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SOIL & LANDSCAPE CONSULTANCY

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9th December 2022
Our Ref: TOHA/22/7685/10/SS
Your Ref: see below

Soil Analysis Report: Bury Hill Horsham Yard – High Permeability Turfsoil (S)

We have completed the analysis of the sample recently submitted, referenced *High Permeability Turfsoil (S)* and have pleasure reporting our findings.

The purpose of the analysis was to determine the suitability of the sample specifically for use as a lawn rootzone for high-performance amenity grass areas with good compaction resistance and a higher drainage rate are required, and where automatic irrigation, and ongoing maintenance are provisioned.

This report presents the results of analysis for the sample submitted to our office, and it should be considered 'indicative' of the soil 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 soil has left the Bury Hill Landscape Supplies Ltd site.

SAMPLE EXAMINATION

The sample was described as a pale yellow (Munsell Colour 10YR 6/3), dry, friable, non-calcareous SAND with a single grain structure. The sample was very slightly stony and contained a low proportion of organic fines and occasional woody fragments. No unusual odours, deleterious materials, roots or rhizomes of pernicious weeds were observed.

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Plate 1: High Permeability Turfsoil (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, drainage rate and fertility of the rootzone, and the concentration of selected potential contaminants. The following parameters were determined:

- detailed particle size analysis (clay, silt, '5 sands');
- 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;
- heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Zn, B);
- 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. Further detailed particle sized distribution found the sample to have a sufficiently narrow particle size distribution, and a predominance of *medium sand* (0.25-0.50mm), with a smaller proportion of *coarse sand* (0.50-1.0mm). This is acceptable for high-use grass areas as sufficient porosity levels should be maintained in a consolidated state and the risk of particle interpacking and surface smearing is minimised.

High sand content soils typically have good aeration, drainage and compaction-resistance properties, but can possess reduced water and nutrient retention capacities. As such, it will be important that the lawn be suitably maintained (seasonal fertiliser applications, irrigation, decompaction etc.) as part of an ongoing maintenance regime.

The sample was virtually stone-free and as such, stones will not restrict the use of the soil.

Saturated Hydraulic Conductivity

The saturated hydraulic conductivity rate (161 mm/hr) recorded under a degree of consolidation was high. This should be considered suitable for high-permeability lawns where a 'fast-draining' soil is required. The high drainage rate will however mean that provision for irrigation will be essential for the long term performance of the sward.

pH and Calcium Carbonate Values

The sample was strongly alkaline in reaction (pH 8.2) and non-calcareous ($\text{CaCO}_3 < 1\%$).

The main source of the 'alkalinity' is likely to be the potassium ions from the compost in the sample. As such, this pH value would be considered suitable for most grass cultivars.

Electrical Conductivity Values

The electrical conductivity (salinity) values (water and CaSO_4 extract) were low, which indicates that soluble salts were not present at levels that would be harmful to plants.

Organic Matter and Fertility Status

The sample was adequately supplied with organic matter and all major plant nutrients.

The C:N ratio of the sample was acceptable for landscape applications.

Potential Contaminants

In the absence of site-specific assessment criteria, the concentrations of potential contaminants that affect human health have been compared with the *residential with home grown 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 was found at levels that exceeded their guideline values.

Phytotoxic Contaminants

Of the phytotoxic (toxic to plants) contaminants determined (copper, nickel, zinc), none was found at levels that exceeded our maximum permissible levels.

CONCLUSION

The purpose of the analysis was to determine the suitability of the sample for use as a *high permeability turfsoil* for high-performance amenity grass / lawn areas.

From the soil examination and subsequent laboratory analysis, the sample was described as an alkaline, non-saline, non-calcareous sand with a single grain structure and very low stone content. The sample contained sufficient reserves of organic matter and all major plant nutrients. Of the potential contaminants determined, none exceeded their respective guideline values.

To conclude, based on our findings, the soil represented by this sample would be considered suitable for high-use lawn areas that are supported by irrigation.

A suitable maintenance regime should also be implemented to support the establishment and continued growth of the grass sward (e.g. decompaction, aeration, fertiliser applications, etc.).

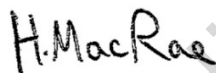
Soil Handling Recommendations

It is important to maintain the physical condition of the soil and avoid compaction during all phases of soil handling (e.g. stockpiling, respreading, cultivating, seeding or turfing). As a consequence, soil handling operations should be carried out when soil and the underlying ground is sufficiently dry and stable.

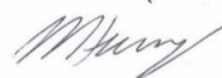
It is important to ensure that the soil is not unnecessarily compacted by trampling or trafficking by site machinery, and soil handling should be stopped during and after heavy rainfall and not continued until the ground has dried out. If the soil is compacted at any stage during the course of soiling or landscaping works, it should be decompacted appropriately.

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
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Graduate Soil Scientist



Matthew Heins
BSc (Hons) MSc
Senior Soil Scientist

For & on behalf of Tim O'Hare Associates LLP



Client:	Bury Hill Landscape Supplies Ltd
Project:	Bury Hill Horsham Yard - High Permeability Turfsoil (S)
Job:	Rootzone Analysis
Date:	09/12/2022
Job Ref No:	TOHA/22/7685/10/SS

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	

High Permeability Turfsoil (S)
2
0
2
7
66
20
3
98
S
1
0
0

Saturated Hydraulic Conductivity	mm/hr	A2LA
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161

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

8.2
< 1.0
484
2652
4.1
2.5
0.10
15
29
479
61

Total Arsenic (As)	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 Zinc (Zn)	mg/kg	MCERTS
Water Soluble Boron (B)	mg/kg	MCERTS
Total Cyanide (CN)	mg/kg	MCERTS
Total (mono) Phenols	mg/kg	MCERTS

3
< 0.2
2.8
< 1.8
9.2
4
< 0.3
< 1.0
< 1.0
8
0.6
< 1.0
< 1.0

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

< 0.05
< 0.05
< 0.05
< 0.05
< 0.05
< 0.05
< 0.05
< 0.05
< 0.05
< 0.05
< 0.05
< 0.05
< 0.05
< 0.05
< 0.05
< 0.05
< 0.05
< 0.80

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

< 0.001
< 0.001
< 0.001
< 1.0
< 2.0
< 8.0
< 8.0
< 10
< 0.001
< 0.001
< 0.001
< 1.0
< 2.0
< 10
< 10
< 10

Benzene	mg/kg	MCERTS
Toluene	mg/kg	MCERTS
Ethylbenzene	mg/kg	MCERTS
p & m-xylene	mg/kg	MCERTS
o-xylene	mg/kg	MCERTS
MTBE (Methyl Tertiary Butyl Ether)	mg/kg	MCERTS

< 0.001
< 0.001
< 0.001
< 0.001
< 0.001
< 0.001

Asbestos	ND/D	ISO 17025
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Not-detected

S = SAND

Visual Examination

The sample was described as a pale yellow (Munsell Colour 10YR 6/3), dry, friable, non-calcareous SAND with a single grain structure. The sample was very slightly stony and contained a low proportion of organic fines and occasional woody fragments. 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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H. MacRae

Harriet MacRae
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Graduate Soil Scientist