Light-Weight Soil Analysis

We have now completed analysis of your light-weight soils and have the pleasure of reporting our findings.

The purpose of the work was to review the horticultural and engineering properties of the samples that were analysed to compare these findings against the latest British Standard for topsoil (BS3882: 2007.) The three samples tested were identified as '*Roof Garden 1-Turf', 'Roof Garden 2-Shrubs/Borders'* and '*Roof Garden 3 Tree Pit Topsoil-Soft Landscape Areas'*.

LABORATORY ANALYSIS

The soil samples were submitted to the laboratory for physical and chemical parameters to confirm their composition and fertility status. The following parameters were determined for the two roof garden soils:

- pH value (1:2.5 soil/water extract & soil/KCl extract);
- electrical conductivity;
- major plant nutrients - N, P, K, Mg;
- organic matter content;
- detailed particle size distribution;
- bulk density under compacted and water-saturated conditions;
- water storage capacity;
- permeability;
- porosity (total, capillary & air-filled.)

Some of these parameters were also determined for the tree pit soil. The results are presented on the attached Certificate of Analysis and an interpretation of the results is given below.

pH values

The pH values of all of the samples using the water- extract were alkaline (7.8-8.3.) Although this pH range is above optimum for several plant species, it is within the permitted range of BS3882 2007: multipurpose grade. The relatively high pH was attributed to potassium ions present in one of the soil components and not due to liming materials such as chalk or limestone. This was confirmed by the significantly lower pH in the potassium Chloride (KCl) extract for the two roof-garden soils (7.5-7.6.) Therefore, the pH of these soils should be suitable for planting the vast majority of species used in commercial landscaping.

Particle Size Distribution

From the laboratory analysis, the physical compositions of the roof garden soils were shown to be very similar. They contained 91-93% sand, and as such fell into the SAND texture class. They were comprised of mainly fine to coarse sand sized particles and predominantly medium sand. The tree pit soil fell into the LOAMY SAND texture class. Soils with these proportions of sand, silt, and clay are typically free-draining and less prone to problems with water-logging and compaction to heavier soils and are therefore considered well-suited to landscaping purposes.

Organic Matter and Nutrient Status

The soils all contained adequate levels of organic matter and were well-supplied with the essential plant nutrients phosphorus, potassium, and magnesium. The level of nitrogen was slightly below optimum, this can easily be rectified by the addition of a high-nitrogen fertiliser at the time of planting (eg. *Nitram* (34.5% N) at 11g/m^2.)

Engineering and Physical Properties of Soil

The results described so far have all been determined on an isolated sample of the soil in a laboratory. In order to obtain a better understanding of how the soil will perform when placed, a dynamic falling-head permeability test was carried out on the samples. This experiment attempts to replicate the physical properties of an in-situ soil. The tests also provide supporting information to designers and engineers to calculate the potential loadings required for these soils.

The water-saturated bulk densities of the two roof garden soil for which it was determined were low (1.41-1.55 tonnes/m^3) compared to those of standard soil and rootzone mixes, demonstrating the light weight nature of these products.

The permeability and porosity information was determined to confirm that the mixes will provide sufficient drainage and aeration once placed and firmed. The results indicate that both mixes will provide satisfactory levels of drainage and aeration for the normal range of roof garden and tree pit planting environments. The permeability rates indicate slow draining soils that will retain good quantities of water for plant uptake, whilst removing surplus water to prevent water ponding and water-logging. This drainage rate reduces the risk of drought stress and the reliance on excessive amounts of irrigation water whilst minimising the risk of anaerobic conditions bought about by water-logging.

This is, of course, dependent on the drainage properties of the material underlying the soil. It is important to give equal consideration to any subsoil or base layer used beneath the soil; if this is likely to only be slow draining, a positive drainage system should be installed before the soil is placed.

CONCLUSIONS

The results of the tests confirm that the two Roof Garden soils and the Tree Pit Backfill soil have the necessary physical and chemical properties to support plant growth in the proposed landscape environments. All soils have been shown to have favourable particle size distributions and drainage characteristics and the roof garden soils were demonstrated to have a relatively low water-saturated density.

Provided the nitrogen deficiency is rectified as per the recommendations, this soil would comply to all aspects of BS3882 2007: multipurpose grade. No other additions of fertiliser or organic matter are required, or indeed recommended for at least the first growing season.

We hope this report meets with your approval and provides the necessary information. Please do not hesitate to contact the undersigned if you have any queries or comments.

Yours sincerely

Dr Eric Crouch

Client	Boughton Loam Limited
Project	Light-weight soil analysis
Job Ref	SLC/08/EC/158/SA

Sample Reference		Roof Garden no1 Turf	Roof Garden no 2 Shrub Beds / Borders	Roof Garden no 3 Tree Pit Topsoil Soft Landscape
pH Value & Salinity				
pH value (1:2.5 s/w extract)	units	8.2	8.3	7.8
pH value (KCl extract)	units	7.6	7.5	nt
Electrical Conductivity (1:2.5 s/w extract)	uS/cm	822	1121	637
Organic Matter & Nutrient Status				
Organic Matter (LOI)	%	4.1	5.9	5.8
Total Nitrogen	%	0.11	0.13	0.11
Extractable Phosphorus	mg/l	38	54	34
Extractable Potassium	mg/l	763	1128	772
Extractable Magnesium	mg/l	140	179	122
Particle Size Analysis				
Clay (<0.002mm)	%	6	7	7
Silt (0.063-0.002mm)	%	1	2	5
Sand (2.0-0.063mm)	%	93	91	88
Texture Class	UK Class	Sand	Sand	Loamy sand
Very Fine Sand (0.15-0.05mm)	%	6	7	7
Fine Sand (0.25-0.15mm)	%	17	17	16
Medium Sand (0.50-0.25mm)	%	47	47	46
Coarse Sand (1.0-0.50mm)	%	16	15	14
Very Coarse Sand (2.0-1.0mm)	%	7	5	5
Engineering Properties: Falling Head Permeability				
Bulk Density: compacted 2.5 kg rammer water-saturated soil	tonne/m^3	1.55	1.41	nt
Total Porosity	%	43	53	38
Air Filled Porosity	%	17	36	12
Capillary Porosity	%	26	18	26
Water Storage Capacity	%	7	9	nt
Permeability	m/s	$1.9x10^{-7}$	$1.3x10^{-7}$	$1.6x10^{-7}$

nt NOT TESTED: eg. No test carrried out

Authorised by:

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