TIM O'HARE ASSOCIATES
SOIL & LANDSCAPE CONSULTANCY

Mr John Coles
Bury Hill Landscape Supplies Ltd
The Estate Office
Old Bury Hill
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Surrey, RH4 3JU

7th December 2023
Our Ref: TOHA/23/1184/6/SS
Your Ref: see below

Dear Sirs

Subsoil Analysis Report: Bury Hill Horsham Yard – Moisture Retentive Subsoil

We have completed the analysis of the soil sample recently submitted, referenced *Moisture Retentive Subsoil* and have pleasure reporting our findings.

The purpose of the analysis was to determine the suitability of the sample for use as subsoil in general landscape purposes (trees, shrubs, amenity grass). In addition, this sample has been assessed to determine its compliance with the requirements of the British Standard for Subsoil *(BS8601:2013 – Specification for subsoil and requirements for use – Table 1, Multipurpose Subsoil),* including analysis of potential contaminants.

This report presents the results of analysis for the sample submitted to our office, and it should be considered 'indicative' of the subsoil source. The report and results should therefore not be used by third parties as a means of verification or validation testing, or for any project-specific applications, especially after the subsoil has left the Bury Hill Landscape Supplies Ltd site.

SAMPLE EXAMINATION

The sample can be described as a yellowish brown (Munsell Colour, 10YR 5/6), slightly moist, friable, non-calcareous LOAMY SAND with a weakly developed, fine to coarse sub-angular blocky structure*. The sample was moderately stony and no unusual odours, deleterious materials, roots or rhizomes of pernicious weeds were observed.

*This appraisal of soil structure was made from examination of a disturbed sample(s). Structure is a key soil characteristic that may only be accurately assessed by examination in an in-situ state.

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Plate 1: Moisture Retentive Subsoil Sample

ANALYTICAL SCHEDULE

The sample was submitted to a UKAS and MCERTS accredited laboratory for a range of physical and chemical tests to confirm the composition of the soil. The following parameters were determined:

- detailed particle size analysis (5 sands, silt, clay);
- stone content (2-20mm, 20-75mm, >75mm);
- saturated hydraulic conductivity;
- pH and electrical conductivity (1:2.5 water extract);
- exchangeable sodium percentage
- calcium carbonate.
- organic matter content;
- visible contaminants;
- heavy metals (Sb, As, B, Ba, Be, Cd, Cr, Cu, Pb, Hg, Ni, Se, V, Zn);
- total cyanide and total (mono) phenols;
- speciated PAHs (US EPA16 suite);
- aromatic and aliphatic TPH (C5-C35 banding);
- benzene, toluene, ethylbenzene, xylene (BTEX);
- asbestos screen.

The results are presented on the attached Certificate of Analysis and an interpretation of the results is given below.

RESULTS OF ANALYSIS

Particle Size Analysis and Saturated Hydraulic Conductivity

The sample fell into the *loamy sand* texture class. Further detailed particle size analysis revealed the sample to have a reasonably broad particle size distribution. This could increase the risk of particle interpacking once the material is placed. In this situation, finer particles fill the voids between the larger particles, thereby reducing drainage and aeration. The soil would not be suited to more demanding planting environments or plant species that require or prefer light or free-draining soil.

If this soil is to be used as subsoil for general landscape purposes, we would recommend that only species tolerant of heavy, moisture retentive soil are selected for planting. In addition, smaller plant stock, such as whips and transplants, would be more suited than containerised or rootballed stock, as they tend to be more tolerant of adverse soil conditions. The soil would not be suitable for use in tree pits.

The subsoil represented by this sample would be described as 'very slow draining' which is confirmed by the low saturated hydraulic conductivity result (<1.0 mm/hr).

Stone Content

The stone content of the sample was low and, as such, stones should not restrict the use of the soil for use as subsoil in general landscape purposes.

pH and Electrical Conductivity Values

The sample was strongly alkaline in reaction (pH 8.0), with a pH value that would be considered suitable for subsoil for general landscape purposes provided plant species selected have a wider pH tolerance or are known to prefer alkaline soil conditions.

The electrical conductivity (salinity) value (water extract) was low, which indicates that soluble salts were not present at levels that would be harmful to plants.

The electrical conductivity value by $CaSO_4$ extract (*BS8601* requirement) fell below the maximum specified value (2800 µS/cm) given in *BS8601:2013 – Table 1*.

Organic Matter Content

The organic matter content was low (<2%) and compliant with *BS8601:2013 – Table 1*.

Potential Contaminants

With reference to *BS8601:2013 – Section 4.2: Note 2*, there is a requirement to confirm levels of potential contaminants in relation to the subsoil's proposed end use. This includes human health, environmental protection and metals considered toxic to plants. In the absence of site-specific assessment criteria, the concentrations of selected potential contaminants that affect human health have been assessed for the concentrations that affect human health have been assessed for *residential* end-use against the Suitable For Use Levels (S4ULs) presented in the LQM/CIEH S4ULs for Human Health Risk Assessment (2015) and the DEFRA SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document (2014).

Of the potential contaminants determined, none exceeded their respective guideline values.

Phytotoxic Contaminants

Of the phytotoxic (toxic to plants) contaminants determined (copper, nickel, zinc), none was found at levels that exceeded the maximum permissible levels specified in *BS8601:2013 – Table 1*.

CONCLUSION

The purpose of the analysis was to determine the suitability of the sample for use as subsoil in general landscape applications (trees, shrubs, amenity grass). In addition, this sample has been assessed to determine its compliance with the requirements of the British Standard for Subsoil *(BS8601:2013 – Specification for subsoil and requirements for use – Table 1, Multipurpose Subsoil).*

From the soil examination and subsequent laboratory analysis, the soil represented by this sample was described as a strongly alkaline, non-saline, non-calcareous loamy sand with a weakly developed soil structure and low stone content. The organic matter content was low and consistent with subsoil. Of the potential contaminants determined, none exceeded their respective guideline values.

To conclude, based on our findings, the subsoil represented by this sample would be suitable for use in a number of landscape applications (shrub planting, native transplants and amenity grass), provided the structural condition of the soil is satisfactory and only plant species tolerant of moisture retentive soil conditions are selected. The soil would not be suitable for plants or planting environments that require or prefer light or free-draining soil conditions.

The sample was also fully compliant with the requirements of the British Standard for Subsoil *(BS8601:2013 – Specification for subsoil and requirements for use – Table 1, Multipurpose Subsoil).*

Soil Handling Recommendations

Reference should be made to Section 6.0 of *BS8601:2013* with regard to the handling and management of the subsoil:

"Soils generally lose strength and become less resistant to damage as they become wetter; therefore, it is essential that they are stripped, handled and trafficked only in the appropriate conditions of weather and soil moisture, and with suitable machinery. If sustained heavy rainfall (e.g. >10 mm in 24 h) occurs during soil stripping operations, work should be suspended and not restarted until the ground has had at least one dry day or until a suitable moisture content has been reached. A soil can be considered to have a suitable moisture content for stripping and handling if the whole thickness of the subsoil layer being stripped and/or handled is at a moisture content below the plastic limit as determined in accordance with BS 1377-2:1990 (incorporating Amendment No. 1).

Machinery should be selected and routed to minimise soil compaction."

Further guidance is provided in Clauses 6.1–6.5.

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We hope this report meets with your approval and provides the necessary information. Please do not hesitate to contact the undersigned if we can be of further assistance.

Yours faithfully

H.MacRae

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Graduate Soil Scientist

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For & on behalf of Tim O'Hare Associates LLP

TIM O'HARE ASSOCIATES
SOIL & LANDSCAPE CONSULTANCY

Client:	**Bury Hill Landscape Supplies Ltd**
Project	**Bury Hill Horsham Yard**
Job:	**Subsoil Analysis**
Date:	**07/12/2023**
Job Ref No:	**TOHA/23/1184/6/SS**

Sample Reference			**Moisture Retentive Subsoil**
		Accreditation	
Clay (<0.002mm)	%	UKAS	9
Silt (0.002-0.05mm)	%	UKAS	7
Very Fine Sand (0.05-0.15mm)	%	UKAS	12
Fine Sand (0.15-0.25mm)	%	UKAS	20
Medium Sand (0.25-0.50mm)	%	UKAS	32
Coarse Sand (0.50-1.0mm)	%	UKAS	17
Very Coarse Sand (1.0-2.0mm)	%	UKAS	3
Total Sand (0.05-2mm)	%	UKAS	84
Texture Class (UK Classification)	--	UKAS	LS
Stones (2-20mm)	% DW	GLP	2
Stones (20-75mm)	% DW	GLP	1
Stones (>75mm)	% DW	GLP	0
Saturated Hydraulic Conductivity	mm/hr	A2LA	<1.0
pH Value (1:2.5 water extract)	units	UKAS	8.0
Calcium Carbonate	%	UKAS	< 1.0
Electrical Conductivity (1:2.5 water extract)	uS/cm	UKAS	145
Electrical Conductivity (1:2 $CaSO_4$ extract)	uS/cm	UKAS	2093
Organic Matter (LOI)	%	UKAS	1.0
Exchangeable Sodium Percentage	%	UKAS	0.4
Visible Contaminants: Plastics >2.00mm	%	UKAS	0
Visible Contaminants: Sharps >2.00mm	%	UKAS	0
Total Antimony (Sb)	mg/kg	MCERTS	< 1.0
Total Arsenic (As)	mg/kg	MCERTS	25
Total Barium (Ba)	mg/kg	MCERTS	11
Total Beryllium (Be)	mg/kg	MCERTS	1.2
Total Cadmium (Cd)	mg/kg	MCERTS	< 0.2
Total Chromium (Cr)	mg/kg	MCERTS	50
Hexavalent Chromium (Cr VI)	mg/kg	MCERTS	< 1.8
Total Copper (Cu)	mg/kg	MCERTS	3.4
Total Lead (Pb)	mg/kg	MCERTS	7.5
Total Mercury (Hg)	mg/kg	MCERTS	< 0.3
Total Nickel (Ni)	mg/kg	MCERTS	17
Total Selenium (Se)	mg/kg	MCERTS	< 1.0
Total Vanadium (V)	mg/kg	MCERTS	100
Total Zinc (Zn)	mg/kg	MCERTS	39
Water Soluble Boron (B)	mg/kg	MCERTS	< 0.2
Total Cyanide (CN)	mg/kg	MCERTS	< 1.0
Total (mono) Phenols	mg/kg	MCERTS	< 1.0
Naphthalene	mg/kg	MCERTS	0.15
Acenaphthylene	mg/kg	MCERTS	< 0.05
Acenaphthene	mg/kg	MCERTS	0.06
Fluorene	mg/kg	MCERTS	< 0.05
Phenanthrene	mg/kg	MCERTS	0.07
Anthracene	mg/kg	MCERTS	< 0.05
Fluoranthene	mg/kg	MCERTS	< 0.05
Pyrene	mg/kg	MCERTS	< 0.05
Benz(a)anthracene	mg/kg	MCERTS	< 0.05
Chrysene	mg/kg	MCERTS	< 0.05
Benzo(b)fluoranthene	mg/kg	MCERTS	< 0.05
Benzo(k)fluoranthene	mg/kg	MCERTS	< 0.05
Benzo(a)pyrene	mg/kg	MCERTS	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	MCERTS	< 0.05
Dibenzo(a,h)anthracene	mg/kg	MCERTS	< 0.05
Benzo(g,h,i)perylene	mg/kg	MCERTS	< 0.05
Total PAHs (sum USEPA16)	mg/kg	MCERTS	< 0.80
Aliphatic TPH >C5 - C6	mg/kg	MCERTS	< 0.020
Aliphatic TPH >C6 - C8	mg/kg	MCERTS	< 0.020
Aliphatic TPH >C8 - C10	mg/kg	MCERTS	< 0.050
Aliphatic TPH >C10 - C12	mg/kg	MCERTS	< 1.0
Aliphatic TPH >C12 - C16	mg/kg	MCERTS	< 2.0
Aliphatic TPH >C16 - C21	mg/kg	MCERTS	< 8.0
Aliphatic TPH >C21 - C35	mg/kg	MCERTS	< 8.0
Aliphatic TPH (C5 - C35)	mg/kg	MCERTS	< 10
Aromatic TPH >C5 - C7	mg/kg	MCERTS	< 0.010
Aromatic TPH >C7 - C8	mg/kg	MCERTS	< 0.010
Aromatic TPH >C8 - C10	mg/kg	MCERTS	< 0.050
Aromatic TPH >C10 - C12	mg/kg	MCERTS	< 1.0
Aromatic TPH >C12 - C16	mg/kg	MCERTS	< 2.0
Aromatic TPH >C16 - C21	mg/kg	MCERTS	< 10
Aromatic TPH >C21 - C35	mg/kg	MCERTS	< 10
Aromatic TPH (C5 - C35)	mg/kg	MCERTS	< 10
Benzene	mg/kg	MCERTS	< 0.005
Toluene	mg/kg	MCERTS	< 0.005
Ethylbenzene	mg/kg	MCERTS	< 0.005
p & m-xylene	mg/kg	MCERTS	< 0.005
o-xylene	mg/kg	MCERTS	< 0.005
MTBE (Methyl Tertiary Butyl Ether)	mg/kg	MCERTS	< 0.005
Asbestos	D/ND	ISO 17025	Not-detected

LS = LOAMY SAND

Visual Examination

The sample can be described as a yellowish brown (Munsell Colour, 10YR 5/6), slightly moist, friable, non-calcareous LOAMY SAND with a weakly developed, fine to coarse sub-angular blocky structure. The sample was moderately stony and no unusual odours, deleterious materials, roots or rhizomes of pernicious weeds were observed.

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Results of analysis should be read in conjunction with the report they were issued with.