TIM O'HARE ASSOCIATES
SOIL & LANDSCAPE CONSULTANCY

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

7th December 2023
Our Ref: TOHA/23/1184/9/SS
Your Ref: see below

Dear Sirs

Soil Analysis Report: Bury Hill Horsham Yard – High Permeability Bio Retention (R)

We have completed the analysis of the *High Permeability Bio Retention (R)* blend sample recently submitted and have pleasure reporting our findings.

INTRODUCTION

The purpose of the analysis was to determine the suitability of the sample for use as a bioretention soil. "Bioretention systems", including raingardens and swales, are shallow landscaped depressions that reduce run-off and treat pollution through the use of engineered soils and the vegetation that the soils support. In doing so they are a key element of many Sustainable Drainage Systems (SuDS).

A bioretention system usually has several components including a vegetation layer, a filter medium, a transition layer and a drainage layer, together with inlets, outlets and pipework. The *bioretention soil* represented by this sample is to be used as the "Filter Medium" of a bioretention system. The purpose of this analysis was therefore to determine the suitability of the sample for this use.

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 topsoil sample was described as a grey (Munsell Colour 10YR 6/1), slightly moist, friable, non-calcareous SAND with a single grain structure. The sample was stone-free 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.

Plate 1: High Permeability Bio Retention (R) 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, performance and fertility of the soil. The following parameters were determined:

- detailed particle size analysis (5 sands, silt, clay);
- 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 (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.

In the absence of site-specific assessment criteria, the concentrations of potential contaminants 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). Levels of phytotoxic metals determined (Cu, Ni, Zn) have also been compared against threshold values indicated in *BS3882:2015 Specification for Topsoil*.

Of the potential contaminants determined, none was found at levels that exceeded their guideline values.

COMMENTS

A bioretention filter medium is normally sand-based with some source of organic matter and slow-release plant nutrients to maintain healthy plant growth, filter out pollutants and control the rate at which water filters through the system, which is a key influence on the effectiveness. The material should be sufficiently permeable and porous to allow water to be infiltrated, attenuated and drained through it so that the surface does not become waterlogged. It also needs to contain sufficient organic matter and plant nutrients to support the vegetation layer.

From the examination and laboratory analysis, the sample was described as a strongly alkaline, non-saline, non-calcareous, stone-free sand. The organic matter content of the sample was borderline low and contained adequate levels of most major plant nutrients with the exception of the total nitrogen content which was low. Of the potential contaminants determined, none exceeded their respective guideline values.

A bioretention soil usually requires a high-water attenuation capacity and a good drainage rate in order to absorb run-off. The grading of this sample is largely within the desirable range. The saturated hydraulic conductivity result is very high, and so may limit the suitability of the material to schemes where a high drainage rate is required.

The organic matter and total nitrogen results are on the low side to support more demanding planting types such as trees and shrubs especially during the initial establishment phase. It may therefore be beneficial to address the deficiencies through appropriate amelioration depending on the project specific applications.

The suitability of the soil for any proposed schemes should be reviewed against any project specific requirements.

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.

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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

Harriet MacRae
BSc MSc
Graduate Soil Scientist

Matthew Heins
BSc (Hons) MISoilSci
Senior Soil Scientist

For and 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 - High Permeability Bioretention (R)**
Job:	**Soil Analysis**
Date:	**07/12/2023**
Job Ref No:	**TOHA/23/1184/9/SS**

Sample Reference			**High Permeabilty Bio Retention (R)**
		Accreditation	
Clay (<0.002mm)	%	UKAS	8
Silt (0.002-0.05mm)	%	UKAS	0
Very Fine Sand (0.05-0.15mm)	%	UKAS	0
Fine Sand (0.15-0.25mm)	%	UKAS	8
Medium Sand (0.25-0.50mm)	%	UKAS	60
Coarse Sand (0.50-1.0mm)	%	UKAS	23
Very Coarse Sand (1.0-2.0mm)	%	UKAS	1
Total Sand (0.05-2.0mm)	%	UKAS	92
Texture Class (UK Classification)	--	GLP	S
Stones (>2mm)	% DW	GLP	0
Stones (>20mm)	% DW	GLP	0
Stones (>50mm)	% DW	GLP	0
Saturated Hydraulic Conductivity (m)	mm/hr	A2LA	315
pH Value (1:2.5 water extract)	units	UKAS	8.5
Calcium Carbonate	%	UKAS	< 1.0
Electrical Conductivity (1:2.5 water extract)	uS/cm	UKAS	522
Electrical Conductivity (1:2 $CaSO_4$ extract)	uS/cm	UKAS	2850
Exchangeable Sodium Percentage	%	UKAS	3.9
Organic Matter (LOI)	%	UKAS	1.6
Total Nitrogen (Dumas)	%	UKAS	0.05
C : N Ratio	ratio	UKAS	18
Extractable Phosphorus	mg/l	UKAS	32
Extractable Potassium	mg/l	UKAS	585
Extractable Magnesium	mg/l	UKAS	59
Total Antimony (Sb)	mg/kg	MCERTS	< 1.0
Total Arsenic (As)	mg/kg	MCERTS	2
Total Barium (Ba)	mg/kg	MCERTS	3.7
Total Beryllium (Be)	mg/kg	MCERTS	< 0.06
Total Cadmium (Cd)	mg/kg	MCERTS	< 0.2
Total Chromium (Cr)	mg/kg	MCERTS	2.6
Hexavalent Chromium (Cr VI)	mg/kg	MCERTS	< 1.8
Total Copper (Cu)	mg/kg	MCERTS	4.6
Total Lead (Pb)	mg/kg	MCERTS	3.5
Total Mercury (Hg)	mg/kg	MCERTS	< 0.3
Total Nickel (Ni)	mg/kg	MCERTS	1.0
Total Selenium (Se)	mg/kg	MCERTS	< 1.0
Total Vanadium (V)	mg/kg	MCERTS	3.2
Total Zinc (Zn)	mg/kg	MCERTS	7.2
Water Soluble Boron (B)	mg/kg	MCERTS	0.5
Total Cyanide (CN)	mg/kg	MCERTS	< 1.0
Total (mono) Phenols	mg/kg	MCERTS	< 1.0
Naphthalene	mg/kg	MCERTS	< 0.05
Acenaphthylene	mg/kg	MCERTS	< 0.05
Acenaphthene	mg/kg	MCERTS	< 0.05
Fluorene	mg/kg	MCERTS	< 0.05
Phenanthrene	mg/kg	MCERTS	< 0.05
Anthracene	mg/kg	MCERTS	< 0.05
Fluoranthene	mg/kg	MCERTS	< 0.05
Pyrene	mg/kg	MCERTS	< 0.05
Benzo(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
Asbestos	ND/D	ISO17025	Not-detected

S = SAND

Visual Examination

The topsoil sample was described as a grey (Munsell Colour 10YR 6/1), slightly moist, friable, non-calcareous SAND with a single grain structure. The sample was stone-free 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.

H.MacRae

Harriet MacRae
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Graduate Soil Scientist

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