



GROUND INVESTIGATION REPORT

for the site at

157 MILTON ROAD, COWPLAIN, HAMPSHIRE PO8 8RE

on behalf of

SOUTHERN CO-OPERATIVE LTD AND PD SCAMMELL LTD

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1.0 INTRODUCTION

1.1 General

Ground and Water Limited were instructed by Southern Co-operative Ltd and PD Scammell Ltd, on the 9th March 2016, to undertake a Ground Investigation at 157 Milton Road, Cowplain, Hampshire PO8 8RE. The scope of the investigation was detailed within the Ground and Water Limited fee proposal ref: GWQ2800, dated 1st March 2015.

1.2 Aims of the Investigation

The aim of the investigation was understood to be to supply the client and their designers with information regarding the ground conditions underlying the site to assist them in preparing an appropriate scheme for development.

The investigation was to be undertaken to provide parameters for the design of foundations by means of in-situ and laboratory geotechnical testing undertaken on soil samples recovered from trial holes.

Included within the fee proposal was an allowance to undertake chemical laboratory testing on soil samples recovered from the site to enable recommendations for the safe redevelopment of the site and the protection of site workers, end-users and the public from any potential contamination identified, as detailed in the Conceptual Site Model (CSM) within the Ground and Water Limited Desk Study Report (ref. GWPR1606/DS/April 2016). This Ground Investigation Report must be read in conjunction with the Desk Study Report.

The techniques adopted for the investigation were chosen considering the anticipated ground conditions and development proposals on-site, and bearing in mind the nature of the site, limitations to site access and other logistical limitations.

1.3 Conditions and Limitations

This report has been prepared based on the terms, conditions and limitations outlined within Appendix A.

2.0 SITE SETTING

2.1 Site Location

The site comprised an 840m² approximately square shaped plot of land, located to the south of Pyrford Close, to the west of Milton Road and to the south-west of the junction between the two roads. The site was located in south-west Cowplain, north of Waterlooville, Hampshire.

A site location plan can be seen in Figure 1 with the site development area shown in Figure 2. The approximate O.S. National Grid Reference at the centre of the site was SU 68133 10860.

2.2 Site Description

A Site Walkover was undertaken on the 14th April 2016. A description of the site, as noted during the Site Walkover, is tabulated below. An aerial view of the site showing an approximate site boundary, is given within Figure 3.

Site Description Sheet: 157 Milton Road, Cowplain, Hampshire PO8 8RE	
Use of site	At the time of the Site Walkover, April 2016, the eastern portion of the site comprised a paved parking area. The western portion of the site was fenced off and comprised the footprint of the demolished former Co-operative convenience store.
Site topography	Generally flat and level.
Area topography	The site's environs sloped gently down to the south.
Structures on-site	No structures were noted on-site.
Structures off-site and use of surrounding ground	Residential properties of Pyrford Close were present directly west and north of the site. Commercial properties off Milton Parade were located directly south. A public house was noted to the east of Milton Road, opposite the site.
Boundary features	Northern Boundary – Within the western portion of the site the northern boundary comprised ~2m high wooden fencing. The site was open onto Pyrford Close along the eastern portion of the boundary with ~1m high shrubs noted along the centre of the boundary. Southern Boundary – The southern boundary of the site ran adjacent with 155 Milton Road, a two-storey commercial property. The western portion of the boundary comprised ~1.8m high wood panelled fencing. Eastern boundary – The southern portion of the boundary was open on to Milton Road with ~1m high shrubs along the northern portion of the boundary. Western boundary - ~2m high wood panelled fencing.
Site covering	100% hardstanding comprising paving stones within the eastern portion of the site and tiled flooring across the footprint of the former convenience store.
Contamination sources on-site	Dark patches relating to potential oil spills were present within the car park. Anecdotal evidence indicated the site was formerly a petrol filling station.
Contamination sources off-site	None.
Vegetation on-site	Occasional ~1-2m high shrubs were located in the western portion of the site. A ~6m high tree was located in the northern portion of the site. ~1m high shrub hedgerows were present along the northern and eastern boundaries of the site.
Vegetation off-site	~15m high trees were located ~10-20m east of the site. ~5m high shrubs were located directly south-west of the site.
Services	None noted.
Comments	None.

2.3 Proposed Development

At the time of reporting, May 2016, final details of the proposed development were yet to be confirmed, but it was understood to comprise a combination of flats with communal gardens, parking and residential houses with private gardens and off-street parking.

2.4 Geology

The BGS Geological Map (Solid and Drift) for the Fareham area (Sheet No. 316) indicated that the site was underlain by Head Deposits over the London Clay Formation. The underlying Lambeth Group was noted to outcrop close to the northern boundary of the site.

No areas of Worked or Made Ground were noted within close proximity to the site.

Head Deposits

The majority of Head Deposits are clay-dominated, derived from the London Clay. Generally less than 2m thick, they probably accumulated in shallow mudslides of softened brecciated bedrock in the active layer. They consist of soft, ochreous brown silty clay with blue-grey mottling in places and angular, frost-shattered fragments of flint occur sporadically throughout. At the base of these deposits and interbedded in places, there is a bed of pebbly clay, generally less than 0.2m thick, with well-rounded flint pebbles derived from nearby outcrops of 'high level' gravel such as Stanmore Gravel.

London Clay Formation

The London Clay Formation comprises stiff grey fissured clay, weathering to brown near surface. Concretions of argillaceous limestone in nodular form (Claystones) occur throughout the formation. Crystals of Gypsum (Selenite) are often found within the weathered part of the London Clay Formation, and precautions against sulphate attack to concrete are sometimes required. The lowest part of the formation is a sandy bed with black rounded gravel and occasional layers of sandstone and is known as the Basement Bed.

Lambeth Group

The Lambeth Group (formerly known as the Woolwich and Reading Beds) is a sedimentary complex comprising a basal bed (the Upnor Formation also known as the Bottom Bed) composed of glauconitic sand, sandy clay and gravel (well-rounded flint pebbles), with laterally variable sand and clay above. In the eastern part of the area the basal bed is mostly overlain by a shelly grey sandy clay or silty sand and laminated beds (Woolwich Formation). At the top of the sedimentary complex is the Reading Formation, which is made up of multi-coloured mottled clays and silty clays.

Lignite, or brown coal, a carbonaceous rock composed of plant remains which has not been subject to the same intensity of heat and pressure as has ordinary coal, is occasionally found within the Lambeth Group, as are individual logs and groups of logs indicating the position of a former log jam, which was covered by sand and clay at the time of deposition.

A BGS borehole adjacent to the eastern boundary of the site revealed 2.30m of brown sandy clayey angular gravel over a light blue silty clay to 2.70m bgl. A stiff blue grey, red and brown mottled clay was then proved to 6.40m bgl.

2.5 Hydrogeology and Hydrology

The Desk Study revealed the site to be located on a **Secondary Undifferentiated Aquifer** comprising the superficial Head Deposits and **Unproductive Strata** relating to the bedrock deposits of the London Clay Formation. The bedrock deposits of the Lambeth Group to the north were classed as a

Secondary (A) Aquifer.

Superficial (Drift) deposits are permeable unconsolidated (loose) deposits, for example, sands and gravels. The bedrock is described as solid permeable formations e.g. sandstone, chalk and limestone.

Secondary aquifers include a wide range of drift deposits with an equally wide range of water permeability and storage capacities.

Secondary (A) Aquifers consist of deposits with permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as Minor Aquifers.

Secondary Undifferentiated Aquifers are assigned in cases where it is not possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

Unproductive strata are rock layers with low permeability that have negligible significance for water supply or river base flow. These were formerly classified as non-aquifers.

Examination of the Environment Agency records showed that the site was located within a Groundwater Source Protection Zone 1c as classified in the Policy and Practice for the Protection of Groundwater.

A Zone 1c (inner zone - subsurface activity only) is defined as the 50 day travel time from any point below the water table to the source.

No surface water features were noted in close proximity to the site.

From analysis of hydrogeological and topographical maps groundwater was anticipated to be encountered within the Lambeth Group at depth (>7m below existing ground level (bgl)). Some groundwater may also be encountered within the superficial Head Deposits at shallow depth (<3m bgl). It was considered that shallow groundwater was flowing in an overall southerly direction in alignment with the local topography. Deeper groundwater may be flowing in a northerly direction towards the outer and inner zones of the Source Protection Zone identified.

Examination of the Environment Agency records showed that the site was **not** situated within flood zone or flood warning area.

2.6 Radon

BRE 211 (2015) Map 4 of Hampshire, Berkshire and south Oxfordshire revealed the site **was not** located within an area where mandatory protection measures against the ingress of Radon were likely to be required. The site **was not** located within an area where a risk assessment was required.

3.0 FIELDWORK

3.1 Scope of Works

Fieldwork was undertaken on the 14th March 2016 and comprised the drilling of five Terrier Windowless Sampler Boreholes (WS1, WS2, WS3, WS3a and WS4) to a depth of 1.00m – 4.95m bgl. Standard Penetration Testing (SPT) was undertaken at 1.00m intervals within all trial holes with the exception of WS3.

The approximate locations of the trial holes can be seen within Figure 4.

Prior to commencing the ground investigation, a walkover survey was carried out to identify the presence of underground services and drainage. Where underground services/drainage were suspected and/or positively identified, exploratory positions were relocated away from these areas.

Upon completion of the site works, the trial holes were backfilled and made good/reinstated in relation to the surrounding area.

3.2 Sampling Procedures

Small disturbed samples were recovered from the trial holes at the depths shown on the trial hole records. Soil samples were generally retrieved from each change of strata and/or at specific areas of concern. Samples were also taken at approximately 0.5m intervals during broad homogenous soil horizons.

A programme of chemical laboratory testing, scheduled by Ground and Water Limited and carried out by QTS Environmental Limited, was undertaken on samples recovered from the trial holes. The testing schedule and suite was based on the Conceptual Site Model developed within the Ground and Water Limited Desk Study Report (ref. GWPR1606/DS/April 2016).

4.0 ENCOUNTERED GROUND CONDITIONS

4.1 Soil Conditions

All exploratory holes were logged by Megan James of Ground and Water Limited generally in accordance with BS EN 14688 'Geotechnical Investigation and Testing – Identification and Classification of Soil'.

The ground conditions encountered within the boreholes drilled on the site conformed to that anticipated from examination of the geology map. Made Ground was noted to overlie Head Deposits and soils of the Lambeth Group. The London Clay Formation was not encountered within the boreholes drilled on-site.

The ground conditions encountered during the investigation are described in this section. For more complete information about the Made Ground, Head Deposits and the Lambeth Group at particular points, reference must be made to the individual trial hole logs within Appendix B.

The trial hole location plan can be viewed in Figure 4.

For the purposes of discussion the succession of conditions encountered within the trial holes in descending order can be summarised as follows:

**Made Ground
Head Deposits
Lambeth Group**

Made Ground

Within all trial holes Made Ground was encountered underlying a 0.15 - 0.25m thick concrete slab and/or brick paving. The initial Made Ground comprised sub-base comprising a pale brown gravelly sand to a depth of 0.25 – 0.35m bgl. The sand was fine to coarse grained. The gravel was occasional, fine to medium, sub-angular to sub-rounded concrete, brick and flint.

From 0.35m bgl within WS1 and WS2, to a depth of 1.30m and 0.70m bgl respectively, the Made Ground comprised a brown to dark brown sandy gravelly clay. The sand was fine to coarse grained. The gravel was abundant, fine to coarse, sub-angular to sub-rounded flint, brick, cemented sands, concrete and carbonaceous material (charcoal/ash).

Limited recovery within WS3 to 1.00m bgl may have masked the presence of Made Ground.

Head Deposits

Soils described as representative of Head Deposits were encountered underlying the Made Ground within all trial holes. The Head Deposits were encountered for the remaining depth of WS3 at 1.00m bgl. Within the remaining trial holes the Head Deposits were noted to a proved depth of between 2.00 – 2.20m bgl.

The Head Deposits were noted to generally comprise an orange brown to brown, with locally orange and red mottling, sandy very gravelly clay, locally a clayey sandy gravel. The sand was fine to coarse grained. The gravel was occasional to abundant, fine to coarse, sub-angular to sub-rounded flint. The gravel was locally rare between 1.70 – 2.10m bgl within WS4.

From 0.80m bgl to the base of WS3 at 1.00m bgl, the Head Deposits were noted to comprise a dark greenish brown sandy gravelly clay. The sand was fine to medium grained. The gravel was occasional, fine to coarse, sub-angular to sub-rounded flint. Black organic material and a slight hydrocarbon type odour was noted.

Lambeth Group

With the exception of WS3, soils described as representative of the Lambeth Group were encountered underlying the Head Deposits within all trial holes and were proved for the remaining depth of each trial at 4.20 – 4.95m bgl.

The soils of the Lambeth Group were noted to generally comprise a grey brown, grey, orange brown and reddish brown mottled silty clay.

For details of the composition of the soils encountered at particular points, reference must be made to the trial hole logs within Appendix B.

4.2 Roots Encountered

Roots were noted to 1.00m, 0.50m and 3.00m bgl within WS1, WS3 and WS4 respectively. No roots were noted within WS2 and WS3a.

It must be noted that the chance of determining actual depth of root penetration through a narrow diameter borehole is low. Roots may be found to greater depths at other locations on the site, particularly close to trees and/or trees that have been removed both within the site and its close environs.

4.3 Groundwater Conditions

No groundwater was encountered in the boreholes.

Exact groundwater levels may only be determined through long term measurements from monitoring wells installed on-site. It should be noted that changes in groundwater level do occur for a number of reasons including seasonal effects and variations in drainage.

The site investigation was conducted in March 2016, when groundwater levels should be falling from their annual maximum (i.e. highest). The long-term groundwater elevation might increase at some time in the future due to seasonal fluctuation in weather conditions. Isolated pockets of groundwater may be perched within any Made Ground found at other locations around the site.

4.4 Obstructions

Due to a sub-surface obstruction, WS3 could not be progressed beyond 1.00m bgl.

Given the slight hydrocarbon type odour noted at the base of WS3 and the history of the site (former filling station) it was considered possible that the obstruction noted at 1.00m bgl within WS3 could be associated with one of the underground fuel tanks or a similar feature present on-site.

5.0 INSITU AND LABORATORY GEOTECHNICAL TESTING

5.1 In-Situ Geotechnical Testing

Standard Penetration Testing (SPT) was undertaken within all trial holes, with the exception of WS3, at 1.00m intervals to a depth of 4.20 – 4.95m bgl. The results of the SPT's have not been amended to take into account hammer efficiency, rod lengths and overburden pressure in accordance with Eurocode 7.

Windowless Sampler Boreholes provide samples of the ground for assessment but they do not give any engineering data.

The Standard Penetration test (SPT) is an in-situ dynamic penetration test designed to provide information on the geotechnical engineering properties of soil. The test uses a thick-walled sample tube, with an outside diameter of 50 mm and an inside diameter of 35 mm, and a length of around 650mm. This is driven into the ground at the bottom of a borehole by blows from a slide hammer with a weight of 63.5 kg falling through a distance of 760 mm. The sample tube is driven 150 mm into the ground and then the number of blows needed for the tube to penetrate each 150 mm up to a depth of 450 mm is recorded. The sum of the number of blows is termed the "standard penetration resistance" or the "N-value".

The cohesive soils of the Head Deposits and the Lambeth Group were classified based on the table below.

Undrained Shear Strength from Field Inspection/ SPT blow counts (N_1) ₆₀ Cohesive Soils (EN ISO 14688-2:2004 & Stroud (1974))		
Classification	Undrained Shear Strength (kPa)	Field Indications
Extremely High	>300	-
Very High	150 – 300	Brittle or very tough
High	75 – 150	Cannot be moulded in the fingers
Medium	40 – 75	Can be moulded in the fingers by strong pressure
Low	20 – 40	Easily moulded in the fingers
Very Low	10 – 20	Exudes between fingers when squeezed in the fist
Extremely Low	<10	-

An interpretation of the in-situ geotechnical testing results is given in the table below.

Interpretation of In-situ Geotechnical Testing Results (SPT)					
Strata	SPT "N" Blow Counts	Equivalent Undrained Shear Strength (kPa) Cohesive Soils	Soil Type		Trial Hole/s
			Cohesive	Granular	
Head Deposits	8 - 19	40 - 95	Low/Medium - High	-	WS1 (1.30 – 2.20m bgl) WS2 (0.70 – 2.20m bgl) WS3 (0.35 – 1.00m bgl) WS3a (1.00 – 2.00m bgl) WS4 (0.35 – 2.10m bgl)
Lambeth Group	12 – 25	60 - 125	Medium - High	-	WS1 (2.20 – 4.45m bgl) WS2 (2.20 – 4.45m bgl) WS3a (2.00 – 4.20m bgl) WS4 (2.10 – 4.95m bgl)

It must be noted that field measurements of undrained shear strength are dependent on a number of variables including disturbance of sample, method of investigation and also the size of specimen or test zone etc.

The test results are presented on the trial hole logs within Appendix B.

5.2 Laboratory Geotechnical Testing

A programme of geotechnical laboratory testing scheduled by Ground and Water Limited and carried out by K4 Soils Laboratory and QTS Environmental Limited was undertaken on samples recovered from the Head Deposits and the Lambeth Group. The results of the tests are presented in Appendix C.

The test procedures used were generally in accordance with the methods described in BS1377:1990.

Details of the specific tests used in each case are given below.

Standard Methodology for Laboratory Geotechnical Testing		
Test	Standard	Number of Tests
Atterberg Limit Tests	BS1377:1990:Part 2:Clauses 3.2, 4.3 & 5	6
Particle Size Distribution	BS1377:1990:Part 2:Clause 9	1
Water Soluble Sulphate & pH	BS1377:1990:Part 3:Clause 5	1
BRE Special Digest 1 (incl. Ph, Electrical Conductivity, Total Sulphate, W/S Sulphate, Total Chlorine, W/S Chlorine, Total Sulphur, Ammonium as NH ₄ , W/S Nitrate, W/S Magnesium)	BRE Special Digest 1 "Concrete in Aggressive Ground" (BRE, 2005).	2

5.2.1 Atterberg Limit Tests

A précis of Atterberg Limit Tests undertaken on two samples of Head Deposits and four samples of the Lambeth Group can be seen tabulated below.

Atterberg Limit Tests Results Summary							
Stratum	Moisture Content (%)	Passing 425 μ m sieve (%)	Modified PI (%)	Soil Class	Consistency Index (Ic)	Volume Change Potential	
						BRE	NHBC
Head Deposits	20	30 - 87	6.0 – 19.1	CL	Stiff – Very Stiff	Low	Low
Lambeth Group	20 - 27	95 - 100	40.0 – 42.0	CL	Stiff – Very Stiff	High	Medium - High

NB: NP – Non-plastic

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

Soil Classification based on British Soil Classification System.

Consistency Index (Ic) based on BS EN ISO 14688-2:2004.

5.2.2 Comparison of Soil's Moisture Content with Index Properties

5.2.2.1 Liquidity Index Analyses

The results of the Atterberg Limit tests undertaken on two samples of Head Deposits and four samples of the Lambeth Group were analysed to determine the

Liquidity Index of the samples. This gives an indication as to whether the samples recovered showed a moisture deficit and their degree of consolidation. The results are tabulated below.

The test results are presented within Appendix C.

Liquidity Index Calculations Summary					
Stratum/Trial Hole/Depth	Moisture Content (%)	Plastic Limit (%)	Modified Plasticity Index (%)	Liquidity Index	Result
Head Deposits WS1/1.50 (Orange and patchy red slightly gravelly silty CLAY (gravel is fine to medium and angular to sub-angular))	20	16	19.14	0.21	Overconsolidated
Lambeth Group WS1/2.50 (Brown and occasional pale grey and red slightly gravelly CLAY with occasional fine brick fragments (gravel is fine to medium and sub-angular))	23	22	41.80	0.02	Heavily Overconsolidated
Head Deposits WS3/0.80 (Orangish brown gravelly silty CLAY (gravel is fine to coarse and angular to rounded))	20	21	6.00	-0.17	Potential Moisture Deficit
Lambeth Group WS3a/4.00 (Pale grey and patchy red CLAY)	20	17	42.00	0.07	Heavily Overconsolidated
Lambeth Group WS4/2.20 (Brown and pale grey CLAY)	27	23	41.00	0.10	Heavily Overconsolidated
Lambeth Group WS4/3.00 (Pale grey and occasional brown and red CLAY)	22	20	40.00	0.05	Heavily Overconsolidated

Liquidity Index testing revealed evidence for a potential moisture deficit within one sample of the Head Deposits (WS3/0.80m bgl).

The sample was described as an orangish brown gravelly silty clay. Roots were noted to 0.50m bgl within WS3 and therefore the apparent moisture deficit was likely to be associated with the gravelly lithology of the soil (overconsolidated soils with 70% coarse fraction) rather than the moisture demand from roots/trees.

It must be noted that the occasional fine brick fragments identified within the sample of the Lambeth Group at WS1/2.50m are likely to be present due to the driving down of material from the surface via processes of the standard penetration testing undertaken within the trial hole.

5.2.2.2 Liquid Limit

A comparison of the soil moisture content and the liquid limit can be seen tabulated overpage.

Moisture Content vs. Liquid Limit				
Strata/Trial Hole/Depth/Soil Description	Moisture Content (MC) (%)	Liquid Limit (LL) (%)	40% Liquid Limit (LL)	Result
Head Deposits WS1/1.50 (Orange and patchy red slightly gravelly silty CLAY (gravel is fine to medium and angular to sub-angular))	20	38	15.2	MC > 0.4 x LL (Not Significantly Desiccated)
Lambeth Group WS1/2.50 (Brown and occasional pale grey and red slightly gravelly CLAY with occasional fine brick fragments (gravel is fine to medium and sub-angular))	23	66	26.4	MC < 0.4 x LL (Potential Significant Moisture Deficit)
Head Deposits WS3/0.80 (Orangish brown gravelly silty CLAY (gravel is fine to coarse and angular to rounded))	20	41	16.4	MC > 0.4 x LL (Not Significantly Desiccated)
Lambeth Group WS3a/4.00 (Pale grey and patchy red CLAY)	20	59	23.6	MC < 0.4 x LL (Potential Significant Moisture Deficit)
Lambeth Group WS4/2.20 (Brown and pale grey CLAY)	27	64	25.6	MC > 0.4 x LL (Not Significantly Desiccated)
Lambeth Group WS4/3.00 (Pale grey and occasional brown and red CLAY)	22	60	24	MC < 0.4 x LL (Potential Significant Moisture Deficit)

The results in the table above indicated that potential significant moisture deficits were present within three samples of the Lambeth Group tested (WS1/2.50m, WS3a/4.00m and WS4/3.00m bgl). The moisture content values were below 40% of the liquid limits.

The sample at WS1/2.50m bgl was described as a brown and occasional pale grey and red slightly gravelly clay. Roots were noted to 1.00m bgl within WS1 therefore the apparent moisture deficit was likely to be associated with the slightly gravelly (5% coarse fraction) and heavily overconsolidated nature of the soil rather than the moisture demand from roots/trees.

The sample at WS3a/4.00m bgl was described as a pale grey and occasional brown and red clay. No roots were encountered within WS3a and therefore the apparent moisture deficit was likely to be associated with the heavily overconsolidated nature of the soil rather than the moisture demand from roots/trees.

The sample at WS4/3.00m bgl was described as a pale grey and patchy red clay. Roots were noted to 3.00m bgl within WS4 and therefore the apparent moisture deficit was likely to be associated with a combination of the heavily overconsolidated nature of the soil and the moisture demand from roots/trees.

5.2.3 Particle Size Distribution (PSD) Tests

The results of PSD testing undertaken on one granular sample of the Head Deposits encountered are tabulated overpage.

PSD Test Results Summary			
Trial Hole/Depth/Soil Description	Volume Change Potential Range		Passing 63µm sieve Range (%)
	BRE	NHBC	
Head Deposits WS2/2.00m bgl (Brown clayey sandy GRAVEL (gravel is fine to coarse and sub-angular to subrounded))	No	No	13.5

NB Volume Change Potential refers to BRE Digest 240 (based on Grading test results).
Shrinkability refers to NHBC Standards Chapter 4.2 (based on Grading test results).

Volume Change Potential – 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%.

5.2.4 Sulphate and pH Tests

A sulphate and pH test was undertaken on one sample of the Head Deposits (WS1/1.50m bgl). A sulphate concentration of 0.16g/l and a pH of 7.58 was determined.

5.2.5 BRE Special Digest 1

In accordance with BRE Special Digest 1 'Concrete in Aggressive Ground' (BRE, 2005) one sample of Head Deposits (WS4/1.00m bgl) and one sample of the Lambeth Group (WS1/4.00m bgl) were scheduled for laboratory analysis to determine parameters for concrete specification.

The results are given within Appendix D and a summary is tabulated below.

Summary of Results of BRE Special Digest Testing			
Determinand	Unit	Minimum	Maximum
pH	-	8.2	8.4
Ammonium as NH ₄	mg/kg	4.9	5.1
Sulphur	%	<0.02	<0.02
Chloride (water soluble)	mg/kg	19	35
Magnesium (water soluble)	mg/l	0.8	3.9
Nitrate (water soluble)	mg/kg	<3	24
Sulphate (water soluble)	mg/l	26	71
Sulphate (total)	mg/kg	247	309

6.0 ENGINEERING CONSIDERATIONS

6.1 Soil Characteristics and Geotechnical Parameters

Based on the results of the intrusive investigation and geotechnical laboratory testing the following interpretations have been made with respect to engineering considerations.

- Made Ground was encountered underlying concrete and/or brick paving to 0.25m - 1.30m bgl.

The Desk Study revealed five underground tanks present on the site. It is likely that the tanks will need to be removed to facilitate construction and therefore localised deep Made Ground will be formed on removal of these tanks. The void left on removal of these tanks is anticipated to be ~2.50 - 3.00m bgl. This will need to be taken into account in final design.

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

Made Ground may be found to deeper depths at other locations on the site, especially close to former structures/foundations and service runs.

- Soils described as representative of Head Deposits were encountered underlying the Made Ground within all trial holes. The Head Deposits were encountered for the remaining depth of WS3 at 1.00m bgl. Within the remaining trial holes the Head Deposits were noted to a proved depth of between 2.00 – 2.20m bgl.

The deposits generally comprised an orange brown to brown, with locally orange and red mottling, sandy very gravelly clay, locally a clayey sandy gravel.

The Head Deposits were shown to have low/medium to high undrained shear strength (40 – 95kPa).

Geotechnical testing revealed the cohesive soils of the Head Deposits to have **low volume change potential** in accordance with both BRE240 and NHBC Standards Chapter 4.2. The more granular soils of the Head Deposits were shown to have **no volume change potential** in accordance with both BRE240 and NHBC Standards Chapter 4.2

Liquidity Index testing revealed evidence for a potential moisture deficit within one sample of the Head Deposits (WS3/0.80m bgl).

The sample was described as an orangish brown gravelly silty clay. Roots were noted to 0.50m bgl within WS3 and therefore the apparent moisture deficit was likely to be associated with the gravelly lithology of the soil (70% coarse fraction) rather than the moisture demand from roots/trees.

The overconsolidated cohesive and more granular soils of the Head Deposits were considered a suitable bearing stratum for moderately loaded footings/foundations. Settlements on loading are likely to be moderate.

- With the exception of WS3, soils described as representative of the Lambeth Group were encountered underlying the Head Deposits within all trial holes and were proved for the remaining depth of each trial at 4.20 – 4.95m bgl.

The soils of the Lambeth Group were noted to generally comprise a grey brown, grey, orange brown and reddish brown mottled silty clay.

The Lambeth Group was shown to have medium to high undrained shear strength (60 – 125kPa).

Geotechnical testing revealed the cohesive soils of the Lambeth Group to have **medium to high volume change potential** in accordance with both BRE240 and NHBC Standards Chapter 4.2.

A comparison of the soil moisture content and the liquid limit indicated that potential significant moisture deficits were present within three samples of the Lambeth Group tested (WS1/2.50m, WS3a/4.00m and WS4/3.00m bgl). The moisture content values were below 40% of the liquid limits.

The sample at WS1/2.50m bgl was described as a brown and occasional pale grey and red slightly gravelly clay. Roots were noted to 1.00m bgl within WS1 therefore the apparent moisture deficit was likely to be associated with the slightly gravelly (5% coarse fraction) and heavily overconsolidated nature of the soil rather than the moisture demand from roots/trees.

The sample at WS3a/4.00m bgl was described as a pale grey and occasional brown and red clay. No roots were encountered within WS3a and therefore the apparent moisture deficit was likely to be associated with the heavily overconsolidated nature of the soil rather than the moisture demand from roots/trees.

The sample at WS4/3.00m bgl was described as a pale grey and patchy red clay. Roots were noted to 3.00m bgl within WS4 and therefore the apparent moisture deficit was likely to be associated with a combination of the heavily overconsolidated nature of the soil and the moisture demand from roots/trees.

The overconsolidated to heavily overconsolidated cohesive soils of the Lambeth Group were considered a suitable bearing stratum for moderately loaded footings/foundations. Settlements on loading are likely to be moderate.

The final design of foundations will need to take into account the volume change potential of the soil, the depth of root penetration and/or desiccation and the likely serviceability and settlement requirements of the proposed structure. These parameters for design are discussed in the next section of this report.

- No groundwater was encountered in the boreholes.
- Roots were noted to 1.00m, 0.50m and 3.00m bgl within WS1, WS3 and WS4 respectively. No roots were noted within WS2 and WS3a.

6.2 Spread Foundations

At the time of reporting, May 2016, final details of the proposed development were yet to be confirmed, but it was understood to comprise a combination of flats with communal gardens, parking and residential houses with private gardens and off-street parking.

The proposed development fell within Geotechnical Design Category 2 in accordance with Eurocode 7. The proposed foundation loads were not known to Ground and Water Limited at the time of reporting but are likely to range from 75 – 150kN/m².

Foundations constructed within the Head Deposits should be designed in accordance with soils of **low volume change potential** in accordance with BRE Digest 240 and NHBC Chapter 4.2.

Foundations constructed within the Lambeth Group should be designed in accordance with soils of **high volume change potential** in accordance with BRE Digest 240 and NHBC Chapter 4.2.

Given the potential for volume change, foundations must **not** be placed within root penetrated soils and the influence of the trees surrounding the site must be taken into account. The base of foundation excavations must extend at least 300mm into non-root penetrated soils.

Foundations must be taken through any Made Ground and into the underlying Head Deposits.

Roots were noted to 1.00m, 0.50m and 3.00m bgl within WS1, WS3 and WS4 respectively. No roots were noted within WS2 and WS3a.

Based on the above, the recommended minimum foundation depths at the locations of the boreholes are tabulated below.

Minimum Recommended Foundation Depths			
Trial Holes	Depth of Root Penetration	Depth of Made Ground	Minimum Foundation Depth
WS1	1.00m	1.30m	1.30m
WS2	No roots noted	0.70m	0.80m
WS3	0.50m	0.35m	0.80m
WS3a	No roots noted	1.00m	1.30m
WS4	3.00m	0.35m	3.30m

Given the depth to which roots were noted in the vicinity of WS4 then consideration should be given to an isolated pad foundation scheme or piled foundation should structures be proposed for this location.

The Desk Study revealed five underground tanks present on the site. It is likely that the tanks will need to be removed to facilitate construction and therefore localised deep Made Ground will be formed on extraction of these tanks. The void left on removal of these tanks is anticipated to be ~2.50 - 3.00m bgl.

Given the slight hydrocarbon type odour noted at the base of WS3 and the history of the site (former filling station), it was considered possible that the obstruction noted at 1.00m bgl within WS3 could be associated with one of the underground fuel tanks or a similar feature present on-site.

Proposed foundations close to the location of WS3 or at the location of any of the underground tanks present on-site must be taken through the localised deep Made Ground formed during the

removal of the tanks. Given the depth to which Made Ground is likely to extend, ~2.50 – 3.00m bgl, then consideration should be given to an isolated pad foundation scheme or piled foundation should structures be proposed for these locations.

The following bearing capacities could be adopted for 5.00m long by 0.75m and 1.00m wide footings, or 1.50m by 1.50m pads at depths of 0.80m, 1.30m and 3.30m. The bearing capacities are tabulated below.

Limit State: Bearing Capacities Calculated (Based on WS4)		
Depth (m BGL)	Foundation System	Limit Bearing Capacity (kN/m ²) (EC2)
0.80m	5.00m by 0.75m Strip	78.47
	5.00m by 1.00m Strip	81.33
	1.50m by 1.50m Pad	90.01
1.30m	5.00m by 0.75m Strip	98.95
	5.00m by 1.00m Strip	102.32
	1.50m by 1.50m Pad	111.74
3.30m	5.00m by 0.75m Strip	158.99
	5.00m by 1.00m Strip	162.25
	1.50m by 1.50m Pad	174.68

Serviceability State: Settlement Parameters Calculated (Based on WS4)			
Depth (m BGL)	Foundation System	Limit Bearing Capacity (kN/m ²)	Settlement (mm)
0.80m	5.00m by 0.75m Strip	75	<18
	5.00m by 1.00m Strip	80	<21
	1.50m by 1.50m Pad	90	<16
1.30m	5.00m by 0.75m Strip	95	<19
	5.00m by 1.00m Strip	100	<21
	1.50m by 1.50m Pad	110	<18
3.30m	5.00m by 0.75m Strip	150	<18
	5.00m by 1.00m Strip	150	<18
	1.50m by 1.50m Pad	170	<17

No groundwater was encountered in the boreholes.

Excavations must be kept dry and either concreted or blinded as soon after excavation as possible. If water were allowed to accumulate on the formation for even a short time not only would an increase in heave occur resulting from the soil increasing in volume by taking up water, but also the shear strength and hence the bearing capacity would also be reduced.

General Recommendations for Spread Foundations:

- Foundation excavations must be carefully bottomed out and any loose soil or soft spots removed prior to the foundation concrete or blinding being placed. Failure to ensure that foundation excavations are suitably bottomed out could result in additional settlements.
- Inspection of foundation excavations, prior to concreting, must be made by a competent and suitably qualified person to check for any soft spots and to check for the presence of roots.

- The excavation must be kept dry as accumulation of water could result in increased settlements.
- Foundations must not be cast over foundations of former structures and/or other hard spots.
- Any groundwater or surface water ingress must be prevented from entering foundation trenches.
- Isolated Pad Foundations must be at least 1.5 times the width of the widest pad apart to keep to the anticipated settlements.
- Given that the samples of the Head Deposits were shown to have a **low volume change potential** and the Lambeth Group a **high volume change potential** in accordance with BRE240 and NHBC Standards Chapter 4, a suspended slab should be considered. The volume change potential of the shallow surface soils must be taken into account in final design (underfloor void diameter/compressible material/void formers etc.).
- Final designs for the foundations should be carried out by a suitably qualified Engineer based on the findings of this investigation and with reference to the anticipated loadings, serviceability requirements for the structure and the developments proximity to former, present and proposed trees.

6.3 Piled Foundations

Given the depth to which roots were noted in the vicinity of WS4 then consideration could be given to a piled foundation scheme should structures be proposed for this location.

Proposed foundations at the location of any of the underground tanks present on-site must be taken through the localised deep Made Ground formed during the removal of the tanks. Given the depth to which Made Ground is likely to extend, ~2.50 – 3.00m bgl, then consideration could be given to a piled foundation scheme should structures be proposed for these locations.

The construction of a piled foundation is a specialist job, and the advice of a reputable contractor, familiar with the type of ground and groundwater conditions encountered on this site, should be sought prior to finalising the foundation design, as the actual pile working load will depend on the particular type of pile and method of installation adopted.

Additional investigation in the form of shell and auger boreholes would be required to provide data for a pile design.

6.4 Excavations

Shallow excavations in the Made Ground, Head Deposits and the Lambeth Group are likely to be marginally stable at best. Long, deep excavations, through these strata are likely to become unstable, especially if groundwater is encountered.

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 before excavations are entered by personnel.

6.5 Sub-Surface Concrete

Sulphate concentrations were measured in 2:1 water/soil extracts taken from the Head Deposits and Lambeth Group fell into class DS-1 of the BRE Special Digest 1, 2005, '*Concrete in Aggressive Ground*'.

Table C1 of the Digest indicated an ACEC (Aggressive Chemical Environment for Concrete) classification of AC-1. For the classification given, the "mobile" and "brownfield" case was adopted given the granular nature of the soils encountered and the historic use of the site as a filling station. The sulphate concentration in the samples ranged from 26 - 160mg/l with a pH range of 7.58 – 8.40. The total potential sulphate concentrations ranged from 0.02 – 0.03%.

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 the pH of the soils.

6.6 Surface Water Disposal

Infiltration tests were beyond the scope of the investigation.

Soakaways constructed within the cohesive, locally granular, soils of the Head Deposits may prove satisfactory due to moderate anticipated infiltration rates.

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

The principles of sustainable urban drainage system (SUDS) should be applied to reduce the risk of flooding from surface water ponding and collection associated with the construction of the foundations.

7.0 PHASE 2 CONTAMINATION RISK ASSESSMENT

7.1 Results of the Phase 1 Risk Assessment (Conceptual Site Model)

The tabulated Conceptual Site Model developed by the Ground and Water Desk Study (ref. GWPR1606/DS/April 2016) is reproduced in this section and can be seen below.

Tabulated Conceptual Site Model – Plausible Pollutant Linkages Only		
Potential Sources	Potential Absorption Pathways	Potential Receptors
On-site Sources		
Contaminants introduced on-site by historic demolition and construction activities and use of site as petrol filling station. - Heavy metals & semi-metals (incl. Arsenic, Cadmium, Chromium, Lead etc); - Combustion products (PAH's, benzo(a)pyrene, fluoranthene, dibenz(a,h)anthracene); - Organic compounds (fuel oils, ash, tar); - Asbestos (building material, pipe lagging). - Volatile organic compounds (incl. solvents) Contaminants introduced on-site by the underground fuel tanks. - Petroleum hydrocarbons; - Volatile organic compounds (incl. solvents)	Direct ingestion of soil and soil derived household dust Dermal contact of soil and soil derived household dust Ingestion of soil with elevated concentration of determinants Dermal contact with impacted soils Inhalation of impacted dust (indoors and outdoors) with elevated concentration of determinants Inhalation of volatiles (indoors and outdoors) with elevated concentration of determinants Via underlying geology (Made Ground and Head Deposits) Via surface water runoff Via anthropogenic pathways	Construction workers (particularly during demolition and remodelling of building) Service and Maintenance Operatives Site Occupiers Groundwater Source Protection Zone 1c and Secondary Undifferentiated Aquifer (Head Deposits) underlying site.
Bio-gases (Carbon Dioxide, Methane) generated by the anaerobic decomposition of any leaked hydrocarbons beneath site. - Carbon Dioxide; - Methane.	Migration through anthropogenic & natural pathways Inhalation Possible Explosive Risk	Site occupiers Buildings Construction workers, service and maintenance operatives, especially in confined spaces.

During the intrusive investigation Made Ground was encountered underlying 0.15 - 0.25m thick concrete and/or brick paving. The Made Ground comprised sub-base of pale brown gravelly sand to a depth of 0.25 – 0.35m bgl. From 0.35m bgl within WS1 and WS2 to a depth of 1.30m and 0.70m bgl respectively, the Made Ground comprised a brown to dark brown sandy gravelly clay.

Due to a sub-surface obstruction, WS3 could not be progressed beyond 1.00m bgl. A slight hydrocarbon type odour was noted at the base of WS3 at ~1.00m bgl. It was considered possible that the obstruction could be associated with one of the underground fuel tanks or a similar feature present on-site.

Made Ground and potential hydrocarbons were anticipated to be on site, consequently there was no need to modify the tabulated Conceptual Site Model developed by the Ground and Water Desk Study (ref. GWPR1606/DS/April 2016).

7.2 Sampling Locations

The methodology for sampling locations can be seen tabulated below. A trial hole location plan is given within Figure 4.

Methodology for Sampling Locations		
Trial Holes	Sampling Strategy	Anticipated Proposed End-use
WS1	Random sampling locations	Proposed development not confirmed.
WS2		
WS3		
WS3a		
WS4		

The area investigated as part of the proposed redevelopment totals 840m² (0.084ha) and with five sampling locations, given an unknown hotspot shape, the sampling density means that a hotspot with an area of approximately 252m² and a radius of approximately 8.96m would be encountered (CLR 4).

Sampling depths were chosen to reflect the receptor of concern, human health and typically comprised a surface or near surface sample and at approximately 0.5m depth increments thereafter, extending into the underlying natural soils. The human health receptors relevant to the sampling depths were as follows:

Near surface samples	Direct ingestion, dermal contact and dust inhalation. Protection of end-users and maintenance workers e.g. Landscape Gardeners. Protection of shallow rooted plants Perched Water/Surface Water Run-off
>0.5m below ground level	Protection of deep rooted plants Perched Water/Surface Water Run-off

The depth of soil sampling can be seen within the trial hole logs presented in Appendix B.

7.3 Chemical Laboratory Testing – Human Health Risk Assessment

A programme of chemical laboratory testing, scheduled by Ground and Water Limited, and carried out by QTS Environmental Limited, was undertaken on one sample of Head Deposits (WS3/1.00m bgl) and three samples of Made Ground (WS1/0.50m, WS2/0.50m and WS4/0.30m bgl).

Four soil samples were sent off for analysis for a broad range of contaminants in accordance with DEFRA/CLEA methodologies. The samples tested and the reasons for testing can be seen tabulated below.

Methodology for Sampling Locations and Chemical Laboratory Testing		
Trial Hole	Depth (m bgl)	Sampling Strategy
WS1	0.50m	Representative sample of Made Ground
WS2	0.50m	
WS3	1.00m	Targeted sampling of soils with hydrocarbon type odour
WS4	0.30m	Representative sample of Made Ground

The analysis suite is presented below and comprised:

- Semi Metals and Heavy Metals incl. Arsenic, Cadmium, Chromium (incl. Hexavalent Chromium), Copper, Lead, Mercury, Nickel, Selenium, Vanadium, Zinc (WS1/0.50m, WS2/0.50m and WS4/0.30m bgl);
- Asbestos Screen (WS1/0.50m, WS2/0.50m and WS4/0.30m bgl);
- Polycyclic Aromatic Hydrocarbons (PAHs) incl. Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(ghi)perylene (WS1/0.50m, WS2/0.50m and WS4/0.30m bgl).
- Fuel Oils – Speciated TPH including full aliphatic/aromatic split (WS1/0.50m, WS2/0.50m, WS3/1.00m and WS4/0.30m bgl);
- BTEX compounds (Benzene, Toluene, Ethylbenzene, Xylene) and MTBE – used as marker compounds for Volatile Organic Compounds (VOCs) (WS1/0.50m, WS2/0.50m, WS3/1.00m and WS4/0.30m bgl);
- Volatile Organic Compounds (VOCs) (WS1/0.50m bgl).

The chemical laboratory results are presented in Appendix D.

7.3.1 Soil Assessment Criteria

The derivation of Soil Assessment Criteria used within this report can be seen within Appendix E.

7.3.2 Determination of Representative Contamination Concentrations

At the time of reporting, May 2016, final details of the proposed development were yet to be confirmed, but it was understood to comprise a combination of flats with communal gardens, parking and residential houses with private gardens and off-street parking.

Therefore, the results of the chemical laboratory testing were compared to the LQM/CIEH Suitable 4 Use Levels (S4UL), and C4SL LLTC for Lead, for a ***‘Residential with homegrown produce’*** land-use scenario, as this was considered the most appropriate land-use scenario. The C4SL LLTC for Lead was compared to a ***“Residential with homegrown produce”*** land-use scenario. The CLAIRE General Assessment Criteria and LQM CIEH General Assessment Criteria (GAC’s) for the Volatile and Semi-volatile Organic Compounds (VOC/SVOC’s) tests for were compared to the ***“Residential”*** land-use scenario.

Where no LQM/CIEH S4UL/C4SL LLTC was available for a particular determinant then preliminary reference was made to the laboratory detection limit of the determinant. If a positive concentration was noted then further risk assessment was undertaken.

For Cyanide, where no SGC/GAC or C4SL LLTC was available a Site Specific Assessment Criteria of 10mg/kg was adopted. This is based on ICRL 59/83, TCL, ATRISK (SOIL) Screening Value and Dutch Intervention Value (ranging from 20 – 34mg/kg). Therefore, a SSAC of ~10mg/kg is considered conservative.

Where a contaminant of concern’s LQM/CIEH S4UL/C4SL LLTC varies according to the Soil’s Organic Matter (SOM), the SOM recorded for each soil sample was used to derive the appropriate SGV/GAC. The average SOM of the samples analysed was 0.93% (SOM ranged between 0.5 - 1.3%). The results of the comparison of the representative contaminant

concentrations are presented in the table below:

Soil Guideline Values and General Acceptance Criteria Results	
Substance	Sample Location Where available LQM/CIEH S4UL/, CSL4 LLTC or GAC were exceeded for relevant land-use scenario
	"Residential with homegrown produce" Land-Use Scenario
Arsenic	None
Boron	None
Cadmium	None
Chromium (III)	None
Hexavalent Chromium (VI)	None
Copper	None
Lead	None
Mercury (Elemental)	None
Nickel	None
Selenium	None
Vanadium	None
Zinc	None
Cyanide (Total)	None
Total Phenol	None
Naphthalene	None
Acenaphthylene	None
Acenaphthene	None
Fluorene	None
Phenanthrene	None
Anthracene	None
Fluoranthene	None
Pyrene	None
Benzo(a)anthracene	None
Chrysene	None
Benzo(b)fluoranthene	None
Benzo(k)fluoranthene	None
Benzo(a)pyrene	None
Indeno(1,2,3-cd)pyrene	None
Dibenz(a,h)anthracene	None
Benzo(ghi)perylene	None
TPH C5 – C6 (aliphatic)	None
TPH C6 – C8 (aliphatic)	None
TPH C8 – C10 (aliphatic)	None
TPH C10 – C12 (aliphatic)	None
TPH C12 – C16 (aliphatic)	None
TPH C16 – C21 (aliphatic)	None
TPH C21 – C34 (aliphatic)	None
TPH C5 – C7 (aromatic)	None
TPH C7 – C8 (aromatic)	None
TPH C8 – C10 (aromatic)	None
TPH C10 – C12 (aromatic)	None
TPH C12 – C16 (aromatic)	None
TPH C16 – C21 (aromatic)	None
TPH C21 – C35 (aromatic)	None
Benzene	None
Toluene	None
Ethylbenzene	None
Xylene (o, m & p)	None
MTBE	None
Asbestos Screen	None
Other Volatile Organic Compounds (VOC's)	No exceedances of GAC's or exceedances above laboratory detection limited
Other Semi-volatile Organic Compounds	No exceedances of GAC's or exceedances above laboratory detection limited

Chemical laboratory testing of the Made Ground revealed no elevated levels of determinants above the guideline levels for a '**Residential with homegrown produce**' or '**Residential**' land-use scenarios.

A slight hydrocarbon odour was noted in WS3 at 1.00m bgl. Targeted sampling revealed no elevated concentrations of hydrocarbons.

The chemical laboratory results have verified that no elevated concentrations of aliphatic/aromatic hydrocarbons (C5-C35) BTEX compounds are present in the soils underlying the site.

Further testing is recommended around the locations of the underground tanks. It is recommended that on removal of the underground tanks a Ground and Water Limited Engineer attends site to inspect and sample the soils around the tank to determine if gross contaminated exists and required remediation.

7.4 Groundwater Risk Assessment

The Desk Study has revealed the site to be located on a **Secondary Undifferentiated Aquifer** comprising the superficial Head Deposits and **Unproductive Strata** relating to the bedrock deposits of the London Clay Formation. The bedrock deposits of the Lambeth Group to the north were classed as a **Secondary (A) Aquifer**.

Examination of the Environment Agency records showed that the site was located within a Groundwater Source Protection Zone 1c as classified in the Policy and Practice for the Protection of Groundwater.

No surface water features were noted in close proximity to the site.

From analysis of hydrogeological and topographical maps groundwater was anticipated to be encountered within the Lambeth Group at depth (>7m below existing ground level (bgl)). Some groundwater may also be encountered within the superficial Head Deposits at shallow depth (<3m bgl). It was considered that shallow groundwater was flowing in an overall southerly direction in alignment with the local topography. Deeper groundwater may be flowing in a northerly direction towards the outer and inner zones of the Source Protection Zone identified.

Examination of the Environment Agency records showed that the site was **not** situated within flood zone or flood warning area.

The intrusive investigation did not reveal any elevated levels of contaminants however further testing is recommended around the locations of the underground tanks to determine if the site is likely to pose a risk to groundwater within the Secondary Undifferentiated Aquifer underlying the site

Further testing is recommended around the locations of the underground tanks. It is recommended that on removal of the underground tanks a Ground and Water Limited Engineer attends site to inspect and sample the soils around the tank to determine if gross contaminated exists and required remediation.

7.5 Re-Evaluated Phase 2 Conceptual Site Model

Following completion of the Phase 2 Site Investigation, the CSM within Section 7.1 of this report was re-evaluated and can be seen overleaf. The plausible pollutant linkages remaining after risk assessment are shown and where risk assessment has indicated no unacceptable risk to sensitive

receptors, the pollutant linkages have been crossed out.

Tabulated Conceptual Site Model – Plausible Pollutant Linkages Only		
Potential Sources	Potential Absorption Pathways	Potential Receptors
On-site Sources Contaminants introduced on-site by historic demolition and construction activities and use of site as petrol filling station. • Heavy metals & semi-metals (incl. Arsenic, Cadmium, Chromium, Lead etc); • Combustion products (PAH's, benzo(a)pyrene, fluoranthene, dibenz(a,h)anthracene); • Organic compounds (fuel oils, ash, tar); • Asbestos (building material, pipe lagging); • Volatile organic compounds (incl. solvents) No elevated levels of determinants noted onsite that were considered to pose a risk to end-users. Contaminants introduced on-site by the underground fuel tanks. • Petroleum hydrocarbons; • Volatile organic compounds (incl. solvents) No elevated levels of determinants noted however further testing around tanks is recommended.	Direct ingestion of soil and soil derived household dust Dermal contact of soil and soil derived household dust Ingestion of soil with elevated concentration of determinants Dermal contact with impacted soils Inhalation of impacted dust (indoors and outdoors) with elevated concentration of determinants Inhalation of volatiles (indoors and outdoors) with elevated concentration of determinants Via underlying geology (Made Ground and Head Deposits) Via surface water runoff Via anthropogenic pathways	Construction workers (particularly during demolition and remodelling of building) Service and Maintenance Operatives Site Occupiers Groundwater Source Protection Zone 1c and Secondary Undifferentiated Aquifer (Head Deposits) underlying site.
Bio-gases (Carbon Dioxide, Methane) generated by the anaerobic decomposition of any leaked hydrocarbons beneath site. • Carbon Dioxide; • Methane. No significant hydrocarbons noted during investigation however further testing and sampling around the location of the tanks if considered necessary.	Migration through anthropogenic & natural pathways Inhalation Possible Explosive Risk	Site occupiers Buildings Construction workers, service and maintenance operatives, especially in confined spaces.

Further testing is recommended around the locations of the underground tanks. It is recommended that on removal of the underground tanks a Ground and Water Limited Engineer attends site to inspect and sample the soils around the tank to determine if gross contaminated exists and required remediation.

7.6 Discovery Strategy

There may be areas of contamination that have not been identified during the course of the intrusive investigation. For example, there may have been underground storage tanks (UST's) not identified during the Desk Study and/or Ground Investigation for which there is no historical or

contemporary evidence.

Such occurrences may be discovered during the demolition and construction phases for the redevelopment of the site.

Groundworkers should be instructed to report to the Site Manager any evidence for such contamination; this may comprise visual indicators, such as fibrous materials within the soil, discolouration, or odours and emission. Upon discovery advice must be taken from a suitably qualified person before proceeding, such that appropriate remedial measures and health and safety protection may be applied.

Should a new source of contamination be suspected or identified then the Local Authority will need to be informed.

7.7 Waste Classification

The excavation of foundations is likely to produce waste which will require classification and then recycling or removal from site.

Under the Landfill (England and Wales) Regulations 2002 (as amended), prior to disposal all waste must be classified as;

- Inert;
- Non-hazardous, or;
- Hazardous.

The Environment Agency's Hazardous Waste Technical Guidance (WM2) document outlines the methodology for classifying wastes. Once the classification was established the waste can be removed to the appropriately licensed facilities, with some waste requiring pre-treatments prior to disposal.

Based on a risk phrase analysis of the chemical laboratory test results, in accordance with EC Hazardous Waste Directive and undertaken by Ground and Water Limited, the samples of Made Ground taken on-site were classed as **NON-HAZARDOUS**. The results of the assessment are given within Appendix F.

INERT waste classification should be undertaken to determine if the proposed waste confirms to INERT or NON-HAZARDOUS Waste Acceptable Criteria (WAC).

It is important to note that whilst we consider our in-house assessment tool to be an accurate interpretation of the requirements of WM2, therefore producing an initial classification in accordance with the guidance, landfill operators have their own assessment tools and can often come to different conclusions. As a result, some landfill operators could refuse to take apparently suitable waste. It is recommended that the receiving landfill views the results of this assessment and the chemical laboratory results to determine their own classification.

7.8 Imported Material

Any soil which is to be imported onto the site must undergo chemical analysis to prove that it is suitable for the purpose for which it is intended.

The Topsoil must be fit for purpose and must either be supplied with traceable chemical laboratory

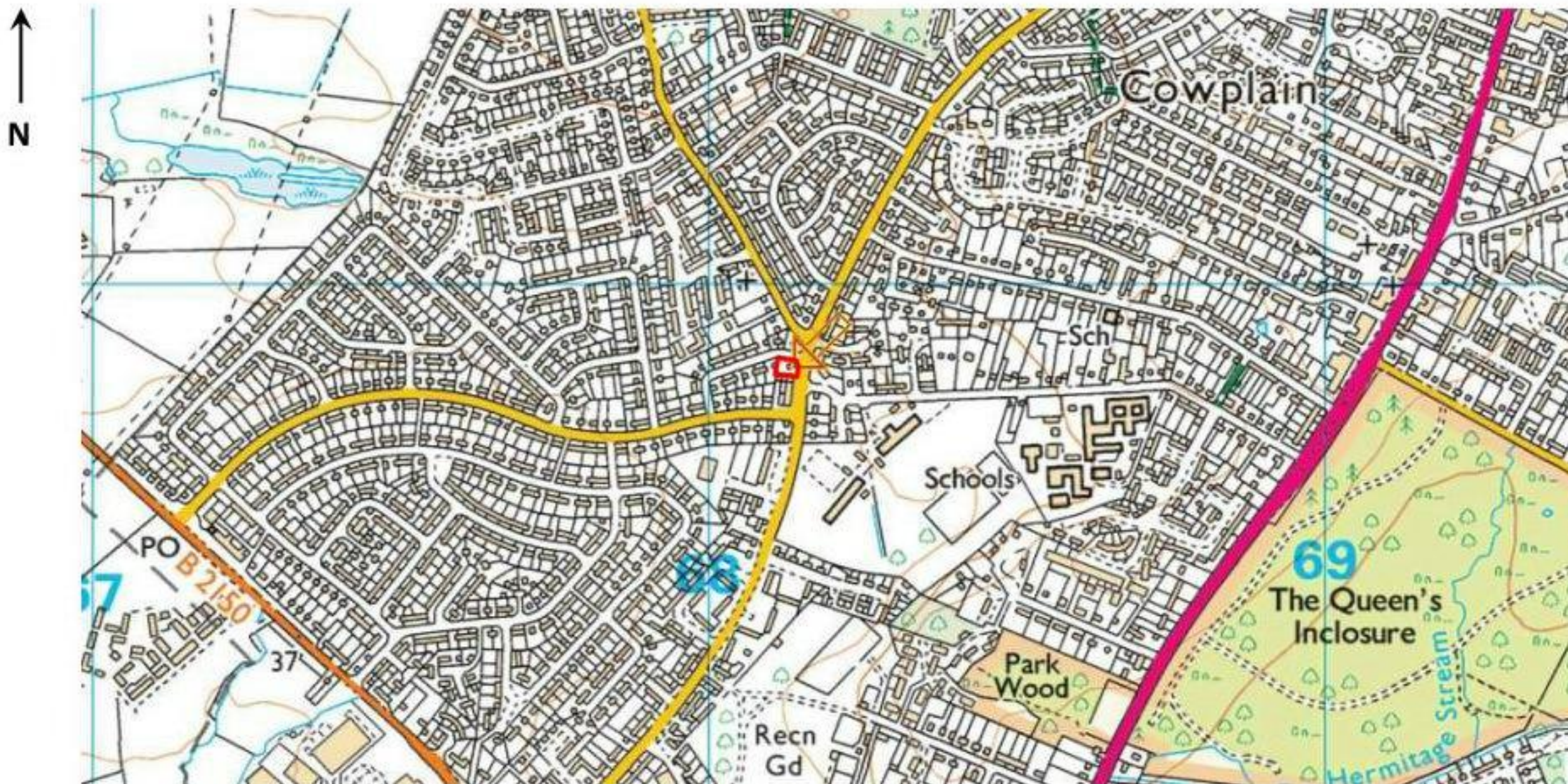
test certificates or be tested, either prior to placing (ideally) or after placing, to ensure that the human receptor cannot come into contact with compounds that could be detrimental to human health. The compounds that are to be tested for are those given in the LQM S4UL's, which can be viewed in Appendix E of this report.

7.9 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 were 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.



— APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project:

157 Milton Road, Cowplain, Hampshire PO8 8RE

Client:

Southern Co-operative Ltd and PD Scammell Ltd

Date:

May 2016

Ref:

GWPR1606

Site Location Plan

Figure 1

ground&water



— APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project:

157 Milton Road, Cowplain, Hampshire PO8 8RE

Client:

Southern Co-operative Ltd and PD Scammell Ltd

Date:

May 2016

Ref:

GWPR1606

Site Development Area

Figure 2

ground&water



— APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project:

157 Milton Road, Cowplain, Hampshire PO8 8RE

Client:

Southern Co-operative Ltd and PD Scammell Ltd

Date:

May 2016

Ref:

GWPR1606

Aerial View of Site

Figure 3

ground&water



— APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project:

157 Milton Road, Cowplain, Hampshire PO8 8RE

Client:

Southern Co-operative Ltd and PD Scammell Ltd

Date:

May 2016

Ref:

GWPR1606

Trial Hole Location Plan

Figure 4

ground&water

APPENDIX A

Conditions and Limitations

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 report has been prepared on the basis of information, data and materials which were available at the time of writing. Accordingly any conclusions, opinions or judgements made in the report should not be regarded as definitive or relied upon to the exclusion of other information, opinions and judgements.

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. No liability is accepted for any reliance placed on it by others unless specifically agreed in writing.

Any decisions made by you, or by any organisation, agency or person who has read, received or been provided with information contained in the report ("you" or "the Recipient") are decisions of the Recipient and we will not make, or be deemed to make, any decisions on behalf of any Recipient. We will not be liable for the consequences of any such decisions.

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.

Any Recipient must take into account any other factors apart from the Report of which they and their experts and advisers are or should be aware. The information, data, conclusions, opinions and judgements set out in the report may relate to certain contexts and may not be suitable in other contexts. It is your responsibility to ensure that you do not use the information we provide in the wrong context.

This report is based on readily available geological records, the recorded physical investigation, the strata observed in the works, together with the results of completed site and laboratory tests. Whilst skill and care has been taken to interpret these conditions likely between or below investigation points, the possibility of other characteristics not revealed cannot be discounted, for which no liability can be accepted. The impact of our assessment on other aspects of the development required evaluation by other involved parties.

The opinions expressed cannot be absolute due to the limitations of time and resources within the context of the agreed brief and the possibility of unrecorded previous in ground activities. The ground conditions have been sampled or monitored in recorded locations and tests for some of the more common chemicals generally expected. Other concentrations of types of chemicals may exist. It was not part of the scope of this report to comment on environment/contaminated land considerations.

The conclusions and recommendations relate to 157 Milton Road, Cowplain, Hampshire PO8 8RE.

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

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. Where trees are mentioned in the text this means existing trees, recently removed trees (approximately 15 years to full recovery on cohesive soils) and those planned as part of the site landscaping.

Ownership of copyright of all printed material including reports, laboratory test results, trial pit and borehole log sheets, including drillers log sheets, remain with Ground and Water Limited. Licence is for the sole use of the client and may not be assigned, transferred or given to a third party.

Recipients are not permitted to publish this report outside of their organisation without our express written consent.

APPENDIX B

Fieldwork Logs

Project Name
157 Milton Road

Project No.
GWPR1606

Co-ords: -

Hole Type
WLS

Location: Cowplain, Portsmouth PO8 8RE

Level: -

Scale
1:50

Client: Southern Co-ops

Dates: 14/03/2016

Logged By
MJ

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	D		0.25			CONCRETE	
		0.50	D		0.35			MADE GROUND: Pale brown gravelly sand. Sand is fine to coarse grained. Gravel is occasional, fine, sub-angular to sub-rounded flint. (Sub-base).	
		0.80	D					MADE GROUND: Brown gravelly very sandy clay. Sand is fine to coarse grained. Gravel is abundant, fine to coarse, sub-angular to sub-rounded carbonaceous material (coal/ash), cemented sands, flint, concrete and brick.	1
		1.00	SPT	N=10 (4,3/ 3,3,2,2)	1.30			HEAD DEPOSITS: Orange and red mottled slightly gravelly sandy CLAY. Sand is fine grained. Gravel is rare, fine to medium, sub-angular to sub-rounded flint.	2
		1.00	D					LAMBETH GROUP: Grey brown and orange/reddish brown mottled silty CLAY.	
		1.50	D						
		2.00	SPT	N=16 (2,3/ 3,4,4,5)	2.20				
		2.00	D						
		2.50	D						
		3.00	SPT	N=20 (3,4/ 4,4,6,6)					3
		3.00	D						
		3.50	D						
		4.00	SPT	N=25 (4,4/ 5,6,6,8)	4.45				4
		4.00	D						
								End of Borehole at 4.45 m	5
									6
									7
									8
									9

Remarks: No groundwater encountered.
Roots noted to 1.00m bgl.

Project Name
157 Milton Road

Project No.
GWPR1606

Co-ords: -

Hole Type
WLS

Location: Cowplain, Portsmouth PO8 8RE

Level: -

Scale
1:50

Client: Southern Co-ops

Dates: 14/03/2016

Logged By
MJ

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	D		0.25			CONCRETE	
		0.50	D		0.35			MADE GROUND: Pale brown/grey gravelly sand. Sand is fine to coarse grained. Gravel is occasional to abundant, fine to coarse, sub-angular to sub-rounded brick, concrete and flint (sub-base).	
		0.80	D		0.70			MADE GROUND: Dark brown sandy gravelly clay. Sand is fine to coarse grained. Gravel is abundant, fine to coarse, sub-angular to sub-rounded flint, brick, concrete and carbonaceous material (charcoal/ash).	1
		1.00	SPT	N=19 (4,6/ 5,4,5,5)				HEAD DEPOSITS: Brown sandy very gravelly CLAY. (Locally clayey sandy gravel). Sand is fine to coarse grained. Gravel is abundant, fine to coarse, sub-angular to sub-rounded flint.	2
		1.00	D					LAMBETH GROUP: Grey brown and orange/reddish brown mottled silty CLAY.	
		1.50	D						
		2.00	SPT	N=18 (2,3/ 4,4,4,6)	2.20				3
		2.00	D						
		2.50	D						
		3.00	SPT	N=24 (4,5/ 5,6,6,7)	3.20				4
		3.00	D						
		3.50	D						
		4.00	SPT	N=20 (2,2/ 3,4,6,7)	4.45				5
		4.00	D						6
								End of Borehole at 4.45 m	7
									8
									9

Remarks: Groundwater not encountered.
No roots noted.

WS3

Sheet 1 of 1

Project Name
157 Milton RoadProject No.
GWPR1606

Co-ords: -

Hole Type
WLS

Location: Cowplain, Portsmouth PO8 8RE

Level: -

Scale
1:50

Client: Southern Co-ops

Dates: 14/03/2016

Logged By
MJ

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	D		0.25			Steel reinforced CONCRETE	
		0.50	D		0.35			MADE GROUND: Pale brown gravelly sand. Sand is fine to coarse grained. Gravel is abundant, fine to medium, sub-angular to sub-rounded concrete, brick and flint (sub-base).	
		0.80	D		0.80			HEAD DEPOSITS: Orange/reddish brown sandy very gravelly CLAY. Sand is fine to coarse grained. Gravel is occasional to abundant, fine to coarse, sub-angular to sub-rounded flint.	1
		1.00	D		1.00			HEAD DEPOSITS: Dark greenish brown sandy, gravelly CLAY. Sand is fine to medium grained. Gravel is occasional, fine to coarse, sub-angular to sub-rounded flint. Black organic material noted. Slight hydrocarbon type odour noted.	2
								End of Borehole at 1.00 m	3
									4
									5
									6
									7
									8
									9

Remarks: No groundwater encountered.
 Roots noted to 0.50m bgl.
 Unable to progress borehole beyond 1.00m bgl due to sub-surface obstruction.



WS3A

Sheet 1 of 1

Project Name
157 Milton RoadProject No.
GWPR1606

Co-ords: -

Hole Type
WLS

Location: Cowplain, Portsmouth PO8 8RE

Level: -

Scale
1:50

Client: Southern Co-ops

Dates: 14/03/2016

Logged By
MJ

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.15			0.15			MADE GROUND: Brick Paving	
		0.25			0.25			MADE GROUND: Pale brown gravelly sand. Sand is fine to coarse grained. Gravel is occasional, fine to medium, sub-angular to sub-rounded brick and flint (sub-base).	
								NO RECOVERY	
		1.00	SPT	N=15 (4,5/ 6,5,3,1)	1.00			HEAD DEPOSITS: Orange brown sandy very gravelly CLAY. Sand is fine to coarse grained. Gravel is occasional to abundant, fine to coarse, sub-angular to sub-rounded flint.	1
		2.00	SPT	N=17 (2,3/ 3,4,5,5)	2.00			LAMBETH GROUP: Grey brown and orange/reddish brown mottled silty CLAY.	2
		3.00	D		3.00			LAMBETH GROUP: Grey and red mottled silty CLAY.	3
		3.50	D						
		3.75	SPT	N=21 (2,3/ 4,5,5,7)					
		4.00	D						
		4.20			4.20			End of Borehole at 4.20 m	4
									5
									6
									7
									8
									9

Remarks: No groundwater encountered.
No roots noted.
No recovery <1.00m bgl.



Project Name
157 Milton Road

Project No.
GWPR1606

Co-ords: -

Hole Type
WLS

Location: Cowplain, Portsmouth PO8 8RE

Level: -

Scale
1:50

Client: Southern Co-ops

Dates: 14/03/2016

Logged By
MJ

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.08			0.08			MADE GROUND: Brick paving over sharp sand.	
		0.20			0.20			MADE GROUND: Concrete	
		0.35			0.35			MADE GROUND: Pale brown gravelly clayey sand. Sand is fine to coarse grained. Gravel is occasional to abundant, fine to coarse, sub-angular to sub-rounded brick, concrete and flint.	
		0.50	D					HEAD DEPOSITS: Orange brown sandy very gravelly CLAY. Sand is fine to coarse grained. Gravel is occasional to abundant, fine to coarse, sub-angular to sub-rounded flint.	1
		0.80	D						
		1.00	SPT	N=8 (4,4/ 3,2,1,2)					
		1.00	D						
		1.50	D						
		1.70			1.70			HEAD DEPOSITS: Orange and red mottled slightly gravelly sandy CLAY. Sand is fine grained. Gravel is rare, fine to medium, sub-angular to sub-rounded flint.	2
		2.00	SPT	N=12 (2,2/ 2,3,3,4)					
		2.00	D		2.10				
		2.20	D		2.40			LAMBETH GROUP: Grey brown and orange/reddish brown mottled silty CLAY.	
		2.50	D					LAMBETH GROUP: Grey and red mottled silty CLAY.	
		3.00	SPT	N=14 (2,2/ 2,4,4,4)					3
		3.00	D						
		3.50	D						
		4.00	D						4
		4.45	SPT	N=19 (2,3/ 4,5,5,5)					
		4.95			4.95			End of Borehole at 4.95 m	5
									6
									7
									8
									9

Remarks: No groundwater encountered.
Roots noted to 3.00m bgl.

APPENDIX C
Geotechnical Laboratory Test Results



Summary of Natural Moisture Content, Liquid Limit and Plastic Limit Results

Job No.	Project Name	Programme	
20611	157 Milton Road, Cowplain P08 8RE	Samples received	23/03/2016
		Schedule received	21/03/2016
Project No.	Client	Project started	24/03/2016
GWPR1606	Ground and Water Ltd	Testing Started	31/03/2016

[illegible]

Test Methods: BS1377: Part 2: 1990:
Natural Moisture Content : clause 3.2
Atterberg Limits: clause 4.3 and 5.0

Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU

Tel: 01923 711 288
Email: James@k4soils.com

Checked and
Approved

Initials J.P

Date: 08/04/2016

2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

MSF-5-R1(b)



PARTICLE SIZE DISTRIBUTION

Job Ref 20611

Borehole/Pit No. WS2

Site Name 157 Milton Road, Cowplain P08 8RE

Sample No. -

Project No. GWPR1606 Client Ground and Water Ltd

Depth 2.00 m

Soil Description Brown clayey sandy GRAVEL (gravel is fmc and sub-angular to sub-rounded)

Sample Type D

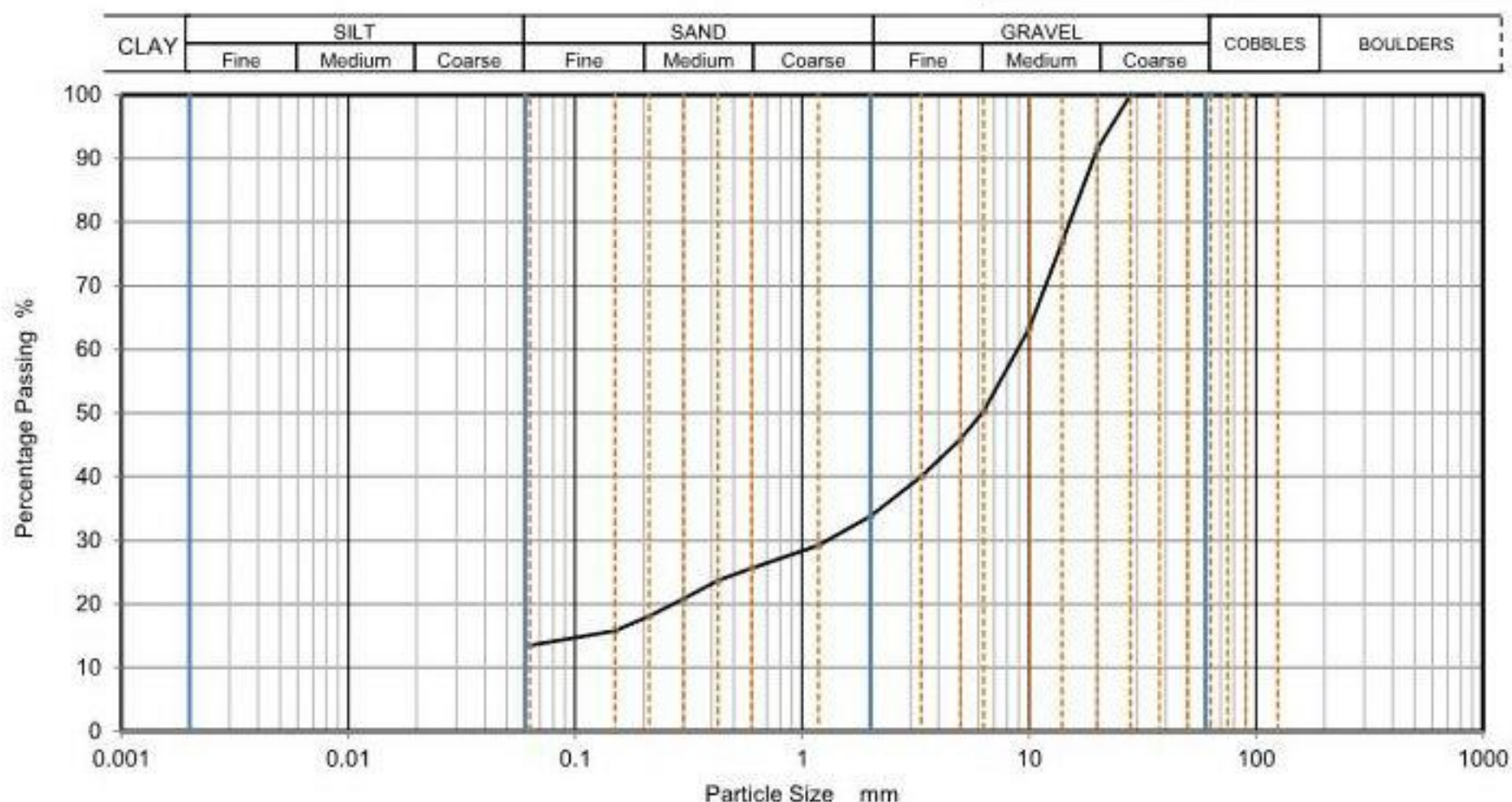
Samples received 23/03/2016

Schedules received 21/03/2016

Test Method BS1377:Part 2: 1990, clause 9.0

Project started 24/03/2016

Date tested 06/04/2016



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	92		
14	77		
10	63		
6.3	50		
5	46		
3.35	40		
2	34		
1.18	29		
0.6	26		
0.425	24		
0.3	21		
0.212	18		
0.15	16		
0.063	14		

Dry Mass of sample, g 385

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	66.2
Sand	20.3
Fines <0.063mm	13.5

Grading Analysis	
D100	mm
D60	mm 8.9
D30	mm 1.29
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks
Preparation and testing in accordance with BS1377 unless noted below



K4 Soils Laboratory
Unit 8, Olds Close, Watford, Herts, WD18 9RU

Email: james@k4soils.com
Tel: 01923 711288

Checked and Approved
Initials: J.P

Date: 08/04/2016



Sulphate Content (Gravimetric Method) for 2:1 Soil: Water Extract and pH Value - Summary of Results

Tested in accordance with BS1377 : Part 3 : 1990, clause 5.3 and clause 9

Job No.	Project Name	Programme	
20611	157 Milton Road, Cowplain P08 8RE	Samples received	23/03/2016
		Schedule received	21/03/2016
Project No.	Client	Project started	24/03/2016
GWPR1606	Ground and Water Ltd	Testing Started	01/04/2016

[illegible]

Test Report by K4 SOILS LABORATORY

Unit 8 Olds Close Olds Approach

Watford Herts WD18 9RU

Tel: 01923 711 288

Email: James@k4soils.com

Checked and
Approved

Initials J.P

Date: 08/04/2016

2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

MSF-5-R29

APPENDIX D
Chemical Laboratory Test Results



Francis Williams
Ground & Water Ltd
2 The Long Barn
Norton Farm
Selborne Road
Alton
Hampshire
GU34 3NB



QTS Environmental Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410
russell.jarvis@qtsenvironmental.com

QTS Environmental Report No: 16-42192

Site Reference: 157 Milton Road, Cowplain, Hampshire PO8 8RE

Project / Job Ref: GWPR1606

Order No: None Supplied

Sample Receipt Date: 23/03/2016

Sample Scheduled Date: 23/03/2016

Report Issue Number: 1

Reporting Date: 31/03/2016

Authorised by:

Russell Jarvis
Associate Director of Client Services
On behalf of QTS Environmental Ltd

Authorised by:

Kevin Old
Associate Director of Laboratory
On behalf of QTS Environmental Ltd

Soil Analysis Certificate

QTS Environmental Report No: 16-42192	Date Sampled	14/03/16	14/03/16	14/03/16	14/03/16	14/03/16
Ground & Water Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: 157 Milton Road, Cowplain, Hampshire PO8 8RE	TP / BH No	WS1	WS2	WS4	WS1	WS4
Project / Job Ref: GWPR1606	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	0.50	0.50	0.30	4.00	1.00
Reporting Date: 31/03/2016	QTSE Sample No	198318	198319	198320	198322	198323

Determinand	Unit	RL	Accreditation					
Asbestos Screen	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected		
pH	pH Units	N/a	MCERTS	8.8	9.0	9.5	8.4	8.2
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2		
Total Sulphate as SO ₄	mg/kg	< 200	NONE				309	247
Total Sulphate as SO ₄	%	< 0.02	NONE				0.03	0.02
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	65	60	142	26	71
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.06	0.06	0.14	0.03	0.07
Total Sulphur	%	< 0.02	NONE				< 0.02	< 0.02
Organic Matter	%	< 0.1	MCERTS	1.3	0.5	1		
Total Organic Carbon (TOC)	%	< 0.1	MCERTS	0.8	0.3	0.6		
Ammonium as NH ₄	mg/kg	< 0.5	NONE				5.1	4.9
Ammonium as NH ₄	mg/l	< 0.05	NONE				0.51	0.49
W/S Chloride (2:1)	mg/kg	< 1	MCERTS				35	19
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS				17.6	9.6
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	< 3	MCERTS				< 3	24
Water Soluble Nitrate (2:1) as NO ₃	mg/l	< 1.5	MCERTS				< 1.5	11.9
Arsenic (As)	mg/kg	< 2	MCERTS	6	4	8		
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1		
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2	< 0.2	< 0.2		
Chromium (Cr)	mg/kg	< 2	MCERTS	15	19	17		
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2		
Copper (Cu)	mg/kg	< 4	MCERTS	11	12	11		
Lead (Pb)	mg/kg	< 3	MCERTS	36	15	27		
W/S Magnesium	mg/l	< 0.1	NONE				3.9	0.8
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1		
Nickel (Ni)	mg/kg	< 3	MCERTS	9	10	8		
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3		
Vanadium (V)	mg/kg	< 2	NONE	30	29	29		
Zinc (Zn)	mg/kg	< 3	MCERTS	56	47	46		
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2		

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

Analysis carried out on the dried sample is corrected for the stone content

The samples have been examined to identify the presence of asbestiform minerals by polarising light microscopy and dispersion staining technique to In-House Procedures QTSE600 Determination of Asbestos in Bulk Materials; Asbestos in Soils/Sediments (fibre screening and identification)

This report refers to samples as received, and QTS Environmental Ltd, takes no responsibility for the accuracy or competence of sampling by others.

The material description shall be regarded as tentative and is not included in our scope of UKAS Accreditation.

Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.

Asbestos Analyst: Marcus Jones

RL: Reporting Limit

Pinch Test: Where pinch test is positive it is reported "Loose Fibres - PT" with type(s).

Subcontracted analysis ^(S)



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



Soil Analysis Certificate - Speciated PAHs

QTS Environmental Report No: 16-42192	Date Sampled	14/03/16	14/03/16	14/03/16		
Ground & Water Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: 157 Milton Road, Cowplain, Hampshire PO8 8RE	TP / BH No	WS1	WS2	WS4		
Project / Job Ref: GWPR1606	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	0.50	0.50	0.30		
Reporting Date: 31/03/2016	QTSE Sample No	198318	198319	198320		

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

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

Soil Analysis Certificate - TPH CWG Banded						
QTS Environmental Report No: 16-42192	Date Sampled	14/03/16	14/03/16	14/03/16	14/03/16	
Ground & Water Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: 157 Milton Road, Cowplain, Hampshire PO8 8RE	TP / BH No	WS1	WS2	WS4	WS3	
Project / Job Ref: GWPR1606	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	0.50	0.50	0.30	1.00	
Reporting Date: 31/03/2016	QTSE Sample No	198318	198319	198320	198321	

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

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



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Soil Analysis Certificate - BTEX / MTBE						
QTS Environmental Report No: 16-42192	Date Sampled	14/03/16	14/03/16	14/03/16	14/03/16	
Ground & Water Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: 157 Milton Road, Cowplain, Hampshire PO8 8RE	TP / BH No	WS1	WS2	WS4	WS3	
Project / Job Ref: GWPR1606	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	0.50	0.50	0.30	1.00	
Reporting Date: 31/03/2016	QTSE Sample No	198318	198319	198320	198321	

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

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

Soil Analysis Certificate - Volatile Organic Compounds (VOC)

QTS Environmental Report No: 16-42192	Date Sampled	14/03/16			
Ground & Water Ltd	Time Sampled	None Supplied			
Site Reference: 157 Milton Road, Cowplain, Hampshire PO8 8RE	TP / BH No	WS1			
Project / Job Ref: GWPR1606	Additional Refs	None Supplied			
Order No: None Supplied	Depth (m)	0.50			
Reporting Date: 31/03/2016	QTSE Sample No	198318			

Determinand	Unit	RL	Accreditation				
Dichlorodifluoromethane	ug/kg	< 5	MCERTS	< 5			
Vinyl Chloride	ug/kg	< 5	MCERTS	< 5			
Chloromethane	ug/kg	< 10	MCERTS	< 10			
Chloroethane	ug/kg	< 5	MCERTS	< 5			
Bromomethane	ug/kg	< 10	MCERTS	< 10			
Trichlorofluoromethane	ug/kg	< 5	MCERTS	< 5			
1,1-Dichloroethene	ug/kg	< 5	MCERTS	< 5			
MTBE	ug/kg	< 5	MCERTS	< 5			
trans-1,2-Dichloroethene	ug/kg	< 5	MCERTS	< 5			
1,1-Dichloroethane	ug/kg	< 5	MCERTS	< 5			
cis-1,2-Dichloroethene	ug/kg	< 5	MCERTS	< 5			
2,2-Dichloropropane	ug/kg	< 5	MCERTS	< 5			
Chloroform	ug/kg	< 5	MCERTS	< 5			
Bromochloromethane	ug/kg	< 5	MCERTS	< 5			
1,1,1-Trichloroethane	ug/kg	< 5	MCERTS	< 5			
1,1-Dichloropropene	ug/kg	< 10	MCERTS	< 10			
Carbon Tetrachloride	ug/kg	< 5	MCERTS	< 5			
1,2-Dichloroethane	ug/kg	< 5	MCERTS	< 5			
Benzene	ug/kg	< 2	MCERTS	< 2			
1,2-Dichloropropane	ug/kg	< 5	MCERTS	< 5			
Trichloroethene	ug/kg	< 5	MCERTS	< 5			
Bromodichloromethane	ug/kg	< 5	MCERTS	< 5			
Dibromomethane	ug/kg	< 5	MCERTS	< 5			
TAME	ug/kg	< 5	MCERTS	< 5			
cis-1,3-Dichloropropene	ug/kg	< 5	MCERTS	< 5			
Toluene	ug/kg	< 5	MCERTS	< 5			
trans-1,3-Dichloropropene	ug/kg	< 5	MCERTS	< 5			
1,1,2-Trichloroethane	ug/kg	< 10	MCERTS	< 10			
1,3-Dichloropropane	ug/kg	< 5	MCERTS	< 5			
Tetrachloroethene	ug/kg	< 5	MCERTS	< 5			
Dibromochloromethane	ug/kg	< 5	MCERTS	< 5			
1,2-Dibromoethane	ug/kg	< 5	MCERTS	< 5			
Chlorobenzene	ug/kg	< 5	MCERTS	< 5			
1,1,1,2-Tetrachloroethane	ug/kg	< 5	MCERTS	< 5			
Ethyl Benzene	ug/kg	< 2	MCERTS	< 2			
m,p-Xylene	ug/kg	< 2	MCERTS	< 2			
o-Xylene	ug/kg	< 2	MCERTS	< 2			
Styrene	ug/kg	< 5	MCERTS	< 5			
Bromoform	ug/kg	< 10	MCERTS	< 10			
Isopropylbenzene	ug/kg	< 5	MCERTS	< 5			
1,1,2,2-Tetrachloroethane	ug/kg	< 5	MCERTS	< 5			
1,2,3-Trichloropropane	ug/kg	< 5	MCERTS	< 5			
n-Propylbenzene	ug/kg	< 5	MCERTS	< 5			
Bromobenzene	ug/kg	< 5	MCERTS	< 5			
2-Chlorotoluene	ug/kg	< 5	MCERTS	< 5			
1,3,5-Trimethylbenzene	ug/kg	< 5	MCERTS	< 5			
4-Chlorotoluene	ug/kg	< 5	MCERTS	< 5			
tert-Butylbenzene	ug/kg	< 5	MCERTS	< 5			
1,2,4-Trimethylbenzene	ug/kg	< 5	MCERTS	< 5			
sec-Butylbenzene	ug/kg	< 5	MCERTS	< 5			
p-Isopropyltoluene	ug/kg	< 5	MCERTS	< 5			
1,3-Dichlorobenzene	ug/kg	< 5	MCERTS	< 5			
1,4-Dichlorobenzene	ug/kg	< 5	MCERTS	< 5			
n-Butylbenzene	ug/kg	< 5	MCERTS	< 5			
1,2-Dichlorobenzene	ug/kg	< 5	MCERTS	< 5			
1,2-Dibromo-3-chloropropane	ug/kg	< 10	MCERTS	< 10			
Hexachlorobutadiene	ug/kg	< 5	MCERTS	< 5			

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



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Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 16-42192	
Ground & Water Ltd	
Site Reference: 157 Milton Road, Cowplain, Hampshire PO8 8RE	
Project / Job Ref: GWPR1606	
Order No: None Supplied	
Reporting Date: 31/03/2016	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
198318	WS1	None Supplied	0.50	14	Light brown clay with brick and concrete
198319	WS2	None Supplied	0.50	13.5	Brown clay with stones
198320	WS4	None Supplied	0.30	10.7	Brown sandy clay with brick and concrete
198321	WS3	None Supplied	1.00	15.8	Brown clay with stones
198322	WS1	None Supplied	4.00	17.2	Brown clay
198323	WS4	None Supplied	1.00	11.2	Brown clay with stones

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

Insufficient Sample ^{U/S}

Unsuitable Sample ^{U/S}

Soil Analysis Certificate - Methodology & Miscellaneous Information

QTS Environmental Report No: 16-42192

Ground & Water Ltd

Site Reference: 157 Milton Road, Cowplain, Hampshire PO8 8RE

Project / Job Ref: GWPR1606

Order No: None Supplied

Reporting Date: 31/03/2016

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

D Dried
AR As Received

APPENDIX E
Soil Assessment Criteria

Appendix E

Soil Guideline Values and General Assessment Criteria

E1 Assessment Criteria

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

E1.1 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:

- 1) EA Science Report SC050021/SR2: *Human health toxicological assessment of contaminants in soil.*
- 2) EA Science Report SC050021/SR3: *Updated technical background to the CLEA model.*
- 3) EA CLEA Bulletin (2009).
- 4) CLEA software version 1.06 (2009)
- 5) Toxicological reports and SGV technical notes.

The CLEA guidance and tools:

- *do not cover other types of risk to humans, such as fire, suffocation or explosion, or short-term and acute exposures.*
- *do not cover risks to the environment, such as groundwater, ecosystems or buildings.*
- *do not provide a definitive test for telling when human health risks are significant.*
- *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.*

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.

E1.2 Land-use Scenarios

The CLEA model uses a range of standard land-use scenarios to develop conceptual exposure models as follows:

1 Residential (with home grown produce) (RwHP)

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 homegrown 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. (Residential without homegrown produce (RwoHP)).

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.

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).

E1.4 **LQM/CIEH SUITABLE 4 USE LEVELS (S4UL)**

For derivation of these S4UL reference must be made to:

Nathanial, P., McCaffrey, C., Gillet, A., Ogden, R., Nathanial, J., *The LQM/CIEH S4UL's for Human Health Risk Assessment*. Land Quality Press. 2015

The LQM/CIEH S4UL for a given land use is the concentration of the contaminant in soil at which the predicted daily exposure, as calculated by the CLEA software, equals the Health Criteria Value.

The final output for each contaminant represents a synthesis of new toxicological (and fate and transport) reviews published since the preparation of the 2nd edition LQM/CIEH GAC's (Nathanial et al., 2009).

In the derivation of LQM/CIEH S4UL's the principles of 'minimal' or 'tolerable' risk enshrined in SR2, which has not been withdrawn, has been maintained.

S4UL's have been derived for the basic CLEA land-uses, as described above, and for two new land uses:

- Public Open Spaces near Residential Housing (POSresi)
- Public Park (POSpark).

Public Open Spaces near Residential Housing (POSresi)

Includes the predominantly grassed areas adjacent to high density housing, the central green area on many 1930's – 1970's housing estates, and smaller areas commonly incorporated in newer developments as informal grassed areas or more formal landscaped areas with a mixture of open space and covered soils with planting. It is assumed that the close proximity to the place of residence will allow tracking back of soil to occur.

Public Park (POSpark)

An area of open space, usually owned and maintained by the local authority, provided for recreational uses including family visits and picnics, children's play area, informal sporting activities (not a dedicated sports pitch), and dog walking. It is assumed that tracking back of soils into places of residence will be negligible.

E1.5 Category 4 Screening Levels (C4SLs)

In the case of Lead, no SGV or GAC has been published to date. This is likely to be due to the toxicity review that is currently being undertaken by the Environment Agency. In the absence of updated toxicity information the SGV derived using CLEA 1.06 methodology and related toxicity will be used.

The overall objective of the C4SLs research project was to assist the provision of technical guidance in support of Defra's revised Statutory Guidance (SG) for Part 2A of the Environmental Protection Act 1990 (Part 2A) (Defra, 2012a). Specifically, the project aimed to deliver:

- A methodology for deriving C4SLs for four generic land-uses comprising residential, commercial, allotments and public open space; and
- A demonstration of the methodology, via the derivation of C4SLs for six substances – arsenic, benzene, benzo(a)pyrene, cadmium, chromium (VI) and lead.

To help achieve a more targeted approach to identifying and managing contaminated land in relation to the risk (or possibility) of harm to human health, the revised SG presented a new four category system for considering land under Part 2A, ranging from Category 4, where there is no risk that land poses a

significant possibility of significant harm (SPOSH), or the level of risk is low, to Category 1, where the risk that land poses a significant possibility of significant harm (SPOSH) is unacceptably high. More specific guidance on what type of land should be considered as Category 4 (Human Health) is provided in Paragraphs 4.21 and 4.22 of the revised SG, as follows:

“4.21 The local authority should consider that the following types of land should be placed into Category 4: Human Health:

(a) Land where no relevant contaminant linkage has been established.

(b) Land where there are only normal levels of contaminants in soil, as explained in Section 3 of this Guidance.

(c) Land that has been excluded from the need for further inspection and assessment because contaminant levels do not exceed relevant generic assessment criteria in accordance with Section 3 of this Guidance, or relevant technical tools or advice that may be developed in accordance with paragraph 3.30 of this Guidance.

(d) Land where estimated levels of exposure to contaminants in soil are likely to form only a small proportion of what a receptor might be exposed to anyway through other sources of environmental exposure (e.g. in relation to average estimated national levels of exposure to substances commonly found in the environment, to which receptors are likely to be exposed in the normal course of their lives).

4.22 The local authority may consider that land other than the types described in paragraph 4.21 should be placed into Category 4: Human Health if following a detailed quantitative risk assessment it is satisfied that the level of risk posed is sufficiently low.”

The C4SLs are intended as “relevant technical tools” (in relation to Paragraph 4.21(c)) to help local authorities and others when deciding to stop further assessment of a site, on the grounds that it falls within Category 4 (Human Health).

The Impact Assessment (IA), which accompanied the revised SG (Defra, 2012b) provides further information on the nature and potential role of the C4SLs. Paragraph 47(h) of the IA states that:

“The new statutory guidance will bring about a situation where the current SGVs/GACs are replaced with more pragmatic (but still strongly precautionary) Category 4 screening levels (C4SLs) which will provide a higher simple test for deciding that land is suitable for use and definitely not contaminated land.”

A key distinction between the Soil Guideline Values (SGVs) and the C4SLs is the level of risk that they describe. As described by the Environment Agency (2009a):
“SGVs are guidelines on the level of long-term human exposure to individual chemicals in soil that, unless stated otherwise, are tolerable or pose a minimal risk to human health.”

The implication of Paragraph 47(h) of the IA is that minimal risk is well within Category 4 and that the C4SLs should describe a higher level of risk which, whilst not minimal, can still be considered low enough to allow a judgement to be made

that land containing substances at, or below, the C4SLs would typically fall within Category 4. This reflects Paragraph 4.20 of the revised SG, which states:

“4.20 The local authority should not assume that land poses a significant possibility of significant harm if it considers that there is no risk or that the level of risk posed is low. For the purposes of this Guidance, such land is referred to as a “Category 4: Human Health” case. The authority may decide that the land is a Category 4: Human Health case as soon as it considers it has evidence to this effect, and this may happen at any stage during risk assessment including the early stages.”

C4SLs, therefore, should not be viewed as “SPOSH levels” and they should not be used as a legal trigger for the determination of land under Part 2A.

The generic screening values referred to before usually take the form of risk-based Soil Guideline Values (SGVs) or other Generic Assessment Criteria (GACs) that are most typically derived using the Environment Agency's Contaminated Land Exposure Assessment (CLEA) model, as described in the Environment Agency's SR2, SR3 and SR7 reports (EA, 2009b & c; EA, 2008). It is anticipated that C4SLs will be used in a similar manner; as generic screening criteria that can be used within a GQRA, albeit describing a higher level of risk than the SGVs.

The suggested approach to the development of C4SLs consists of the retention and use of the CLEA framework, modified according to considerations of the underlying science within the context of Defra's policy objectives relating to the revised SG. Within this context, it is suggested that the development of C4SLs may be achieved in one of three ways, namely:

- By modifying the toxicological parameters used within CLEA (while maintaining current exposure parameters);
- By modifying the exposure parameters embedded within CLEA (while maintaining current toxicological “minimal risk” interpretations); and
- By modifying both toxicological and exposure parameters.

There is also a suggested check on “other considerations” (e.g., background levels, epidemiological data, sources of uncertainty) within the approach, applicable to all three options.

It is suggested that a new term is defined for the toxicological guidance values associated with the derivation of C4SLs – a Low Level of Toxicological Concern (LLTC). A LLTC should represent an intake of low concern that remains suitably protective of health, and definitely does not approach an intake level that could be defined as SPOSH.

E1.6 CL:AIRE Generic Assessment Criteria (GAC)

For derivation of the CL:AIRE Generic Assessment Criteria (GAC) reference should be made to the following report:

CL:AIRE, *The Soil Generic Assessment Criteria for Human Health Risk Assessment. Contaminated Land: Applications in the Real Environment*, 2009.

Within this report CL:AIRE provided Generic Assessment Criteria (GAC's) in accordance with the CLEA software and the principles outlined above for a further 35 contaminants sometime encountered on land affected by contamination.

E1.7 Detailed Quantitative Risk Assessments (DQRA)

Where the adoption of an S4UL/GAC/C4SL is not appropriate, for instance when the intended land-use is at variance the CLEA standard land-uses then a DQRA may be undertaking 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.

E1.8 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.*

E1.8 Statistical Tests

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

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

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

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

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

Treatment of Hot-Spots

⇒ A statistical test is applied to establish whether the data is a part of a single set, or whether data outliers are present.

⇒ Provided that the data is based on random sampling and no distinct contamination source was present at the sampling location, the hot-spot(s) may be excluded and the mean of the remaining data assessed.

E2 Ground and Water Limited Soil Assessment Criteria

The Soil Assessment Criteria used in the preparation of this report are tabulated in the following pages:

C4SL Low Level of Toxicological Concern

C4SL Low Level of Toxicological Concern						
Contaminant	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Lead	<210	<330	<84	<6000	<760	<1400

Phytotoxicity Recommendations

ICRCL 70/90 Restoration of metalliferous mining areas

Phytotoxicity (Harmful to Plants) Threshold Trigger Values	
Copper	250mg/kg
Zinc	1000mg/kg
Notes: Many cultivars and specifically grasses have a high tolerance and there will be no ill-effect at the threshold trigger values given for neutral or near neutral pH. Site observation of plant vitality may give additional guidance.	

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LQM CIEH Suitable 4 Use Levels (S4UL's)

LQM/CIEH Suitable 4 Use Levels – Metals and Semi-metals						
Contaminant	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
<i>Metals:</i>						
Arsenic	37	40	43	640	79	170
Beryllium	1.7	1.7	35	12	2.2	63
Boron	290	11000	45	240000	21000	46000
Cadmium	11	85	1.9	190	120	532
Chromium (III)	910	910	18000	8600	1500	33000
Chromium (VI)	6	6	1.8	33	7.7	20
Copper	2400	7100	520	68000	12000	44000
Elemental Mercury	1.2	1.2	21	58	16	30
Inorganic Mercury	40	56	19	1100	120	240
Methylmercury	11	15	6	320	40	68
Nickel	180	180	230	980	230	3400
Selenium	250	430	88	12000	1100	1800
Vanadium	410	1200	91	9000	2000	5000
Zinc	3700	40000	620	730000	81000	170000

LQM/CIEH Suitable 4 Use Levels – BTEX Compounds							
Contaminant	Soil Organic Matter	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Benzene	1.0% SOM	0.087	0.38	0.017	27	72	90
	2.5% SOM	0.170	0.70	0.034	47	72	100
	6.0% SOM	0.370	1.40	0.075	90	73	110
Toluene	1.0% SOM	130	880	22	56000	56000	87000
	2.5% SOM	290	1900	51	110000	56000	95000
	6.0% SOM	660	3900	120	180000	56000	100000
Ethylbenzene	1.0% SOM	47	83	16	5700	24000	17000
	2.5% SOM	110	190	39	13000	24000	22000
	6.0% SOM	260	440	91	27000	25000	27000
o-Xylene	1.0% SOM	60	88	28	6600	41000	17000
	2.5% SOM	140	210	67	15000	42000	24000
	6.0% SOM	330	480	160	33000	43000	33000
m-Xylene	1.0% SOM	59	82	31	6200	41000	17000
	2.5% SOM	140	190	74	14000	42000	24000
	6.0% SOM	320	450	170	31000	43000	33000
p-Xylene	1.0% SOM	56	79	29	5900	41000	17000
	2.5% SOM	130	180	69	14000	42000	23000
	6.0% SOM	310	430	160	30000	43000	31000
The most health protective value in each scenario for Xylene is highlighted in bold.							

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LQM/CIEH Suitable 4 Use Levels For TPH							
Aliphatic		RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
EC 5-6	1.0% SOM	42	42	730	3,200 (304) ^{sol}	570,000 (304) ^{sol}	95,000 (304) ^{sol}
	2.5% SOM	78	78	1,700	5,900 (558) ^{sol}	590,000	130,000 (558) ^{sol}
	6.0% SOM	160	160	3,900	12,000 (1150) ^{sol}	600,000	180,000 (1150) ^{sol}
EC >6-8	1.0% SOM	100	100	2,300	7,800 (144) ^{sol}	600,000	150,000 (144) ^{sol}
	2.5% SOM	230	230	5,600	17,000 (322) ^{sol}	610,000	220,000 (322) ^{sol}
	6.0% SOM	530	530	13,000	40,000 (736) ^{sol}	620,000	320,000 (736) ^{sol}
EC >8-10	1.0% SOM	27	27	320	2,000 (78) ^{sol}	13,000	14,000 (78) ^{sol}
	2.5% SOM	65	65	770	4,800 (118) ^{vap}	13,000	18,000 (118) ^{vap}
	6.0% SOM	150	150	1,700	11,000 (451) ^{vap}	13,000	21,000 (451) ^{vap}
EC >10-12	1.0% SOM	130 (48) ^{vap}	130 (48) ^{vap}	2,200	9,700 (48) ^{sol}	13,000	21,000 (48) ^{sol}
	2.5% SOM	330 (118) ^{vap}	330 (118) ^{vap}	4,400	23,000 (118) ^{vap}	13,000	23,000 (118) ^{vap}
	6.0% SOM	760 (283) ^{vap}	770 (283) ^{vap}	7,300	47,000 (283) ^{vap}	13,000	24,000 (283) ^{vap}
EC >12-16	1.0% SOM	1,100 (24) ^{sol}	1,100 (24) ^{sol}	11,000	59,000 (24) ^{sol}	13,000	25,000 (24) ^{sol}
	2.5% SOM	2,400 (59) ^{sol}	2,400 (59) ^{sol}	13,000	82,000 (59) ^{sol}	13,000	25,000 (59) ^{sol}
	6.0% SOM	4,300 (142) ^{sol}	4,400 (142) ^{sol}	13,000	90,000 (142) ^{sol}	13,000	26,000 (142) ^{sol}
EC >16-35	1.0% SOM	65,000 (8.48) ^{sol}	65,000 (8.48) ^{sol}	260,000	1,600,000	250,000	450,000
	2.5% SOM	92,000 (21) ^{sol}	92,000 (21) ^{sol}	270,000	1,700,000	250,000	480,000
	6.0% SOM	110,000	110,000	270,000	1,800,000	250,000	490,000
EC >35-44	1.0% SOM	65,000 (8.48) ^{sol}	65,000 (8.48) ^{sol}	260,000	1,600,000	250,000	450,000
	2.5% SOM	92,000 (21) ^{sol}	92,000 (21) ^{sol}	270,000	1,700,000	250,000	480,000
	6.0% SOM	110,000	110,000	270,000	1,800,000	250,000	490,000

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LQM/CIEH Sutable 4 Use Levels For TPH							
Aromatic		RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
EC 5-7 (Benzene)	1.0% SOM	70	370	13	26,000 (1220) ^{sol}	56,000	76,000 (1220) ^{sol}
	2.5% SOM	140	690	27	46,000 (2260) ^{sol}	56,000	84,000 (2260) ^{sol}
	6.0% SOM	300	1,400	57	86,000 (4710) ^{sol}	56,000	92,000 (4710) ^{sol}
EC >7-8 (Toluene)	1.0% SOM	130	860	22	56,000 (869) ^{vap}	56,000	87,000 (869) ^{sol}
	2.5% SOM	290	1,800	51	110,000 (1920) ^{sol}	56,000	95,000 (1920) ^{sol}
	6.0% SOM	660	3,900	120	180,000 (4360) ^{vap}	56,000	100,000 (4360) ^{vap}
EC >8-10	1.0% SOM	34	47	8.6	3,500 (613) ^{vap}	5,000	7,200 (613) ^{vap}
	2.5% SOM	83	110	21	8,100 (1500) ^{vap}	5,000	8,500 (1500) ^{vap}
	6.0% SOM	190	270	51	17,000 (3850) ^{vap}	5,000	9,300 (3580) ^{vap}
EC >10-12	1.0% SOM	74	250	13	16,000 (364) ^{sol}	5,000	9,200 (364) ^{sol}
	2.5% SOM	180	590	31	28,000 (899) ^{sol}	5,000	9,700 (889) ^{sol}
	6.0% SOM	380	1,200	74	34,000 (2150) ^{sol}	5,000	10,000
EC >12-16	1.0% SOM	140	1,800	23	36,000 (169) ^{sol}	5,100	10,000
	2.5% SOM	330	2,300 (419) ^{sol}	57	37,000	5,100	10,000
	6.0% SOM	660	2,500	130	38,000	5,000	10,000
EC >16-21	1.0% SOM	260	1,900	46	28,000	3,800	7,600
	2.5% SOM	540	1,900	110	28,000	3,800	7,700
	6.0% SOM	930	1,900	260	28,000	3,800	7,800
EC >21-35	1.0% SOM	1,100	1,900	370	28,000	3,800	7,800
	2.5% SOM	1,500	1,900	820	28,000	3,800	7,800
	6.0% SOM	1,700	1,900	1,600	28,000	3,800	7,900
EC >35-44	1.0% SOM	1,100	1,900	370	28,000	3,800	7,800
	2.5% SOM	1,500	1,900	820	28,000	3,800	7,800
	6.0% SOM	1,700	1,900	1,600	28,000	3,800	7,900
EC >44-70	1.0% SOM	1,600	1,900	1,200	28,000	3,800	7,800
	2.5% SOM	1,800	1,900	2,100	28,000	3,800	7,800
	6.0% SOM	1,900	1,900	3,000	28,000	3,800	7,900

SOM = Soil Organic Matter Content (%)

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LQM/CIEH Suitable 4 Use Levels For Polycyclic Aromatic Hydrocarbons (PAH's)

Determinants		RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Acenaphthene	1.0% SOM	210	3,000 (57.0) ^{sol}	34	84,000(57.0) ^{sol}	15,000	29,000
	2.5% SOM	510	4,700(141) ^{sol}	85	97,000(141) ^{sol}	15,000	30,000
	6.0% SOM	1100	6,000(336) ^{sol}	200	100,000	15,000	30,000
Acenaphthylene	1.0% SOM	170	2,900(86.1) ^{sol}	28	83,000(86.1) ^{sol}	15,000	29,000
	2.5% SOM	420	4,600(212) ^{sol}	69	97,000(212) ^{sol}	15,000	30,000
	6.0% SOM	920	6,000(506) ^{sol}	160	100,000	15,000	30,000
Anthracene	1.0% SOM	2,400	31,000(1.17) ^{vap}	380	520,000	74,000	150,000
	2.5% SOM	5,400	35,000	950	540,000	74,000	150,000
	6.0% SOM	11,000	37,000	2,200	540,000	74,000	150,000
Benzo(a)anthracene	1.0% SOM	7.20	11	2.90	170	29	49
	2.5% SOM	11	14	6.50	170	29	56
	6.0% SOM	13	15	13	180	29	62
Benzo(a)pyrene	1.0% SOM	2.20	3.20	0.97	35	5.70	11
	2.5% SOM	2.70	3.20	2.00	35	5.70	12
	6.0% SOM	3.00	3.20	3.50	36	5.70	13
Benzo(b)fluoranthene	1.0% SOM	2.60	3.90	0.99	44	7.10	13
	2.5% SOM	3.30	4.00	2.10	44	7.20	15
	6.0% SOM	3.70	4.00	3.90	45	7.20	16
Benzo(ghi)perylene	1.0% SOM	320	360	290	3,900	640	1,400
	2.5% SOM	340	360	470	4,000	640	1,500
	6.0% SOM	350	360	640	4,000	640	1,600
Benzo(k)fluoranthene	1.0% SOM	77	110	37	1,200	190	370
	2.5% SOM	93	110	75	1,200	190	410
	6.0% SOM	100	110	130	1,200	190	440
Chrysene	1.0% SOM	15	30	4.10	350	57	93
	2.5% SOM	22	31	9.40	350	57	110
	6.0% SOM	27	32	19	350	57	120
Dibenzo(ah)anthracene	1.0% SOM	0.24	0.31	0.14	3.50	0.57	1.10
	2.5% SOM	0.28	0.32	0.27	3.60	0.57	1.30
	6.0% SOM	0.30	0.32	0.43	3.60	0.58	1.40

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LQM/CIEH Suitable 4 Use Levels For Polycyclic Aromatic Hydrocarbons (PAH's)							
Determinants		RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Flouranthene	1.0% SOM	280	1,500	52	2,3000	3,100	6,300
	2.5% SOM	560	1,600	130	2,3000	3,100	6,300
	6.0% SOM	890	1,600	290	2,3000	3,100	6,300
Flourene	1.0% SOM	170	2,800 (30.9) ^{sol}	27	63,000(30.9) ^{sol}	9,900	20,000
	2.5% SOM	400	3,800(76.5) ^{sol}	67	68,000	9,900	20,000
	6.0% SOM	860	4,500(183) ^{sol}	160	71,000	9,900	20,000
Indeno(123-cd)pyrene	1.0% SOM	27	45	9.50	500	82	150
	2.5% SOM	36	46	21	510	82	170
	6.0% SOM	41	46	39	510	82	180
Napthalene	1.0% SOM	2.30	2.6	4.10	190 ^f (76.4) ^{sol}	4,900 ^f	1,200 ^f (76.4) ^{sol}
	2.5% SOM	5.60	5.6	10	460 ^f (183) ^{sol}	4,900 ^f	1,900 ^f (183) ^{sol}
	6.0% SOM	13	13	24	1,100 ^f (432) ^{sol}	4,900 ^f	3,000
Phenanthrene	1.0% SOM	95	1,300(183) ^{sol}	18	22,000	3,100	6,200
	2.5% SOM	220	1,500	38	22,000	3,100	6,200
	6.0% SOM	440	1,500	90	23,000	3,100	6,300
Pyrene	1.0% SOM	620	3,700	110	54,000	7,400	15,000
	2.5% SOM	1200	3,800	270	54,000	7,400	15,000
	6.0% SOM	2000	3,800	620	54,000	7,400	15,000
Coal Tar (Benzo(a)pyrene used as marker compound)	1.0% SOM	0.79	1.2	0.32	15	2.20	4.40
	2.5% SOM	0.98	1.2	0.67	15	2.20	4.70
	6.0% SOM	1.10	1.2	1.20	15	2.20	4.80

^{vap} – GAC presented exceeds the vapour saturation limit, which is presented in brackets.

^{sol} – GAC presented exceeds the soil saturation limit, which is presented in brackets.

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LQM/CIEH Suitable 4 Use Levels (cont.)

LQM CIEH General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds						
Contaminant	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Chloroalkanes & alkenes						
1,2 Dichloroethane						
1.0% SOM	0.0071	0.0092	0.0046	0.67	29	21
2.5% SOM	0.011	0.013	0.0083	0.97	29	24
6.0% SOM	0.019	0.023	0.016	1.70	29	28
1,1,2,2 Tetrachloroethane						
1.0% SOM	1.60	3.90	0.41	270	1,400	1,800
2.5% SOM	3.40	8.00	0.89	550	1,400	2,100
6.0% SOM	7.50	17	2.00	1,100	1,400	2,300
1,1,1,2 Tetrachloroethane						
1.0% SOM	1.20	1.50	0.79	110	1,400	1,500
2.5% SOM	2.80	3.50	1.90	250	1,400	1,800
6.0% SOM	6.40	8.20	4.40	560	1,400	2,100
Tetrachloroethene						
1.0% SOM	0.18	0.18	0.65	19	1,400	810 ^{sol} (424)
2.5% SOM	0.39	0.40	1.50	42	1,400	1,100 ^{sol} (951)
6.0% SOM	0.90	0.92	3.60	95	1,400	1,500
1,1,1 Trichloroethane						
1.0% SOM	8.80	9.00	48	660	140,000	57,000 ^{vap} (1425)
2.5% SOM	18	18	110	1,300	140,000	76,000 ^{vap} (2915)
6.0% SOM	39	40	240	3,000	140,000	100,000 ^{vap} (6392)
Tetrachloromethene						
1.0% SOM	0.026	0.026	0.45	2.90	890	190
2.5% SOM	0.056	0.056	1.00	6.30	920	270
6.0% SOM	0.130	0.130	2.40	14	950	400
Trichloroethene						
1.0% SOM	0.016	0.017	0.041	1.20	120	70
2.5% SOM	0.034	0.036	0.091	2.60	120	91
6.0% SOM	0.075	0.080	0.210	5.70	120	120
Trichloromethane						
1.0% SOM	0.91	1.20	0.42	99	2,500	2,600
2.5% SOM	1.70	2.10	0.83	170	2,500	2,800
6.0% SOM	3.40	4.20	1.70	350	2,500	3,100
Vinyl Chloride						
1.0% SOM	0.00064	0.00077	0.00055	0.059	3.50	4.80
2.5% SOM	0.00087	0.00100	0.00100	0.077	3.50	5.00
6.0% SOM	0.00014	0.00150	0.00180	0.120	3.50	5.40

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LQM CIEH General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds						
Contaminant	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Explosives						
2,4,6 Trinitrotoluene						
1.0% SOM	1.60	65	0.24	1,000	130	260
2.5% SOM	3.70	66	0.58	1,000	130	270
6.0% SOM	8.10	66	1.40	1,000	130	270
RDX (Hexogen/Cyclonite/1,3,5- trinitro-1,3,5- triazacyclohexane)						
1.0% SOM	120	13,000	17	210,000	26,000	49,000(18.7) ^{sol}
2.5% SOM	250	13,000	38	210,000	26,000	51,000
6.0% SOM	540	13,000	85	210,000	27,000	53,000
HMX (Octogen/1,3,5,7- tetrenitro-1,3,5,7- tetrazacyclo-octane)						
1.0% SOM	5.70	67,00	0.86	110,000	13,000	23,000(0.35) ^{vap}
2.5% SOM	13	67,00	1.90	110,000	13,000	23,000(0.39) ^{vap}
6.0% SOM	26	67,00	3.90	110,000	13,000	24,000(0.48) ^{vap}
Atrazine						
1.0% SOM	3.30	610	0.50	9,300	1,200	2,300
2.5% SOM	7.60	620	1.20	9,400	1,200	2,400
6.0% SOM	17.40	620	2.70	9,400	1,200	2,400
Pesticides						
Aldrin						
1.0% SOM	5.70	7.30	3.20	170	18	30
2.5% SOM	6.60	7.40	6.10	170	18	31
6.0% SOM	7.10	7.50	9.60	170	18	31
Dieldrin						
1.0% SOM	0.97	7.00	0.17	170	18	30
2.5% SOM	2.00	7.30	0.41	170	18	30
6.0% SOM	3.50	7.40	0.96	170	18	31
Dichlorvos						
1.0% SOM	0.032	6.40	0.0049	140	16	26
2.5% SOM	0.066	6.50	0.0100	140	16	26
6.0% SOM	0.140	6.60	0.0220	140	16	27
Alpha - Endosulfan						
1.0% SOM	7.40	160(0.003) ^{vap}	1.20	5,600(0.003) ^{vap}	1,200	2,400
2.5% SOM	18	280(0.007) ^{vap}	2.90	7,400(0.007) ^{vap}	1,200	2,400
6.0% SOM	41	410(0.016) ^{vap}	6.80	8,400(0.016) ^{vap}	1,200	2,400

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LQM CIEH General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds						
Contaminant	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Pesticides						
Beta - Endosulfan						
1.0% SOM	7.00	190(0.00007) ^{vap}	1.10	6,300(0.00007) ^{vap}	1,200	2,400
2.5% SOM	17	320(0.0002) ^{vap}	2.70	7,800(0.0002) ^{vap}	1,200	2,400
6.0% SOM	39	440(0.0004) ^{vap}	6.40	8700	1,200	2,500
Alpha - Hexachlorocyclohexanes						
1.0% SOM	0.23	6.90	0.035	170	24	47
2.5% SOM	0.55	9.20	0.087	180	24	48
6.0% SOM	1.20	11	0.210	180	24	48
Beta - Hexachlorocyclohexanes						
1.0% SOM	0.085	3.70	0.013	65	8.10	15
2.5% SOM	0.200	3.80	0.032	65	8.10	15
6.0% SOM	0.460	3.80	0.077	65	8.10	16
Gamma - Hexachlorocyclohexanes						
1.0% SOM	0.06	2.90	0.0092	67	8.2	14
2.5% SOM	0.14	3.30	0.0230	69	8.2	15
6.0% SOM	0.33	3.50	0.0540	70	8.2	15
Chlorobenzenes						
Chlorobenzene						
1.0% SOM	0.46	0.46	5.90	56	11,000	1,300(675) ^{sol}
2.5% SOM	1.00	1.00	14	130	13,000	2,000(1520) ^{sol}
6.0% SOM	2.40	2.40	32	290	14,000	2,900
1,2-Dichlorobenzene						
1.0% SOM	23	24	94	2,000 (571) ^{sol}	90,000	24,000(571) ^{sol}
2.5% SOM	55	57	230	4,800 (1370) ^{sol}	95,000	36,000(1370) ^{sol}
6.0% SOM	130	130	540	11,000 (3240) ^{sol}	98,000	51,000(3240) ^{sol}
1,3-Dichlorobenzene						
1.0% SOM	0.40	0.44	0.25	30	300	390
2.5% SOM	1.00	1.10	0.60	73	300	440
6.0% SOM	2.30	2.50	1.50	170	300	470
1,4-Dichlorobenzene						
1.0% SOM	61	61	15	4,400 (224) ^{vap}	17,000 ^B	36,000 (224) ^{vap}
2.5% SOM	150	150	37	10,000 (540) ^{vap}	17,000 ^B	36,000 (540) ^{vap}
6.0% SOM	350	350	88 ^B	25,000 (1280) ^{vap}	17,000 ^B	36,000 (1280) ^{vap}
1,2,3,-Trichlorobenzene						
1.0% SOM	1.50	1.50	4.70	102	1,800	770(134) ^{vap}
2.5% SOM	3.60	3.70	12	250	1,800	1,100(330) ^{vap}
6.0% SOM	8.60	8.80	28	590	1,800	1,600(789) ^{vap}

Cont'd Overleaf:

**LQM CIEH General Assessment Criteria:
Volatile and Semi-Volatile Organic Compounds**

Contaminant	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Chlorobenzenes						
1,2,3,- Trichlorobenzene						
1.0% SOM	1.50	1.50	4.70	102	1,800	770(134) ^{vap}
2.5% SOM	3.60	3.70	12	250	1,800	1,100(330) ^{vap}
6.0% SOM	8.60	8.80	28	590	1,800	1,600(789) ^{vap}
1,2,4,- Trichlorobenzene						
1.0% SOM	2.60	2.60	55	220	15,000	1,700(318) ^{vap}
2.5% SOM	6.40	6.40	140	530	17,000	2,600(786) ^{vap}
6.0% SOM	15	15	320	1,300	19,000	4,000(1880) ^{vap}
1,3,5,- Trichlorobenzene						
1.0% SOM	0.33	0.33	4.70	23	1,700	380(36.7) ^{vap}
2.5% SOM	0.81	0.81	12	55	1,700	590(90.8) ^{vap}
6.0% SOM	1.90	1.90	140	130	1,800	860(217) ^{vap}
1,2,3,4,- Tetrachlorobenzene						
1.0% SOM	15	24	4.40	1,700(122) ^{vap}	830	1,500(122) ^{vap}
2.5% SOM	36	56	11	3,080(304) ^{vap}	830	1,600
6.0% SOM	78	120	26	4,400(728) ^{vap}	830	1,600
1,2,3,5,- Tetrachlorobenzene						
1.0% SOM	0.66	0.75	0.38	49(39.4) ^{vap}	78	110(39) ^{vap}
2.5% SOM	1.60	1.90	0.90	120(98.1) ^{vap}	79	120
6.0% SOM	3.70	4.30	2.20	240(235) ^{vap}	79	130
1,2,4, 5,- Tetrachlorobenzene						
1.0% SOM	0.33	0.73	0.06	42(19.7) ^{sol}	13	25
2.5% SOM	0.77	1.70	0.16	72(49.1) ^{sol}	13	26
6.0% SOM	1.60	3.50	0.37	96	13	26
Pentachlorobenzene						
1.0% SOM	5.80	19	1.20	640(43.0) ^{sol}	100	190
2.5% SOM	12	30	3.10	770(107) ^{sol}	100	190
6.0% SOM	22	38	7.00	830	100	190
Hexachlorobenzene						
1.0% SOM	1.80(0.20) ^{vap}	4.10 (0.20) ^{vap}	0.47	110(0.20) ^{vap}	16	30
2.5% SOM	3.30(0.50) ^{vap}	5.70 (0.50) ^{vap}	1.10	120	16	30
6.0% SOM	4.90	6.70 (1.2) ^{vap}	2.50	120	16	30

Cont'd Overleaf:

**LQM CIEH General Assessment Criteria:
Volatile and Semi-Volatile Organic Compounds**

Contaminant	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Phenols & Chlorophenols						
Phenols						
1.0% SOM	280	750	66	760 ^{dir} (31,000)	760 ^{dir} (11,000)	760 ^{dir} (8,600)
2.5% SOM	550	1,300	140	1,500 ^{dir} (35,000)	1,500 ^{dir} (11,000)	1,500 ^{dir} (9,700)
6.0% SOM	1100	2,300	280	3,200 ^{dir} (37,000)	3,200 ^{dir} (11,000)	3,200 ^{dir} (11,000)
Chlorophenols (4 Congeners)						
1.0% SOM	0.87	94	0.13	3,500	620	1,100
2.5% SOM	2.00	150	0.30	4,000	620	1,100
6.0% SOM	4.50	210	0.70	4,300	620	1,100
Pentachlorophenols						
1.0% SOM	0.22	27(16.4) ^{vap}	0.03	400	60	110
2.5% SOM	0.52	29	0.08	400	60	120
6.0% SOM	1.20	31	0.19	400	60	120
Others						
Carbon Disulphide						
1.0% SOM	0.14	0.14	4.80	11	11,000	1,300
2.5% SOM	0.29	0.29	10	22	11,000	1,900
6.0% SOM	0.62	0.62	23	47	12,000	2,700
Hexachloro-1,3-Butadiene						
1.0% SOM	0.29	0.32	0.25	31	25	48
2.5% SOM	0.70	0.78	0.61	68	25	50
6.0% SOM	1.60	1.80	1.40	120	25	51

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CL:AIRE Soil Generic Assessment Criteria				
Contaminant	Residential (mg/kg)	Residential without plant uptake (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)
<i>Metals:</i>				
Antimony	ND	550	ND	7500
Barium	ND	1300	ND	22000
Molybdenum	ND	670	ND	17000

ND – Not Derived.
NA – Not Applicable

Cont'd Overleaf:

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**CL:AIRE General Assessment Criteria:
Volatile and Semi-Volatile Organic Compounds**

Contaminant	Residential (mg/kg)	Residential without plant uptake (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)
1,1,2 Trichloroethane				
1.0% SOM	0.60	0.88	0.28	94
2.5% SOM	1.20	1.8	0.61	190
6.0% SOM	2.70	3.9	1.40	400
1,1-Dichloroethane				
1.0% SOM	2.40	2.50	9.20	280
2.5% SOM	3.90	4.10	17	450
6.0% SOM	7.40	7.70	35	850
1,1-Dichloroethene				
1.0% SOM	0.23	0.23	2.80	26
2.5% SOM	0.40	0.41	5.60	46
6.0% SOM	0.82	0.82	12	92
1,2,4-Trimethylbenzene				
1.0% SOM	0.35	0.41	0.38	42
2.5% SOM	0.85	0.99	0.93	99
6.0% SOM	2.00	2.30	2.20	220
1,2-Dichloropropane				
1.0% SOM	0.024	0.024	0.62	3.3
2.5% SOM	0.042	0.042	1.20	5.9
6.0% SOM	0.084	0.085	2.60	12
2,4-Dimethylphenol				
1.0% SOM	19	210	3.10	16000*
2.5% SOM	43	410	7.20	24000*
6.0% SOM	97	730	17	30000*
2,4-Dinitrotoluene				
1.0% SOM	1.50	170*	0.22	3700*
2.5% SOM	3.20	170	0.49	3700*
6.0% SOM	7.20	170	1.10	3800*
2,6-Dinitrotoluene				
1.0% SOM	0.78	78	0.12	1900*
2.5% SOM	1.70	84	0.27	1900*
6.0% SOM	3.90	87	0.61	1900*
2-Chloronaphthalene				
1.0% SOM	3.70	3.80	40	390*
2.5% SOM	9.20	9.30	98	960*
6.0% SOM	22	22	230	2200*

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**CL:AIRE General Assessment Criteria:
Volatile and Semi-Volatile Organic Compounds**

Contaminant	Residential (mg/kg)	Residential without plant uptake (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)
Biphenyl				
1.0% SOM	66*	220*	14	18000*
2.5% SOM	160	500*	35	33000*
6.0% SOM	360	980*	83	48000*
Bis (2-ethylhexyl) phthalate				
1.0% SOM	280*	2700*	47*	85000*
2.5% SOM	610*	2800*	120*	86000*
6.0% SOM	1100*	2800*	280*	86000*
Bromobenzene				
1.0% SOM	0.87	0.91	3.2	97
2.5% SOM	2.0	2.1	7.6	220
6.0% SOM	4.7	4.9	18	520
Bromodichloromethane				
1.0% SOM	0.016	0.019	0.016	2.1
2.5% SOM	0.030	0.034	0.032	3.7
6.0% SOM	0.061	0.070	0.068	7.6
Bromoform				
1.0% SOM	2.8	5.2	0.95	760
2.5% SOM	5.9	11	2.1	1500
6.0% SOM	13	23	4.6	3100
Butyl benzyl phthalate				
1.0% SOM	1400*	42000*	220*	940000*
2.5% SOM	3300*	44000*	550*	940000*
6.0% SOM	7200*	44000*	1300*	950000*
Chloroethane				
1.0% SOM	8.3	8.4	110	960
2.5% SOM	11	11	200	1300
6.0% SOM	18	18	380	2100
Chloromethane				
1.0% SOM	0.0083	0.0085	0.066	1.0
2.5% SOM	0.0098	0.0099	0.13	1.2
6.0% SOM	0.013	0.013	0.23	1.6
Cis 1,2 Dichloroethene				
1.0% SOM	0.11	0.12	0.26	14
2.5% SOM	0.19	0.20	0.50	24
6.0% SOM	0.37	0.39	1.0	47

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**CL:AIRE General Assessment Criteria:
Volatile and Semi-Volatile Organic Compounds**

Contaminant	Residential (mg/kg)	Residential without plant uptake (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)
Dichloromethane				
1.0% SOM	0.58	2.10	0.10	270
2.5% SOM	0.98	2.80	0.19	360
6.0% SOM	1.70	4.50	0.34	560
Diethyl Phthalate				
1.0% SOM	120*	1800*	19*	150000*
2.5% SOM	260*	3500*	41*	220000*
6.0% SOM	570*	6300*	94*	290000*
Di-n-butyl phthalate				
1.0% SOM	13*	450*	2.00	15000*
2.5% SOM	31*	450*	5.00	15000*
6.0% SOM	67*	450*	12	15000*
Di-n-octyl phthalate				
1.0% SOM	2300*	3400*	940*	89000*
2.5% SOM	2800*	3400*	2100*	89000*
6.0% SOM	3100*	3400*	3900*	89000*
Hexachloroethane				
1.0% SOM	0.20	0.22	0.27	22*
2.5% SOM	0.48	0.54	0.67	53*
6.0% SOM	1.10	1.30	1.60	120*
Isopropylbenzene				
1.0% SOM	11	12	32	1400*
2.5% SOM	27	28	79	3300*
6.0% SOM	64	67	190	7700*
Methyl tert-butyl ether				
1.0% SOM	49	73	23	7900
2.5% SOM	84	120	44	13000
6.0% SOM	160	220	90	24000
Propylbenzene				
1.0% SOM	34	40	34	4100*
2.5% SOM	82	97	83	9700*
6.0% SOM	190	230	200	21000*
Styrene				
1.0% SOM	8.10	35	1.60	3300*
2.5% SOM	19	78	3.70	6500*
6.0% SOM	43	170	8.70	11000*

Cont'd Overleaf:

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**CL:AIRE General Assessment Criteria:
Volatile and Semi-Volatile Organic Compounds**

Contaminant	Residential (mg/kg)	Residential without plant uptake (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)
Total Cresols (2-, 3-, and 4-methylphenol)				
1.0% SOM	80	3700	12	160000
2.5% SOM	180	5400	27	180000*
6.0% SOM	400	6900	63	180000*
Trans 1,2 Dichloroethene				
1.0% SOM	0.19	0.19	0.93	22
2.5% SOM	0.34	0.35	1.90	40
6.0% SOM	0.70	0.71	0.24	81
Tributyl tin oxide				
1.0% SOM	0.25	1.40	0.042	130*
2.5% SOM	0.59	3.10	0.100	180*
6.0% SOM	1.30	5.70	0.240	200*

Notes: *Soil concentration above soil saturation limit

APPENDIX F
Waste Hazard Assessment

Waste Classification Report



UA4ZY-LT6V6-6Z4N4

Job name

GWPR1606

Waste Stream

Ground and Water V2 PA

Comments

Project

GWPR1606

Site

157 Milton Road, Cowplain

Classified by

Name:

Dalziel, James

Date:

04/05/2016 15:30 UTC

Telephone:

0333 600 1221

Company:

Ground and Water

2 The Long Barn

Norton Farm, Selborne Road

Alton

GU34 3NB

Report

Created by: Dalziel, James

Created date: 04/05/2016 15:30 UTC

Job summary

#	Sample Name	Depth [m]	Classification Result	Hazardous properties	Page
1	WS1/0.50		Non Hazardous		2
2	WS2/0.50		Non Hazardous		4
3	WS4/0.30		Non Hazardous		6

Appendices

	Page
Appendix A: Classifier defined and non CLP determinands	8
Appendix B: Notes	10
Appendix C: Version	10

Classification of sample: WS1/0.50

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

Sample details

Sample Name:	LoW Code:
WS1/0.50	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 m	
Moisture content: 0% (no correction)	

Hazard properties

None identified

Determinands (Moisture content: 0%, no correction)

pH: (Whole conc. entered as: 8.8 pH, converted to conc.: 8.8 pH or 8.8 pH)
 salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex: (Cation conc. entered: <2 mg/kg, converted to compound conc.: <3.768 mg/kg or <0.000377%) **IGNORED Because: "<LOD"**
 arsenic trioxide: (Cation conc. entered: 6 mg/kg, converted to compound conc.: 7.922 mg/kg or 0.000792%)
 boron tribromide/trichloride/trifluoride (combined): (Cation conc. entered: <1 mg/kg, converted to compound conc.: <13.43 mg/kg or <0.00134%) **IGNORED Because: "<LOD"**
 cadmium sulfide: (Cation conc. entered: <0.2 mg/kg, converted to compound conc.: <0.257 mg/kg or <0.0000257%, Note 1 conc.: <0.00002%) **IGNORED Because: "<LOD"**
 Chromium (III) Sulphate: (Whole conc. entered as: 15 mg/kg or 0.0015%)
 chromium(VI) oxide: (Cation conc. entered: <2 mg/kg, converted to compound conc.: <3.846 mg/kg or <0.000385%)
IGNORED Because: "<LOD"
 copper (I) oxide: (Cation conc. entered: 11 mg/kg, converted to compound conc.: 12.385 mg/kg or 0.00124%)
 lead chromate: (Cation conc. entered: 36 mg/kg, converted to compound conc.: 56.153 mg/kg or 0.00562%, Note 1 conc.: 0.0036%)
 mercury dichloride: (Cation conc. entered: <1 mg/kg, converted to compound conc.: <1.353 mg/kg or <0.000135%)
IGNORED Because: "<LOD"
 nickel dihydroxide: (Cation conc. entered: 9 mg/kg, converted to compound conc.: 14.215 mg/kg or 0.00142%)
 selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex: (Cation conc. entered: <3 mg/kg, converted to compound conc.: <7.661 mg/kg or <0.000766%) **IGNORED Because: "<LOD"**
 divanadium pentaoxide; vanadium pentoxide: (Cation conc. entered: 30 mg/kg, converted to compound conc.: 53.556 mg/kg or 0.00536%)
 zinc chromate: (Cation conc. entered: 56 mg/kg, converted to compound conc.: 155.352 mg/kg or 0.0155%)
 phenol: (Whole conc. entered as: <2 mg/kg or <0.0002%) **IGNORED Because: "<LOD"**
 naphthalene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 acenaphthylene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 acenaphthene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 fluorene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 phenanthrene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 anthracene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 fluoranthene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 pyrene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 benzo[a]anthracene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 chrysene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 benzo[b]fluoranthene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**

benzo[k]fluoranthene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 benzo[a]pyrene; benzo[def]chrysene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 indeno[123-cd]pyrene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 dibenz[a,h]anthracene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 benzo[ghi]perylene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 benzene: (Whole conc. entered as: <2 mg/kg or <0.0002%) **IGNORED Because: "<LOD"**
 toluene: (Whole conc. entered as: <5 mg/kg or <0.0005%) **IGNORED Because: "<LOD"**
 ethylbenzene: (Whole conc. entered as: <2 mg/kg or <0.0002%) **IGNORED Because: "<LOD"**
 xylene: (Whole conc. entered as: <2 mg/kg or <0.0002%) **IGNORED Because: "<LOD"**
 o-xylene; [1] p-xylene; [2] m-xylene; [3] xylene [4]: (Whole conc. entered as: <2 mg/kg or <0.0002%) **IGNORED Because: "<LOD"**
 diesel petroleum group: (Whole conc. entered as: <21 mg/kg or <0.0021%) **IGNORED Because: "<LOD"**
 TPH (C6 to C40) petroleum group: (Whole conc. entered as: <42 mg/kg or <0.0042%) **IGNORED Because: "<LOD"**

Legend

 - This determinand has one or more of its Hazard Statements and Risk Phrases defined and maintained by the Classifier

Notes utilised in assessment

C14: Step 5

"identify whether any individual ecotoxic substance is present at or above a cut-off value ..." , used on:

Test: "HP 14 on R50, R50/53, R51/53, R52/53, R52, R53" for determinand: "arsenic trioxide"
 Test: "HP 14 on R50, R50/53, R51/53, R52/53, R52, R53" for determinand: "copper (I) oxide"
 Test: "HP 14 on R50, R50/53, R51/53, R52/53, R52, R53" for determinand: "lead chromate"
 Test: "HP 14 on R50, R50/53, R51/53, R52/53, R52, R53" for determinand: "nickel dihydroxide"
 Test: "HP 14 on R50, R50/53, R51/53, R52/53, R52, R53" for determinand: "zinc chromate"
 Test: "HP 14 on R50, R50/53, R51/53, R52/53, R52, R53" for determinand: "divanadium pentoxide; vanadium pentoxide"

Note 1 , used on:

Test: "HP 5 on STOT SE 2; H371, STOT RE 2; H373" for determinand: "lead chromate"
 Test: "HP 7 on Carc. 1A; H350, Carc. 1B; H350, Carc. 1A; H350i, Carc. 1B; H350i" for determinand: "lead chromate"
 Test: "HP 10 on Repr. 1A; H360, Repr. 1A; H360D, Repr. 1A; H360Df, Repr. 1A; H360F, Repr. 1A; H360Fd, Repr. 1A; H360FD, Repr. 1B; H360, Repr. 1B; H360D, Repr. 1B; H360Df, Repr. 1B; H360F, Repr. 1B; H360Fd, Repr. 1B; H360FD" for determinand: "lead chromate"
 Test: "HP 14 on R50, R50/53, R51/53, R52/53, R52, R53" for determinand: "lead chromate"

Determinand notes

Note 1 , used on:

determinand: "lead chromate"

Note A , used on:

determinand: "zinc chromate"

Classification of sample: WS2/0.50

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

Sample details

Sample Name:	LoW Code:
WS2/0.50	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 m	
Moisture content: 0% (no correction)	

Hazard properties

None identified

Determinands (Moisture content: 0%, no correction)

pH: (Whole conc. entered as: 9 pH, converted to conc.: 9 pH or 9 pH)
salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex: (Cation conc. entered: <2 mg/kg, converted to compound conc.: <3.768 mg/kg or <0.000377%) **IGNORED Because: "<LOD"**
arsenic trioxide: (Cation conc. entered: 4 mg/kg, converted to compound conc.: 5.281 mg/kg or 0.000528%)
boron tribromide/trichloride/trifluoride (combined): (Cation conc. entered: <1 mg/kg, converted to compound conc.: <13.43 mg/kg or <0.00134%) **IGNORED Because: "<LOD"**
cadmium sulfide: (Cation conc. entered: <0.2 mg/kg, converted to compound conc.: <0.257 mg/kg or <0.0000257%, Note 1 conc.: <0.00002%) **IGNORED Because: "<LOD"**
 Chromium (III) Sulphate: (Whole conc. entered as: 19 mg/kg or 0.0019%)
chromium(VI) oxide: (Cation conc. entered: <2 mg/kg, converted to compound conc.: <3.846 mg/kg or <0.000385%) **IGNORED Because: "<LOD"**
copper (I) oxide: (Cation conc. entered: 12 mg/kg, converted to compound conc.: 13.511 mg/kg or 0.00135%)
lead chromate: (Cation conc. entered: 15 mg/kg, converted to compound conc.: 23.397 mg/kg or 0.00234%, Note 1 conc.: 0.0015%)
mercury dichloride: (Cation conc. entered: <1 mg/kg, converted to compound conc.: <1.353 mg/kg or <0.000135%) **IGNORED Because: "<LOD"**
nickel dihydroxide: (Cation conc. entered: 10 mg/kg, converted to compound conc.: 15.795 mg/kg or 0.00158%)
selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex: (Cation conc. entered: <3 mg/kg, converted to compound conc.: <7.661 mg/kg or <0.000766%) **IGNORED Because: "<LOD"**
divanadium pentaoxide; vanadium pentoxide: (Cation conc. entered: 29 mg/kg, converted to compound conc.: 51.77 mg/kg or 0.00518%)
zinc chromate: (Cation conc. entered: 47 mg/kg, converted to compound conc.: 130.385 mg/kg or 0.013%)
phenol: (Whole conc. entered as: <2 mg/kg or <0.0002%) **IGNORED Because: "<LOD"**
naphthalene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
acenaphthylene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
acenaphthene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
fluorene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
phenanthrene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
anthracene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
fluoranthene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
pyrene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
benzo[a]anthracene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
chrysene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
benzo[b]fluoranthene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**

benzo[k]fluoranthene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 benzo[a]pyrene; benzo[def]chrysene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 indeno[123-cd]pyrene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 dibenz[a,h]anthracene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 benzo[ghi]perylene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 benzene: (Whole conc. entered as: <2 mg/kg or <0.0002%) **IGNORED Because: "<LOD"**
 toluene: (Whole conc. entered as: <5 mg/kg or <0.0005%) **IGNORED Because: "<LOD"**
 ethylbenzene: (Whole conc. entered as: <2 mg/kg or <0.0002%) **IGNORED Because: "<LOD"**
 xylene: (Whole conc. entered as: <2 mg/kg or <0.0002%) **IGNORED Because: "<LOD"**
 o-xylene; [1] p-xylene; [2] m-xylene; [3] xylene [4]: (Whole conc. entered as: <2 mg/kg or <0.0002%) **IGNORED Because: "<LOD"**
 diesel petroleum group: (Whole conc. entered as: <21 mg/kg or <0.0021%) **IGNORED Because: "<LOD"**
 TPH (C6 to C40) petroleum group: (Whole conc. entered as: <42 mg/kg or <0.0042%) **IGNORED Because: "<LOD"**

Legend

 - This determinand has one or more of its Hazard Statements and Risk Phrases defined and maintained by the Classifier

Notes utilised in assessment

C14: Step 5

"identify whether any individual ecotoxic substance is present at or above a cut-off value ..." , used on:

Test: "HP 14 on R50, R50/53, R51/53, R52/53, R52, R53" for determinand: "arsenic trioxide"
 Test: "HP 14 on R50, R50/53, R51/53, R52/53, R52, R53" for determinand: "copper (I) oxide"
 Test: "HP 14 on R50, R50/53, R51/53, R52/53, R52, R53" for determinand: "lead chromate"
 Test: "HP 14 on R50, R50/53, R51/53, R52/53, R52, R53" for determinand: "nickel dihydroxide"
 Test: "HP 14 on R50, R50/53, R51/53, R52/53, R52, R53" for determinand: "zinc chromate"
 Test: "HP 14 on R50, R50/53, R51/53, R52/53, R52, R53" for determinand: "divanadium pentoxide; vanadium pentoxide"

Determinand notes

Note 1 , used on:

determinand: "lead chromate"

Note A , used on:

determinand: "zinc chromate"

Classification of sample: WS4/0.30

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

Sample details

Sample Name:	LoW Code:
WS4/0.30	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 m	
Moisture content: 0% (no correction)	

Hazard properties

None identified

Determinands (Moisture content: 0%, no correction)

pH: (Whole conc. entered as: 9.5 pH, converted to conc.: 9.5 pH or 9.5 pH)
salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex: (Cation conc. entered: <2 mg/kg, converted to compound conc.: <3.768 mg/kg or <0.000377%) **IGNORED Because: "<LOD"**
arsenic trioxide: (Cation conc. entered: 8 mg/kg, converted to compound conc.: 10.563 mg/kg or 0.00106%)
boron tribromide/trichloride/trifluoride (combined): (Cation conc. entered: <1 mg/kg, converted to compound conc.: <13.43 mg/kg or <0.00134%) **IGNORED Because: "<LOD"**
cadmium sulfide: (Cation conc. entered: <0.2 mg/kg, converted to compound conc.: <0.257 mg/kg or <0.0000257%, Note 1 conc.: <0.00002%) **IGNORED Because: "<LOD"**
 Chromium (III) Sulphate: (Whole conc. entered as: 17 mg/kg or 0.0017%)
chromium(VI) oxide: (Cation conc. entered: <2 mg/kg, converted to compound conc.: <3.846 mg/kg or <0.000385%)
IGNORED Because: "<LOD"
copper (I) oxide: (Cation conc. entered: 11 mg/kg, converted to compound conc.: 12.385 mg/kg or 0.00124%)
lead chromate: (Cation conc. entered: 27 mg/kg, converted to compound conc.: 42.115 mg/kg or 0.00421%, Note 1 conc.: 0.0027%)
mercury dichloride: (Cation conc. entered: <1 mg/kg, converted to compound conc.: <1.353 mg/kg or <0.000135%)
IGNORED Because: "<LOD"
nickel dihydroxide: (Cation conc. entered: 8 mg/kg, converted to compound conc.: 12.636 mg/kg or 0.00126%)
selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex: (Cation conc. entered: <3 mg/kg, converted to compound conc.: <7.661 mg/kg or <0.000766%) **IGNORED Because: "<LOD"**
divanadium pentaoxide; vanadium pentoxide: (Cation conc. entered: 29 mg/kg, converted to compound conc.: 51.77 mg/kg or 0.00518%)
zinc chromate: (Cation conc. entered: 46 mg/kg, converted to compound conc.: 127.611 mg/kg or 0.0128%)
phenol: (Whole conc. entered as: <2 mg/kg or <0.0002%) **IGNORED Because: "<LOD"**
naphthalene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
acenaphthylene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
acenaphthene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
fluorene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
phenanthrene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
anthracene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
fluoranthene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
pyrene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
benzo[a]anthracene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
chrysene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
benzo[b]fluoranthene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**

benzo[k]fluoranthene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 benzo[a]pyrene; benzo[def]chrysene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 indeno[123-cd]pyrene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 dibenz[a,h]anthracene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 benzo[ghi]perylene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) **IGNORED Because: "<LOD"**
 benzene: (Whole conc. entered as: <2 mg/kg or <0.0002%) **IGNORED Because: "<LOD"**
 toluene: (Whole conc. entered as: <5 mg/kg or <0.0005%) **IGNORED Because: "<LOD"**
 ethylbenzene: (Whole conc. entered as: <2 mg/kg or <0.0002%) **IGNORED Because: "<LOD"**
 xylene: (Whole conc. entered as: <2 mg/kg or <0.0002%) **IGNORED Because: "<LOD"**
 o-xylene; [1] p-xylene; [2] m-xylene; [3] xylene [4]: (Whole conc. entered as: <2 mg/kg or <0.0002%) **IGNORED Because: "<LOD"**
 diesel petroleum group: (Whole conc. entered as: <21 mg/kg or <0.0021%) **IGNORED Because: "<LOD"**
 TPH (C6 to C40) petroleum group: (Whole conc. entered as: <42 mg/kg or <0.0042%) **IGNORED Because: "<LOD"**

Legend

 - This determinand has one or more of its Hazard Statements and Risk Phrases defined and maintained by the Classifier

Notes utilised in assessment

C14: Step 5

"identify whether any individual ecotoxic substance is present at or above a cut-off value ..." , used on:

Test: "HP 14 on R50, R50/53, R51/53, R52/53, R52, R53" for determinand: "arsenic trioxide"
 Test: "HP 14 on R50, R50/53, R51/53, R52/53, R52, R53" for determinand: "copper (I) oxide"
 Test: "HP 14 on R50, R50/53, R51/53, R52/53, R52, R53" for determinand: "lead chromate"
 Test: "HP 14 on R50, R50/53, R51/53, R52/53, R52, R53" for determinand: "nickel dihydroxide"
 Test: "HP 14 on R50, R50/53, R51/53, R52/53, R52, R53" for determinand: "zinc chromate"
 Test: "HP 14 on R50, R50/53, R51/53, R52/53, R52, R53" for determinand: "divanadium pentoxide; vanadium pentoxide"

Note 1 , used on:

Test: "HP 5 on STOT SE 2; H371, STOT RE 2; H373" for determinand: "lead chromate"
 Test: "HP 7 on Carc. 1A; H350, Carc. 1B; H350, Carc. 1A; H350i, Carc. 1B; H350i" for determinand: "lead chromate"
 Test: "HP 10 on Repr. 1A; H360, Repr. 1A; H360D, Repr. 1A; H360Df, Repr. 1A; H360F, Repr. 1A; H360Fd, Repr. 1A; H360FD, Repr. 1B; H360, Repr. 1B; H360D, Repr. 1B; H360Df, Repr. 1B; H360F, Repr. 1B; H360Fd, Repr. 1B; H360FD" for determinand: "lead chromate"
 Test: "HP 14 on R50, R50/53, R51/53, R52/53, R52, R53" for determinand: "lead chromate"

Determinand notes

Note 1 , used on:

determinand: "lead chromate"

Note A , used on:

determinand: "zinc chromate"

Appendix A: Classifier defined and non CLP determinands

pH

Comments: Appendix C4
Data source: WM3 1st Edition 2015
Data source date: 25/05/2015
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 Statements: EUH032>= 0.2%
Reason:
14/12/2015 - EUH032>= 0.2% hazard statement sourced from: WM3, Table C12.2

boron tribromide/trichloride/trifluoride (combined) (CAS Number: 10294-33-4, 10294-34-5, 7637-07-2)

Conversion factor: 13.43
Comments: Combines the hazard statements and the average of the conversion factors for boron tribromide, boron trichloride and boron trifluoride
Data source: N/A
Data source date: 06/08/2015
Risk Phrases: R14, T+; R26/28, C; R34, C; R35
Hazard Statements: EUH014, Acute Tox. 2; H330, Acute Tox. 2; H300, Skin Corr. 1A; H314, Skin Corr. 1B; H314

Chromium (III) Sulphate (CAS Number: 10101-53-8)

Comments:
Data source: 10101-53-8
Data source date: 23/06/2015
Risk Phrases: None.
Hazard Statements: None.

acenaphthylene (CAS Number: 208-96-8)

Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 17/07/2015
Risk Phrases: R22, R26, R27, R36, R37, R38
Hazard Statements: Acute Tox. 4; H302, Acute Tox. 1; H330, Acute Tox. 1; H310, Eye Irrit. 2; H319, STOT SE 3; H335, Skin Irrit. 2; H315

acenaphthene (CAS Number: 83-32-9)

Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 17/07/2015
Risk Phrases: R36, R37, R38, N; R50/53, N; R51/53
Hazard Statements: Eye Irrit. 2; H319, STOT SE 3; H335, Skin Irrit. 2; H315, Aquatic Acute 1; H400, Aquatic Chronic 1; H410, Aquatic Chronic 2; H411

fluorene (CAS Number: 86-73-7)

Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 06/08/2015
Risk Phrases: N; R50/53
Hazard Statements: Aquatic Acute 1; H400, Aquatic Chronic 1; H410

phenanthrene (CAS Number: 85-01-8)

Comments: Data from C&L Inventory Database

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

Data source date: 06/08/2015

Risk Phrases: R22, R36, R37, R38, R40, R43, N; R50/53

Hazard Statements: Acute Tox. 4; H302, Eye Irrit. 2; H319, STOT SE 3; H335, Carc. 2; H351, Skin Sens. 1; H317, Aquatic Acute 1; H400, Aquatic Chronic 1; H410, Skin Irrit. 2; H315

anthracene (CAS Number: 120-12-7)

Comments: Data from C&L Inventory Database

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

Data source date: 17/07/2015

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

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

fluoranthene (CAS Number: 206-44-0)

Comments: Data from C&L Inventory Database

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

Data source date: 21/08/2015

Risk Phrases: Xn; R22, N; R50/53

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

pyrene (CAS Number: 129-00-0)

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: 21/08/2015

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

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

indeno[123-cd]pyrene (CAS Number: 193-39-5)

Comments: Data from C&L Inventory Database

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

Data source date: 06/08/2015

Risk Phrases: R40

Hazard Statements: Carc. 2; H351

benzo[ghi]perylene (CAS Number: 191-24-2)

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: 23/07/2015

Risk Phrases: N; R50/53

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

ethylbenzene (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 Statements: Carc. 2; H351

Reason:

03/06/2015 - Carc. 2; H351 hazard statement sourced from: IARC Group 2B (77) 2000

diesel petroleum group (CAS Number: 68334-30-5, 68476-34-6, 94114-59-7, 1159170-26-9)

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

Data source: WM3 1st Edition 2015

Data source date: 25/05/2015

Risk Phrases: R40, R51/53, R65, R66

Hazard Statements: Flam. Liq. 3; H226, Skin Irrit. 2; H315, Acute Tox. 4; H332, Carc. 2; H351, Asp. Tox. 1; H304, STOT RE 2; H373, Aquatic Chronic 2; H411

TPH (C6 to C40) petroleum group

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

Data source: WM3 1st Edition 2015

Data source date: 25/05/2015

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

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

Appendix B: Notes

C14: Step 5

from section: WM3: C14 in the document: "WM3 - Waste Classification"

"identify whether any individual ecotoxic substance is present at or above a cut-off value ..."

Note 1

from section: 1.1.3.2, Annex VI in the document: "CLP Regulations"

"The concentration stated or, in the absence of such concentrations, the generic concentrations of this Regulation (Table 3.1) or the generic concentrations of Directive 1999/45/EC (Table 3.2), are the percentages by weight of the metallic element calculated with reference to the total weight of the mixture."

Note A

from section: 1.1.3.1, Annex VI in the document: "CLP Regulations"

"Without prejudice to Article 17(2), the name of the substance must appear on the label in the form of one of the designations given in Part 3. In Part 3, use is sometimes made of a general description such as '... compounds' or '... salts'. In this case, the supplier is required to state on the label the correct name, due account being taken of section 1.1.1.4."

Appendix C: Version

Classification utilises the following:

- CLP Regulations - 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
- WM3 - Waste Classification - May 2015
- 7th ATP - Regulation 2015/1221/EU of 24 July 2015
- 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

HazWasteOnline Engine: WM3 1st Edition, May 2015

HazWasteOnline Engine Version: 2016.92.3052.6057 (01 Apr 2016)

HazWasteOnline Database: 2016.92.3052.6057 (03 Apr 2016)