

[illegible]



TIM O'HARE ASSOCIATES
SOIL & LANDSCAPE CONSULTANCY

BAM Nuttall Ltd
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1st October 2013

Our Ref: TOHA/13/3820/46/CS
Your Ref: as below

Dear Sirs

Queen Elizabeth Olympic Park Legacy Transformation

Imported Soil Analysis – Allotment Topsoil

Source: Freeland Horticulture, Bat & Ball

We have completed the analysis of the *Allotment Topsoil* samples, referenced *AT3 – AT18*, collected for the Queen Elizabeth Olympic Park Legacy Transformation project and have pleasure reporting the findings.

Introduction

The purpose of this analysis was to determine the compliance of the samples with the requirements of *Appendix 6/8-16 – Allotment Topsoil* of the project specification, *Queen Elizabeth Olympic Park Legacy Transformation – Olympic Park Infrastructure Specification Earthworks Appendix 6 – LC401-LCI-APK-C-SPE-0600 – Revision C01 – 16/11/2012*).

Sampling

The soil was examined and sampled at the Freeland Horticulture source at Bat & Ball Quarry, Sevenoaks on 18/09/2013 by Ceri Spears of Tim O'Hare Associates LLP. A representative composite soil sample was collected in accordance with *Clause 2 (Soil Sampling)* of *Appendix 6/8-16*.

At the time of our visit, the soil was stored in a single stockpile.

We understand that this soil is a manufactured topsoil containing a blend of quarry overburden material and green waste compost (BSI PAS100:2011 certified).

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Plate 1: Allotment Topsoil Stockpile



Plate 2: Allotment Topsoil

Laboratory Analysis

The samples were submitted to the laboratory for a range of physical and chemical analyses in accordance with *Clause 3 (Soil Testing)* within *Appendix 6/8-16* of the specification. The following parameters were determined:

- Visual examination to record Munsell colour, moisture status, aerobic state, the presence of any deleterious materials, unusual odours (e.g. petroleum hydrocarbons);
- detailed particle size analysis;
- stone content (>2mm, >20mm, >50mm);
- visible contaminants (>2mm) (of which glass/sharps or plastic);
- pH value;
- calcium carbonate;
- electrical conductivity values (water and CaSO₄ extracts);
- exchangeable sodium percentage;
- organic matter content;
- total nitrogen;
- carbon:nitrogen ratio;
- extractable phosphorus, potassium and magnesium;
- phytotoxic heavy metals (Cu, Ni, Zn, B);
- total and water soluble sulphate.

With reference to *Clause 5 (General Remediation Standards)* of *Appendix 6/8-16*, in addition to the requirements for phytotoxic metals and sulphate (listed above), the soil is to comply fully with all the chemical requirements of the baseline remediation specification, zone specific remediation specification, and site-specific remediation strategy and all other relevant documents detailed. In this instance, we understand that all contamination tests will be carried out by others as part of a separate testing package.

Results of Analysis

We have cross-referenced the results for each of the samples against *Clause 4 (Allotment Topsoil Specification)* within *Appendix 6/8-16* of the specification. The results of this process are presented on the attached Certificates of Analysis, and a summary of our findings is provided below.

Visual Examination

The stockpiled topsoil was consistent in visual appearance and was described as a dark brown (Munsell Colour 10YR 3/3) to very dark brown (Munsell Colour 10YR 2/2), moist, friable sandy loam, with a moderately developed fine to medium granular structure. The soil was slightly stony and contained frequent organic fines. No deleterious materials, unusual odours or evidence of anaerobism were recorded. No roots or rhizomes of pernicious weeds were observed.

Horticultural Parameters

The samples were largely compliant with the requirements of *Appendix 6/8-16, Clause 4* with the exception of the following parameter:

Parameter	Result	Specified Requirement
Electrical Conductivity (CaSO ₄ extract)	2855 - 3154 μ S/cm (Samples AT3 – AT6, AT10 – AT11, AT13 & AT16 – AT18)	< 2800 μ S/cm

Many of the electrical conductivity values by CaSO₄ extract exceeded the maximum specified value (2800 μ S/cm). However, further testing found the samples to possess low and compliant Exchangeable Sodium Percentage (ESP) values, indicating compliance with the specification in this respect.

Phytotoxic Contaminants and Sulphate

Of the phytotoxic (toxic to plants) contaminants determined (copper, nickel, zinc, water-soluble boron), none was found at levels that exceeded the maximum permissible levels specified.

The levels of total sulphate and water soluble sulphate recorded fell below the maximum specified permissible values.


Visible Contaminants >2mm

No visible contaminants >2mm (of which plastics or sharps) were recorded.

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 faithfully




BSc MSc MSc SoilSci
Soil Scientist




BSc MSc MSc SoilSci MBIAC CSci
Principal Consultant

For & on behalf of Tim O'Hare Associates LLP



TIM O'HARE ASSOCIATES
SOIL & LANDSCAPE CONSULTANCY

Client:	BAM Nuttall Ltd
Project:	Queen Elizabeth Olympic Park Legacy Transformation
Job:	Imported Soil Testing
Soil Type:	Appendix 6/8-16: Allotment Topsoil
Source:	Freeland Horticulture - Bat & Ball
Date:	September 2013
Job Ref No:	TOHA/13/3820/46/CS

Sample Reference		Accreditation	Specified Requirement
Clay (<0.002mm)	%	UKAS	10-25
Silt (0.002-0.05mm)	%	UKAS	10-40
Very Fine Sand (0.05-0.15mm)	%	UKAS	--
Fine Sand (0.15-0.25mm)	%	UKAS	≥ 35
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	45-70
Texture Class (UK Classification)		UKAS	--
Stones (>2mm)	% DW	GLP	0-20
Stones (>20mm)	% DW	GLP	0
Stones (>50mm)	% DW	GLP	0

pH Value (1:2.5 water extract)	units	UKAS	5.5-8.5
Calcium Carbonate	%	UKAS	<10
Electrical Conductivity (1:2.5 water extract)	uS/cm	UKAS	<1500
Electrical Conductivity (1:2 CaSO4 extract)	uS/cm	UKAS	<2800
Exchangeable Sodium Percentage	%	UKAS	<15

Organic Matter (WB)	%	UKAS	3.0-15.0
Total Nitrogen (Dumas)	%	UKAS	≥ 0.20
C : N Ratio	ratio	UKAS	<20:1
Extractable Phosphorus	mg/l	UKAS	26-100
Extractable Potassium	mg/l	UKAS	240-1200
Extractable Magnesium	mg/l	UKAS	80-600

Water Soluble Boron (B)	mg/kg	MCERTS	<3
Total Copper (Cu)	mg/kg	MCERTS	<200#
Total Nickel (Ni)	mg/kg	MCERTS	<110#
Total Zinc (Zn)	mg/kg	MCERTS	<300#
Total Sulphate	mg/kg	MCERTS	<2000
Water Soluble Sulphate (SO4)	g/l	MCERTS	<1.2

Visible Contaminants >2mm	%	UKAS	<0.5
Plastics >2mm	%	UKAS	<0.25
Sharps >2mm	%	UKAS	0

SL	Sandy Loam Texture Class
✓	Compliant with Appendix 6/8-16 Allotment Topsoil Specification
X	Fails Appendix 6/8-16 Allotment Topsoil Specification
*	See report comments
#	Specified criterion is pH dependent

Visual Examination

The stockpiled soil was consistent in appearance and was described as a dark brown to very dark brown, slightly moist, friable SANDY LOAM with a moderately developed fine to medium granular structure. The soil was slightly stony and contained frequent woody fibres and organic fines. No unusual odours, deleterious materials, roots or rhizomes of pernicious weeds were observed.

AT3	
15	✓
16	✓
6	--
18	✓
33	✓
8	--
4	--
69	✓
SL	--
1	✓
0	✓
0	✓

8.0	✓
2	✓
1090	✓
3154	*
7	✓

6.0	✓
0.28	✓
12	✓
64	✓
1009	✓
169	✓

1.6	✓
16	✓
40	✓
88	✓
500	✓
0.14	✓

0	✓
0	✓
0	✓

AT4	
16	✓
18	✓
6	--
17	✓
31	✓
8	--
4	--
66	✓
SL	--
3	✓
1	✓
0	✓

8.0	✓
2	✓
974	✓
2933	*
7	✓

5.6	✓
0.23	✓
14	✓
69	✓
981	✓
171	✓

1.9	✓
17	✓
37	✓
86	✓
700	✓
0.45	✓

0	✓
0	✓
0	✓

AT5	
14	✓
19	✓
6	--
17	✓
33	✓
8	--
3	--
67	✓
SL	--
3	✓
0	✓
0	✓

8.1	✓
3	✓
1140	✓
3150	*
7	✓

7.0	✓
0.32	✓
13	✓
68	✓
1154	✓
178	✓

1.7	✓
17	✓
42	✓
170	✓
630	✓
0.26	✓

0	✓
0	✓
0	✓

AT6	
15	✓
20	✓
7	--
16	✓
31	✓
8	--
3	--
65	✓
SL	--
3	✓
1	✓
0	✓

8.1	✓
2	✓
1097	✓
3150	*
6	✓

6.7	✓
0.25	✓
16	✓
67	✓
1055	✓
177	✓

2.3	✓
22	✓
34	✓
85	✓
340	✓
0.11	✓

0	✓
0	✓
0	✓

AT7	
16	✓
18	✓
7	--
18	✓
30	✓
8	--
3	--
66	✓
SL	--
1	✓
0	✓
0	✓

7.9	✓
2	✓
727	✓
2729	✓
6	✓

6.6	✓
0.3	✓
13	✓
78	✓
750	✓
151	✓

1.8	✓
18	✓
32	✓
76	✓
520	✓
0.31	✓

0	✓
0	✓
0	✓

AT8	
16	✓
17	✓
6	--
15	✓
35	✓
8	--
3	--
67	✓
SL	--
1	✓
0	✓
0	✓

8.2	✓
3	✓
955	✓
2623	✓
5	✓

6.5	✓
0.29	✓
13	✓
67	✓
819	✓
152	✓

1.6	✓
15	✓
31	✓
73	✓
460	✓
0.43	✓

0	✓
0	✓
0	✓

AT9	
16	✓
17	✓
6	--
16	✓
34	✓
8	--
3	--
67	✓
SL	--
2	✓
0	✓
0	✓

8.1	✓
3.2	✓
928	✓
2755	✓
6.2	✓

6.3	✓
0.28	✓
13	✓
80	✓
899	✓
163	✓

2.2	✓
18	✓
38	✓
94	✓
750	✓
0.46	✓

0	✓
0	✓
0	✓

AT10	
17	✓
19	✓
7	--
18	✓
29	✓
7	--
3	--
64	✓
SL	--
3	✓
0	✓
0	✓

8.1	✓
2.3	✓
909	✓
2940	*
4.6	✓

6.4	✓
0.29	✓
13	✓
74	✓
1029	✓
169	✓

1.9	✓
18	✓
38	✓
91	✓
720	✓
0.39	✓

0	✓
0	✓
0	✓



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Coarse Sand (0.50-1.0mm)	%	UKAS	--
Very Coarse Sand (1.0-2.0mm)	%	UKAS	--
Total Sand (0.05-2.0mm)	%	UKAS	45-70
Texture Class (UK Classification)	--	UKAS	--
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AT11
16 ✓
19 ✓
6 --
18 ✓
29 ✓
7 --
5 --
65 ✓
SL --
2 ✓
0 ✓
0 ✓

7.8 ✓
2 ✓
1055 ✓
2855 *
5 ✓

7.0 ✓
0.31 ✓
13 ✓
64 ✓
998 ✓
176 ✓

1.4 ✓
15 ✓
37 ✓
120 ✓
600 ✓
0.39 ✓

0 ✓
0 ✓
0 ✓

AT12
16 ✓
19 ✓
6 --
15 ✓
30 ✓
10 --
4 --
65 ✓
SL --
5 --
2 ✓
0 ✓
0 ✓

8.3 ✓
3 ✓
770 ✓
2668 ✓
4 ✓

7.6 ✓
0.32 ✓
14 ✓
74 ✓
999 ✓
155 ✓

2.3 ✓
17 ✓
41 ✓
90 ✓
530 ✓
0.20 ✓

0 ✓
0 ✓
0 ✓

AT13
18 ✓
15 ✓
6 --
16 ✓
32 ✓
10 --
3 --
67 ✓
SL --
3 ✓
0 ✓
0 ✓

7.8 ✓
3 ✓
1103 ✓
2926 *
5 ✓

8.2 ✓
0.28 ✓
17 ✓
57 ✓
850 ✓
159 ✓

2.6 ✓
20 ✓
38 ✓
89 ✓
450 ✓
0.23 ✓

0 ✓
0 ✓
0 ✓

AT14
15 ✓
18 ✓
6 --
15 ✓
32 ✓
10 --
4 --
67 ✓
SL --
2 ✓
0 ✓
0 ✓

8.0 ✓
3 ✓
550 ✓
2476 ✓
3 ✓

8.8 ✓
0.38 ✓
13 ✓
74 ✓
852 ✓
143 ✓

2.1 ✓
18 ✓
37 ✓
86 ✓
460 ✓
0.17 ✓

0 ✓
0 ✓
0 ✓

AT15
18 ✓
15 ✓
6 --
18 ✓
32 ✓
8 --
3 --
67 ✓
SL --
2 ✓
0 ✓
0 ✓

7.8 ✓
2 ✓
812 ✓
2786 ✓
5 ✓

8.5 ✓
0.29 ✓
17 ✓
55 ✓
893 ✓
170 ✓

1.8 ✓
19 ✓
32 ✓
73 ✓
400 ✓
0.24 ✓

0 ✓
0 ✓
0 ✓

AT16
16 ✓
19 ✓
6 --
16 ✓
32 ✓
8 --
3 --
65 ✓
SL --
3 ✓
0 ✓
0 ✓

8.1 ✓
3 ✓
956 ✓
3064 *
5 ✓

7.9 ✓
0.33 ✓
14 ✓
74 ✓
1184 ✓
167 ✓

1.7 ✓
14 ✓
37 ✓
81 ✓
690 ✓
0.56 ✓

0 ✓
0 ✓
0 ✓

AT17
18 ✓
16 ✓
7 --
20 ✓
32 ✓
6 --
1 --
66 ✓
SL --
4 ✓
1 ✓
0 ✓

8.0 ✓
3 ✓
1027 ✓
3020 *
4 ✓

6.9 ✓
0.26 ✓
15 ✓
68 ✓
1051 ✓
221 ✓

1.8 ✓
16 ✓
33 ✓
79 ✓
590 ✓
0.48 ✓

0 ✓
0 ✓
0 ✓

AT18
15 ✓
18 ✓
6 --
16 ✓
33 ✓
8 --
4 --
67 ✓
SL --
3 ✓
0 ✓
0 ✓

7.9 ✓
3 ✓
1122 ✓
3076 *
6 ✓

8.4 ✓
0.31 ✓
16 ✓
74 ✓
985 ✓
166 ✓

1.4 ✓
13 ✓
29 ✓
69 ✓
450 ✓
0.26 ✓

0 ✓
0 ✓
0 ✓