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SOIL & LANDSCAPE CONSULTANCY

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5th January 2024
Our Ref: TOHA/24/1197/5/SS
Your Ref: see below

Dear Sirs

Topsoil Analysis Report: Bury Hill Horsham Yard – Ericaceous 'Elevated pH' Topsoil (S)

We have completed the analysis of the soil sample recently submitted, referenced *Ericaceous 'Elevated pH' Topsoil (S)* and have pleasure reporting our findings.

The purpose of the analysis was to determine the suitability of the sample for use as an ericaceous topsoil for calcifuge planting. In addition, this sample has been assessed to determine its compliance with the requirements of the British Standard for Topsoil (*BS3882:2015 – Specification for Topsoil – Table 1, Specific Purpose Topsoil - Acidic*).

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

SAMPLE EXAMINATION

The sample can be described as a pale brown (Munsell Colour 10YR 6/3), moist, non-plastic, non-calcareous SAND with a single grain structure. The sample was stone free and contained a high proportion of organic fines. No unusual odours, deleterious materials, roots or rhizomes of pernicious weeds were observed.

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Plate 1: Ericaceous 'Elevated pH' Topsoil (S) 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 and fertility of the soil, and the concentration of selected potential contaminants. The following parameters were determined:

- detailed particle size analysis ('5 sands', silt, clay);
- stone content (2-20mm, 20-50mm, >50mm);
- saturated hydraulic conductivity;
- pH and electrical conductivity values;
- calcium carbonate;
- exchangeable sodium percentage;
- major plant nutrients (N, P, K, Mg);
- organic matter content;
- C:N ratio;
- 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 Stone Content

The sample fell into the *sand* texture class which exceeds the maximum recommended value of given in *BS3882:2015 – Figure 1*. Further detailed particle size analysis found the sample to have a narrow particle size distribution and a predominance of *medium sand* (0.25-0.50mm) followed by smaller proportion of *coarse sand* (0.50-1.0mm). The total sand content was 96%, which exceeds the maximum recommended value of given in *BS3882:2015 – Figure 1*.

Such soils typically have good aeration and drainage properties, but can possess poor water and nutrient retention capacities. As a consequence, they often have a greater risk of excessive leaching and drought particularly during dry periods. In this instance, however, the higher organic matter content of the sample (8.7%) should assist in offsetting these factors and aid in water and nutrient retention. However, consideration should be made for additional irrigation.

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

Saturated Hydraulic Conductivity

The saturated hydraulic conductivity test is designed to test the sample's drainage potential under a moderate degree of compaction. The saturated hydraulic conductivity of the sample was high (441 mm/hr) and would be described as 'free-draining' and considered suitable for general landscape purposes.

pH and Electrical Conductivity Values

The sample was slightly acid in reaction (pH 6.2), with a pH value that would be considered suitable for ericaceous planting. The pH value slightly exceeded the maximum value specified in *BS3882:2015 – Table 1* (pH 5.5).

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

The electrical conductivity value by CaSO₄ extract (*BS3882* requirement) fell below the maximum specified value (3300 µS/cm) given in *BS3882:2015 – Table 1*.

Organic Matter and Fertility Status

The sample was adequately supplied with organic matter and most major plant nutrients but was deficient in total nitrogen. This deficiency can be remedied by a fertiliser application.

The C:N ratio was high (57:1) and exceeded the maximum upper limit set by *BS3882:2015 - Table 1* (20:1). This could cause 'nitrogen lock up' and result in growth restriction in sensitive plants in particular. The fertiliser application should address the imbalance.

Potential Contaminants

With reference to *BS3882:2015 - Table 1*: Notes 3 and 4, there is a requirement to confirm levels of potential contaminants in relation to the topsoil'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 that affect human health have been compared with the *residential with homegrown produce* land use in 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 (C4SLs) 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 *BS3882:2015 – Table 1*.

CONCLUSION

The purpose of the analysis was to determine the suitability of the sample for use as an ericaceous topsoil for calcifuge planting. In addition, this sample has been assessed to determine its compliance with the requirements of the British Standard for Topsoil (*BS3882:2015 – Specification for Topsoil – Table 1, Specific Purpose Topsoil - Acidic*).

From the soil examination and subsequent laboratory analysis, the sample was described as a slightly acid, non-saline, non-calcareous, stone free sand with a single grain structure. The sample was adequately supplied with organic matter and most major plant nutrients but was deficient in total nitrogen and had a high C:N ratio. Of the potential contaminants determined, none exceeded their respective guideline values.

The sample was described as being 'free-draining' and would therefore benefit from support of an irrigation system.

To conclude, based on our findings, the topsoil represented by this sample would be considered suitable for use in ericaceous planting environments where a free-draining topsoil is required provided the total nitrogen deficiency and high C:N ratio is addressed and the physical condition of the soil is satisfactory. Consideration should also be made for additional irrigation, particularly during dry periods.

The topsoil was mostly compliant with the requirements of the British Standard for Topsoil (*BS3882:2015 – Specification for Topsoil – Table 1, Specific Purpose Topsoil - Acidic*) with the exception of the following parameters:

- high sand content
- slightly high pH value
- total nitrogen deficiency
- high C:N Ratio

On this occasion, these non-compliances are considered minor in the context of all other results provided the total nitrogen and C:N ratio of the sample is addressed through an appropriate fertiliser application, and a free-draining topsoil is required.

RECOMMENDATIONS

Fertiliser for Planting

To address the total nitrogen deficiency and high C:N ratio and to help promote effective plant establishment, we recommend applying and incorporating the compound, controlled release fertiliser *ICL Osmocote PrePlant* (17%N:9%P₂O₅:10%K₂O:2%MgO+TE) at a rate of 70 g/m² for planting beds and/or 180 g/tree pit, and to a depth of 200mm.

Soil Handling Recommendations

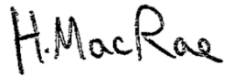
It is important to maintain the physical condition of the soil and avoid structural damage during all phases of soil handling (e.g. stockpiling, resspreading, cultivating, planting, seeding or turfing). As a consequence, soil handling operations should be carried out when soil is reasonably dry and non-plastic (friable) in consistency.

It is important to ensure that the soil is not unnecessarily compacted by trampling or trafficking by site machinery, and soil handling should be stopped during and after heavy rainfall and not continued until the soil is friable in consistency. If the soil is structurally damaged and compacted at any stage during the course of soiling or landscaping works, it should be cultivated appropriately to relieve the compaction and to restore the soil's structure prior to any planting, turfing or seeding.

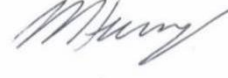
Further details on soil handling are provided in Annex A of *BS3882:2015*.

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



Harriet MacRae
BSc MSc
Graduate Soil Scientist



Matthew Heins
BSc (Hons) MSc
Senior Soil Scientist

For & on behalf of Tim O'Hare Associates LLP



Sample Reference		Accreditation
Clay (<0.002mm)	%	UKAS
Silt (0.002-0.05mm)	%	UKAS
Very Fine Sand (0.05-0.15mm)	%	UKAS
Fine Sand (0.15-0.25mm)	%	UKAS
Medium Sand (0.25-0.50mm)	%	UKAS
Coarse Sand (0.50-1.0mm)	%	UKAS
Very Coarse Sand (1.0-2.0mm)	%	UKAS
Total Sand (0.05-2.0mm)	%	UKAS
Texture Class (UK Classification)	--	UKAS
Stones (2-20mm)	% DW	GLP
Stones (20-50mm)	% DW	GLP
Stones (>50mm)	% DW	GLP

pH Value (1:2.5 water extract)	units	UKAS
Calcium Carbonate	%	UKAS
Electrical Conductivity (1:2.5 water extract)	uS/cm	UKAS
Electrical Conductivity (1:2 CaSO ₄ extract)	uS/cm	UKAS
Exchangeable Sodium Percentage	%	UKAS

Organic Matter (LOI)	%	UKAS
Total Nitrogen (Dumas)	%	UKAS
C : N Ratio	ratio	UKAS
Extractable Phosphorus	mg/l	UKAS
Extractable Potassium	mg/l	UKAS
Extractable Magnesium	mg/l	UKAS

Visible Contaminants: Plastics >2.00mm	%	UKAS
Visible Contaminants: Sharps >2.00mm	%	UKAS

Total Antimony (Sb)	mg/kg	MCERTS
Total Arsenic (As)	mg/kg	MCERTS
Total Barium (Ba)	mg/kg	MCERTS
Total Beryllium (Be)	mg/kg	MCERTS
Total Cadmium (Cd)	mg/kg	MCERTS
Total Chromium (Cr)	mg/kg	MCERTS
Hexavalent Chromium (Cr VI)	mg/kg	MCERTS
Total Copper (Cu)	mg/kg	MCERTS
Total Lead (Pb)	mg/kg	MCERTS
Total Mercury (Hg)	mg/kg	MCERTS
Total Nickel (Ni)	mg/kg	MCERTS
Total Selenium (Se)	mg/kg	MCERTS
Total Vanadium (V)	mg/kg	MCERTS
Total Zinc (Zn)	mg/kg	MCERTS
Water Soluble Boron (B)	mg/kg	MCERTS
Total Cyanide (CN)	mg/kg	MCERTS
Total (mono) Phenols	mg/kg	MCERTS

Naphthalene	mg/kg	MCERTS
Acenaphthylene	mg/kg	MCERTS
Acenaphthene	mg/kg	MCERTS
Fluorene	mg/kg	MCERTS
Phenanthrene	mg/kg	MCERTS
Anthracene	mg/kg	MCERTS
Fluoranthene	mg/kg	MCERTS
Pyrene	mg/kg	MCERTS
Benzo(a)anthracene	mg/kg	MCERTS
Chrysene	mg/kg	MCERTS
Benzo(b)fluoranthene	mg/kg	MCERTS
Benzo(k)fluoranthene	mg/kg	MCERTS
Benzo(a)pyrene	mg/kg	MCERTS
Indeno(1,2,3-cd)pyrene	mg/kg	MCERTS
Dibenzo(a,h)anthracene	mg/kg	MCERTS
Benzo(g,h,i)perylene	mg/kg	MCERTS
Total PAHs (sum USEPA16)	mg/kg	MCERTS

Aliphatic TPH (C5-C6)	mg/kg	MCERTS
Aliphatic TPH (C6-C8)	mg/kg	MCERTS
Aliphatic TPH (C8-C10)	mg/kg	MCERTS
Aliphatic TPH (C10-C12)	mg/kg	MCERTS
Aliphatic TPH (C12-C16)	mg/kg	MCERTS
Aliphatic TPH (C16-C21)	mg/kg	MCERTS
Aliphatic TPH (C21-C35)	mg/kg	MCERTS
Aliphatic TPH (C5-C35)	mg/kg	MCERTS
Aromatic TPH (C5-C7)	mg/kg	MCERTS
Aromatic TPH (C7-C8)	mg/kg	MCERTS
Aromatic TPH (C8-C10)	mg/kg	MCERTS
Aromatic TPH (C10-C12)	mg/kg	MCERTS
Aromatic TPH (C12-C16)	mg/kg	MCERTS
Aromatic TPH (C16-C21)	mg/kg	MCERTS
Aromatic TPH (C21-C35)	mg/kg	MCERTS
Aromatic TPH (C5-C35)	mg/kg	MCERTS

Benzene	mg/kg	MCERTS
Toluene	mg/kg	MCERTS
Ethylbenzene	mg/kg	MCERTS
p & m-xylene	mg/kg	MCERTS
o-xylene	mg/kg	MCERTS

Asbestos	ND/D	ISO17025
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Visual Examination

The sample can be described as a pale brown (Munsell Colour 10YR 6/3), moist, non-plastic, non-calcareous SAND with a single grain structure. The sample was virtually stone free and contained a high proportion of organic fines. No unusual odours, deleterious materials, roots or rhizomes of pernicious weeds were observed.

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

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**Ericaceous 'Elevated pH'
Topsoil (S)**

3
1
3
7
57
23
6
96
S
0
0
0

441

6.2
< 1.0
741
2792
2.1

8.7
0.09
57
32
396
135

0
0

1
6.6
11
0.09
< 0.2
7.0
< 1.8
6.6
6.3
< 0.3
2
< 1.0
15
16
0.5
< 1.0
< 1.0

[illegible]

< 0.020
< 0.020
< 0.050
< 1.0
< 2.0
< 8.0
< 8.0
< 10
< 0.010
< 0.010
< 0.050
< 1.0
< 2.0
< 10
< 10
< 10

< 0.005
< 0.005
< 0.005
< 0.005
< 0.005

Not-detected

H. MacRae

Harriet MacRae
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