



Phase II Ground Investigation Report

at

**Land adjacent to Orchard Business Park, North End Road,
Yapton, West Sussex BN18 0GA**

for

Crayfern Homes

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November 2017

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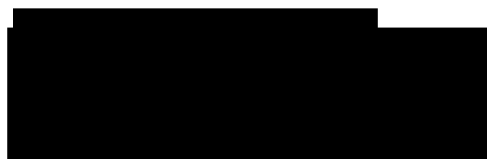
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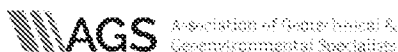
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This is not a valid document for use in the design of the project unless it is titled Final in the document status box.

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

Soils Limited were commissioned by Crayfern Homes to undertake a Phase II Ground Investigation on land at Land adjacent to Orchard Business Park, North End Road, Yapton, West Sussex BN18 0GA. The scope of the investigation was outlined in the Soils Limited quotation reference Q19310 dated 30th October 2017.

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

This Phase II report must be read in conjunction with the Phase I Desk Study undertaken on the above site by Soils Limited, Report ref: 16612DS, dated November 2017.

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 EN 1997-1:2004+A1:2013 Eurocode 7
- 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 QTS 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.

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Section I Introduction

I.1 Objective of Investigation

Soils Limited was commissioned by Crayfern Homes to undertake a Phase II Ground Investigation 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 residential 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 Phase I Desk Study undertaken for the site by Soils Limited (Report ref: 16612/DS, November 2017) and/or the Revised Conceptual Site Model presented in Appendix C.1.

I.2 Location

The site was located at Land adjacent to Orchard Business Park, North End Road, Yapton, West Sussex BN18 0GA and had an approximate O.S Land Ranger Grid Reference of SU 978037.

The site location plan is given in Figure 1.

I.3 Site Description

The site comprised a residential garden: the property was situated off-site to the southeast.

The only structure onsite was a car port, comprising a concrete slab and scaffold-pole constructed frame. The site covering consisted of a gravel driveway which ran across the northern boundary and a concrete slab (car port) in the east. The remainder of the site was covered in grass with tree and hedge row borders. Semi-mature to mature trees and bushes lay to the west, south and west boundaries, and intersected the site in the southeast. A number of large fir trees were noted on the western boundary. Scattered shrubs were located to the west of the site.

The site had a very gradual gradient down to the southwest.

An aerial photograph has been included in Figure 2.

1.4 Proposed Development

At the time of reporting, November 2017, the proposed development comprised seven detached and semi-detached three to four bed houses. The development included hard landscaping such as access roads driveways and pavements and soft landscaping such as boarder planting and private gardens.

In compiling this report reliance was placed on drawing number Sk4_Siteplan_OrchardExtraLand_A2, dated September 2017 and was prepared by Crossley Design Architecture. Any change or deviation from the scheme outlined in the drawing could invalidate the recommendations presented within this report. Soils Limited must be notified about any such changes.

Development plans provided by the client are presented in Appendix D.

1.5 Anticipated Geology

The 1:50,000 BGS Geology map showed the site to be situated on the bedrock Lewis Nodular Chalk Formation with superficial deposits of River Terrace Deposits overlying.

1.5.1 River Terrace Deposits

River Terrace Deposits are superficial deposits of Quaternary age that lie along the margins of rivers and are predominantly found in the southern part of West Sussex, along the coastal plain and are typically less than 10m thick. The composition of the River Terrace 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. In West Sussex the rivers flow mainly south over the Weald Clay, which contains some sandstones and limestone that could be incorporated into the river gravel.

1.5.2 Lewis Nodular Chalk Formation

The Lewes Nodular Chalk Formation is composed of hard to very hard nodular chalks and hardgrounds with interbedded soft to medium hard chalks (some grainy) and marls; some griotte chalks. The softer chalks become more abundant towards the top. Nodular chalks are typically lumpy and iron-stained. Brash is rough and flaggy or rubbly, and tends to be dirty. First regular seams of nodular flint, some large, commence near the base and continue throughout. Chalk formations are susceptible to ground dissolution, typically caused by water passing through soluble rocks producing underground cavities and cave systems. These cavities reduce support to the ground above and can cause localised collapse of the overlying rocks and deposits.

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 Phase II Ground Investigation Report relates to the site located at Land adjacent to Orchard Business Park, North End Road, Yapton, West Sussex BN18 0GA and was prepared for the sole benefit of Crayfern Homes (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 on 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 (Q19310 dated 30th October 2017), was therefore to comprise the following items:

- 4No. 5m deep windowless sampler boreholes
- 4No. 6m deep dynamic probes
- Well installations
- Machine excavated trial holes and infiltration testing to BRE 365
- Geotechnical laboratory testing
- Contamination laboratory testing.

2.1.1 Actual Project Works

The actual project works were undertaken on 9th November 2017 and comprised:

- 4No. 5m deep windowless sampler boreholes (WS1 – WS4)
- 4No. 6m deep dynamic probes (DP1 – DP4)
- Well installations (WS1, WS2, WS4)
- Machine excavated trial holes and infiltration testing to BRE 365 (TPA–TPC)
- Geotechnical laboratory testing
- Contamination laboratory testing.

Three windowless sampler boreholes (WS1, WS2 and WS4) were backfilled with gravel and bentonite following the installation of monitoring wells. One borehole (WS3) was backfilled with arisings. 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

On 9th November 2017 four windowless sampler boreholes (WS1 – WS4) were drilled, using a Premier Compact 110 windowless and dynamic probe rig to a depth of 5.00m below ground level (bgl) at locations selected by Soils Limited using a development plan provided by the client.

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

Three standpipes were installed within window sample borehole locations (WS1, WS2 and WS4) to allow for continued monitoring of both groundwater and soils gas, where present.

Three trial pits (TPA – TPC) were machine excavated to a range of depths between 3.70m and of 4.10m bgl, infiltration testing in accordance with BRE DG365 was then carried out.

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 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 Hole	Depth (m bgl)
WS/DP 1 _w	5.00/6.00	TP A	3.70
WS/DP 2 _w	5.00/6.00	TP B	3.70
WS/DP 3	5.00/6.00	TP C	4.10
WS/DP 4 _w	5.00/6.00		
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/Topsoil (MG/TS)
River Terrace Deposits (RTD)
Lewis Nodular Chalk Formation (LNCK)

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		
TS	Athropocene	G.L.	0.20–0.24	0.22	The Topsoil comprised dark brown clayey SILT.
MG		G.L.	0.40	0.40	Soft dark brown very silty CLAY with very rare fine to medium sub-angular flint and brick gravel.
RTD	Quaternary	G.L–0.40	2.70–5.70 ^{1,3}	4.50 ⁴	Firm dark orangey brown slightly sandy silty CLAY. Sand was fine to coarse.
LNCK	Turonian	2.70–5.00 ¹	3.70–6.00 ^{1,3}	Not Proven ²	Yellowish white and off-white extremely weathered structureless CHALK recovered as fine to medium weak intact blocks in a sandy silty matrix.

Note: ¹ Final depth of trial hole. ² Base of strata not encountered, ³Inferred depth. ⁴ Where proven

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 one out of the seven trial holes from ground level to a depth of 0.40 (WS/DP1).

The Made Ground typically comprised soft dark brown very silty CLAY with very rare fine to medium sub-angular flint and brick gravel and frequent very fine white rootlets.

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

Soils described as Topsoil were encountered in five of the seven trial holes from ground level to depths ranging between 0.20m bgl (WS/DP2) and 0.24m bgl (TP A, B, C).

The Topsoil comprised dark brown clayey SILT. Frequent fine roots and rootlets were noted.

The depth of Topsoil has been included in Table 2.3.

Table 2.3 Final Depth of Made Ground/Topsoil

Trial Hole	Strata	Depth (m bgl)
WS/DP 1	MG	0.40
WS/DP 2	Not encountered	
WS/DP 3	TS	0.20

Trial Hole	Strata	Depth (m bgl)
WS/DP 4	TS	0.20
TP A	TS	0.24
TP B	TS	0.24
TP C	TS	0.24

2.3.2 River Terrace Deposits

Soils described as River Terrace Deposits were encountered in all seven trial holes from directly below the Made Ground / Topsoil (from Ground level in WS/DP 2) and persisted to a depth of 5.60m bgl, and was inferred from DP4.

The River Terrace Deposits typically comprised firm dark orangey brown slightly sandy silty CLAY. Sand was fine to coarse. Rare fine to medium flint gravels were noted. Frequent black decayed root tracks.

The depth of River Terrace Deposits has been included in Table 2.4.

Table 2.4 Final Depth of River Terrace Deposits

Trial Hole	Depth (m bgl)
WS/DP 1	4.50/4.50
WS/DP 2	5.00 ¹ /5.20 ²
WS/DP 3	3.90/3.90
WS/DP 4	5.00 ¹ /5.60 ²
TP A	2.70
TP B	2.70
TP C	3.40

Note: ¹ Final depth of trial hole. ² Inferred depth

2.3.3 Lewis Nodular Chalk Formation

Soils described as Lewis Nodular Chalk Formation were encountered in all seven trial holes from directly below the River Terrace Deposits and persisted to a depth of 6.00m bgl, the final depth of all WS/DP holes. Unweathered chalk is a weak rock and it must be noted that the drilling process can disturb the structure and fabric.

The Lewis Nodular Chalk Formation typically comprised yellowish white and off-white weathered structureless CHALK recovered as fine to medium weak intact blocks in a sandy silty matrix. Occasional pockets of fine to medium angular flint were noted.

The depth of Lewis Nodular Chalk Formation has been included in Table 2.5.

Table 2.5 Final Depth of Lewis Nodular Chalk Formation

Trial Hole	Depth (m bgl)
WS/DP 1	5.00 ¹ /6.00 ^{1,2}
WS/DP 2	Note encountered / 6.00 ^{1,2}
WS/DP 3	5.00 ¹ /6.00 ^{1,2}

Trial Hole	Depth (m bgl)
WS/DP 4	Note encountered / 6.00 ^{1,2}
TP A	3.70 ¹
TP B	3.70 ¹
TP C	4.10 ¹

Note: ¹ Final depth of trial hole. ² Inferred depth

2.4 Roots

Roots were encountered in all seven trial holes at depths ranging between just below ground level and 2.90m bgl (WS 4). The depths of root penetration have been included in Table 2.6.

Table 2.6 Depth of Root Penetration

Trial Hole	Depth (m bgl)
WS 1	2.40
WS 2	1.00
WS 3	2.80
WS 4	2.90
TP A	1.65
TP B	2.45
TP C	2.35

Semi-mature to mature trees and bushes lay to the west, south and west boundaries, and intersected the site in the southeast. Notably large fir trees on the western boundary. Scattered shrubs were located to the west of the site. Roots may be found to greater depth at other locations on the site particularly close to trees and/or trees that may 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 was not encountered within any trial holes during the investigation. Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was conducted in November (2017), when groundwater levels should be rising from their annual minimum (lowest) elevation, which typically occurs around September.

Groundwater equilibrium conditions may only be conclusively established, if a series of observations are made via groundwater monitoring wells. Further groundwater monitoring was being conducted on a monthly basis over a three-month period. The results of which will be issued as an addendum once the monitoring period has been completed.

Section 3 Discussion of Geotechnical In-Situ and Laboratory Testing

3.1 Dynamic Probe Tests

Dynamic probing (DPSH) was undertaken at four locations (DP1 to DP4) adjacent and prior to the drilling of their corresponding WS hole to 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, Table B.1.1 to Table B.1.3.

The River Terrace Deposits recorded equivalent SPT “N60” values between <3 and 42 within the cohesive soils. Classifying the cohesive soils as extremely low to very high strength and inferred undrained cohesive strength of <10kPa to 210kPa. Typically, cohesive strength was low and medium with undrained cohesive strength values between 20 and 40kPa.

The Lewis Nodular Chalk Formation recorded equivalent SPT “N60” values 11 and 50. The chalk was classified as Structureless (Dc) to structured chalk (C5 – A1). Typically, SPT “N60” values were in excess of 15.

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 is archived within the Soils Limited project file and can be provided on request.

A full interpretation of the DPSH tests are outlined in Appendix B.2, Table B.2.1.

3.2 Dynamic Cone Penetrometer Tests

The Transport Research Laboratory (TRL), Dynamic Cone Penetrometer (DCP) was undertaken at six locations (DCP1 – DCP6). The results were interpreted based on the classification outlined in Appendix B.1.

The results from DCP testing indicated CBR values of between 3% and 12% for the soils encountered in the top 1.00m bgl. Typically, when removing the top 0.60m bgl of material values were in excess of 5%.

The DCP results are presented in Appendix B.3.

3.3 Infiltration Tests

Infiltration testing was undertaken in three machine excavated trial holes (TPA – TPC) within the River Terrace Deposits and Lewis Nodular Chalk Formation. Test was carried out following the principles of BRE Digest 365 Soakaway design: 2015. BRE 365 states that for an accurate infiltration rate to be obtained a soakage pit needs to be filled three times in quick succession. Each test can only be ended once 75% of the water present

has drained away. Furthermore, in accordance with BRE DG365:2015, 50% of the total volume of water must have soaked in a 24-hour period. BRE software BRESOAK was used to calculate the infiltration rates.

Due to slow infiltration rates a single test was carried in each TPA, TPB and TPC within the River Terrace Deposits and Lewis Nodular Chalk Formation. Where stated, data has been extrapolated in order to obtain an infiltration rate, and should only be used in preliminary design.

The results outlined in Table 3.1.

Table 3.1 Infiltration Rates

Trial Hole (Strata)	Test No.	Infiltration Rate (m/s)	Notes
TPC (RTD/LNCK)	I	9.710E-07	Data has been extrapolated after 210 minutes in order to calculate an infiltration rate
Notes:			

Infiltration rates for TPA and TPB could not be calculated as testing did not record a sufficient rate to drain 50% of the total volume of water in a 24-hour period.

3.4 Particle Size Distribution Tests

Particle Size Distribution (PSD) testing was performed on one sample from the River Terrace Deposits. Given the proportion of fines encountered, the sample was classified as a cohesive soil with volume change potential. It is therefore concluded that no granular soils of the River Terrace Deposits were encountered during the intrusive investigation.

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

3.5 Saturation Moisture Content Tests

Saturated Moisture Content (SMC) tests were performed on two samples recovered from the Lewis Nodular Chalk Formation. The results were classified based on Table 3.2, CIRIA Publication, Engineering in Chalk, C574, 2002.

The SMC tests classified the Lewis Nodular Chalk Formation as low to medium density, with dry density ranging between 1.52Mg/m³ and 1.65Mg/m³.

A full interpretation of the SMC tests are outlined in Table B.2.4, Appendix B.2 and the laboratory report in Appendix C.2.

3.6 Atterberg Limit Tests

Atterberg Limit tests were performed on five samples obtained from the cohesive soils of River Terrace Deposits. The results were classified in accordance with BRE Digest 240 and NHBC Standards Chapter 4.2.

The cohesive soils of the River Terrace Deposits were classified as having no volume change potential to 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.2.2, Appendix B.2 and the laboratory report in Appendix B.3.

3.7 Sulphate and pH Tests

Three samples were taken from the River Terrace Deposits for water soluble sulphate (2:1) and pH testing in accordance with Building Research Establishment Special Digest 1, 2005, 'Concrete in Aggressive Ground'.

The tests recorded water soluble sulphate between 16mg/l and 17mg/l with pH values of 7.5 to 7.7.

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* 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 8004:1986, Clause 2.2.2.3.5 Made Ground and Fill, includes the caveat that *'all Topsoil should be treated as suspect, because of the likelihood of extreme variability'*.

Soils described as Made Ground were encountered in one out of the seven trial holes from ground level to a depth of 0.40 (WS/DP1). The Made Ground typically comprised soft dark brown very silty CLAY with very rare fine to medium sub-angular flint and brick gravel and frequent very fine white rootlets.

Soils described as Topsoil were encountered in five of the seven trial holes from ground level to depths ranging between 0.20m bgl (WS/DP2) and 0.24m bgl (TP A, B, C). The Topsoil comprised dark brown clayey SILT. Frequent fine roots and rootlets were noted.

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 River Terrace Deposits

Soils described as River Terrace Deposits were encountered in all seven trial holes from directly below the Made Ground / Topsoil and persisted to a depth of 5.00m bgl, the final depth of WS/DP2 and WS/DP4. The River Terrace Deposits typically comprised firm dark orangey brown slightly sandy silty CLAY. Sand was fine to coarse. Rare fine to medium flint gravels were noted. Frequent black decayed root tracks were seen throughout.

The River Terrace Deposits recorded equivalent SPT “N60” values between <3 and 42. Classifying the cohesive soils as extremely low to very high strength and inferred undrained cohesive strength of <10kPa to 210kPa. Typically, cohesive strength was between low and medium with **undrained cohesive strength values of 20 and 40kPa.**

The River Terrace Deposits was classified as having **none to medium volume change potential** in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

Soils of the River Terrace Deposits are normally consolidated and are typically predominately granular, however, those soils encountered during this investigation were cohesive. Therefore, the soils are expected to display low to moderate bearing capacities and moderate to high settlements. The soils of the River Terrace Deposits were considered suitable for the proposed development (Subject to being placed at suitable depth to allow sufficient bearing capacity).

4.1.3 Lewis Nodular Chalk Formation

Soils described as Lewis Nodular Chalk Formation were encountered in all seven trial holes from directly below the River Terrace Deposits and persisted to an inferred depth of 6.00m bgl, the final depth of all WS/DP holes. The Lewis Nodular Chalk Formation typically comprised yellowish white and off-white extremely weathered structureless CHALK recovered as fine to medium weak intact blocks in a sandy silty matrix. Occasional pockets of fine to medium angular flint fragments were noted.

The results from the dynamic probing inferred that the Lewis Nodular Chalk Formation recorded equivalent SPT “N60” values ranging between 11 and 50. The chalk was classified as Structureless (Dc) to structured chalk (C5 – A1). Typically, SPT “N60” were in excess of 15.

Saturated moisture content testing classified the Lewis Nodular Chalk Formation as low to medium density, with dry density ranging between 1.52Mg/m³ and 1.65Mg/m³.

Chalk descriptions from windowless sampler boreholes are not in accordance with CIRIA C574 and are unlikely to be representative of in-situ chalk. Generally, soils of the Lewis Nodular Chalk Formation were structureless to weak rock and would possess low to moderate bearing and settlement characteristics. The Lewis Nodular Chalk Formation would be suitable as a bearing stratum, however given the depth encountered a deep (piled) foundation would be required, which has not been considered in this investigation / report.

4.1.4 Roots

Roots were encountered in all seven trial holes at depths ranging between just below ground level and 2.90m bgl (WS 4). Roots may be found to greater depth at

other locations on the site particularly close to trees and/or trees that may have been removed both within the site and its close environs.

4.1.5 Groundwater

Groundwater was not encountered within any trial holes. Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was conducted in November (2017), when groundwater levels should be rising from their annual minimum (lowest) elevation, which typically occurs around September.

Groundwater equilibrium conditions may only be conclusively established, if a series of observations are made via groundwater monitoring wells. Further groundwater monitoring was being conducted monthly over a three-month period. The results of which will be issued as an addendum once the monitoring period has been completed.

4.2 Foundation Scheme General

At the time of reporting, November 2017, the proposed development comprised seven detached and semi-detached three to four bed houses. The development included hard landscaping such as access roads driveways and pavements and soft landscaping such as boarder planting and private gardens.

In compiling this report reliance was placed on drawing number Sk4_Siteplan_OrchardExtraLand_A2, dated September 2017 and was prepared by Crossley Design Architecture. Any change or deviation from the scheme outlined in the drawing could invalidate the recommendations presented within this report. Soils Limited must be notified about any such changes.

Development plans provided by the client are presented in Appendix D.

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 investigation has found that the River Terrace Deposits on this site were predominantly cohesive at the test hole locations.

The results from Atterberg Limits Tests showed that the River Terrace Deposits had **none to 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 River Terrace Deposits.

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 stated intention of the NHBC is to ensure that shrinkage and swelling of plastic soils does not adversely affect the structural integrity of foundations to such a degree that remedial works would be required to restore the serviceability of the building. It must be borne in mind that adherence to the NHBC tables and design recommendations may not, in all cases, totally prevent foundation movement and cracking of brickwork might occur.

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/Topsoil due to the likely variability and potential for large load induced settlements both total and differential.

Roots were encountered in all seven trial holes at depths ranging between just below ground level and 2.90m bgl. If roots are encountered during the construction phase foundations **must not be placed within any live root penetrated** or desiccated **cohesive soils or those with a volume change potential**. Should the foundation excavations reveal such materials, the excavations **must** be extended to greater depth in order to bypass these unsuitable soils. Excavations must be checked by a suitable person prior to concrete being poured.

Considering the type of development, a shallow foundation solution was considered the most suitable, subject to confirmation of root absence at recommended founding depths. Should significant roots be encountered beyond 2.50m bgl within the footprint of the proposed properties, a piled foundation must be considered.

The proposed development is likely to be both light and brittle. It is therefore considered

that foundation design is undertaken using NHBC Standards Chapter 4.2.

4.3.1 Shallow Foundations into the River Terrace Deposits

Based on a 5.00 by 0.75m strip foundation, using commercial software Table 4.1 shows the calculated bearing values and anticipated settlement characteristics. Given the poor ground conditions encountered between ground level and 2.00m bgl and the depth of roots observed, bearing capacities below 2.00m bgl were considered. A value at 1.50m bgl has been included in order to show the poor ground conditions encountered at shallower depth.

Table 4.1 Allowable Bearing Capacities within the River Terrace Deposits

Depth (m bgl)	Size (m)	Bearing Capacity (kPa)	Anticipated Settlement (mm)
1.50	5.00 x 0.75	45	10
2.00		95	15
2.50		190	25

The use of reinforced trench fill foundations is recommended as they would simplify construction and reduce the possibility of differential settlement affecting the foundations.

For the allowable bearing value given above, settlements should not exceed the presented values, provided that excavation bases are carefully bottomed out and blinded, or concreted as soon after excavation as possible and kept dry. Foundations must not be constructed over former structures and other hard spots. The foundations design must be suitable for the conditions present at the site.

The anticipated settlement includes both elastic settlement and long-term drained settlement (in the case of cohesive soils).

Anticipated settlements may be taken as proportional to the bearing capacity adopted (for the same configuration of foundation), therefore if the bearing value is halved the anticipated settlement will halve.

All loose material and soft spots must be removed from the base of the excavations, these excavations then being either concreted or blinded as soon after excavation as possible. Failure to do so could results in increased settlements.

4.3.2 Ground Floor Slab

NHBC Standards 2017, Chapter 5.2, Suspended Ground Floors, states:

- *“Ground floors should be constructed as suspended floors where the depth of fill exceeds 600mm”.*
- *“Suspended slabs should be adopted where the foundation depth dictated by the NHBC Standards 2017, Chapter 4.2, Appendix 4.2-C would exceed 1.5m bgl.”*

Due to the poor ground conditions and roots encountered, and the resultant deepened strip foundations, suspended slabs should be considered for the proposed redevelopment.

4.4 Subsurface Concrete

Sulphate concentration measured in 2:1 water/soil extracts 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 7.5 and 7.7. The classification given was determined using the static groundwater case, in view of groundwater being encountered. 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/Topsoil and are likely to be marginally stable in the short term at best.

Deeper excavations taken into the River Terrace Deposits Formation are likely to be marginally stable at best in the short term, depending on the thickness of overlying Made Ground/Topsoil and the granular proportion of the soils. 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, if encountered, 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 six locations (DCP1 – DCP6). The results were interpreted based on the classification outlined in Appendix B.1.

The results from DCP testing indicated CBR values of between 3% and 12% for the soils encountered in the top 1.00m bgl. Typically, when removing the top 0.60m bgl of material values were in excess of 5%.

It is recommended that in-situ testing is to be undertaken immediately prior to the

installation of pavements/roads. Any soft spots at formation level, should be dug out and replaced with a suitably compacted granular fill. Prior to construction the formation level should be proof rolled.

The cohesive soils of the River Terrace Deposits would be considered as frost susceptible as one of the samples tested showed plasticity indexes <20% and the pavement thickness will be dictated by its frost susceptibility.

4.7 Soakaways

Due to slow infiltration rates a single test was carried in each TPA, TPB and TPC. Data has been extrapolated in order to obtain an infiltration rate, and should only be used in preliminary design. Infiltration rates could not be calculated in TPA and TPB as they did not obtain a sufficient rate as to drain 50% of the total volume of water in a 24-hour period.

A rate of $9.71\text{E-}07\text{m/s}$ was calculated, which is unlikely to be suitable for designed purposes. data has been extrapolated in order to obtain an infiltration rate, and should only be used in preliminary design. The soils of the Lewis Nodular Chalk Formation, at depth, could be suitable for soakaways but more localised in-situ testing to BRE 365 Soakaway Design or borehole soakaway testing would be required.

Occasional erosional features, such as pipes, swallow holes and solution cavities, usually in-filled with drift deposits, are found in the chalk within this area. These features sometimes manifesting themselves' at the surface, as shallow circular depressions.

Dissolution features can form due to manmade features such as deneholes. These features can then be reactivated or caused to collapse by the concentrated ingress of water from leaking drains or soakaways.

In line with current guidance (BRE Digest 365, NHBC and CIRIA C574) soakaways should be located remote from the proposed foundations, ideally greater than 20m away from the face of any existing or proposed footing.

In respect to the control of drainage CIRIA C574, Engineering in Chalk; 2002 states;

- “Concentrated ingress of water into the chalk can initiate new dissolution features, particularly in low-density chalk, and destabilise the loose backfill of existing ones. For this reason, any soakaways should be sited well away from foundations for structures, roads or railways, as indicated below:
- In areas where dissolution features are known to be prevalent, soakaways should be avoided if at all possible but, if unavoidable, should be sited at least 20m away from any foundations;

- Where the chalk is of low density, or its density is not known, soakaways should be sited at least 10m away from any foundations;
- Where the chalk is of medium density (or higher), the closest part of the soakaway should be at least 5m away from any foundations.
- For drainage systems, flexible jointed pipes should be used wherever possible; particular care should be taken for the avoidance of leaks in both water supply and drainage pipework.

As the Chalk is a vitally important aquifer, the Environment Agency and local authority must be consulted when planning soakaway installations where chalk lies below the site even where it is mantled with superficial deposits.

Consultation with the Environment Agency must be sought regarding any use which may have an impact on groundwater resources.

Section 5 Determination of Chemical Analysis

5.1 Site Characterisation and Revised Conceptual Site Model

The Phase I Desk Study undertaken by Soils Limited (report ref: 16612/DS dated November 2017) identified a low to moderate risk of ground contamination and from previous usage of the site and offsite sources.

Soils described as Made Ground were encountered in one out of the seven trial holes from ground level to a depth of 0.40 (WS/DP1). The Made Ground typically comprised soft dark brown very silty CLAY with very rare fine to medium sub-angular flint and brick gravel and frequent very fine white rootlets.

Superficial deposits of River Terrace Deposits were encountered underlying the Made Ground and Topsoil. Shallow groundwater was not encountered. The conceptual site model was updated to take account the absence of shallow groundwater and is presented in Appendix C.1.

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.

The CSM identified potential sources and a **targeted sampling pattern** was adopted as appropriate to these sources. Table 5.1 outlines the sampling undertaken.

Table 5.1 Sampling Strategy

Sample	Strategy	Proposed Use
WS1:0.20	Made Ground	Private garden
WS1:0.60	Subsoil below Made Ground	Private garden
WS2:0.40	Down hydraulic gradient from industrial site	Private rear garden
WS3:0.20	Near car port and down hydraulic gradient from adjacent	Private garden
WS4:0.50	industrial site	Private rear garden

5.3 Determination of Chemical Analysis

The driver for determination of the analysis suite was the information obtained from the Phase I Desk Study and Phase II intrusive investigation. Table 5.2 outlines the specification for each sample tested.

Table 5.2 Chemical Analysis Specification

Substance	Locations: Depths (m bgl)				
	WS1:0.20 ^s	WS1:0.60 ^s	WS2:0.40 ^s	WS3:0.20 ^s	WS4:0.50 ^s
Asbestos Screen	✓	✓	✓	✓	✓
Total Phenols	✓	✓	✓	✓	✓
Total Cyanide	✓	✓	✓	✓	✓
Organic Matter	✓	✓	✓	✓	✓
pH	✓	✓	✓	✓	✓
Metals	✓	✓	✓	✓	✓
Metalloids	✓	✓	✓	✓	✓
Organics	✓	✓	✓	✓	✓
PAHs	✓	✓	✓	✓	✓
TPH-CWG	✓				✓
BTEX	✓				✓

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 **Asbestos screening** was undertaken in accordance with HSG 248. ^s = Soil sample.

Section 6 Qualitative Risk Assessment

6.1 Assessment Criteria

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

6.2 Representative Contamination Criteria - Soil

At the time of reporting, November 2017, the proposed development comprised seven detached and semi-detached three to four bed houses. The development included hard landscaping such as access roads driveways and pavements and soft landscaping such as boarder planting and private gardens.

In compiling this report reliance was placed on drawing number Sk4_Siteplan_OrchardExtraLand_A2, dated September 2017 and was prepared by Crossley Design Architecture. Any change or deviation from the scheme outlined in the drawing could invalidate the recommendations presented within this report. Soils Limited must be notified about any such changes.

The chemical laboratory results were compared against the representative contaminants concentration for human health receptor to Soil Guideline Values (SGV), Category 4 Screening Levels (C4SL's) or Suitable 4 Use Level (S4UL).

Table 6.1 outlines the samples that have exceeded their relevant 'residential with plant up-take' assessment criteria. The full laboratory report is presented in Appendix C.2.

Table 6.1 Summary of Chemical Analysis of Soils Sample Exceedance

Substance	Sample locations where SGV, C4SL or S4UL adopted were exceeded for the 'Residential with plant uptake' land-use scenario
Lead	WS3:0.20 522mg/kg against 200mg/kg

The guideline values are assessed against the "Residential with plant uptake" land-use scenario, which was considered the most appropriate land-use scenario, given the type of the proposed development.

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 0.6% and 3.1%. For each soil sample tested, the Soil Organic Matter recorded was used to derive the appropriate guideline value for organic determinants.

In summary, one of the samples tested showed concentrations in excess of the relevant C4SL for a residential with plant uptake land-use scenario.

In WS3 at 0.20m bgl lead was recorded at a concentration of 522mg/kg against

the residential with plant uptake end-use C4SL of 200mg/kg.

None of the other substances tested recorded concentrations above the residential end-use screening values.

6.2.1 Asbestos

Asbestos Containing Material (ACM) was not detected within any of the samples tested. Although asbestos containing material was not identified at this stage of testing, 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.

6.3 Risk to Groundwater

Groundwater was not encountered within any trial holes. Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The Environment Agency Hydrogeological Maps showed that the Lewis Nodular Chalk Formation had a Principal Aquifer Designation and the River Terrace Deposits had a Secondary A Aquifer Designation. The overall groundwater vulnerability was soils of intermediate leaching potential (L1), soils which can possibly transmit a wide range of pollutants.

6.4 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 C.1. The full laboratory chemical report is presented in Appendix D.2.

6.4.1 Soils

In summary, one of the samples tested showed concentrations in excess of the relevant C4SL for a residential with plant uptake land-use scenario. In WS3 at 0.20m bgl lead was recorded at a concentration of 522mg/kg against the residential with plant uptake end-use C4SL of 200mg/kg.

The Tier 1 Quantitative risk assessment therefore established that there was **a risk to the human health receptors** of construction workers or future end-users.

6.4.2 Groundwater

A review of the risk to groundwater established that in light of no groundwater being encountered and the low leaching nature of the predominantly cohesive underlying River Terrace Deposits, and limited amount of Made Ground it is considered that the risk to groundwater was negligible.

6.4.3 Soil Gas

The Phase I Desk Study identified a low risk of soil gas associated with proximally fuel tanks and nearby industrial uses, including garages.

Monitoring of the wells installed within WS1, WS2 and WS4 has been undertaken on two occasions, including targeting periods of low and falling pressure, at the time of reporting four more visits were scheduled. Therefore, the results of the soil gas risk assessment will be provided in an addendum once the regime is complete.

6.5 Remedial Objective

Soil chemical analysis recorded one of the samples tested showed concentrations in excess of the relevant C4SL for a residential with plant uptake land-use scenario. In WS3 at 0.20m bgl lead was recorded at a concentration of 522mg/kg against the residential with plant uptake end-use C4SL of 200mg/kg.

Therefore, there was a risk to the Human Health and Groundwater receptor, which would require a remediation strategy.

The remedial objective for the site is to ensure site clean-up removes any unacceptable risk to the identified receptors of Human Health, Building Structures and Services and Groundwater receptor.

In essence, the remedial objective should sever any source-pathway-receptor pollutant linkages that have been established. Once this has been achieved, by whatever means, there can theoretically be no risk.

6.6 Development of Soil Remediation Strategy

Production of a remediation strategy report was not part of the brief for this Phase II Intrusive Investigation. A number of examples remedial options are outlined below.

6.6.1 Further Chemical Testing and Human Health Risk Assessment

It is **recommended** that due to the shallow depth of the identified areas of contamination, that further testing is undertaken once the site strip has been completed.

6.6.2 Adoption of Cover System in Soft Landscaped Areas

The BRE "*Cover Systems For Land Regeneration, Thickness Design of Cover Systems for Contaminated Land, BRE, March 2004*", allows for the design of cover systems to impacted soils where the concentration of substances within the ground does not exceed any of the respective SGV, C4SL or S4UL by more than six times. In such a situation, a maximum cover thickness of 600mm is given. However, the concentration of substances within the certified clean soil/topsoil, which comprises the cover system, determines the overall thickness of the system and can reduce the required thickness markedly below 600mm.

Where the concentration of substances within the ground does exceed any of the respective SGV, C4SL or S4UL by more than six then an engineered capping

system would be required.

The concentrations of elevated contaminants outlined in Table 6.1 did not show any substances, which were greater than six times their respective guideline value.

6.6.3 Excavation of Impacted Soil

It could be proposed to excavate and stockpile the impacted material on the site in preparation for classification and subsequent disposal off-site to a suitable licensed facility.

The initial excavations should be centred on the trial-holes with impacted soil and then extended in all directions, so that the impacted soils can be 'chased' out. Once excavation has been completed validation would be required to prove all impacted soil has been removed. Validation would involve taking a representative number of samples from the sides and base of any excavation and then sent off for appropriate chemical analysis.

The stockpiled soils must be placed on an impermeable liner with raised edges. During periods of rainfall, the stockpile must be covered over to minimise leaching and run-off into the underlying soils. Covering of the stockpile may be required to prevent fumes impacting receptors off-site.

The remedial works must be inspected and independently validated by a suitable person.

On completion of the development, a Validation and Closure Report must be supplied to both the Local Authority and the NHBC detailing the remediation works undertaken on the site.

Any voids resulting from the removal of impacted soil must be backfilled with a suitable certified clean granular soil.

6.6.4 Asbestos

Asbestos Containing Material (ACM) was not detected within any of the samples tested. Although asbestos containing material was not identified at this stage of testing, 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. Asbestos-containing soils (ACSs) do not necessarily require removal or treatment, but would require a suitable capping layer to remain in-situ. All future works should have suitable health and safety procedures in place to protect workers from airborne asbestos fibres. If ACSs remain in-situ measures should be put in place to insure the risk of exposures is not increased, such as exposing buried asbestos at the surface. Where ACSs have to be removed from site quantification of the asbestos would be required. Waste containing asbestos will be hazardous waste if it contains more the 0.1% by weight of asbestos, (CIRIA C733, Asbestos in soil and made

ground: a guide to understanding and managing risks).

Asbestos quantification would be recommended on the soil samples where asbestos was identified, so an assessment can be carried out.

6.7 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.

6.8 Excavated Material

Excavated material must be classified with the Environment Agency for disposal at an appropriately licensed disposal facility. The requirements of Duty of Care and Health and Safety Guidance must be complied with.

Both Producers and Waste Management companies must ensure compliance with the new Waste Acceptance Criteria (WAC) prior to landfill in hazardous, stable non-reactive cells and inert sites. These regulations govern the operation of landfill in England and Wales. Basic characterisation is the responsibility of the waste producer and compliance checking is generally the responsibility of the landfill operator. Therefore, landfill operators will be unlikely to accept waste that does not meet the Waste Acceptance Criteria for their class of site.

There is an obligation to 'treat' all soils destined for landfill, including non-hazardous waste. This treatment must now be documented and presented to the landfill operator or waste may be refused entry. Note that all liquids are banned from landfill.

For the purposes of legal compliance, 'treatment' must comprise three things (the 'three-point test'):

1. It must be a physical, thermal, chemical or biological process.
2. It must change the characteristics of the waste.
3. It must do so in order to:
 - (a) reduce its volume, or
 - (b) reduce its hazardous nature, or
 - (c) facilitate its handling, or enhance its recovery.

WAC testing was not undertaken at this stage but may be necessary depending upon whether material is required to be taken off-site.

6.8.1 Risk Based Hazard Assessment of Waste

The analysis results of the chemical laboratory testing undertaken as part of report, prepared by QTS Environmental Ltd were used for the **Hazardous Waste Classification** process. The determination of the hazardous waste classification process is outlined in Appendix C.4.

Full results of the laboratory analysis and hazardous waste classification tool are given in Appendix C.2. All samples tested were classified as non-hazardous.

6.9 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.

6.10 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.

6.11 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.

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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 Chemical Laboratory Testing

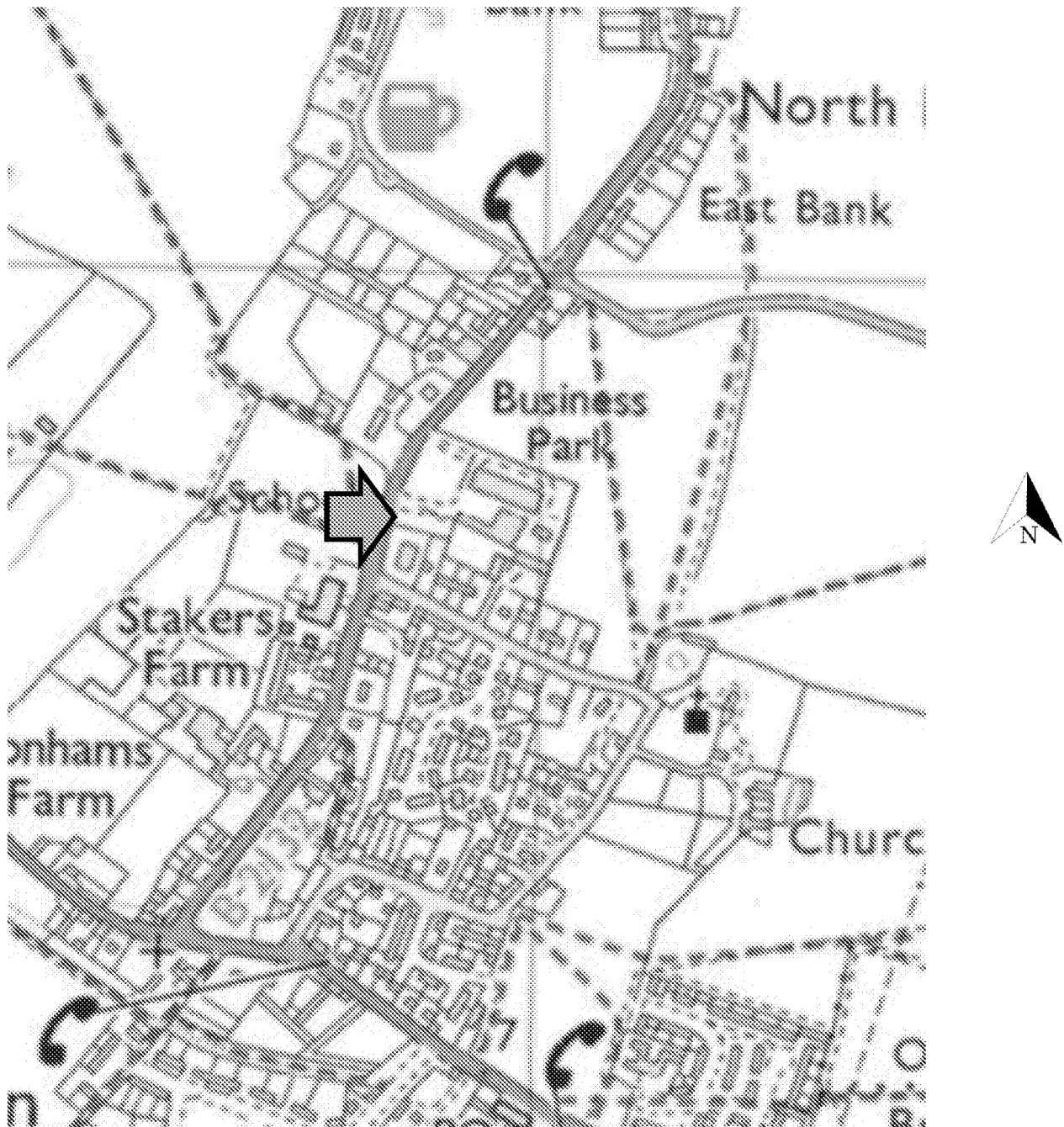
Appendix C.1 Conceptual Site Model

Appendix C.2 Chemical Laboratory Results

Appendix C.3 General Assessment Criteria

Appendix C.4 Determination of Hazardous Waste Classification

Appendix D Information Provided by the Client

Figure 1 – Site Location Map

Job Number
16612

Project
Land adjacent to Orchard Business Park, North End
Road, Yapton, West Sussex BN18 0GA

Client
Crayfern Homes

Date
November 2017



Figure 2 – Aerial Photograph

Project

Land adjacent to Orchard Business
Park, North End Road, Yapton,
West Sussex BN18 0GA

Client

Crayfern Homes

Date

November 2017

Job Number

16612





Figure 3 – Trial Hole Plan

Project

Land adjacent to Orchard Business
Park, North End Road, Yapton,
West Sussex BN18 0GA

Client

Crayfern Homes

Date

November 2017

Job Number

16645



Appendix A Field Work

Appendix A.1 Engineers Logs



Soils Limited



Borehole Log

Borehole No.

WS1

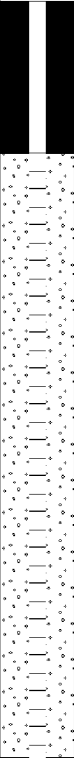
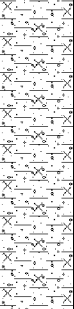
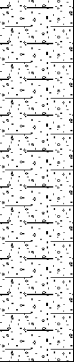
Sheet 1 of 1

Project Name:	Land adjacent to Orchard Business Park,	Project No.:	16612	Co-ords:		Hole Type	WS
Location:	North End Road, Yapton, BN18 0GA			Level:		Scale	1:50
Client:	Crayfern Homes			Dates:	16-11-2017	Logged By	AP

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (mAOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	J+D		0.40			Soft dark brown very silty CLAY. Very rare fine to medium sub-angular flint and brick gravel. Frequent very fine white rootlets. MADE GROUND.	1
		0.40	D						
		0.60	J+D						
		0.90	J+D					Very soft to soft off-white and brown slightly sandy silty CLAY. Sand is fine to coarse. Rare fine to medium sub-angular flint gravel. Rare very fine white rootlets to 2.40m bgl. Frequent decayed root tracks throughout. RIVER TERRACE DEPOSITS.	
		1.50	D		2.80				2
		2.30	D						
		2.90	D					Firm dark orangey brown very sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium sub-angular to angular flint. RIVER TERRACE DEPOSITS.	
		3.60	D						
		4.60	D		4.50			Yellowish white and off white extremely weathered structureless CHALK recovered as fine to medium weak intact blocks in a sandy silty matrix. Rare fine to medium angular flint fragments. LEWIS NODULAR CHALK FORMATION.	5
					5.00			End of Borehole at 5.00m	
									6
									7
									8
									9
									10

General Remarks: Roots to 2.40m bgl.				Borehole Type CP: Cable Percussive WS: Windowless Sampler RC: Rotary Cored		Sample Types D: Disturbed B: Bulk J: Jar W: Water U: Undisturbed	
Groundwater Remarks: No groundwater encountered.				In-Situ Testing SPT: Split spoon - Standard Penetration Test CPT: Cone - Standard Penetration Test			

Project Name:	Land adjacent to Orchard Business Park,	Project No.:	16612	Co-ords:		Hole Type	WS
Location:	North End Road, Yapton, BN18 0GA			Level:		Scale	1:50
Client:	Crayfern Homes			Dates:	16-11-2017	Logged By	AP

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (mAOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	J+D					Soft to very soft off-white and brown with occasional grey mottling silty slightly sandy CLAY. Sand is fine to coarse. Rare fine to medium sub-angular flint gravels. Frequent very fine white rootlets to 1.00m bgl. . RIVER TERRACE DEPOSITS.	1
		0.40	J+D						
		0.80	J+D						
		1.70	D		2.60			Dark orangey brown gravelly clayey fine to coarse SAND. Gravel is fine to medium sub-angular flint. A pocket of yellowish white weathered and structureless CHALK at 4.65-4.85m bgl. . RIVER TERRACE DEPOSITS.	2
		2.70	D						
		3.70	D						
		4.70	D		5.00			End of Borehole at 5.00m	3
									4
									5
									6
									7
									8
									9
									10

General Remarks:

Roots to 1.00m bgl

Groundwater Remarks:

No groundwater encountered.

Borehole Type

CP: Cable Percussive
WS: Windowless Sampler
RC: Rotary Cored

Sample Types

D: Disturbed
B: Bulk
J: Jar
W: Water
U: Undisturbed

In-Situ Testing

SPT: Split spoon - Standard Penetration Test
CPT: Cone - Standard Penetration Test

**Soils Limited**

Newton House, Cross Road, Tadworth KT20 5SR

Borehole Log

Borehole No.

WS3

Sheet 1 of 1

Project Name:	Land adjacent to Orchard Business Park,	Project No.:	16612	Co-ords:		Hole Type	WS
Location:	North End Road, Yapton, BN18 0GA			Level:		Scale	1:50
Client:	Crayfern Homes			Dates:	16-11-2017	Logged By	AP

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (mAOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	J+D		0.20			Dark brown clayey SILT. Frequent fine roots and rootlets. TOPSOIL.	
		0.50	J+D					Dark orangey brown slightly sandy SILT. Sand is fine. Frequent fine roots and rootlets. RIVER TERRACE DEPOSITS.	
		0.75	J+D						
		1.00	D		1.00			Firm dark orangey brown slightly sandy silty CLAY. Sand is fine to coarse. Rare fine to medium flint gravels. Frequent black decayed root track throughout. Occasional very fine rootlets becoming very rare at 2.00-2.80m bgl. RIVER TERRACE DEPOSITS.	1
		1.50	D						2
		2.50	D						
		3.10			3.10			Firm off-white and brown sandy gravelly CLAY. Sand is fine. Gravel is fine to medium sub-angular flint chalk. RIVER TERRACE DEPOSITS.	3
		3.50	D						
		3.90			3.90			Yellowish white and off white extremely weathered structureless CHALK recovered as fine to medium weak intact blocks in a sandy silty matrix. A pocket of fine to medium angular flint fragments at 4.75-4.80m bgl. LEWIS NODULAR CHALK FORMATION.	4
		4.50	D						
		5.00			5.00			End of Borehole at 5.00m	5
									6
									7
									8
									9
									10

General Remarks:

Roots to 2.80m bgl

Groundwater Remarks:

No groundwater encountered.

Borehole TypeCP: Cable Percussive
WS: Windowless Sampler
RC: Rotary Cored**Sample Types**D: Disturbed
B: Bulk
J: Jar
W: Water
U: Undisturbed**In-Situ Testing**SPT: Split spoon - Standard Penetration Test
CPT: Cone - Standard Penetration Test

**Soils Limited**

Newton House, Cross Road, Tadworth KT20 5SR

Borehole Log

Borehole No.

WS4

Sheet 1 of 1

Project Name:	Land adjacent to Orchard Business Park,	Project No.:	16612	Co-ords:		Hole Type	WS
Location:	North End Road, Yapton, BN18 0GA			Level:		Scale	1:50
Client:	Crayfern Homes			Dates:	16-11-2017	Logged By	AP

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (mAOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	J+D		0.20			Dark brown clayey SILT. Frequent fine roots and rootlets. TOPSOIL.	
		0.50	J+D					Soft to firm dark orangey brown slightly sandy silty CLAY. Sand is fine to coarse. Rare fine to medium flint gravels. Frequent black decayed root track throughout. Occasional fine roots very fine rootlets becoming very rare at 2.00-2.90m bgl. RIVER TERRACE DEPOSITS.	1
		0.75	J+D						
		1.00	D						
		1.50	D						2
		2.50	D						3
		3.50	D		3.40			Soft to very soft off-white brown gravelly sandy CLAY. Sand is fine. Gravel is fine to medium angular flint. RIVER TERRACE DEPOSITS.	4
		4.50	D		4.20			Firm off-white brown sandy gravelly CLAY. Sand is fine. Gravel is fine to medium sub-angular flint chalk. RIVER TERRACE DEPOSITS.	
					5.00			End of Borehole at 5.00m	5
									6
									7
									8
									9
									10

General Remarks:

Roots to 2.90m bgl.

Groundwater Remarks:

No groundwater encountered.

Borehole TypeCP: Cable Percussive
WS: Windowless Sampler
RC: Rotary Cored**Sample Types**D: Disturbed
B: Bulk
J: Jar
W: Water
U: Undisturbed**In-Situ Testing**SPT: Split spoon - Standard Penetration Test
CPT: Cone - Standard Penetration Test

Project Name:	Land adjacent to Orchard Business Park,	Project No.	16612	Co-ords:		Hole Type	DP
Location:	North End Road, Yapton, BN18 0GA	Level:	m AOD			Scale	1:50
Client:	Crayfern Homes	Dates:	16-11-2017			Logged By	JO

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Remarks	Fall Height 700mm		Cone Base Diameter 50.5mm		
	Hammer Weight 63.5kg		Final Depth 6m		
	Probe Type DPSH-B		Energy Ratio (Er) 80.98%		

Project Name:	Land adjacent to Orchard Business Park,	Project No.	16612	Co-ords:		Hole Type	DP
Location:	North End Road, Yapton, BN18 0GA	Level:	m AOD			Scale	1:50
Client:	Crayfern Homes	Dates:	16-11-2017			Logged By	JO

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Remarks					
Fall Height		700mm		Cone Base Diameter 50.5mm	
Hammer Weight		63.5kg		Final Depth 6m	
Probe Type		DPSH-B		Energy Ratio (Er) 80.98%	



Project Name:	Land adjacent to Orchard Business Park,	Project No.	16612	Co-ords:		Hole Type	DP
Location:	North End Road, Yapton, BN18 0GA	Level:	m AOD			Scale	1:50
Client:	Crayfern Homes	Dates:	16-11-2017			Logged By	JO

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
0					
1	1				
2	2				
3	2				
4	2				
5	2				
6	2				
7	2				
8	2				
9	2				
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318	2				
319	2				
320	2				
321	2				
322	2				
323	2				
324	2				
325	2				
326	2				
327	2				

Project Name:	Land adjacent to Orchard Business Park,	Project No.	16612	Co-ords:		Hole Type	DP
Location:	North End Road, Yapton, BN18 0GA	Level:	m AOD			Scale	1:50
Client:	Crayfern Homes	Dates:	16-11-2017			Logged By	JO

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
0					
1	2				
	3				
	2				
	2				
	2				
	2				
2	2				
	3				
	5				
	5				
	3				
	2				
	1				
3	2				
	3				
	3				
	2				
	3				
4	3				
	4				
	5				
	7				
	8				
	6				
	7				
	8				
	10				
	11				
5	11				
	9				
	12				
	12				
	10				
	10				
	8				
	7				
6	6				
	6				
	6				
	6				
7					
8					
9					
10					
Remarks	Fall Height 700mm		Cone Base Diameter 50.5mm		
	Hammer Weight 63.5kg		Final Depth 6m		
	Probe Type DPSH-B		Energy Ratio (Er) 80.98%		

		Soils Limited Newton House, Cross Road, Tadworth KT20 5SP			Trial Pit Log		Trial Pit No. TPA Sheet 1 of 1	
Project Name: Land adjacent to Orchard Business Park,		Project No.: 16612		Method: Mechanical Excavator		Hole Type TP		
Location: North End Road, Yapton, BN18 0GA				Plant: JCB 3CX		Scale 1:25		
Client: Crayfern Homes		Trial Pit Length: 2.90m		Trial Pit Width: 0.52m		Logged By DP		
Dates: 30-12-1899		Level:		Co-ords:				
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	J+D		0.24			Soft brown silty gravelly CLAY. Gravel is fine to medium sub-angular to angular flint. TOPSOIL.	
	0.50	J+D					Soft to firm orange brown gravelly silty CLAY. Gravel is fine to coarse sub-angular flint. RIVER TERRACE DEPOSITS.	
	0.80	J+D						
	1.00	D						1
	1.50	D						
	2.00	D						2
	2.50	D						
	2.80	D		2.70			Off-white structureless CHALK recovered as fine to coarse sub-angular flint and fine to coarse block chalk in a silty clayey matrix. (Grade Dm). LEWIS NODULAR CHALK FORMATION.	
	3.00	D						3
	3.50	D						
	3.70	D		3.70				
	End of Pit at 3.70m							4
								5
General Remarks: Roots to 1.65m bgl								Sample Type D: Disturbed B: Bulk J: Jar W: Water
Groundwater Remarks: No groundwater encountered.								

		Soils Limited Newton House, Cross Road, Tadworth KT20 5SP			Trial Pit Log		Trial Pit No. TPB Sheet 1 of 1	
Project Name: Land adjacent to Orchard Business Park,		Project No.: 16612		Method: Mechanical Excavator		Hole Type TP		
Location: North End Road, Yapton, BN18 0GA				Plant: JCB 3CX		Scale 1:25		
Client: Crayfern Homes		Trial Pit Length: 2.20m		Trial Pit Width: 0.50m		Logged By DP		
Dates: 30-12-1899		Level:		Co-ords:				
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	J+D		0.24			Soft brown silty gravelly CLAY. Gravel is fine to medium sub-angular to angular flint. TOPSOIL.	
	0.50	J+D					Soft to firm orange brown gravelly silty CLAY. Gravel is fine to coarse sub-angular flint. RIVER TERRACE DEPOSITS.	
	0.80	J+D						
	1.00	D						
	1.50	D						
	2.00	D						
	2.50	D						
	2.80	D		2.70			Off-white structureless CHALK recovered as fine to coarse sub-angular flint and fine to coarse block chalk in a silty clayey matrix. (Grade Dm). LEWIS NODULAR CHALK FORMATION.	
	3.00	D						
	3.50	D						
	3.70	D		3.70				
End of Pit at 3.70m								
General Remarks: Roots to 2.45m bgl							Sample Type D: Disturbed B: Bulk J: Jar W: Water	
Groundwater Remarks: No groundwater encountered.								

		Soils Limited Newton House, Cross Road, Tadworth KT20 5SR [Redacted Address Line]			Trial Pit Log		Trial Pit No. TPC Sheet 1 of 1	
Project Name: Land adjacent to Orchard Business Park,		Project No.: 16612		Method: Mechanical Excavator		Hole Type TP		
Location: North End Road, Yapton, BN18 0GA				Plant: JCB 3CX		Scale 1:25		
Client: Crayfern Homes		Trial Pit Length: 2.70m		Trial Pit Width: 0.50m		Logged By DP		
Dates: 30-12-1899		Level:		Co-ords:				
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	J+D		0.24			Soft brown silty gravelly CLAY. Gravel is fine to medium sub-angular to angular flint. TOPSOIL.	
	0.50	J+D					Soft to firm orange brown gravelly silty CLAY. Gravel is fine to coarse sub-angular flint. RIVER TERRACE DEPOSITS.	
	0.80	J+D						
	1.00	D						
	1.50	D						
	2.00	D						
	2.50	D						
	2.80	D						
	3.00	D						
	3.50	D		3.40			Off-white structureless CHALK recovered as fine to coarse sub-angular flint and fine to coarse block chalk in a silty clayey matrix. (Grade Dm). LEWIS NODULAR CHALK FORMATION.	
	4.00	D						
	4.10	D		4.10			End of Pit at 4.10m	
General Remarks: Roots to 2.35m bgl								Sample Type D: Disturbed B: Bulk J: Jar W: Water
Groundwater Remarks: No groundwater encountered.								

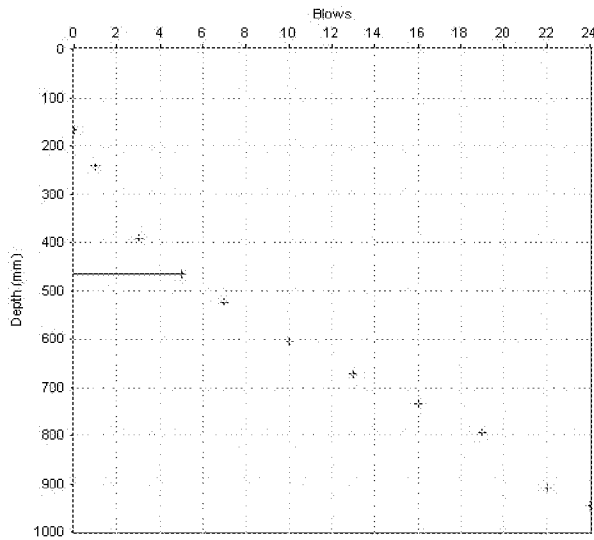
DCP Layer Strength Analysis Report

Project Name: UK DCP

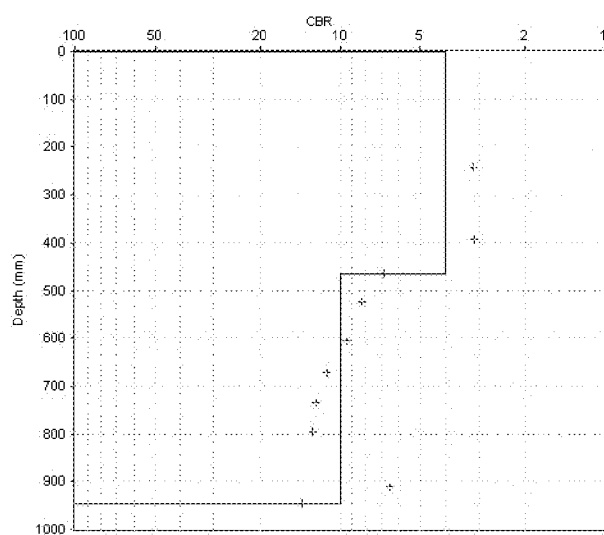
Chainage (km): 1.000
 Direction: 0
 Location/Offset: Lane 1
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 27/11/2017

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	59.60	4	465	465	Base	0.01	0.21	0.21	0.21
2	25.32	10	481	946	Base	0.03	0.51	0.51	0.51

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	0.72	0.72	0.72
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	0.72	0.72	0.72

CBR Relationship:

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

Report produced by

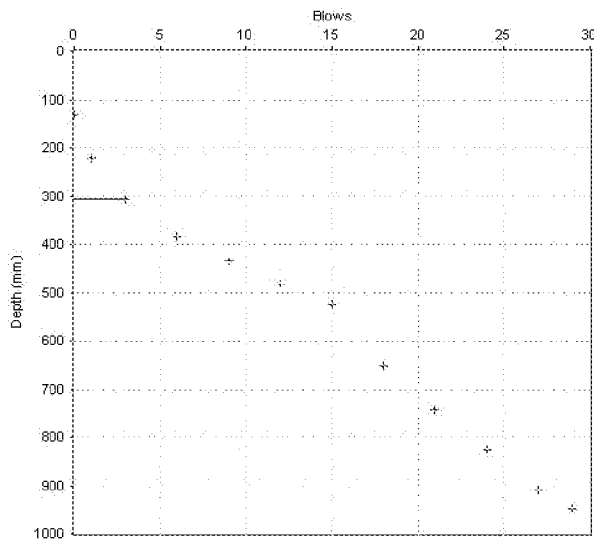
DCP Layer Strength Analysis Report

Project Name: UK DCP

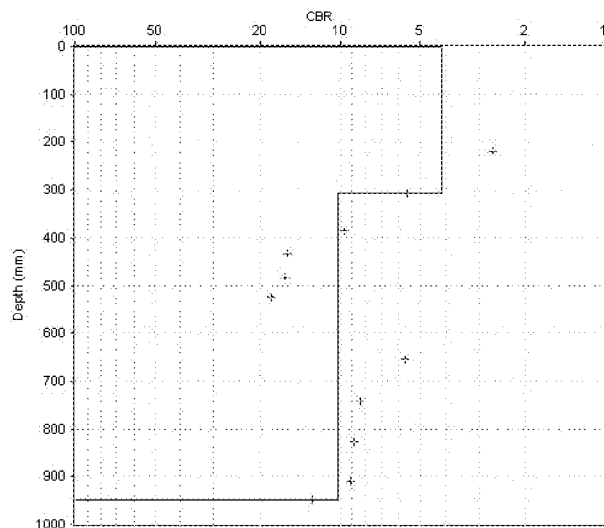
Chainage (km): 2.000
 Direction: 0
 Location/Offset: Lane 1
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 09/11/2017

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	58.33	4	307	307	Base	0.01	0.14	0.14	0.14
2	24.69	10	642	949	Base	0.03	0.70	0.70	0.70

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	0.84	0.84	0.84
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	0.84	0.84	0.84

CBR Relationship:

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

Report produced by

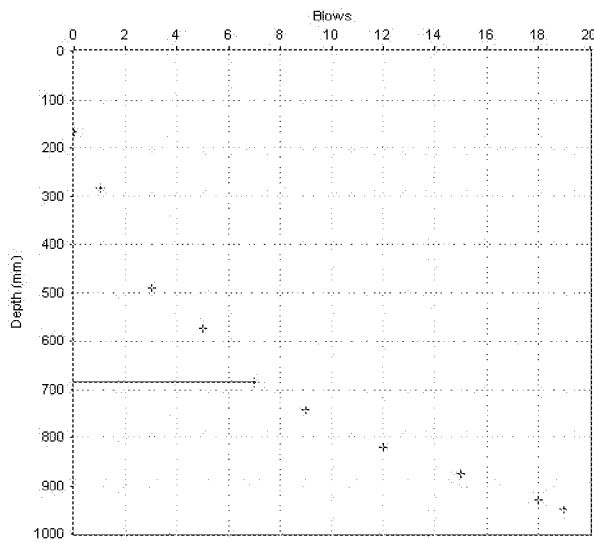
DCP Layer Strength Analysis Report

Project Name: UK DCP

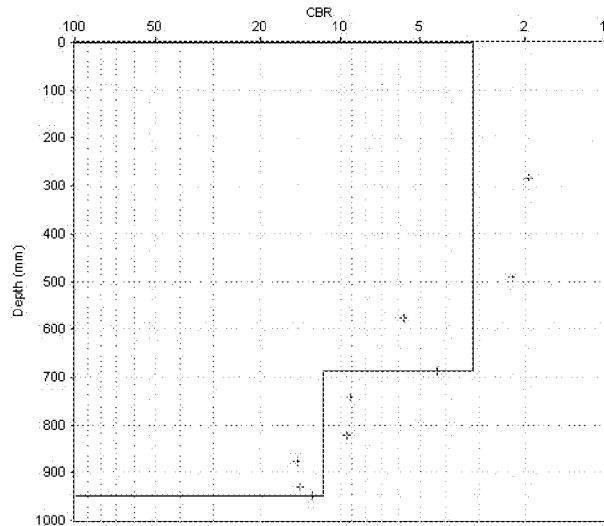
Chainage (km): 3.000
 Direction: 0
 Location/Offset: Lane 1
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 09/11/2017

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	74.57	3	687	687	Base	0.01	0.24	0.24	0.24
2	21.83	12	262	949	Base	0.03	0.32	0.32	0.32

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	0.57	0.57	0.57
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	0.57	0.57	0.57

CBR Relationship:

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

Report produced by

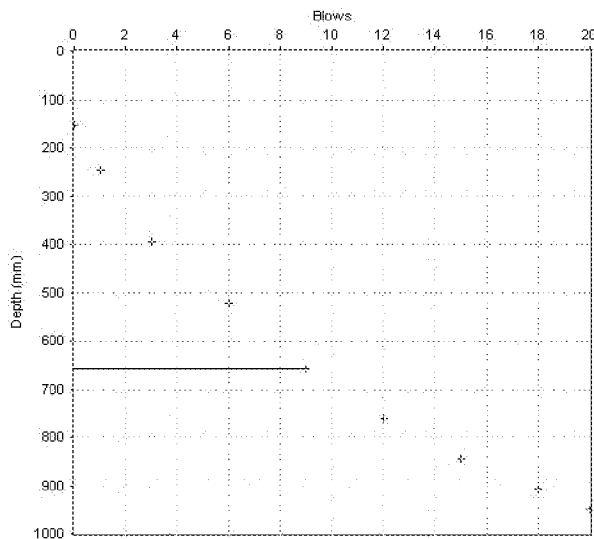
DCP Layer Strength Analysis Report

Project Name: UK DCP

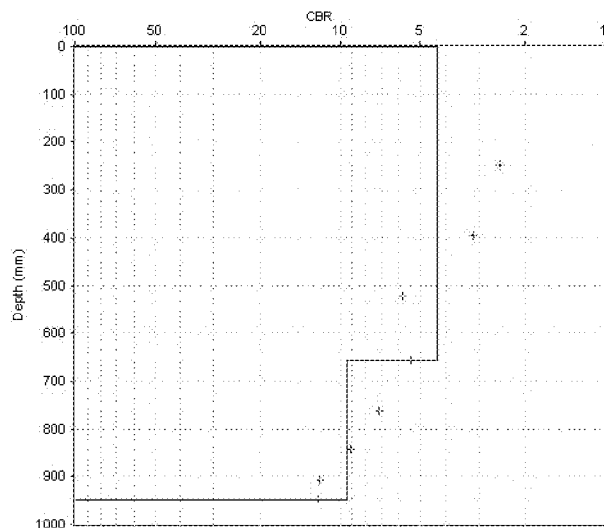
Chainage (km): 4.000
 Direction: 0
 Location/Offset: Lane 1
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 09/11/2017

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	56.00	4	657	657	Base	0.01	0.31	0.31	0.31
2	26.55	9	292	949	Base	0.03	0.30	0.30	0.30

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	0.61	0.61	0.61
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	0.61	0.61	0.61

CBR Relationship:

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

Report produced by

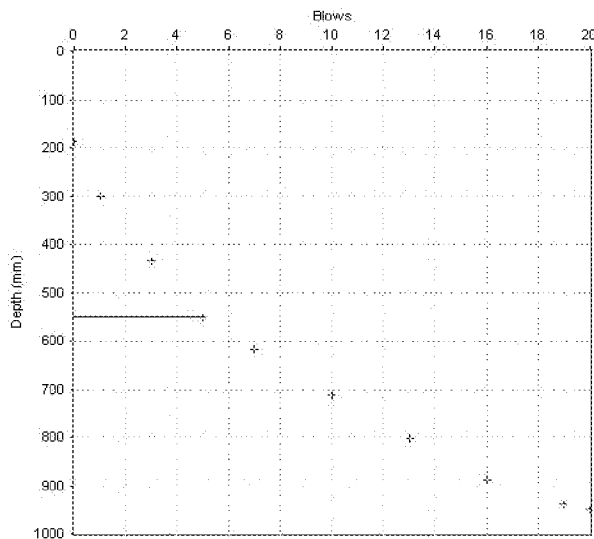
DCP Layer Strength Analysis Report

Project Name: UK DCP

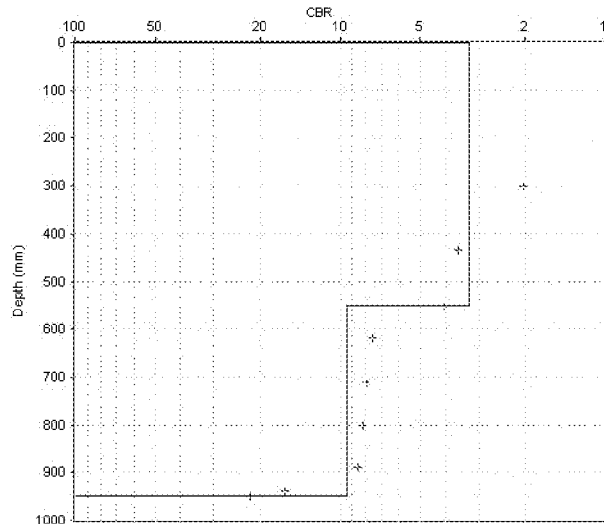
Chainage (km): 5.000
 Direction: 0
 Location/Offset: Lane 1
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 09/11/2017

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	72.80	3	551	551	Base	0.01	0.20	0.20	0.20
2	26.53	9	398	949	Base	0.03	0.40	0.40	0.40

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	0.60	0.60	0.60
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	0.60	0.60	0.60

CBR Relationship:

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

Report produced by

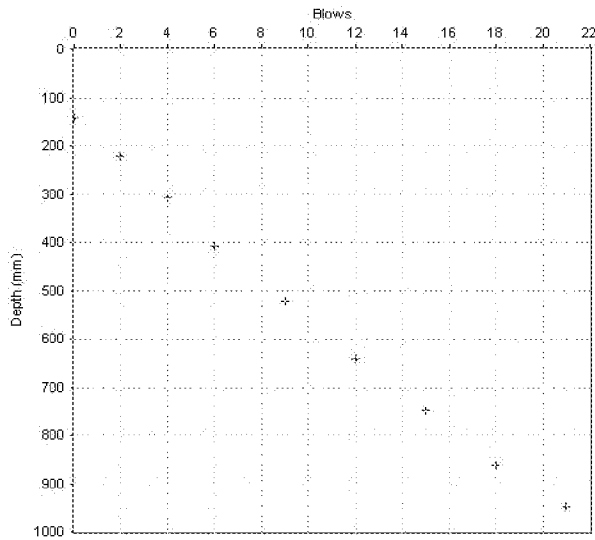
DCP Layer Strength Analysis Report

Project Name: UK DCP

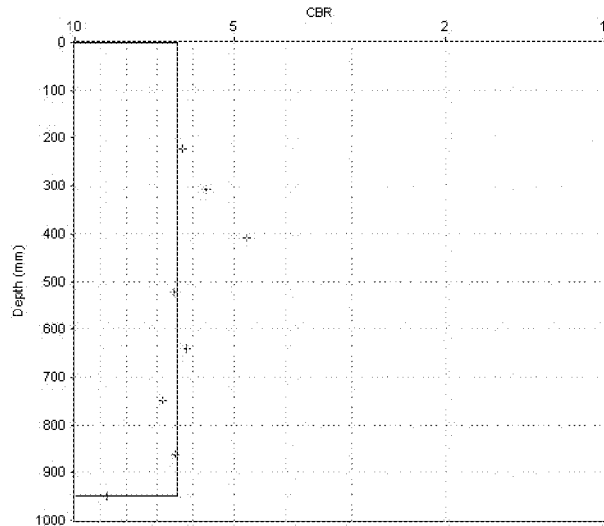
Chainage (km): 6.000
 Direction: 0
 Location/Offset: Lane 1
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 09/11/2017

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	38.38	6	949	949	Base	0.02	0.67	0.67	0.67

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	0.67	0.67	0.67
Sub-Base	--	--	--
Subgrade	--	--	--
Pavement Strength	0.67	0.67	0.67

CBR Relationship:

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

Report produced by

Soakaway Calculations

Soakaway Test No.	TP C - Test1
Contract:	Yapton
Contract No.	16612

Field Test

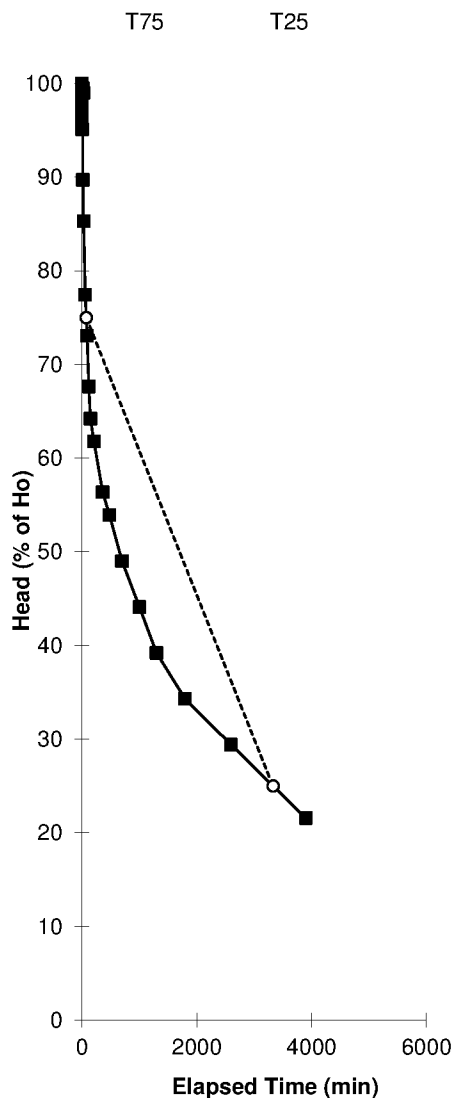
Trial Pit Log (include details of groundwater):
See trial Pit record

Depth of Pit	4.10 m
Width of Pit	0.52 m
Length of Pit	2.90 m
Depth of Pit Soaked	2.70 m
ap50	10.742 m ²
Vp75-25	2.0358 m ³
t75-25	3254.6 min
water used	4.0716 m ³
i	9.705E-07 m/sec.

Field Data

Depth to Water	Elapsed Time	Head of Water	Head of Water
(m)	(min)	(% of 140)	(m)
2.06	0	100	2.04
2.07	15	100	2.03
2.08	30	99	2.02
2.09	1	99	2.01
2.11	2	98	1.99
2.13	3	97	1.97
2.15	4	96	1.95
2.16	5	95	1.94
2.27	15	90	1.83
2.36	30	85	1.74
2.52	60	77	1.58
2.61	90	73	1.49
2.72	120	68	1.38
2.79	150	64	1.31
2.84	210	62	1.26
2.95	360.0	56	1.15
3	480.0	54	1.10
3.10	700.0	49	1.00
3.2	1000.0	44	0.90
3.30	1300.0	39	0.80
3.40	1800.0	34	0.70
3.50	2600.0	29	0.60
3.66	3900.0	22	0.44

T75	76.667	75
T25	3331.250	25
T75-25	3254.583	Derived from Best Fit



Comments

Data after 360minutes has been extrapolated in order to calculate an infiltration rate

SOILS LIMITED

**Newton House, Cross Road, Tadworth
Surrey, KT20 5SR**

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 DPSH Blow Counts

DP	Strata	Equivalent SPT N60 Blow Counts	Inferred Cohesive Strength/Granular Density/Approximate CIRIA Chalk Grade
DPI	RTD 0.40 – 2.80 Sandy silty CLAY	4 - 11	Low to medium (Cu = 20 – 55kPa)
	RTD 2.80 – 4.50 Sandy gravelly CLAY	11 – 31	Medium to very high (Cu = 55 – 155kPa)
	LNCK 4.50 – 6.00 CHALK ¹	11 - 34	Structureless (Dc) to structured chalk (C5 – A1)
DP2	RTD 0.80 – 2.60 Sandy silty CLAY	<3 - 27	Extremely low to high (Cu = <10 – 135kPa)
	RTD 2.60 – 5.20 ¹ Sandy gravelly CLAY	4 - 34	Extremely low to very high (Cu = 20 – 155kPa)
	LNCK 5.20 ¹ – 6.00 ¹ CHALK ¹	19 - 34	Structured chalk (C5 – A1)
DP3	RTD 1.20 – 3.10 Sandy silty CLAY	4 - 11	Low to medium (Cu = 20 – 55kPa)
	RTD 3.10 – 3.90 Sandy Gravelly CLAY	8 - 15	Medium (Cu = 40 – 75kPa)
	LNCK 3.90 – 6.00 ¹ CHALK ¹	19 - 50	Structured chalk (C5 – A1)
DP4	RTD 1.20 – 4.20 Sandy silty CLAY	4 - 19	Low to medium (Cu = 20 – 55kPa)
	RTD 4.20 – 5.60 Sandy Gravelly CLAY	19 - 42	High to very high (Cu = 95 – 210kPa)
	LNCK 5.60 – 6.00 ¹ CHALK ¹	23 - 27	Structured chalk (C5 – A1)

Note: ¹ Ground conditions inferred past the base of windowless sampler boreholes.

Table B.2.2 Interpretation of Atterberg Limit Tests

Stratum	Moisture Content (%)	Plasticity Index (%)	Passing 425µm Sieve (%)	Modified Plasticity Index (%)	Soil Classification	Volume Change Potential	
						BRE	NHBC
RTD	11 – 23	9 – 21	76 – 100	7 - 21	CL - CI	None to medium	None to 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.2.3 Interpretation of PSD Tests

Location	Depth (m bgl)	Soil Description	Volume Change Potential		Passing 63µm Sieve (%)
			BRE	NHBC	
WS2	3.70	Brown fine to coarse gravelly fine to coarse sandy SILT/CLAY	Yes	Yes	43

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.2.4 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)
WS1	4.60	1.89	1.65	14	24	Medium
WS3	4.50	1.82	1.52	19	29	Low

Note: (The Determination of Saturation Moisture Content of Chalk Tests were made in accordance with BS 1377: Part 2: 1990 Clauses 3.3)

Appendix B.3 Geotechnical In-Situ and Laboratory Results



Laboratory Report



Contract Number: 37368

Client Ref: **16612**Report Date: **24-11-2017**

Client PO:

Client **Soils Limited**
Newton House
Cross Road
Tadworth
Surrey
KT20 5SR

Contract Title: **Yapton, BN18 0GA**
For the attention of: **John Hills**

Date Received: **21-11-2017**
Date Commenced: **21-11-2017**
Date Completed: **24-11-2017**

Test Description	Qty
Moisture Content 1377 : 1990 Part 2 : 3.2 - * UKAS	5
1 Point Liquid & Plastic Limit 1377 : 1990 Part 2 : 4.4 & 5.3 - * UKAS	5
(SMC) Saturated Moisture Content 1377 : 1990 Part 2 : 3.3 & 7.3 - * UKAS	2
PSD Wet Sieve method 1377 : 1990 Part 2 : 9.2 - * UKAS	1
Disposal of Samples on Project	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:

Alex Wynn (Associate Director) - Ben Sharp (Contracts Manager) - Emma Sharp (Office Manager)

Paul Evans (Quality/Technical Manager) - Richard John (Advanced Testing Manager) - Sean Penn (Administrative Assistant)

Vaughan Edwards (Managing Director) - Wayne Honey (Administrative/Quality Assistant)

GEO Site & Testing Services Ltd

Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN

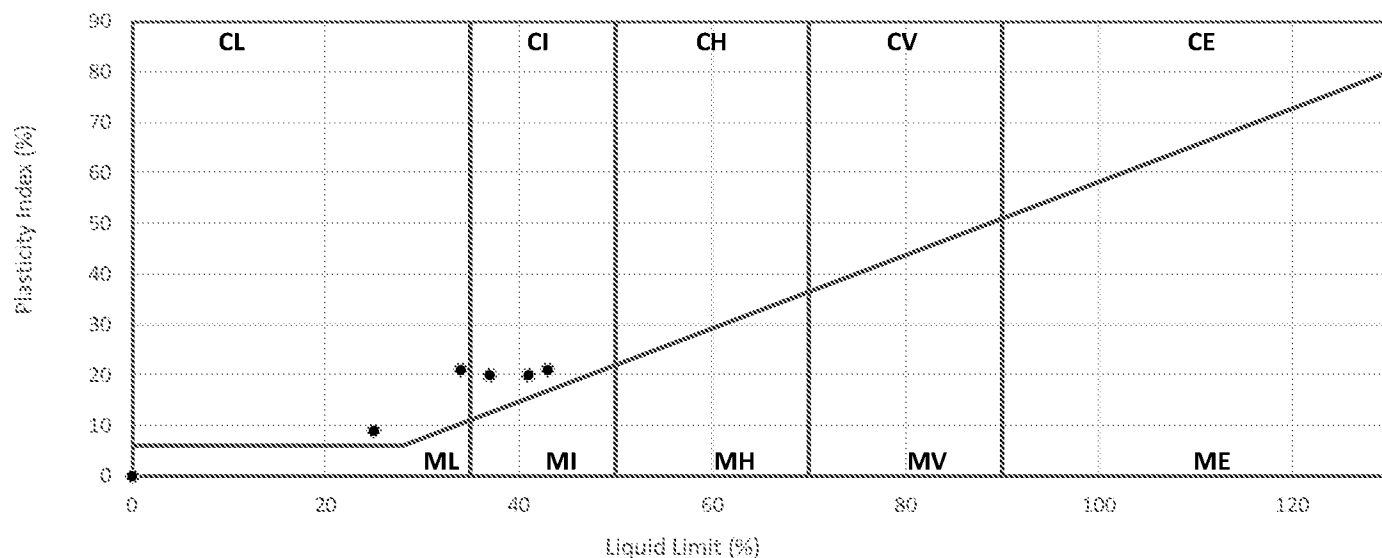
LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX (BS 1377 : Part 2 : 1990 Method 5)

Contract Number	37368	
Site Name	Yapton, BN18 0GA	

[illegible]

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

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION



Operators	Checked	23/11/2017	Sean Penn
DB	Approved	24/11/2017	Ben Sharp



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

Contract Number	37368	
Site Name	Yapton, BN18 0GA	

[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

Operators	Checked	23/11/2017	Sean Penn
RO/MH	Approved	24/11/2017	Paul Evans





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

Contract Number

37368

Borehole/Pit No.

WS2

Site Name

Yapton, BN18 0GA

Sample No.

Soil Description

Brown fine to coarse gravelly fine to coarse sandy SILT/CLAY

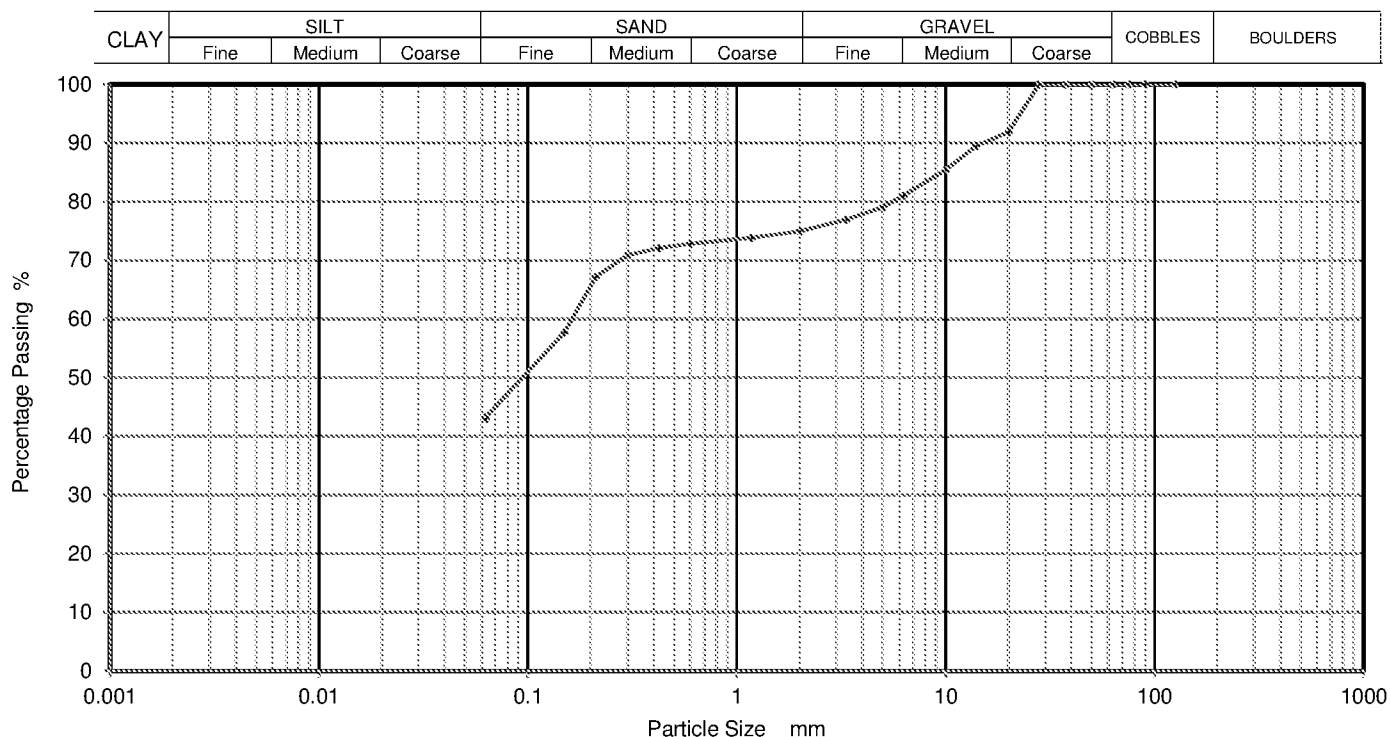
Depth Top

3.70

Depth Base

Sample Type

D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	100		
50	100		
37.5	100		
28	100		
20	92		
14	89		
10	85		
6.3	81		
5	79		
3.35	77		
2	75		
1.18	74		
0.6	73		
0.425	72		
0.3	71		
0.212	67		
0.15	58		
0.063	43		

Sample Proportions	% dry mass
Cobbles	0
Gravel	25
Sand	32
Silt and Clay	43

Grading Analysis	
Uniformity Coefficient	

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	23/11/2017	Sean Penn
RO/MH	Approved	24/11/2017	Ben Sharp





John Hills
Soils Ltd
Thomas Telford House - Unit 11
Sun Valley Business Park
Winnall Close
Winchester
SO23 0LB

QTS Environmental Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2TN

QTS Environmental Report No: 17-67293

Site Reference: Yapton

Project / Job Ref: 16612

Order No: 16612/JH

Sample Receipt Date: 20/11/2017

Sample Scheduled Date: 20/11/2017

Report Issue Number: 1

Reporting Date: 24/11/2017

Authorised by:

Kevin Old
Associate Director of Laboratory

Russell Jarvis
Associate Director of Client Services

QTSE is the trading name of DETS Ltd, company registration number 03705645



QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN



Soil Analysis Certificate						
QTS Environmental Report No: 17-67293	Date Sampled	16/11/17	16/11/17	16/11/17		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Yapton	TP / BH No	WS1	WS2	WS4		
Project / Job Ref: 16612	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: 16612/JH	Depth (m)	2.90	2.70	1.50		
Reporting Date: 24/11/2017	QTSE Sample No	302599	302600	302601		

Determinand	Unit	RL	Accreditation				
pH	pH Units	N/a	MCERTS	7.6	7.7	7.5	
Total Sulphate as SO ₄	mg/kg	< 200	NONE	< 200	< 200	< 200	
Total Sulphate as SO ₄	%	< 0.02	NONE	< 0.02	< 0.02	< 0.02	
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	17	17	16	
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.02	0.02	0.02	
Total Sulphur	%	< 0.02	NONE	< 0.02	< 0.02	< 0.02	
Ammonium as NH ₄	mg/kg	< 0.5	NONE	0.6	1.3	< 0.5	
Ammonium as NH ₄	mg/l	< 0.05	NONE	0.06	0.13	< 0.05	
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	21	15	12	
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	10.5	7.7	6.1	
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	< 3	MCERTS	5	4	< 3	
Water Soluble Nitrate (2:1) as NO ₃	mg/l	< 1.5	MCERTS	2.6	2	< 1.5	
W/S Magnesium	mg/l	< 0.1	NONE	2.6	3.1	1.7	

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



QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
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Lenham Heath
Maidstone
Kent ME17 2JN



Soil Analysis Certificate - Sample Descriptions

QTS Environmental Report No: 17-67293

Soils Ltd

Site Reference: Yapton

Project / Job Ref: 16612

Order No: 16612/JH

Reporting Date: 24/11/2017

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
302599	WS1	None Supplied	2.90	11	Light brown sandy clay with stones
302600	WS2	None Supplied	2.70	8.8	Light brown sandy clay with stones
302601	WS4	None Supplied	1.50	11.3	Light brown sandy clay

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

Insufficient Sample ^{U/S}

Unsuitable Sample ^{U/S}



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Maidstone
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Soil Analysis Certificate - Methodology & Miscellaneous Information

QTS Environmental Report No: 17-67293

Soils Ltd

Site Reference: Yapton

Project / Job Ref: 16612

Order No: 16612/JH

Reporting Date: 24/11/2017

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 dphenylcarbazine 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 Chemical Laboratory Testing

Appendix C.1 Conceptual Site Model

Table C.1.1 CSM Revised Pre Testing

Potential Contaminants	Pathway	Receptor	Risk Assessment Methodology (plus anticipated quantitative risk assessment methods)	Site specific settings	Risk Classification: Based on Desk Study and Phase II Investigation	Pollutant Linkage & Action Required
P3, P4, P5, P6	Uptake (root and stomata), ingestion, inhalation and dermal	Ecological features (i.e. Flora and Fauna)	Presence of SSSI, Nature reserves and others within 0- 250m to the site.	Residential development with plant uptake.	Low to moderate	Further Action Required. Chemical testing required
P4, P5, P6	Chemical attack	Building structures/services	BRE SDI 2005 for risk assessment. Water UK (2014) for pipes. Use Anglian Water trigger for services risk assessment	Residential development	none	Recommended sulphate characteristics to be used.
P1, P3, P4, P5, P6	Inhalation, ingestion and dermal contact	Human health Site residents	Use CLEA for human risk assessment	Residential development with plant uptake	Low	Further Action Required. Chemical testing required
		Human Health Workers	Assessment not within the scope of this Desk study (responsibility of building contractor). Ground workers should follow regulations on health and safety during development (HSE, 1991)	Workers and the general public should follow regulation on health and safety during development (HSE, 1991)	Low	Follow HSE Procedures
P2, P3, P4, P5, P6	Leaching (direct precipitation, overland flow and through flow)	Shallow groundwater	Assess distance from watercourse and direction of flow – Consider use of R&D 20 publication and EA remediation target for risk assessment	RTD has Secondary A Aquifer designation. Surface water present 180m S	None	No Further Action Required
P2, P3, P4, P5, P6	Leaching (direct precipitation, overland flow, through and groundwater flow)	Deep groundwater	Undertake groundwater or leachate testing depending on site specific ground conditions. Consider use of R&D 20 publication and EA remediation target for risk assessment if contamination is identified.	LNCK has a Principal Aquifer designation.	None	No Further Action Required
P7	Through fissures, shafts, high permeability strata and inhalation	Human and Building Structures	Current or former Landfill sites within 0-250m to the site. Assess nature/age/size of site for Risk Assessment. Use CIRIA I49 & 665 to assess need for gas protection measures where necessary following ground gas testing	VOC's from tanks and garages.	Low	Further Action Required. Ongoing SGRA

Note: P1: Asbestos, P2: Pesticide, P3: Metals and semi-metals P4: Organic compounds P5: Organic Solvents P6: non-chlorinated Solvents P7: Soils gas HSE = Health and Safety Executive

Table C.1.2 CSM Revised Post Testing

Potential Contaminants	Pathway	Receptor	Risk Assessment Methodology (plus anticipated quantitative risk assessment methods)	Site specific settings	Risk Classification: Based on Desk Study and Phase II Investigation	Pollutant Linkage & Action Required
Lead	Uptake (root and stomata), ingestion, inhalation and dermal	Ecological features (i.e. Flora and Fauna)	Presence of SSSI, Nature reserves and others within 0- 250m to the site.	Residential development with plant uptake.	Low	Remediation required
None	Chemical attack	Building structures/services	BRE SDI 2005 for risk assessment. Water UK (2014) for pipes. Use Anglian Water trigger for services risk assessment	Proposed foundations and service pipes	None	Recommended sulphate characteristics to be used.
Lead	Inhalation, ingestion and dermal contact	Human health Site residents	Use CLEA for human risk assessment	Residential development with plant uptake	Low	Remediation required
		Human Health Workers	Assessment not within the scope of this Desk study (responsibility of building contractor). Ground workers should follow regulations on health and safety during development (HSE, 1991)	Workers and the general public should follow regulation on health and safety during development (HSE, 1991)	Low	Follow HSE Procedures
None	Leaching (direct precipitation, overland flow and through flow)	Shallow groundwater/ Surface Water	Assess distance from watercourse and direction of flow – Consider use of R&D 20 publication and EA remediation target for risk assessment	Risk to shallow groundwater is considered negligible	None	No further action required
None	Leaching (direct precipitation, overland flow, through and groundwater flow)	Deep groundwater	Undertake groundwater or leachate testing depending on site specific ground conditions. Consider use of R&D 20 publication and EA remediation target for risk assessment if contamination is identified.	Risk to deep groundwater is considered negligible	None	No further action required
Soil Gas	Through fissures, shafts, high permeability strata and inhalation	Human and Building Structures	Current or former Landfill sites within 0-250m to the site. Assess nature/age/size of site for Risk Assessment. Use CIRIA I49 & 665 to assess need for gas protection measures where necessary following ground gas testing	VOC's from tanks and garages.	Low	Further Action Required. Ongoing SGRA
Note: HSE = Health and Safety Executive						

Appendix C.2 Chemical Laboratory Results



John Hills
Soils Ltd
Thomas Telford House - Unit 11
Sun Valley Business Park
Winnall Close
Winchester
SO23 0LB



QTS Environmental Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2TN

QTS Environmental Report No: 17-67292

Site Reference: Yapton

Project / Job Ref: 16612

Order No: 16612/JH

Sample Receipt Date: 20/11/2017

Sample Scheduled Date: 20/11/2017

Report Issue Number: 1

Reporting Date: 24/11/2017

Authorised by:

Kevin Old
Associate Director of Laboratory

QTSE is the trading name of DETS Ltd, company registration number 03705645

Authorised by:

Russell Jarvis
Associate Director of Client Services



QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN



Soil Analysis Certificate						
QTS Environmental Report No: 17-67292	Date Sampled	16/11/17	16/11/17	16/11/17	16/11/17	16/11/17
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Yapton	TP / BH No	WS1	WS1	WS2	WS3	WS4
Project / Job Ref: 16612	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 16612/JH	Depth (m)	0.20	0.60	0.40	0.20	0.50
Reporting Date: 24/11/2017	QTSE Sample No	302594	302595	302596	302597	302598

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	6.5	6.8	6.8	7.1	7.5
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	215	69	33	25	17
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.22	0.07	0.03	0.03	0.02
Sulphide	mg/kg	< 5	NONE	< 5	< 5	< 5	< 5	< 5
Organic Matter	%	< 0.1	MCERTS	2.3	0.6	0.8	3.1	1
Total Organic Carbon (TOC)	%	< 0.1	MCERTS	1.4	0.4	0.5	1.8	0.6
Antimony (Sb)	mg/kg	< 1	NONE	< 1	< 1	< 1	1.9	< 1
Arsenic (As)	mg/kg	< 2	MCERTS	8	8	9	8	7
Beryllium (Be)	mg/kg	< 0.5	NONE	0.5	0.6	0.6	0.5	< 0.5
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2	< 0.2	< 0.2	0.2	< 0.2
Chromium (Cr)	mg/kg	< 2	MCERTS	18	21	23	19	19
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	14	11	12	18	10
Lead (Pb)	mg/kg	< 3	MCERTS	49	19	16	522	55
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	12	14	16	13	13
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	< 3
Vanadium (V)	mg/kg	< 2	NONE	28	30	32	28	27
Zinc (Zn)	mg/kg	< 3	MCERTS	52	49	50	152	52
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)



QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN



Soil Analysis Certificate - Speciated PAHs

QTS Environmental Report No: 17-67292	Date Sampled	16/11/17	16/11/17	16/11/17	16/11/17	16/11/17
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Yapton	TP / BH No	WS1	WS1	WS2	WS3	WS4
Project / Job Ref: 16612	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 16612/JH	Depth (m)	0.20	0.60	0.40	0.20	0.50
Reporting Date: 24/11/2017	QTS Sample No	302594	302595	302596	302597	302598

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 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	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.64	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	0.18	< 0.1	< 0.1	1.41	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	0.16	< 0.1	< 0.1	1.14	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.61	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.75	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.13	< 0.1	< 0.1	0.91	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.39	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.65	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.30	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.32	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	< 1.6	7.1	< 1.6

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



QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN



Soil Analysis Certificate - TPH LQM Banded

QTS Environmental Report No: 17-67292	Date Sampled	16/11/17	16/11/17			
Soils Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: Yapton	TP / BH No	WS1	WS4			
Project / Job Ref: 16612	Additional Refs	None Supplied	None Supplied			
Order No: 16612/JH	Depth (m)	0.20	0.50			
Reporting Date: 24/11/2017	QTSE Sample No	302594	302598			

Determinand	Unit	RL	Accreditation				
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01		
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05		
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2		
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2		
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3		
Aliphatic >C16 - C35	mg/kg	< 10	MCERTS	< 10	< 10		
Aliphatic >C35 - C44	mg/kg	< 10	NONE	< 10	< 10		
Aliphatic (C5 - C44)	mg/kg	< 30	NONE	< 30	< 30		
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01		
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05		
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2		
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2		
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	< 2		
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3		
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10	< 10		
Aromatic >C35 - C44	mg/kg	< 10	NONE	< 10	< 10		
Aromatic (>C5 - C44)	mg/kg	< 30	NONE	< 30	< 30		
Total >C5 - C44	mg/kg	< 60	NONE	< 60	< 60		

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						
QTS Environmental Report No: 17-67292	Date Sampled	16/11/17	16/11/17			
Soils Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: Yapton	TP / BH No	WS1	WS4			
Project / Job Ref: 16612	Additional Refs	None Supplied	None Supplied			
Order No: 16612/JH	Depth (m)	0.20	0.50			
Reporting Date: 24/11/2017	QTSE Sample No	302594	302598			

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2	< 2			
Toluene	ug/kg	< 5	MCERTS	< 5	< 5			
Ethylbenzene	ug/kg	< 2	MCERTS	< 2	< 2			
p & m-xylene	ug/kg	< 2	MCERTS	< 2	< 2			
o-xylene	ug/kg	< 2	MCERTS	< 2	< 2			
MTBE	ug/kg	< 5	MCERTS	< 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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Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN



Soil Analysis Certificate - Sample Descriptions

QTS Environmental Report No: 17-67292

Soils Ltd

Site Reference: Yapton

Project / Job Ref: 16612

Order No: 16612/JH

Reporting Date: 24/11/2017

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
302594	WS1	None Supplied	0.20	18.2	Brown sandy clay
302595	WS1	None Supplied	0.60	17.3	Light brown clay
302596	WS2	None Supplied	0.40	16.1	Light brown sandy clay
302597	WS3	None Supplied	0.20	17.5	Brown sandy clay with vegetation
302598	WS4	None Supplied	0.50	16.6	Brown sandy clay

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

Insufficient Sample ^{1/5}

Unsuitable Sample ^{1/5}



QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN



Soil Analysis Certificate - Methodology & Miscellaneous Information

QTS Environmental Report No: 17-67292

Soils Ltd

Site Reference: Yapton

Project / Job Ref: 16612

Order No: 16612/JH

Reporting Date: 24/11/2017

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 dphenylcarbazine 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.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 CL: AIRE 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 CL: AIRE 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 CLAIRE/CIEH published a joint report, *Guidance in comparing soil contamination data with a critical concentration* (CLAIRE/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				
			With			Without			Allotments			Commercial			Residential			Park									
			home-grown produce	1.0	2.5	6	home-grown produce	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1				2.5	6		
Type	Contaminants	Species	Year	SGM	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					
Metals	Antimony		2010					550					7500										EIC/AGS/CLAIRE	EIC/AGS/CLAIRE	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				28			149			4.9			410			220			800	C4SL	DEFRA	2014		
	Chromium	III	2015				910			910			18000			8600			1500			33000	S4UL	LQM/CIEH	2015		
		VI	2014				21			21			170			49			22			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			90			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 >C3 - 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 >C3 - 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									Allotments			Commercial			Public Open Space (POS)						Media	Authority	Date
			With			Without			Residential									Park								
			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																							
	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 (PAHs) (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	CASL	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(g,h)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	4700	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		
Explosives	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		
	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-tetranitro-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		
Pesticides	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		
	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	69	70	8.2	8.2	8.2	14	15	15	S4UL	LQM/CIEH	2015		
Chlorobenzenes	Chlorobenzene		2015	0.46	1	2.4	0.46	1	2.4	5.9	14	32	56	130	290	11000	13000	14000	1300	2000	2900	S4UL	LQM/CIEH	2015		
	1,2-Dichlorobenzene		2015	23	55	130	24	57	130	94	230	540	2000	4800	11000	90000	95000	98000	24000	36000	51000	S4UL	LQM/CIEH	2015		
	1,3-Dichlorobenzene		2015	0.4	1	2.3	0.44	1.1	2.5	0.25	0.6	1.5	30	73	170	300	300	300	390	440	470	S4UL	LQM/CIEH	2015		
	1,4-Dichlorobenzene		2015	61	150	350	61	150	350	15	37	88	4400	10000	25000	17000	17000	1700	36000	36000	36000	S4UL	LQM/CIEH	2015		
	1,2,3-, Trichlorobenzene		2015	1.5	3.6	8.6	1.5	3.7	8.8	4.7	12	28	102	250	590	1800	1800	1800	770	1100	1600	S4UL	LQM/CIEH	2015		
	1,2,4-, Trichlorobenzene		2015	2.6	6.4	15	2.6	6.4	15	55	140	320	220	530	1300	15000	17000	19000	1700							

Land Use			Residential With or Without Plant Uptake									Public Open Space (POS)									Media	Authority	Date			
			With						Allotments			Commercial			Residential									Park		
			home-grown produce			Without home-grown produce																				
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				
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- Tetrachlorobenzene		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- Tetrachlorobenzene		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		
	Pentachlorobenzene		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	2015		
	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 (CLARE), 2014)	
3	2012: Soil Guideline Value (SGV) (Environment Agency, 2009)	
4	2015: Suitable 4 Use Level (S4UL) (Nathanail <i>et al</i> , 2015)	
For Generic Risk Assessment, the values in Bold have priority		

Appendix C.4 Determination of Hazardous Waste Classification

Software such as the HazWasteOnline produced Hazardous Waste Classification Tool, enables soils 'total' chemical testing data to be used to identify the classification of waste soils in accordance with Environment Agency guidance. The HazWasteOnline Hazardous Waste Classification Tool was designed primarily for the classification of soil wastes as identified by the European Waste Catalogue (EWC) Chapter 17 - Construction and demolition wastes (including contaminated soils).

The classification of waste as either hazardous or non-hazardous must be conducted in accordance with the 2003 Environment Agency publication Interpretation of the Definition and Classification of Hazardous Waste (Technical Guidance WM2). This establishes the regulatory framework and allows classification of wastes based on their various risk phrases. Additional guidance provided by the 2007 Environment Agency publication 'How to Find Out if Waste Oil and Wastes that Contain Oil Are Hazardous' (HWR08) provides further clarification on the classification methodology for hydrocarbon contamination.

As part of the Hazardous Waste Classification process, contaminant compounds are selected based on historical and contemporary land-use. The inclusion of such data on the input form enables the correct waste classification to be determined. For example, in cases of land associated with former gasworks, the classification of coal-tar contaminated soils can be partially determined using total PAH concentrations as opposed to TPH concentrations as coal-tar may be deemed a "substance". Hazardous (HWR08) provides further clarification on the classification methodology for hydrocarbon contamination.

Waste Classification Report



ZXNNK-7EUFF-CB7MA

Job name

Land adjacent to Orchard Business Park

Description/Comments

Project

16612 Land adjacent to Orchard Business Park

Site

Waste Stream Template

Soils Suite 2 Aug 17

Classified by

Name:

James Hucklesby

Date:

11/28/2017 10:07:18 AM UTC

Telephone:

Company:

Soils Ltd
Thomas Telford House
Sun Valley Business Park, Winnall Close
Winchester
SO23 0LB

Report

Created by: James Hucklesby

Created date: 11/28/2017 10:07 UTC

Job summary

#	Sample Name	Depth [m]	Classification Result	Hazard properties	Page
1	WS1	0.20	Non Hazardous		2
2	WS1[1]	0.60	Non Hazardous		5
3	WS2	0.40	Non Hazardous		7
4	WS3	0.20	Non Hazardous		9
5	WS4	0.50	Non Hazardous		11

Appendices

	Page
Appendix A: Classifier defined and non CLP determinands	14
Appendix B: Rationale for selection of metal species	15
Appendix C: Version	16

Classification of sample: WS1

 **Non Hazardous Waste**
 Classified as 17 05 04
 in the List of Waste

Sample details

Sample Name:	LoW Code:	
WS1	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
0.20 m		
Moisture content:		
18.2%		
(dry weight correction)		

Hazard properties

None identified

Determinands

Moisture content: 18.2% Dry Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
1	∞	pH			6.5	pH		6.5	pH	6.5 pH		
2	☠	cyanides { ∞ salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }			<2	mg/kg	1.884	<3.768	mg/kg	<0.000377 %		<LOD
		008-007-00-5										
3	☠	antimony { antimony trioxide }			<1	mg/kg	1.197	<1.197	mg/kg	<0.00012 %		<LOD
		051-005-00-X	215-175-0	1309-64-4								
4	☠	arsenic { arsenic trioxide }			8	mg/kg	1.32	8.936	mg/kg	0.000894 %	✓	
		033-003-00-0	215-431-4	1327-53-3								
5	☠	beryllium { beryllium oxide }			0.5	mg/kg	2.775	1.174	mg/kg	0.000117 %	✓	
		004-003-00-8	215-133-1	1304-56-9								
6	☠	boron { diboron trioxide; boric oxide }			<1	mg/kg	3.22	<3.22	mg/kg	<0.000322 %		<LOD
		005-003-00-8	215-125-8	1303-86-2								
7	☠	cadmium { cadmium oxide }			<0.2	mg/kg	1.142	<0.228	mg/kg	<0.0000228 %		<LOD
		043-002-00-0	215-146-2	1306-19-0								
8	☠	chromium in chromium(III) compounds { ∞ chromium(III) oxide }			18	mg/kg	1.462	22.257	mg/kg	0.00223 %	✓	
			215-160-9	1308-38-9								
9	☠	chromium in chromium(VI) compounds { chromium(VI) oxide }			<2	mg/kg	1.923	<3.846	mg/kg	<0.000385 %		<LOD
		024-001-00-0	215-607-8	1333-82-0								
10	☠	copper { ∞ dicopper oxide; copper (I) oxide }			14	mg/kg	1.126	13.335	mg/kg	0.00133 %	✓	
		029-002-00-X	215-270-7	1317-39-1								
11	☠	lead { lead chromate }		1	49	mg/kg	1.56	64.662	mg/kg	0.00415 %	✓	
		082-004-00-2	231-846-0	7758-97-6								
12	☠	mercury { mercury dichloride }			<1	mg/kg	1.353	<1.353	mg/kg	<0.000135 %		<LOD
		080-010-00-X	231-299-8	7487-94-7								
13	☠	nickel { nickel chromate }			12	mg/kg	2.976	30.216	mg/kg	0.00302 %	✓	
		028-035-00-7	238-766-5	14721-18-7								

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
14	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<3	mg/kg	2.554	<7.661	mg/kg	<0.000766 %		<LOD
	004-002-00-8											
15	vanadium { divanadium pentaoxide; vanadium pentoxide }				28	mg/kg	1.785	42.289	mg/kg	0.00423 %	✓	
	023-001-00-8	215-239-8	1314-82-1									
16	zinc { zinc chromate }				52	mg/kg	2.774	122.044	mg/kg	0.0122 %	✓	
	024-007-00-3											
17	naphthalene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-052-00-2	202-049-5	81-20-3									
18	acenaphthylene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-917-1	208-98-8									
19	acenaphthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-469-6	83-32-9									
20	fluorene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-695-5	86-73-7									
21	phenanthrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-581-5	85-01-8									
22	anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		204-371-1	120-12-7									
23	fluoranthene				0.18	mg/kg		0.152	mg/kg	0.0000152 %	✓	
		205-912-4	208-44-0									
24	pyrene				0.16	mg/kg		0.135	mg/kg	0.0000135 %	✓	
		204-927-3	129-00-0									
25	benzo[a]anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-033-00-9	200-260-6	56-55-3									
26	chrysene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-048-00-0	205-923-4	218-01-9									
27	benzo[b]fluoranthene				0.13	mg/kg		0.11	mg/kg	0.000011 %	✓	
	001-054-00-4	205-911-9	205-98-2									
28	benzo[k]fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-036-00-5	205-916-6	207-08-9									
29	benzo[a]pyrene; benzo[def]chrysene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-032-00-3	200-028-5	50-32-8									
30	indeno[123-cd]pyrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-893-2	193-39-5									
31	dibenz[a,h]anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-041-00-2	200-181-8	53-70-3									
32	benzo[ghi]perylene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-883-8	181-24-2									
33	phenol				<1.6	mg/kg		<1.6	mg/kg	<0.00016 %		<LOD
	004-001-00-2	203-632-7	108-95-2									
34	TPH (C6 to C40) petroleum group				<30	mg/kg		<30	mg/kg	<0.003 %		<LOD
			TPH									
35	benzene				<2	mg/kg		<2	mg/kg	<0.0002 %		<LOD
	001-020-00-8	200-753-7	71-43-2									
36	toluene				<5	mg/kg		<5	mg/kg	<0.0005 %		<LOD
	001-021-00-3	200-625-9	108-88-3									
37	ethylbenzene				<2	mg/kg		<2	mg/kg	<0.0002 %		<LOD
	001-023-00-4	202-849-4	100-41-4									
38	xylene				<2	mg/kg		<2	mg/kg	<0.0002 %		<LOD
	001-022-00-9	202-422-2 [1] 203-398-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 106-38-3 [3] 1330-20-7 [4]									
39	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane				<5	mg/kg		<5	mg/kg	<0.0005 %		<LOD
	003-181-00-X	215-653-1	1634-04-4									
Total:										0.0352 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: WS1[1]

 **Non Hazardous Waste**
Classified as 17 05 04
in the List of Waste

Sample details

Sample Name:	LoW Code:	
WS1[1]	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
0.60 m		
Moisture content:		
17.3%		
(dry weight correction)		

Hazard properties

None identified

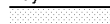
Determinands

Moisture content: 17.3% Dry Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
1	pH				6.8	pH		6.8	pH	6.8 pH		
2	cyanides { * salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<2	mg/kg	1.884	<3.768	mg/kg	<0.000377 %		<LOD
	006-007-00-5											
3	antimony { antimony trioxide }				<1	mg/kg	1.197	<1.197	mg/kg	<0.00012 %		<LOD
	051-005-00-X	215-175-0	1309-84-4									
4	arsenic { arsenic trioxide }				8	mg/kg	1.32	9.005	mg/kg	0.0009 %	✓	
	003-003-00-0	215-461-4	1327-53-3									
5	beryllium { beryllium oxide }				0.6	mg/kg	2.775	1.42	mg/kg	0.000142 %	✓	
	004-003-00-8	215-133-1	1304-56-9									
6	boron { diboron trioxide; boric oxide }				<1	mg/kg	3.22	<3.22	mg/kg	<0.000322 %		<LOD
	005-006-00-8	215-125-8	1303-36-2									
7	cadmium { cadmium oxide }				<0.2	mg/kg	1.142	<0.228	mg/kg	<0.0000228 %		<LOD
	048-002-00-0	215-146-2	1306-19-0									
8	chromium in chromium(III) compounds { * chromium(III) oxide }				21	mg/kg	1.462	26.166	mg/kg	0.00262 %	✓	
		215-160-9	1308-38-9									
9	chromium in chromium(VI) compounds { chromium(VI) oxide }				<2	mg/kg	1.923	<3.846	mg/kg	<0.000385 %		<LOD
	024-001-00-0	215-607-8	1333-82-0									
10	copper { * dicopper oxide; copper (I) oxide }				11	mg/kg	1.126	10.558	mg/kg	0.00106 %	✓	
	029-002-00-X	215-270-7	1317-39-1									
11	lead { lead chromate }			1	19	mg/kg	1.56	25.266	mg/kg	0.00162 %	✓	
	062-004-00-2	231-846-0	7758-97-8									
12	mercury { mercury dichloride }				<1	mg/kg	1.353	<1.353	mg/kg	<0.000135 %		<LOD
	060-010-00-X	231-299-8	7487-94-7									
13	nickel { nickel chromate }				14	mg/kg	2.976	35.522	mg/kg	0.00355 %	✓	
	028-035-00-7	233-766-5	14721-18-7									

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	M/C Applied	Conc. Not Used
	CLP Index number	EC Number	CAS Number									
14	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<3	mg/kg	2.554	<7.661	mg/kg	<0.000766 %		<LOD
	034-002-00-8											
15	vanadium { divanadium pentaoxide; vanadium pentoxide }				30	mg/kg	1.785	45.657	mg/kg	0.00457 %	✓	
	023-001-00-8	215-239-8	1314-62-1									
16	zinc { zinc chromate }				49	mg/kg	2.774	115.885	mg/kg	0.0116 %	✓	
	024-007-00-3											
17	naphthalene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-052-00-2	202-049-5	91-20-3									
18	acenaphthylene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-917-1	208-96-8									
19	acenaphthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-489-6	83-32-9									
20	fluorene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-695-5	96-73-7									
21	phenanthrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-581-5	85-01-8									
22	anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		204-371-1	120-12-7									
23	fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-912-4	206-44-0									
24	pyrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		204-927-3	129-00-0									
25	benzo[a]anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-033-00-9	200-230-6	56-55-3									
26	chrysene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-043-00-0	205-920-4	218-01-9									
27	benzo[b]fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-054-00-4	205-911-9	205-99-2									
28	benzo[k]fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-036-00-5	205-916-6	207-06-9									
29	benzo[a]pyrene; benzo[def]chrysene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-032-00-3	200-026-5	50-32-8									
30	indeno[123-cd]pyrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-893-2	193-39-5									
31	dibenz[a,h]anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-041-00-2	200-181-8	53-70-3									
32	benzo[ghi]perylene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-883-8	191-24-2									
33	phenol				<1.6	mg/kg		<1.6	mg/kg	<0.00016 %		<LOD
	004-001-00-2	203-632-7	108-95-2									
Total:										0.0285 %		

Key

-  User supplied data
-  Determinand values ignored for classification, see column 'Conc. Not Used' for reason
-  Determinand defined or amended by HazWasteOnline (see Appendix A)
-  Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD** Below limit of detection
- CLP: Note 1 Only the metal concentration has been used for classification

Classification of sample: WS2

 **Non Hazardous Waste**
Classified as 17 05 04
in the List of Waste

Sample details

Sample Name:	LoW Code:	
WS2	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
0.40 m		
Moisture content:		
16.1%		
(dry weight correction)		

Hazard properties

None identified

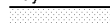
Determinands

Moisture content: 16.1% Dry Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
1	pH				6.8	pH		6.8	pH	6.8 pH		
2	cyanides { * salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<2	mg/kg	1.884	<3.768	mg/kg	<0.000377 %		<LOD
	006-007-00-5											
3	antimony { antimony trioxide }				<1	mg/kg	1.197	<1.197	mg/kg	<0.00012 %		<LOD
	051-005-00-X	215-175-0	1309-34-4									
4	arsenic { arsenic trioxide }				9	mg/kg	1.32	10.235	mg/kg	0.00102 %	✓	
	003-003-00-0	215-461-4	1327-53-3									
5	beryllium { beryllium oxide }				0.6	mg/kg	2.775	1.434	mg/kg	0.000143 %	✓	
	004-003-00-8	215-133-1	1304-56-9									
6	boron { diboron trioxide; boric oxide }				<1	mg/kg	3.22	<3.22	mg/kg	<0.000322 %		<LOD
	005-006-00-8	215-125-8	1303-36-2									
7	cadmium { cadmium oxide }				<0.2	mg/kg	1.142	<0.228	mg/kg	<0.0000228 %		<LOD
	048-002-00-0	215-146-2	1306-19-0									
8	chromium in chromium(III) compounds { * chromium(III) oxide }				23	mg/kg	1.462	28.954	mg/kg	0.0029 %	✓	
		215-160-9	1308-38-9									
9	chromium in chromium(VI) compounds { chromium(VI) oxide }				<2	mg/kg	1.923	<3.846	mg/kg	<0.000385 %		<LOD
	024-001-00-0	215-607-8	1333-82-0									
10	copper { * dicopper oxide; copper (I) oxide }				12	mg/kg	1.126	11.637	mg/kg	0.00116 %	✓	
	029-002-00-X	215-270-7	1317-39-1									
11	lead { lead chromate }			1	16	mg/kg	1.56	21.496	mg/kg	0.00138 %	✓	
	062-004-00-2	231-846-0	7758-97-8									
12	mercury { mercury dichloride }				<1	mg/kg	1.353	<1.353	mg/kg	<0.000135 %		<LOD
	060-010-00-X	231-299-8	7487-94-7									
13	nickel { nickel chromate }				16	mg/kg	2.976	41.017	mg/kg	0.0041 %	✓	
	028-035-00-7	233-766-5	14721-18-7									

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP Index number	EC Number	CAS Number									
14	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<3	mg/kg	2.554	<7.661	mg/kg	<0.000766 %		<LOD
	034-002-00-8											
15	vanadium { divanadium pentaoxide; vanadium pentoxide }				32	mg/kg	1.785	49.204	mg/kg	0.00492 %	✓	
	023-001-00-8	215-239-8	1314-62-1									
16	zinc { zinc chromate }				50	mg/kg	2.774	119.472	mg/kg	0.0119 %	✓	
	024-007-00-3											
17	naphthalene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-052-00-2	202-049-5	91-20-3									
18	acenaphthylene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-917-1	208-96-8									
19	acenaphthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-489-6	83-32-9									
20	fluorene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-695-5	86-73-7									
21	phenanthrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-581-5	85-01-8									
22	anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		204-371-1	120-12-7									
23	fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-912-4	206-44-0									
24	pyrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		204-927-3	129-00-0									
25	benzo[a]anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-033-00-9	200-230-6	56-55-3									
26	chrysene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-043-00-0	205-920-4	218-01-9									
27	benzo[b]fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-054-00-4	205-911-9	205-99-2									
28	benzo[k]fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-036-00-5	205-916-6	207-06-9									
29	benzo[a]pyrene; benzo[def]chrysene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-032-00-3	200-026-5	50-32-8									
30	indeno[123-cd]pyrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-893-2	193-39-5									
31	dibenz[a,h]anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-041-00-2	200-181-8	53-70-3									
32	benzo[ghi]perylene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-883-8	191-24-2									
33	phenol				<1.6	mg/kg		<1.6	mg/kg	<0.00016 %		<LOD
	004-001-00-2	203-632-7	108-95-2									
Total:										0.03 %		

Key

-  User supplied data
-  Determinand values ignored for classification, see column 'Conc. Not Used' for reason
-  Determinand defined or amended by HazWasteOnline (see Appendix A)
-  Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD** Below limit of detection
- CLP: Note 1 Only the metal concentration has been used for classification

Classification of sample: WS3

 **Non Hazardous Waste**
Classified as 17 05 04
in the List of Waste

Sample details

Sample Name:	LoW Code:	
WS3	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
0.20 m		
Moisture content:		
17.5%		
(dry weight correction)		

Hazard properties

None identified

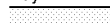
Determinands

Moisture content: 17.5% Dry Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
1	☐ pH		PH		7.1 pH		7.1 pH	7.1 pH		
2	☒ cyanides { * salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<2 mg/kg	1.884	<3.768 mg/kg	<0.000377 %		<LOD
	006-007-00-5									
3	☒ antimony { antimony trioxide }				1.9 mg/kg	1.197	1.936 mg/kg	0.000194 %	✓	
	051-005-00-X	215-175-0	1309-84-4							
4	☒ arsenic { arsenic trioxide }				8 mg/kg	1.32	8.989 mg/kg	0.000899 %	✓	
	003-003-00-0	215-461-4	1327-53-3							
5	☒ beryllium { beryllium oxide }				0.5 mg/kg	2.775	1.181 mg/kg	0.000118 %	✓	
	004-003-00-8	215-133-1	1304-56-9							
6	☒ boron { diboron trioxide; boric oxide }				<1 mg/kg	3.22	<3.22 mg/kg	<0.000322 %		<LOD
	005-006-00-8	215-125-8	1303-36-2							
7	☒ cadmium { cadmium oxide }				0.2 mg/kg	1.142	0.194 mg/kg	0.0000194 %	✓	
	048-002-00-0	215-146-2	1306-19-0							
8	☒ chromium in chromium(III) compounds { * chromium(III) oxide }				19 mg/kg	1.462	23.634 mg/kg	0.00236 %	✓	
		215-160-9	1308-38-9							
9	☒ chromium in chromium(VI) compounds { chromium(VI) oxide }				<2 mg/kg	1.923	<3.846 mg/kg	<0.000385 %		<LOD
	024-001-00-0	215-607-8	1333-82-0							
10	☒ copper { * dicopper oxide; copper (I) oxide }				18 mg/kg	1.126	17.248 mg/kg	0.00172 %	✓	
	029-002-00-X	215-270-7	1317-39-1							
11	☒ lead { lead chromate }			1	522 mg/kg	1.56	692.956 mg/kg	0.0444 %	✓	
	062-004-00-2	231-846-0	7758-97-8							
12	☒ mercury { mercury dichloride }				<1 mg/kg	1.353	<1.353 mg/kg	<0.000135 %		<LOD
	060-010-00-X	231-299-8	7487-94-7							
13	☒ nickel { nickel chromate }				13 mg/kg	2.976	32.929 mg/kg	0.00329 %	✓	
	028-035-00-7	233-766-5	14721-18-7							

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	M/C Applied	Conc. Not Used
	CLP Index number	EC Number	CAS Number									
14	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<3	mg/kg	2.554	<7.661	mg/kg	<0.000766 %		<LOD
	034-002-00-8											
15	vanadium { divanadium pentaoxide; vanadium pentoxide }				28	mg/kg	1.785	42.541	mg/kg	0.00425 %	✓	
	023-001-00-8	215-239-8	1314-62-1									
16	zinc { zinc chromate }				152	mg/kg	2.774	358.868	mg/kg	0.0359 %	✓	
	024-007-00-3											
17	naphthalene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-052-00-2	202-049-5	91-20-3									
18	acenaphthylene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-917-1	208-96-8									
19	acenaphthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-489-6	83-32-9									
20	fluorene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-695-5	86-73-7									
21	phenanthrene				0.64	mg/kg		0.545	mg/kg	0.0000545 %	✓	
		201-581-5	85-01-8									
22	anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		204-371-1	120-12-7									
23	fluoranthene				1.41	mg/kg		1.2	mg/kg	0.00012 %	✓	
		205-912-4	206-44-0									
24	pyrene				1.14	mg/kg		0.97	mg/kg	0.000097 %	✓	
		204-927-3	129-00-0									
25	benzo[a]anthracene				0.61	mg/kg		0.519	mg/kg	0.0000519 %	✓	
	001-033-00-9	200-230-6	56-55-3									
26	chrysene				0.75	mg/kg		0.638	mg/kg	0.0000638 %	✓	
	001-043-00-0	205-920-4	218-01-9									
27	benzo[b]fluoranthene				0.91	mg/kg		0.774	mg/kg	0.0000774 %	✓	
	001-034-00-4	205-911-9	205-99-2									
28	benzo[k]fluoranthene				0.39	mg/kg		0.332	mg/kg	0.0000332 %	✓	
	001-036-00-5	205-916-6	207-06-9									
29	benzo[a]pyrene; benzo[def]chrysene				0.65	mg/kg		0.553	mg/kg	0.0000553 %	✓	
	001-032-00-3	200-028-5	50-32-8									
30	indeno[123-cd]pyrene				0.3	mg/kg		0.255	mg/kg	0.0000255 %	✓	
		205-893-2	193-39-5									
31	dibenz[a,h]anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-041-00-2	200-181-8	53-70-3									
32	benzo[ghi]perylene				0.32	mg/kg		0.272	mg/kg	0.0000272 %	✓	
		205-883-8	191-24-2									
33	phenol				7.1	mg/kg		6.043	mg/kg	0.000604 %	✓	
	004-001-00-2	203-632-7	108-95-2									
Total:										0.0964 %		

Key

-  User supplied data
-  Determinand values ignored for classification, see column 'Conc. Not Used' for reason
-  Determinand defined or amended by HazWasteOnline (see Appendix A)
-  Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD** Below limit of detection
- CLP: Note 1 Only the metal concentration has been used for classification

Classification of sample: WS4

 **Non Hazardous Waste**
Classified as 17 05 04
in the List of Waste

Sample details

Sample Name:	LoW Code:	
WS4	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
0.50 m		
Moisture content:		
16.6%		
(dry weight correction)		

Hazard properties

None identified

Determinands

Moisture content: 16.6% Dry Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
1	☐ pH		PH4		7.5 pH		7.5 pH	7.5 pH		
2	☒ cyanides { * salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<2 mg/kg	1.884	<3.768 mg/kg	<0.000377 %		<LOD
	006-007-00-5									
3	☒ antimony { antimony trioxide }				<1 mg/kg	1.197	<1.197 mg/kg	<0.00012 %		<LOD
	051-005-00-X	215-175-0	1309-84-4							
4	☒ arsenic { arsenic trioxide }				7 mg/kg	1.32	7.926 mg/kg	0.000793 %	✓	
	003-003-00-0	215-461-4	1327-53-3							
5	☒ beryllium { beryllium oxide }				<0.5 mg/kg	2.775	<1.388 mg/kg	<0.000139 %		<LOD
	004-003-00-8	215-133-1	1304-56-9							
6	☒ boron { diboron trioxide; boric oxide }				<1 mg/kg	3.22	<3.22 mg/kg	<0.000322 %		<LOD
	005-006-00-8	215-125-8	1303-86-2							
7	☒ cadmium { cadmium oxide }				<0.2 mg/kg	1.142	<0.228 mg/kg	<0.0000228 %		<LOD
	048-002-00-0	215-146-2	1306-19-0							
8	☒ chromium in chromium(III) compounds { * chromium(III) oxide }				19 mg/kg	1.462	23.816 mg/kg	0.00238 %	✓	
		215-160-9	1308-38-9							
9	☒ chromium in chromium(VI) compounds { chromium(VI) oxide }				<2 mg/kg	1.923	<3.846 mg/kg	<0.000385 %		<LOD
	024-001-00-0	215-607-8	1333-82-0							
10	☒ copper { * dicopper oxide; copper (I) oxide }				10 mg/kg	1.126	9.656 mg/kg	0.000966 %	✓	
	029-002-00-X	215-270-7	1317-39-1							
11	☒ lead { lead chromate }			1	55 mg/kg	1.56	73.576 mg/kg	0.00472 %	✓	
	062-004-00-2	231-846-0	7758-97-8							
12	☒ mercury { mercury dichloride }				<1 mg/kg	1.353	<1.353 mg/kg	<0.000135 %		<LOD
	060-010-00-X	231-299-8	7487-94-7							
13	☒ nickel { nickel chromate }				13 mg/kg	2.976	33.183 mg/kg	0.00332 %	✓	
	028-035-00-7	233-766-5	14721-18-7							

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	M/C Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
14	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<3	mg/kg	2.554	<7.661	mg/kg	<0.000766 %		<LOD
	034-002-00-8											
15	vanadium { divanadium pentaoxide; vanadium pentoxide }				27	mg/kg	1.785	41.338	mg/kg	0.00413 %	✓	
	023-001-00-8	215-239-8	1314-62-1									
16	zinc { zinc chromate }				52	mg/kg	2.774	123.718	mg/kg	0.0124 %	✓	
	024-007-00-3											
17	naphthalene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-052-00-2	202-049-5	91-20-3									
18	acenaphthylene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-917-1	208-96-8									
19	acenaphthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-489-6	83-32-9									
20	fluorene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-695-5	96-73-7									
21	phenanthrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-581-5	85-01-8									
22	anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		204-371-1	120-12-7									
23	fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-912-4	206-44-0									
24	pyrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		204-927-3	129-00-0									
25	benzo[a]anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-033-00-9	200-230-6	56-55-3									
26	chrysene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-043-00-0	205-920-4	218-01-9									
27	benzo[b]fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-034-00-4	205-911-9	205-99-2									
28	benzo[k]fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-036-00-5	205-916-6	207-06-9									
29	benzo[a]pyrene; benzo[def]chrysene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-032-00-3	200-026-5	50-32-8									
30	indeno[123-cd]pyrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-893-2	193-39-5									
31	dibenz[a,h]anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-041-00-2	200-181-8	53-70-3									
32	benzo[ghi]perylene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-883-8	191-24-2									
33	phenol				<1.6	mg/kg		<1.6	mg/kg	<0.00016 %		<LOD
	004-001-00-2	203-632-7	108-95-2									
34	TPH (C6 to C40) petroleum group				<30	mg/kg		<30	mg/kg	<0.003 %		<LOD
			TPH									
35	benzene				<2	mg/kg		<2	mg/kg	<0.0002 %		<LOD
	001-020-00-8	200-753-7	71-43-2									
36	toluene				<5	mg/kg		<5	mg/kg	<0.0005 %		<LOD
	001-021-00-3	203-625-9	106-86-3									
37	ethylbenzene				<2	mg/kg		<2	mg/kg	<0.0002 %		<LOD
	001-023-00-4	202-849-4	100-41-4									
38	xylene				<2	mg/kg		<2	mg/kg	<0.0002 %		<LOD
	001-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 109-39-3 [3] 1330-20-7 [4]									
39	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane				<5	mg/kg		<5	mg/kg	<0.0005 %		<LOD
	003-181-00-X	216-653-1	1534-04-4									
Total:										0.0359 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Appendix A: Classifier defined and non CLP determinands

* pH (CAS Number: PH)

Description/Comments: Appendix C4
Data source: WM3 1st Edition 2015
Data source date: 5/25/2015
Risk Phrases: None.
Hazard Statements: None.

* salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex

CLP index number: 006-007-00-5
Data source: Commission Regulation (EC) No 790/2009 - 1st Adaptation to Technical Progress for Regulation (EC) No 1272/2008. (ATP1)
Additional Risk Phrases: None.
Additional Hazard Statement(s): EUH032 >= 0.2 %
Reason for additional Hazards Statement(s)/Risk Phrase(s):
12/14/2015 - EUH032 >= 0.2 % hazard statement sourced from: WM3, Table C12.2

* chromium(III) oxide (EC Number: 215-160-9, CAS Number: 1308-38-9)

Conversion factor: 1.462
Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 7/17/2015
Risk Phrases: R61 , R60 , R50/53 , R43 , R42 , R38 , R37 , R36 , R22 , R20
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Repr. 1B H360FD , Skin Sens. 1 H317 , Resp. Sens. 1 H334 , Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Acute Tox. 4 H302 , Acute Tox. 4 H332

* dicopper oxide; copper (I) oxide (EC Number: 215-270-7, CAS Number: 1317-39-1)

CLP index number: 029-002-00-X
Data source: Regulation (EU) 2016/1179 of 19 July 2016 (ATP9)
Additional Risk Phrases: N R50/53 >= 0.25 % , N R50/53
Additional Hazard Statement(s): None.
Reason for additional Hazards Statement(s)/Risk Phrase(s):
10/10/2016 - N R50/53 >= 0.25 % risk phrase sourced from: WM3 v1 still uses ecotoxic risk phrases
10/10/2016 - N R50/53 risk phrase sourced from: WM3 v1 still uses ecotoxic risk phrases

* acenaphthylene (EC Number: 205-917-1, CAS Number: 208-96-8)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 7/17/2015
Risk Phrases: R38 , R37 , R36 , R27 , R26 , R22
Hazard Statements: Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Acute Tox. 1 H310 , Acute Tox. 1 H330 , Acute Tox. 4 H302

* acenaphthene (EC Number: 201-469-6, CAS Number: 83-32-9)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 7/17/2015
Risk Phrases: N R51/53 , N R50/53 , R38 , R37 , R36
Hazard Statements: Aquatic Chronic 2 H411 , Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319

* fluorene (EC Number: 201-695-5, CAS Number: 86-73-7)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 8/6/2015
Risk Phrases: N R50/53
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400

* phenanthrene (EC Number: 201-581-5, CAS Number: 85-01-8)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 8/6/2015
Risk Phrases: N R50/53 , R43 , R40 , R38 , R37 , R36 , R22
Hazard Statements: Skin Irrit. 2 H315 , Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Skin Sens. 1 H317 , Carc. 2 H351 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Acute Tox. 4 H302

* **anthracene** (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 7/17/2015

Risk Phrases: N R50/53 , R43 , R38 , R37 , R36

Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Skin Sens. 1 H317 , Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319

* **fluoranthene** (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 8/21/2015

Risk Phrases: N R50/53 , Xn R22

Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Acute Tox. 4 H302

* **pyrene** (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 8/21/2015

Risk Phrases: N R50/53 , Xi R36/37/38

Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Skin Irrit. 2 H315

* **indeno[123-cd]pyrene** (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 8/6/2015

Risk Phrases: R40

Hazard Statements: Carc. 2 H351

* **benzo[ghi]perylene** (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 7/23/2015

Risk Phrases: N R50/53

Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400

* **TPH (C6 to C40) petroleum group** (CAS Number: TPH)

Description/Comments: Hazard statements taken from WM3 1st Edition 2015; Risk phrases: WM2 3rd Edition 2013

Data source: WM3 1st Edition 2015

Data source date: 5/25/2015

Risk Phrases: R65 , R63 , R51/53 , R46 , R45 , R10

Hazard Statements: Aquatic Chronic 2 H411 , Repr. 2 H361d , Carc. 1B H350 , Muta. 1B H340 , STOT RE 2 H373 , Asp. Tox. 1 H304 , Flam. Liq. 3 H226

* **ethylbenzene** (EC Number: 202-849-4, CAS Number: 100-41-4)

CLP index number: 601-023-00-4

Data source: Commission Regulation (EU) No 605/2014 – 6th Adaptation to Technical Progress for Regulation (EC) No 1272/2008. (ATP6)

Additional Risk Phrases: None.

Additional Hazard Statement(s): Carc. 2 H351

Reason for additional Hazards Statement(s)/Risk Phrase(s):

6/3/2015 - Carc. 2 H351 hazard statement sourced from: IARC Group 2B (77) 2000

Appendix B: Rationale for selection of metal species

cyanides {salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex}

Harmonised group entry used as most reasonable case as complex cyanides and those specified elsewhere in the annex are not likely to be present in this soil: [Note conversion factor based on a worst case compound: sodium cyanide]

antimony {antimony trioxide}

Worst case CLP species based on hazard statements/molecular weight and low solubility. Industrial sources include: flame retardants in electrical apparatus, textiles and coatings

arsenic {arsenic trioxide}

Reasonable case CLP species based on hazard statements/molecular weight and most common (stable) oxide of arsenic. Industrial sources include: smelting; main precursor to other arsenic compounds

beryllium {beryllium oxide}

Reasonable case CLP species based on hazard statements/molecular weight. Industrial sources include: most common (non alloy) form, used in ceramics

boron {diboron trioxide; boric oxide}

Reasonable case CLP species based on hazard statements/ molecular weight, physical form and low solubility. Industrial sources include: fluxing agent for glass/enamels; additive for fibre optics, borosilicate glass

cadmium {cadmium oxide}

Reasonable case CLP species based on hazard statements/molecular weight, very low solubility in water. Industrial sources include: electroplating baths, electrodes for storage batteries, catalysts, ceramic glazes, phosphors, pigments and nematocides.

chromium in chromium(III) compounds {chromium(III) oxide}

Reasonable case species based on hazard statements/molecular weight. Industrial sources include: tanning, pigment in paint, inks and glass

chromium in chromium(VI) compounds {chromium(VI) oxide}

Worst case CLP species based on hazard statements/molecular weight. Industrial sources include: production stainless steel, electroplating, wood preservation, anti-corrosion agents or coatings, pigments

copper {dicopper oxide; copper (I) oxide}

Reasonable case CLP species based on hazard statements/molecular weight and insolubility in water. Industrial sources include: oxidised copper metal, brake pads, pigments, antifouling paints, fungicide.

lead {lead chromate}

Worst case CLP species based on hazard statements/molecular weight

mercury {mercury dichloride}

Worst case CLP species based on hazard statements/molecular weight

nickel {nickel chromate}

Worst case CLP species based on hazard statements/molecular weight

selenium {selenium compounds with the exception of cadmium selenosulfide and those specified elsewhere in this Annex}

Harmonised group entry used as most reasonable case. Pigment cadmium selenosulfide not likely to be present in this soil. No evidence for the other CLP entries: sodium selenite, nickel II selenite and nickel selenide, to be present in this soil. (edit as required)

vanadium {divanadium pentaoxide; vanadium pentoxide}

Worst case

zinc {zinc chromate}

Worst case CLP species based on hazard statements/molecular weight

Appendix C: Version

HazWasteOnline Classification Engine: WM3 1st Edition, May 2015
HazWasteOnline Classification Engine Version: 2017.320.3428.6948 (16 Nov 2017)
HazWasteOnline Database: 2017.331.3444.7000 (28 Nov 2017)

This classification utilises the following guidance and legislation:

WM3 - Waste Classification - May 2015

CLP Regulation - Regulation 1272/2008/EC of 16 December 2008

1st ATP - Regulation 790/2009/EC of 10 August 2009

2nd ATP - Regulation 286/2011/EC of 10 March 2011

3rd ATP - Regulation 618/2012/EU of 10 July 2012

4th ATP - Regulation 487/2013/EU of 8 May 2013

Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013

5th ATP - Regulation 944/2013/EU of 2 October 2013

6th ATP - Regulation 605/2014/EU of 5 June 2014

WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014

Revised List of Wastes 2014 - Decision 2014/955/EU of 18 December 2014

7th ATP - Regulation 2015/1221/EU of 24 July 2015

8th ATP - Regulation (EU) 2016/918 of 19 May 2016

9th ATP - Regulation (EU) 2016/1179 of 19 July 2016

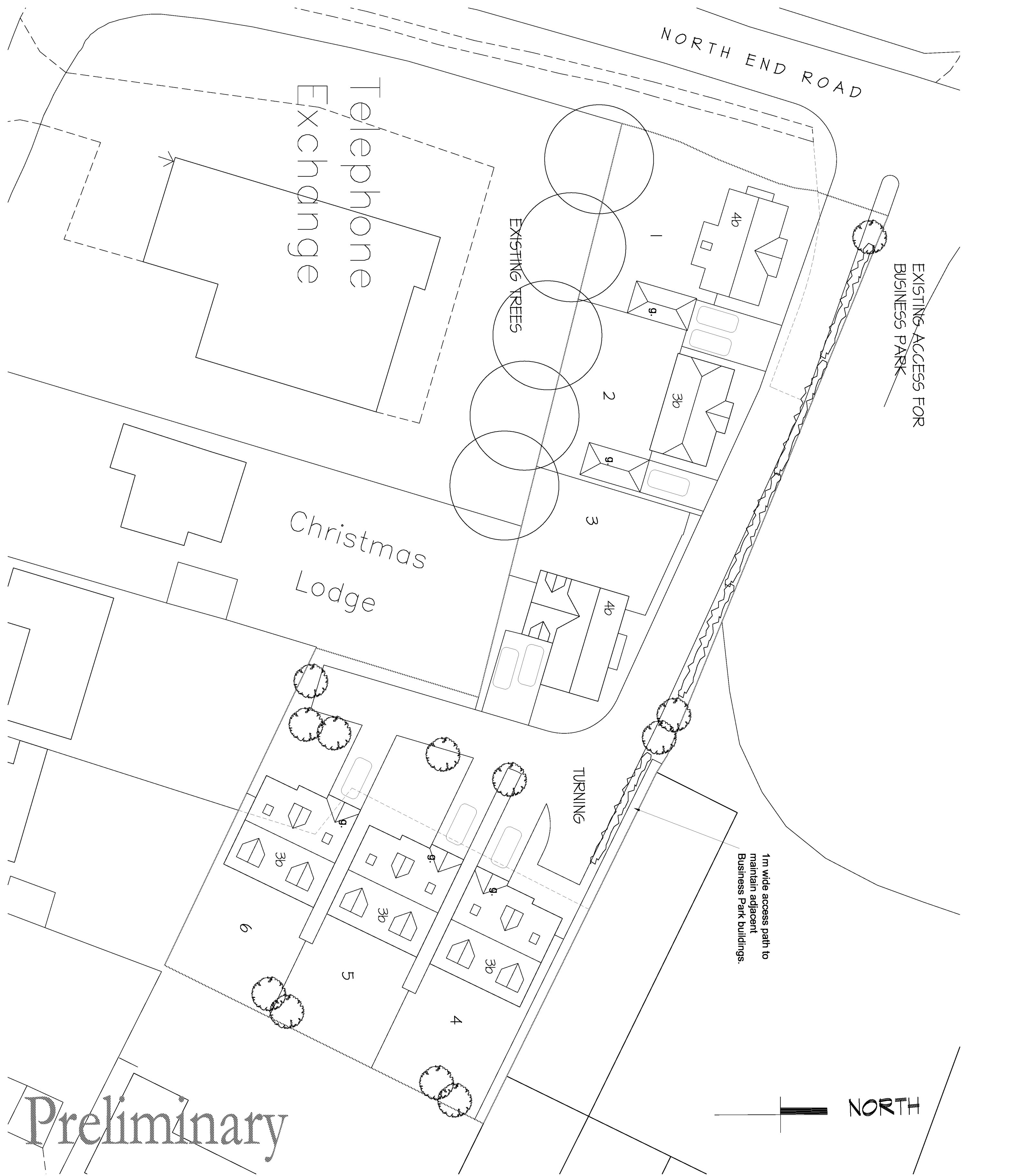
10th ATP - Regulation (EU) 2017/776 of 4 May 2017

POPs Regulation 2004 - Regulation 850/2004/EC of 29 April 2004

1st ATP to POPs Regulation - Regulation 756/2010/EU of 24 August 2010

2nd ATP to POPs Regulation - Regulation 757/2010/EU of 24 August 2010

Appendix D Information Provided by the Client



SCHEDULE OF UNITS - 1 TOTAL

- Plot 1, 4 bedroom detached unit @ 120 sqm.
Plot 2, - 3 bedroom detached units @ 100 sqm.
Plot 3 - 4 bedroom houses @ 134 sqm.
Plots 4, 5 & 6 - 3 bedroom detached chalets @ 130.5 sqm.



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client
CRAYFERN HOMES

project
RESIDENTIAL DEVELOPMENT
LAND ADJACENT ORCHARD BUSINESS PARK
NORTH END ROAD
YAPTON, BN18 0GA

drawing

SITE PLAN

scale	date	job no.	dwg no.	rev.
1:250 @A2	SEPT. 17	SK4	-	P

Soils Limited
Geotechnical & Environmental Consultants

**Newton House
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