TIM O'HARE ASSOCIATES
SOIL & LANDSCAPE CONSULTANCY

Mr Andy Spetch
British Sugar plc Co-Products
Oundle Road
Peterborough
PE2 9QU

26th April 2016
Our Ref: TOHA/16/6623/SS
Your Ref: O/N 50098076

Dear Sirs

Topsoil Analysis Report: Wissington Hort Loam

We have completed the analysis of the Wissington sample recently submitted, referenced *Hort Loam* and have pleasure reporting our findings.

We understand the sample represents a blend of Conditioned Topsoil, Washed Sand and Green Compost. The topsoil is intended for use in general landscaping, and in particular 'higher specification' applications such as rootballed trees, ornamental shrubs, raised beds and kitchen gardens.

The purpose of the analysis was to determine the suitability of the sample for these types of landscape applications. In addition, this sample has been assessed to determine its compliance with the requirements of the British Standard for Topsoil *(BS3882:2015 - Specification for topsoil* – Table 1, *Multipurpose Topsoil)*.

This report presents the results of analysis for the sample submitted to our office, and it should be considered 'indicative' of the topsoil 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 topsoil has left the British Sugar factory.

SAMPLE EXAMINATION

The sample was described as a dark brown (Munsell Colour 10YR 3/3), slightly moist, friable SANDY LOAM with a moderately developed fine to coarse granular structure*. The sample was virtually stone-free and contained occasional organic compost fines. No unusual odours, deleterious materials, roots or rhizomes of pernicious weeds were observed.

*This appraisal of soil structure was made from examination of a disturbed sample. 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:

- particle size analysis and stone content;
- pH and electrical conductivity values;
- exchangeable sodium percentage;
- major plant nutrients (N, P, K, Mg);
- organic matter content;
- C:N ratio;
- bulk density;
- heavy metals (As, B, Ba, Be, Cd, Cr, Cu, Pb, Hg, Ni, Se, V, Zn);
- total cyanide and total (mono) phenols;
- speciated PAHs (US EPA16 suite);
- aromatic and aliphatic TPH (C5-C35 banding);
- 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. The interpretation considers the use of the topsoil for a number of landscape applications.

RESULTS OF ANALYSIS

Particle Size Analysis and Stone Content

The sample fell into the *sandy loam* texture class, which is usually considered suitable for a wide range of landscape applications (e.g. tree pits, planting beds, lawns) provided the soil's physical condition is satisfactory.

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

pH and Electrical Conductivity Values

The sample was strongly alkaline in reaction (pH 7.8). This pH value would be considered suitable for a wide variety of landscape applications, providing species with a broad 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 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 (3300 µS/cm) given in *BS3882:2015 – Table 1*.

Organic Matter and Fertility Status

The sample was well supplied with organic matter and all major plant nutrients.

The C:N ratio of the sample was acceptable for landscape applications.

Potential Contaminants

With reference to *BS3882:2015* - Table 1: Notes 3 and 4, there is a recommendation to confirm levels of potential contaminants in relation to the topsoil's proposed end use. This includes human health, environmental protection and metals considered toxic to plants. In the absence of site-specific criteria, the concentrations that affect human health have been compared with the *allotment* land use in 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). The concentration of barium has been compared with the *residential* land use given in the document *EIC/AGS/CL:AIRE Soil Generic Assessment Criteria for Human Health Risk Assessment* (2010).

Of the potential contaminants determined, none was found at levels that exceeded their guideline 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 *BS3882:2015 – Table 1*.

CONCLUSION

The purpose of the analysis was to determine the suitability of the *Hort Loam* sample for general landscape purposes, and in particular 'higher specification' applications such as rootballed trees, ornamental shrubs, raised beds and kitchen gardens. In addition, this sample has been assessed to determine its compliance with the requirements of the British Standard for Topsoil *(BS3882:2015 - Specification for topsoil* – Table 1, *Multipurpose Topsoil)*.

From the soil examination and laboratory analysis, the sample was described as a strongly alkaline, non-saline, virtually stone-free sandy loam with an adequate structure. The sample contained good reserves of organic matter and all major plant nutrients. Of the potential contaminants determined, none was found at levels that exceeded their guideline values.

Based on our findings, the topsoil represented by this sample would be considered suitable for a wide variety of landscape purposes provided species selected for planting have a wide pH tolerance, and the physical condition of the soil is satisfactory.

The topsoil was also fully compliant with the requirements of the British Standard for Topsoil *(BS3882:2015 – Specification for topsoil – Table 1, Multipurpose Topsoil).*

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, respreading, cultivating, planting). 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, and soil handling should be stopped during and after heavy rainfall, and not continued until the soil is friable in consistency. If the soil is structurally damaged and compacted at any stage during the course of the soiling or landscaping works, it should be cultivated appropriately to relieve the compaction and to restore the soil's structure prior to any planting, turfing or seeding.

Further details on soil handling are provided in Annex A of *BS3882:2015.*

Further guidance on the management, preparation and handling of soils is provided in the DEFRA publication *Construction code of practice for the sustainable use of soils on construction sites*, 2009.

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

Iain Gould
BSc MSc PhD
Soil Scientist

Tim O'Hare
BSc MSc MISoilSci MBIAC CSci
Principal Consultant

For & on behalf of Tim O'Hare Associates LLP

Client:	**British Sugar plc Co-Products**
Client Ref:	**Wissington Hort Loam**
Job:	**Topsoil Analysis**
Date:	**26/04/2016**
Job Ref No:	**TOHA/16/6605/SS**

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Sample Reference			**Hort Loam**	
Clay (<0.002mm)	%	U	12	✓
Silt (0.002-0.063mm)	%	U	20	✓
Sand (0.063-2.0mm)	%	U	68	✓
Texture Class (UK Classification)	--	U	SL	--
Stones (2-20mm)	% DW	G	1	✓
Stones (20-50mm)	% DW	G	0	✓
Stones (>50mm)	% DW	G	0	✓
pH Value (1:2.5 water extract)	units	U	7.8	✓
Electrical Conductivity (1:2.5 water extract)	uS/cm	U	1202	✓
Electrical Conductivity (1:2 $CaSO_4$ extract)	uS/cm	U	3086	✓
Exchangeable Sodium Percentage	%	U	4.2	✓
Moisture Content	%	U	16	--
Organic Matter (LOI)	%	U	7.4	✓
Total Nitrogen (Dumas)	%	U	0.4	✓
C : N Ratio	ratio	U	11	✓
Extractable Phosphorus	mg/l	U	70	✓
Extractable Potassium	mg/l	U	1019	✓
Extractable Magnesium	mg/l	U	105	✓
Total Arsenic (As)	mg/kg	M	9.5	✓
Total Barium (Ba)	mg/kg	M	54	✓
Total Beryllium (Be)	mg/kg	M	0.6	✓
Total Cadmium (Cd)	mg/kg	M	0.2	✓
Total Chromium (Cr)	mg/kg	M	21	✓
Hexavalent Chromium (Cr VI)	mg/kg	M	< 4.0	✓
Total Copper (Cu)	mg/kg	M	26	✓
Total Lead (Pb)	mg/kg	M	16	✓
Total Mercury (Hg)	mg/kg	M	< 0.3	✓
Total Nickel (Ni)	mg/kg	M	17	✓
Total Selenium (Se)	mg/kg	M	< 1.0	✓
Total Vanadium (V)	mg/kg	M	32	✓
Total Zinc (Zn)	mg/kg	M	55	✓
Water Soluble Boron (B)	mg/kg	M	2.4	✓
Total Cyanide (CN)	mg/kg	M	< 1	✓
Total (mono) Phenols	mg/kg	M	< 1.0	✓
Naphthalene	mg/kg	M	< 0.05	✓
Acenaphthylene	mg/kg	M	< 0.10	✓
Acenaphthene	mg/kg	M	< 0.10	✓
Fluorene	mg/kg	M	< 0.10	✓
Phenanthrene	mg/kg	M	0.40	✓
Anthracene	mg/kg	M	< 0.10	✓
Fluoranthene	mg/kg	M	0.70	✓
Pyrene	mg/kg	M	0.50	✓
Benzo(a)anthracene	mg/kg	M	0.70	✓
Chrysene	mg/kg	M	0.22	✓
Benzo(b)fluoranthene	mg/kg	M	< 0.10	✓
Benzo(k)fluoranthene	mg/kg	M	< 0.10	✓
Benzo(a)pyrene	mg/kg	M	< 0.10	✓
Indeno(1,2,3-cd)pyrene	mg/kg	M	< 0.10	✓
Dibenzo(a,h)anthracene	mg/kg	M	< 0.10	✓
Benzo(g,h,i)perylene	mg/kg	M	< 0.05	✓
Total PAHs (sum USEPA16)	mg/kg	M	2.52	✓
Aliphatic TPH (C5-C6)	mg/kg	M	< 0.1	✓
Aliphatic TPH (C6-C8)	mg/kg	M	< 0.1	✓
Aliphatic TPH (C8-C10)	mg/kg	M	< 0.1	✓
Aliphatic TPH (C10-C12)	mg/kg	M	< 1.0	✓
Aliphatic TPH (C12-C16)	mg/kg	M	< 2.0	✓
Aliphatic TPH (C16-C21)	mg/kg	M	< 8.0	✓
Aliphatic TPH (C21-C35)	mg/kg	M	< 8.0	✓
Aliphatic TPH (C5-C35)	mg/kg	M	< 10	✓
Aromatic TPH (C5-C7)	mg/kg	M	< 0.1	✓
Aromatic TPH (C7-C8)	mg/kg	M	< 0.1	✓
Aromatic TPH (C8-C10)	mg/kg	M	< 0.1	✓
Aromatic TPH (C10-C12)	mg/kg	M	< 1.0	✓
Aromatic TPH (C12-C16)	mg/kg	M	< 2.0	✓
Aromatic TPH (C16-C21)	mg/kg	M	< 10	✓
Aromatic TPH (C21-C35)	mg/kg	M	< 10	✓
Aromatic TPH (C5-C35)	mg/kg	M	< 10	✓
Benzene	mg/kg	M	< 0.001	✓
Toluene	mg/kg	M	< 0.001	✓
Ethylbenzene	mg/kg	M	< 0.001	✓
p & m-xylene	mg/kg	M	< 0.001	✓
o-xylene	mg/kg	M	< 0.001	✓
Asbestos	ND/D	I	Not-detected	✓

Visual Examination

The sample was described as a dark brown (Munsell Colour 10YR 3/3), slightly moist, friable SANDY LOAM with a well developed fine to coarse granular structure. The sample was virtually stone-free. No unusual odours, deleterious materials, roots or rhizomes of pernicious weeds were observed.

✓	Compliant with BS3882:2015
X	Non-compliant with BS3882:2015
SL	SANDY LOAM Texture Class
M	MCERTS accredited method (& UKAS accredited method)
I	ISO 17025 accredited method
U	UKAS accredited method
G	GLP accredited method

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

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Test Type	**Bulk Density (Mg/m^3)**	**Moisture Content (%)**	**Dry Density (Mg/m3)**
Light Tamping	1.42	22	1.16
Light Tamping (Saturated)	1.65	43	1.15
Standard Compaction	1.76	22	1.44
Standard Compaction (Staurated)	1.82	25	1.46

Tested in accordance with BS EN 1377-2: 1990: Clause 7.2

Comments
Compaction - Hand tamped with tamping rod

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