



TIM O'HARE ASSOCIATES
SOIL & LANDSCAPE CONSULTANCY

Drew Wetherell
Bourne Amenity Ltd
The Wharf
Newenden
Cranbrook
Kent TN18 5QG

10th February 2021
Our Ref: TOHA/21/9813/SS
Your Ref: PO 66751

Dear Sirs

Soil Analysis Report: Lightweight Subsoil

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

The purpose of the analysis was to determine the suitability of the material for use as a lightweight subsoil in a rooftop garden environment.

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 Bourne Amenity Ltd site.

SAMPLE EXAMINATION

The sample was described as a yellow (Munsell Colour 10YR 7/6), slightly moist, friable, non-calcareous SAND with a single grain structure*. The sample was free of stone-sized material, with the exception of frequent lightweight expanded clay aggregate particles (Ieca). No deleterious materials, unusual odours, 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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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);
- bulk density (oven dry, field capacity, saturated);
- saturated hydraulic conductivity;
- porosity;
- particle density;
- visible contaminants (>2mm);
- pH and electrical conductivity values;
- calcium carbonate;
- exchangeable sodium percentage;
- organic matter content;
- heavy metals (Sb, As, B, Ba, Be, Cd, Cr, Cr VI, Cu, Pb, Hg, Ni, Se, V, Zn);
- soluble sulphate, elemental sulphur, acid volatile sulphide;
- total cyanide and total (mono) phenols;
- aromatic and aliphatic TPH (C5-C44 banding);
- speciated PAHs (US EPA16 suite);
- 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 & Stone Content

The sample fell into the *sand* texture class and would be described as light in texture. Further detailed particle size analysis revealed the sample to have a sufficiently narrow particle size distribution and a predominance of *medium sand* (0.25-0.50mm), followed by *coarse sand* (0.50-1.0mm). This is acceptable for subsoil for roof garden environments as porosity levels are maintained under a degree of consolidation and the risk of particle interpacking is minimised.

With the exception of 'leca' particles, the sample was virtually free of 'stone' sized material (>2mm).

Bulk Density, Saturated Hydraulic Conductivity and Porosity

The sample displayed slightly lower bulk density values compared to those typically recorded for the base material without the addition of leca. The suitability of the bulk density results for the requirements of the recipient site should be confirmed by the project engineer.

The saturated hydraulic conductivity of the sample was high (10.5 mm/minute or 635 mm/hour), and suitable for lightweight subsoil, provided a free draining soil is suited to the recipient scheme.

The sample displayed a satisfactory total porosity value.

pH and Electrical Conductivity Values

The sample was slightly alkaline in reaction (pH 7.1), with a pH value that would be suitable as subsoil for general landscape purposes.

The electrical conductivity (salinity) values (water and CaSO₄ extracts) were low, which indicates that soluble salts should not be present at levels that would be harmful to plants.

Organic Matter

The organic matter content was low (<0.5%) and consistent with that of subsoil.

Potential Contaminants

In the absence of site-specific criteria, the concentrations that affect human health have been assessed for *residential with homegrown produce* 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 was found at levels that exceed their guideline values.

Phytotoxic Contaminants

Of the phytotoxic (toxic to plants) contaminants determined (copper, nickel, zinc), none was found at levels that exceeded their guideline values.

CONCLUSION

The purpose of the analysis was to determine the suitability of the material for use as a lightweight subsoil for landscaping purposes in a rooftop garden environment.

From the sample examination and laboratory analysis, the substrate was described as a slightly alkaline, non-saline, non-calcareous sand with frequent leca particles. The sample possessed a high saturated hydraulic conductivity and satisfactory total porosity value. The organic matter content was low. Of the potential contaminants determined, none exceeded their respective guideline values.

Based on our findings, the substrate represented by this sample should be suitable for use as a lightweight growing medium in roof garden environment, provided a free draining soil is suited to the recipient scheme. The suitability of the bulk density results for the requirements of the recipient site should be confirmed by the project engineer.

RECOMMENDATIONS

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. If the soil is compacted at any stage during the course of soiling or landscaping works, it should be cultivated appropriately to relieve the compaction.

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



Tilly Kimble-Wilde
BSc MSc
Graduate Soil Scientist



Ceri Spears
BSc MSc MSc SoilSci
Senior Associate

For & on behalf of Tim O'Hare Associates LLP



TIM O'HARE ASSOCIATES
SOIL & LANDSCAPE CONSULTANCY

Client:	Bourne Amenity Ltd
Project:	Lightweight Subsoil for Roof Gardens
Job:	Physical and Horticultural Properties
Date:	10/02/2021
Job Ref No:	TOHA/21/9813/SS

Sample Reference		
		Accreditation
Clay (<0.002mm)	%	UKAS
Silt (0.002-0.063mm)	%	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	UKAS
Stones (20-50mm)	% DW	UKAS
Stones (>50mm)	% DW	UKAS

Bulk Density (at Field Capacity)	g/cm ³	A2LA
Bulk Density (at Saturation)	g/cm ³	A2LA
Bulk Density (when Oven Dried)	g/cm ³	A2LA
Field Capacity	% v/v	A2LA
Particle Density	g/cm ³	A2LA

Saturated Hydraulic Conductivity	mm/hr mm/min	A2LA
Total Porosity	%	A2LA
Porosity at Field Capacity		A2LA

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

S = SAND

Visual Examination

The sample was described as a yellow (Munsell Colour 10YR 7/6), slightly moist, friable, non-calcareous SAND with a single grain structure. The sample was free of stone-sized material, with the exception of frequent lightweight expanded clay aggregate particles (leca). No deleterious materials, unusual odours, 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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Lightweight Washed Sand Subsoil

1
1
1
9
67
19
2
98
S
14
0
0

1.73
1.61
1.35
38
1.82

630
10.5
26
0

7.1
<1.0
203
2197
2.8

<0.5

0
0

mkimble-wilde

Tilly Kimble-Wilde
BSc MSc
Graduate Soil Scientist



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SOIL & LANDSCAPE CONSULTANCY

Client:	Bourne Amenity Ltd
Project	Lightweight Subsoil for Roof Gardens
Job:	Chemical Properties
Date:	10/02/2021
Job Ref No:	TOHA/21/9813/SS

Sample Reference		Accreditation
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
Elemental Sulphur (S)	mg/kg	MCERTS
Acid Volatile Sulphide (S)	mg/kg	MCERTS
Water Soluble Sulphate (SO ₄)	g/l	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
MTBE (Methyl Tertiary Butyl Ether)	mg/kg	MCERTS

Asbestos Screen	ND/D	ISO 17025
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**Lightweight
Washed Sand
Subsoil**

< 1.0
7.7
7.1
0.2
< 0.2
17
< 4.0
24
4
< 0.3
18
< 1.0
30
30
< 0.2
< 1
< 1.0
99
400
0.13

< 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

< 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

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

Not-detected

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