Report prepared at
Land to rear of 41-67 Hook Road
Epsom
KT19 8TP

Report prepared for
Hook Road Limited

Report reference
19-128.03

Report date
December 2020

Prepared by
Aviron Associates Limited

Report Quality Management

Project Name	Land to the rear of 41-67 Hook Road, Epsom, KT19 8TP		
Project Title	Soil Verification Report		
Client	Hook Road Limited		
Project Number	19-128.03		
Version	Revision A		**Date**
Prepared by	Gavin Roberts BSc (Hons) FGS	Geo-Environmental Engineer	22/12/2020
Checked by	James Burkitt BEng (Hons) CEnv MRICS	Managing Director	31/12/2020

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1.0 PROJECT AND SITE INFORMATION

1.1 APPOINTMENT

Aviron Associates Limited (Aviron) was retained by Hook Road Limited (the "Client") to prepare a Soil Verification Report for the following premises:

Land to the Rear of 41-67 Hook Road, Epsom, KT19 8TP (hereafter referred to as the "site").

The purpose of this report is to review remediation excavation undertaken by the Principal Contractor and undertake soil verification works such that it can be demonstrated that any previously (or undiscovered) soil contamination has been removed and the site can be considered suitable for residential occupancy and does not present a risk to the wider environment.

1.2 THE SITE

Table 1.2 presents the site details.

Table 1.2 : Site Details

Site Location	The site is located on Hook Road in Epsom, approximately 375 metres (m) to the north-east of Epsom railway station.
Land Use	Presently the site is in the final stages of residential re-development, comprising new homes with surrounding private gardens and limited communal soft landscaping. **Figure 1** is presented as a Site Plan, which also serves as a Verification Trial Hole Location Plan.
Surrounding Land Use	The site is directly surrounded by residential premises in all directions. A small commercial property is noted to the south-east of the site.

1.3 REMEDIATION REQUIREMENT

A Remediation Method Statement (RMS) was prepared by Aviron, referenced 19-128.02 Revision B and dated March 2019.

In summary the remedial requirements are to provide a 600mm clean cover system to private gardens and in-situ planting beds.

Table 1.3 provides the necessary detail for the required cover systems.

Table 1.3 : Cover System Construction

Garden Type	Depth (bgl)	Description
Private	Ground Level - 300mm	BS3882:2015 'clean' Topsoil
	300mm – 600mm	BS3882:2015 'clean' Topsoil or 'clean' sub-soil
	At 600mm permeable geotextile membrane	Terram Hi-Vis or similar product

Soil verification inspections are necessary as follows:

1. Verification of imported Topsoil (and sub-soil) to new garden and in-situ soft landscaped areas.

2. Confirmation of at least 600mm of 'clean' Topsoil and sub-soil cover upon a membrane.

1.4 LIMITATIONS OF APPOINTMENT

The installation and verification of ground gas protection is beyond the scope of this appointment and an addendum from the gas protection installer or building control surveyor should be submitted in this regard.

Excavation works were not supervised by Aviron and therefore a waste management audit is beyond our appointment. As necessary the Principal Contractor should compile waste transfer notes to audit the volume of material removed and relate to the volume of material imported.

The objective of this report is to gain regulatory and stake holder approval and written confirmation such that the soil verification (inspection) confirm the absence of contaminative risk to site end users. This report has also been prepared to address the requirements of the Local Planning Authority and also development warranty providers.

2.0 VERIFICATION INSPECTIONS

The following section document site visits completed in order to inspect the progress of remedial works.

2.1 PLOT 1 - COVER SYSTEM VERIFICATION

An Aviron geo-environmental engineer attended site on:

- 27 October 2020 in order to verify the thickness of the 'clean' Topsoil cover to the rear garden (HP8 and HP9); and
- 21 December 2020 in order to verify the thickness of the 'clean' Topsoil cover to the corner soft landscaped area (HP12).

The means of verification was completed by hand excavated trial holes through the recently placed outcropping Topsoil cover in areas of soft landscaping which are shown on **Figure 1** and described in table 2.1. **Appendix I** is enclosed as the inspection photographs.

Table 2.1 provides a summary, rationale and cover thickness of trial holes completed.

Table 2.1 : Verification Trial Holes

Location	Rationale	Thickness of Topsoil (mm)	Thickness of sub-soil (mm)	Membrane?	Suitable cover system?
HP8	Located in rear garden	600	n/a	Yes, orange	Yes
HP9	Located in rear garden	600	n/a	Yes, orange	Yes
HP12	Located in front corner planter	600	n/a	Yes, orange	Yes

It is concluded that a suitable cover system has been constructed which required a minimum of 600mm upon an orange geotextile membrane.

During the inspection an awareness for potentially deleterious objects and materials was made both at surface level, throughout the trial holes and in the base of trial holes. The purpose being to ensure garden areas are free from objects and materials which may be harmful to occupants of the new homes.

It is confirmed that no evidence of potentially deleterious objects and materials was observed.

2.2 PLOT2 2, 3 AND 4 - COVER SYSTEM VERIFICATION

An Aviron geo-environmental engineer attended site on:

- 9 October 2020 in order to verify the thickness of the 'clean' Topsoil cover to the rear gardens along the row of Plots 2, 3 and 4 (HP1 to HP6); and
- 21 December 2020 in order to attempt to get a photograph of the membrane (HP1a, HP4a, HP6a) at 600mm as identified on 9 October 2020 whereby a photograph of the membrane was not possible due to water logging of the trial holes.

The means of verification was completed by hand excavated trial holes through the recently placed outcropping Topsoil cover in areas of soft landscaping which are shown on **Figure 1** and described in table 2.2. **Appendix I** is enclosed as the inspection photographs.

Table 2.2 provides a summary, rationale and cover thickness of trial holes completed.

Table 2.2 : Verification Trial Holes

Location	Rationale	Thickness of Topsoil (mm)	Thickness of sub-soil (mm)	Membrane?	Suitable cover system?
HP1	Located in rear garden of P2	300	n/a	Yes, orange	Yes
HP1a	Located in rear garden of P2	310	n/a	Yes, orange	Yes
HP2	Located in rear garden of P2	600	n/a	Yes, orange	Yes
HP3	Located in rear garden of P3	600	n/a	Yes, orange	Yes
HP4	Located in rear garden of P3	600	n/a	Yes, orange	Yes
HP4a	Located in rear garden of P3	600	n/a	Yes, orange	Yes
HP5	Located in rear garden of P4	600	n/a	Yes, orange	Yes
HP6	Located in rear garden of P4	600	n/a	Yes, orange	Yes
HP6a	Located in rear garden of P4	600	n/a	Yes, orange	Yes

It is concluded that a suitable cover system has been constructed which required a minimum of 600mm upon an orange geotextile membrane.

During the inspection an awareness for potentially deleterious objects and materials was made both at surface level, throughout the trial holes and in the base of trial holes. The purpose being to ensure garden areas are free from objects and materials which may be harmful to occupants of the new homes.

It is confirmed that no evidence of potentially deleterious objects and materials was observed.

2.3 COMMUNAL PLANTER- COVER SYSTEM VERIFICATION

An Aviron geo-environmental engineer attended site on:

- 9 October 2020 (HP7) and 21 December 2020 (HP10 and HP11) in order to verify the thickness of the 'clean' Topsoil cover to the communal side planter to the site entrance.

The means of verification was completed by hand excavated trial holes through the recently placed outcropping Topsoil cover in areas of soft landscaping which are shown on **Figure 1** and described in table 2.3. **Appendix I** is enclosed as the inspection photographs.

Table 2.3 provides a summary, rationale and cover thickness of trial holes completed.

Table 2.3 : Verification Trial Holes

Location	Rationale	Thickness of Topsoil (mm)	Thickness of sub-soil/sand (mm)	Membrane?	Suitable cover system?
HP7	Side planter – far end	600	n/a	Yes, orange	Yes
HP10	Side planter – middle	600	n/a	Yes, orange	Yes
HP11	Side planter – near end	600	n/a	Yes, orange	Yes

It is concluded that a suitable cover system has been constructed which required a minimum of 600mm upon an orange geotextile membrane. The membrane was visibly observed within each trial hole.

During the inspection an awareness for potentially deleterious objects and materials was made both at surface level, throughout the trial holes and in the base of trial holes.

The site manager was informed to complete a surface 'brick' pick to remove any surface debris which may sit on the Topsoil prior to spreading of bark following tree planting.

2.4 IMPORTED SOIL TESTING

During the site visit of 27 October 2020 soil samples were collected for verification chemical analysis from recently imported Topsoil and sub-soil to ensure chemical suitability for residential use.

Three Topsoil samples (TS1 to TS3) were collected from the outcropping Topsoil present on-site across the gardens of Plots 1 to 4 and within areas of communal soft landscaping awaiting spreading. The Topsoil was obtained from shallow trowel dug holes.

Three sub-soil 'Sand' samples (SS1 to SS3) were collected from the sub-cropping Sand present on-site beneath the overlying Topsoil of gardens to Plots 2 to 4. The Sand was obtained from shovel-holer dug trial holes.

All Topsoil and sub-soil samples were composite samples comprising ten fist size sub-samples placed into a clean bulk sampling bag for homogenisation and then transferred to testing jars. The purpose of composite sampling was to provide a representative *en mass* chemical appraisal of the imported soils. Sub-samples to create testing samples TS1 to TS3 comprised in-situ recently laid Topsoil and samples SS1 to SS3 from the underlying Sand. The composite samples were placed into clean pre-labelled 250ml and 50ml glass amber jars with ice-packed cool boxes for submission to i2 Analytical Limited. Samples were submitted for the following analysis:

- Aviron's **'Suite 1'** includes the following parameters; arsenic, barium, cadmium, total chromium, copper, nickel, zinc, lead, mercury, selenium, water soluble boron, total cyanide, total sulphate, water soluble sulphate (SO4), total sulphur, speciated PAH, total phenols, pH and organic matter.
- The **TPH CWG** (Total Petrol Hydrocarbon Criteria Working Group) suite of analysis contains aromatic and aliphatic TPH speciation, Benzene, Toluene, Ethylbenzene, Xylenes (BTEX) and Methyl Tert-Butyl Ether (MTBE).
- **Asbestos.**
- **Soil Organic Matter** (SOM)

The analysis chosen provides broad and suitable screening of soil contaminants to enable potential risk to human health to be determined.

3.0 SOIL VERIFICATION LABORATORY RESULTS

3.1 REMEDIATION TARGETS

Aviron has followed the guidance provided by CLR11 and other available guidance to assess contaminant concentrations. Details of the methodology and Aviron's position on the adoption of guidance values are outlined below.

The available chemical data, from soil samples tested, is sorted into appropriate datasets depending on sampling regime and ground conditions. An initial generic quantitative risk assessment is completed using the relevant tier 1 screening criteria and where appropriate statistical modelling. Risks to human health shall be initially assessed by comparing soil chemical data against various published screening criteria. These have been sourced from the following and in order of preference:

- Suitable 4 Use Levels (S4ULs) prepared by Land Quality Management/Chartered Institute of Environmental Health (LQM/CEIH) and published December 2014. LQM acknowledgement for use of S4ULs. *"Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3275. All rights reserved".*

- Category 4 Screening Levels (C4SLs) prepared by the Department of Environmental Food and Rural Affairs (DEFRA) and published March 2014.

- Soil Guidance Values (SGVs) prepared by the Environment Agency (EA)/DEFRA and published 2009.

- Soil Generic Assessment Criteria (GAC) prepared by Environment Industries Commission (EIC)/Association of Geotechnical and Geoenvironmental Specialists (AGS)/Contaminated Land: Application In Real Environments (CL:AIRE) and published 2010.

Aviron have adopted the S4ULs in preference given the modelling of the values against a minimal risk (1 in 100,000 risk of death or serious injury) criteria to provide a further level of conservativeness.

Atkins Limited has made their ARTISK^{SOIL} Soil Screening Values (SSVs) commercially available; however, there remains industry debate about their use and derivation. Hence, Aviron have adopted the applied tier 1 guidance values published by recognised industry associations and statutory authorities. The application of ATRISK^{SOIL} SSVs is under on-going assessment.

In regard of lead; an S4UL does not exist, nor does any other reliable published guidance. Lead will only be compared to the C4SL because no S4UL or other guidance exists.

The C4SLs for lead has been developed using a low risk criteria (1 in 10,000 risk of death or serious injury). Presently (2019) there is no published health criteria for what is considered to be a minimum risk for lead, unlike the compounds modelled in the S4ULs. It is understood this is due to lead being a non-threshold compound. To determine minimal risk criteria a scientific rationale needs to be established; which can be either toxicology or policy led. As yet neither has been established and hence the minimal risk criteria for lead have not been set.

The C4SL working group, on behalf of DEFRA were tasked with establishing the C4SLs modelling to known low risk criteria. In terms of the Categories (Cat) of risk; the following generical assumptions apply:

- Cat 1 – land is definitely contaminated and no need for investigation to prove;
- Cat 2 – land is most certainly contaminated and can be proved by investigation;
- Cat 3 – land unlikely to be contamination and can be proved by investigation;
- Cat 4 – land definitely not contaminated.

The C4SLs were developed in the context that they would appraise chemical concentrations within land to demonstrate it was 'not contaminated'. The use of the C4SLs have been widely adopted by the UK contaminated land industry by numerous consultants and local planning authorities. It is the view of Aviron and may others in the industry that the C4SL is suitable for both the Part IIA and planning system as it allows identification of sites that fall within Category 4 and thus land which is 'not contaminated'.

In July 2014 the CIEH advised against the use of the C4SLs; and released their S4ULs in collaboration with LQM at The University of Nottingham in December 2014. Despite the earlier criticism from the CIEH a S4UL for lead was not provided.

Whilst deriving the lead C4SL a variety of lead blood levels were determined; being 1.6mg µg/dL, 3.5µg/dL and 5µg/dL. The respective lead C4SLs were 86mg/kg, 200mg/kg and 210mg/kg.

DEFRA selected the 3.5µg/dL value of 200mg/kg which is now used widely thorough the UK contaminated land industry for similar reasons stated above; establishing a nationwide precedence, generally because of the absence of an alternative and also the Category 4 compliance in accordance with DEFRA's criteria.

Without an established minimal risk health criteria for lead it is not possible to determine a reliable 'in-house' screening value; not one which can withstand scrutiny and be indemnified. Any such value would be subject to a variety of assumptions and hence limit the credibility of the modelled output.

As such the application of the strongly precautionary C4SL for lead, selected by DEFRA for a site considered to be Category 4 and 'not contamination' is considered acceptable.

3.2 REVIEW OF LABORATORY RESULTS

Laboratory certificates of analysis along with the 'residential with plant uptake' end use criteria (private gardens) are enclosed within **Appendix I**.

Concentrations of all determinants analysed in the three representative samples of Topsoil (TS1 to TS3) and sub-soil/Sand (SS1 to SS3) recovered from in-situ soils have been recorded at acceptable concentrations when compared to the guidance explained within section 3.1 for a private gardens end use.

4.0 RISK ASSESSMENT

4.1 METHODOLOGY

A Conceptual Site Model (CSM) has been prepared in accordance with CLR11 based on the information obtained as part of this verification exercise which in turn was derived from previous risk assessment works. Possible risks associated with potential sources of contamination and sensitive receptors identified have been assessed via a source-pathway-receptor (SPR) model in accordance with current UK protocols.

A risk may only exist where a plausible SPR linkage is presented and where the quantity or concentration of a contaminant is sufficient to pose harm. Under the statutory definition "Contamination" may only exist where contaminants pose a risk of harm to a receptor. Risk may be defined as a function of the likelihood and severity of any adverse effects resulting from a contamination event. This risk classification has been assessed in accordance with CIRIA C552. A summary of how risk is derived and the associated definition is presented in tables 4.1.1 and 4.1.2.

Table 4.1.1 : Risk Ratings Matrix

	Consequence			
Probability	**Severe**	**Medium**	**Mild**	**Minor**
High Likelihood	Very high risk	High risk	Moderate Risk	Moderate/low risk
Likely	High risk	Moderate Risk	Moderate/low risk	Low risk
Low Likelihood	Moderate Risk	Moderate/low risk	Low risk	Very low risk
Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk

Table 4.1.2 : Risk Ratings Definition

Risk Rationale	Definition
Very high risk	A high probability that severe harm could occur to determined receptor from identified contaminant - OR - evidence exists that severe harm to receptor is currently occurring. Urgent investigation and remediation should be considered. If demonstrated this risk is likely to result in substantial liability.
High risk	Harm is likely to occur to determined receptor from identified contaminant. Urgent investigation and short term risk minimisation remediation followed by longer term fit for purpose remediation should be considered. If demonstrated this risk is likely to result in substantial liability.
Moderate Risk	It is possible that harm could occur to a determined receptor from identified contaminant. It is relatively unlikely that any harm would be severe or should harm occur it is likely to be relatively mild.
Moderate/low risk	It is possible that harm could occur to a determined receptor from identified contaminant. It is unlikely that any harm would be severe or should harm occur it is probable to be relatively mild.
Low risk	It is possible that harm could occur to a determined receptor from identified contaminant. It is unlikely that such harm, if indeed present, would at worst be mild.
Very low risk	There is a low possibility that harm could occur to a receptor. In such event the harm would not be severe.

4.2 SUMMARY OF POLLUTANT LINKAGES FOR PROPOSED LAND USE - CSM

The initial CSM is based upon the proposed site end use and the information currently consulted relating to various risk sources and plausible pollutant linkages and is presented within table 4.2.

Table 4.2 : Conceptual Site Model (for plausible pollutant linkage pathways)

Source	Receptor	Pathway	Probability	Consequence	Risk & Justification
Former In-situ Made Ground Contamination	Construction workers	Direct contact	Unlikely	Minor	Very Low Suitable cover system in place upon geotextile membrane acting as a capillary break to prevent soil mixing between imported 'clean' Topsoil and any underlying Made Ground
	End users	Direct contact	Unlikely	Minor	
	Adjacent land users	Direct contact via run-off	Unlikely	Minor	
	Soft landscaping	Root uptake	Unlikely	Minor	
	Water supply pipes	Direct contact	Unlikely	Minor	
	Buildings & infrastructure	Direct contact	Unlikely	Minor	
Contaminants within imported Topsoil and sub-soil to new gardens	End users Soft Landscaping	Direct contact	Unlikely	Minor	Very Low All concentrations of determinants recorded at acceptable concentrations within imported Topsoil and sub-soil.

It is considered the site presents a **VERY LOW** risk and no further soil contamination assessment is considered necessary.

5.0 CONCLUSIONS

A thickness 600mm of 'clean' Topsoil and sub-soil cover has been constructed upon the private gardens and in-situ planters surrounding the new homes.

Three samples have been collected from both the imported Topsoil and sub-soil (Sand) which confirms the chemical suitability of the imported soils for use at a residential development.

It is considered that in-situ soils within soft landscaped areas do not present a chemical risk to human health from dermal contact, ingestion, inhalation or gassing via organic degradation.

A VERY LOW risk is now assigned in respect of soil contamination and further assessment is not considered necessary.

It is evident former Made Ground/re-worked Topsoil is no longer present within the gardens and soft landscaped areas. However, a waste management audit has not been completed. As necessary the Principal Contractor should compile waste transfer notes.

The building control surveyor (or specialist installation) should confirm and verify the installation of the necessary ground gas membrane.

6.0 PROJECT INSTRUCTION AND LIMITATIONS

6.1 SCOPE OF WORKS

The following scope of work was undertaken to an agreed proposal prior to the works:

- Attend site as instructed to inspect site and collect soil samples for verification laboratory analysis.
- All soil samples shall be collected in accordance with the instruction and ground conditions and submitted to UKAS/MCERTS accredited laboratories for testing.
- Prepare a Verification Report to document the exercise.

Aviron has relied upon information received from the Client and their agents as accurate, unless contradicted by written documentation or site observations.

6.2 PUBLISHED GUIDANCE

This report follows the technical approach presented in Contaminated Land Report 11 (CLR11) "Model Procedures for the Management of Land Contamination" prepared by the Environment Agency in 2004. CLR11 provides guidance on the application of management processes when assessing potentially contaminated land.

This project and report have been designed to fulfil the information requirements set out in the Environment Agency Guidance on Requirements for Land Contamination Reports prepared by the Environment Agency in 2005.

Notwithstanding the above this report is additionally prepared in accordance with current guidance notes, standards and practices as set out by the Environment Agency and statutory organisations in order to establish potential and significant pollutant linkages as defined in Part IIA of the Environmental Protection Act 1990.

6.3 LIMITATIONS

The information used in this report has been derived from the verification site investigation, which in turn were based on known current and historical land uses identified at the site and surrounding area, available to Aviron at the time of the investigation.

Intrusive points chosen relate to the data collected and the risk assessment will rely on these points only. It

therefore follows that some areas of the site will not be examined. It is always possible that some areas not investigated may contain conditions which would be impossible to determine due to lack of evidence or time and budget restrictions.

Should changes in legislation, statutory requirements or industry practices occurred following issue of this report, this report should be viewed in light of these changes.

Should a notable time period elapse between the date issue of this report and the date of application of this report changes to site dynamics may occur and in particular the site inspection notes may no longer be applicable should any change of use occur to the site in the interim.

7.0 REFERENCES AND OTHER SOURCES OF INFORMATION

Aviron. Report listed in section 1.0.

DEFRA and Environment Agency, 2004. Model Procedures for the Management of Land Contamination, Contaminated Land Report 11.

NHBC (2010). National House Building Council Standards. Chapter 4.

BS EN ISO 22475-1 Geotechnical investigation and testing - sampling methods and groundwater measurements.

BS10175: 2011. British Standards Institute. Investigation of Potentially Contaminated Land - Code of Practice

LQM/CIEH: Paul Nathanail, Caroline McCaffrey, Andy Gillett, Richard Ogden and Judith Nathanail. 2014. The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham. ISBN 978-0-9931084-0-2. "Copyright Land Quality Management Limited reproduced with permission; Publication number S4UL3275. All rights reserved"

SP1010 - Development of Category 4 Screening Levels for Land Affected by Contamination. Final Project Report (Revision 2). Contaminated Land : Applications In Real Environmental (CL:AIRE). September 2014.

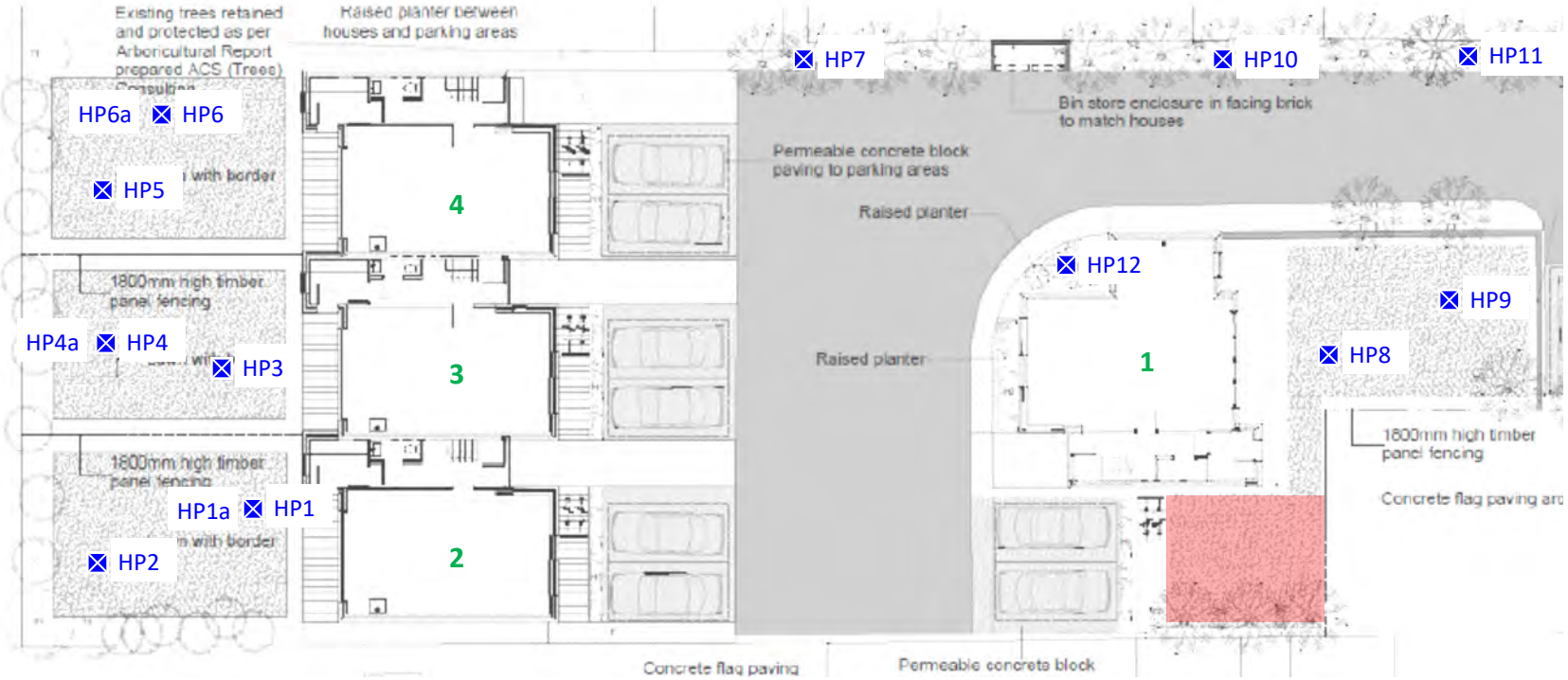
SR2: Human health toxicological assessment of contaminants in soil, Science Report SC050021/SR2, Environment Agency, August 2008.

SR7: Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values, Science Report SC050021/SR7, Environment Agency, November 2008.

Environment Agency. July 2005. Guidance on Requirements for Land Contamination Reports.

Figures

1 Site and Verification Trial Hole Location Plan



Legend

- Hand Inspection Pit
- Area occupied by double garage
- 1 Plot Number

Notes

Figure 1

Drawing Title	Site and Verification Trial Hole Location Plan
Project Number	19-128.03
Project Title	Land to rear of 41-67 Hook Road, Epsom, KT19 8TP
Drawn by	OB
Checked by	JB
Scale	NTS

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Appendices

I Site Inspection Photographs

II Laboratory Certificates of Anaylsis

Appendix

I Site Inspection Photographs

PLOT 1 - Inspection Photographs

Project Number	19-128.03	Project Title	Land at read of 41-67 Hook Road, Epsom, KT19 8TP	Taken by	JD	Date	27/10/2020	Taken by	GR	Date	21/12/2020

HP8
27/10/2020

HP9
27/10/2020

HP12
21/12/2020

HP8
27/10/2020

HP9
27/10/2020

PLOT 1 - Inspection Photographs

Project Number	19-128.03	Project Title	Land at read of 41-67 Hook Road, Epsom, KT19 8TP	Taken by	DN	Date	09/10/2020	Taken by	GR	Date	21/12/2020

Garden of Plot 1
09/10/2020
Not accessible as turf soft and recently laid.

Completed Garage to Plot 1
21/12/2020

PLOTS 2, 3 + 4 - Inspection Photographs

Project Number	19-128.03	Project Title	Land at read of 41-67 Hook Road, Epsom, KT19 8TP	Taken by	DN	Date	09/10/2020	Taken by	GR	Date	21/12/2020

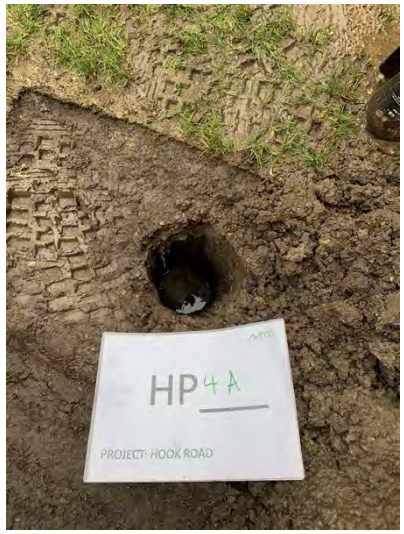
HP1 - Plot 2
09/10/2020

HP1a - Plot 2
21/12/2020

HP2 - Plot 2
09/10/2020

HP3 - Plot 3
09/10/2020

HP4 - Plot 3
09/10/2020



HP4a - Plot 3
09/10/2020

PLOTS 2, 3 + 4 - Inspection Photographs

Project Number	19-128.03	Project Title	Land at read of 41-67 Hook Road, Epsom, KT19 8TP	Taken by	DN	Date	09/10/2020	Taken by	GR	Date	21/12/2020

HP5 - Plot 4
09/10/2020

HP6- Plot 4
09/10/2020

HP6a - Plot 4
21/12/2020

PLOTS 2, 3 + 4 - Inspection Photographs

Project Number	19-128.03	Project Title	Land at read of 41-67 Hook Road, Epsom, KT19 8TP	Taken by	JD	Date	27/10/2020	Taken by		Date	

Rear gardens
27/10/2020

Rear gardens
27/10/2020

PLANTER - Inspection Photographs

Project Number	19-128.03	Project Title	Land at read of 41-67 Hook Road, Epsom, KT19 8TP	Taken by	DN	Date	09/10/2020	Taken by	GR	Date	21/12/2020

HP7
09/10/2020

HP10
21/12/2020

HP11
21/12/2020

Appendix

II Laboratory Certificates of Anaylsis

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Analytical Report Number : 20-38148

Project / Site name:	Land r-o 41-67 Hood Road, Epsom, KT19 8TP	**Samples received on:**	27/10/2020
Your job number:	19-128.03	**Samples instructed on/ Analysis started on:**	27/10/2020
Your order number:	19-128.03	**Analysis completed by:**	03/11/2020
Report Issue Number:	1	**Report issued on:**	03/11/2020
Samples Analysed:	6 soil samples		

Signed:

Zina Abdul Razzak
Senior Quality Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 20-38148
Project / Site name: Land r-o 41-67 Hood Road, Epsom, KT19 8TP
Your Order No: 19-128.03

Lab Sample Number				1666022	1666023	1666024	1666025
Sample Reference				TS1	TS2	TS3	SS1
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				27/10/2020	27/10/2020	27/10/2020	27/10/2020
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**				
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	16	11	13	8.7
Total mass of sample received	kg	0.001	NONE	0.2	0.2	0.2	0.2

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.3	8.5	8.4	8.5
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1
Total Sulphate as SO4	mg/kg	50	MCERTS	2400	2200	2400	510
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.62	0.6	0.57	0.085
Total Sulphur	mg/kg	50	MCERTS	1600	1400	1500	230
Organic Matter	%	0.1	MCERTS	7.6	8.2	8.4	1

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.54	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	0.42	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.34	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	0.28	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.34	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.2	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.29	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	2.41	< 0.80	< 0.80

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	14	14	14	3.4
Boron (water soluble)	mg/kg	0.2	MCERTS	0.6	2.6	1.9	0.3
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	21	20	19	4.4
Copper (aqua regia extractable)	mg/kg	1	MCERTS	20	18	18	5.4
Lead (aqua regia extractable)	mg/kg	1	MCERTS	30	28	27	6.1
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.4	< 0.3	< 0.3	0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	17	17	16	4
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	72	66	65	16

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Analytical Report Number: 20-38148
Project / Site name: Land r-o 41-67 Hood Road, Epsom, KT19 8TP
Your Order No: 19-128.03

Lab Sample Number				1666022	1666023	1666024	1666025
Sample Reference				TS1	TS2	TS3	SS1
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				27/10/2020	27/10/2020	27/10/2020	27/10/2020
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**				
Monoaromatics & Oxygenates							
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Petroleum Hydrocarbons							
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample

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Analytical Report Number: 20-38148
Project / Site name: Land r-o 41-67 Hood Road, Epsom, KT19 8TP
Your Order No: 19-128.03

Lab Sample Number				1666026	1666027
Sample Reference				SS2	SS3
Sample Number				None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied
Date Sampled				27/10/2020	27/10/2020
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	8.3	9
Total mass of sample received	kg	0.001	NONE	0.2	0.2

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.4	8.3
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1
Total Sulphate as SO4	mg/kg	50	MCERTS	570	690
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.077	0.11
Total Sulphur	mg/kg	50	MCERTS	200	340
Organic Matter	%	0.1	MCERTS	1	1.9

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	4.2	3.1
Boron (water soluble)	mg/kg	0.2	MCERTS	0.4	0.4
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	5.9	5.2
Copper (aqua regia extractable)	mg/kg	1	MCERTS	7.3	5.8
Lead (aqua regia extractable)	mg/kg	1	MCERTS	7.9	6.5
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	5.2	4.6
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	20	16

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Analytical Report Number: 20-38148
Project / Site name: Land r-o 41-67 Hood Road, Epsom, KT19 8TP
Your Order No: 19-128.03

Lab Sample Number				1666026	1666027
Sample Reference				SS2	SS3
Sample Number				None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied
Date Sampled				27/10/2020	27/10/2020
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**		
Monoaromatics & Oxygenates					
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	< 10	< 10
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10

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Analytical Report Number : 20-38148
Project / Site name: Land r-o 41-67 Hood Road, Epsom, KT19 8TP

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1666022	TS1	None Supplied	None Supplied	Brown loam and sand with vegetation and gravel.
1666023	TS2	None Supplied	None Supplied	Brown loam and sand with vegetation and gravel.
1666024	TS3	None Supplied	None Supplied	Brown loam and sand with vegetation and gravel.
1666025	SS1	None Supplied	None Supplied	Light brown sand with gravel.
1666026	SS2	None Supplied	None Supplied	Light brown sand with gravel.
1666027	SS3	None Supplied	None Supplied	Light brown sand with gravel.

Analytical Report Number : 20-38148
Project / Site name: Land r-o 41-67 Hood Road, Epsom, KT19 8TP

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE

Analytical Report Number : 20-38148
Project / Site name: Land r-o 41-67 Hood Road, Epsom, KT19 8TP

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

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