the upper few metres are invariably discoloured brown, due to leaching from the overlying strata. The interface with any overlying stratum is invariably extremely irregular as a result of localised weathering and general solution. Weathering by frost action may extend to a depth of several metres.

Occasional erosional features, such as pipes, swallow holes and solution cavities, usually in-filled with drift deposits, are found in the chalk. The features sometimes manifest themselves at the surface as shallow circular depressions. Solution features may be reactivated by the concentrated ingress of water from leaking drains or soakaways. Reactivation may lead to surface collapse.

1.6 Limitations and Disclaimers

This Main Investigation Report relates to the site located at Rivermead Leisure Centre, Richfield Avenue, Reading, Berkshire RG1 8EQ and was prepared for the sole benefit of Reading Borough Council (The "Client"). The report was prepared solely for the brief described in Section 1.1 of this report.

Soils Limited disclaims any responsibility to the Client and others in respect of any matters outside the scope of the above.

This report has been prepared by Soils Limited, with all reasonable skill, care and diligence within the terms of the Contract with the Client, incorporation of our General Conditions of Contract of Business and taking into account the resources devoted to us by agreement with the Client.

The report is personal and confidential to the Client and Soils Limited accept no responsibility of whatever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report wholly at its own risk.

The Client may not assign the benefit of the report or any part to any third party without the written consent of Soils Limited.

The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the client in accordance with their brief. As such these do not necessarily address all aspects of ground behaviour at the site.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot by plot basis prior to the construction of foundations. Supplied site surveys may not include substantial shrubs or bushes and is also unlikely to have data or any trees, bushes or shrubs removed prior to or following the site survey.

Where trees are mentioned in the text this means existing trees, substantial bushes or shrubs, recently removed trees (approximately 20 years to full recovery on cohesive soils) and those planned as part of the site landscaping).

Ownership of land brings with it onerous legal liabilities in respect of harm to the environment. "Contaminated Land" is defined in Section 57 of the Environment Act 1995 as:

"Land which is in such a condition by reason of substances in, on or under the land that significant harm is being caused or that there is a significant possibility of such harm being caused or that pollution of controlled waters is being, or is likely to be caused".

The investigation, analysis or recommendations in respect of contamination are made solely in respect of the prevention of harm to vulnerable receptors, using where possible best practice at the date of preparation of the report. The investigation and report do not address, define or make recommendations in respect of environmental liabilities. A separate environmental audit and liaison with statutory authorities is required to address these issues.

Ownership of copyright of all printed material including reports, laboratory test results, trial pit and borehole log sheets, including drillers log sheets remains with Soils Limited.

License is for the sole use of the client and may not be assigned, transferred or given to a third party.

Section 2 Site Works

2.1 Proposed Project Works

The proposed intrusive investigation was designed to provide information on the ground conditions and to aid the design of foundations for the proposed residential development. The intended investigation, as outlined within the Soils Limited quotation (Q21577/rev102, dated 9th July 2019), was therefore to comprise the following items:

- 4No. dynamic boreholes
- 4No. dynamic probes
- 10No. DCP-TRL probes
- 4No. 12m, 2No. 15m & 2No. 20m deep cable percussive boreholes with alternate SPT/U100 testing at 1m centres for the top 5m below ground level and at 1.5m centres thereafter
- Installation and monitoring of soil gas and groundwater monitoring wells
- Contamination laboratory testing
- Geotechnical laboratory testing.

2.1.1 Actual Project Works

The actual project works were undertaken between 15th and 23rd July 2019 and comprised:

- 4No. dynamic boreholes (WS1 – WS4)
- 4No. super heavy dynamic probes (DP1 – DP4)
- 4No. 12m (BH4 – BH8), 2No. 15m (BH3 & BH4) and 2No. 20m (BH1 & BH2) deep cable percussive boreholes
- 10No. DCP-TRL probes
- Installation of soil gas and groundwater monitoring wells
- Contamination laboratory testing
- Geotechnical laboratory testing.

Soil gas and groundwater monitoring wells were installed within trial holes BH1 to BH3 comprising 50mm pipework with a response zone comprising slotted pipe with non-calcareous gravel surround with bentonite seal above. The headworks comprised a single gas tap within metal stopcock cover set in concrete.

The remaining trial holes were backfilled with gravel and arisings upon completion.

All trial hole locations have been presented in Figure 3.

Following completion of site works, soil cores were logged and sub sampled so that samples could be sent to the laboratory for both contamination and geotechnical testing.

2.2 Ground Conditions

Eight cable percussive boreholes (BH1 – BH8) were drilled between the 12th and 23rd July 2019 to depths ranging between 12.00m and 20.00m below ground level (bgl) at locations selected by the client. Alternate SPT/U100 testing were undertaken at 1m intervals for the first 5m bgl and at 1.5m intervals thereafter, where applicable.

Three standpipes were installed within trial holes BH1 to BH3 each to a depth of 15.00m below ground level to allow for continued monitoring of both groundwater and soil gas, where present. A total of twelve post-works monitoring rounds were commissioned by the client.

On 15th July 2019, four windowless sampler boreholes (WS1 – WS4) were drilled to depths ranging between 1.50m and 4.00m bgl at locations selected by Soils Limited and confirmed by the client.

Four super heavy dynamic probes (DP1 – DP4) were driven prior and adjacent to their corresponding windowless sampler borehole each to a depth of 6.00m bgl.

On 19th July 2019, ten TRL-DCP probes (DCP01 – DCP10) were undertaken at locations selected by Soils Limited and confirmed by the client.

The maximum depths of trial holes have been included in Table 2.1.

All trial holes were scanned with a Cable Avoidance Tool (C.A.T.) and signal generator (Genny) prior to excavation to ensure the health and safety of the operatives.

Table 2.1 Final Depth of Trial Holes

Trial Hole	Depth (m bgl)	Trial Probe	Depth (m bgl)
BH1 ^w	20.00	DP1	6.00
BH2 ^w	20.00	DP2	6.00
BH3 ^w	15.00	DP3	6.00
BH4	15.00	DP4	6.00
BH5	12.00	DCP01	0.91
BH6	12.00	DCP02	0.64
BH7	12.00	DCP03	0.92
BH8	12.00	DCP04	0.89
WS1	3.00	DCP05	0.42
WS2	1.50	DCP06	0.79
WS3	4.00	DCP07	0.44
WS4	3.00	DCP08	0.75
		DCP09	0.91
		DCP10	0.90

Trial Hole	Depth (m bgl)	Trial Probe	Depth (m bgl)
Note: w - well installation			

The approximate trial hole locations are shown on Figure 3.

The soil conditions encountered were recorded and soil sampling commensurate with the purposes of the investigation was carried out. The depths given on the trial hole logs and quoted in this report were measured from ground level.

The soils encountered from immediately below ground surface have been described in the following manner. Where the soil incorporated an organic content such as either decomposing leaf litter or roots, or has been identified as part of the in-situ weathering profile, it has been described as Topsoil both on the logs and within this report. Where man has clearly either placed the soil, or the composition altered, with say greater than an estimated 5% of a non-natural constituent, it has been referred to as Made Ground both on the log and within this report.

For more complete information about the soils encountered within the general area of the site reference should be made to the detailed records given within Appendix A, but for the purposes of discussion, the succession of conditions encountered in the trial holes in descending order can be summarised as:

Made Ground (MG)
Kempton Park Gravel Member (KPGR)
Seaford and Newhaven Chalk Formation (SNCK)

The ground conditions encountered in the trial holes are summarised in Table 2.2.

Table 2.2 Ground Conditions

Strata	Epoch	Depth Encountered (m bgl)		Typical Thickness (m)	Typical Description
		Top	Bottom		
MG	Anthropocene	0.00	2.20–4.30	3.30	Greyish brown and dark brown slightly sandy gravelly CLAY and sandy silty GRAVEL. Gravel comprises fragments of brick, glass, tiles, slate, plastics metals and misc. unidentifiable anthropogenic materials. Hydrocarbon type odours noted in majority of trial holes.
KPGR	Quaternary	2.20–4.30	8.50–10.50	6.90	Medium dense to dense multicoloured slightly silty sandy GRAVEL. Gravel was subangular to subrounded clasts of flint. Sand was medium to coarse.
SNCK	L. Cretaceous	8.50–10.50	>20.00 ¹	Not proven ²	Structureless to structured CHALK recovered as off-white becoming bright white silty sandy GRAVEL.

Strata	Epoch	Depth Encountered (m bgl)		Typical Thickness (m)	Typical Description
		Top	Bottom		

Note: ¹ Final depth of trial hole. ² Base of strata not encountered. 0.00 denotes ground level.

2.3 Ground Conditions Encountered in Trial Holes

The ground conditions encountered in trial holes have been described below in descending order. The engineering logs are presented in Appendix A.1.

2.3.1 Made Ground and Topsoil

Soils described as Made Ground were encountered in all twelve trial holes from ground level and persisted to depths ranging between 2.20m and 4.30m bgl.

The Made Ground typically comprised greyish brown and dark brown slightly sandy gravelly CLAY and sandy silty GRAVEL. Gravel was fragments of brick, glass, tiles, slate, plastics, metals and miscellaneous unidentifiable anthropogenic materials forming part of the underlying historic landfill, including wood, paper, plastic, glass and fabric.

Hydrocarbon type odours were noted in trial holes BH2, BH4, BH5, BH6, BH7, WS3 and WS4.

The final depths of Made Ground have been included in Table 2.3.

Table 2.3 Final Depth of Made Ground

Trial Hole	Depth (m bgl)
BH1	2.20
BH2	3.50
BH3	4.30
BH4	2.50
BH5	3.40
BH6	3.50
BH7	3.50
BH8	3.50
WS1/DP1	3.00 ¹ /3.80
WS2/DP2	1.50 ¹ /3.50
WS3	2.80
WS4	2.70

Note: ¹ Final depth of trial hole.

2.3.2 Kempton Park Gravel Member

Soils described as Kempton Park Gravel Member were encountered in all twelve trial holes underlying the Made Ground and was proven to depths ranging between 8.50m and 10.50m bgl within cable percussive boreholes.

The Kempton Park Gravel Member typically comprised medium dense to dense multicoloured slightly silty sandy GRAVEL. Gravel was subangular to subrounded clasts of flint. Sand was medium to coarse.

A predominantly cohesive horizon described as dark green slightly gravelly sandy CLAY was encountered overlying the granular soils in BH1 and BH3. This horizon is likely to form part of the Langley Silt Member, anticipated to overlie the Kempton Park Gravel Member, and was encountered discontinuously across the site. For simplicity, the unit is referred to as cohesive Kempton Park Gravel Member.

The depth of Kempton Park Gravel Member has been included in Table 2.4.

Table 2.4 Final Depth of Kempton Park Gravel Member

Trial Hole	Depth (m bgl)
BH1	10.50
BH2	9.50
BH3	9.00
BH4	8.50
BH5	8.50
BH6	9.20
BH7	8.80
BH8	8.90
DPI	6.00 ¹
DP2	6.00 ¹
WS3/DP3	4.00 ¹ /6.00 ¹
WS4/DP4	3.00 ¹ /6.00 ¹

Note: ¹ Final depth of trial hole.

2.3.3 Seaford and Newhaven Chalk Formation

Soils described as Seaford and Newhaven Chalk Formation were encountered in all eight deep cable percussive boreholes underlying the Kempton Park Gravel Member and persisted to the full investigatory depth of 20.00m bgl.

The Seaford and Newhaven Chalk Formation comprised structureless to structured CHALK recovered as off white becoming bright white silty sandy GRAVEL. Gravel was subangular to surrounded clasts of intact chalk. Frequent subrounded coarse gravel and cobble sized clasts of flint.

Chalk is a weak rock and as such the drilling process significantly modifies the in-situ fabric and structure of the soil.

The depth of Seaford and Newhaven Chalk Formation has been included in Table 2.5.

Table 2.5 Final Depth of Seaford and Newhaven Chalk Formation

Trial Hole	Depth (m bgl)
BH1	20.00 ¹
BH2	20.00 ¹
BH3	15.00 ¹
BH4	15.00 ¹
BH5	12.00 ¹
BH6	12.00 ¹
BH7	12.00 ¹
BH8	12.00 ¹
WS1/DPI	Not encountered
WS2/DP2	Not encountered
WS3/DP3	Not encountered
WS4/DP4	Not encountered

Note: ¹ Final depth of trial hole.

2.4 Roots

Roots/rootlets were encountered in five out of the twelve trial holes persisting to depths ranging between 1.30m and 4.50m bgl.

The depths of root penetration have been included in Table 2.6.

Table 2.6 Depth of Root Penetration

Trial Hole	Depth (m bgl)
BH1	4.50
BH2	None observed
BH3	None observed
BH4	None observed
BH5	None observed
BH6	None observed
BH7	None observed
BH8	None observed
WS1	3.00 ¹
WS2	1.30
WS3	1.50
WS4	None observed

Note: ¹ Final depth of trial hole.

Roots may be found to greater depth at other locations on the site particularly close to trees and/or trees that have been removed both within the site and its close environs.

It must be emphasised that the probability of determining the maximum depth of roots from a narrow diameter borehole is low. A direct observation such as from within a trial pit is necessary to gain a better indication of the maximum root depth.

2.5 Groundwater

Groundwater “strikes” were recorded in ten of the twelve trial holes at depths ranging between 0.70m and 4.50m bgl.

Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was conducted in July (2019), when groundwater levels should be reducing from their annual maximum (highest) elevation, which typically occurs around March.

Twelve post-works groundwater monitoring visits were requested, undertaken at approximate fortnightly intervals between 25th July 2019 and 3rd January 2020. The results have been presented in Table 2.7.

Table 2.7 Groundwater Monitoring

Trial Hole	Depth to Water (m bgl)												Base of Hole (m bgl)
	25/07/2019	05/08/2019	15/08/2019	10/09/2019	17/09/2019	08/10/2019	23/10/2019	31/10/2019	11/11/2019	28/11/2019	09/12/2019	03/01/2020	
BH1	2.75	2.75	2.72	2.75	2.77	2.62	2.62	2.60	2.48	2.52	2.50	2.56	15.00
BH2	2.65	2.68	2.62	-	-	2.52	2.52	2.52	2.39	2.41	2.56	2.44	15.00
BH3	2.99	3.04	3.04	3.05	3.05	2.90	2.92	2.88	2.76	2.78	3.00	2.82	15.00
Notes: Absent values indicate well was not serviceable.													

The post-works groundwater monitoring indicated a reasonably consistent groundwater level measured at depths of between 2.39m bgl and 3.05m bgl during the monitoring period.

Section 3 Discussion of Geotechnical In-Situ and Laboratory Testing

3.1 Standard Penetration Tests

Standard Penetration Tests (SPTs) were undertaken in cable percussive boreholes BH1 to BH8. The results were interpreted based on the classifications outlined in Appendix B.1.

The SPT “N60” values presented have been corrected in accordance with BS EN 22476 Part 3, to account for the rig efficiency, borehole depth, overburden factors etc. Further correction of the ‘N’ values should therefore not be necessary. Raw field data are included within engineer logs in Appendix A.1. The energy ratio of the rig used was 60% (72% for BH4 & BH7).

The Kempton Park Gravel Member recorded SPT “N60” values between 2 and 8 in cohesive beds and between 7 and 50+ in granular beds. The cohesive beds were classified as very low to medium strength with inferred undrained cohesive strength of 10kPa to 40kPa. The granular beds were classified as loose to very dense relative density, however, were typically recorded as medium dense to dense relative density.

The Seaford and Newhaven Chalk Formation recorded SPT “N60” values between 7 and 50+ inferring the chalk as CIRIA grade structureless Dm to structured (C5 – A1) chalk. The structureless chalk was typically recorded within the upper 2.00m of the chalk unit.

A full interpretation of the SPT results are outlined in Appendix B.2, Table B.2.1.

3.2 Dynamic Probe Tests

Dynamic probing (DPSH) was undertaken at four locations (DP1 – DP4) adjacent and prior to the drilling of their corresponding windowless sampler borehole (WS1 – WS4) each to a depth of 6.00m bgl. The results were converted to equivalent SPT “N60” values based on dynamic energy using commercial computer software (Geostru). The results were then interpreted based on the classifications outlined in Appendix B.1.

The SPT “N60” values presented have been corrected in accordance with BS EN 22476 Part 3, to account for the rig efficiency, borehole depth, overburden factors etc. Further correction of the ‘N’ values should therefore not be necessary. The energy ratio of the rig used was 79.93%. Raw field data are presented in the probe logs in Appendix B.3.

The Kempton Park Gravel Member recorded equivalent SPT “N60” values between 15 and 46, classifying the granular soils as medium dense to dense relative density.

A full interpretation of the DPSH tests are outlined in Appendix B.2, Table B.2.2.

3.3 Dynamic Cone Penetrometer Tests

The Transport Research Laboratory (TRL), Dynamic Cone Penetrometer (DCP) was undertaken at ten locations (DCP01 – DCP10) selected to achieve sufficient coverage of the site given no development plans were available. The results were interpreted based on the classification outlined in Appendix B.1.

The results from DCP testing indicated CBR values of between 8% and 208% for the soils encountered in the top 1.00m bgl. The high CBR values encountered were anticipated to be large gravel clasts struck during the test.

The DCP results are presented in Appendix B.3.

3.4 Quick Unconsolidated Undrained Triaxial Compression Tests

Quick Unconsolidated Undrained Triaxial Compression testing (QUU) was performed on one sample obtained from the cohesive horizon of the Kempton Park Gravel Member. The strength interpretation was based on the classification outlined in Table B.1.1.

The QUU test indicated the cohesive soils of the Kempton Park Gravel Member were of a low strength with an undrained cohesion of 32kPa.

A full interpretation of the QUU tests are outlined in Table B.2.3, Appendix B.2 and the laboratory report in Appendix B.3.

3.5 Atterberg Limit Tests

Atterberg Limit testing was performed on one sample obtained from the cohesive horizon of the Kempton Park Gravel Member. The results were classified in accordance with BRE Digest 240 and NHBC Standards Chapter 4.2.

The cohesive horizon of the Kempton Park Gravel Member was classified as medium volume change potential in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

A full interpretation of the Atterberg Limit tests are outlined in Table B.2.4, Appendix B.2 and the laboratory report in Appendix B.3.

3.6 Particle Size Distribution Tests

Particle Size Distribution (PSD) tests were performed on ten samples obtained from the granular soils of the Kempton Park Gravel Member.

The PSD tests showed the granular soils of the Kempton Park Gravel Member did not have a volume change potential in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2. Note that a cohesive soil is only classified as having a volume

change potential if it is also plastic and an Atterberg Limit test can be conducted on the strata.

A full interpretation of the PSD tests are outlined in Table B.2.5, Appendix B.2 and the laboratory report in Appendix B.3.

3.7 Saturation Moisture Content Tests

Saturated Moisture Content (SMC) tests were performed on ten samples recovered from the Seaford and Newhaven Chalk Formation. One sample had intact clasts of chalk of sufficient size to undertake tests in accordance with BS 1377: Part 2: 1990 Clause 3.3. Non-standard tests were performed on the remaining samples. The results were classified based on Table 3.2, CIRIA Publication, Engineering in Chalk, C574, 2002.

The SMC tests classified the Seaford and Newhaven Chalk Formation as medium to very high density, with dry density values ranging between 1.59Mg/m³ and 1.99Mg/m³. The standardised test yielded a dry density of 1.66Mg/m³, classified as medium density.

A full interpretation of the SMC tests are outlined in Table B.2.6, Appendix B.2 and the laboratory report in Appendix B.3.

3.8 Sulphate and pH Tests

Four samples were taken from soils of Made Ground and seven samples from the Kempton Park Gravel Member for water soluble sulphate (2:1) and pH testing in accordance with Building Research Establishment Special Digest 1, 2005, 'Concrete in Aggressive Ground'. A further twenty water soluble sulphate (2:1) and pH tests were undertaken on samples of Made Ground as part of the contamination soil chemical analysis.

The results have been summarised in Table 3.1.

Table 3.1 Sulphate Content

Stratum	No. of Tests	W/S Sulphate (mg/l)	pH
MG	24	10 – 1810	6.9 – 8.2
KPGR	7	10 – 196	7.1 – 8.4

The significance of the sulphate and pH Test results are discussed in Section 4.4 and the laboratory report in Appendix B.3.

Section 4 Foundation Design

4.1 General

An engineering appraisal of the soil types encountered during the site investigation and likely to be encountered during the redevelopment of this site is presented. Soil descriptions are based on analysis of disturbed samples taken from the trial holes.

4.1.1 Made Ground and Topsoil

The terms *Fill* and *Made Ground (non-engineered fill)* are used to describe material, which has been placed by man either for a particular purpose e.g. to form an embankment, or to dispose of unwanted material. For the former use, the Fill and/or Made Ground may well have been selected for the purpose and placed and compacted in a controlled manner. With the latter, great variations in material type, thickness and degree of compaction invariably occur and there can be deleterious or harmful matter, as well as potentially methanogenic organic material.

The BSI Code of Practice for Foundations, BS 8004:2015, Clause 4.1.2.2 states, *'Spread foundations should not be placed on non-engineered fill unless such use can be justified on the basis of a thorough ground investigation and detailed design.'*

Soils described as Made Ground were encountered in all twelve trial holes from ground level and persisted to depths ranging between 2.20m and 4.30m bgl. The Made Ground greyish brown and dark brown slightly sandy gravelly CLAY and sandy silty GRAVEL. Gravel was fragments of brick, glass, tiles, slate, plastics, metals and miscellaneous unidentifiable anthropogenic materials forming part of the underlying historical landfill. The depths of Made Ground have been included in Table 2.3.

A result of the inherent variability, particularly of uncontrolled Topsoil, Fill and/or Made Ground is that it is usually unpredictable in terms of bearing capacity and settlement characteristics. Foundations should, therefore, be taken through any Topsoil and/or Made Ground and either into, or onto a suitable underlying natural stratum of adequate bearing characteristics.

4.1.2 Kempton Park Gravel Member

Soils described as Kempton Park Gravel Member were encountered in all twelve trial holes underlying the Made Ground and was proven to depths ranging between 8.50m and 10.50m bgl within cable percussive boreholes.

The Kempton Park Gravel Member typically comprised medium dense to dense multicoloured slightly silty sandy GRAVEL. Gravel was subangular to subrounded clasts of flint. Sand was medium to coarse.

A predominantly cohesive horizon described as dark green slightly gravelly sandy CLAY was encountered overlying the granular soils in BH1 and BH3, likely to form part of the Langley Silt Member anticipated to overlie the Kempton Park Gravel Member.

The results from SPT testing inferred that the granular soils of the Kempton Park Gravel Member were typically medium dense to dense relative density. The cohesive soils where encountered were of low to medium strength with undrained cohesions of between 10kPa and 40kPa.

The results from DPSH testing inferred that the granular soils of the Kempton Park Gravel Member were of medium dense to dense relative density.

The QUU test indicated the cohesive soils of the Kempton Park Gravel Member were of low strength with an undrained cohesion of 32kPa.

The results from Atterberg Limit testing showed that the cohesive horizon had medium volume change potential in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

The results from PSD testing showed the granular soils of the Kempton Park Gravel Member had no volume change potential in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

Soils of the Kempton Park Gravel Member are normally consolidated predominantly granular soils and are expected to display moderate to high bearing capacities with low to moderate settlement characteristics. The granular soils of the Kempton Park Gravel Member were considered a suitable bearing stratum for the proposed development adopting a deep foundation solution, given the depth to the upper horizon.

4.1.3 Seaford and Newhaven Chalk Formation

Soils described as Seaford and Newhaven Chalk Formation were encountered in all eight deep cable percussive boreholes underlying the Kempton Park Gravel Member and persisted to the full investigatory depth of 20.00m bgl.

The Seaford and Newhaven Chalk Formation comprised structureless to structured CHALK recovered as off white becoming bright white silty sandy GRAVEL. Gravel was subangular to surrounded clasts of intact chalk. Frequent subrounded coarse gravel and cobble sized clasts of flint.

The results from SPT testing inferred that the Seaford and Newhaven Chalk Formation comprised CIRIA grade structureless Dm to structured chalk (C5 – A1), becoming more structured with depth. Structureless chalk was typically only recorded within the upper 2.00m of the chalk unit.

The results from SMC tests indicated that the Seaford and Newhaven Chalk Formation comprised medium to very high-density chalk. Given the majority of chalk samples did not contain intact clasts of sufficient size to perform SMC testing in accordance with current standards, medium density chalk must be assumed for the chalk unit as a whole.

Generally, soils of the Seaford and Newhaven Chalk Formation are structureless to weak rock and would possess moderate bearing and settlement characteristics. The Seaford and Newhaven Chalk Formation would be suitable as a bearing stratum for a deep foundation solution, given the depth to the upper horizon.

4.1.4 Roots

Roots/rootlets were encountered in five out of the twelve trial holes persisting to depths ranging between 1.30m and 4.50m bgl. Roots may be found to greater depth at other locations on the site particularly close to trees and/or trees that have been removed both within the site and its close environs.

Given the proposed foundation scheme for the development and encountered ground conditions, root and tree influence will not be a factor on design.

4.1.5 Groundwater

Groundwater “strikes” were recorded in ten of the twelve trial holes at depths ranging between 0.70m and 4.50m bgl. Changes in groundwater level occur for reasons including seasonal effects and variations in drainage. The investigation was conducted in July (2019), when groundwater levels should be reducing from their annual maximum (highest) elevation, which typically occurs around March.

The results from twelve post-works groundwater monitoring visits, presented in Table 2.7, recorded a reasonable consistent groundwater level within the monitoring wells, measured at depths of between 2.39m bgl and 3.05m bgl between 25th July 2019 and 3rd January 2020.

4.2 Foundation Scheme General

The proposed development was to comprise construction of a new two storey leisure centre, constructed in the area of the existing carpark, and subsequent demolition of the existing complex once the new facility is operational. The proposed development was to include areas of hard landscaping including access road, pavements and parking, and areas of soft landscaping to include planters and recreation grounds.

At the time of reporting, no proposed development plans were available. Site plans provided by the client are presented in Appendix E.

4.2.1 Guidance on Shrinkable Soils

The Building Research Establishment (BRE) Digests 240, 241 and 242 provide

guidance on 'best practice' for the design and construction of foundations on shrinkable soils.

The results from Atterberg Limit testing showed that the cohesive horizon of the Kempton Park Gravel Member had medium volume change potential in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

Medium volume change potential must therefore be adopted where foundations pass through the cohesive Kempton Park Gravel Member (Langley Silt Member).

The BRE Digest 241 states: *"An increasingly common, potentially damaging situation is where trees or hedges have been cut down prior to building. The subsequent long-term swelling of the zone of clay desiccated by the roots, as moisture slowly returns to the ground, can be substantial. The rate at which the ground recovers is very difficult to predict and if there is any doubt that recovery is complete then bored pile foundations with suspended beams and floors should be used"*.

The BRE Digest 240 suggests: *"Two courses of action are open:*

Estimate the potential for swelling or shrinkage and try to avoid large changes in the water content, for example by not planting trees near the foundations.

Accept that swelling or shrinkage will occur and take account of it. The foundations can be designed to resist resulting ground movements or the superstructure can be designed to accommodate movement without damage."

The design of foundations suitable to withstand movements is presented in BRE Digest 241 "Low-rise buildings on shrinkable clay soils: Part 2"

4.3 Foundation Scheme

Foundations **must not** be constructed within any Made Ground due to the likely variability and potential for large load induced settlements both total and differential.

It was understood a piled foundation solution was to be adopted for the development.

4.3.1 Piled Foundations

The piled foundations must be taken through any Made Ground into suitable soils of the Kempton Park Gravel Member and Seaford and Newhaven Chalk Formation.

The construction of a piled foundation is a specialist job with the actual pile working load depending on the particular type pile and installation method. Prior to finalising the foundation design the advice from a reputable contractor who is familiar with the ground and groundwater conditions present at the site should be sought.

The vertical load capacities are provided for varying diameters and lengths of bored piles taken into the Kempton Park Gravel Member and Seaford and Newhaven Chalk Formation, based on SPT “N60” values and must only be used for preliminary design purposes. These values have been calculated modelling the Kempton Park Gravel Member as granular soils. A factor of safety of 3 was applied to both the shaft and base for the Kempton Park Gravel Member and a factor of safety of 1.5 and 10 was applied to the shaft and base respectively for the Seaford and Newhaven Chalk Formation.

The bearing values given in Appendix C.1., are applicable to single piles. Where piles are to be constructed in groups the bearing value of each individual pile should be reduced by a factor of about 0.8 and a calculation made to check the factor of safety against block failure.

From ground level the upper 4m of the pile shaft has been ignored in the preliminary pile design given.

To prevent necking of the green concrete, temporary casing may be required where the pile passes through the Made Ground and below the groundwater table (if encountered), recorded at a depth of between 2.00m and 3.00m bgl. To achieve the full bearing value a pile should penetrate the bearing stratum by at least five times the pile diameter.

No allowance has been made for negative skin friction that could be generated where piles pass through Made Ground and Kempton Park Gravel Member deposits underlying the site. The negative skin friction must be applied to the pile working load and must not be factored.

4.3.2 Floor Slabs

Given the presence of Made Ground in excess of 0.60m deep underlying the site, the floor slabs must be designed as suspended.

4.4 Subsurface Concrete

Sulphate concentration measured in 2:1 water/soil extracts from the Made Ground fell into Class **DS-3** of the BRE Special Digest 1 2005, ‘*Concrete in Aggressive Ground*’. Table C2 of the Digest indicated ACEC (Aggressive Chemical Environment for Concrete) site classifications of **AC-3**. The pH of the soils tested ranged between 6.9 and 8.2.

Sulphate concentration measured in 2:1 water/soil extracts from the Kempton Park Gravel Member fell into Class **DS-1** of the BRE Special Digest 1 2005, ‘*Concrete in Aggressive Ground*’. Table C2 of the Digest indicated ACEC (Aggressive Chemical Environment for Concrete) site classifications of **AC-1**. The pH of the soils tested ranged between 7.1 and 8.4

The DS and ACEC classifications are summarised in Table 4.1.

Table 4.1 Aggressive Chemical Environment Concrete Classification

Stratum	DS	ACEC
MG	DS-3	AC-3
KPGR	DS-I	AC-I

The classification given was determined using the mobile groundwater case given the groundwater encountered at the time of investigation and post-works groundwater level monitoring. The laboratory results are presented in Appendix B.3.

Concrete to be placed in contact with soil or groundwater must be designed in accordance with the recommendations of Building Research Establishment Special Digest 1 2005, '*Concrete in Aggressive Ground*' taking into account any possible exposure of potentially pyrite bearing natural ground and the pH of the soils.

4.5 Excavations

Shallow excavations in the Made Ground are likely to be marginally stable in the short term at best.

Deeper excavations taken into the deeper Made Ground, Kempton Park Gravel Member and Seaford and Newhaven Chalk Formation are likely to be unstable in both the short and long term, depending on the likely presence of groundwater. Unsupported earth faces formed during excavation may be liable to collapse without warning and suitable safety precautions should therefore be taken to ensure that such earth faces are adequately supported or battered back to a safe angle of repose before excavations are entered by personnel.

Excavations beneath the groundwater table are likely to be unstable and dewatering of foundation trenches may be necessary.

4.6 Pavements

The Transport Research Laboratory (TRL) Dynamic Cone Penetrometer (DCP) was undertaken at ten locations on site (DCP01 – DCP10). The results from dynamic cone penetrometer tests indicated CBR values of between 8% and 208% for the soils encountered in the top 1.00m bgl. The high CBR values encountered were anticipated to be coarse gravel clasts struck during the test.

Worst case CBR value of 8% was considered suitable for design purposes for the Made Ground underlying the site. The shallow soils of Made Ground should be assumed as frost susceptible.

As CBR values were highly variable due to changes in moisture content and inherent variability of Made Ground conditions, in-situ testing must be undertaken immediately

prior to the installation of pavements/roads.

The Made Ground encountered has only been subject to self-compaction. Loadings during construction and when in use as well as drainage may lead to settlements which, given the variable composition and thickness of the Made Ground, would be differential and could result in surface ponding, failure of drains and distortions at entrances to piled structures.

Additional tests are required to quantify this, and options included for consideration are the use of geo-grid reinforcement within the road system, excavation and re-compaction or ground improvement of suitable type of which dynamic compaction might be appropriate, subject to further investigation at design stage.

Section 5 Determination of Chemical Analysis

5.1 Site Characterisation and Revised Conceptual Site Model

The Preliminary Investigation Report undertaken by Soils Limited (report ref: 17755/PIR dated April 2016) identified a low to moderate risk of ground contamination from previous usage of the site and offsite sources.

The intrusive investigation identified Made Ground to depths ranging between 2.20m and 4.30m bgl. The Made Ground comprised greyish brown and dark brown slightly sandy gravelly CLAY and sandy silty GRAVEL. Gravels comprised fragments of brick, glass, tiles, slate, plastics, metals and miscellaneous unidentifiable anthropogenic materials forming part of the underlying historic landfill, including wood, paper, plastic, glass and fabric.

Hydrocarbon type odours were identified in BH2, BH4, BH5, BH6, BH7, WS3 and WS4, present at depths between 1.00m and 3.50m bgl.

Superficial Kempton Park Gravel Member was encountered underlying the Made Ground, proven to depths ranging between 8.50m and 10.50m bgl and comprised multicoloured slightly silty sandy GRAVEL. The Kempton Park Gravel Member was underlain by Seaford and Newhaven Chalk Formation, which persisted to the full investigatory depth of 20.00m bgl.

5.2 Soil Sampling

A non-targeted sampling strategy is appropriate when there is:

- No adequate information available regarding the likely locations of contamination;
- No sensitive areas where there is a need for a high degree of confidence.

A targeted sampling strategy is appropriate when there is:

- Adequate information available regarding the likely locations of contamination
- Sensitive areas where there is a need for a high degree of confidence.

A targeted and non-targeted sampling strategy was adopted, with sampling locations selected by the client. Sample depths were selected appropriate to visual and olfactory evidence of potential contamination.

Table 5.1 outlines the sampling undertaken.

Table 5.1 Sampling Strategy

Sample	Strategy	Proposed Use
BH1:0.50-1.00	Non-targeted: Made Ground. Bulk sample for WAC testing	Building footprint

Sample	Strategy	Proposed Use
BH1:2.00	Non-targeted: Made Ground	Building footprint
BH2:0.35	Non-targeted: Made Ground	Building footprint
BH2:1.20	Non-targeted: Made Ground – hydrocarbon odours	Building footprint
BH2:2.50	Non-targeted: Made Ground – hydrocarbon odours	Building footprint
BH4:0.50-1.00	Non-targeted: Made Ground	Building footprint
BH4:1.50-1.70	Non-targeted: Made Ground. Bulk sample for WAC testing. Hydrocarbon odours	Building footprint
BH5:0.45	Non-targeted: Made Ground – potential ACM.	Building footprint
BH5:0.80	Non-targeted: Made Ground	Building footprint
BH5:2.00	Non-targeted: Made Ground – hydrocarbon odours	Building footprint
BH6:0.50	Non-targeted: Made Ground	Building footprint
BH6:1.50	Non-targeted: Made Ground – hydrocarbon odours	Building footprint
BH7:0.30	Non-targeted: Made Ground – hydrocarbon odours	Building footprint
BH7:0.40	Non-targeted: Made Ground – hydrocarbon odours	Building footprint
BH7:2.50	Non-targeted: Made Ground – hydrocarbon staining and odours	Building footprint
BH3:0.50-1.00	Non-targeted: Made Ground. Bulk sample for WAC testing	Building footprint
BH3:2.00	Non-targeted: Made Ground	Building footprint
WS1:0.30	Non-targeted: Made Ground	Building footprint
WS2:0.40	Non-targeted: Made Ground	Building footprint
WS4:0.40	Non-targeted: Made Ground	Building footprint
BH1	Targeted: Groundwater	Building footprint
BH2	Targeted: Groundwater	Building footprint
BH3	Targeted: Groundwater	Building footprint

5.3 Determination of Chemical Analysis

The driver for determination of the analysis suite was the information obtained from the Preliminary Investigation Report and Main Investigation Report intrusive investigation. Table 5.2 outlines the specification for each sample tested.

Table 5.2 Chemical Analysis Specification

Substance	Locations:Depths (m bgl)														
	BH1:0.50-1.00 ^s	BH1:2.00 ^s	BH2:0.35 ^s	BH2:1.20 ^s	BH2:2.50 ^s	BH4:0.50-1.00 ^s	BH4:1.00 ^s	BH4:1.50-1.70 ^s	BH5:0.45 ^s	BH5:0.80 ^s	BH5:2.00 ^s	BH6:0.50 ^s	BH6:1.50 ^s	BH7:0.30 ^s	BH7:0.40 ^s
Asbestos Screen	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Total Phenols	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Total Cyanide	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Organic Matter	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
pH	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Metals	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Metalloids	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Organics	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Substance	Locations:Depths (m bgl)														
	BH1:0.50-1.00 ^s	BH1:2.00 ^s	BH2:0.35 ^s	BH2:1.20 ^s	BH2:2.50 ^s	BH4:0.50-1.00 ^s	BH4:1.00 ^s	BH4:1.50-1.70 ^s	BH5:0.45 ^s	BH5:0.80 ^s	BH5:2.00 ^s	BH6:0.50 ^s	BH6:1.50 ^s	BH7:0.30 ^s	BH7:0.40 ^s
PAHs	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EPH Texas	✓							✓							
TPH-CWG		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
BTEX		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
WAC	✓							✓							

Notes: **Metals:** Cd, Cr, Pb, Hg, Ni, Se, CN, S, Cu, Zn, Bo, V. **metalloids:** As. **organics:** USEPA 16 speciated PAH, TPH-CWG (speciated TPH), BTEX, VOC/SVOC. **WAC** Waste Acceptance Criteria certificate **Asbestos screening** was undertaken in accordance with HSG 248. ^s = Soil sample. ^w = Water sample.

Substance	Locations: Depths (m bgl)										
	BH7:2.50 ^s	BH3:0.50-1.00 ^s	BH3:1.30 ^s	BH3:2.00 ^s	WS1:0.30 ^s	WS2:0.40 ^s	WS3:0.40 ^s	WS4:0.40 ^s	BH1 ^w	BH2 ^w	BH3 ^w
Asbestos Screen	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Total Phenols	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Total Cyanide	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Organic Matter	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
pH	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Metals	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Metalloids	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Organics	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PAHs	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EPH Texas		✓									
TPH-CWG	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
BTEX	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
WAC		✓									

Notes: **Metals:** Cd, Cr, Pb, Hg, Ni, Se, CN, S, Cu, Zn, Bo, V. **metalloids:** As. **organics:** USEPA 16 speciated PAH, TPH-CWG (speciated TPH), BTEX, VOC/SVOC. **WAC** Waste Acceptance Criteria certificate **Asbestos screening** was undertaken in accordance with HSG 248. ^s = Soil sample. ^w = Water sample.

Section 6 Soil Gas Monitoring

6.1 General

The Preliminary Investigation Report identified a high risk of soil gas associated with a historical landfill underlying the site.

As part of the site investigation monitoring wells were installed within BH1, BH2 and BH3. The wells were monitored on twelve occasions between the 25th July 2019 and the 3rd January 2020.

It should be noted that during the monitoring period BH2 was damaged and the head works reinstated. This is reflected in the monitoring visits where no readings were taken in BH2 on two occasions.

During each visit the concentrations of methane (both total and LEL), hydrogen sulphide, carbon monoxide, carbon dioxide and oxygen were measured using a portable infrared monitor. Readings of flow-rate were taken with a differential manometer calibrated to give flow rate. A Photo Ionisation Detector (PID) was used to detect for Volatile Organic Compounds (VOCs).

The results from the soil gas monitoring undertaken to date is presented in Table 6.1.

Table 6.1 Soil Gas Monitoring Results

Date	Trial Hole	CH ₄ (v/v %)	CO ₂ (v/v %)	O ₂ (v/v %)	H ₂ S (ppm)	CO (ppm)	LEL (%)	aP (mb)	Flow (l/h)	H ₂ O (m bgl)	VOC (ppm)	Dp (Pa)
25/07/19	ATM	<0.1	<0.1	20.4	<0.1	<0.1	<0.1	1000	<0.1	-	<0.1	-
	BH1	40.5	19.0	0.1	<0.1	1.0	>>>>	1000	<0.1	2.75	<0.1	0
	BH2	82.0	11.0	<0.1	1.0	<0.1	>>>>	1000	1.8	2.65	<0.1	4
	BH3	29.5	13.0	0.1	<0.1	<0.1	>>>>	1000	0.2	2.99	1.0	0
05/08/19	ATM	<0.1	<0.1	20.0	<0.1	<0.1	<0.1	1004	<0.1	-	<0.1	-
	BH1	23.0	17.0	3.2	<0.1	<0.1	>>>>	1004	0.5	2.75	<0.1	0
	BH2	85.0	12.0	<0.1	<0.1	<0.1	>>>>	1004	4.9	2.68	<0.1	12
	BH3	30.0	15.0	<0.1	<0.1	<0.1	>>>>	1002	<0.1	3.04	1.0	0
15/08/19	ATM	<0.1	<0.1	21.0	<0.1	<0.1	<0.1	1007	<0.1 ¹	-	<0.1	2 ¹
	BH1	<0.1	0.9	20.3	<0.1	<0.1	<0.1	1007	1.0 ¹	2.72	<0.1	2 ¹
	BH2	80.0	11.5	1.4	<0.1	<0.1	>>>>	1007	2.4 ¹	2.62	<0.1	5 ¹
	BH3	<0.1	2.7	19.3	<0.1	<0.1	<0.1	1007	<0.1 ¹	3.04	1.0	0 ¹
10/09/19	ATM	<0.1	<0.1	21.1	<0.1	<0.1	<0.1	1014	<0.1	-	<0.1	0
	BH1	7.7	12.0	1.1	<0.1	1.0	55.0	1014	0.6	2.75	<0.1	1
	BH2	Well damaged – not serviceable. Well repaired 27/09/19.										
	BH3	<0.1	4.5	13.3	<0.1	<0.1	<0.1	1014	<0.1	3.05	3.0	0
17/09/19	ATM	<0.1	<0.1	21.5	<0.1	<0.1	<0.1	1019	<0.1	-	<0.1	0
	BH1	17.0	17.0	0.1	<0.1	<0.1	81.0	1019	<0.1	2.77	<0.1	0
	BH2	Well damaged – not serviceable. Well repaired 27/09/19.										

	BH3	0.5	8.6	6.9	<0.1	<0.1	6.0	1019	<0.1	3.05	1.0	0
08/10/19	ATM	<0.1	<0.1	21.3	<0.1	<0.1	<0.1	1004	<0.1	-	<0.1	0
	BH1	41.0	18.0	<0.1	8.0	<0.1	>>>>	1004	1.2	2.64	<0.1	2
	BH2	80.0	18.0	<0.1	8.0	<0.1	>>>>	1004	<0.1	2.52	<0.1	0
	BH3	22.0	16.0	<0.1	<0.1	<0.1	>>>>	1004	<0.1	2.90	5.0	0
23/10/19	ATM	<0.1	<0.1	21.2	<0.1	<0.1	<0.1	1006	<0.1	-	<0.1	0
	BH1	42.0	17.0	<0.1	19	<0.1	>>>>	1006	1.2	2.62	<0.1	3
	BH2	77.0	12.0	2.1	<0.1	<0.1	>>>>	1006	<0.1	2.52	<0.1	0
	BH3	20.5	14.0	<0.1	<0.1	<0.1	>>>>	1006	<0.1	2.92	<0.1	0
31/10/19	ATM	<0.1	<0.1	20.3	<0.1	<0.1	<0.1	1013	<0.1	-	<0.1	0
	BH1	45.5	16.0	<0.1	19.0	<0.1	>>>>	1013	<0.1	2.60	<0.1	0
	BH2	80.0	12.0	1.7	<0.1	<0.1	>>>>	1013	<0.1	2.52	<0.1	0
	BH3	25.5	14.0	0.3	<0.1	<0.1	>>>>	1013	<0.1	2.88	1.0	0
11/11/19	ATM	<0.1	<0.1	21.3	<0.1	<0.1	<0.1	998	<0.1	-	<0.1	0
	BH1	50	15.0	<0.1	<0.1	<0.1	>>>>	998	1.9	2.48	<0.1	4
	BH2	87	12.0	<0.1	<0.1	<0.1	>>>>	998	<0.1	2.39	<0.1	0
	BH3	26.5	14.0	0.1	<0.1	<0.1	>>>>	998	<0.1	2.76	<0.1	0
28/11/19	ATM	<0.1	<0.1	20.1	<0.1	<0.1	<0.1	994	<0.1	-	<0.1	0
	BH1	26.8	15.0	5.5	<0.1	<0.1	>>>>	994	-0.4	2.52	1.0	-2
	BH2	72	10.9	1.6	<0.1	<0.1	>>>>	994	<0.1	2.41	<0.1	0
	BH3	<0.1	1.0	19.5	<0.1	<0.1	<0.1	994	<0.1	2.78	1.0	0
09/12/19	ATM	<0.1	<0.1	20.1	<0.1	<0.1	<0.1	1009	<0.1	-	<0.1	0
	BH1	12	8.7	13.3	<0.1	<0.1	>>>>	1009	-1.0	2.50	<0.1	-4
	BH2	79.5	11.3	0.1	<0.1	<0.1	>>>>	1009	<0.1	2.56	<0.1	0
	BH3	<0.1	0.4	19.8	<0.1	<0.1	<0.1	1009	<0.1	3.00	1.0	0
03/01/20	ATM	<0.1	<0.1	20.0	<0.1	<0.1	<0.1	1022	<0.1	-	<0.1	0
	BH1	<0.1	0.3	19.9	<0.1	<0.1	<0.1	1022	-2.0 ¹	2.56	<0.1	-7 ¹
	BH2	69.9	8.4	2.7	<0.1	<0.1	>>>>	1022	-0.8 ¹	2.44	<0.1	-3 ¹
	BH3	<0.1	0.70	19.4	<0.1	<0.1	<0.1	1022	<0.1 ¹	2.82	<0.1	0 ¹
Minimum		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	994	-2.0	2.39	<0.1	<0.1
Maximum		87.0	19.0	20.3	19.0	1.0	>>>>	1022	4.9	3.05	5	5.0

Note: reading of <0.1 = not detected (below detection level). VOC=Volatile Organic Compounds. Dp=Pressure Difference. ¹ Strong wind conditions recorded. >>>> = above instrument detection level.

The results of the soil gas monitoring recorded the presence of the following ranges in soil gases

- Methane in concentrations between <0.1% v/v and 87.0% v/v
- Carbon dioxide between <0.1% v/v and 19.0% v/v
- Oxygen in the range of <0.1% to 20.3%.

Borehole flow rates measured between <0.1/hr and 4.9/hr and atmospheric pressure was recorded between 994mb and 1022mb.

The elevated flow readings and differential pressure recorded in BH1 and BH2 were attributed to high local wind speeds during the monitoring.

Groundwater levels remained reasonably consistent over the monitoring period lying between 2.52m and 3.05m bgl.

Section 7 Qualitative Risk Assessment

7.1 Assessment Criteria

The assessment criteria used to determine risks to human health are derived and explained within Appendix D.3.

7.2 Representative Contamination Criteria - Soil

The proposed development was to comprise construction of a new two storey leisure centre, constructed in the area of the existing carpark, and subsequent demolition of the existing complex once the new facility is operational. The proposed development was to include areas of hard landscaping including access road, pavements and parking, and areas of soft landscaping to include planters and recreation grounds.

At the time of reporting, no proposed development plans were available. Site plans provided by the client are presented in Appendix E.

Based on the proposed redevelopment of the site, as a leisure centre, the results were therefore compared against generic guidance values based on a “Commercial” and more conservative “Public Open Space” (POS) for park use. These generic screening values have been adopted from values published in SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination December 2014 (C4SL), derived for the protection of human health. Where this document has not published screening values for determinants, screening values derived for the same end use have been adopted from the following published guidance; LQM/CIEH/Suitable 4 Use Levels (S4UL)

To assess the potential toxicity to the human health receptor from the concentrations of organic compounds tested for, Soil Organic Matter (SOM) tests were undertaken on the samples submitted for chemical testing, which revealed SOM values of between 0.2% and 10.4%. For each soil sample tested, the Soil Organic Matter recorded was used to derive the appropriate guideline value for organic determinants.

Table 7.1 and Table 7.2 outlines the samples that have exceeded their relevant assessment criteria. The full laboratory report is presented in Appendix D.2.

Table 7.1 Summary of Chemical Analysis of Soils Sample Exceedance for Commercial Land-use Scenario

Substance	Sample locations where SGV, C4SL or S4UL adopted were exceeded for the ‘commercial’ land-use scenario
None	No exceedances

Table 7.2 Summary of Chemical Analysis of Soils Sample Exceedance for POS Park Land-use scenario

Substance	Sample locations where SGV, C4SL or S4UL adopted were exceeded for the 'POS park' land-use scenario
None	No exceedances

In summary, none of the samples tested showed concentrations in excess either commercial or POS park land-use screening values.

7.2.1 Asbestos

Although no asbestos containing material was identified in any of the samples tested, it is possible that asbestos is present in other areas of the site. If encountered, care must be taken to ensure any such material is separated and disposed of in an appropriate manner to a licensed waste facility.

7.3 Risk to Groundwater

Groundwater samples were obtained from each monitoring well (BH1, BH2 and BH3) installed onsite to establish whether groundwater underlying the site had been impacted by sources present on or below the site (landfill).

The chemical laboratory results were compared against the Environmental Quality Standard (EQS) for freshwater and UK Drinking Water Standard (DWS). If no EQS/DWS was available, standards from the World Health Organisation (WHO) were used.

Table 7.3 outlines the samples that have exceeded their relevant assessment criteria. The full laboratory report is presented in Appendix D.2

Table 7.3 Summary of Chemical Analysis for Groundwater and Leachate Samples Exceedances

Substance	Units	EQS Source	EQS Concentration	Borehole	Sample Concentration
Anthracene	µg/l	EQS	0.02	BH2	0.10
Fluoranthene	µg/l	EQS	0.02	BH2	0.12

The groundwater chemical testing identified PAH concentrations in excess of their respective guideline value.

BH2 recorded anthracene at 0.10µg/l against 0.02µg/l EQS screening value, and fluoranthene at 0.12µg/l against 0.02µg/l EQS screening value.

None of the other substances tested recorded concentrations above the adopted groundwater screening values.

7.4 Soil Gas Risk Assessment

The results of the soil gas monitoring recorded between 25th July 2019 and 3rd January 2020 the presence of the following ranges in soil gases

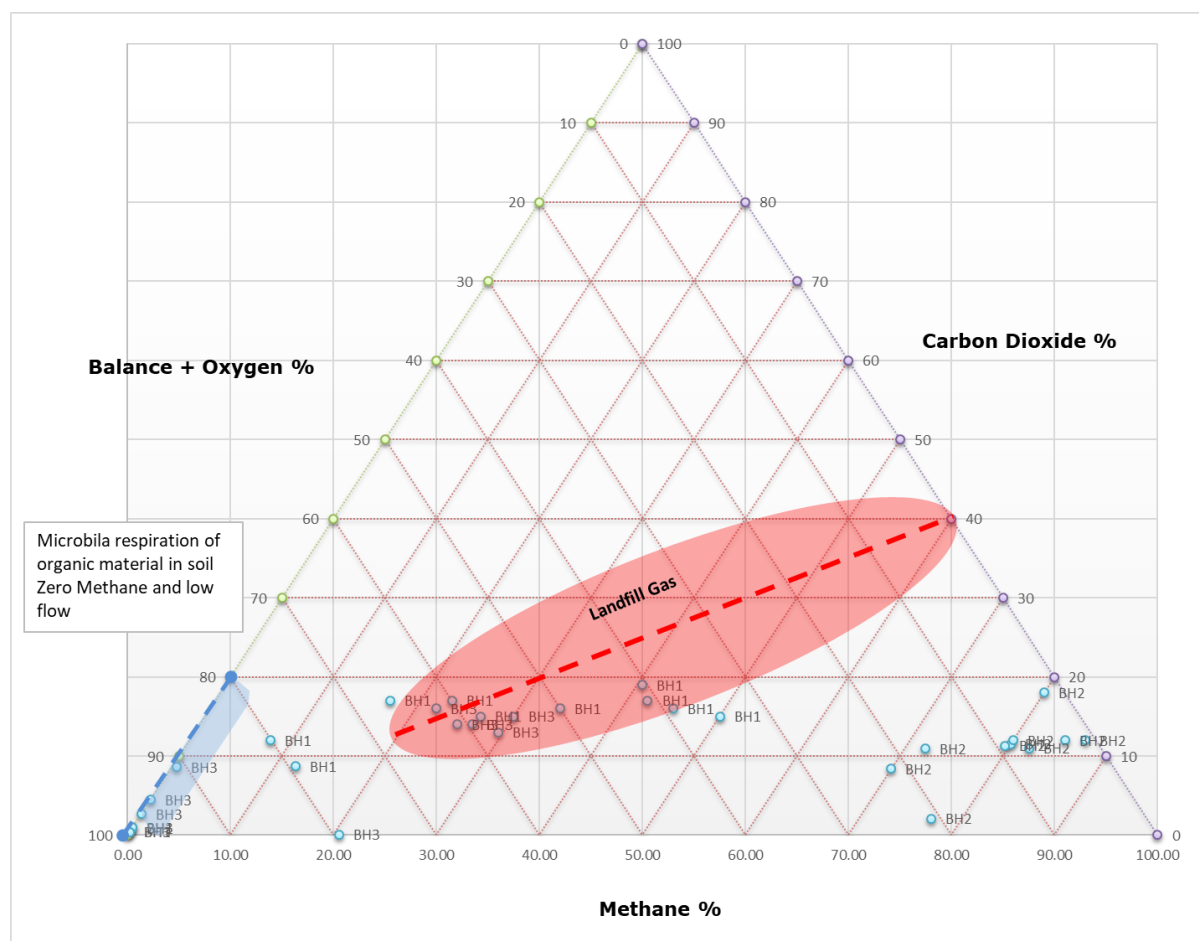
- Methane in concentrations between <0.1% v/v and 87.0% v/v
- Carbon dioxide between <0.1% v/v and 19.0% v/v
- Oxygen in the range of <0.1% to 20.3%.

Borehole flow rates measured between <0.1/hr and 4.9l/hr and atmospheric pressure was recorded between 994mb and 1022mb.

The elevated flow readings and differential pressure recorded in BH1 and BH2 were attributed to high wind speeds during the monitoring.

As part of the assessment the results of the soil gas monitoring have been plotted on a ternary plot to determine the nature and source of the soil gas concentrations recorded in line with the 'Ground Gas Information Sheet No 1 Paper 1.0 dated 30/07/2018 Using ternary plots for interpretation of ground gas monitoring results, Wilson, Collins and Lavery'. The ternary plot for this data is presented below as Graph 1.

Graph 1: Soil Gas Ternary Plot



The results of the ternary plot indicate that BH1 and BH3 are generating soil gas concentrations that fluctuate between land gas and microbial respiration within the soils beneath the site. This indicates that this may be an artefact caused by the installation process whereby oxygen introduced into the underlying landfill has initiated aerobic activity into a system that was anaerobic prior to drilling. It also suggests some level of variability within the landfill materials themselves and their relative decomposition rates.

As noted on the ternary plot, BH2 exhibited a completely different gassing environment, where elevated methane and carbon dioxide were recorded along with low to very low concentrations of oxygen. This suggests bacterial activity is dominant with a process of methane oxidation occurring via the introduction of oxygen into the system probably by the construction of the monitoring well as it appears to reduce over time. The extent of this oxidation is considered to be primarily constrained by the movement of oxygen within the borehole.

To determine the potential risk to the proposed development, an assessment has been undertaken following the principles of CIRIA C665 and BS8485:2015 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new building to determine the site's underlying gas characteristic situation. The results of the assessment are presented below.

A hazardous flow rate (Q_{hg}) was calculated for each monitoring location and was calculated using Equation 1 presented:

$$Q_{hg} = (C_{hg}/100) * q \quad \text{Equation 1}$$

Where:

C_{hg} is the measured hazardous gas concentration (in percentage volume-by-volume).

q is the flow rate in litres per hour of combined gases found by direct measurement.

Table 7.4 presents the hazardous flow rate (Q_{hg}) for each monitoring location, based on the highest soil gas concentration and the associated recorded flow rate for each monitoring well.

Table 7.4 Hazardous Flow Rates

Monitoring Well	Highest Concentration		Flow Rate (l/h)	Hazardous Flow Rate (Q_{hg})
	Methane	Carbon Dioxide		
BH1	50.0	19.4	1.9	(Methane) 0.95 (Carbon Dioxide) 0.361
BH2	87	18	4.9	(Methane) 4.263 (Carbon Dioxide) 0.882
BH3	30	16	0.2	(Methane) 0.06 (Carbon Dioxide) 0.06

Note: Where flow rates were recorded below the detection limits of the gas monitor a flow rate of 0.1 l/hr has been adopted in line with current standards and guidance

Table 7.5 presents the worst-case flow rate calculated from the highest recorded soil gas concentrations and the flow rate recorded over the twelve monitoring visits.

Table 7.5 Worst Case Hazardous Flow Rates

Monitoring Well	Adopted Highest Concentration		Adopted Flow Rate (l/h)	Hazardous Flow Rate (Q _{hg})
	Methane	Carbon Dioxide		
BH1	87	19	4.9	(Methane) 4.263 (Carbon Dioxide) 0.931

The results of the soil gas calculations for the maximum volumes recorded, produced Q_{hg} values of between 0.06l/h and 4.263l/h for methane and carbon dioxide values of between 0.06l/h and 0.882l/h. These figures place the proposed development somewhere between Characteristic Situation 1 (CS1) and Characteristic Situation 4 (CS4).

CIRIA C665 and BS8485:2015 state that where concentrations of methane and carbon dioxide are consistently recorded over 1%v/v and 5% v/v respectively, consideration should be given to increasing the Characteristic Situation to 2. As the majority of the concentrations of both methane and carbon dioxide are greater than 1% v/v and 5% v/v respectively, it is considered appropriate in this case to upgrade the site to at least CS2.

The hazardous flow rates derived from the maximum gas concentrations and flow readings within BH1 and BH2 classified the site as between CS3 and CS4. BH3 was classified as CS1. However, based on the methane and carbon dioxide concentrations CS2 is considered more appropriate for this specific location.

To determine the characteristic situation for the site as a whole, a review has been undertaken of the gas monitoring results and the hazardous flow calculations based on the maximum calculated values and the 'worst case' scenario.

The 'worst-case' scenario suggests that the site should be classified as Characteristic Situation 4. However, based on the readings taken, conditions giving rise to CS4 only occurred on one occasion during the entire monitoring period. It is therefore not considered appropriate to adopt this as being characteristic of the gas regime beneath the whole site, though it does suggest a precautionary approach should be taken.

Conditions giving rise to Characteristic Situation 3 occurred on three occasions during the monitoring but in two different well locations, BH1 and BH2, suggesting a precautionary approach is advised. The level of risk at this site has therefore primarily been determined on the basis of the flow rates recorded within the monitoring wells, which do show some relative consistency over time, as well as consideration of the extant source concentrations. Sufficient soil gas concentrations are clearly present as a generating source within the underlying materials at sufficient levels so as to present a risk and there is potential for the site (under suitable atmospheric pressure variations and on exposure) to generate sufficient gas flow to present a risk.

On this basis it is considered that a Characteristic Situation 3 should be adopted for the site as a precautionary measure, to protect future site occupants from the identified potential risk.

To determine the level of soil gas protection required, the type of development must first be considered. The proposed development is to comprise of a leisure centre with swimming pool and diving pool. This usage would place the building as Type C in accordance with Table 3, presented in BS8485:2015 which covers commercial buildings with central building management control of any alterations to the buildings and maintenance. To achieve the minimum gas protection required, a score of equal or greater than 3 must be achieved to ensure risks are minimized. Tables 5, 6 and 7 within BS8485:2015 detail the gas protection measures that may be incorporated into the design to achieve the required score.

Details of any and all proposed gas protection measures must also be presented to the Local Planning Authority in the form of a remediation strategy for their comment, approval and agreement prior to installation.

7.5 Tier 1 Quantitative Risk Assessment

Quantitative risk assessments are undertaken for the soil, groundwater and soil gas. The CSM has been updated to take account of the assessments below and presented in Appendix D.1. The full laboratory chemical report is presented in Appendix D.2.

7.5.1 Soils

None of the samples tested recorded determinant concentrations in excess of either commercial or POS park end-use screening values.

The Tier 1 Quantitative risk assessment therefore established that there was no risk to the human health receptor of future end-users.

7.5.2 Groundwater

Groundwater chemical analysis identified the presence of elevated concentrations of PAHs in the groundwater beneath the site, with one of the three samples tested recording elevated PAH concentration against EQS freshwater screening values. The Groundwater Risk Assessment therefore established that there was risk to the groundwater receptor.

Shallow groundwater was recorded onsite within the monitoring wells onsite. It is considered unlikely that future end users to come into direct contact with the groundwater and as such no protection measures are considered necessary in this respect. Furthermore, there was no evidence of stressed vegetation onsite.

The River Thames is considered the most likely main groundwater receptor to the site, given its close proximity. It is considered based on the close proximity of the river to the site and the absence of any lining layer within the landfill, the

groundwater levels are in hydraulic conductivity with the river. If this is the case then it is likely the elevated PAH identified within the groundwater samples is already impacting river water quality.

It is likely that this source will be either reduced or removed as part of the proposed redevelopment, which will include the excavation of a swimming pool and diving pool and therefore the risk post construction is considered to be low. It should be noted that remediation of the whole landfill is not considered practicable based on the proposed development.

However, consideration must be given to the mobilisation of contamination to groundwater as a result of the excavation and construction of the building and swimming pools. The Environment Agency must be consulted to in relation to construction methodologies in place to minimise any risks to groundwater and the River Thames.

7.5.3 Soil Gas

The Preliminary Investigation Report identified a moderate risk of soil gas associated with a historic landfill underlying the site.

Monitoring of the soil gas on site indicates that a Characteristic Situation 3 should be adopted as a precautionary measure. To achieve the minimum gas protection required, a score of equal or greater than 3 must be achieved to ensure risks are minimized. Tables 5, 6 and 7 within BS8485:2015 detail the gas protection measures that may be incorporated into the design to achieve the required score.

Details of any and all proposed gas protection measures must also be presented to the Local Planning Authority in the form of a remediation strategy for their comment, approval and agreement prior to installation.

7.6 Duty of Care

Groundworkers must maintain a good standard of personal hygiene including the wearing of overalls, boots, gloves and eye protectors and the use of dust masks during periods of dry weather.

To prevent exposure to airborne dust by both the general public and construction personnel the site should be kept damp during dry weather and at other times when dust is generated as a result of construction activities. The site should be securely fenced at all times to prevent unauthorised access.

Washing facilities should be provided and eating restricted to mess huts.

7.7 Excavated Material

Excavated material as waste must be defined or classified prior to any disposal,

transport, recycling or re-use at or by an appropriately licensed or exempt carrier and/or off-site disposal facility. The requirements inherent in both Duty of Care and Health and Safety must also be complied with. In order to determine what is to happen, what is suitable, appropriate and most effective in the disposal of wastes, especially those subject to CDM waste management plan requirements, several factors must be considered and competent advice should always be sought.

The amount, type and nature of the material to be removed will in part determine the amount and type of analysis that may be required to comply with current waste guidance, and thereby allow a competent person to suitably classify the material. Often this data is uncertain or unavailable, especially in the early stages of a project, and therefore further investigation, testing and analysis may be required as additional information regarding the development becomes available.

Wastes must be classified and defined by their solid characteristics to comply with current waste guidance. Existing information and analysis derived for environmental purposes may therefore be suitable for use in this context. Waste Acceptance Criteria (WAC) report the leachability of materials and therefore cannot be used to classify, characterise or define wastes. The only purpose of a WAC analysis is to determine the suitability of a given material for acceptance at one of the three different types of available licenced landfills (inert, stable non-reactive hazardous or hazardous).

WAC analysis was undertaken on three samples obtained from near surface soils and the certificates are included in Appendix D.2.

Other options are available that may lead to significant savings against disposal to landfill and expert advice should always be sought from a competent person to advise on their relative costs or benefits and advise on any additional analysis, sampling or investigation that may be required to reduce remaining uncertainties and comply with current guidance. Further consideration of results using HazWasteOnline™ can be undertaken on request to give an indication of potentially hazardous properties in the materials analysed.

7.8 Re-use of Excavated Material On-site

The re-use of on-site soils may be undertaken either under the Environmental Permitting Regulations 2007 (EPR), in which case soils other than uncontaminated soils are classed as waste, or under the CL:AIRE Voluntary Code of Practice (CoP) which was published in September 2008 and is accepted as an alternative regime to the EPR.

Under the EPR, material that is contaminated but otherwise suitable for re-use is also classified as waste and its re-use should be in accordance with the Environmental Permitting Regulations 2007 (EPR). Environmental Permit Exemptions (EPE) are for the re-use of non-hazardous or inert waste only; hazardous waste cannot be re-used under a permit exemption. EPE apply only to imported inert waste materials; inert material arising on site and recovered on site is not classified as waste and does not require an

exemption. It is possible that materials arising on-site will be classified as inert and would not need an exemption.

Environmental Permit Exemptions are only allowed for certain activities, placing controls on the quantities that can be stored and re-used. The re-use of waste shall be within areas and levels defined in planning applications and permissions for the development. An EPE requires a site-specific risk assessment for the receptor site to demonstrate that the materials are suitable for use, i.e. that they will not give rise to harm to human health or pollution of the environment.

Under the CL:AIRE voluntary code of practice (CoP) materials excavated on-site are not deemed contaminated if suitable for re-use at specified locations or generally within the site.

Material that may have been classified as hazardous waste under the EPR may be re-used. The CoP regime requires that a 'Qualified Person' as defined under the CoP reviews the development of the Materials Management Plan, including review of Risk Assessments and Remediation Strategy/Design Statement together with documentation relating to Planning and Regulatory issues, and signs a Declaration which is forwarded to the Environment Agency and which confirms compliance with the CoP.

Should it be necessary to import materials from another site where materials are excavated and which is not material from a quarry or produced under a WRAP protocol, then an EPE would be necessary for the imported material whether the work was managed under the CoP or the EPR.

7.9 Imported Material

Any soil, which is to be imported onto the site, must undergo chemical analysis to permit classification prior to its importation and placement in order to ascertain its status with specific regard to contamination, i.e. to prove that it is suitable for the purpose for which it is intended.

7.10 Discovery Strategy

There may be areas of contamination not identified during the course of the investigation. Such occurrences may also be discovered during the demolition and construction phases for the redevelopment of the site.

Care should be taken during excavation works especially to investigate any soils, which appear by eye (e.g. such as fibrous materials, large amounts of ash and unusual discolouration), odour (e.g. fuel, oil and chemical type odours or unusual odours such as sweet odours or fishy odours) or wellbeing (e.g. light headedness and/or nausea, burning of nasal passages and blistering or reddening of skin due to contact with soil) to be contaminated or of unusual and/or different character to standard soils or those analysed.

In the event of any discovery of potentially contaminated soils or materials, this discovery should be quarantined and reported to the most senior member of site staff or the designated responsible person at the site for action. The location, type and quantity must be recorded and the Local Authority, and a competent and appropriate third party Engineer/Environmental consultant notified immediately. An approval from the Local authority must be sought prior to implementing any proposed mitigation action.

The discovery strategy must remain on site at all times and must demonstrate a clear allocation of responsibility for reporting and dealing with contamination. A copy of the strategy must be placed on the health and safety notice board and /or displayed in a prominent area where all site staff are able to take note of and consult the document at any time. Any member of the workforce entering the site to undertake any excavation must be made aware of the potential to discover contamination and the discovery strategy.

List of Figures

Figure 1 – Site Location Map	40
Figure 2 – Aerial Photograph	41
Figure 3 – Trial Hole Plan	42

List of Appendices

Appendix A Field Work

Appendix A.1 Engineers Logs

Appendix B Geotechnical In-Situ and Laboratory Testing

Appendix B.1 Classification

Appendix B.2 Interpretation

Appendix B.3 Geotechnical In-Situ and Laboratory Results

Appendix C Foundation Design

Appendix C.1 Preliminary Pile Design

Appendix D Chemical Laboratory Testing

Appendix D.1 Conceptual Site Model

Appendix D.2 Chemical Laboratory Results

Appendix D.3 General Assessment Criteria

Appendix E Information Provided by the Client

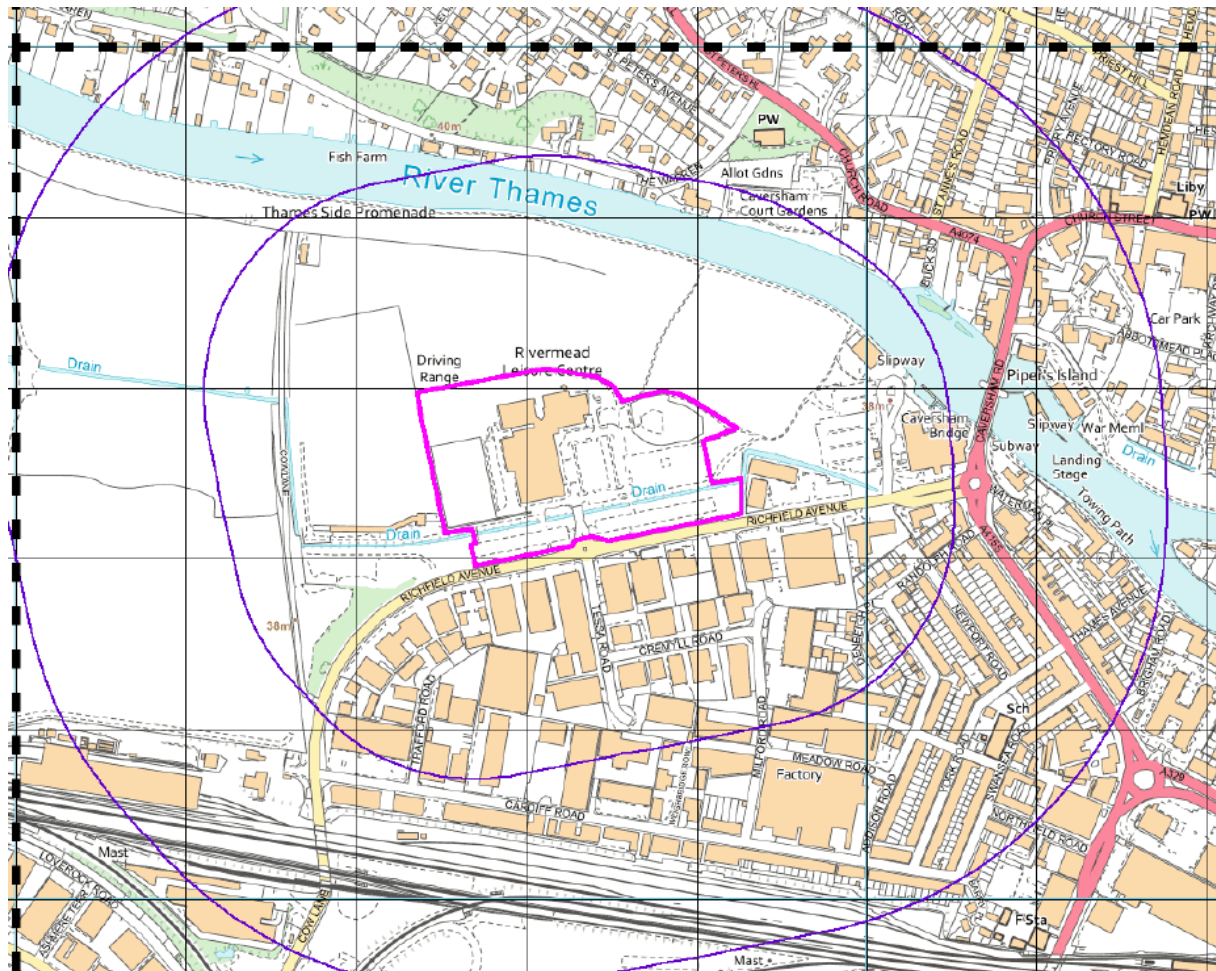


Figure I – Site Location Map



Job Number
17755

Project
Rivermead Leisure Centre, Richfield Avenue,
Reading, Berkshire RG1 8EQ

Client
Reading Borough Council

Date
August 2019



Figure 2 – Aerial Photograph

Project

Rivermead Leisure Centre,
Richfield Avenue, Reading,
Berkshire RG1 8EQ

Client

Reading Borough Council

Date

August 2019

Job Number

17755



Figure 3 – Trial Hole Plan

Project
Rivermead Leisure Centre,
Richfield Avenue, Reading,
Berkshire RG1 8EQ

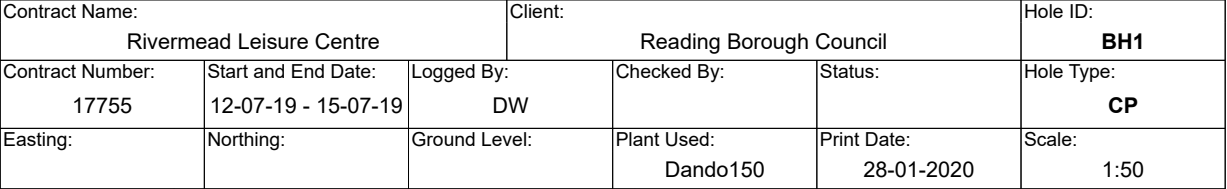
Client
Reading Borough Council

Date
August 2019

Job Number
17755

Appendix A Field Work

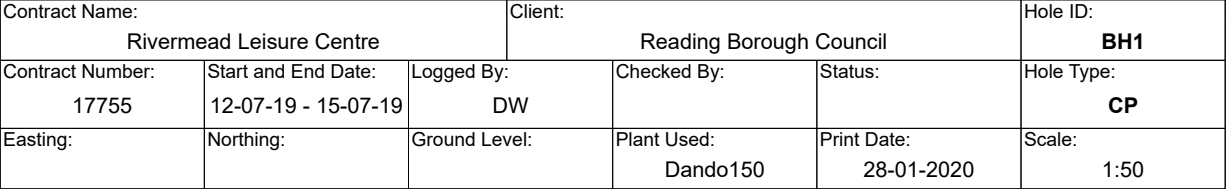
Appendix A.1 Engineers Logs



Samples & In Situ Testing	Strata Details	Groundwater
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Depth (m)	Soil Type	Soil Description	Soil Profile
0.20	D	N=3 (1,0/0,1,0,2)	Greyish brown, slightly gravelly, sandy desiccated CLAY. Gravel is angular to sub rounded, fine to coarse flint. Rare angular, fine brick gravel. Becomes gravelly with depth. MADE GROUND. Black and brown slightly gravelly sandy CLAY. Gravel is angular to sub angular, Fine to medium, flint, brick and clinker. MADE GROUND
0.50	D		
0.50 - 1.00	B		
1.00	D		
1.50	SPT	N=2 (1,0/1,0,1,0)	Dark multicoloured mottled blackish brown, slightly sandy, clayey GRAVEL/gravelly CLAY. Gravel is angular, fine to coarse, flint, brick, ash and clinker. Frequent fragments of wood , paper, plastic, glass and fabric. MADE GROUND Dark green slightly gravelly sandy CLAY. Gravel is angular to sub rounded, fine to coarse, flint. Occasional black organic staining. Rare rootlets. KEMPTON PARK GRAVEL MEMBER
1.50 - 2.00	D		
2.00	D		
2.20 - 2.50	B		
2.50	SPT	Ublow = 27	Multicoloured mottled, yellowish brown, slightly silty, sandy GRAVEL. Gravel is sub angular to sub rounded, fine to coarse clasts of flint. Sand is predominantly coarse. KEMPTON PARK GRAVEL MEMBER
2.50 - 2.95	J		
3.00	D		
3.50 - 3.95	U		
4.00	D	N=11 (2,2/3,2,3,3)	Multicoloured mottled, yellowish brown, slightly silty, sandy GRAVEL. Gravel is sub angular to sub rounded, fine to coarse clasts of flint. Sand is predominantly coarse. KEMPTON PARK GRAVEL MEMBER
4.50	SPT		
4.50 - 5.00	B		
5.00	D		
5.50	D	N=15 (2,2/3,3,4,5)	Multicoloured mottled, yellowish brown, slightly silty, sandy GRAVEL. Gravel is sub angular to sub rounded, fine to coarse clasts of flint. Sand is predominantly coarse. KEMPTON PARK GRAVEL MEMBER
6.00	SPT		
6.00 - 6.50	B		
6.50	D		
7.00	D	N=23 (3,4/4,6,6,7)	Multicoloured mottled, yellowish brown, slightly silty, sandy GRAVEL. Gravel is sub angular to sub rounded, fine to coarse clasts of flint. Sand is predominantly coarse. KEMPTON PARK GRAVEL MEMBER
7.50	SPT		
7.50 - 8.00	B		
8.00	D		
8.50	D	N=16 (3,4/4,3,4,5)	Multicoloured mottled, yellowish brown, slightly silty, sandy GRAVEL. Gravel is sub angular to sub rounded, fine to coarse clasts of flint. Sand is predominantly coarse. KEMPTON PARK GRAVEL MEMBER
9.00	SPT		
9.00 - 9.50	B		
9.50	D		
10.00	D		

Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
					12.00 20.00	200 150	12.00 19.50	200 150						
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
					0.00 1.00	1.00 15.00	PLAIN SLOTTED	50 50	3.00			20	3.00	
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

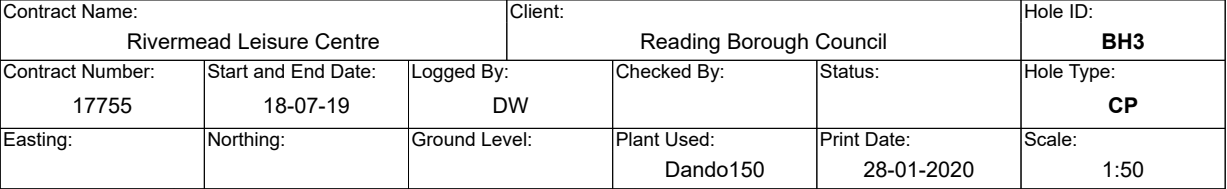


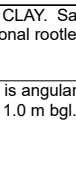
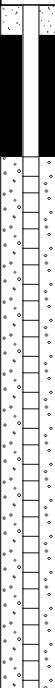
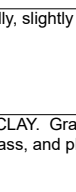
Weather:	Termination:	SPT Hammer: AR2102 Energy Ratio: 60%	Sheet 2 of 2
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Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
					12.00	200	12.00	200						
					20.00	150	19.50	150						
					Water Strikes									
Chiselling					Installation				Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	3.00			20	3.00	
					0.00	1.00	PLAIN	50						
					1.00	15.00	SLOTTED	50						
									Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.					

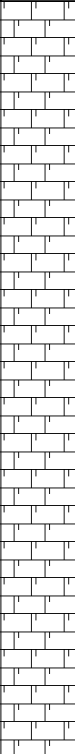
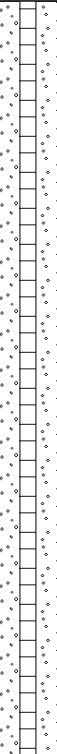
soils L I M I T E D	Contract Name: Rivermead Leisure Centre				Client: Reading Borough Council				Hole ID: BH2					
	Contract Number: 17755		Start and End Date: 17-07-19		Logged By: DW		Checked By:		Status:		Hole Type: CP			
	Easting:		Northing:		Ground Level:		Plant Used: Dando150		Print Date: 28-01-2020		Scale: 1:50			
Weather:			Termination:				SPT Hammer: AR2102 Energy Ratio: 60%				Sheet 1 of 2			
Samples & In Situ Testing				Strata Details								Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/Installation	
0.20	D	N=8 (2,2/1,2,3,2)		0.05		TARMAC						1		
0.20				Blackish brown and pink mottled, slightly sandy, silty GRAVEL. Gravel is angular to sub angular limestone, and tarmac. Underlain by woven plastic membrane. MADE GROUND.										
0.30				Slightly green mottled, dark brown, slightly sandy, clayey GRAVEL. Gravel is angular to sub angular, fine to coarse limestone, flint, and rare brick. Sand content increases with depth. MADE GROUND.										
0.50				Brown, slightly silty, sandy GRAVEL. Gravel is angular to sub angular, fine to coarse limestone, flint, and rare brick. MADE GROUND.										
0.50 - 1.00	B													
1.00	D	N=34 (10,9/10,13,6,5)		1.20		Black and brown, slightly sandy, slightly gravelly, silty organic CLAY. Gravel is angular to sub rounded, fine to coarse flint, concrete, and clinker. Frequent decomposing woody, and unidentifiable anthropogenic materials. Occasional, becoming frequent with depth, plastic fragments. Odour of decomposition/faint hydrocarbon odour. Clay content increases with depth. MADE GROUND.						2		
1.20														
1.20 - 2.00	B													
1.50	SPT													
2.00	D													
2.50	SPT	N=13 (3,4/4,3,3,3)		(2.30)								3		
3.00	D													
3.50														
3.50 - 4.00	B													
4.00	D													
4.50	SPT	N=16 (3,3/4,4,4,4)		4.50		Multicoloured mottled, greyish brown, slightly silty, slightly sandy, GRAVEL. Gravel is angular to sub rounded, fine to coarse flint. Very rare metal fragments. KEMPTON PARK GRAVEL MEMBER						4		
4.50 - 5.00	B													
5.00	D													
5.50	D													
6.00														
6.00 - 6.50	SPT	N=7 (1,2/2,1,2,2)		(4.50)								5		
6.50	B													
6.50	D													
7.00	D													
7.50														
7.50 - 8.00	SPT	N=29 (4,5/6,7,7,9)										6		
8.00	B													
8.00	D													
8.50	D													
9.00														
9.00 - 9.50	SPT	N=16 (1,3/4,4,4,4)		9.00		Multicoloured, sandy, GRAVEL. Gravel is angular to sub angular, fine to coarse flint and occasional quartzite. Occasional sub-rounded flint cobbles. KEMPTON PARK GRAVEL MEMBER						7		
9.50	B													
9.50 - 10.00	B													
10.00	D													
Start & End of Shift Observations				Borehole Diameter		Casing Diameter		Remarks:						
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
							12.00	200						
							20.00	150						
Chiselling				Installation				Water Strikes						
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
					0.00	1.00	PLAIN	50	4.00	4.00		20	3.30	
					1.00	15.00	SLOTTED	50						
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

	Contract Name: Rivermead Leisure Centre				Client: Reading Borough Council				Hole ID: BH2					
	Contract Number: 17755		Start and End Date: 17-07-19		Logged By: DW		Checked By:		Status:		Hole Type: CP			
	Easting:		Northing:		Ground Level:		Plant Used: Dando150		Print Date: 28-01-2020		Scale: 1:50			
Weather:			Termination:				SPT Hammer: AR2102 Energy Ratio: 60%				Sheet 2 of 2			
Samples & In Situ Testing					Strata Details							Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/Installation	
10.50	SPT D	N=7 (1,2/1,2,2,2)				STRUCTURELESS CHALK. Recovered as sub angular to sub rounded, fine to coarse, moderately strong to very strong, white clasts in a creamy white to white with depth, silty matrix. Frequent sub-rounded, coarse gravel to cobble sized, rinded flint nodules. SEAFORD AND NEWHAVEN CHALK FORMATION								
11.00	D											11		
11.50	D													
12.00	SPT D	N=18 (2,4/5,4,4,5)										12		
12.50	D													
13.00	D											13		
13.50	SPT D	N=13 (3,3/4,3,5,1)												
14.00	D											14		
14.50	D													
15.00	SPT D	N=28 (3,3/5,5,9,9)		(10.50)								15		
15.50	D													
16.00	D											16		
16.50	SPT D	N=50 (9,12/50 for 290mm)												
17.00	D											17		
17.50	D													
18.00	SPT D	40 (4,9/40 for 135mm)										18		
18.50	D													
19.00	D											19		
19.50	SPT D	50 (5,8/50 for 195mm)												
20.00	D			20.00								20		
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
							12.00	200						
							20.00	150						
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
					0.00	1.00	PLAIN	50	4.00	4.00		20	3.30	
					1.00	15.00	SLOTTED	50						
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

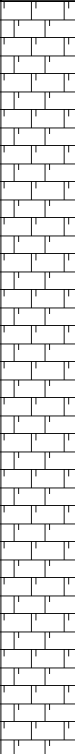


Samples & In Situ Testing				Strata Details			Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation	
0.20	D	N=15 (2,2/3,4,4,4)		(0.50)		greyish brown, slightly sandy, gravelly, desiccated CLAY. Sand is fine. Gravel is angular to sub-rounded, fine to coarse concrete and flint. Occasional rootlets. MADE GROUND.	1		
0.50	D			0.50		dark brown, slightly gravelly, sandy, CLAY. Gravel is angular to sub-angular, fine to coarse, flint, brick, and rare ceramics and glass. Peaty around 1.0 m bgl. MADE GROUND.			
0.50 - 1.00	B			(0.80)					
1.00	D			1.30		Firm, greyish brown mottled, brown, slightly gravelly, slightly sandy CLAY. Gravl is ngular, fine flint. Rare reddish brown speckles. MADE GROUND.			
1.30	D			(0.70)					
1.50	SPT	N=8 (1,1/2,1,3,2)		2.00		Soft, dark brown, slightly gravelly, sandy, organic CLAY. Gravel is angular to sub-angular, fine to coarse, clinker, flint, and brick. Frequent, wood, glass, and plastic fragments. MADE GROUND.	2		
1.50 - 2.00	B								
2.00	D			2.30					
2.50	SPT								
2.50 - 3.00	B								
3.00	D	N=10 (2,2/3,2,2,3)		(2.30)			3		
3.50	SPT								
3.50 - 4.00	B								
4.00	D								
4.30	D			4.30					
4.50	SPT	N=8 (1,0/1,0,2,5)		(0.70)		Brown and greyish brown mottled, slightly sandy, gravelly CLAY. Gravel is angular to rounded, fine to coarse flint. KEMPTON PARK GRAVEL MEMBER <i>Green and grey motting around 4.0 m bgl.</i>	4		
4.60 - 5.00	B								
5.00	D			5.00					
5.50	D								
6.00	SPT			N=14 (2,2/2,3,4,5)					Multicoloured, very sandy, GRAVEL. Gravel is angular to rounded, fine to coarse flint and occasional quartzite. Occasional sub-rounded flint cobbles. KEMPTON PARK GRAVEL MEMBER
6.00 - 6.50	B								
6.50	D	(3.00)							
7.00	D								
7.50	SPT	N=14 (2,2/3,3,4,4)	8.00						
7.50 - 8.00	B								
8.00	D			Multicoloured, very gravelly SAND. Gravel is angular to rounded, fine to coarse flint. KEMPTON PARK GRAVEL MEMBER	8				
8.50	D			(1.00)					
9.00	SPT			N=17 (2,3/4,4,4,5)			9.00		
9.00 - 9.50	B								
9.50 - 10.00	B								
10.00	D								

Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
							10.50 15.00	200 150						
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
					0.00 1.00	1.00 15.00	PLAIN SLOTTED	50 50	4.50	4.50		20	3.50	
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

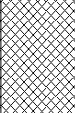
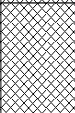
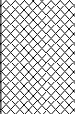
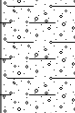
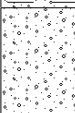
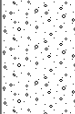
	Contract Name: Rivermead Leisure Centre				Client: Reading Borough Council				Hole ID: BH3					
	Contract Number: 17755		Start and End Date: 18-07-19		Logged By: DW		Checked By:		Status:		Hole Type: CP			
	Easting:		Northing:		Ground Level:		Plant Used: Dando150		Print Date: 28-01-2020		Scale: 1:50			
Weather:			Termination:				SPT Hammer: AR2102 Energy Ratio: 60%				Sheet 2 of 2			
Samples & In Situ Testing				Strata Details								Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/Installation	
10.50	SPT D	N=13 (2,2/3,3,4,3)		(6.00)		STRUCTURELESS CHALK. Recovered as sub angular to sub rounded, fine to coarse, moderately strong to very strong, white clasts in a creamy white to white with depth, silty matrix. Frequent sub-rounded, coarse gravel to cobble sized, rinded flint nodules. SEAFROD AND NEWHAVEN CHALK FORMATIO					11			
11.00	D													
11.50	D													
12.00	SPT D	N=13 (2,3/3,3,4,3)												
12.50	D													
13.00	D													
13.50	SPT D	N=16 (1,2/3,3,5,5)												
14.00	D													
14.50	D		15.00			End of Borehole at 15.00m				15				
15.00	SPT D	N=12 (2,3/3,2,3,4)												
											16			
											17			
											18			
											19			
											20			
Start & End of Shift Observations				Borehole Diameter		Casing Diameter		Remarks:						
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)							Dia (mm)
							10.50 15.00							200 150
Chiselling				Installation				Water Strikes						
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
					0.00 1.00	1.00 15.00	PLAIN SLOTTED	50 50	4.50	4.50		20	3.50	
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

	Contract Name: Rivermead Leisure Centre				Client: Reading Borough Council				Hole ID: BH4					
	Contract Number: 17755		Start and End Date: 12-07-19		Logged By: DW		Checked By:		Status:		Hole Type: CP			
	Easting:		Northing:		Ground Level:		Plant Used: Dando150		Print Date: 28-01-2020		Scale: 1:50			
Weather:			Termination:				SPT Hammer: AR2144 Energy Ratio: 72%				Sheet 1 of 2			
Samples & In Situ Testing					Strata Details							Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description					Water Strike	Backfill/Installation		
0.15	D	N=22 (3,4/6,4,6,6)		0.15		TARMAC					1			
0.50	D			Bluish black and greyish mottled, brown slightly gravelly, slightly sandy, gravelly CLAY. Gravel is angular to sub rounded, fine to coarse, flint, brick and clinker. Occasional plastic and fabric fragments. KEMPTON PARK GRAVEL MEMBER										
0.50 - 1.00	J			Band of slightly sandy clayey gravel at 0.5m bgl.										
1.00	J													
1.20	D													
1.50	SPT	N=27 (5,6/7,8,7,5)		1.70		Black and brown, slightly sandy, slightly gravelly, silty organic CLAY. Gravel is angular to sub rounded, fine to coarse flint and clinker. Frequent decomposing plastic, and unidentifiable anthropogenic materials. Distinct hydrocarbon odour. MADE GROUND.					2			
1.50 - 1.70	B													
1.70	J													
1.70 - 2.30	D													
	B													
2.50	SPT	N=29 (4,5/7,7,7,8)		2.50		Grey mottled brown, slightly gravelly clayey SAND. Gravel is angular to sub-angular, fine to coarse flint. Strong hydrocarbon odour. KEMPTON PARK GRAVEL MEMBER					3			
2.50 - 3.00	B			lower boundary ambiguous due to sample depths										
3.30	D	N=50 (6,7/50 for 295mm)		3.00		Multicoloured, sandy to very sandy, GRAVEL. Gravel is angular to rounded, fine to coarse flint. KEMPTON PARK GRAVEL MEMBER					4			
3.50	SPT			Band of very sandy at 5m bgl.										
3.50 - 4.00	B													
4.30	D	N=40 (4,6/7,9,10,14)		(5.50)							5			
4.50	SPT													
4.50 - 5.00	B													
5.50	D	N=36 (6,8/10,9,8,9)		(5.50)							6			
6.00	SPT													
6.00 - 6.50	B													
7.00	D	N=40 (4,6/7,9,10,14)		(5.50)							7			
7.50	SPT													
7.50 - 8.00	B													
8.50	D	N=11 (2,3/2,3,3,3)		8.50		STRUCTURELESS CHALK. Recovered as sub angular to sub rounded, fine to coarse, moderately strong to very strong, white clasts in a creamy white to white with depth, silty matrix. Frequent sub-rounded, coarse gravel to cobble sized, ringed flint nodules. SEAFORD AND NEWHAVEN CHALK FORMATION					8			
9.00	SPT													
9.00 - 9.50	B													
10.00	D										10			
Start & End of Shift Observations				Borehole Diameter		Casing Diameter		Remarks:						
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)						Dia (mm)	
					9.00 15.00	200 150	9.00 15.00						200 150	
Chiselling				Installation				Water Strikes						
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
									3.00			20	3.00	
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

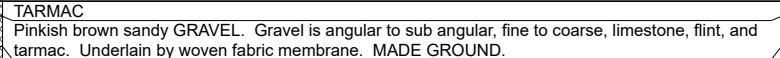
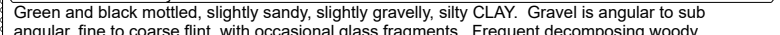
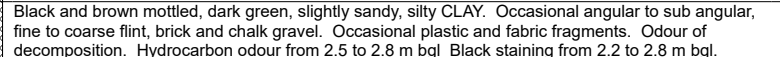
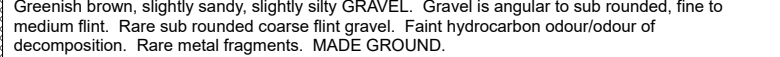
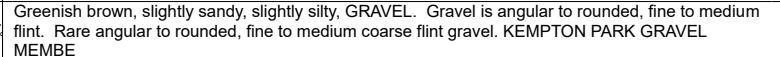
	Contract Name: Rivermead Leisure Centre				Client: Reading Borough Council				Hole ID: BH4					
	Contract Number: 17755		Start and End Date: 12-07-19		Logged By: DW		Checked By:		Status:		Hole Type: CP			
	Easting:		Northing:		Ground Level:		Plant Used: Dando150		Print Date: 28-01-2020		Scale: 1:50			
Weather:			Termination:				SPT Hammer: AR2144 Energy Ratio: 72%				Sheet 2 of 2			
Samples & In Situ Testing				Strata Details								Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/Installation	
10.50 10.50 - 11.00	SPT B	N=10 (2,2/2,2,3,3)		(6.50)		STRUCTURELESS CHALK. Recovered as sub angular to sub rounded, fine to coarse, moderately strong to very strong, white clasts in a creamy white to white with depth, silty matrix. Frequent sub-rounded, coarse gravel to cobble sized, rinded flint nodules. SEAFORD AND NEWHAVEN CHALK FORMATION						11		
11.50	D													12
12.00 12.00 - 12.50	SPT B	N=13 (2,3/3,3,4,3)												13
13.00	D													14
13.50 13.50 - 14.00	SPT B	N=26 (4,5/6,9,6,5)												15
14.50	D													16
15.00	SPT	N=24 (4,4/5,6,7,6)		15.00	End of Borehole at 15.00m						17			
												18		
												19		
												20		
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
					9.00 15.00	200 150	9.00 15.00	200 150						
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
									3.00			20	3.00	
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

	Contract Name: Rivermead Leisure Centre				Client: Reading Borough Council				Hole ID: BH5					
	Contract Number: 17755		Start and End Date: 15-07-19 - 16-07-19		Logged By: DW		Checked By:		Status:	Hole Type: CP				
	Easting:		Northing:		Ground Level:		Plant Used: Dando150		Print Date: 28-01-2020	Scale: 1:50				
Weather:			Termination:				SPT Hammer: AR2102 Energy Ratio: 60%				Sheet 1 of 2			
Samples & In Situ Testing				Strata Details							Groundwater			
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description					Water Strike	Backfill/Installation		
0.20	D	N=6 (1,1/1,1,2,2)		(0.40)		Greyish brown, slightly gravelly, sandy desiccated CLAY. Gravel is angular to sub rounded, fine to coarse flint. Rare angular, fine brick gravel. Becomes gravelly with depth. MADE GROUND.					1			
0.40	J			0.40										
0.50	D			0.60										
0.50 - 1.00	B			0.80										
0.80	J			(0.40)										
1.00	D			1.20										
1.20	D	N=7 (1,1/1,1,2,3)		1.20		Blackish brown, slightly silty, sandy GRAVEL. Gravel is angular to sub rounded, fine to coarse flint, brick and clinker. Frequent anthropogenic materials including plastic, metal, oven door seal. MADE GROUND.					2			
1.50	SPT			(0.80)										
1.50 - 2.00	B			2.00										
2.00	D			(1.40)										
2.50	J			3.40										
2.50 - 3.00	B			3.40										
3.00	D	N=11 (2,2/2,3,3,3)		3.40		Soft, brown mottled, black, slightly sandy, gravelly CLAY/SILT. Gravel is angular to sub angular, fine to medium, flint, brick, clinker, and tarmac. Frequent plastic fragments. Frequent organic woody fragments. Rare glass fragments. Distinct hydrocarbon odour. Oily at 2.0 m bgl. Bulk bag at 2.5-3.0 m falls within water table, and is recovered as dark greenish brown, slightly sandy SILT/ GRAVEL. MADE GROUND.					3			
3.40	J			4.00										
3.50	SPT			4.00										
3.50 - 4.00	B			4.50										
4.00	D			5.00										
4.50	SPT			5.00										
4.50 - 5.00	B	N=25 (3,3/6,6,6,7)		5.00		Multicoloured mottled, yellowish brown, slightly silty, sandy GRAVEL. GRAVEL is sub angular to sub rounded, fine to coarse flint. Sand is predominantly coarse. Becoming very sandy with depth. KEMPTON PARK GRAVEL MEMBER					4			
5.00	D			5.50										
5.50	D			6.00										
6.00	SPT			6.50										
6.50	D			7.00										
7.00	D			7.50										
7.50	SPT	N=14 (3,3/4,4,3,3)		7.50		STRUCTURELESS CHALK. Recovered as sub angular to sub rounded, fine to coarse, moderately strong to very strong, white clasts in a creamy white to white with depth, silty matrix. Frequent sub-rounded, coarse gravel to cobble sized, rinded flint nodules. Occasional orange staining from 8.5 m bgl. SEAFORD AND NEWHAVEN CHALK FORMATION					5			
8.00	D			8.50										
8.50	D			8.50										
8.50 - 9.00	B			9.00										
9.00	SPT			9.50										
9.50	D			10.00										
10.00	D	N=5 (1,1/1,1,1,2)		8.50		STRUCTURELESS CHALK. Recovered as sub angular to sub rounded, fine to coarse, moderately strong to very strong, white clasts in a creamy white to white with depth, silty matrix. Frequent sub-rounded, coarse gravel to cobble sized, rinded flint nodules. Occasional orange staining from 8.5 m bgl. SEAFORD AND NEWHAVEN CHALK FORMATION					6			
9.50	D			9.50										
10.00	D			10.00										
10.00	D			10.00										
10.00	D			10.00										
10.00	D			10.00										
Start & End of Shift Observations				Borehole Diameter		Casing Diameter		Remarks:						
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)						Dia (mm)	
					12.00	200	12.00						200	
Chiselling				Installation				Water Strikes						
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
									2.50	2.50		20	2.10	
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

	Contract Name: Rivermead Leisure Centre				Client: Reading Borough Council				Hole ID: BH5					
	Contract Number: 17755		Start and End Date: 15-07-19 - 16-07-19		Logged By: DW		Checked By:		Status:		Hole Type: CP			
	Easting:		Northing:		Ground Level:		Plant Used: Dando150		Print Date: 28-01-2020		Scale: 1:50			
Weather:			Termination:				SPT Hammer: AR2102 Energy Ratio: 60%				Sheet 2 of 2			
Samples & In Situ Testing				Strata Details								Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/ Installation	
10.50	SPT D	N=14 (1,1/3,4,4,3)		(3.50)		STRUCTURELESS CHALK. Recovered as sub angular to sub rounded, fine to coarse, moderately strong to very strong, white clasts in a creamy white to white with depth, silty matrix. Frequent sub-rounded, coarse gravel to cobble sized, rinded flint nodules. Occasional orange staining from 8.5 m bgl. SEAFORD AND NEWHAVEN CHALK FORMATION								
11.00	D											11		
11.50	D													
12.00	SPT D	N=8 (5,3/3,2,1,2)			12.00									12
						End of Borehole at 12.00m								
												13		
												14		
												15		
												16		
												17		
												18		
												19		
												20		
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
					12.00	200	12.00	200						
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
									2.50	2.50		20	2.10	
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

	Contract Name: Rivermead Leisure Centre				Client: Reading Borough Council				Hole ID: BH6					
	Contract Number: 17755		Start and End Date: 19-07-19 - 22-07-19		Logged By: DW		Checked By:		Status:		Hole Type: CP			
	Easting:		Northing:		Ground Level:		Plant Used: Dando150		Print Date: 28-01-2020		Scale: 1:50			
Weather:			Termination:				SPT Hammer: AR2102 Energy Ratio: 60%				Sheet 1 of 2			
Samples & In Situ Testing				Strata Details								Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/Installation	
0.20	D			0.05		TARMAC Blackish brown and pink mottled, slightly sandy, silty GRAVEL. Gravel is angular to sub angular limestone, and tarmac. Underlain by woven plastic membrane. MADE GROUND. Greyish to greenish brown with depth, slightly sandy, clayey GRAVEL. Gravel is angular to sub angular, fine to coarse limestone, flint, and rare brick. Sand content increases with depth. MADE GROUND.								
0.50	D													
0.50 - 1.00	B													
1.00	D													
1.50	SPT B	N=13 (2,3/4,4,3,2)		1.50		Blackish brown to brown with depth, slightly sandy, clayey GRAVEL. Gravel is angular to sub angular, fine to coarse flint, clinker, brick and concrete. Frequent decomposing woody, and unidentifiable anthropogenic materials. Frequent plastic and fabric fragments. Odour of decomposition/faint hydrocarbon odour. MADE GROUND.						1		
1.50 - 2.00	D													
2.00	D													
2.50	SPT B													
2.50 - 3.00	B	N=9 (1,1/2,2,2,3)		(2.00)		Multicoloured mottled, greyish brown, slightly silty, slightly sandy, GRAVEL. Gravel is angular to sub rounded, fine to coarse flint. Very rare metal fragments. Possibly re-worked. Faint hydrocarbon odour, odour of decomposition. KEMPTON PARK GRAVEL MEMBER						2		
3.00	D													
3.50	SPT B													
3.50 - 4.00	B													
4.00	D	N=10 (1,2/2,3,2,3)		3.50		Yellowish brown very sandy GRAVEL. Gravel is angular to sub angular, fine to coarse, flint. KEPTON PARK GRAVEL MEMBER						3		
4.00	D													
4.50	SPT B													
4.50 - 5.00	B													
5.00	D	N=18 (3,3/4,4,5,5)		4.50		STRUCTURELESS CHALK. Recovered as sub angular to sub rounded, fine to coarse, moderately strong to very strong, white clasts in a creamy white to white with depth, silty matrix. Frequent sub-rounded, coarse gravel to cobble sized, rinded flint nodules. SEAFORD AND NEWHAVEN CHALK FORMATION						4		
5.00	D													
5.50	D													
6.00	SPT B													
6.00 - 6.50	B	N=16 (2,3/2,4,4,6)		(4.70)								5		
6.50	D													
7.00	D													
7.50	SPT B													
7.50 - 8.00	B	N=22 (4,5/5,6,5,6)		7.50								6		
8.00	D													
8.50	D													
9.00	SPT B													
9.00 - 9.20	B	N=7 (3,2/2,2,1,2)		9.20								7		
9.20 - 9.50	B													
9.50	D													
10.00	D													
Start & End of Shift Observations				Borehole Diameter		Casing Diameter		Remarks:						
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)						Dia (mm)	
							12.00						200	
Chiselling				Installation				Water Strikes						
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
									0.70		1.50	20	0.40	
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

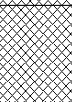
	Contract Name: Rivermead Leisure Centre				Client: Reading Borough Council				Hole ID: BH6					
	Contract Number: 17755		Start and End Date: 19-07-19 - 22-07-19		Logged By: DW		Checked By:		Status:		Hole Type: CP			
	Easting:		Northing:		Ground Level:		Plant Used: Dando150		Print Date: 28-01-2020		Scale: 1:50			
Weather:			Termination:				SPT Hammer: AR2102 Energy Ratio: 60%				Sheet 2 of 2			
Samples & In Situ Testing				Strata Details								Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/Installation	
10.50	SPT D	N=29 (25 for 140mm/14,5,4,6)		(2.80)		STRUCTURELESS CHALK. Recovered as sub angular to sub rounded, fine to coarse, moderately strong to very strong, white clasts in a creamy white to white with depth, silty matrix. Frequent sub-rounded, coarse gravel to cobble sized, rinded flint nodules. SEAFORD AND NEWHAVEN CHALK FORMATION								
11.00	D											11		
11.50	D													
12.00	SPT D	N=37 (3,5/19,9,5,4)			12.00									12
						End of Borehole at 12.00m								
												13		
												14		
												15		
												16		
												17		
												18		
												19		
												20		
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
							12.00	200						
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
									0.70		1.50	20	0.40	
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

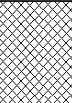
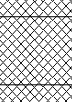
	Contract Name: Rivermead Leisure Centre				Client: Reading Borough Council				Hole ID: BH7						
	Contract Number: 17755		Start and End Date: 15-07-19		Logged By: DW		Checked By:		Status:		Hole Type: CP				
	Easting:		Northing:		Ground Level:		Plant Used: Dando150		Print Date: 28-01-2020		Scale: 1:50				
Weather:			Termination:				SPT Hammer: AR2144 Energy Ratio: 72%				Sheet 1 of 2				
Samples & In Situ Testing				Strata Details								Groundwater			
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/Installation		
0.10 0.20 0.30 0.40 0.50 0.50 - 1.00	D J D J J B	N=2 (2,1/1,0,1,0)		0.10 0.30 (0.90)	 TARMAC  Pinkish brown sandy GRAVEL. Gravel is angular to sub angular, fine to coarse, limestone, flint, and tarmac. Underlain by woven fabric membrane. MADE GROUND.  Green and black mottled, slightly sandy, slightly gravelly, silty CLAY. Gravel is angular to sub angular, fine to coarse flint, with occasional glass fragments. Frequent decomposing woody organics. Odour of hydrocarbons/decomposition. Frequent plastic fragments. MADE GROUND.	           STRUCTURELESS CHALK. Recovered as sub angular to sub rounded, fine to coarse, moderately strong to very strong, white clasts in a locally light brown mottled, silty matrix. Occasional sub-rounded, fine to coarse, rinded flint gravel and cobbles. Occasional river terrace gravels to 9.45 m bgl. Occasional orange staining from 10.5 m bgl. SEAFORD AND NEWHAVEN CHALK FORMATIO									
1.20 1.50 1.50 - 2.00	D J SPT J B			N=23 (2,3/5,5,6,7)	1.20 (1.60)									Black and brown mottled, dark green, slightly sandy, silty CLAY. Occasional angular to sub angular, fine to coarse flint, brick and chalk gravel. Occasional plastic and fabric fragments. Odour of decomposition. Hydrocarbon odour from 2.5 to 2.8 m bgl Black staining from 2.2 to 2.8 m bgl. MADE GROUND.	1
2.30 2.50 2.50 - 2.80 2.80	D SPT J B D J				2.80 (0.70)									Greenish brown, slightly sandy, slightly silty GRAVEL. Gravel is angular to sub rounded, fine to medium flint. Rare sub rounded coarse flint gravel. Faint hydrocarbon odour/odour of decomposition. Rare metal fragments. MADE GROUND.	2
3.50 3.50 - 4.00	SPT B				3.50 (0.80)									Greenish brown, slightly sandy, slightly silty, GRAVEL. Gravel is angular to rounded, fine to medium flint. Rare angular to rounded, fine to medium coarse flint gravel. KEMPTON PARK GRAVEL MEMBE	3
4.30 4.50 4.50 - 5.00	D SPT B	N=37 (3,5/6,9,11,11)	4.30 (4.50)		Multi-coloured mottled, slightly sandy GRAVEL. Gravel is angular to rounded, fine to coarse flint. KEMPTON PARK GRAVEL MEMBER	4									
5.50	D		5.50		5										
6.00 6.00 - 6.50	SPT B		N=43 (4,6/7,10,12,14)	6.00 (4.50)		6									
7.00	D			7.00		7									
7.50 7.50 - 8.00	SPT B	50 (5,10/50 for 170mm)		7.50 (4.50)		8									
8.80 9.00 9.00 - 9.50	D SPT B	N=6 (1,1/1,2,1,2)		8.80 (4.50)		9									
10.00	D		10.00		10										
Start & End of Shift Observations				Borehole Diameter		Casing Diameter		Remarks:							
Date	Time		Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)					Depth (m)	Dia (mm)		
					9.00 12.00	200 150	9.00 12.00					200 150			
Chiselling				Installation				Water Strikes							
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	
									3.10	3.10		20	3.00		
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.															

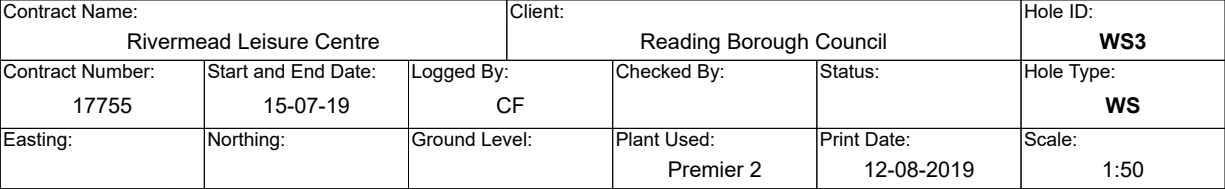
	Contract Name: Rivermead Leisure Centre				Client: Reading Borough Council				Hole ID: BH7					
	Contract Number: 17755		Start and End Date: 15-07-19		Logged By: DW		Checked By:		Status:		Hole Type: CP			
	Easting:		Northing:		Ground Level:		Plant Used: Dando150		Print Date: 28-01-2020		Scale: 1:50			
Weather:			Termination:				SPT Hammer: AR2144 Energy Ratio: 72%				Sheet 2 of 2			
Samples & In Situ Testing				Strata Details								Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/ Installation	
10.50 10.50 - 11.00	SPT B	N=14 (1,2/2,2,5,5)		(3.20)		STRUCTURELESS CHALK. Recovered as sub angular to sub rounded, fine to coarse, moderately strong to very strong, white clasts in a locally light brown mottled, silty matrix. Occasional sub-rounded, fine to coarse, rinded flint gravel and cobbles. Occasional river terrace gravels to 9.45 m bgl. Occasional orange staining from 10.5 m bgl. SEAFORD AND NEWHAVEN CHALK FORMATIO						11		
11.50	D											12		
12.00	SPT	N=19 (2,1/3,5,6,5)		12.00		End of Borehole at 12.00m						12		
												13		
												14		
												15		
												16		
												17		
												18		
												19		
												20		
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
					9.00 12.00	200 150	9.00 12.00	200 150						
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
									3.10	3.10		20	3.00	
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

	Contract Name: Rivermead Leisure Centre				Client: Reading Borough Council				Hole ID: BH8					
	Contract Number: 17755		Start and End Date: 23-07-19		Logged By: DW		Checked By:		Status:		Hole Type: CP			
	Easting:		Northing:		Ground Level:		Plant Used: Dando150		Print Date: 28-01-2020		Scale: 1:50			
Weather:			Termination:					SPT Hammer: AR2102 Energy Ratio: 60%				Sheet 1 of 2		
Samples & In Situ Testing				Strata Details								Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/Installation	
0.20	D			0.05		TARMAC								
0.50	D			(0.45)		Pinkish brown to yellowish brown, slightly silty sandy GRAVEL. Gravel is angular to sub angular, fine to coarse, limestone, flint and rare brick. MADE GROUND.								
0.50 - 1.00	D			0.50		Yellowish brown, slightly silty gravelly SAND. Gravel is angular to sub angular fine to coarse, flint. Rare fabric fragments. MADE GROUND								
1.00	D			(0.50)		Yellowish brown slightly clayey, sand and GRAVEL. Gravel is angular to sub rounded, fine to coarse flint. Faint odour of decomposition. MADE GROUND								
1.50	SPT B	N=4 (1,0/1,1,0,2)		1.00		1								
1.50 - 2.00														
2.00	D	2.00		2										
2.50	SPT B	N=6 (1,1/1,1,2,2)		(1.50)										
2.50 - 3.00				3.00		Blackish brown, slightly gravelly blackish brown CLAY. Gravel is angular to sub rounded. Fine to coarse flint and rare brick and clinker, frequent unidentified decomposing organic fragments. Occasional decomposing fabric and wood fragments. MADE GROUND								
3.00	D	3.00		3										
3.50	SPT B	N=7 (1,0/1,1,2,3)		3.50										
3.50 - 4.00				Multicoloured mottled, greyish brown, slightly silty, slightly sandy, GRAVEL. Gravel is angular to sub rounded, fine to coarse flint. Very rare metal fragments. KEMPTON PARK GRAVEL MEMBER										
4.00	D			4.00		4								
4.50	SPT B	N=17 (3,3/4,3,5,5)		4.50 - 5.00										
5.00	D	5.00		5										
5.50	D	5.50		5.50										
6.00	SPT B	N=17 (2,3/3,4,5,5)		6.00		6								
6.00 - 6.50				6.00 - 6.50										
6.50	D	6.50		7										
7.00	D	7.00		7.00										
7.50	SPT B	N=22 (3,4/5,5,5,7)		7.50		7.50 - 8.00								
7.50 - 8.00				8.00										
8.00	D	8.00		8.00										
8.50	D	8.50		8.50										
8.90	SPT B	N=6 (4,3/2,1,1,2)		8.90		STRUCTURELESS CHALK. Recovered as sub angular to sub rounded, fine to coarse, moderately strong to very strong, white clasts in a creamy white to white with depth, silty matrix. Frequent sub-rounded, coarse gravel to cobble sized, rounded flint nodules. SEAFORD AND NEWHAVEN CHALK FORMATION								
9.00				9.00 - 9.50										
9.50	D	9.50		9.50										
10.00	D	10.00		10										
Start & End of Shift Observations				Borehole Diameter		Casing Diameter		Remarks:						
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)							Dia (mm)
							12.00							200
Chiselling				Installation				Water Strikes						
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

	Contract Name: Rivermead Leisure Centre				Client: Reading Borough Council				Hole ID: BH8					
	Contract Number: 17755		Start and End Date: 23-07-19		Logged By: DW		Checked By:		Status:		Hole Type: CP			
	Easting:		Northing:		Ground Level:		Plant Used: Dando150		Print Date: 28-01-2020		Scale: 1:50			
Weather:			Termination:				SPT Hammer: AR2102 Energy Ratio: 60%				Sheet 2 of 2			
Samples & In Situ Testing				Strata Details								Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/Installation	
10.50	SPT D	N=13 (1,2/2,4,3,4)		(3.10)		STRUCTURELESS CHALK. Recovered as sub angular to sub rounded, fine to coarse, moderately strong to very strong, white clasts in a creamy white to white with depth, silty matrix. Frequent sub-rounded, coarse gravel to cobble sized, rounded flint nodules. SEAFORD AND NEWHAVEN CHALK FORMATION								
11.00	D											11		
11.50	D													
12.00	SPT D	N=13 (2,2/3,4,3,3)			12.00									12
						End of Borehole at 12.00m								
												13		
												14		
												15		
												16		
												17		
												18		
												19		
												20		
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
							12.00	200						
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

	Contract Name: Rivermead Leisure Centre				Client: Reading Borough Council				Hole ID: WS1					
	Contract Number: 17755		Start and End Date: 15-07-19		Logged By: CF		Checked By:		Status:		Hole Type: WS			
	Easting:		Northing:		Ground Level:		Plant Used: Premier 2		Print Date: 12-08-2019		Scale: 1:50			
Weather:			Termination:					Sheet 1 of 1						
Samples & In Situ Testing					Strata Details							Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/ Installation	
0.30	J D			0.20		TARMAC								
				(0.80)		Dark brown sandy clayey GRAVEL. Gravel is angular to sub rounded clasts of flint. MADE GROUND								
0.80	J D			1.00		Soft dark grey slightly gravelly sandy silty CLAY. Sand is fine to coarse, gravel is fine to medium, sub angular to sub rounded, made up of flint, brick and concrete. Occasional black staining, Decaying organic material odour. MADE GROUND.						1		
1.20	J D			(1.50)								2		
1.80	J D			2.50		Dark grey slightly sandy, slightly silty, clayey, fine to medium sub angular to sub rounded flint, brick and chalk GRAVEL. Sand is fine to coarse. Frequent rootlets, odour of decomposition MADE GROUND.						3		
2.30	J D			(0.50)										
2.80	J D			3.00		End of Borehole at 3.00m								
												4		
												5		
												6		
												7		
												8		
												9		
												10		
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
									2.00			20	2.00	
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

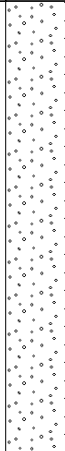
	Contract Name: Rivermead Leisure Centre				Client: Reading Borough Council				Hole ID: WS2					
	Contract Number: 17755		Start and End Date: 15-07-19		Logged By: CF		Checked By:		Status:		Hole Type: WS			
	Easting:		Northing:		Ground Level:		Plant Used: Premier 2		Print Date: 12-08-2019		Scale: 1:50			
Weather:			Termination:					Sheet 1 of 1						
Samples & In Situ Testing					Strata Details							Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/Installation	
0.40	J D			(0.70)		Brown very silty sandy GRAVEL with frequent rootlets. Gravel is angular to sub rounded clasts of flint.								
0.80	D			0.70 0.85		Greyish brown sandy gravelly desiccated CLAY. Gravel is angular to sub rounded, fine to coarse, flint, limestone with rare brick and clinker. Rare rootlets. MADE GROUND.						1		
1.20	D			(0.45)		Greyish brown to brownish grey mottled slightly gravelly sandy CLAY. Gravel is angular to sub rounded, fine to coarse, flint, desiccated concrete, limestone with rare clinker and brick. Rare rootlets MADE GROUND.								
1.40	D			1.30 1.50		Multicoloured mottled, reddish brown, slightly sandy, slightly clayey GRAVEL. Gravel is angular to rounded, fine to medium flint, with rare limestone. MADE GROUND								
						End of Borehole at 1.50m								
												2		
												3		
												4		
												5		
												6		
												7		
												8		
												9		
												10		
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
												0	0.00	No groundwater encountered.
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														



Weather:	Termination:		Sheet 1 of 1
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Samples & In Situ Testing			Strata Details						Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description		Water Strike	Backfill/ Installation	
0.20	D			0.15		TARMAC	1			
						Limestone scalping. MADE GROUND				
0.40	J D					Greyish brown and orange very clayey sandy GRAVEL. Gravel is fine to medium occasionally coarse angular to sub rounded clasts of flint and rare brick. MADE GROUND				
0.80	J D			(0.70)						
1.20	D			1.00		Brown mottled, dark brown, slightly sandy, gravelly CLAY. Gravel is angular to sub-rounded, fine to coarse flint,, with rare brick. Occasional rootlets. MADE GROUND.				
1.60	D			1.50		Brownish grey, slightly sandy, very gravelly CLAY. Gravel is angular to sub-rounded, fine to coarse, flint, brick, and concrete. Occasional medium sized pockets of SAND. Rare rootlets. Rare plastic fragments. Rare black staining. MADE GROUND.				
				2.00		Black and dark brown mottled, slightly sandy, gravelly, peaty CLAY. Gravel is angular to sub-rounded, fine to coarse, clinker and unidentified anthropogenic materials. Frequent, wood, plastic, glass, and organic matter. Distinct hydrocarbon odour/odour of decomposition. MADE GROUND.	2			
2.50	D			(0.80)						
2.90	D			2.80		Light yellowish brown, slightly clayey, SAND AND GRAVEL. Gravel is sub-angular to sub-rounded, fine to coarse, flint. KEMPTON PARK GRAVEL MEMBER	3			
				(0.60)						
3.60	D	3.40		Light yellowish brown, gravelly SAND. Gravel is sub-angular to sub-rounded, fine to coarse, flint. KEMPTON PARK GRAVEL MEMBER						
		(0.60)								
		4.00		End of Borehole at 4.00m				4		
							5			
							6			
							7			
							8			
							9			
							10			

Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
									2.70			20	2.70	
									Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.					

	Contract Name: Rivermead Leisure Centre				Client: Reading Borough Council				Hole ID: WS4					
	Contract Number: 17755		Start and End Date: 15-07-19		Logged By: CF		Checked By:		Status:		Hole Type: WS			
	Easting:		Northing:		Ground Level:		Plant Used: Premier 2		Print Date: 12-08-2019		Scale: 1:50			
Weather:			Termination:					Sheet 1 of 1						
Samples & In Situ Testing				Strata Details								Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill/ Installation	
1.20 1.50 1.70	D			(0.30)		TARMAC over angular limestone scalplings. MADE GROUND						1		
				0.30		Greyish brown and orange very clayey sandy GRAVEL. Gravel is fine to medium occasionally coarse angular to sub rounded clasts of flint and rare brick. MADE GROUND								
				(0.70)										
				1.00		Brown, slightly clayey, SAND AND GRAVEL. Gravel is angular to sub-rounded, fine to coarse, flint. MADE GROUND.								
				(0.30)		Black and dark brown mottled, slightly sandy, gravelly, peaty CLAY. Gravel is angular to sub-rounded, fine to coarse, clinker and unidentified anthropogenic materials. Frequent, wood, plastic, glass, and organic matter. Distinct hydrocarbon odour/odour of decomposition. MADE GROUND								
2.80	D			(0.30)		Black, slightly sandy, slightly gravelly, CLAY. Gravel is angular, fine to coarse flint, brick, and clinker. Frequent plastic, glass, fabric, wood, and unidentified fragments. MADE GROUND.						2		
				1.60										
				(1.10)								3		
				2.70		Yellowish brown, slightly clayey, SAND AND GRAVEL. Gravel is sub-angular to sub-rounded, fine to coarse, flint. Pocket of grey sandy gravel. KEMPTON PARK GRAVEL MEMBER								
				(0.30)										
				3.00		End of Borehole at 3.00m						3		
												4		
												5		
												6		
												7		
												8		
												9		
												10		
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
									2.00			20	2.00	
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														

Appendix B Geotechnical In-Situ and Laboratory Testing

Appendix B.1 Classification

Classification based on SPT “N” values:

The inferred undrained strength of the cohesive soils was based on the SPT “N” blow counts, derived from the relationship suggested by Stroud (1974) and classified using Table B.1.1. (Ref: Stroud, M. A. 1974, “The Standard Penetration Test – its application and interpretation”, Proc. ICE Conf. on Penetration Testing in the UK, Birmingham. Thomas Telford, London.).

Table B.1.1 SPT “N” Blow Count Cohesive Classification

Classification	Undrained Cohesive Strength C_u (kPa)
Extremely low	<10
Very low	10 – 20
Low	20 – 40
Medium	40 – 75
High	75 – 150
Very high	150 – 300
Extremely high	> 300

Note: (Ref: BS EN ISO 14688-2:2004+A1:2013 Clause 5.3.)

The relative density of granular soils was classified based of the relationship given in Table B.1.2.

The *UK National Annex to Eurocode 7: Geotechnical design – Part 2: Ground investigation and testing*, NA 3.7 SPT test, BS EN 1997-2:2007, Annex F states “Relative density descriptions on borehole records should also be based on uncorrected SPT N values, unless significantly disturbed, using the density classification in BS 5930:2015, Table 7.

Table B.1.2 SPT “N” Blow Count Granular Classification

Classification	SPT “N” blow count (blows/300mm)
Very loose	0 to 4
Loose	4 to 10
Medium dense	10 to 30
Dense	30 to 50
Very dense	Greater than 50

Note: (Ref: The Standard Penetration Test (SPT): Methods and Use, CIRIA Report 143, 1995)

Chalk samples recovered are disturbed by the sampling process. Therefore, it is difficult to assess an accurate chalk grade for in accordance with CIRIA C574 ‘Engineering in

Chalk'. In the absence of a standardised correlation between SPT "N" values and chalk grade for the most recent chalk classification (CIRIA C574) a broad indication of the in-situ chalk grade can be assessed using a paper by T.R.M. Wakeling from a site in Mundford, Norfolk, which compares SPT "N" values to the old Spink & Norbury chalk classification. From the Spink & Norbury classification it is possible to infer a basic CIRIA Grade (structureless or structured), as outlined in Table B.1.3.

Table B.1.3 Interpretation of SPT "N" Blow Counts in Chalk

SPT "N" Value Range	Spink & Norbury Grade	Inferred CIRIA Grade
<8	VI	Structureless (Dm)
8 – 15	V	Structureless (Dc)
15 – 20	IV	Structured chalk (C5 – A1)
20 – 25	III	Structured chalk (C5 – A1)
25 – 35	II	Structured chalk (C5 – A1)
>35	I	Structured chalk (C5 – A1)

Note:

Classification of DCP results to CBR:

The DCP consists of a cone fixed to the bottom of a 575mm vertical rod. An 8kg weight is repeatedly lifted and dropped onto an anvil at the mid-height of the rod to deliver a 'blow'. A vertical scale alongside the rod is used to measure the depth of penetration of the cone. These measurements are then converted to CBR values using the following equation derived from the DTP Interim Advice Note 73/06 – Design Guidance for Road Pavement Foundations:

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10}(\text{mm/blow})$$

Appendix B.2 Interpretation

Table B.2.1 Interpretation of SPT Tests

BH	Strata	SPT N60 Blow Counts	Inferred Cohesive Strength/Granular Density/ Approximate CIRIA Chalk Grade
BH1	KPGR 2.20 – 4.50 Gravelly CLAY	2	Very low (Cu = 10kPa)
	KPGR 4.50 – 10.50 Sandy GRAVEL	11 – 23	Medium dense
	SNCK 10.50 – 13.00 CHALK	10 – 12	Structureless Dc chalk
	DNCK 13.00 – 20.00 CHALK	15 – 50+	Structured C5 – A1 chalk
BH2	KPGR 3.50 – 9.50 Sandy GRAVEL	7 – 29	Loose to medium dense
	SNCK 9.50 – 20.00 CHALK	7 – 50+	Structureless Dc to structured C5 – A1 chalk
BH3	KPGR 4.30 – 5.00 Gravelly CLAY	8	Low to medium (Cu = 40kPa)
	KPGR 5.00 – 9.00 Sandy GRAVEL	14	Medium dense
	SNCK 9.00 – 15.00 CHALK	12 – 17	Structureless Dc to structured C5 – A1 chalk
BH4	KPGR 2.50 – 8.50 Sandy GRAVEL	21 – 50+	Dense to very dense
	SNCK 8.50 – 13.00 CHALK	12 – 16	Structureless Dc to structured C5 – A1 chalk
	SNCL 13.00 – 15.00	29 – 31	Structured C5 – A1 chalk
BH5	KPGR 3.40 – 8.50 Sandy GRAVEL	11 – 33	Medium dense to dense
	SNCK 8.50 – 10.00 CHALK	5	Structureless Dm chalk
	SNCK 10.00 – 12.00 CHALK	8 – 14	Structureless Dc chalk

BH	Strata	SPT N60 Blow Counts	Inferred Cohesive Strength/Granular Density/ Approximate CIRIA Chalk Grade
BH6	KPGR 3.50 – 9.20 Sandy GRAVEL	10 – 22	Medium dense
	SNCK 9.20 – 12.00 CHALK	29 – 37	Structured C5 – A1 chalk
BH7	KPGR 3.50 – 8.80 Sandy GRAVEL	29 – 50+	Medium dense to very dense
	SNCK 8.80 – 11.00 CHALK	7 – 17	Structureless Dm to structured C5 – A1 chalk
	SNCK 11.00 – 12.0 CHALK	23	Structured C5 – A1 chalk
BH8	KPGR 3.50 – 8.90 Sandy GRAVEL	7 – 22	Loose to medium dense
	KPGR 8.90 – 12.00 CHALK	6 – 13	Structureless Dm to Dc chalk

Note: Rig efficiency: 60% (72% for BH4 & BH7)

Table B.2.2 Interpretation of DPSH Blow Counts

DP	Strata	Equivalent SPT N60 Blow Counts	Inferred Cohesive Strength/Granular Density
DPI	KPGR ¹ 3.80 – 4.00 Sandy GRAVEL	30 – 42	Dense
	KPGR ¹ 4.00 – 6.00 Sandy GRAVEL	15 – 27	Medium dense
DP2	KPGR ¹ 3.50 – 6.00 Sandy GRAVEL	11 – 46	Medium dense to dense
DP3	KPGR ¹ 2.60 – 6.00 Sandy GRAVEL	19 – 46	Medium dense to dense
DP4	KPGR ¹ 2.60 – 6.00 Sandy GRAVEL	19 – 42	Medium dense to dense

Note: ¹ Ground conditions inferred past the base of windowless sampler boreholes. Rig efficiency: 79.93%

Table B.2.3 Interpretation of QUU Tests

Location	Stratum	Sample Depth (m bgl)	Moisture Content (%)	Soil Strength	Shear Strength (kPa)
BH1	KPGR	3.50	22	Low	32

Table B.2.4 Interpretation of Atterberg Limit Tests

Stratum	Moisture Content (%)	Plasticity Index (%)	Passing 425µm Sieve (%)	Modified Plasticity Index (%)	Soil Classification	Volume Change Potential	
						BRE	NHBC
KPGR	26	45	66	30	CH	Medium	Medium

Note: BRE Volume Change Potential refers to BRE Digest 240 (based on Atterberg results)

NHBC Volume Change Potential refers to NHBC Standards Chapter 4.2

Soils Classification based on British Soil Classification System

The most common use of the term clay is to describe a soil that contains enough clay-sized material or clay minerals to exhibit cohesive properties. The fraction of clay-sized material required varies, but can be as low as 15%. Unless stated otherwise, this is the sense used in Digest 240. The term can be used to denote the clay minerals. These are specific, naturally occurring chemical compounds, predominately silicates. The term is often used as a particle size descriptor. Soil particles that have a nominal diameter of less than 2 µm are normally considered to be of clay size, but they are not necessarily clay minerals. Some clay minerals are larger than 2 µm and some particles, 'rock flour' for example, can be finer than 2 µm but are not clay minerals.

(The Atterberg Limit Tests were undertaken in accordance with BS 1377:Part 2:1990 Clauses 3.2, 4.3 and 5)

Table B.2.5 Interpretation of PSD Tests

Location	Depth (m bgl)	Soil Description	Volume Change Potential		Passing 63µm Sieve (%)
			BRE	NHBC	
BH1	4.50-5.00	Slightly silty sandy GRAVEL	No	No	3
BH1	6.00-6.50	Slightly silty very sandy GRAVEL	No	No	1
BH1	7.50-8.00	Slightly silty sandy GRAVEL	No	No	1
BH1	9.00-9.50	Sandy GRAVEL	No	No	0
BH4	3.50-4.00	Very gravelly silty SAND	No	No	7
BH4	6.00-6.50	Slightly silty very gravelly SAND	No	No	2
BH5	6.00-6.50	Slightly silty sandy GRAVEL	No	No	2
BH5	7.50-8.00	Slightly silty sandy GRAVEL	No	No	1
BH7	3.50-4.00	Very sandy silty GRAVEL	No	No	5
BH7	6.00-6.50	Slightly silty sandy GRAVEL	No	No	3

Note: BRE 240 states that a soil has a volume change potential when the clay fraction **exceeds 15%**. Only the silt and clay combined fraction are determined by sieving therefore the volume change potential is estimated from the percentage passing the 63µm sieve. NHBC Standards Chapter 4.2 states that a soil is shrinkable if the percentage of silt and clay passing the 63µm sieve is greater than 35% and the Plasticity Index is greater than 10%.

(The Particle Size Distribution Tests were undertaken in accordance with BS 1377: Part 2: 1990 Clause 9)

Table B.2.6 Interpretation of SMC Tests

Location	Depth (m bgl)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Moisture Content (%)	Saturation Moisture Content (%)	Density Classification (CIRIA)
BH1*	11.00	2.20	1.74	26	20	High
BH1*	13.00	1.95	1.59	23	26	Medium

Location	Depth (m bgl)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Moisture Content (%)	Saturation Moisture Content (%)	Density Classification (CIRIA)
BH1*	15.00	2.47	1.99	24	13	Very high
BH1*	17.00	2.24	1.81	24	18	High
BH1*	19.00	2.28	1.84	24	17	High
BH4*	9.00	2.30	1.84	25	17	High
BH4*	12.00	2.09	1.68	24	22	Medium
BH4*	13.50	2.20	1.76	25	20	High
BH7*	9.00	2.31	1.82	27	18	High
BH7	10.50	2.15	1.66	29	23	Medium

Note: (The Determination of Saturation Moisture Content of Chalk Tests were made in accordance with BS 1377: Part 2: 1990 Clauses 3.3). * Indicates non-standard testing as no intact chalk clast of sufficient volume were present in sample.

Appendix B.3 Geotechnical In-Situ and Laboratory Results



Project Name:	Rivermead Leisure Centre	Project No.	17755	Co-ords:		Hole Type	DP
Location:	Richfield Avenue, Reading, Berkshire RG1 8EQ	Level:	m AOD			Scale	1:50
Client:	Reading Borough Council	Dates:	15-07-2019			Logged By	

Depth (m)	Blows/100mm				Torque (Nm)	
	10	20	30	40		
1	6 7 5 4 4 4 4				20	
2	3 8 17 19 18 16 13 12 8 4 4 2 2 3 3 4 4 2					
3	1 2 2 2 3 2 9 12 12 12 10 12 8 9 9 7 8 6 3 4 7 8 8 10 11 11 10 11 8 6					
4						60
5						
6						
7						
8						
9						
10						
Remarks						
Fall Height 750mm					Cone Base Diameter 50.5mm	
Hammer Weight 63.5kg					Final Depth 6m	
Probe Type DPSH-B					Energy Ratio (Er) 79.93%	



Project Name:	Rivermead Leisure Centre	Project No.	17755	Co-ords:		Hole Type	DP
Location:	Richfield Avenue, Reading, Berkshire RG1 8EQ	Level:	m AOD			Scale	1:50
Client:	Reading Borough Council	Dates:	15-07-2019			Logged By	

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
1	8 15 13 9 10 5 1 4 2 2 2 3 2 3				5
2	1 2 1 1 1 2 5 14 12 12 9 8 8 6 6 5 7 8 8 10 10 9 10 8 9 8 7 9 11 10 8 9 8 8 8 8 6 6				20
3					20
4					20
5					20
6					20
7					
8					
9					
10					
Remarks					
Fall Height 750mm					Cone Base Diameter 50.5mm
Hammer Weight 63.5kg					Final Depth 6m
Probe Type DPSH-B					Energy Ratio (Er) 79.93%
					

Project Name:	Rivermead Leisure Centre	Project No.	17755	Co-ords:		Hole Type	DP
Location:	Richfield Avenue, Reading, Berkshire RG1 8EQ	Level:	m AOD			Scale	1:50
Client:	Reading Borough Council	Dates:	15-07-2019			Logged By	

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
1	8 12 11 12 12 13 13 11 11				10
2	4 4 4 2 2 3 2 2 1 2 1 4 9 10 11 7 6 8 9 11 10 6 5 5 5				20
3	8 8 8 7 8 7 7 10 9 10 12 10 11 11 10 7 5 5 6				20
4	8 8 8 7 8 7 7 10 9 10 12 10 11 11 10 7 5 5 6				20
5	7 10 10 11 11 10 7 5 5 6 7				40
6	5 5 6 7				30
7					
8					
9					
10					
Remarks	Fall Height 750mm		Cone Base Diameter 50.5mm		
	Hammer Weight 63.5kg		Final Depth 6m		
	Probe Type DPSH-B		Energy Ratio (Er) 79.93%		

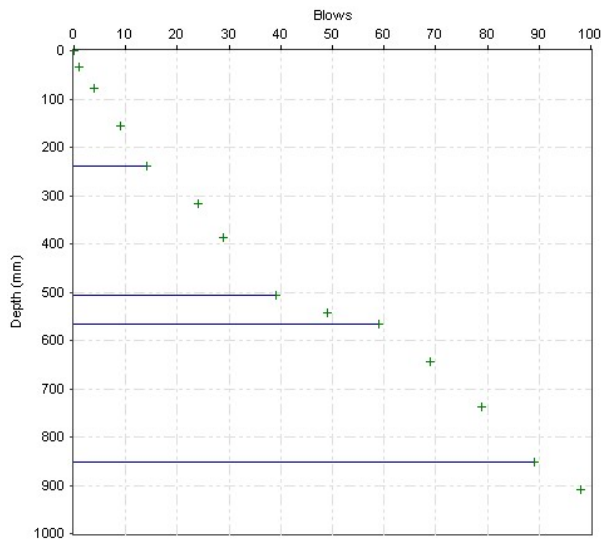
DCP Layer Strength Analysis Report

Project Name: DCPs

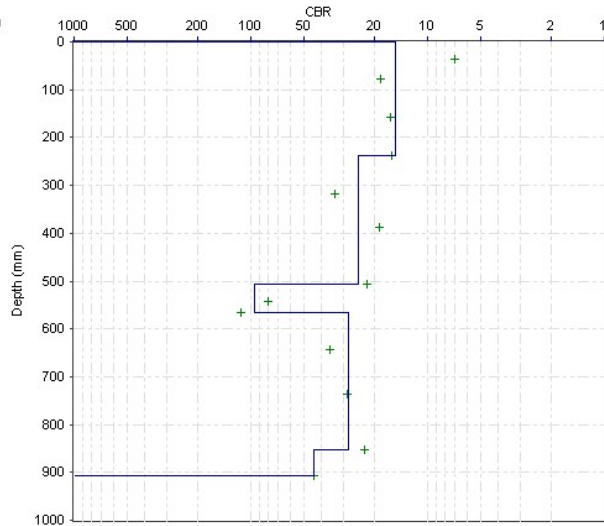
Chainage (km): 1.000
 Direction:
 Location/Offset: Carriageway
 Cone Angle: 60 degrees
 Zero Error (mm): 42
 Test Date: 19/07/2019

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 1.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	17.00	15	238	238	Base	0.04	0.37	0.37	0.37
2	10.76	25	269	507	Base	0.06	0.64	0.64	0.64
3	3.00	95	60	567	Base	0.14	0.32	0.32	0.32
4	9.50	28	285	852	Base	0.07	0.75	0.75	0.75
5	6.22	44	56	908	Base	0.09	0.21	0.21	0.21

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	2.29	2.29	2.29
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	2.29	2.29	2.29

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

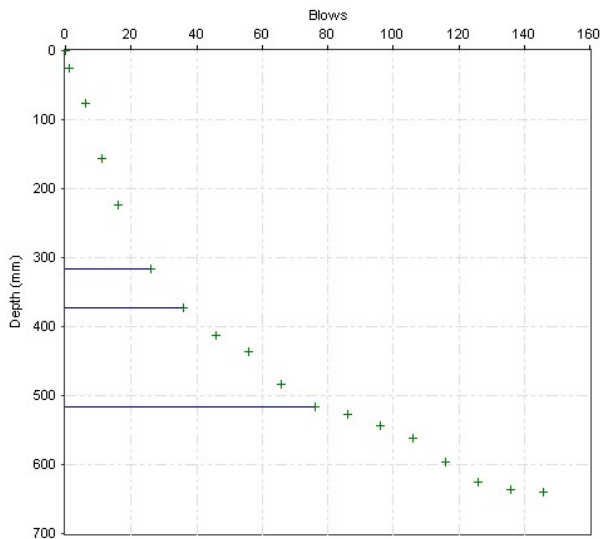
DCP Layer Strength Analysis Report

Project Name: DCPs

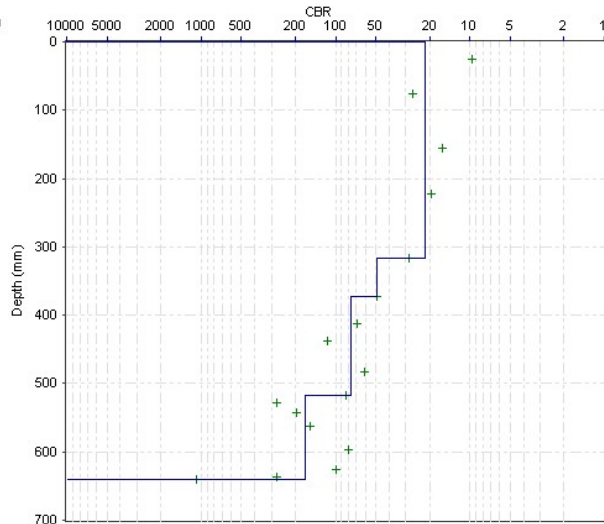
Chainage (km): 2.000
 Direction:
 Location/Offset: Carriageway
 Cone Angle: 60 degrees
 Zero Error (mm): 48
 Test Date: 19/07/2019

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 2.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	12.15	22	316	316	Base	0.05	0.67	0.67	0.67
2	5.60	49	56	372	Base	0.10	0.22	0.22	0.22
3	3.63	77	145	517	Base	0.13	0.73	0.73	0.73
4	1.76	166	123	640	Base	0.14	0.70	0.70	0.70

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	2.32	2.32	2.32
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	2.32	2.32	2.32

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

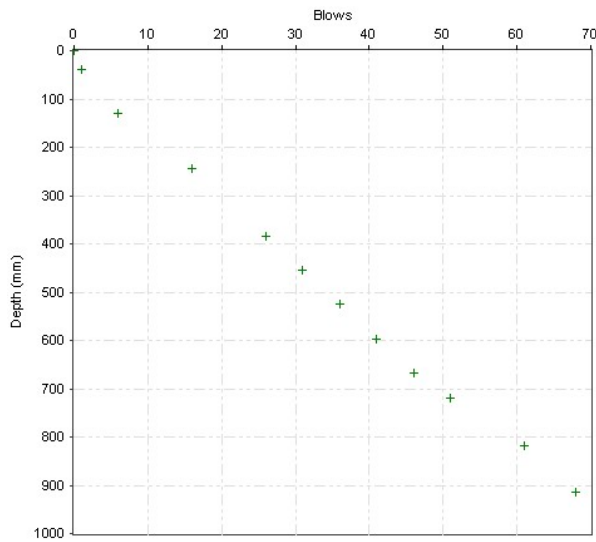
DCP Layer Strength Analysis Report

Project Name: DCPs

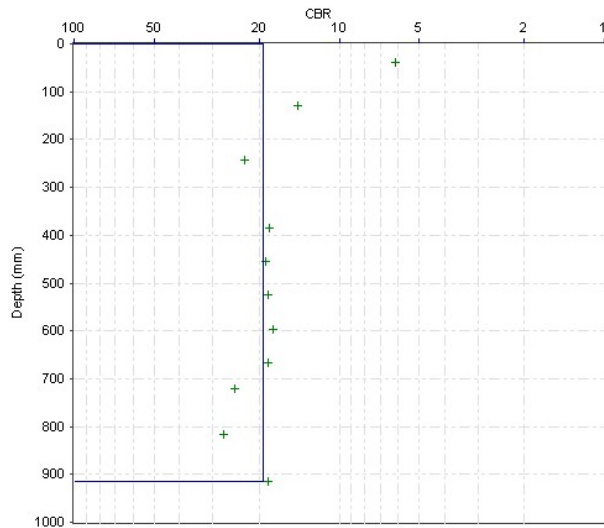
Chainage (km): 3.000
 Direction:
 Location/Offset: Carriageway
 Cone Angle: 60 degrees
 Zero Error (mm): 35
 Test Date: 19/07/2019

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 3.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	13.46	19	915	915	Base	0.05	1.78	1.78	1.78

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	1.78	1.78	1.78
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	1.78	1.78	1.78

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

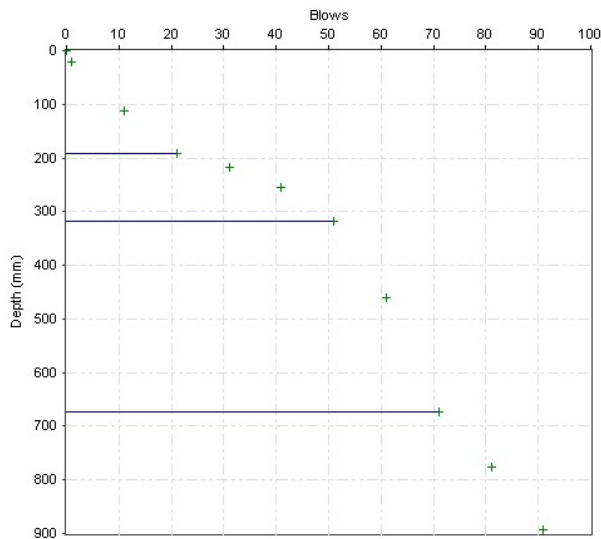
DCP Layer Strength Analysis Report

Project Name: DCPs

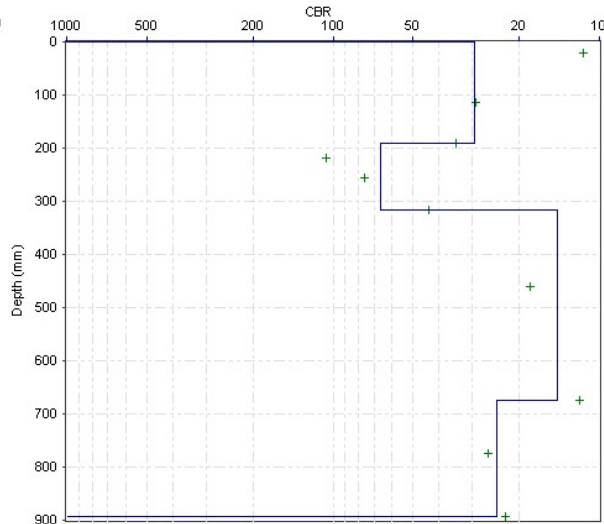
Chainage (km): 4.000
 Direction:
 Location/Offset: Carriageway
 Cone Angle: 60 degrees
 Zero Error (mm): 58
 Test Date: 19/07/2019

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 4.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	9.10	29	191	191	Base	0.07	0.52	0.52	0.52
2	4.20	66	126	317	Base	0.12	0.59	0.59	0.59
3	17.85	14	357	674	Base	0.04	0.53	0.53	0.53
4	10.90	24	218	892	Base	0.06	0.51	0.51	0.51

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	2.16	2.16	2.16
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	2.16	2.16	2.16

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

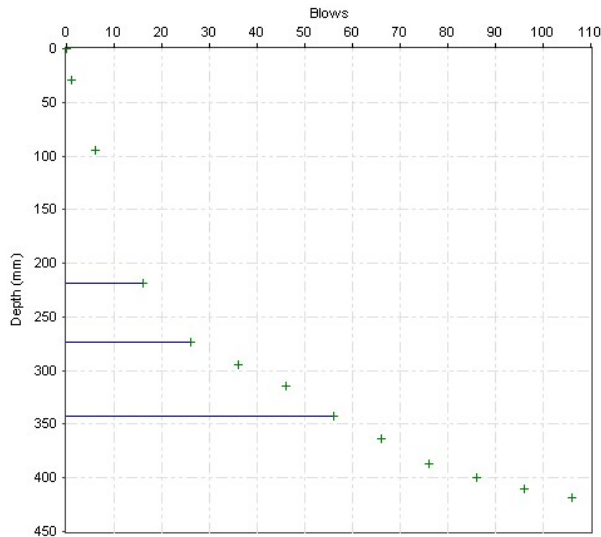
DCP Layer Strength Analysis Report

Project Name: DCPs

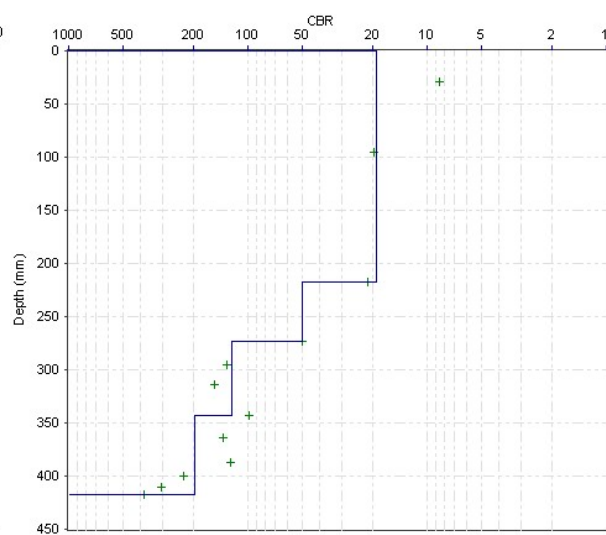
Chainage (km): 5.000
 Direction:
 Location/Offset: Carriageway
 Cone Angle: 60 degrees
 Zero Error (mm): 51
 Test Date: 19/07/2019

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 5.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	13.63	19	218	218	Base	0.05	0.42	0.42	0.42
2	5.50	50	55	273	Base	0.10	0.22	0.22	0.22
3	2.33	123	70	343	Base	0.14	0.39	0.39	0.39
4	1.50	197	75	418	Base	0.14	0.43	0.43	0.43

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	1.46	1.46	1.46
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	1.46	1.46	1.46

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

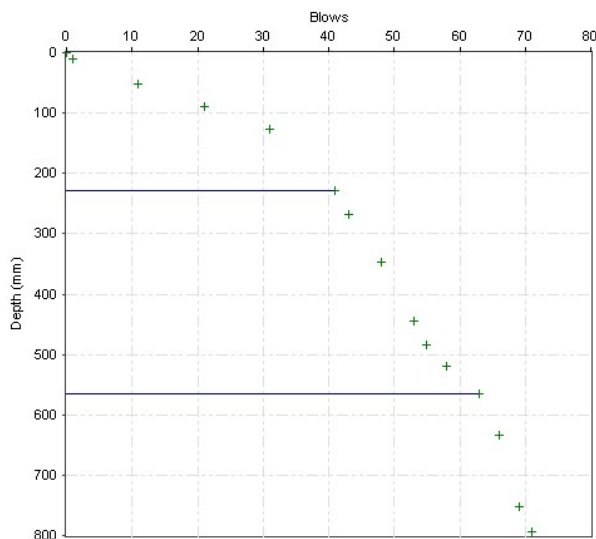
DCP Layer Strength Analysis Report

Project Name: DCPs

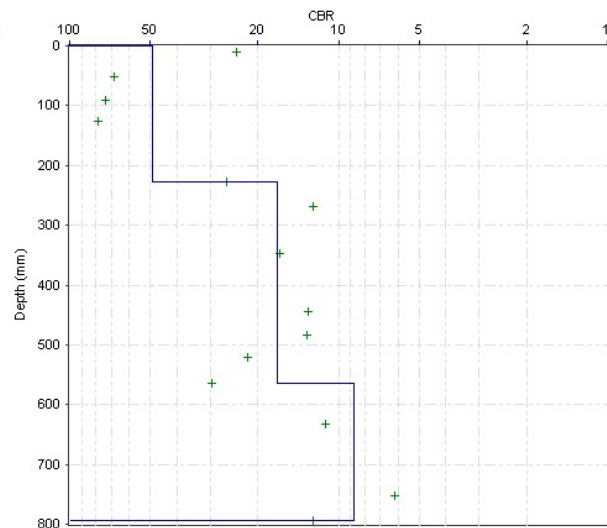
Chainage (km): 6.000
 Direction:
 Location/Offset: Carriageway
 Cone Angle: 60 degrees
 Zero Error (mm): 157
 Test Date: 19/07/2019

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 6.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	5.56	49	228	228	Base	0.10	0.91	0.91	0.91
2	15.32	17	337	565	Base	0.04	0.58	0.58	0.58
3	28.50	9	228	793	Base	0.02	0.22	0.22	0.22

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	1.70	1.70	1.70
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	1.70	1.70	1.70

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

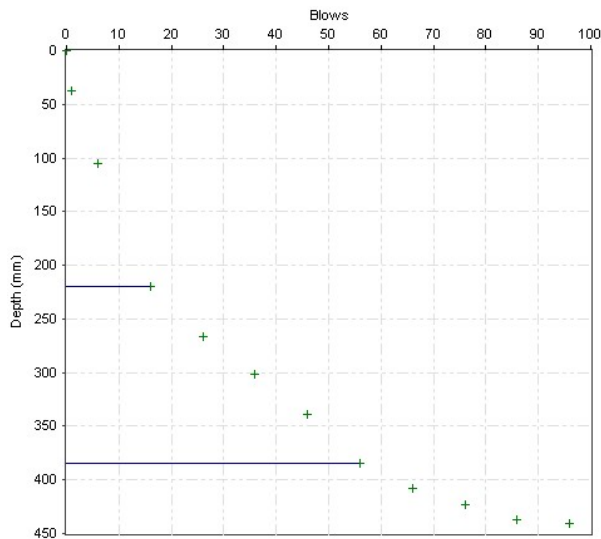
DCP Layer Strength Analysis Report

Project Name: DCPs

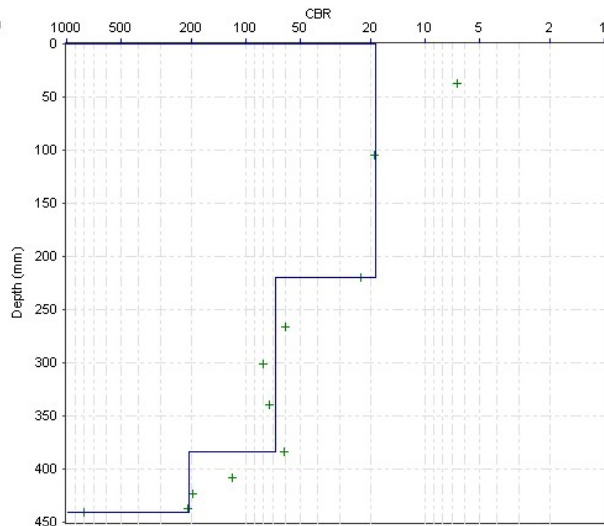
Chainage (km): 7.000
 Direction:
 Location/Offset: Carriageway
 Cone Angle: 60 degrees
 Zero Error (mm): 46
 Test Date: 19/07/2019

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 7.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	13.75	19	220	220	Base	0.05	0.42	0.42	0.42
2	4.10	68	164	384	Base	0.12	0.78	0.78	0.78
3	1.43	208	57	441	Base	0.14	0.32	0.32	0.32

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	1.52	1.52	1.52
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	1.52	1.52	1.52

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

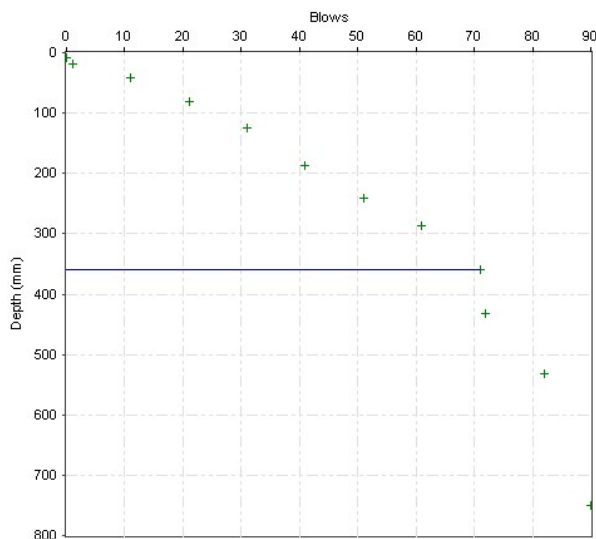
DCP Layer Strength Analysis Report

Project Name: DCPs

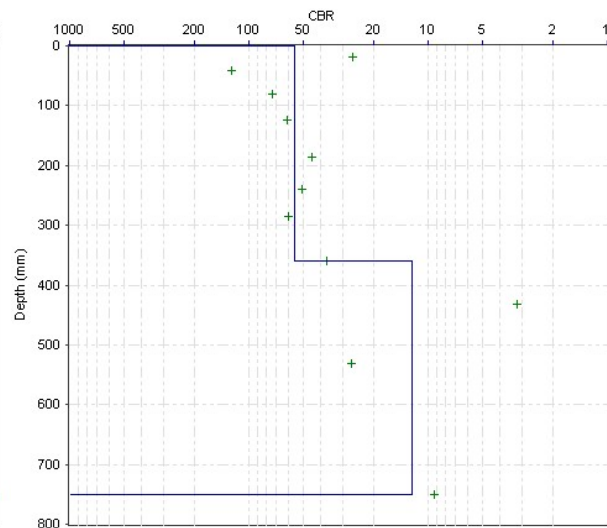
Chainage (km): 8.000
 Direction:
 Location/Offset: Carriageway
 Cone Angle: 60 degrees
 Zero Error (mm): 200
 Test Date: 19/07/2019

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 8.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	4.93	56	359	359	Base	0.11	1.54	1.54	1.54
2	20.58	12	391	750	Base	0.03	0.51	0.51	0.51

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	2.05	2.05	2.05
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	2.05	2.05	2.05

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

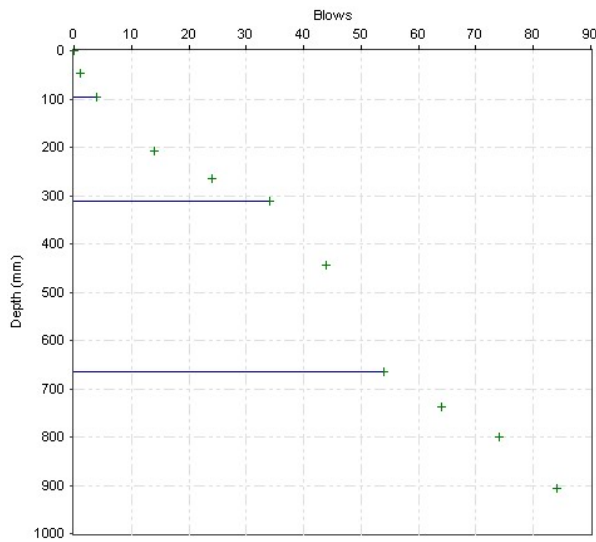
DCP Layer Strength Analysis Report

Project Name: DCPs

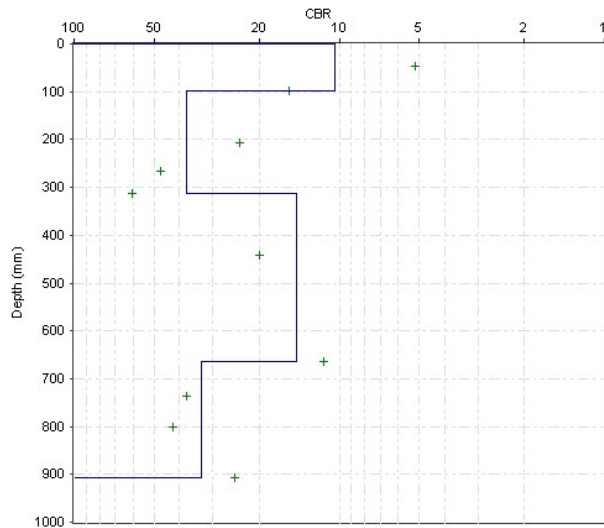
Chainage (km): 9.000
 Direction:
 Location/Offset: Carriageway
 Cone Angle: 60 degrees
 Zero Error (mm): 43
 Test Date: 19/07/2019

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 9.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	24.25	10	97	97	Base	0.03	0.11	0.11	0.11
2	7.17	38	215	312	Base	0.08	0.71	0.71	0.71
3	17.65	15	353	665	Base	0.04	0.53	0.53	0.53
4	8.07	33	242	907	Base	0.08	0.73	0.73	0.73

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	2.08	2.08	2.08
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	2.08	2.08	2.08

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

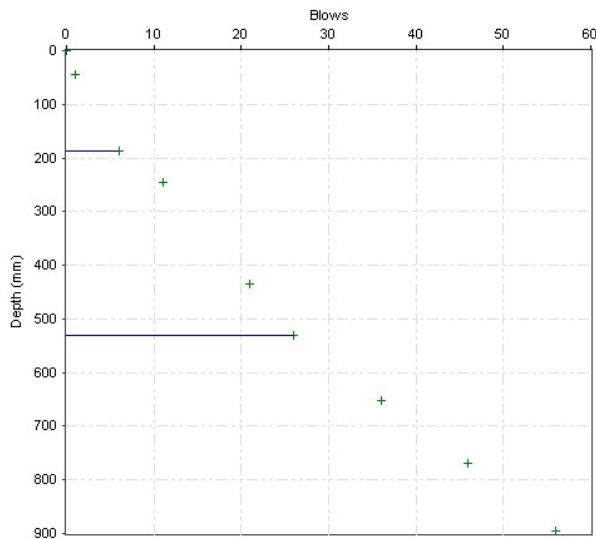
DCP Layer Strength Analysis Report

Project Name: DCPs

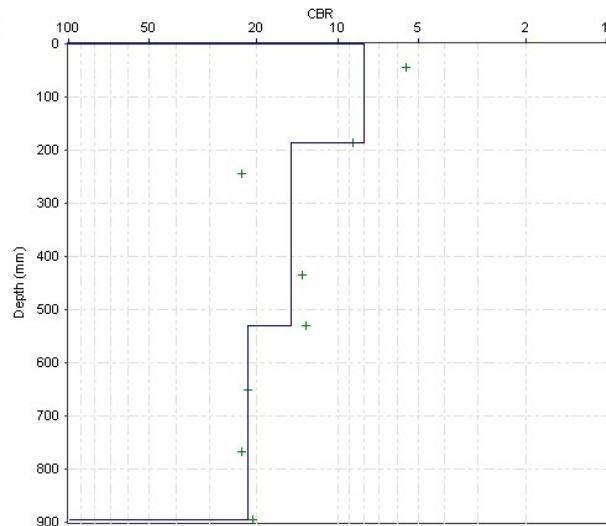
Chainage (km): 10.000
 Direction:
 Location/Offset: Carriageway
 Cone Angle: 60 degrees
 Zero Error (mm): 55
 Test Date: 19/07/2019

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 10.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	31.17	8	187	187	Base	0.02	0.16	0.16	0.16
2	17.20	15	344	531	Base	0.04	0.53	0.53	0.53
3	12.13	22	364	895	Base	0.05	0.78	0.78	0.78

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	1.47	1.47	1.47
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	1.47	1.47	1.47

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by



Contract Number: 45152

Client Ref: **17755**

Report Date: **02-08-2019**

Client PO: **17755**

Client **Soils Limited**
Thomas Telford House
Unit 11
Sun Valley Business Park
Winnall Close
Winchester
SO23 0LB

Contract Title: **Rivermead Leisure Centre**
For the attention of: **Tim Rudkin**

Date Received: **26-07-2019**
Date Commenced: **26-07-2019**
Date Completed: **02-08-2019**

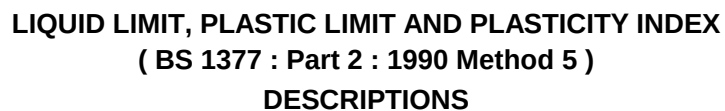
Test Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	1
1 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.4 & 5.3 - * UKAS	1
PSD Wet Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	10
Saturated Moisture Content of chalk (SMC) BS 1377:1990 - Part 2 : 3.3 - * UKAS	10
Quick Undrained Triaxial Compression test - single specimen at one confining pressure (100mm or 38mm diameter) BS 1377:1990 - Part 7 : 8 - * UKAS	1
Disposal of samples for job	1

Notes: Observations and Interpretations are outside the UKAS Accreditation
* - denotes test included in laboratory scope of accreditation
- denotes test carried out by approved contractor
@ - denotes non accredited tests

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 except in full, without the prior written approval of the laboratory.

Approved Signatories:

Emma Sharp (Office Manager) - Paul Evans (Quality/Technical Manager) - Richard John (Advanced Testing Manager)
Sean Penn (Administrative/Accounts Assistant) - Shaun Jones (Laboratory manager) - Wayne Honey (Administrative/Quality Assistant)



45152

Rivermead Leisure Centre

30/07/2019

Operators	Checked	02/08/2019	Wayne Honey (Administrative/Quality Assistant)
Ieuan Williams	Approved	02/08/2019	Paul Evans (Quality/Technical Manager)



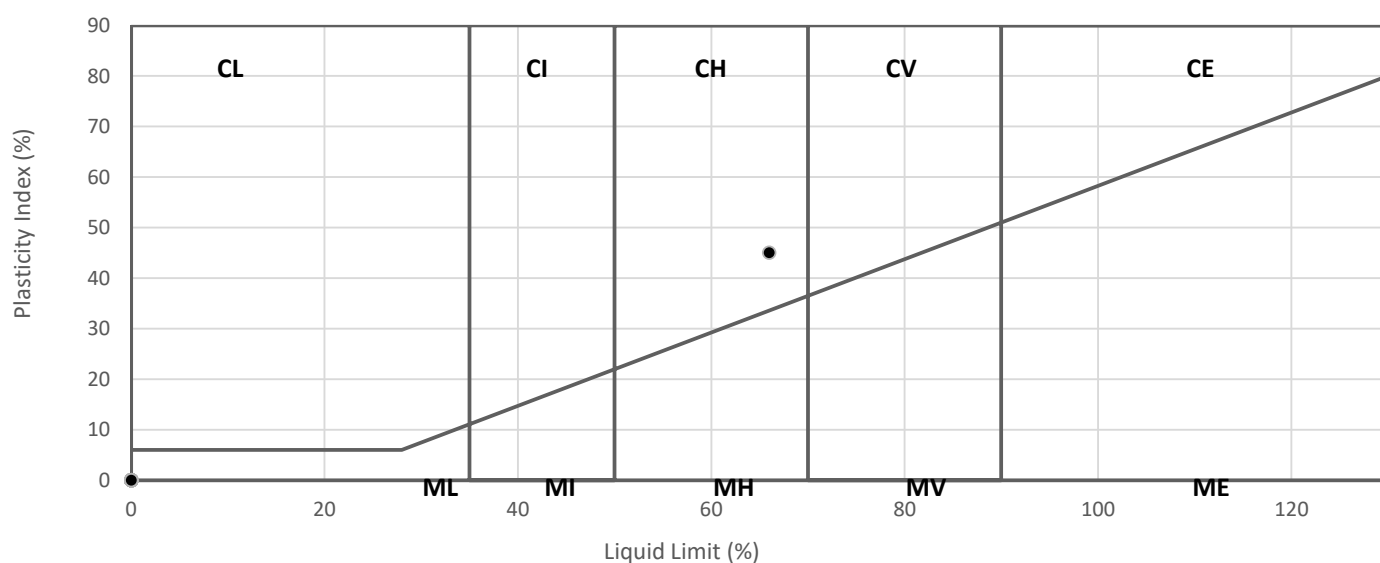
LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX (BS 1377 : Part 2 : 1990 Method 5)

Contract Number	45152	
Site Name	Rivermead Leisure Centre	
Date Tested	30/07/2019	

[illegible]

Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION



Operators	Checked	02/08/2019	Wayne Honey (Administrative/Quality Assistant)
Ieuan Williams	Approved	02/08/2019	Paul Evans (Quality/Technical Manager)



PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number **45152**

Borehole/Pit No. **BH1**

Site Name **Rivermead Leisure Centre**

Sample No.

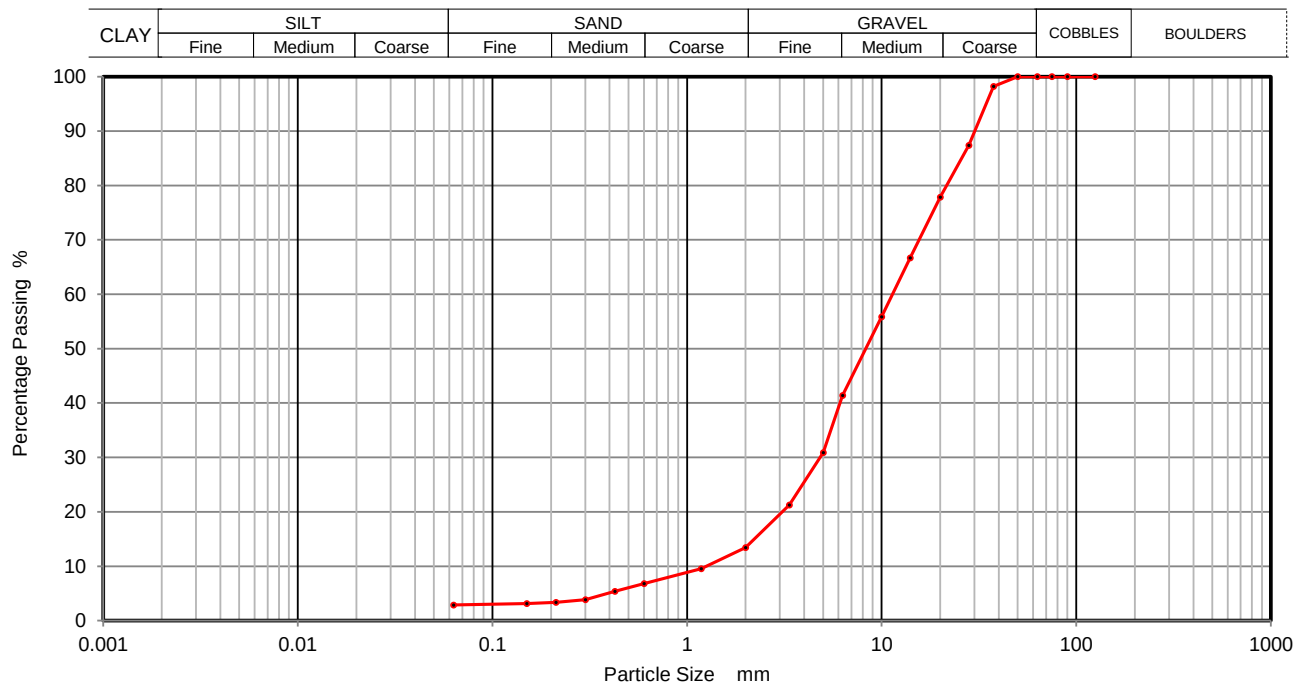
Soil Description **Brown slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL**

Depth Top **4.50**

Depth Base **5.00**

Date Tested **30/07/2019**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	98		
28	87		
20	78		
14	67		
10	56		
6.3	41		
5	31		
3.35	21		
2	13		
1.18	10		
0.6	7		
0.425	5		
0.3	4		
0.212	3		
0.15	3		
0.063	3		

Sample Proportions	% dry mass
Cobbles	0
Gravel	87
Sand	10
Silt and Clay	3

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	01/08/2019	Wayne Honey	<i>W. Honey</i>
RO/MH	Approved	02/08/2019	Paul Evans	<i>P. Evans</i>



2788



PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number **45152**

Borehole/Pit No. **BH1**

Site Name **Rivermead Leisure Centre**

Sample No.

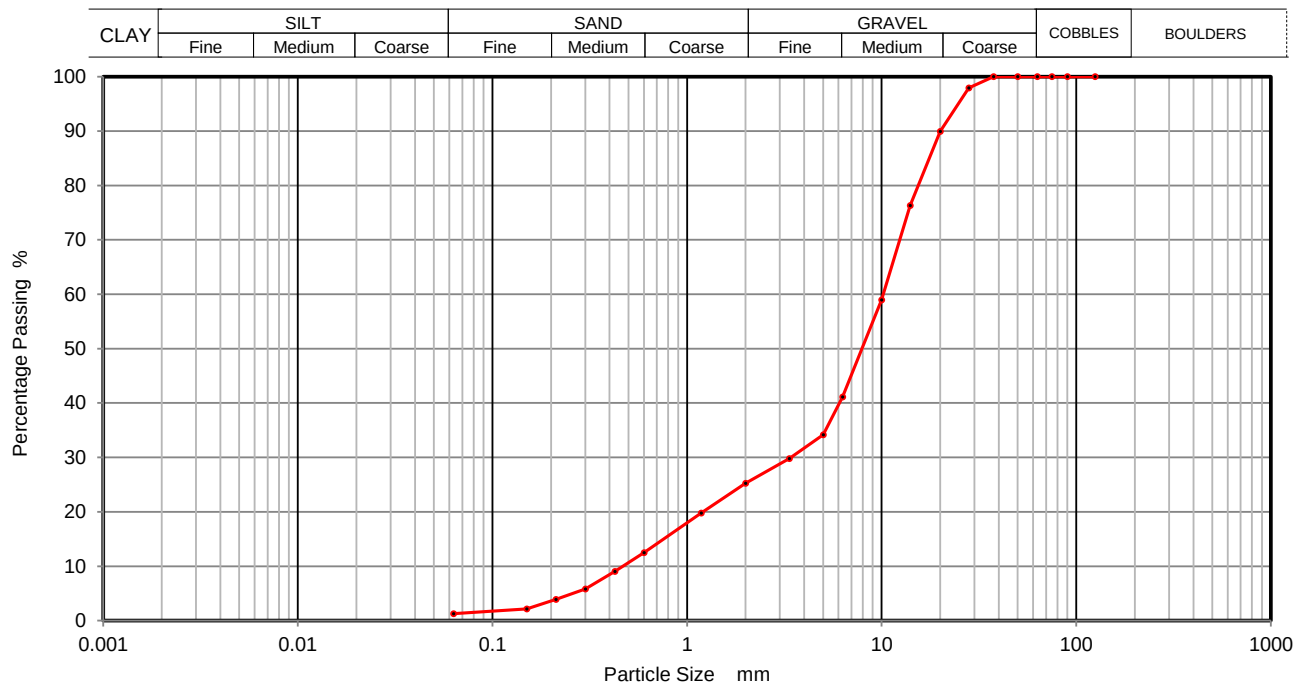
Soil Description **Brown slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL**

Depth Top **6.00**

Depth Base **6.50**

Date Tested **30/07/2019**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	98		
20	90		
14	76		
10	59		
6.3	41		
5	34		
3.35	30		
2	25		
1.18	20		
0.6	12		
0.425	9		
0.3	6		
0.212	4		
0.15	2		
0.063	1		

Sample Proportions	% dry mass
Cobbles	0
Gravel	75
Sand	24
Silt and Clay	1

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	01/08/2019	Wayne Honey	<i>W. Honey</i>
RO/MH	Approved	02/08/2019	Paul Evans	<i>P. Evans</i>



2788



PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number **45152**

Borehole/Pit No. **BH1**

Site Name **Rivermead Leisure Centre**

Sample No.

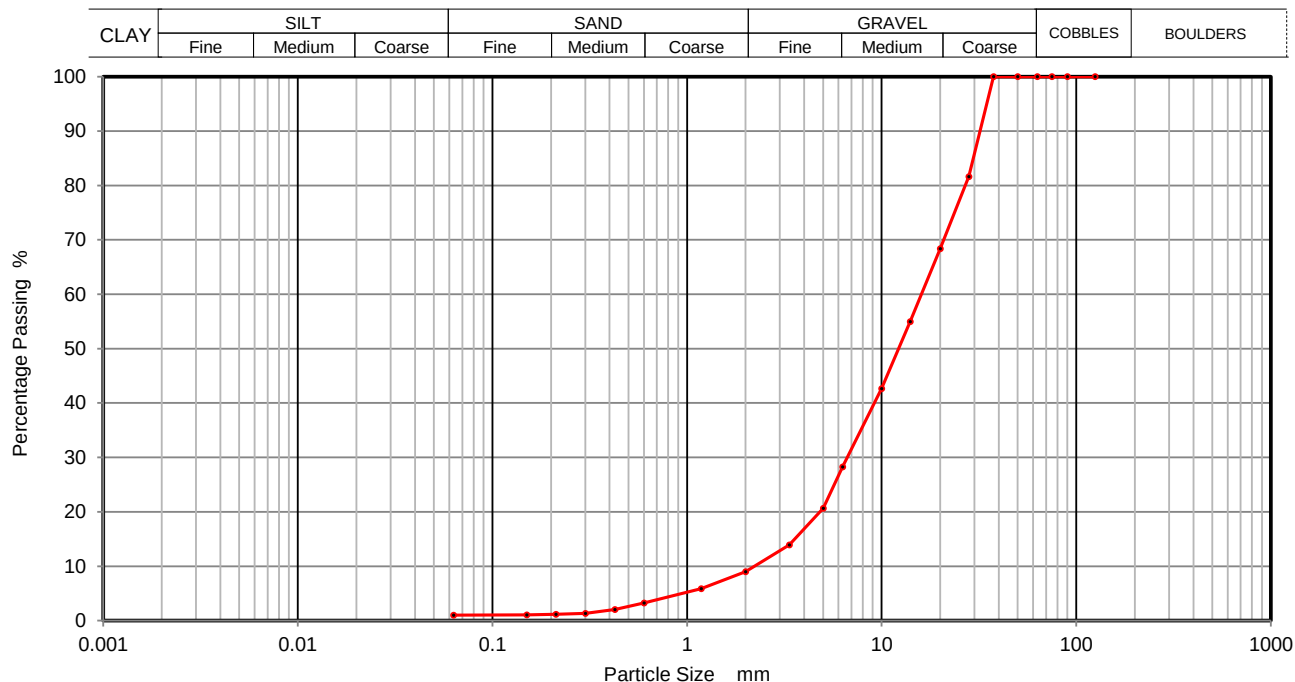
Soil Description **Brown slightly silty/ clayey slightly fine to coarse sandy fine to coarse GRAVEL**

Depth Top **7.50**

Depth Base **8.00**

Date Tested **30/07/2019**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	82		
20	68		
14	55		
10	43		
6.3	28		
5	21		
3.35	14		
2	9		
1.18	6		
0.6	3		
0.425	2		
0.3	1		
0.212	1		
0.15	1		
0.063	1		

Sample Proportions	% dry mass
Cobbles	0
Gravel	91
Sand	8
Silt and Clay	1

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	01/08/2019	Wayne Honey	<i>W. Honey</i>
RO/MH	Approved	02/08/2019	Paul Evans	<i>P. Evans</i>





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number **45152**

Borehole/Pit No. **BH1**

Site Name **Rivermead Leisure Centre**

Sample No.

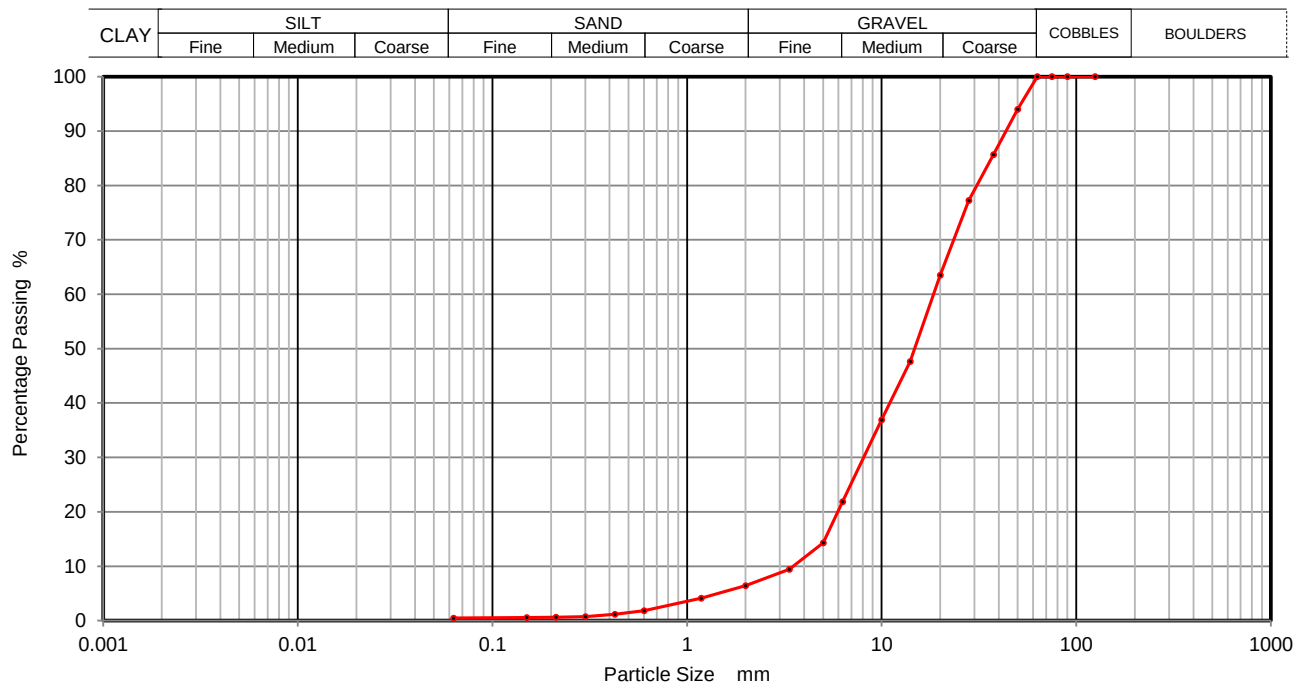
Soil Description **Brown slightly fine to coarse sandy fine to coarse GRAVEL**

Depth Top **9.00**

Depth Base **9.50**

Date Tested **30/07/2019**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	94		
37.5	86		
28	77		
20	63		
14	48		
10	37		
6.3	22		
5	14		
3.35	9		
2	6		
1.18	4		
0.6	2		
0.425	1		
0.3	1		
0.212	1		
0.15	1		
0.063	0		

Sample Proportions	% dry mass
Cobbles	0
Gravel	94
Sand	6
Silt and Clay	0

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	01/08/2019	Wayne Honey	<i>W. Honey</i>
RO/MH	Approved	02/08/2019	Paul Evans	<i>P. Evans</i>

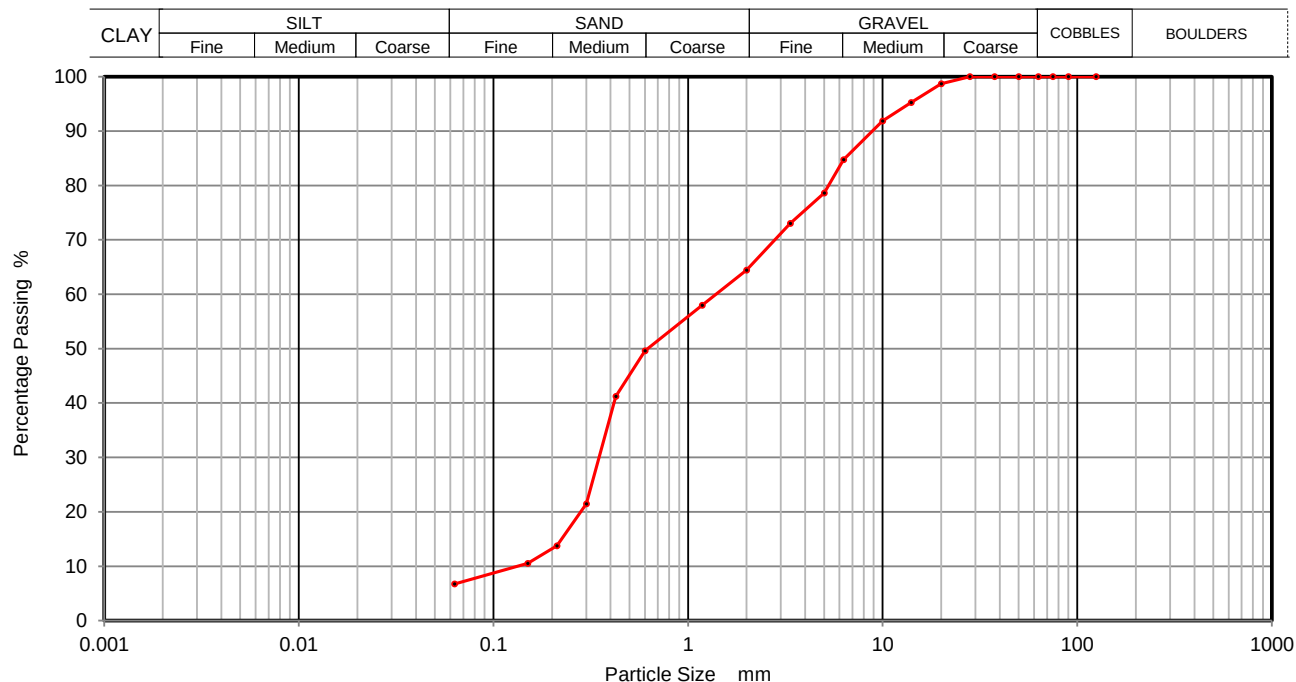


2788



**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	45152
		Borehole/Pit No.	BH4
Site Name	Rivermead Leisure Centre	Sample No.	
Soil Description	Brown slightly silty/ clayey fine to coarse gravelly fine to coarse SAND	Depth Top	3.50
		Depth Base	4.00
Date Tested	30/07/2019	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	99		
14	95		
10	92		
6.3	85		
5	79		
3.35	73		
2	64		
1.18	58		
0.6	50		
0.425	41		
0.3	21		
0.212	14		
0.15	11		
0.063	7		

Sample Proportions	% dry mass
Cobbles	0
Gravel	36
Sand	57
Silt and Clay	7

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	01/08/2019	Wayne Honey	<i>W. Honey</i>
RO/MH	Approved	02/08/2019	Paul Evans	<i>P. Evans</i>





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number **45152**

Borehole/Pit No. **BH4**

Site Name **Rivermead Leisure Centre**

Sample No.

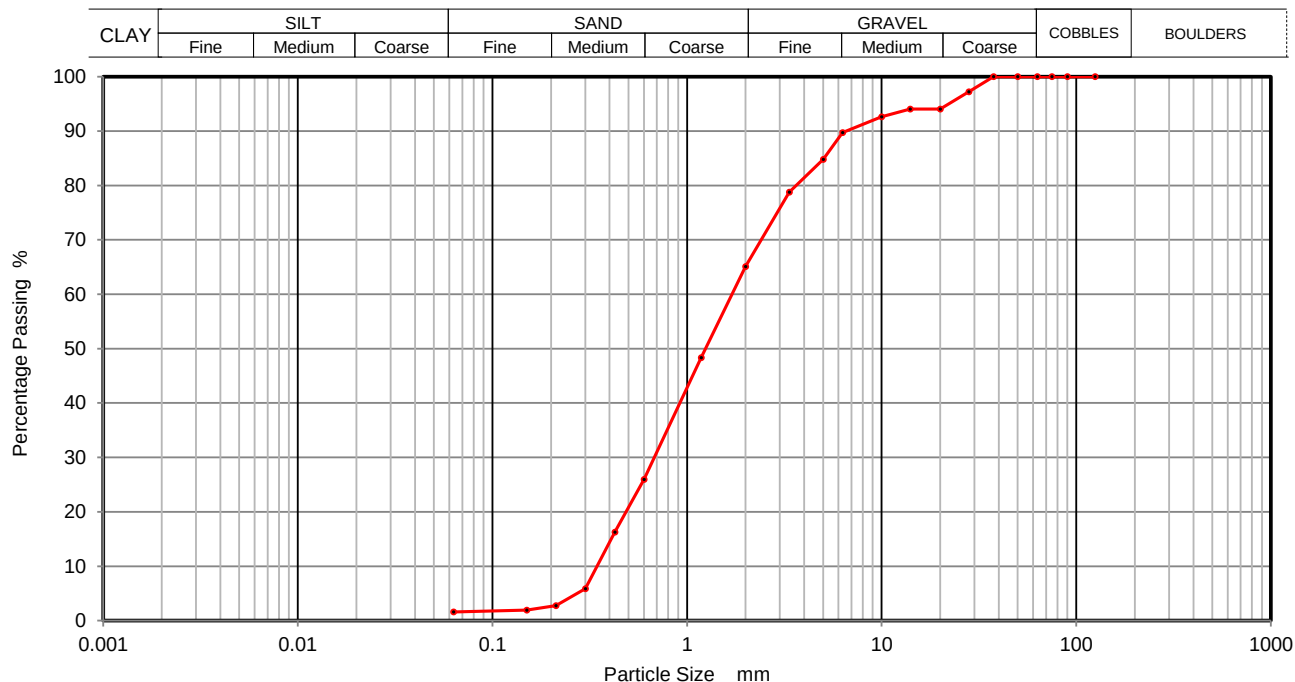
Soil Description **Brown slightly silty/ clayey fine to coarse gravelly fine to coarse SAND**

Depth Top **6.00**

Depth Base **6.50**

Date Tested **30/07/2019**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	97		
20	94		
14	94		
10	93		
6.3	90		
5	85		
3.35	79		
2	65		
1.18	48		
0.6	26		
0.425	16		
0.3	6		
0.212	3		
0.15	2		
0.063	2		

Sample Proportions	% dry mass
Cobbles	0
Gravel	35
Sand	63
Silt and Clay	2

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	01/08/2019	Wayne Honey	<i>W. Honey</i>
RO/MH	Approved	02/08/2019	Paul Evans	<i>P. Evans</i>



2788



PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number **45152**

Borehole/Pit No. **BH5**

Site Name **Rivermead Leisure Centre**

Sample No.

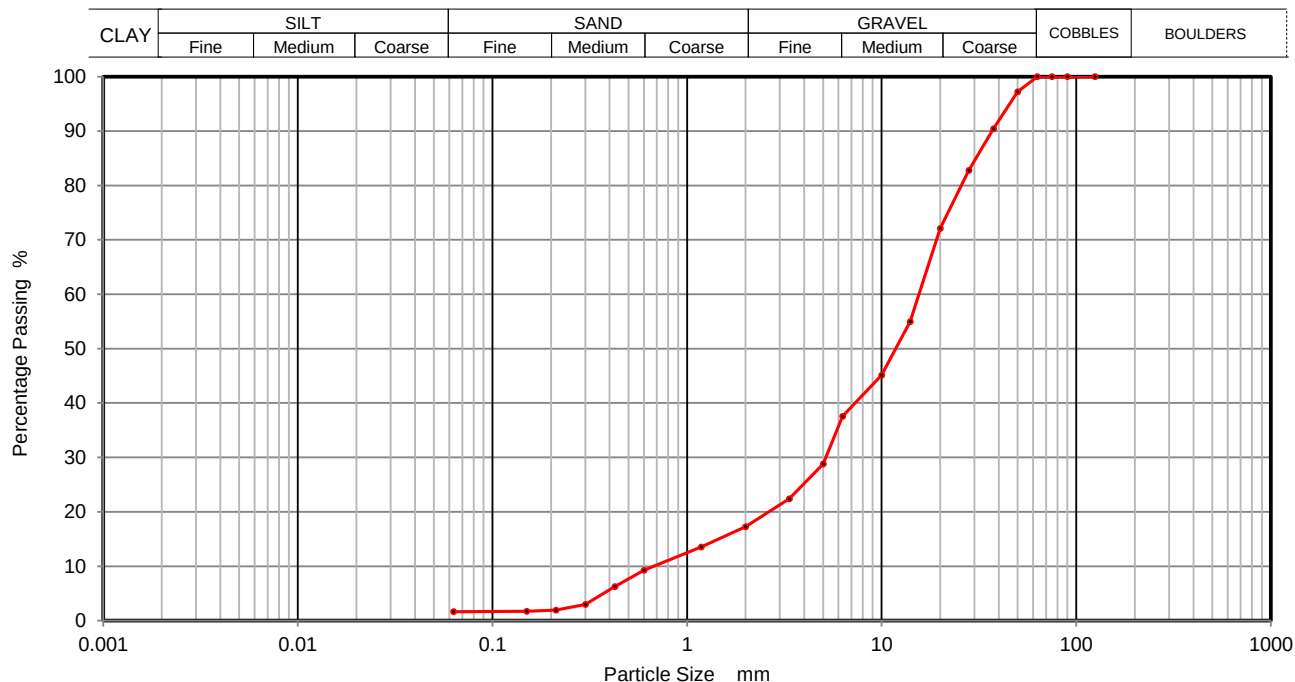
Soil Description **Brown slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL**

Depth Top **6.00**

Depth Base **6.50**

Date Tested **30/07/2019**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	97		
37.5	90		
28	83		
20	72		
14	55		
10	45		
6.3	38		
5	29		
3.35	22		
2	17		
1.18	14		
0.6	9		
0.425	6		
0.3	3		
0.212	2		
0.15	2		
0.063	2		

Sample Proportions	% dry mass
Cobbles	0
Gravel	83
Sand	15
Silt and Clay	2

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	01/08/2019	Wayne Honey	<i>W. Honey</i>
RO/MH	Approved	02/08/2019	Paul Evans	<i>P. Evans</i>



2788



PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number **45152**

Borehole/Pit No. **BH5**

Site Name **Rivermead Leisure Centre**

Sample No.

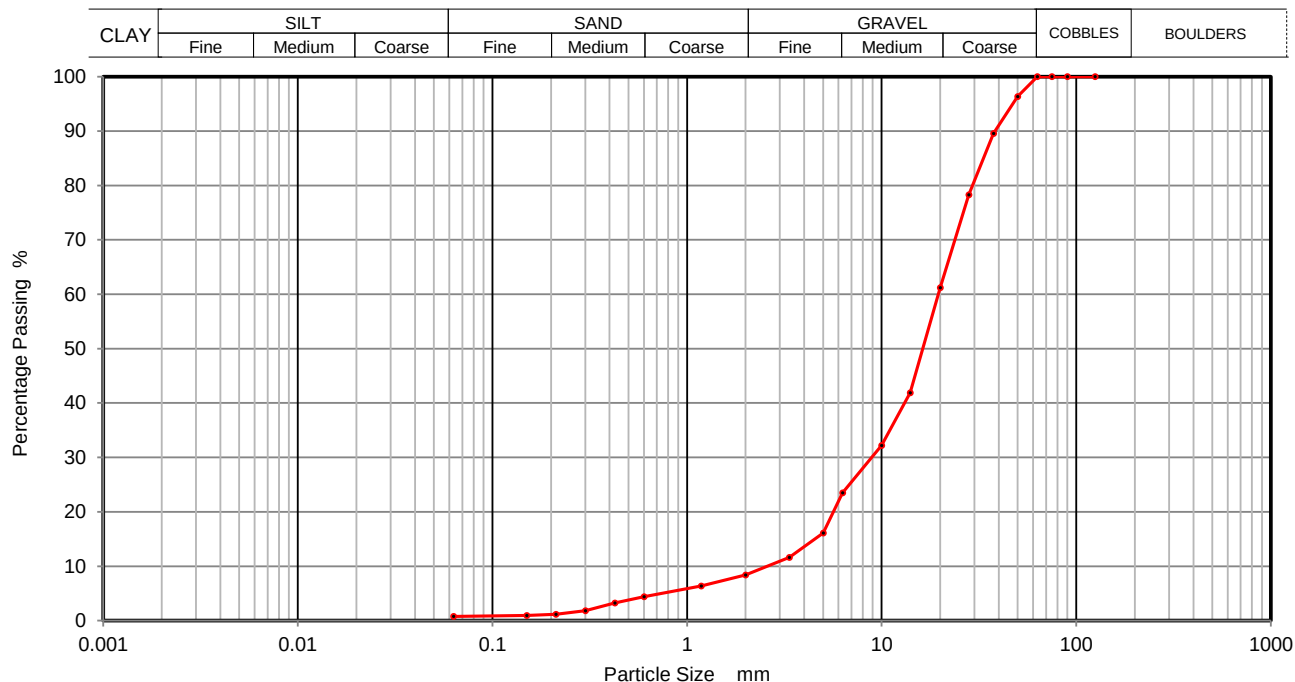
Soil Description **Brown slightly silty/ clayey slightly fine to coarse sandy fine to coarse GRAVEL**

Depth Top **7.50**

Depth Base **8.00**

Date Tested **30/07/2019**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	96		
37.5	90		
28	78		
20	61		
14	42		
10	32		
6.3	23		
5	16		
3.35	12		
2	8		
1.18	6		
0.6	4		
0.425	3		
0.3	2		
0.212	1		
0.15	1		
0.063	1		

Sample Proportions	% dry mass
Cobbles	0
Gravel	92
Sand	7
Silt and Clay	1

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	01/08/2019	Wayne Honey	<i>W. Honey</i>
RO/MH	Approved	02/08/2019	Paul Evans	<i>P. Evans</i>



2788



PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number **45152**

Borehole/Pit No. **BH7**

Site Name **Rivermead Leisure Centre**

Sample No.

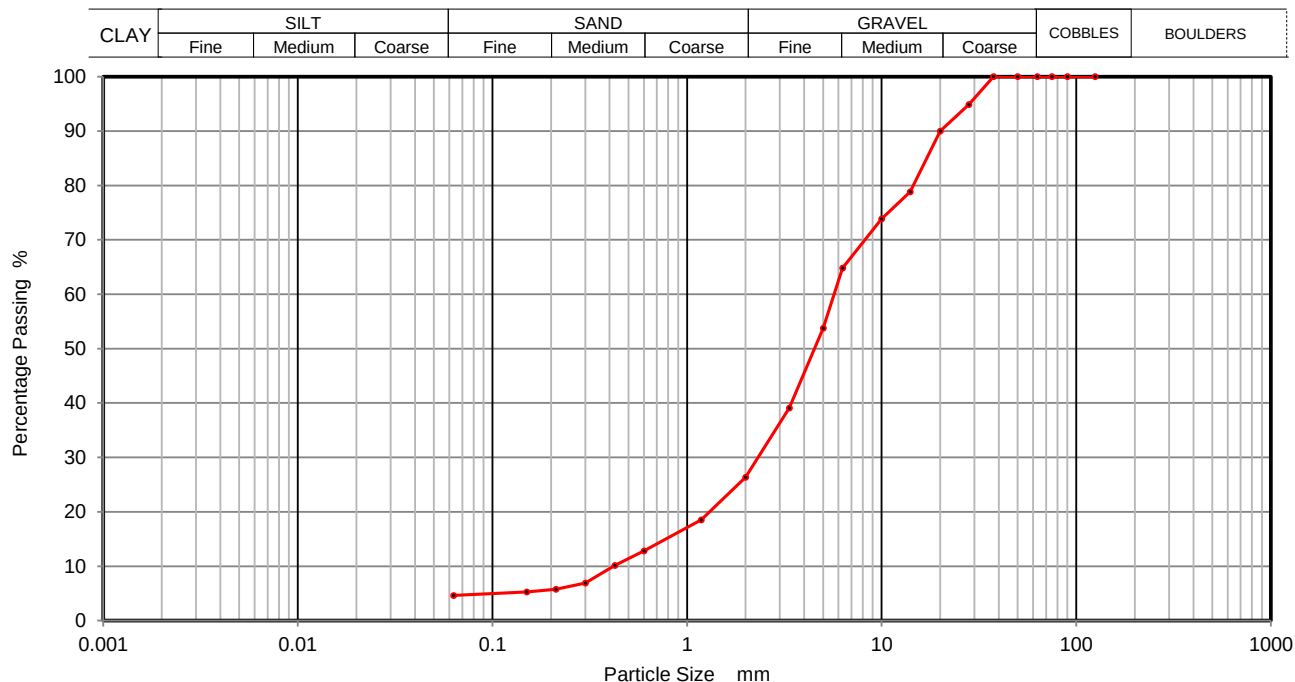
Soil Description **Brown slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL**

Depth Top **3.50**

Depth Base **4.00**

Date Tested **30/07/2019**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	95		
20	90		
14	79		
10	74		
6.3	65		
5	54		
3.35	39		
2	26		
1.18	19		
0.6	13		
0.425	10		
0.3	7		
0.212	6		
0.15	5		
0.063	5		

Sample Proportions	% dry mass
Cobbles	0
Gravel	74
Sand	21
Silt and Clay	5

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	01/08/2019	Wayne Honey	<i>W. Honey</i>
RO/MH	Approved	02/08/2019	Paul Evans	<i>P. Evans</i>



2788



PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number **45152**

Borehole/Pit No. **BH7**

Site Name **Rivermead Leisure Centre**

Sample No.

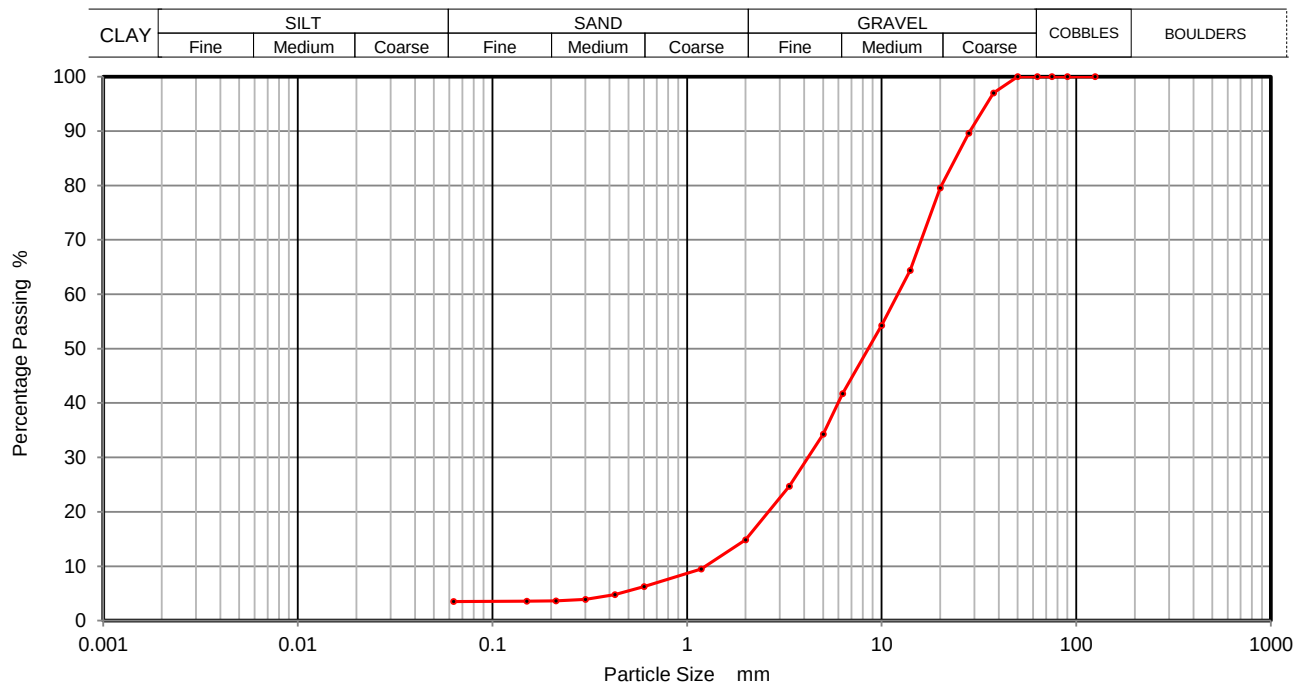
Soil Description **Brown slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL**

Depth Top **6.00**

Depth Base **6.50**

Date Tested **30/07/2019**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	97		
28	90		
20	80		
14	64		
10	54		
6.3	42		
5	34		
3.35	25		
2	15		
1.18	9		
0.6	6		
0.425	5		
0.3	4		
0.212	4		
0.15	4		
0.063	3		

Sample Proportions	% dry mass
Cobbles	0
Gravel	85
Sand	12
Silt and Clay	3

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	01/08/2019	Wayne Honey	<i>W. Honey</i>
RO/MH	Approved	02/08/2019	Paul Evans	<i>P. Evans</i>



2788

Saturation Moisture Content of Chalk
BS 1377 : Part 2 : 1990 Section 3.3

Contract Number	45152	
Site Name	Rivermead Leisure Centre	
Date Tested	27/07/2019	

[illegible]

Key	Reported As	Clause
-----	-------------	--------

Moisture Content	%	3.2
Bulk Density	Mg/m ³	7.2
Dry Density	Mg/m ³	7.2
SMC	%	3.3.6

If there is a NON-STANDARD in the remarks next to the reported SMC result this means there was no lump of chalk of sufficient volume (300mL-500mL) present in the samples received to meet the testing requirements of the stated standard.

Operators	Checked	01/08/2019	Emma Sharp	
CJ	Approved	02/08/2019	Paul Evans	



Single Stage Unconsolidated-Undrained Triaxial Test
BS 1377 : 1990 Part 7 : 8

Contract Number 45152

Borehole/Pit No. BH1

Site Name Rivermead Leisure Centre

Sample No.

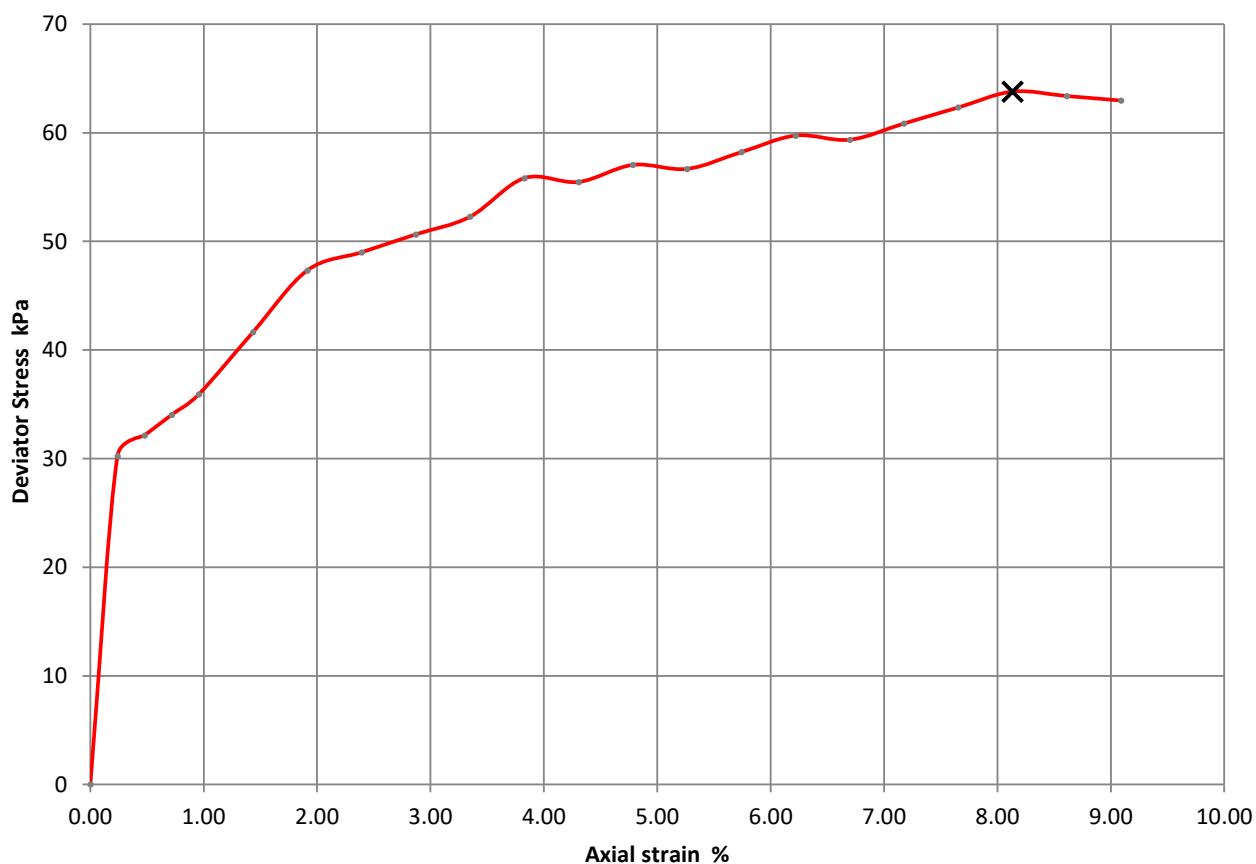
Soil Description Brown sandy fine to medium gravelly CLAY

Depth Top (m) 3.50

Depth Base (m) 3.95

Date Tested 29/07/2019

Sample Type U



Moisture Content (%)	22
Bulk Density (Mg/m ³)	2.12
Dry Density (Mg/m ³)	1.73
Specimen Length (mm)	209
Specimen Diameter (mm)	102
Cell Pressure (kPa)	70
Deviator Stress (kPa)	64
Undrained Shear Strength (kPa)	32
Failure Strain (%)	8
Mode Of Failure	Compound
Membrane Used/Thickness	Rubber/0.3mm
Rate of Strain (%/min)	1.44

Specimen Post Test



Sample Split



Checked	01/08/2019	Emma Sharp	
Approved	02/08/2019	Paul Evans	





Tim Rudkin
Soils Ltd
Newton House
Cross Road
Tadworth
Surrey
KT20 5SR

DETS Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 19-10509

Site Reference: Rivermead Leisure Centre

Project / Job Ref: 17755

Order No: 17755/TR

Sample Receipt Date: 23/07/2019

Sample Scheduled Date: 23/07/2019

Report Issue Number: 1

Reporting Date: 29/07/2019

Authorised by:

A handwritten signature in grey ink, appearing to read "Dave Ashworth".

Dave Ashworth
Technical Manager

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DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410



Soil Analysis Certificate						
DETS Report No: 19-10509	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Rivermead Leisure Centre	TP / BH No	BH1	BH1	BH1	BH1	BH1
Project / Job Ref: 17755	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 17755/TR	Depth (m)	1.00	3.00	5.00	7.00	9.50
Reporting Date: 29/07/2019	DETS Sample No	423196	423197	423198	423199	423200

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	MCERTS	7.8	7.3	8.4	8.4	8.4
Total Sulphate as SO ₄	mg/kg	< 200	NONE	1471	610	288	206	< 200
Total Sulphate as SO ₄	%	< 0.02	NONE	0.15	0.06	0.03	0.02	< 0.02
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	472	196	< 10	< 10	< 10
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.47	0.20	< 0.01	< 0.01	< 0.01
Total Sulphur	%	< 0.02	NONE	0.08	0.05	< 0.02	< 0.02	< 0.02
Ammonium as NH ₄	mg/kg	< 0.5	NONE	341	546	< 0.5	< 0.5	< 0.5
Ammonium as NH ₄	mg/l	< 0.05	NONE	34.10	54.60	< 0.05	< 0.05	< 0.05
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	70	52	6	6	2
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	35.2	25.8	2.9	3.1	0.9
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	< 3	MCERTS	20	< 3	< 3	3	< 3
Water Soluble Nitrate (2:1) as NO ₃	mg/l	< 1.5	MCERTS	9.8	< 1.5	< 1.5	1.6	< 1.5
W/S Magnesium	mg/l	< 0.1	NONE	10	5.3	0.7	0.7	0.2

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
Subcontracted analysis (S)



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Soil Analysis Certificate						
DETS Report No: 19-10509	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Rivermead Leisure Centre	TP / BH No	BH5	BH5	BH5	BH5	BH7
Project / Job Ref: 17755	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 17755/TR	Depth (m)	1.20	3.00	5.00	7.00	1.20
Reporting Date: 29/07/2019	DETS Sample No	423201	423202	423203	423204	423205

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	MCERTS	6.9	7.1	7.1	7.2	7.5
Total Sulphate as SO ₄	mg/kg	< 200	NONE	374	227	499	426	709
Total Sulphate as SO ₄	%	< 0.02	NONE	0.04	0.02	0.05	0.04	0.07
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	24	< 10	53	11	279
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.02	< 0.01	0.05	0.01	0.28
Total Sulphur	%	< 0.02	NONE	0.02	< 0.02	0.04	0.03	0.06
Ammonium as NH ₄	mg/kg	< 0.5	NONE	258	6.4	24.6	< 0.5	328
Ammonium as NH ₄	mg/l	< 0.05	NONE	25.80	0.64	2.46	< 0.05	32.80
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	20	55	9	11	30
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	9.9	27.6	4.6	5.3	15.2
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3
Water Soluble Nitrate (2:1) as NO ₃	mg/l	< 1.5	MCERTS	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
W/S Magnesium	mg/l	< 0.1	NONE	2.4	0.7	1.5	1.4	6.1

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
Subcontracted analysis (S)



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Soil Analysis Certificate						
DETS Report No: 19-10509	Date Sampled	None Supplied				
Soils Ltd	Time Sampled	None Supplied				
Site Reference: Rivermead Leisure Centre	TP / BH No	BH7				
Project / Job Ref: 17755	Additional Refs	None Supplied				
Order No: 17755/TR	Depth (m)	5.50				
Reporting Date: 29/07/2019	DETS Sample No	423206				

Determinand	Unit	RL	Accreditation				
pH	pH Units	N/a	MCERTS	7.3			
Total Sulphate as SO ₄	mg/kg	< 200	NONE	< 200			
Total Sulphate as SO ₄	%	< 0.02	NONE	< 0.02			
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	< 10			
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	< 0.01			
Total Sulphur	%	< 0.02	NONE	< 0.02			
Ammonium as NH ₄	mg/kg	< 0.5	NONE	1.2			
Ammonium as NH ₄	mg/l	< 0.05	NONE	0.12			
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	2			
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	1			
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	< 3	MCERTS	< 3			
Water Soluble Nitrate (2:1) as NO ₃	mg/l	< 1.5	MCERTS	< 1.5			
W/S Magnesium	mg/l	< 0.1	NONE	0.2			

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
Subcontracted analysis (S)



DETS Ltd
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Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 19-10509	
Soils Ltd	
Site Reference: Rivermead Leisure Centre	
Project / Job Ref: 17755	
Order No: 17755/TR	
Reporting Date: 29/07/2019	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
^ 423196	BH1	None Supplied	1.00	13.2	Black loamy sand
^ 423197	BH1	None Supplied	3.00	16.2	Brown loamy clay with stones
^ 423198	BH1	None Supplied	5.00	4.5	Brown sandy gravel with stones
^ 423199	BH1	None Supplied	7.00	3.4	Brown sandy gravel with stones
^ 423200	BH1	None Supplied	9.50	1.4	Brown sandy gravel with stones
^ 423201	BH5	None Supplied	1.20	9.5	Brown loamy sand with stones
^ 423202	BH5	None Supplied	3.00	4.6	Brown sandy gravel with stones
^ 423203	BH5	None Supplied	5.00	6.7	Brown sandy gravel with stones
^ 423204	BH5	None Supplied	7.00	6.6	Brown sandy gravel with stones
^ 423205	BH7	None Supplied	1.20	12.8	Brown loamy sand with stones and brick
^ 423206	BH7	None Supplied	5.50	1.7	Brown sandy gravel with stones

Moisture content is part of procedure E003 & is not an accredited test
Insufficient Sample ^{1/S}
Unsuitable Sample ^{U/S}
^ no sampling date provided; unable to confirm if samples are within acceptable holding times



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Soil Analysis Certificate - Methodology & Miscellaneous Information	
DETS Report No: 19-10509	
Soils Ltd	
Site Reference: Rivermead Leisure Centre	
Project / Job Ref: 17755	
Order No: 17755/TR	
Reporting Date: 29/07/2019	

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

Appendix C Foundation Design

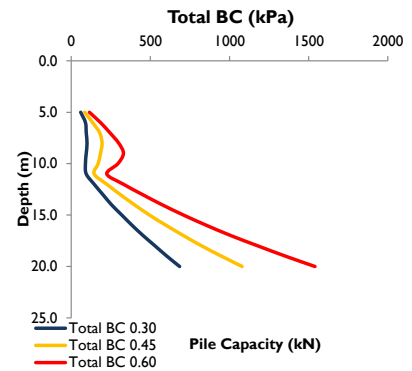
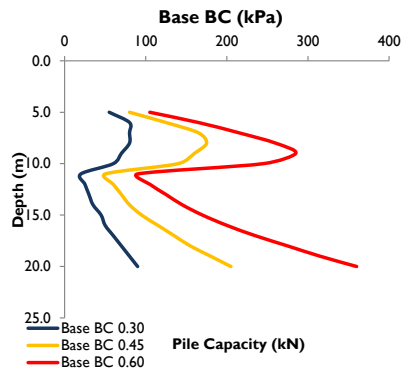
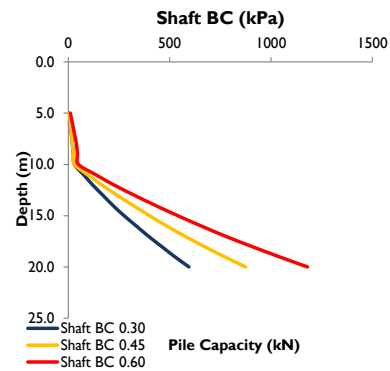
Appendix C.1 Preliminary Pile Design

Preliminary Pile Working Loads

Single Vertically Loaded Pile (kN)

Parameters:	FOS:	Shaft	Base	Alpha Value (α):	0	Maximum no. of layers	2
Name: TR	Clay:	0	0	GW Level: 2	NC Value:	0	
Job No: 17755	Chalk:	1.5	10		Specific Chalk Density:	16	
Date: 7.8.19	Gravel:	3	3		Depth to top of strata:	3	

Notes:



Pile Diameter (m):

Pile Depths		0.3			0.45			0.6			Layer
Material	(m bgl)	Shaft	Base	Total	Shaft	Base	Total	Shaft	Base	Total	
Gravel	5.0	5	55	60	5	80	85	10	105	115	1
Gravel	6.0	10	80	90	10	125	135	20	165	185	1
Gravel	7.0	15	80	95	15	165	180	30	215	245	1
Gravel	8.0	20	80	100	20	175	195	40	260	300	1
Gravel	9.0	25	70	95	25	160	185	45	285	330	1
Gravel	10.0	30	60	90	30	140	170	50	245	295	1
Chalk	11.0	75	20	95	95	50	145	135	90	225	2
Chalk	12.0	120	25	145	165	60	225	225	105	330	2
Chalk	13.0	170	30	200	240	70	310	325	125	450	2
Chalk	14.0	220	35	255	320	80	400	430	145	575	2
Chalk	15.0	275	45	320	400	95	495	540	170	710	2
Chalk	16.0	335	50	385	485	115	600	655	200	855	2
Chalk	17.0	395	60	455	575	135	710	775	235	1010	2
Chalk	18.0	460	70	530	670	155	825	905	275	1180	2
Chalk	19.0	525	80	605	770	180	950	1040	315	1355	2
Chalk	20.0	595	90	685	875	205	1080	1180	360	1540	2

Appendix D Chemical Laboratory Testing

Appendix D.1 Conceptual Site Model

Table D.I.I CSM Revised Post Testing

Source	Identified Contaminant	Exposure Pathway	Receptor	Initial Assessment from Desk Study and Main Investigation Report Information			Comments	Proposed Investigation
				Severity	Probability	Risk		
Made Ground/Landfill Onsite source of contamination	PAHs	Inhalation of dust	Site Workers/Site Maintenance	Mild	Low	Low	Soil chemical analysis recorded marginally elevated PAH concentrations. The elevated levels did not exceed relevant screening criteria for the proposed end-use.	Soil gas risk assessment. Monitoring ongoing.
			End Users	Mild	Unlikely	Very low		
			Off-site Users	Mild	Unlikely	Very low		
	PAHs, Soil gas	Inhalation of Vapour/gases	Site Workers/Site Maintenance	Mild	Unlikely	Very low	Water chemical analysis recorded elevated PAH concentrations in one of three samples against EQS freshwater values. Remediation of underlying landfill is not practicable. The proposed development is unlikely to mobilise additional contamination to groundwater and will likely improve on the situation with removal of Made Ground and reduction of local infiltration.	
			End Users	Medium	Low	Low		
			Off-site Users	Minor	Unlikely	Very low		
	PAHs	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	Mild	Low	Low		
			End Users	Mild	Unlikely	Very low		
	PAHs	Migration via surface runoff	Surface Water	-	-	-	Intrusive investigation identified granular Made Ground and superficial geology, therefore, no surface runoff anticipated.	
		Migration in solution via groundwater	Surface Water	-	-	-		
			Shallow Aquifer	Mild	Likely	Low		
			Deep Aquifer	Mild	Likely	Low		
		Direct contact with construction material	Buried structures	Minor	Likely	Low		
			Buried Services	Minor	Likely	Low		
	PAHs, Soil gas	Migration of gases via permeable soils	Site Workers/Site Maintenance	Mild	Likely	Low	Soil gas monitoring ongoing.	
			End Users	Medium	Likely	Moderate		
			Off-site Users	Minor	Unlikely	Very low		
			Building and confined spaces	Mild	Likely	Low		

Appendix D.2 Chemical Laboratory Results



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Cross Road
Tadworth
Surrey
KT20 5SR

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Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 19-10510

Site Reference: Rivermead Leisure Centre

Project / Job Ref: 17755

Order No: None Supplied

Sample Receipt Date: 23/07/2019

Sample Scheduled Date: 23/07/2019

Report Issue Number: 1

Reporting Date: 30/07/2019

Authorised by:

A handwritten signature in grey ink, appearing to read "Dave Ashworth".

Dave Ashworth
Technical Manager

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. 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 except in full, without the prior written approval of the laboratory.



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Soil Analysis Certificate						
DETS Report No: 19-10510	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Rivermead Leisure Centre	TP / BH No	BH1	BH1	BH2	BH2	BH2
Project / Job Ref: 17755	Additional Refs	J&B	J	J	J	J
Order No: None Supplied	Depth (m)	0.50 - 1.00	2.00	0.35	1.20	2.50
Reporting Date: 30/07/2019	DETS Sample No	423207	423208	423209	423210	423211

Determinand	Unit	RL	Accreditation					
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	7.2	7.2	7.1	7.4	7.3
Total Cyanide	mg/kg	< 2	NONE		< 2	< 2	< 2	4
Free Cyanide	mg/kg	< 2	NONE		< 2	< 2	< 2	< 2
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS		339	44	162	78
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS		0.34	0.04	0.16	0.08
Organic Matter	%	< 0.1	MCERTS	2.2	4.6	1.4	3.7	10.4
Arsenic (As)	mg/kg	< 2	MCERTS	19	32	20	36	47
W/S Boron	mg/kg	< 1	NONE	4.7	6.9	1.2	3	2
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	1.6	1.2	1	1.5	4.5
Chromium (Cr)	mg/kg	< 2	MCERTS	25	41	22	37	46
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	151	78	19	80	865
Lead (Pb)	mg/kg	< 3	MCERTS	230	251	36	164	331
Mercury (Hg)	mg/kg	< 1	NONE	1.1	2.7	< 1	2.7	2.9
Nickel (Ni)	mg/kg	< 3	MCERTS	24	36	13	36	52
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	< 3
Vanadium (V)	mg/kg	< 2	NONE	13	39	22	40	75
Zinc (Zn)	mg/kg	< 3	MCERTS	526	213	115	291	859
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
Subcontracted analysis (S)



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Soil Analysis Certificate						
DETS Report No: 19-10510	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Rivermead Leisure Centre	TP / BH No	BH4	BH4	BH4	BH5	BH5
Project / Job Ref: 17755	Additional Refs	J	J	J&B	J	J
Order No: None Supplied	Depth (m)	0.50 - 1.00	1.00	1.50 - 1.70	0.45	0.80
Reporting Date: 30/07/2019	DETS Sample No	423212	423213	423214	423215	423216

Determinand	Unit	RL	Accreditation					
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	7.2	7.4	7.4	7.2	7.1
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2		< 2	< 2
Free Cyanide	mg/kg	< 2	NONE	< 2	< 2		< 2	< 2
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	44	23		14	158
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.04	0.02		0.01	0.16
Organic Matter	%	< 0.1	MCERTS	1.3	1	2.5	2	4.7
Arsenic (As)	mg/kg	< 2	MCERTS	14	12	35	6	28
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	4.2	< 1	4.3
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.5	0.4	1.1	0.5	1.8
Chromium (Cr)	mg/kg	< 2	MCERTS	22	20	29	11	25
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	7	5	38	13	66
Lead (Pb)	mg/kg	< 3	MCERTS	39	37	118	35	139
Mercury (Hg)	mg/kg	< 1	NONE	1.5	< 1	1.1	< 1	1
Nickel (Ni)	mg/kg	< 3	MCERTS	12	11	24	7	38
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	< 3
Vanadium (V)	mg/kg	< 2	NONE	< 2	12	40	9	< 2
Zinc (Zn)	mg/kg	< 3	MCERTS	67	48	273	94	398
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
Subcontracted analysis (S)



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Soil Analysis Certificate						
DETS Report No: 19-10510	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Rivermead Leisure Centre	TP / BH No	BH5	BH6	BH6	BH7	BH7
Project / Job Ref: 17755	Additional Refs	J	J	J	J	J
Order No: None Supplied	Depth (m)	2.00	0.50	1.50	0.30	0.40
Reporting Date: 30/07/2019	DETS Sample No	423217	423218	423219	423220	423221

Determinand	Unit	RL	Accreditation					
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	7.1	7.3	7.2	8.2	7.7
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	12
Free Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	1810	36	111	37	104
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	1.81	0.04	0.11	0.04	0.10
Organic Matter	%	< 0.1	MCERTS	6.8	0.5	5.9	2.5	7.9
Arsenic (As)	mg/kg	< 2	MCERTS	59	4	24	24	34
W/S Boron	mg/kg	< 1	NONE	6.5	< 1	2	1.2	12.8
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	3	< 0.2	1.8	1.6	1.9
Chromium (Cr)	mg/kg	< 2	MCERTS	55	6	41	13	42
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	182	4	180	22	47
Lead (Pb)	mg/kg	< 3	MCERTS	284	6	685	81	347
Mercury (Hg)	mg/kg	< 1	NONE	2.2	< 1	2.7	1.7	1.7
Nickel (Ni)	mg/kg	< 3	MCERTS	104	< 3	78	7	33
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	< 3
Vanadium (V)	mg/kg	< 2	NONE	57	7	21	2	51
Zinc (Zn)	mg/kg	< 3	MCERTS	651	32	496	152	521
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
Subcontracted analysis (S)



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Soil Analysis Certificate						
DETS Report No: 19-10510	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Rivermead Leisure Centre	TP / BH No	BH7	BH3	BH3	BH3	WS1
Project / Job Ref: 17755	Additional Refs	J	J&B	J	J	J
Order No: None Supplied	Depth (m)	2.50	0.50 - 1.00	1.30	2.00	0.30
Reporting Date: 30/07/2019	DETS Sample No	423222	423223	423224	423225	423226

Determinand	Unit	RL	Accreditation					
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	8.1	7.2	7.1	7.3	8.0
Total Cyanide	mg/kg	< 2	NONE	7		< 2	< 2	< 2
Free Cyanide	mg/kg	< 2	NONE	< 2		< 2	< 2	< 2
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	70		230	267	29
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.07		0.23	0.27	0.03
Organic Matter	%	< 0.1	MCERTS	8	4.9	2.7	8.7	0.2
Arsenic (As)	mg/kg	< 2	MCERTS	21	36	33	37	3
W/S Boron	mg/kg	< 1	NONE	5.3	2.5	3.8	8.5	< 1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	2.9	2.9	1.2	3.5	< 0.2
Chromium (Cr)	mg/kg	< 2	MCERTS	33	46	46	50	4
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	424	419	52	510	< 4
Lead (Pb)	mg/kg	< 3	MCERTS	513	1010	112	390	8
Mercury (Hg)	mg/kg	< 1	NONE	3.5	2.6	1.2	4	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	45	55	30	62	< 3
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	< 3
Vanadium (V)	mg/kg	< 2	NONE	40	9	63	65	4
Zinc (Zn)	mg/kg	< 3	MCERTS	1170	1450	192	849	17
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
Subcontracted analysis (S)



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Soil Analysis Certificate						
DETS Report No: 19-10510	Date Sampled	None Supplied	None Supplied	None Supplied		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Rivermead Leisure Centre	TP / BH No	WS2	WS3	WS4		
Project / Job Ref: 17755	Additional Refs	J	J	J		
Order No: None Supplied	Depth (m)	0.40	0.40	0.40		
Reporting Date: 30/07/2019	DETS Sample No	423227	423228	423229		

Determinand	Unit	RL	Accreditation				
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	
pH	pH Units	N/a	MCERTS	7.8	7.9	7.9	
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	
Free Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	21	20	14	
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.02	0.02	0.01	
Organic Matter	%	< 0.1	MCERTS	0.3	0.7	0.5	
Arsenic (As)	mg/kg	< 2	MCERTS	3	6	5	
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2	< 0.2	< 0.2	
Chromium (Cr)	mg/kg	< 2	MCERTS	9	12	12	
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	
Copper (Cu)	mg/kg	< 4	MCERTS	5	6	8	
Lead (Pb)	mg/kg	< 3	MCERTS	8	8	6	
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1	
Nickel (Ni)	mg/kg	< 3	MCERTS	4	5	5	
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	
Vanadium (V)	mg/kg	< 2	NONE	11	< 2	< 2	
Zinc (Zn)	mg/kg	< 3	MCERTS	21	32	26	
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
Subcontracted analysis (S)



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Maidstone
Kent ME17 2JN
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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 19-10510	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Rivermead Leisure Centre	TP / BH No	BH1	BH1	BH2	BH2	BH2
Project / Job Ref: 17755	Additional Refs	J&B	J	J	J	J
Order No: None Supplied	Depth (m)	0.50 - 1.00	2.00	0.35	1.20	2.50
Reporting Date: 30/07/2019	DETS Sample No	423207	423208	423209	423210	423211

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.14	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.17
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.23
Phenanthrene	mg/kg	< 0.1	MCERTS	0.30	0.25	< 0.1	0.55	1.88
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.13	0.46
Fluoranthene	mg/kg	< 0.1	MCERTS	1.03	0.33	0.12	0.84	3.75
Pyrene	mg/kg	< 0.1	MCERTS	0.99	0.28	< 0.1	0.74	3.24
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.55	0.13	< 0.1	0.36	1.53
Chrysene	mg/kg	< 0.1	MCERTS	0.57	0.14	< 0.1	0.37	1.57
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.82	0.19	< 0.1	0.50	1.93
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	0.26	< 0.1	< 0.1	0.16	0.59
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.57	0.14	< 0.1	0.36	1.45
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.40	< 0.1	< 0.1	0.23	0.78
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.16
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	0.38	< 0.1	< 0.1	0.22	0.71
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	5.9	< 1.6	< 1.6	4.6	18.4

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 19-10510	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Rivermead Leisure Centre	TP / BH No	BH4	BH4	BH4	BH5	BH5
Project / Job Ref: 17755	Additional Refs	J	J	J&B	J	J
Order No: None Supplied	Depth (m)	0.50 - 1.00	1.00	1.50 - 1.70	0.45	0.80
Reporting Date: 30/07/2019	DETS Sample No	423212	423213	423214	423215	423216

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	1.82	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.51	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.75	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	0.14	3.46	< 0.1	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.98	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	0.14	3.20	0.15	0.21
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	2.24	0.13	0.19
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	1.25	0.15	0.18
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	1.09	< 0.1	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	1.42	0.17	0.21
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.36	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.96	0.11	0.13
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.73	0.24	0.27
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.14	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.56	0.15	0.16
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	19.5	< 1.6	< 1.6

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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 19-10510	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Rivermead Leisure Centre	TP / BH No	BH5	BH6	BH6	BH7	BH7
Project / Job Ref: 17755	Additional Refs	J	J	J	J	J
Order No: None Supplied	Depth (m)	2.00	0.50	1.50	0.30	0.40
Reporting Date: 30/07/2019	DETS Sample No	423217	423218	423219	423220	423221

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.51	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.51	< 0.1	0.15
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.81	< 0.1	0.18
Phenanthrene	mg/kg	< 0.1	MCERTS	0.62	< 0.1	4.38	< 0.1	0.91
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	1.30	< 0.1	0.18
Fluoranthene	mg/kg	< 0.1	MCERTS	0.67	< 0.1	4.99	0.14	1.40
Pyrene	mg/kg	< 0.1	MCERTS	0.58	< 0.1	4.29	0.12	1.28
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.33	< 0.1	2.20	< 0.1	0.52
Chrysene	mg/kg	< 0.1	MCERTS	0.24	< 0.1	2.07	< 0.1	0.55
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.34	< 0.1	2.54	< 0.1	0.63
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.93	< 0.1	0.21
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.22	< 0.1	2	< 0.1	0.46
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.33	< 0.1	1.11	< 0.1	0.29
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.26	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	0.20	< 0.1	0.97	< 0.1	0.29
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	3.5	< 1.6	28.9	< 1.6	7.1

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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 19-10510	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Rivermead Leisure Centre	TP / BH No	BH7	BH3	BH3	BH3	WS1
Project / Job Ref: 17755	Additional Refs	J	J&B	J	J	J
Order No: None Supplied	Depth (m)	2.50	0.50 - 1.00	1.30	2.00	0.30
Reporting Date: 30/07/2019	DETS Sample No	423222	423223	423224	423225	423226

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	0.63	0.28	< 0.1	38.40	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.37	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	5.15	< 0.1	< 0.1	29.70	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	6.68	0.17	< 0.1	32.20	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	47.90	1.71	< 0.1	104	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	7.57	0.44	< 0.1	31	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	45.90	3.21	0.13	68.80	0.12
Pyrene	mg/kg	< 0.1	MCERTS	37.80	2.73	0.11	50.20	0.10
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	9.67	1.28	< 0.1	22.10	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	10.30	1.63	< 0.1	18	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	11.60	2.20	0.14	18.90	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	3.86	0.73	< 0.1	6.69	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	8	1.50	< 0.1	15.60	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	4.60	1.14	< 0.1	7.60	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	0.87	0.23	< 0.1	1.18	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	4.43	1.01	< 0.1	6.17	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	205	18.3	< 1.6	451	< 1.6

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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 19-10510	Date Sampled	None Supplied	None Supplied	None Supplied		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Rivermead Leisure Centre	TP / BH No	WS2	WS3	WS4		
Project / Job Ref: 17755	Additional Refs	J	J	J		
Order No: None Supplied	Depth (m)	0.40	0.40	0.40		
Reporting Date: 30/07/2019	DETS Sample No	423227	423228	423229		

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Fluoranthene	mg/kg	< 0.1	MCERTS	0.24	< 0.1	< 0.1		
Pyrene	mg/kg	< 0.1	MCERTS	0.21	< 0.1	< 0.1		
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.19	< 0.1	< 0.1		
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.20	< 0.1	< 0.1		
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.20	< 0.1	< 0.1		
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.36	< 0.1	< 0.1		
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	0.27	< 0.1	< 0.1		
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	1.6	< 1.6	< 1.6		

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Soil Analysis Certificate - EPH Texas Banded						
DETS Report No: 19-10510	Date Sampled	None Supplied	None Supplied	None Supplied		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Rivermead Leisure Centre	TP / BH No	BH1	BH4	BH3		
Project / Job Ref: 17755	Additional Refs	J&B	J&B	J&B		
Order No: None Supplied	Depth (m)	0.50 - 1.00	1.50 - 1.70	0.50 - 1.00		
Reporting Date: 30/07/2019	DETS Sample No	423207	423214	423223		

Determinand	Unit	RL	Accreditation					
EPH Texas (C6 - C8)	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05		
EPH Texas (>C8 - C10)	mg/kg	< 1	MCERTS	< 1	8	< 1		
EPH Texas (>C10 - C12)	mg/kg	< 1	MCERTS	< 1	13	1		
EPH Texas (>C12 - C16)	mg/kg	< 1	MCERTS	3	18	7		
EPH Texas (>C16 - C21)	mg/kg	< 1	MCERTS	18	83	40		
EPH Texas (>C21 - C40)	mg/kg	< 6	MCERTS	107	596	200		
EPH Texas (C6 - C40)	mg/kg	< 6	NONE	128	719	248		

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Soil Analysis Certificate - TPH CWG Banded

DETS Report No: 19-10510	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Rivermead Leisure Centre	TP / BH No	BH1	BH2	BH2	BH2	BH4
Project / Job Ref: 17755	Additional Refs	J	J	J	J	J
Order No: None Supplied	Depth (m)	2.00	0.35	1.20	2.50	0.50 - 1.00
Reporting Date: 30/07/2019	DETS Sample No	423208	423209	423210	423211	423212

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	4	5	< 2
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	7	10	< 2
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3	3	5	< 3
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	4	19	< 3
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10	< 10	< 10	89	< 10
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21	< 21	< 21	127	< 21
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	< 2	2	3	< 2
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	3	< 3	19	49	< 3
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10	< 10	25	190	56
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21	< 21	47	243	56
Total >C5 - C35	mg/kg	< 42	NONE	< 42	< 42	64	370	56

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Soil Analysis Certificate - TPH CWG Banded

DETS Report No: 19-10510	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Rivermead Leisure Centre	TP / BH No	BH4	BH5	BH5	BH5	BH6
Project / Job Ref: 17755	Additional Refs	J	J	J	J	J
Order No: None Supplied	Depth (m)	1.00	0.45	0.80	2.00	0.50
Reporting Date: 30/07/2019	DETS Sample No	423213	423215	423216	423217	423218

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	< 21
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	< 21
Total >C5 - C35	mg/kg	< 42	NONE	< 42	< 42	< 42	< 42	< 42

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Soil Analysis Certificate - TPH CWG Banded

DETS Report No: 19-10510	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Rivermead Leisure Centre	TP / BH No	BH6	BH7	BH7	BH7	BH3
Project / Job Ref: 17755	Additional Refs	J	J	J	J	J
Order No: None Supplied	Depth (m)	1.50	0.30	0.40	2.50	1.30
Reporting Date: 30/07/2019	DETS Sample No	423219	423220	423221	423222	423224

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	9	< 2	< 2	29	< 2
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	34	< 2	< 2	72	< 2
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	11	< 3	< 3	61	< 3
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	27	< 3	< 3	133	< 3
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	54	< 10	< 10	452	< 10
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	135	< 21	< 21	747	< 21
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	0.02	< 0.01	< 0.01
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	10	< 2
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	< 2	6	110	< 2
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	66	< 3	38	515	< 3
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	227	< 10	153	1477	< 10
Aromatic (C5 - C35)	mg/kg	< 21	NONE	293	< 21	198	2111	< 21
Total >C5 - C35	mg/kg	< 42	NONE	428	< 42	198	2858	< 42

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Soil Analysis Certificate - TPH CWG Banded

DETS Report No: 19-10510	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Rivermead Leisure Centre	TP / BH No	BH3	WS1	WS2	WS3	WS4
Project / Job Ref: 17755	Additional Refs	J	J	J	J	J
Order No: None Supplied	Depth (m)	2.00	0.30	0.40	0.40	0.40
Reporting Date: 30/07/2019	DETS Sample No	423225	423226	423227	423228	423229

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	221	< 2	< 2	< 2	< 2
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	12	< 2	< 2	< 2	< 2
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	18	< 3	< 3	< 3	< 3
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	34	< 3	< 3	< 3	< 3
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	172	< 10	< 10	< 10	< 10
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	458	< 21	< 21	< 21	< 21
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	55	< 2	< 2	< 2	< 2
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	269	< 2	< 2	< 2	< 2
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	476	< 3	< 3	< 3	< 3
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	547	< 10	< 10	< 10	< 10
Aromatic (C5 - C35)	mg/kg	< 21	NONE	1347	< 21	< 21	< 21	< 21
Total >C5 - C35	mg/kg	< 42	NONE	1805	< 42	< 42	< 42	< 42

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 19-10510	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Rivermead Leisure Centre	TP / BH No	BH1	BH2	BH2	BH2	BH4
Project / Job Ref: 17755	Additional Refs	J	J	J	J	J
Order No: None Supplied	Depth (m)	2.00	0.35	1.20	2.50	0.50 - 1.00
Reporting Date: 30/07/2019	DETS Sample No	423208	423209	423210	423211	423212

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	6	< 2
Toluene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5
Ethylbenzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
p & m-xylene	ug/kg	< 2	MCERTS	< 2	5	3	9	< 2
o-xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	4	< 2
MTBE	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5

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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 19-10510	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Rivermead Leisure Centre	TP / BH No	BH4	BH5	BH5	BH5	BH6
Project / Job Ref: 17755	Additional Refs	J	J	J	J	J
Order No: None Supplied	Depth (m)	1.00	0.45	0.80	2.00	0.50
Reporting Date: 30/07/2019	DETS Sample No	423213	423215	423216	423217	423218

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Toluene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5
Ethylbenzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
p & m-xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
o-xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
MTBE	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 19-10510	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Rivermead Leisure Centre	TP / BH No	BH6	BH7	BH7	BH7	BH3
Project / Job Ref: 17755	Additional Refs	J	J	J	J	J
Order No: None Supplied	Depth (m)	1.50	0.30	0.40	2.50	1.30
Reporting Date: 30/07/2019	DETS Sample No	423219	423220	423221	423222	423224

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	4	< 2	21	< 2	< 2
Toluene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5
Ethylbenzene	ug/kg	< 2	MCERTS	2	< 2	4	4	< 2
p & m-xylene	ug/kg	< 2	MCERTS	9	3	78	11	2
o-xylene	ug/kg	< 2	MCERTS	6	< 2	15	14	< 2
MTBE	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5

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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 19-10510	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Rivermead Leisure Centre	TP / BH No	BH3	WS1	WS2	WS3	WS4
Project / Job Ref: 17755	Additional Refs	J	J	J	J	J
Order No: None Supplied	Depth (m)	2.00	0.30	0.40	0.40	0.40
Reporting Date: 30/07/2019	DETS Sample No	423225	423226	423227	423228	423229

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Toluene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5
Ethylbenzene	ug/kg	< 2	MCERTS	70	< 2	< 2	< 2	< 2
p & m-xylene	ug/kg	< 2	MCERTS	890	< 2	< 2	< 2	< 2
o-xylene	ug/kg	< 2	MCERTS	61	< 2	< 2	< 2	< 2
MTBE	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5

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Soil Analysis Certificate - PCB (7 Congeners)						
DETS Report No: 19-10510	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Rivermead Leisure Centre	TP / BH No	BH1	BH2	BH2	BH2	BH4
Project / Job Ref: 17755	Additional Refs	J	J	J	J	J
Order No: None Supplied	Depth (m)	2.00	0.35	1.20	2.50	0.50 - 1.00
Reporting Date: 30/07/2019	DETS Sample No	423208	423209	423210	423211	423212

Determinand	Unit	RL	Accreditation					
PCB Congener 28	mg/kg	0.008	NONE	< 0.008	0.011	0.035	0.080	< 0.008
PCB Congener 52	mg/kg	0.008	NONE	< 0.008	< 0.008	0.012	< 0.008	< 0.008
PCB Congener 101	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
PCB Congener 118	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
PCB Congener 138	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
PCB Congener 153	mg/kg	0.008	NONE	< 0.008	< 0.008	0.012	< 0.008	< 0.008
PCB Congener 180	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
Total PCB (7 Congeners)	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



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Soil Analysis Certificate - PCB (7 Congeners)						
DETS Report No: 19-10510	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Rivermead Leisure Centre	TP / BH No	BH4	BH5	BH5	BH5	BH6
Project / Job Ref: 17755	Additional Refs	J	J	J	J	J
Order No: None Supplied	Depth (m)	1.00	0.45	0.80	2.00	0.50
Reporting Date: 30/07/2019	DETS Sample No	423213	423215	423216	423217	423218

Determinand	Unit	RL	Accreditation					
PCB Congener 28	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
PCB Congener 52	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
PCB Congener 101	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
PCB Congener 118	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
PCB Congener 138	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
PCB Congener 153	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
PCB Congener 180	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
Total PCB (7 Congeners)	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



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Soil Analysis Certificate - PCB (7 Congeners)						
DETS Report No: 19-10510	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Rivermead Leisure Centre	TP / BH No	BH6	BH7	BH7	BH7	BH3
Project / Job Ref: 17755	Additional Refs	J	J	J	J	J
Order No: None Supplied	Depth (m)	1.50	0.30	0.40	2.50	1.30
Reporting Date: 30/07/2019	DETS Sample No	423219	423220	423221	423222	423224

Determinand	Unit	RL	Accreditation					
PCB Congener 28	mg/kg	0.008	NONE	0.049	< 0.008	0.042	< 0.008	< 0.008
PCB Congener 52	mg/kg	0.008	NONE	0.012	< 0.008	< 0.008	< 0.008	< 0.008
PCB Congener 101	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
PCB Congener 118	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
PCB Congener 138	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
PCB Congener 153	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
PCB Congener 180	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
Total PCB (7 Congeners)	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



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Soil Analysis Certificate - PCB (7 Congeners)						
DETS Report No: 19-10510	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Rivermead Leisure Centre	TP / BH No	BH3	WS1	WS2	WS3	WS4
Project / Job Ref: 17755	Additional Refs	J	J	J	J	J
Order No: None Supplied	Depth (m)	2.00	0.30	0.40	0.40	0.40
Reporting Date: 30/07/2019	DETS Sample No	423225	423226	423227	423228	423229

Determinand	Unit	RL	Accreditation					
PCB Congener 28	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
PCB Congener 52	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
PCB Congener 101	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
PCB Congener 118	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
PCB Congener 138	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
PCB Congener 153	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
PCB Congener 180	mg/kg	0.008	NONE	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
Total PCB (7 Congeners)	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

Waste Acceptance Criteria Analytical Certificate - BS EN 12457/2																																							
DETS Report No: 19-10510		Date Sampled		None Supplied		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="3" style="text-align: left; padding: 5px;">Landfill Waste Acceptance Criteria Limits</th> </tr> <tr> <th style="width: 33%; padding: 5px;">Inert Waste Landfill</th> <th style="width: 33%; padding: 5px;">Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill</th> <th style="width: 33%; padding: 5px;">Hazardous Waste Landfill</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding: 5px;">3%</td> <td style="text-align: center; padding: 5px;">5%</td> <td style="text-align: center; padding: 5px;">6%</td> </tr> <tr> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px;">10%</td> </tr> <tr> <td style="text-align: center; padding: 5px;">6</td> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px;">--</td> </tr> <tr> <td style="text-align: center; padding: 5px;">1</td> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px;">--</td> </tr> <tr> <td style="text-align: center; padding: 5px;">500</td> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px;">--</td> </tr> <tr> <td style="text-align: center; padding: 5px;">100</td> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px;">--</td> </tr> <tr> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px;">>6</td> <td style="text-align: center; padding: 5px;">--</td> </tr> <tr> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px; color: red;">To be evaluated</td> <td style="text-align: center; padding: 5px; color: red;">To be evaluated</td> </tr> </tbody> </table>				Landfill Waste Acceptance Criteria Limits			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill	3%	5%	6%	--	--	10%	6	--	--	1	--	--	500	--	--	100	--	--	--	>6	--	--	To be evaluated	To be evaluated
Landfill Waste Acceptance Criteria Limits																																							
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6	--	--																																					
1	--	--																																					
500	--	--																																					
100	--	--																																					
--	>6	--																																					
--	To be evaluated	To be evaluated																																					
Soils Ltd		Time Sampled		None Supplied																																			
Site Reference: Rivermead Leisure Centre		TP / BH No		BH1																																			
Project / Job Ref: 17755		Additional Refs		J&B																																			
Order No: None Supplied		Depth (m)		0.50 - 1.00																																			
Reporting Date: 30/07/2019		DETS Sample No		423207																																			
Determinand	Unit	MDL																																					
TOC ^{MU}	%	< 0.1	1.3																																				
Loss on Ignition	%	< 0.01	3.82																																				
BTEX ^{MU}	mg/kg	< 0.05	< 0.05																																				
Sum of PCBs	mg/kg	< 0.1	< 0.1																																				
Mineral Oil ^{MU}	mg/kg	< 10	< 10																																				
Total PAH ^{MU}	mg/kg	< 1.7	5.9																																				
pH ^{MU}	pH Units	N/a	7.2																																				
Acid Neutralisation Capacity	mol/kg (+/-)	< 1	1.2																																				
Eluate Analysis			10:1 mg/l			Cumulative 10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)																																
Arsenic ^U			< 0.01			< 0.1	0.5	2	25																														
Barium ^U			0.09			0.9	20	100	300																														
Cadmium ^U			< 0.0005			< 0.005	0.04	1	5																														
Chromium ^U			< 0.005			< 0.05	0.5	10	70																														
Copper ^U			< 0.01			< 0.1	2	50	100																														
Mercury ^U			< 0.0005			< 0.01	0.01	0.2	2																														
Molybdenum ^U			0.023			0.23	0.5	10	30																														
Nickel ^U			< 0.007			< 0.07	0.4	10	40																														
Lead ^U			< 0.005			< 0.05	0.5	10	50																														
Antimony ^U			0.0158			0.16	0.06	0.7	5																														
Selenium ^U			< 0.005			< 0.05	0.1	0.5	7																														
Zinc ^U			0.008			0.08	4	50	200																														
Chloride ^U			6			61	800	15000	25000																														
Fluoride ^U			< 0.5			< 5	10	150	500																														
Sulphate ^U			162			1624	1000	20000	50000																														
TDS			305			3049	4000	60000	100000																														
Phenol Index			< 0.01			< 0.1	1	-	-																														
DOC	10.4			104	500	800	1000																																
Leach Test Information																																							
Sample Mass (kg)			0.10																																				
Dry Matter (%)			89.3																																				
Moisture (%)			12																																				
Stage 1																																							
Volume Eluate L10 (litres)			0.89																																				

Results are expressed on a dry weight basis, after correction for moisture content where applicable

Stated limits are for guidance only and DETS Ltd cannot be held responsible for any discrepancies with current legislation

M Denotes MCERTS accredited test

U Denotes ISO17025 accredited test

Waste Acceptance Criteria Analytical Certificate - BS EN 12457/2																																							
DETS Report No: 19-10510		Date Sampled		None Supplied		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="3" style="text-align: left; padding: 5px;">Landfill Waste Acceptance Criteria Limits</th> </tr> <tr> <th style="width: 33%; padding: 5px;">Inert Waste Landfill</th> <th style="width: 33%; padding: 5px;">Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill</th> <th style="width: 33%; padding: 5px;">Hazardous Waste Landfill</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding: 5px;">3%</td> <td style="text-align: center; padding: 5px;">5%</td> <td style="text-align: center; padding: 5px;">6%</td> </tr> <tr> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px;">10%</td> </tr> <tr> <td style="text-align: center; padding: 5px;">6</td> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px;">--</td> </tr> <tr> <td style="text-align: center; padding: 5px;">1</td> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px;">--</td> </tr> <tr> <td style="text-align: center; padding: 5px;">500</td> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px;">--</td> </tr> <tr> <td style="text-align: center; padding: 5px;">100</td> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px;">--</td> </tr> <tr> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px;">>6</td> <td style="text-align: center; padding: 5px;">--</td> </tr> <tr> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px; color: red;">To be evaluated</td> <td style="text-align: center; padding: 5px; color: red;">To be evaluated</td> </tr> </tbody> </table>				Landfill Waste Acceptance Criteria Limits			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill	3%	5%	6%	--	--	10%	6	--	--	1	--	--	500	--	--	100	--	--	--	>6	--	--	To be evaluated	To be evaluated
Landfill Waste Acceptance Criteria Limits																																							
Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill																																					
3%	5%	6%																																					
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6	--	--																																					
1	--	--																																					
500	--	--																																					
100	--	--																																					
--	>6	--																																					
--	To be evaluated	To be evaluated																																					
Soils Ltd		Time Sampled		None Supplied																																			
Site Reference: Rivermead Leisure Centre		TP / BH No		BH4																																			
Project / Job Ref: 17755		Additional Refs		J&B																																			
Order No: None Supplied		Depth (m)		1.50 - 1.70																																			
Reporting Date: 30/07/2019		DETS Sample No		423214																																			
Determinand	Unit	MDL																																					
TOC ^{MU}	%	< 0.1	1.5																																				
Loss on Ignition	%	< 0.01	4.80																																				
BTEX ^{MU}	mg/kg	< 0.05	0.08																																				
Sum of PCBs	mg/kg	< 0.1	< 0.1																																				
Mineral Oil ^{MU}	mg/kg	< 10	319																																				
Total PAH ^{MU}	mg/kg	< 1.7	19.5																																				
pH ^{MU}	pH Units	N/a	7.4																																				
Acid Neutralisation Capacity	mol/kg (+/-)	< 1	< 1																																				
Eluate Analysis			10:1 mg/l			Cumulative 10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)																																
Arsenic ^U			< 0.01			< 0.1	0.5	2	25																														
Barium ^U			0.07			0.7	20	100	300																														
Cadmium ^U			< 0.0005			< 0.005	0.04	1	5																														
Chromium ^U			< 0.005			< 0.05	0.5	10	70																														
Copper ^U			< 0.01			< 0.1	2	50	100																														
Mercury ^U			< 0.0005			< 0.01	0.01	0.2	2																														
Molybdenum ^U			0.015			0.15	0.5	10	30																														
Nickel ^U			< 0.007			< 0.07	0.4	10	40																														
Lead ^U			< 0.005			< 0.05	0.5	10	50																														
Antimony ^U			< 0.0060			< 0.06	0.06	0.7	5																														
Selenium ^U			< 0.005			< 0.05	0.1	0.5	7																														
Zinc ^U			< 0.005			< 0.05	4	50	200																														
Chloride ^U			4			38	800	15000	25000																														
Fluoride ^U			< 0.5			< 5	10	150	500																														
Sulphate ^U			73			733	1000	20000	50000																														
TDS			246			2461	4000	60000	100000																														
Phenol Index			< 0.01			< 0.1	1	-	-																														
DOC	10.4			104	500	800	1000																																
Leach Test Information																																							
Sample Mass (kg)	0.10																																						
Dry Matter (%)	91.5																																						
Moisture (%)	9.4																																						
Stage 1																																							
Volume Eluate L10 (litres)	0.89																																						

Results are expressed on a dry weight basis, after correction for moisture content where applicable

Stated limits are for guidance only and DETS Ltd cannot be held responsible for any discrepancies with current legislation

M Denotes MCERTS accredited test

U Denotes ISO17025 accredited test

Waste Acceptance Criteria Analytical Certificate - BS EN 12457/2																																							
DETS Report No: 19-10510		Date Sampled		None Supplied		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="3" style="text-align: left; padding: 5px;">Landfill Waste Acceptance Criteria Limits</th> </tr> <tr> <th style="width: 33%; padding: 5px;">Inert Waste Landfill</th> <th style="width: 33%; padding: 5px;">Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill</th> <th style="width: 33%; padding: 5px;">Hazardous Waste Landfill</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding: 5px;">3%</td> <td style="text-align: center; padding: 5px;">5%</td> <td style="text-align: center; padding: 5px;">6%</td> </tr> <tr> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px;">10%</td> </tr> <tr> <td style="text-align: center; padding: 5px;">6</td> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px;">--</td> </tr> <tr> <td style="text-align: center; padding: 5px;">1</td> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px;">--</td> </tr> <tr> <td style="text-align: center; padding: 5px;">500</td> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px;">--</td> </tr> <tr> <td style="text-align: center; padding: 5px;">100</td> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px;">--</td> </tr> <tr> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px;">>6</td> <td style="text-align: center; padding: 5px;">--</td> </tr> <tr> <td style="text-align: center; padding: 5px;">--</td> <td style="text-align: center; padding: 5px; color: red;">To be evaluated</td> <td style="text-align: center; padding: 5px; color: red;">To be evaluated</td> </tr> </tbody> </table>				Landfill Waste Acceptance Criteria Limits			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill	3%	5%	6%	--	--	10%	6	--	--	1	--	--	500	--	--	100	--	--	--	>6	--	--	To be evaluated	To be evaluated
Landfill Waste Acceptance Criteria Limits																																							
Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill																																					
3%	5%	6%																																					
--	--	10%																																					
6	--	--																																					
1	--	--																																					
500	--	--																																					
100	--	--																																					
--	>6	--																																					
--	To be evaluated	To be evaluated																																					
Soils Ltd		Time Sampled		None Supplied																																			
Site Reference: Rivermead Leisure Centre		TP / BH No		BH3																																			
Project / Job Ref: 17755		Additional Refs		J&B																																			
Order No: None Supplied		Depth (m)		0.50 - 1.00																																			
Reporting Date: 30/07/2019		DETS Sample No		423223																																			
Determinand	Unit	MDL																																					
TOC ^{MU}	%	< 0.1	2.8																																				
Loss on Ignition	%	< 0.01	7.30																																				
BTEX ^{MU}	mg/kg	< 0.05	< 0.05																																				
Sum of PCBs	mg/kg	< 0.1	< 0.1																																				
Mineral Oil ^{MU}	mg/kg	< 10	< 10																																				
Total PAH ^{MU}	mg/kg	< 1.7	18.4																																				
pH ^{MU}	pH Units	N/a	7.2																																				
Acid Neutralisation Capacity	mol/kg (+/-)	< 1	< 1																																				
Eluate Analysis			10:1 mg/l			Cumulative 10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)																																
Arsenic ^U			< 0.01			< 0.1	0.5	2	25																														
Barium ^U			0.12			1.2	20	100	300																														
Cadmium ^U			< 0.0005			< 0.005	0.04	1	5																														
Chromium ^U			< 0.005			< 0.05	0.5	10	70																														
Copper ^U			< 0.01			< 0.1	2	50	100																														
Mercury ^U			< 0.0005			< 0.01	0.01	0.2	2																														
Molybdenum ^U			0.017			0.17	0.5	10	30																														
Nickel ^U			< 0.007			< 0.07	0.4	10	40																														
Lead ^U			< 0.005			< 0.05	0.5	10	50																														
Antimony ^U			0.0162			0.16	0.06	0.7	5																														
Selenium ^U			< 0.005			< 0.05	0.1	0.5	7																														
Zinc ^U			0.019			0.19	4	50	200																														
Chloride ^U			1			12	800	15000	25000																														
Fluoride ^U			< 0.5			< 5	10	150	500																														
Sulphate ^U			66			657	1000	20000	50000																														
TDS			201			2009	4000	60000	100000																														
Phenol Index			< 0.01			< 0.1	1	-	-																														
DOC	5.7			57.4	500	800	1000																																
Leach Test Information																																							
Sample Mass (kg)	0.10																																						
Dry Matter (%)	86																																						
Moisture (%)	16.4																																						
Stage 1																																							
Volume Eluate L10 (litres)	0.89																																						

Results are expressed on a dry weight basis, after correction for moisture content where applicable

Stated limits are for guidance only and DETS Ltd cannot be held responsible for any discrepancies with current legislation

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U Denotes ISO17025 accredited test



DETS Ltd
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Tel : 01622 850410



Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 19-10510	
Soils Ltd	
Site Reference: Rivermead Leisure Centre	
Project / Job Ref: 17755	
Order No: None Supplied	
Reporting Date: 30/07/2019	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
^ 423207	BH1	J&B	0.50 - 1.00	10.7	Brown loamy sand with stones and brick
^ 423208	BH1	J	2.00	21	Brown loamy sand with stones
^ 423209	BH2	J	0.35	5.3	Brown sandy clay with stones
^ 423210	BH2	J	1.20	14.6	Brown loamy sand with stones
^ 423211	BH2	J	2.50	25.4	Brown loamy sand with stones and vegetation
^ 423212	BH4	J	0.50 - 1.00	7.8	Brown sandy gravel with stones
^ 423213	BH4	J	1.00	5.3	Brown sandy gravel with stones and chalk
^ 423214	BH4	J&B	1.50 - 1.70	8.5	Brown loamy sand with stones and concrete
^ 423215	BH5	J	0.45	5.5	Brown sandy gravel with stones and vegetation
^ 423216	BH5	J	0.80	10.9	Brown loamy sand with stones and vegetation
^ 423217	BH5	J	2.00	24	Brown loamy sand with stones and vegetation
^ 423218	BH6	J	0.50	7.9	Brown sandy gravel with stones
^ 423219	BH6	J	1.50	18.4	Brown loamy sand with stones and concrete
^ 423220	BH7	J	0.30	4.5	Brown sandy gravel with brick and concrete
^ 423221	BH7	J	0.40	28.6	Brown loamy sand with rubble
^ 423222	BH7	J	2.50	20.4	Black loamy sand with stones
^ 423223	BH3	J&B	0.50 - 1.00	14	Black loamy sand
^ 423224	BH3	J	1.30	12.5	Brown loamy sand with stones
^ 423225	BH3	J	2.00	33.2	Black loamy sand with fibrous material
^ 423226	WS1	J	0.30	2.3	Brown sandy gravel with stones
^ 423227	WS2	J	0.40	2.8	Brown sandy clay with stones and vegetation
^ 423228	WS3	J	0.40	6.2	Brown sandy gravel with stones
^ 423229	WS4	J	0.40	3.9	Brown sandy gravel with stones and chalk

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample ^{1/s}

Unsuitable Sample ^{u/s}

^ no sampling date provided; unable to confirm if samples are within acceptable holding times



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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 19-10510

Soils Ltd

Site Reference: Rivermead Leisure Centre

Project / Job Ref: 17755

Order No: None Supplied

Reporting Date: 30/07/2019

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received



Tim Rudkin
Soils Ltd
Newton House
Cross Road
Tadworth
Surrey
KT20 5SR

DETS Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 19-10741

Site Reference: Rivermead Leisure Centre

Project / Job Ref: 17755

Order No: None Supplied

Sample Receipt Date: 26/07/2019

Sample Scheduled Date: 29/07/2019

Report Issue Number: 1

Reporting Date: 02/08/2019

Authorised by:

A handwritten signature in grey ink, appearing to read "Dave Ashworth".

Dave Ashworth
Technical Manager

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. 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 except in full, without the prior written approval of the laboratory.



DETS Ltd
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Maidstone
Kent ME17 2JN
Tel : 01622 850410



Water Analysis Certificate						
DETS Report No: 19-10741	Date Sampled	25/07/19	25/07/19	25/07/19		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Rivermead Leisure Centre	TP / BH No	BH1	BH2	BH3		
Project / Job Ref: 17755	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	None Supplied	None Supplied	None Supplied		
Reporting Date: 02/08/2019	DETS Sample No	424165	424166	424167		

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	ISO17025	7.3	7.0	7.4		
Total Cyanide	ug/l	< 5	NONE	< 5	< 5	< 5		
Free Cyanide	ug/l	< 5	NONE	< 5	< 5	< 5		
Sulphate as SO ₄	mg/l	< 1	ISO17025	58	6	31		
Total Organic Carbon (TOC)	mg/l	< 0.1	NONE	13.6	37.6	10.8		
Arsenic (dissolved)	ug/l	< 5	ISO17025	< 5	< 5	< 5		
Boron (dissolved)	ug/l	< 5	ISO17025	421	376	317		
Cadmium (dissolved)	ug/l	< 0.4	ISO17025	< 0.4	< 0.4	< 0.4		
Chromium (dissolved)	ug/l	< 5	ISO17025	< 5	< 5	< 5		
Chromium (hexavalent)	ug/l	< 20	NONE	< 20	< 20	< 20		
Copper (dissolved)	ug/l	< 5	ISO17025	< 5	< 5	< 5		
Lead (dissolved)	ug/l	< 5	ISO17025	< 5	< 5	< 5		
Mercury (dissolved)	ug/l	< 0.05	ISO17025	< 0.05	< 0.05	< 0.05		
Nickel (dissolved)	ug/l	< 5	ISO17025	< 5	21	< 5		
Selenium (dissolved)	ug/l	< 5	ISO17025	< 5	< 5	< 5		
Vanadium (dissolved)	ug/l	< 5	ISO17025	< 5	< 5	< 5		
Zinc (dissolved)	ug/l	< 2	ISO17025	7	10	9		
Total Phenols (monohydric)	ug/l	< 10	NONE	< 10	< 10	< 10		

Subcontracted analysis ^(S)
Insufficient sample ^{1/S}
Unsuitable Sample ^{U/S}



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Maidstone
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Water Analysis Certificate - Speciated PAH						
DETS Report No: 19-10741	Date Sampled	25/07/19	25/07/19	25/07/19		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Rivermead Leisure Centre	TP / BH No	BH1	BH2	BH3		
Project / Job Ref: 17755	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	None Supplied	None Supplied	None Supplied		
Reporting Date: 02/08/2019	DETS Sample No	424165	424166	424167		

Determinand	Unit	RL	Accreditation					
Naphthalene	ug/l	< 0.01	NONE	0.13	0.07	< 0.01		
Acenaphthylene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Acenaphthene	ug/l	< 0.01	NONE	< 0.01	0.97	< 0.01		
Fluorene	ug/l	< 0.01	NONE	< 0.01	0.54	< 0.01		
Phenanthrene	ug/l	< 0.01	NONE	0.04	0.15	< 0.01		
Anthracene	ug/l	< 0.01	NONE	< 0.01	0.10	< 0.01		
Fluoranthene	ug/l	< 0.01	NONE	0.04	0.12	< 0.01		
Pyrene	ug/l	< 0.01	NONE	0.03	0.07	< 0.01		
Benzo(a)anthracene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Chrysene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Benzo(b)fluoranthene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Benzo(k)fluoranthene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Benzo(a)pyrene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Indeno(1,2,3-cd)pyrene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Dibenz(a,h)anthracene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Benzo(ghi)perylene	ug/l	< 0.008	NONE	< 0.008	< 0.008	< 0.008		
Total EPA-16 PAHs	ug/l	< 0.01	NONE	0.24	2.02	< 0.01		



DETS Ltd
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Kent ME17 2JN
Tel : 01622 850410

Water Analysis Certificate - TPH CWG Banded						
DETS Report No: 19-10741	Date Sampled	25/07/19	25/07/19	25/07/19		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Rivermead Leisure Centre	TP / BH No	BH1	BH2	BH3		
Project / Job Ref: 17755	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	None Supplied	None Supplied	None Supplied		
Reporting Date: 02/08/2019	DETS Sample No	424165	424166	424167		

Determinand	Unit	RL	Accreditation						
Aliphatic >C5 - C6	ug/l	< 10	NONE	< 10	< 10	< 10			
Aliphatic >C6 - C8	ug/l	< 10	NONE	< 10	< 10	< 10			
Aliphatic >C8 - C10	ug/l	< 10	NONE	< 10	< 10	< 10			
Aliphatic >C10 - C12	ug/l	< 10	NONE	< 10	< 10	< 10			
Aliphatic >C12 - C16	ug/l	< 10	NONE	< 10	< 10	< 10			
Aliphatic >C16 - C21	ug/l	< 10	NONE	< 10	< 10	< 10			
Aliphatic >C21 - C34	ug/l	< 10	NONE	< 10	< 10	< 10			
Aliphatic (C5 - C34)	ug/l	< 70	NONE	< 70	< 70	< 70			
Aromatic >C5 - C7	ug/l	< 10	NONE	< 10	< 10	< 10			
Aromatic >C7 - C8	ug/l	< 10	NONE	< 10	< 10	< 10			
Aromatic >C8 - C10	ug/l	< 10	NONE	< 10	< 10	< 10			
Aromatic >C10 - C12	ug/l	< 10	NONE	< 10	< 10	< 10			
Aromatic >C12 - C16	ug/l	< 10	NONE	< 10	< 10	< 10			
Aromatic >C16 - C21	ug/l	< 10	NONE	< 10	< 10	< 10			
Aromatic >C21 - C35	ug/l	< 10	NONE	< 10	< 10	< 10			
Aromatic (C5 - C35)	ug/l	< 70	NONE	< 70	< 70	< 70			
Total >C5 - C35	ug/l	< 140	NONE	< 140	< 140	< 140			



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Rose Lane
Lenham Heath
Maidstone
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Tel : 01622 850410



Water Analysis Certificate - BTEX / MTBE						
DETS Report No: 19-10741	Date Sampled	25/07/19	25/07/19	25/07/19		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Rivermead Leisure Centre	TP / BH No	BH1	BH2	BH3		
Project / Job Ref: 17755	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	None Supplied	None Supplied	None Supplied		
Reporting Date: 02/08/2019	DETS Sample No	424165	424166	424167		

Determinand	Unit	RL	Accreditation					
Benzene	ug/l	< 1	ISO17025	< 1	< 1	< 1		
Toluene	ug/l	< 5	ISO17025	< 5	< 5	< 5		
Ethylbenzene	ug/l	< 5	ISO17025	< 5	< 5	< 5		
p & m-xylene	ug/l	< 10	ISO17025	< 10	< 10	< 10		
o-xylene	ug/l	< 5	ISO17025	< 5	< 5	< 5		
MTBE	ug/l	< 10	ISO17025	< 10	< 10	< 10		



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Water Analysis Certificate - PCB (7 Congeners)						
DETS Report No: 19-10741	Date Sampled	25/07/19	25/07/19	25/07/19		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Rivermead Leisure Centre	TP / BH No	BH1	BH2	BH3		
Project / Job Ref: 17755	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	None Supplied	None Supplied	None Supplied		
Reporting Date: 02/08/2019	DETS Sample No	424165	424166	424167		

Determinand	Unit	RL	Accreditation					
PCB Congener 28	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
PCB Congener 52	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
PCB Congener 101	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
PCB Congener 118	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
PCB Congener 138	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
PCB Congener 153	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
PCB Congener 180	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1		
Total PCB (7 Congeners)	ug/l	< 0.7	NONE	< 0.7	< 0.7	< 0.7		



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Water Analysis Certificate - Methodology & Miscellaneous Information	
DETS Report No: 19-10741	
Soils Ltd	
Site Reference: Rivermead Leisure Centre	
Project / Job Ref: 17755	
Order No: None Supplied	
Reporting Date: 02/08/2019	

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Water	UF	Alkalinity	Determination of alkalinity by titration against hydrochloric acid using bromocresol green as the end point	E103
Water	UF	BTEX	Determination of BTEX by headspace GC-MS	E101
Water	F	Cations	Determination of cations by filtration followed by ICP-MS	E102
Water	UF	Chemical Oxygen Demand (COD)	Determination using a COD reactor followed by colorimetry	E112
Water	F	Chloride	Determination of chloride by filtration & analysed by ion chromatography	E109
Water	F	Chromium - Hexavalent	Determination of hexavalent chromium by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E116
Water	UF	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E115
Water	UF	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through liquid:liquid extraction with cyclohexane	E111
Water	F	Diesel Range Organics (C10 - C24)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	Dissolved Organic Content (DOC)	Determination of DOC by filtration followed by low heat with persulphate addition followed by IR detection	E110
Water	UF	Electrical Conductivity	Determination of electrical conductivity by electrometric measurement	E123
Water	F	EPH (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E104
Water	F	Fluoride	Determination of Fluoride by filtration & analysed by ion chromatography	E109
Water	F	Hardness	Determination of Ca and Mg by ICP-MS followed by calculation	E102
Leachate	F	Leachate Preparation - NRA	Based on National Rivers Authority leaching test 1994	E301
Leachate	F	Leachate Preparation - WAC	Based on BS EN 12457 Pt1, 2, 3	E302
Water	F	Metals	Determination of metals by filtration followed by ICP-MS	E102
Water	F	Mineral Oil (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GI-FID	E104
Water	F	Nitrate	Determination of nitrate by filtration & analysed by ion chromatography	E109
Water	UF	Monohydric Phenol	Determination of phenols by distillation followed by colorimetry	E121
Water	F	PAH - Speciated (EPA 16)	Determination of PAH compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E105
Water	F	PCB - 7 Congeners	Determination of PCB compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E108
Water	UF	Petroleum Ether Extract (PEE)	Gravimetrically determined through liquid:liquid extraction with petroleum ether	E111
Water	UF	pH	Determination of pH by electrometric measurement	E107
Water	F	Phosphate	Determination of phosphate by filtration & analysed by ion chromatography	E109
Water	UF	Redox Potential	Determination of redox potential by electrometric measurement	E113
Water	F	Sulphate (as SO4)	Determination of sulphate by filtration & analysed by ion chromatography	E109
Water	UF	Sulphide	Determination of sulphide by distillation followed by colorimetry	E118
Water	F	SVOC	Determination of semi-volatile organic compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E106
Water	UF	Toluene Extractable Matter (TEM)	Gravimetrically determined through liquid:liquid extraction with toluene	E111
Water	UF	Total Organic Carbon (TOC)	Low heat with persulphate addition followed by IR detection	E110
Water	F	TPH CWG (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C35. C5 to C8 by headspace GC-MS	E104
Water	F	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C44. C5 to C8 by headspace GC-MS	E104
Water	UF	VOCs	Determination of volatile organic compounds by headspace GC-MS	E101
Water	UF	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E101

Key

F Filtered
UF Unfiltered

Appendix D.3 General Assessment Criteria

HUMAN HEALTH RISK ASSESSMENT

1.1 Introduction

Human Health Generic Quantitative Risk Assessment (GQRA) involves the comparison of contaminant concentrations measured in soil at the site with Generic Assessment Criteria (GAC).

GAC are conservative values adopted to ensure that they are applicable to the majority of possible contaminated site. These values may be published Contaminated Land Exposure Assessment Model (CLEA) derived GAC derived by a third party or the Environment Agency/ DEFRA. It is imperative to the risk assessor to understand the uncertainties and limitations associated with these GAC to ensure that they are used appropriately. Where the adoption of a GAC is not appropriate, for instance when the intended land-use is at variance the CLEA standard land-uses, then a Detailed Quantitative Risk Assessment (DQRA) may be undertaken to develop site specific values for relevant soil contaminants based on the site specific conditions.

1.2 General Assessment Criteria

The Contaminated Land Regime reflects the UK Government's stated objectives of achieving sustainable development through the 'suitable for use approach'.

1.2.1 Contaminated Land Exposure Assessment Model (CLEA)

Current United Kingdom risk assessment practice is based on the Contaminated Land Exposure Assessment Model (CLEA).

The CLEA Guidance comprises the following documents:

- EA Science Report SC050021/SR2: Human health toxicological assessment of contaminants in soil.
 - EA Science Report SC050021/SR3: Updated technical background to the CLEA model.
 - EA CLEA Bulletin (2009).
 - CLEA software version 1.04 (2009)
 - Toxicological reports and SGV technical notes.
-

The CLEA guidance and tools:

1. do not cover other types of risk to humans, such as fire, suffocation or explosion, or short-term and acute exposures.
 2. do not cover risks to the environment, such as groundwater, ecosystems or buildings.
 3. do not provide a definitive test for telling when human health risks are significant.
 4. are not a legal requirement in assessing land contamination risks. They are not part of the legal regime for Part 2A of the Environmental Protection Act 1990.
-

1.3 Soil Guideline Values (2009)

The EA are publishing a series of SGV reports for a selection of common contaminants relevant to the assessment of land contamination.

SGV's are generic assessment criteria based on CLEA standard land-uses and can be used to simplify the assessment of human health risks from long-term exposure to

chemical contamination in soil. They do not cover short-term exposure (i.e. construction and maintenance workers), acute exposure or other risks such as fire, suffocation or explosion, as might arise from an accumulation of gases such as methane and carbon dioxide, or either odour or aesthetic issues.

SGV's represent 'trigger values', indicators that soil concentrations above the SGV level may pose a possibility of *significant harm* to human health. The converse, where soil concentrations are less than the SGV, is that the long-term human health risks are considered to be tolerable or minimal.

The CLEA guidance derives soil concentrations of contaminants above which (in the opinion of the EA) there may be a concern that warrants further investigation. It does not provide a definitive test for establishing that the risk is significant.

1.4 Ongoing development of CLEA based guidance

The EA is involved in a programme of publishing SGV's and related toxicity data (the TOX reports). As at July 2009 ten SGV's and matching TOX reports had been published. Soil Assessment Criteria (SAC's) may be derived using toxicity data from the updated TOX reports, where these are published, or from the original TOX reports. SGV reports also take account of recent updates for plant uptake and other factors.

-
- GAC's developed by CLEA guidance and given in this report will need to be assessed against updated TOX reports and SGV's when these are published.
-
- SGV reports may give values that differ from the GAC's used in this report.
-
- These variations may materially alter the remediation requirement for the site, requiring either an increase or decrease in the extent, type and cost of remediation.
-

1.5 Phytotoxicity

CLEA guidance only addresses human health toxicity; assessment of plant toxicity (phytotoxicity) is based on threshold trigger values obtained from the following source:

ICRCL 70/90: *Notes on the restoration and aftercare of metalliferous mining sites for pasture and grazing.*

1.6 Other Generic Assessment Criteria

If an SGV is not available for a substance identified in the soil then the range of Generic Assessment Criteria published from a collaborative research by Land Quality Management Limited (LQM) and the Chartered Institute of Environmental Health (CIEH) are used for example. In the case of Lead, Category 4 screening levels (C4SLs) have replaced the AtRisk Soil SSV.

1.6.1 EIC/AGS/CL: AIRE

The report represents the collaborative effort of risk assessors from 26 EIC and AGS member companies to produce generic assessment criteria (GAC) for soils for human health risk assessment. The project involved the collation and review of physico-chemical data, toxicological data and information on background

exposure for 44 contaminants sometimes encountered on land affected by contamination in the UK and the derivation of GAC for 351 of these using the CLEA model (v1.06). The GAC are intended to complement soil guideline values (SGV) produced by the Environment Agency of England and Wales and the 2nd edition GAC produced by LQM and CIEH (Nathanail et al, 2009). All three sets of assessment criteria have been derived in general accordance with the Environment Agency of England and Wales Contaminated Land Exposure Assessment (CLEA) guidance and thus the combined efforts of these three groups have resulted in a useful set of screening criteria for the assessment of risks to human health from soil contamination for more than 120 potentially contaminative substances.

1.6.2 Category 4 screening levels (C4SLs) (2014)

A new statutory DEFRA guidance recently (i.e. August 2014) published some GACs with a more pragmatic (but still strongly precautionary) approach in their derivation called the Category 4 screening levels (C4SLs). These values provide a higher simple test for deciding that land is suitable for use and definitely not contaminated land. They are intended as generic screening values, (ii) they describe a level of risk that whilst above 'minimal' is still 'low' and (iii) they provide a 'higher simple test' for deciding that land is suitable for use and definitely not contaminated. These values were derived for four generic land uses: residential, commercial, allotments, and public open space.

1.6.3 LQM/CIEH Suitable 4 Use Level (S4UL) (2015)

The new S4UL's ((Nathanail et al, 2015), was developed for around 85 substances and are intended to enable a screening assessment of the risks posed by soil quality on development sites. The updated LQM/CIEH GAC publication was developed to accommodate recent developments in the understanding of chemical, toxicological and routine exposure to soil-based contaminants. The S4ULs were:

- based on Health Criteria Values, updated to reflect changes since 2009
- derived for the standard CLEA land uses and the two public open space scenarios developed by Defra SP1010
- developed for ca 85 substances (those previously covered by the LQM/CIEH GAC and the SGV substances);
- Compliant with SR2 and the long standing principle of 'suitable for use' and reflecting changes to exposure parameters produced by Defra SP1010.

For derivation of these Generic Assessment Criteria reference must be made to: Nathanail, P., McCaffrey, C., Ashmore, M., Cheng, Y., Gillet, A., Ogden, R., Scott, D. *The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment (3rd edition)*. **Land Quality Press**. 2015.

1.7 Standard Land-use Scenarios

The standard land-use scenarios used to develop conceptual exposure models are presented in the following sections:

1.7.1 Residential

Generic scenario assumes a typical two-storey house built on a ground bearing slab with a private garden having a lawn, flowerbeds and a small fruit and vegetable patch.

-
- Critical receptor is a young female child (zero to six years old)
 - Exposure duration is six years.
 - Exposure pathways include direct soil and indoor dust ingestion, consumption of home-grown produce and any adhering soil, skin contact with soils and indoor dust and inhalation of indoor and outdoor dust and vapours.
 - Building type is a two-storey small terraced house.
-

A sub-set of this land-use is residential apartments with communal landscaped gardens where the consumption of home grown vegetables will not occur.

1.7.2 Allotments

Provision of open space (about 250sq.m) commonly made available to tenants by the local authority to grow fruit and vegetable for their own consumption.

Typically, there are a number of plots to a site which may have a total area of up to 1 hectare. The tenants are assumed to be adults and that young children make occasional accompanied visits.

Although some allotment holders may choose to keep animals including rabbits, hens, and ducks, potential exposure to contaminated meat and eggs is not considered.

-
- Critical receptor is a young female child (zero to six years old)
 - Exposure duration is six years.
 - Exposure pathways include direct soil ingestion, consumption of homegrown produce and any adhering soil, skin contact with soils and inhalation of outdoor dust and vapours.
 - There is no building.
-

1.7.3 Commercial/Industrial

The generic scenario assumes a typical commercial or light industrial property comprising a three-storey building at which employees spend most time indoors and are involved in office-based or relatively light physical work.

-
- Critical receptor is a working female adult (aged 16 to 65 years old).
 - Exposure duration is a working lifetime of 49 years.
 - Exposure pathways include direct soil and indoor dust ingestion, skin contact with soils and dusts and inhalation of dust and vapours.
 - Building type is a three-storey office (pre 1970).
-

1.7.4 Public Open Space within Residential Area

The generic scenario refers to any grassed area 0.05 ha and that is close to Housing.

-
- Grassed area of up to 0.05 ha and a considerable proportion of this (up to 50%) may be bare soil
-
- Predominantly used by children for playing and may be used for activities such as a football kick about
-
- Sufficiently close proximity to home for tracking back of soil to occur, thus indoor exposure pathways apply
-
- older children as the critical receptor on basis that they will use site most frequently (Age class 4-9)
-
- ingestion rate 75 mg.day^{-1}
-

1.7.5 Public Open Space Park

This generic scenario refers to any public park that is more than 0.5ha in area:

-
- Public park (>0.5 ha), predominantly grassed and may also contain children's play equipment and border areas of soil containing flowers or shrubs (75% cover)
-
- Female child age classes 1-6
-
- Soil ingestion rate of 50 mg.day^{-1}
-
- Occupancy period outdoors = 2 hours.day^{-1}
-
- Exposure frequency of 170 days.year⁻¹ for age classes 2-18 and 85 days.year⁻¹ for age class 1
-
- Outdoor exposure pathways only (no tracking back).
-

1.8 Detailed Quantitative Risk Assessments (DQRA)

Where the adoption of an SGV/GAC is not appropriate, for instance when the intended land-use is at variance the CLEA standard land-uses, then a DQRA may be undertaken to develop site specific values for relevant soil contaminants.

-
- Establishing the plausibility that generic exposure pathways exist in practice by measurement and observation.
-
- Developing more accurate parameters using site data.
-

1.9 Current Criteria

Table 1 presents the current Generic Assessment Criteria and reference should be made to the original publications if needed.

1.10 Statistical Tests

DEFRA R&D Publication CLR 7 (DOE 1994) and Category 4 screening levels (C4SLs) (2014) addressed the statistical treatment of test results and their comparison to Soil Guideline Values.

Consideration must be given to the appropriate area of land to be considered termed the critical averaging area.

For a communal open space or commercial land-use, the critical averaging area will depend on the proposed layout. For a residential use with private gardens the averaging area is the individual plot.

It may be appropriate to compare the upper 95th percentile concentration with the Soil Guideline Value, subject to applying a statistical test to establish that the range of concentrations are reasonably consistent and belonging to the same underlying distribution of data.

The DEFRA discussion paper Assessing risks from land contamination – a proportionate approach ('the way forward') (CLAN06/2006) aimed to increase understanding of the role that statistics can play in quantifying the uncertainty attached to the estimates of the mean concentration of contaminants in soil. In direct response CL:AIRE/CIEH published a joint report, *Guidance in comparing soil contamination data with a critical concentration* (CL:AIRE/CIEH 2008). A software implementation of the statistical techniques given in the report was published by ESI International (2008).

Treatment of Hot-Spots

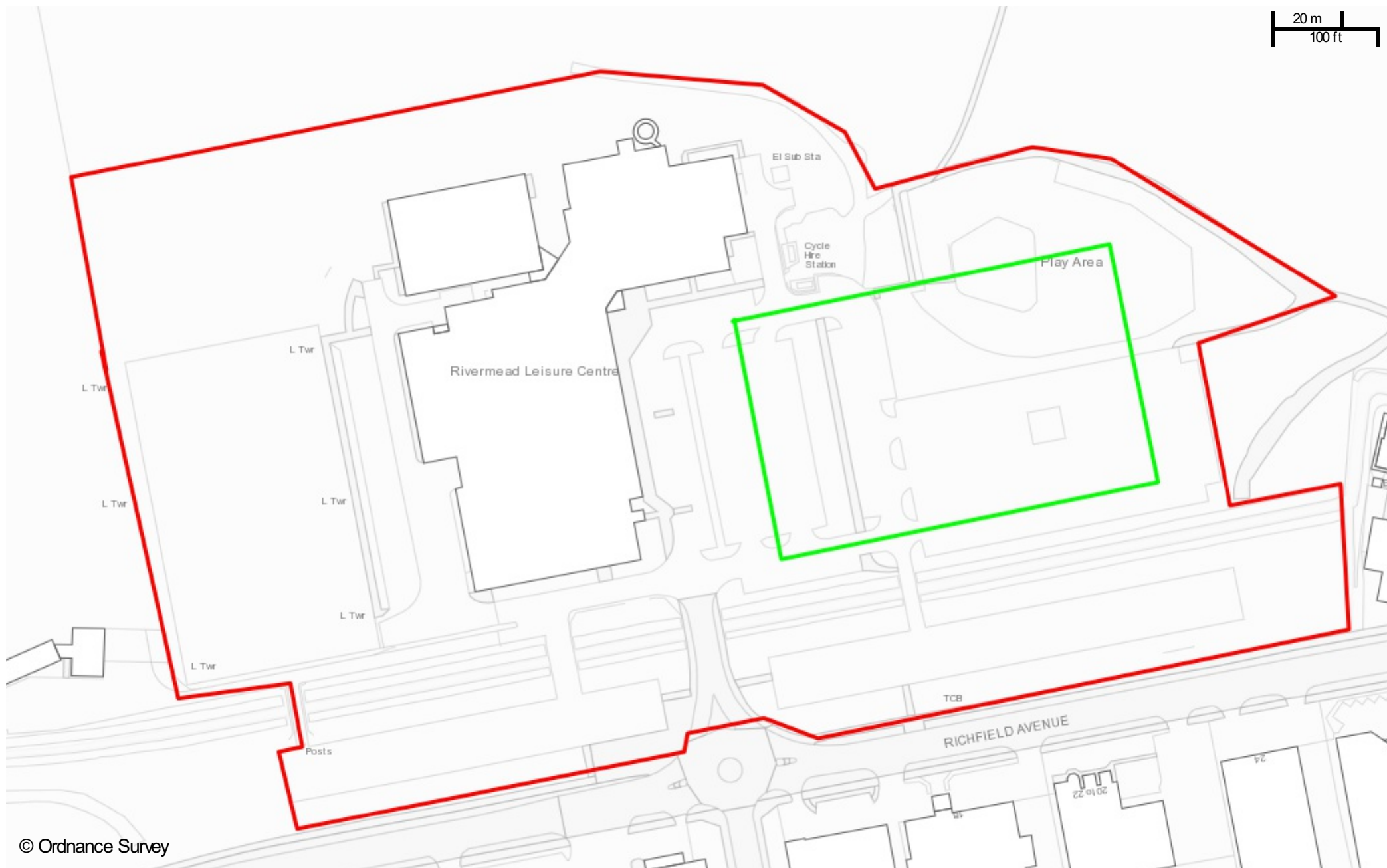
- A statistical test is applied to establish whether the data is a part of a single set, or whether data outliers are present.
 - Provided that the data is based on random sampling and no distinct contamination source was present at the sampling location, the hot-spot(s) may be excluded and the mean of the remaining data assessed.
-

Land Use			Residential With or Without Plant Uptake									Public Open Space (POS)									Name	Authority	Date									
			Allotments						Commercial						Residential									Park								
			With home-grown produce			Without home-grown produce			1			2.5			6			1						2.5			6			1		
Type	Contaminants	Species	Year	SOM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6				
Metals	Antimony		2010							550						7500								EIC/AGS/ CL:AIRE	EIC/AGS/ CL:AIRE	2010						
	Arsenic		2014				37			40			49			640			79			168		C4SL	DEFRA	2014						
			2015				37			40			40			640			79			170		S4UL	LQM/CIEH	2015						
	Beryllium		2015				1.7			1.7			35			12			2.2			63		S4UL	LQM/CIEH	2015						
	Boron		2015				290			11000			45			240000			21000			46000		S4UL	LQM/CIEH	2015						
	Cadmium		2015				11			85			1.9			190			120			532		S4UL	LQM/CIEH	2015						
			2014				26			149			4.9			410			220			880		C4SL	DEFRA	2014						
	Chromium	III	2015				910			910			18000			8600			1500			33000		S4UL	LQM/CIEH	2015						
		VI	2014				21			21			170			49			23			250		C4SL	DEFRA	2014						
		VI	2015				6			6			1.8			33			7.7			220		S4UL	LQM/CIEH	2015						
	Copper		2015				2400			7100			520			68000			12000			44000		S4UL	LQM/CIEH	2015						
	Lead						200			310			80			2330			630			1300		C4SL	DEFRA	2014						
	Mercury	Elemental	2012				1.0			1.0			26			26								SGV	DEFRA	2012						
			2015				1.2			1.2			21			58			16			30		S4UL	LQM/CIEH	2015						
		Inorganic	2012				170			170			80			36000								SGV	DEFRA	2012						
			2015				40			56			19			1100			120			240		S4UL	LQM/CIEH	2015						
		Methyl	2012				11			11			8			410								SGV	DEFRA	2012						
			2015				11			15			6			320			40			68		S4UL	LQM/CIEH	2015						
	Nickel		2012				130			130			230			1800								SGV	DEFRA	2012						
			2015				130			180			53			980			230			800		S4UL	LQM/CIEH	2015						
	Selenium		2012				350			350			120			13000								SGV	DEFRA	2012						
			2015				250			430			88			12000			1100			1800		S4UL	LQM/CIEH	2015						
	Vanadium		2015				410			1200			91			9000			2000			5000		S4UL	LQM/CIEH	2015						
	Zinc		2015				3700			40000			620			730000			81000			170000		S4UL	LQM/CIEH	2015						
BTEX & MTBE	Benzene		2012				0.33			0.33			0.07			95								SGV	DEFRA	2012						
			2014				0.87			3.3			0.18			98			140			230		C4SL	DEFRA	2014						
			2015	0.087	0.17	0.37	0.38	0.7	1.4	0.017	0.034	0.075	27	47	90	72	72	73	90	100	110		S4UL	LQM/CIEH	2015							
	Toluene		2012				610			610			120			4400								SGV	DEFRA	2012						
			2015	130	290	660	880	1900	3900	22	51	120	65000	110000	180000	56000	56000	56000	87000	95000	100000		S4UL	LQM/CIEH	2015							
	Ethylbenzene		2012				350			350			90			2800								SGV	DEFRA	2012						
			2015	47	110	260	83	190	440	16	39	91	4700	13000	27000	24000	24000	25000	17000	22000	27000		S4UL	LQM/CIEH	2015							
	Xylenes	o-xylene	2012				250			250			160			2600								SGV	DEFRA	2012						
			2015	60	140	330	88	210	480	28	67	160	6600	15000	33000	41000	42000	43000	17000	24000	33000		S4UL	LQM/CIEH	2015							
		m-xylene	2012				240			240			180			3500								SGV	DEFRA	2012						
			2015	59	140	320	82	190	450	31	74	170	6200	14000	31000	41000	42000	43000	17000	24000	32000		S4UL	LQM/CIEH	2015							
		p-xylene	2012				230			230			160			3200								SGV	DEFRA	2012						
			2015	56	130	310	79	180	310	29	69	160	5900	14000	30000	41000	42000	43000	17000	23000	31000		S4UL	LQM/CIEH	2015							
Petroleum Hydrocarbons Fractions	Aliphatic >C5 - C6		2015	42	78	160	42	78	160	730	1700	3900	3200	5900	12000	570000	590000	600000	95000	130000	180000		S4UL	LQM/CIEH	2015							
	Aliphatic >C6 - C8		2015	100	230	530	100	230	530	2300	5600	13000	7800	17000	40000	600000	610000	620000	150000	220000	320000		S4UL	LQM/CIEH	2015							
	Aliphatic >C8 - C10		2015	27	65	150	27	65	150	320	770	1700	2000	4800	11000	13000	13000	13000	14000	18000	21000		S4UL	LQM/CIEH	2015							
	Aliphatic >C10 - C12		2015	130	330	760	130	330	770	2200	4400	7300	9700	23000	47000	13000	13000	13000	21000	23000	24000		S4UL	LQM/CIEH	2015							
	Aliphatic >C12 - C16		2015	1100	2400	4300	1100	2400	4400	11000	13000	13000	59000	82000	90000	13000	13000	13000	25000	25000	26000		S4UL	LQM/CIEH	2015							
	Aliphatic >C16 - C35		2015	65000	92000	110000	65000	92000	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000		S4UL	LQM/CIEH	2015							
	Aliphatic >C35 - C44		2015	65000	92000	140000	65000	92000	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000		S4UL	LQM/CIEH	2015							
	Aromatic >C5 - C7		2015	70	140	300	370	690	1400	13	27	57	26000	46000	86000	56000	56000	56000	76000	84000	92000		S4UL	LQM/CIEH	2015							
	Aromatic >C7 - C8		2015	130	290	660	860	1800	3900	22	51	120	56000	110000	180000	56000	56000	56000	87000	95000	100000		S4UL	LQM/CIEH	2015							
	Aromatic >C8 - C10		2015	34	83	190	47	110	270	8.6	21	51	3500	8100	17000	5000	5000	5000	7200	8500	9300		S4UL	LQM/CIEH	2015							
	Aromatic >C10 - C12		2015	74	180	380	250	590	1200	13	31	74	16000	28000	34000	5000	5000	5000	9200	9700	10000		S4UL	LQM/CIEH	2015							
	Aromatic >C12 - C16		2015	140	330	660	1800	2300	2500	23	57	130	36000	37000	38000	5100	5100	5000	10000	10000	10000		S4UL	LQM/CIEH	2015							
	Aromatic >C16 - C21		2015	260	540	930	1900	1900	1900	46	110	260	28000	28000	28000	3800	3800	3800	7600	7700	7800		S4UL	LQM/CIEH	2015							

Land Use			Residential With or Without Plant Uptake									Public Open Space (POS)										Name	Authority	Date	
			Allotments			Commercial			Residential						Park										
			With home-grown produce			Without home-grown produce			1			2.5			6			1			2.5				6
Type	Contaminants	Species	Year	SOM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6			
	Aromatic >C21 - C35		2015		1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015
	Aromatic >C34 - C44		2015		1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015
	Aliphatic + Aromatic >C44 - C70				1600	1800	1900	1900	1900	1900	1200	2100	3000	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015
Polycyclic Aromatic Hydrocarbons (PAH's) (mg/kg)	Acenaphthene		2015		210	510	1100	3000	4700	6000	34	85	200	84000	97000	100000	15000	15000	15000	29000	30000	30000	S4UL	LQM/CIEH	2015
	Acenaphthylene		2015		170	420	920	2900	4600	6000	28	69	160	83000	97000	100000	15000	15000	15000	29000	30000	30000	S4UL	LQM/CIEH	2015
	Anthracene		2015		2400	5400	11000	31000	35000	37000	380	950	2200	520000	54000	540000	74000	74000	74000	150000	150000	150000	S4UL	LQM/CIEH	2015
	Benzo(a)anthracene		2015		7.2	11	13	11	14	15	2.9	6.5	13	170	170	180	29	29	29	49	56	62	S4UL	LQM/CIEH	2015
	Benzo(a)pyrene		2014				5				5.3			5.7			76			10		21	C4SL	DEFRA	2014
			2015		2.2	2.7	3	3.2	3.2	3.2	0.97	2	3.5	35	35	36	5.7	5.7	5.7	11	12	13	S4UL	LQM/CIEH	2015
	Benzo(b)fluoranthene		2015		2.6	3.3	3.7	3.9	4.0	4.0	0.99	2.1	3.9	44	44	45	7.1	7.2	7.2	13	15	16	S4UL	LQM/CIEH	2015
	Benzo(ghi)perylene		2015		320	340	250	360	360	360	290	470	640	3900	4000	4000	640	640	640	1400	1500	1600	S4UL	LQM/CIEH	2015
	Benzo(k)fluoranthene		2015		77	93	100	110	110	110	37	75	130	1200	1200	1200	190	190	190	370	410	440	S4UL	LQM/CIEH	2015
	Chrysene		2015		15	22	27	30	31	32	4.1	9.4	19	350	350	350	57	57	57	93	110	120	S4UL	LQM/CIEH	2015
	Dibenz(a,h)anthracene		2015		0.24	0.28	0.3	0.31	0.32	0.32	0.14	0.27	0.43	3.5	3.6	3.6	0.57	0.57	0.58	1.1	1.3	1.4	S4UL	LQM/CIEH	2015
	Fluoranthene		2015		280	560	890	1500	1600	1600	52	130	290	23000	23000	23000	3100	3100	3100	6300	6300	6400	S4UL	LQM/CIEH	2015
	Fluorene		2015		170	400	860	2800	3800	4500	27	67	160	63000	68000	71000	9900	9900	9900	20000	20000	20000	S4UL	LQM/CIEH	2015
	Indeno(1,2,3-cd)pyrene		2015		27	36	41	45	46	46	9.5	21	39	500	510	510	82	82	82	150	170	180	S4UL	LQM/CIEH	2015
	Naphthalene		2015		2.3	5.6	13	2.3	5.6	13	4.1	10	24	190	460	1100	4900	4900	4900	1200	1900	3000	S4UL	LQM/CIEH	2015
	Phenanthrene		2015		95	220	440	1300	1500	1500	15	38	90	22000	22000	23000	3100	3100	3100	6200	6200	6300	S4UL	LQM/CIEH	2015
	Pyrene		2015		620	1200	2000	3700	3800	3800	110	270	620	54000	54000	54000	7400	7400	7400	15000	15000	15000	S4UL	LQM/CIEH	2015
	Coal Tar(Bap as surrogate matter)		2015		0.79	0.98	1.1	1.2	1.2	1.2	0.32	0.67	1.2	15	15	15	2.2	2.2	2.2	4.4	4.7	4.8	S4UL	LQM/CIEH	2015
Chloroalkanes & alkenes	1,2 Dichloroethane		2015		0.0071	0.011	0.019	0.0092	0.013	0.023	0.0046	0.0083	0.016	0.67	0.97	1.7	29	29	29	21	24	28	S4UL	LQM/CIEH	2015
	1,1,1 Trichloroethane		2015		8.8	18	39	9	18	40	48	110	240	660	1300	3000	140000	140000	140000	57000	76000	100000	S4UL	LQM/CIEH	2015
	1,1,2,2 Tetrachloroethane		2015		1.6	3.4	7.5	3.9	8	17	0.41	0.89	2	270	550	1100	1400	1400	1400	1800	2100	2300	S4UL	LQM/CIEH	2015
	1,1,1,2 Tetrachloroethane		2015		1.2	2.8	6.4	1.5	3.5	8.2	0.79	1.9	4.4	110	250	560	1400	1400	1400	1500	1800	2100	S4UL	LQM/CIEH	2015
	Tetrachloroethene		2015		0.18	0.39	0.9	0.18	0.4	0.92	0.65	1.5	3.6	19	42	95	1400	1400	1400	810	1100	1500	S4UL	LQM/CIEH	2015
	Tetrachloromethane (Carbon Tetrachloride)		2015		0.026	0.056	0.13	0.026	0.056	0.13	0.45	1	2.4	2.9	6.3	14	890	920	950	190	270	400	S4UL	LQM/CIEH	2015
	Trichloroethene		2015		0.016	0.034	0.075	0.017	0.036	0.08	0.041	0.091	0.21	1.2	2.6	5.7	120	120	120	70	91	120	S4UL	LQM/CIEH	2015
	Trichloromethane		2015		0.91	1.7	3.4	1.2	2.1	4.2	0.42	0.83	1.7	99	170	350	2500	2500	2500	2600	2800	3100	S4UL	LQM/CIEH	2015
	Vinyl Chloride (chloroethene)		2015		0.00064	0.00087	0.0014	0.00077	0.001	0.0015	0.00055	0.001	0.0018	0.059	0.077	0.12	3.5	3.5	3.5	4.8	5	5.4	S4UL	LQM/CIEH	2015
	2,4,6 Trinitrotoluene		2015		1.6	3.7	8.1	65	66	66	0.24	0.58	1.4	1000	1000	1000	130	130	130	260	270	270	S4UL	LQM/CIEH	2015
Explosives	RDX (Hexogen/Cyclonite/1,3,5-trinitro-1,3,5-triazacyclohexane)		2015		120	250	540	13000	13000	13000	17	38	85	210000	210000	210000	26000	26000	27000	49000	51000	53000	S4UL	LQM/CIEH	2015
	HMX (Octogen/1,3,5,7-tetrenitro-1,3,5,7-tetrazacyclo-octane)		2015		5.7	13	26	6700	6700	6700	0.86	1.9	3.9	110000	110000	110000	13000	13000	13000	23000	23000	24000	S4UL	LQM/CIEH	2015
	Aldrin		2015		5.7	6.6	7.1	7.3	7.4	7.5	3.2	6.1	9.6	170	170	170	18	18	18	30	31	31	S4UL	LQM/CIEH	2015
Pesticides	Dieldrin		2015		0.97	2	3.5	7	7.3	7.4	0.17	0.41	0.96	170	170	170	18	18	18	30	30	31	S4UL	LQM/CIEH	2015
	Atrazine		2015		3.3	7.6	17.4	610	620	620	0.5	1.2	2.7	9300	9400	9400	1200	1200	1200	2300	2400	2400	S4UL	LQM/CIEH	2015
	Dichlorvos		2015		0.032	0.066	0.14	6.4	6.5	6.6	0.0049	0.01	0.022	140	140	140	16	16	16	26	26	27	S4UL	LQM/CIEH	2015
	Alpha - Endosulfan		2015		7.4	18	41	160	280	410	1.2	2.9	6.8	5600	7400	8400	1200	1200	1200	2400	2400	2500	S4UL	LQM/CIEH	2015
	Beta - Endosulfan		2015		7	17	39	190	320	440	1.1	2.7	6.4	6300	7800	8700	1200	1200	1200	2400	2400	2500	S4UL	LQM/CIEH	2015
	Alpha -Hexachlorocyclohexanes		2015		0.23	0.55	1.2	6.9	9.2	11	0.035	0.087	0.21	170	180	180	24	24	24	47	48	48	S4UL	LQM/CIEH	2015
	Beta -Hexachlorocyclohexanes		2015		0.085	0.2	0.46	3.7	3.8	3.8	0.013	0.032	0.077	65	65	65	8.1	8.1	8.1	15	15	16	S4UL	LQM/CIEH	2015
	Gamma -Hexachlorocyclohexanes		2015		0.06	0.14	0.33	2.9	3.3	3.5	0.0092	0.023	0.054	67</											

Land Use			Residential With or Without Plant Uptake									Public Open Space (POS)									Name	Authority	Date	
			With			Without			Allotments			Commercial			Residential			Park						
			home-grown produce			home-grown produce																		
			SOM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6			
Type	Contaminants	Species	Year																					
Phenols & Chlorophenols	1,2,3,4,-Tetrachlorobenzene		2015	15	36	78	24	56	120	4.4	11	26	1700	3080	4400	830	830	830	1500	1600	1600	S4UL	LQM/CIEH	2015
	1,2,3,5,- Tetrachlobenzene		2015	0.66	1.6	3.7	0.75	1.9	4.3	0.38	0.9	2.2	49	120	240	78	79	79	110	120	130	S4UL	LQM/CIEH	2015
	1,2,4, 5,- Tetrachlobenzene		2015	0.33	0.77	1.6	0.73	1.7	3.5	0.06	0.16	0.37	42	72	96	13	13	13	25	26	26	S4UL	LQM/CIEH	2015
	Pentachlrobenzene		2015	5.8	12	22	19	30	38	1.2	3.1	7	640	770	830	100	100	100	190	190	190	S4UL	LQM/CIEH	2015
	Hexachlorobenzene		2015	1.8	3.3	4.9	4.1	5.7	6.7	0.47	1.1	2.5	110	120	120	16	16	16	30	30	30	S4UL	LQM/CIEH	2015
	Phenols		2012			420			420			280			3200							SGV	DEFRA	2012
			2015	120	200	380	440	690	1200	23	42	83	440	690	1300	440	690	1300	440	690	1300	S4UL	LQM/CIEH	2015
	Chlorophenols (4 Congeners)		2015	0.87	2	4.5	94	150	210	0.13	0.3	0.7	3500	4000	4300	620	620	620	1100	1100	1100	S4UL	LQM/CIEH	2015
	Pentachlorophenols		2015	0.22	0.52	1.2	27	29	31	0.03	0.08	0.19	400	400	400	60	60	60	110	120	120	S4UL	LQM/CIEH	2015
	Others	Carbon Disulphide		2015	0.14	0.29	0.62	0.14	0.29	0.62	4.8	10	23	11	22	47	11000	11000	12000	1300	1900	2700	S4UL	LQM/CIEH
Hexachloro-1,3-Butadiene			2015	0.29	0.7	1.6	0.32	0.78	1.8	0.25	0.61	1.4	31	66	120	25	25	25	48	50	51	S4UL	LQM/CIEH	2015
Sum of PCDDs, PCDFs and dioxin-like PCB's.			2012			8			8			8			240							SGV	DEFRA	2012
NOTE																								
Priority		Guideline (mg kg ⁻¹)																						
1		Site Specific Assessment Criteria (SSAC) (Soils Limited)																						
2		2014: Category 4 Screening Level (C4SL) (Contaminated Land: Application in Real Environment (CL:ARE), 2014)																						
3		2012: Soil Guideline Value (SGV) (Environment Agency, 2009)																						
4		2015: Suitable 4 Use Level (S4UL) (Nathanail et al, 2015)																						
For Generic Risk Assessment, the values in Bold have priority																								
Table reviewed February 2018																								

Appendix E Information Provided by the Client



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Rivermead Leisure Centre

Scale: 1:1500

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