



TIM O'HARE ASSOCIATES
SOIL & LANDSCAPE CONSULTANCY

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27th March 2017
Our Ref: TOHA/17/7042/SS
Your Ref: see below

Dear Sirs

Urban Tree Soil Analysis: 80:20 Mix

We have completed the analysis and testing of the sample recently submitted, referenced *80:20 Mix*, and have pleasure reporting our findings.

The purpose of the analysis was to determine the suitability of the urban tree soil sample 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 urban tree 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 urban tree soil has left the Boughton Loam & Turf Management site.

SAMPLE EXAMINATION

The sample was described as a dark yellowish brown (Munsell Colour 10YR 4/4), slightly moist, friable, very slightly calcareous SAND with a single grained structure*. The sample contained occasional organic fines and woody fragments. No unusual odours, deleterious materials, roots or rhizomes of pernicious weeds were recorded.

* 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.

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).

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Horticultural Properties

- detailed particle size distribution;
- moisture content;
- pH value;
- electrical conductivity value;
- exchangeable sodium percentage;
- major plant nutrients (N, P, K, Mg);
- organic matter content;
- C:N ratio.

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

RESULTS OF ANALYSIS

Particle Size Distribution

The sample fell into the *sand* texture class. The grading of the sand indicates a sufficiently narrow particle size distribution and a predominance of *medium sand* (0.25-0.50mm). This is acceptable for urban tree soils as sufficient porosity levels are maintained in a compacted state and the risk of particle interpacking is minimised.

Permeability and Porosity

The permeability of the sample when in a compacted state (Standard Compaction) was high (251 mm/hr) and indicates that the urban tree soil should demonstrate satisfactory drainage performance for tree planting in hard landscape situations.

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. However, the sample contains less large, air-filled pores, which indicates that, in its compacted state, there could be reduced aeration for root function.

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 9.3%. 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 (12%)).

As the performance of the soil 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 9.3%, 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 alkaline in reaction (pH 7.8). This pH value would be considered suitable for an urban tree soil providing species with a wide pH tolerance or those known to prefer alkaline soils are selected for planting, turfing and seeding.

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

The electrical conductivity value by CaSO₄ extract fell below our maximum recommended value (3300 µS/cm).

Organic Matter and Fertility Status

The organic matter content of the sample fell within the target range for an urban tree soil and the recorded levels of most major plant nutrients were sufficient. The recorded total nitrogen value was a little low and as such, should be remedied with a routine fertiliser application.

The C:N ratio was acceptable for use as an urban tree soil.

CONCLUSION

The purpose of the analysis was to determine the suitability of the urban tree soil for tree planting in hard landscape situations.

From the visual examination and laboratory analysis undertaken, the sample can be described as an alkaline, non-saline, very slightly calcareous SAND with a suitably narrow particle size distribution and high permeability result. The sample contained sufficient levels of organic matter and most major plant nutrients, with a low level of total nitrogen.

Based on our findings, the horticultural and geotechnical properties of the urban tree soil represented by this sample would be considered suitable for tree planting in hard landscape, provided species tolerant of alkaline soil conditions are selected.

In order to minimise the risk of anaerobic (oxygen depleted) soil conditions developing within the tree pit, this urban tree soil should not be placed deeper than 600mm. A suitable washed sand, preferably with the same particle size distribution as this sample, should be used beneath the urban tree soil.

The nitrogen deficiency should be addressed by an appropriate fertiliser application.

RECOMMENDATIONS

Fertiliser for Planting

To address the nitrogen deficiency, we recommend applying the compound, slow release fertiliser *ICL Agroblen* (15%-8%-16%+5%MgO) at a rate of 70g/m² into the upper 150mm of the rootzone prior to consolidation of this layer.

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

Yours faithfully



Rebecca Hollands
BSc MSc AMIAgrE
Graduate Soil Scientist



Ceri Spears
BSc MSc MISOilSci
Senior Associate

For and on behalf of Tim O'Hare Associates LLP



Client:	Boughton Loam & Turf Management
Project	Urban Tree Soil Analysis
Testing:	Horticultural and Geotechnical Properties
Date:	27/03/2017
Job Ref No:	TOHA/17/7042/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	
Texture Class (UK Classification)	--	UKAS	

80:20 Mix
4
1
4
20
59
12
0
S

pH Value (1:2.5 water extract)	units	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	

7.8
730
3114
2.9

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	

2.8
0.09
18
38
1025
58

Determination of Permeability and Porosity - K H Volume 10.7 method		
Initial Height	mm	UKAS
Initial Diameter	mm	UKAS
Particle Density	Mg/m ³	UKAS
Initial Bulk Density	Mg/m ³	UKAS
Final Bulk Density	Mg/m ³	UKAS
Initial Moisture Content	%	UKAS
Final Moisture Content	%	UKAS
Initial Dry Density	Mg/m ³	UKAS
Final Dry Density	Mg/m ³	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

130.0
100.0
2.66
1.75
1.96
12
25
1.57
1.57
41.1
40.9
22.8
2.4
18.2
38.5
251

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 ³	UKAS
Initial Dry Density	Mg/m ³	UKAS
CBR Top	%	UKAS
CBR Base	%	UKAS

12
12
12
12
1.79
1.60
9.3
14.0

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 : 12.0kg

S = SAND

Visual Examination

The sample was described as a dark yellowish brown (Munsell Colour 10YR 4/4), slightly moist, friable, very slightly calcareous SAND with a single grained structure. The sample contained occasional organic fines and woody fragments. No unusual odours, deleterious materials, roots or rhizomes of pernicious weeds were recorded.

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Graduate Soil Scientist

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

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