



TIM O'HARE ASSOCIATES  
SOIL & LANDSCAPE CONSULTANCY

Jonathan Bourne  
Bourne Amenity Ltd  
The Wharf  
Newenden  
Cranbrook  
Kent TN18 5QG

22<sup>nd</sup> February 2023  
Our Ref: TOHA/23/7818/8/SS  
Your Ref: PO 114359

Dear Sirs

**Structural Subsoil Analysis Report – Washed Sand Subsoil**

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

The purpose of the analysis was to determine the suitability of the sample for use as a 'structural subsoil for tree planting in hard landscape situations'.

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, waste designation purposes or for any project-specific application, especially after the material has left the Bourne Amenity Ltd site.

**SAMPLE EXAMINATION**

The sample was described as a brownish yellow (Munsell Colour 10YR 6/8), moist, friable, non-calcareous SAND with a single grain structure. The sample was very slightly stony and no unusual odours, deleterious materials, roots or rhizomes of pernicious weeds were recorded.

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Tim O'Hare Associates LLP  
Howbery Park Wallingford Oxfordshire OX10 8BA  
T:01491 822653 E:info@toha.co.uk  
www.toha.co.uk



*Plate 1: Washed Sand Subsoil Sample*

### **ANALYTICAL SCHEDULE**

The sample was submitted to the laboratory for a range of physical and chemical analyses in accordance with the following schedule:

#### **Geotechnical Properties**

- permeability;
- total, air-filled and capillary porosity;
- bulk density;
- California Bearing Ratio (CBR).

#### **Horticultural Properties**

- detailed particle size distribution;
- stone content;
- moisture content;
- pH value;
- calcium carbonate;
- organic matter content;
- electrical conductivity values;
- exchangeable sodium percentage;
- visible contaminants (>2mm).

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

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## **RESULTS OF ANALYSIS**

### **Particle Size Distribution and Stone Content**

The sample fell into the *sand* texture class. The grading of the sand indicates a 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 a 'structural subsoil' as sufficient porosity levels are maintained in a compacted state and the risk of particle interpacking is minimised.

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

### **Permeability and Porosity**

The permeability of the sample when in a compacted state (Standard Compaction) was high (376mm/hr) and indicates that the sand would demonstrate a high drainage performance for tree planting in hard landscape situations. This would probably need to be compensated for by an irrigation system.

The sample displayed a reasonable total porosity value in a compacted state, comprising mainly capillary pores. This indicates that the sample has a good water-holding capacity, and given its particle size distribution, a significant proportion of the water is likely to be plant available.

### **California Bearing Ratio**

A re-compacted California Bearing Ratio (CBR) was completed as part of the engineering testing undertaken on the sample. The sample was re-compacted using the 2.5kg rammer at the as received moisture content and the sample returned a minimum CBR of 10%. Assuming that the in-situ compaction method selected during installation provides similar levels of compaction to that of the laboratory test, the in-situ performance of the material should be able to achieve a similar result (provided it is compacted at the same moisture content (3.4%)).

As the performance of the sand will be linked to the moisture content at time of compaction, further work may be required in order to correlate the change in engineering performance of the material over the range of moisture contents at which the soil is likely to be placed and compacted.

We recommend a more conservative approach with the performance of the material, and as opposed to a CBR of 10%, we would quote "should achieve a CBR in excess of 5%..." The 5% CBR is important as this is the lower limit for the sub-grade for the minimum construction thickness.

### **pH and Electrical Conductivity Values**

The sample was slightly acid in reaction (pH 6.7), with a pH value that would be considered ideal for landscape purposes.

The electrical conductivity (salinity) value (water and CaSO<sub>4</sub> extracts) was low, which indicates that soluble salts were not present at levels that would be harmful to plants.

### **Organic Matter and Fertility Status**

The sample contained a low organic matter content, which is appropriate for a 'structural subsoil' material.

## **CONCLUSION**

The purpose of the analysis was to determine the suitability of the sample for use as a 'structural subsoil for tree planting in hard landscape situations'.

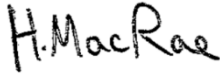
From the visual examination and laboratory analysis undertaken, the sample can be described as a slightly acid, non-saline, non-calcareous SAND with a low stone content. The organic matter content of the sample was low and the permeability rate was high, with sufficient total porosity recorded.

Based on our findings, the horticultural and geotechnical properties of the sand represented by this sample would be considered suitable for use as a structural subsoil for tree planting in hard landscape situations.

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We hope this report meets with your approval. Please call us if you wish to talk through the findings and recommendations.

Yours faithfully



**Harriet MacRae**  
BSc MSc  
Graduate Soil Scientist



**Matthew Heins**  
BSc (Hons) MSc SoilSci  
Senior Soil Scientist

For and on behalf of Tim O'Hare Associates LLP



Client:	Bourne Amenity Ltd
Project:	Washed Sand Subsoil
Date:	22/02/2023
Job Ref No:	TOHA/23/7818/8/SS

Sample Reference
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		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

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

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 <sub>4</sub> extract)	uS/cm	UKAS
Exchangeable Sodium Percentage	%	UKAS

Organic Matter (LOI)	%	UKAS
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**Determination of Permeability and Porosity - K H Volume 10.7 method**

Initial Height	mm	UKAS
Initial Diameter	mm	UKAS
Particle Density	Mg/m <sup>3</sup>	UKAS
Initial Bulk Density	Mg/m <sup>3</sup>	UKAS
Final Bulk Density	Mg/m <sup>3</sup>	UKAS
Initial Moisture Content	%	UKAS
Final Moisture Content	%	UKAS
Initial Dry Density	Mg/m <sup>3</sup>	UKAS
Final Dry Density	Mg/m <sup>3</sup>	UKAS
Total Porosity (Initial)	%	UKAS
Total Porosity (Final)	%	UKAS
Air Filled Porosity (Initial)	%	UKAS
Air Filled Porosity (Final)	%	UKAS
Capillary Porosity (Initial)	%	UKAS
Capillary Porosity (Final)	%	UKAS
Permeability	mm/hr	UKAS

**California Bearing Ratio - BS 1377-4:1990:Method 7.4**

Moisture Content (Initial)	%	UKAS
Moisture Content (Top)	%	UKAS
Moisture Content (Base)	%	UKAS
Moisture Content (Mean)	%	UKAS
Initial Bulk Density	Mg/m <sup>3</sup>	UKAS
Initial Dry Density	Mg/m <sup>3</sup>	UKAS
CBR Top	%	UKAS
CBR Base	%	UKAS

**Determination of Permeability and Porosity - K H Volume 10.7 method**

Notes
Material recompacted at the 'as-received' moisture with a 2.5kg rammer
Sample is assumed to be fully saturated when a rate of steady flow is achieved
Permeability is determined when sample achieved a state of steady flow

**Determination of California Bearing Ratio - BS 1377-4:1990:Method 7.4**

Notes
Material recompacted at the 'as-received' moisture with a 2.5kg rammer
Sample tested in an unsoaked condition
Applied Seating Load (top) : 48N
Applied Seating Load (base) : 48N
Applied Surcharge : 12.0kq

S = SAND

**Visual Examination**

The sample was described as a brownish yellow (Munsell Colour 10YR 6/8), moist, friable, non-calcareous SAND with a single grain structure. The sample was slightly stony and no unusual odours, deleterious materials, roots or rhizomes of pernicious weeds were recorded.

**Washed Sand Subsoil**

2
1
2
9
46
26
14
97
S
1
1
0

0
0

6.7
<1.0
96
2112
1.2

<0.5
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129.7
100.1
2.66
1.75
1.96
4
17
1.69
1.68
37
37
31
9
6
28
376

3.5
3.4
3.4
3.4
1.78
1.73
10
27

H. MacRae

Harriet MacRae  
BSc MSc  
Graduate Soil Scientist

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