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TIM O'HARE ASSOCIATES
SOIL & LANDSCAPE CONSULTANCY

[redacted]
H. Sivyer Transport Ltd
160 Sydenham Road
London
SE26 5JZ

6th October 2014

Our Ref: TOHA/14/6050/1/SS
Your Ref: 1410/2685SR

Dear Sirs

Topsoil Manufacture Component Assessment

Mill House Farm, Tilbury – Screened Subsoil

We have completed the analysis of the *'Screened Subsoil'* sample recently collected and have pleasure reporting our findings.

The purpose of the analysis was to determine the composition of the sample and assess its suitability as a mineral component in a manufactured topsoil.

SAMPLING

The soil was examined and sampled at Mill House Farm, West Tilbury, Essex on 26/09/2014 by Ceri Spears of Tim O'Hare Associates LLP. A representative composite soil sample was collected in accordance with BS3882:2007 (*Specification for Topsoil and Requirements for Use*).

At the time of our visit, the soil was screened and subsequently placed into a single stockpile. We understand that this soil is a natural as dug subsoil arising from excavation of an irrigation reservoir at the site.

VISUAL EXAMINATION

The stockpiled subsoil was consistent in visual appearance and was described as yellowish brown (Munsell Colour 10YR 5/8) to strong brown (Munsell Colour 7.5YR 5/8), slightly moist, sand with a weakly developed fine granular structure. The soil was moderately stony, comprising mostly rounded to subangular gravel <20mm. No roots or rhizomes of pernicious weeds were observed.

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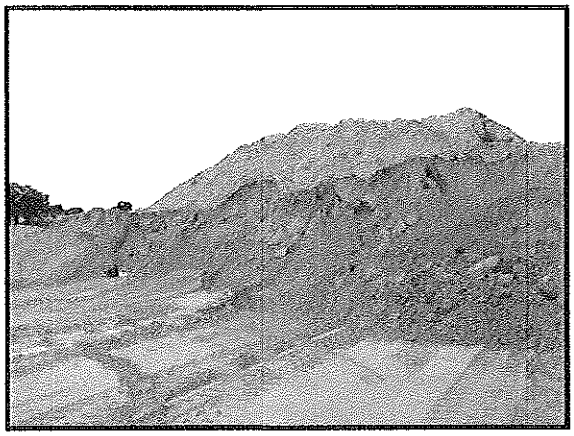

Plate 1: Screened Subsoil Stockpile

Plate 2: Screened Subsoil

ANALYTICAL SCHEDULE

The sample was submitted to the laboratory for a range of physical and chemical analyses to confirm the composition and fertility of the screened subsoil material. The following parameters were determined:

- detailed particle size analysis (5 sands, silt, clay);
- stone content (2-20mm, 20-50mm, >50mm);
- pH and electrical conductivity values;
- exchangeable sodium percentage;
- major plant nutrients (N, P, K, Mg);
- organic matter content;
- C:N ratio;
- heavy metals (As, B, Cd, Cr, Cu, Pb, Hg, Ni, Se, Zn);
- soluble sulphate, elemental sulphur, acid volatile sulphide;
- total cyanide and total (mono) phenols;
- speciated PAHs (US EPA16 suite);
- aromatic and aliphatic TPH (C5-C35 banding);
- benzene, toluene, ethylbenzene, xylene (BTEX).

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 and Stone Content

The sample fell into the *sand* texture class, with a predominance of medium sand (0.25-0.50mm) to coarse sand (0.50-1.0mm). This particle size distribution may be considered suitable for a mineral component in a manufactured topsoil.

The stone content of the sample was moderate and, as such, stones are unlikely to constitute a limitation for topsoil manufacture. However, it may be prudent to remove a proportion of the larger stones by raking, picking or screening, should the soil be used for amenity grass areas or sports pitches.

pH and Electrical Conductivity Values

The sample was acid in reaction (pH 5.7), with a pH value that would be considered suitable for a mineral component for topsoil manufacture. Addition of an organic ameliorant such as green compost (PAS100:2011 compliant) is likely to raise the pH of the topsoil blend.

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

The electrical conductivity value by $CaSO_4$ extract (*BS3882* requirement) fell below the maximum specified value (2800 µS/cm) given in *BS3882:2007 – Table 1*.

Organic Matter and Fertility Status

The sample contained low levels of organic matter and all major plant nutrients. An addition of organic material, such as green compost (PAS100:2011 compliant), will raise the organic matter content and address the nutrient deficiencies to create a balanced topsoil.

Potential Contaminants

In the absence of site-specific assessment criteria, the concentrations of selected potential contaminants that affect human health have been assessed for *residential* end-use against the Soil Guideline Values (SGV) presented in the Contaminated Land Exposure Assessment (CLEA) (EA/DEFRA: 2009) and the CIEH/LQM Generic Assessment Criteria (GAC) (2nd Edition, 2009).

Of the potential contaminants determined, none exceeded their respective SGV or GAC values.

Phytotoxic Contaminants

Of the phytotoxic (toxic to plants) contaminants determined (copper, nickel, zinc), none was found at levels that exceeded the maximum permissible levels specified in *BS3882:2007 – Table 1*.

CONCLUSIONS AND RECOMMENDATIONS

The purpose of the analysis was to determine the composition of the sample and assess its suitability as a mineral component in a manufactured topsoil.

From the visual examination and laboratory analysis, the material is described as an acid, non-saline sand with a weak structure and moderate stone content. The sample contained low levels of organic matter and major plant nutrients. Of the potential contaminants determined, none exceeded their respective SGV or GAC values.

Based on our findings, the material represented by this sample would be considered suitable for use as a mineral component for topsoil manufacture purposes. The organic matter content and nutrient levels should be raised by incorporation of organic material, such as green compost (PAS100:2011 compliant).

The stone content of the sample was moderately high and, as such, it may be preferable to remove a proportion of the larger stones (>20mm) prior to topsoil manufacture.

Appropriate mixing ratios for topsoil manufacture using this material and suitable green compost should be determined by subsequent mixing trials.

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 sincerely

[redacted]
BSc MSc PhD
Graduate Soil Scientist

[redacted]
BSc MSc MISoilSci
Soil Scientist

For and on behalf of Tim O'Hare Associates LLP

TIM O'HARE ASSOCIATES

SOIL & LANDSCAPE CONSULTANCY

Client:	H Slyver Transport Ltd
Project:	Topsoil Manufacture Component Assessment
Source:	Mill House Farm, Tilbury
Material:	Screened Subsoil
Date:	October 2014
Job Ref No:	TOHA/14/6050/1/SS

Sample Reference		Accreditation	Screened Subsoil
Clay (<0.002mm)	%	UKAS	4
Silt (0.002-0.05mm)	%	UKAS	1
Very Fine Sand (0.05-0.15mm)	%	UKAS	9
Fine Sand (0.15-0.25mm)	%	UKAS	8
Medium Sand (0.25-0.50mm)	%	UKAS	49
Coarse Sand (0.50-1.0mm)	%	UKAS	25
Very Coarse Sand (1.0-2.0mm)	%	UKAS	6
Total Sand (0.05-2.0mm)	%	UKAS	95
Texture Class (UK Classification)	--	UKAS	S
Stones (2-20mm)	% DW	GLP	21
Stones (20-50mm)	% DW	GLP	2
Stones (>50mm)	% DW	GLP	0
pH Value (1:2.5 water extract)	units	UKAS	5.7
Electrical Conductivity (1:2.5 water extract)	uS/cm	UKAS	67
Electrical Conductivity (1:2 $CaSO_4$ extract)	uS/cm	UKAS	2102
Exchangeable Sodium Percentage	%	UKAS	0.7
Organic Matter (LOI)	%	UKAS	0.6
Total Nitrogen (Dumas)	%	UKAS	0.01
Extractable Phosphorus	mg/l	UKAS	13
Extractable Potassium	mg/l	UKAS	19
Extractable Magnesium	mg/l	UKAS	25
Total Arsenic (As)	mg/kg	MCERTS	14
Total Cadmium (Cd)	mg/kg	MCERTS	< 0.2
Total Chromium (Cr)	mg/kg	MCERTS	15
Hexavalent Chromium (Cr VI)	mg/kg	MCERTS	< 4.0
Total Copper (Cu)	mg/kg	MCERTS	7
Total Lead (Pb)	mg/kg	MCERTS	8
Total Mercury (Hg)	mg/kg	MCERTS	< 0.3
Total Nickel (Ni)	mg/kg	MCERTS	16
Total Selenium (Se)	mg/kg	MCERTS	< 1.0
Total Zinc (Zn)	mg/kg	MCERTS	21
Water Soluble Boron (B)	mg/kg	MCERTS	< 0.2
Total Cyanide (CN)	mg/kg	MCERTS	< 1
Total (mono) Phenols	mg/kg	MCERTS	< 2.0
Elemental Sulphur (S)	mg/kg	MCERTS	< 20
Acid Volatile Sulphide (S)	mg/kg	MCERTS	< 1.0
Water Soluble Sulphate (SO_4)	g/l	MCERTS	0.03
Naphthalene	mg/kg	MCERTS	< 0.05
Acenaphthylene	mg/kg	MCERTS	< 0.10
Acenaphthene	mg/kg	MCERTS	< 0.10
Fluorene	mg/kg	MCERTS	< 0.10
Phenanthrene	mg/kg	MCERTS	< 0.10
Anthracene	mg/kg	MCERTS	< 0.10
Fluoranthene	mg/kg	MCERTS	< 0.10
Pyrene	mg/kg	MCERTS	< 0.10
Benzo(a)anthracene	mg/kg	MCERTS	< 0.10
Chrysene	mg/kg	MCERTS	< 0.05
Benzo(b)fluoranthene	mg/kg	MCERTS	< 0.10
Benzo(k)fluoranthene	mg/kg	MCERTS	< 0.10
Benzo(a)pyrene	mg/kg	MCERTS	< 0.10
Indeno(1,2,3-cd)pyrene	mg/kg	MCERTS	< 0.10
Dibenzo(a,h)anthracene	mg/kg	MCERTS	< 0.10
Benzo(g,h,i)perylene	mg/kg	MCERTS	< 0.05
Total PAHs (sum USEPA16)	mg/kg	MCERTS	< 1.60
Aliphatic TPH >C5 - C6	mg/kg	MCERTS	< 0.1
Aliphatic TPH >C6 - C8	mg/kg	MCERTS	< 0.1
Aliphatic TPH >C8 - C10	mg/kg	MCERTS	< 0.1
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	< 0.1
Aromatic TPH >C7 - C8	mg/kg	MCERTS	< 0.1
Aromatic TPH >C8 - C10	mg/kg	MCERTS	< 0.1
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	<0.001
Toluene	mg/kg	MCERTS	<0.001
Ethylbenzene	mg/kg	MCERTS	<0.001
o-xylene	mg/kg	MCERTS	<0.001
MTBE (Methyl Tertiary Butyl Ether)	mg/kg	MCERTS	<0.001

S = SAND

Visual Examination

The stockpiled subsoil was consistent in visual appearance and was described as yellowish brown (Munsell Colour 10YR 5/8) to strong brown (Munsell Colour 7.5YR 5/8), slightly moist, sand with a weakly developed fine granular structure. The soil was moderately stony, comprising mostly rounded to subangular gravel <20mm. No roots or rhizomes of pernicious weeds were observed.