



Internal Memo

HASKONING UK LTD.
WATER

To : Jamie Gardiner, Steve Rayner, Paul Knight, Emma Hick
From : Rachel Brown
Date : 30 November 2011
Copy : Ruth Tyson
Our reference : 9W5572/M/303924/Newc

Subject : Assessment of suitability of re-use of soil

Introduction

In order to assess the suitability of re-using surplus soil from the re-grading of the slope at Sandsend, soil samples collected during the geotechnical site investigation and further site visit were analysed at the Environmental Scientifics Group (ESG) laboratory. The laboratory testing comprised a range of contaminants of concern, as identified in Royal Haskoning's Sandsend Contaminated Land – Addendum to Geotechnical Investigation Proposal (17 August 2011). This assessment of the chemical results for the suitability for re-use will inform the design specification at Sandsend.

Methodology and Results

Soil samples were collected for analysis during the geotechnical site investigation on the 5 and 6 October 2011 and during a subsequent site visit on the 30 October 2011. An attached plan indicates the locations of the sampling points. In addition to the soil analysis, leachability testing was also undertaken on a number of soil samples, in order to assess the potential risk to controlled waters from the re-use of the soils at Raithwaite Gill.

It is our understanding that the re-grading of the slope at Sandsend will be limited to the top 2m. On this basis samples were collected and tested from the topsoil at depths ranging from 0.10m bgl to 0.30m bgl and underlying clay at depths ranging from 0.15m bgl to 2.0mbgl. The topsoil was described as orange and light brown sandy slightly gravelly clay. The underlying clay was described as firm dark brown slightly sandy slightly gravelly clay. Made Ground was encountered in boreholes BH4, BH5 and BH6, underlying the macadam on the side of the road. Made Ground was described as dark grey sandy clayey gravel of ash, macadam and sandstone to a depth of up to 0.25 m bgl. A slight hydrocarbon odour was noted during the excavation of this stratum in BH4. This Made Ground material was underlain by another layer of fill comprising a sub base of limestone gravel to a depth of up to 0.8 m bgl. Although Made Ground was encountered, it was not sampled or analysed as this material will not be excavated as part of the re-grading works. Refer to the final borehole logs (appended to this memo) for further details.

Three samples of topsoil and four samples of clay were scheduled for laboratory analysis. Leachate testing was undertaken on two samples of topsoil and three samples of underlying clay. The laboratory tests were scheduled on the basis of the conceptual site model, which took into account the history of the site.

The soil samples were analysed for the following determinands:

- Metals – aluminium, arsenic, boron, barium, cadmium, cobalt, chromium, copper, manganese, nickel, lead, zinc, selenium, iron, magnesium, mercury, vanadium;

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- Sulphate;
- pH;
- TOC;
- Asbestos;
- PCBs (7 Congeners);
- PAHs (16 Speciated);
- Speciated TPH (USEPA banding);
- GRO / BTEX / MTBE; and
- Cyanide.

In addition, herbicides concentrations were determined in a subset of the soil samples.

The leachate tests comprised the following determinands:

- Metals – aluminium, arsenic, boron, barium, cadmium, cobalt, chromium, copper, manganese, nickel, lead, zinc, selenium, iron, magnesium, mercury, vanadium;
- Sulphate;
- pH;
- TOC;
- PCBs (7 Congeners);
- PAHs (16 Speciated);
- Speciated TPH (USEPA banding);
- GRO / BTEX / MTBE;
- Cyanide;

The soil sample results were compared against Contaminated Land Exposure Assessment (CLEA) Generic Assessment Criteria (GAC) based on a residential without garden land use scenario. The exceedances of the GAC are described below:

- One exceedance of the GAC for benzo(a)pyrene was reported in the topsoil sample obtained from hand dug pit 2 at a depth of 0.15 m below ground level. The reported concentration was 3.86 mg/kg compared to the GAC of 1.1 mg/kg. Although we do not perceive these levels of benzo(a)pyrene to present a significant risk based on the proposed end use, further risk assessment may be required. This will comprise formulation of a site specific risk assessment model. Discussions with the Local Authority are required to determine whether further risk assessment is required.
- Concentrations of manganese exceeded the GAC in two of the three topsoil samples and one out of four clay samples, however, these levels are considered to represent natural background levels in soils.

The results of the leachate analyses were compared against Water Framework Directive (WFD) Environmental Quality Standards (EQS), where available. Where these standards are unavailable, EQS's applicable under freshwater fish, bathing, dangerous substances and groundwater directives were used or alternatively EU drinking water standards were applied. The exceedances of relevant standards are discussed in detail below. The raw data is included as an appendix to this memo.

Leachable dissolved chromium concentrations exceeded the WFD annual mean value for good status coastal and transitional water bodies in all samples (topsoil and clay). The concentrations



of leachable dissolved chromium in the topsoil samples were determined to be 0.035 and 0.005 mg/l compared to the WFD EQS of 0.0006 mg/l. The concentrations of leachable dissolved chromium in the clay samples were determined to range from 0.003 to 0.004 mg/l, compared to the WFD EQS of 0.0006 mg/l.

Leachable dissolved copper concentrations exceeded the WFD EQS in all samples (topsoil and clay). The concentrations of leachable dissolved copper detected in topsoil samples were determined to be 0.046 and 0.148 mg/l compared to the WFD EQS of 0.005 mg/l. The concentrations of leachable dissolved copper in the clay samples were determined to range from 0.006 to 0.007 mg/l, compared to the WFD EQS of 0.005 mg/l.

Leachable concentrations of dissolved zinc exceeded the WFD annual mean value for good status coastal and transitional water bodies in the majority of samples. Two out of three leachate analyses on clay samples recorded concentrations of 0.16 mg/l and 0.083 mg/l, which exceeded the EQS of 0.04 mg/l. The leachable zinc concentrations recorded in both topsoil samples were 0.076 and 0.252 mg/l, which exceeded the EQS of 0.04 mg/l.

The exceedances of leachable chromium, copper and zinc are not considered to present a significant risk to controlled waters if the soils are re-used at Raithwaite Gill. However, if the location of the soil re-use was to alter in the future, further assessment would be required. The metal concentrations reported to date are considered to present a low risk and potentially representative of background concentrations. For example, the presence of chromium in leachate is likely to be the result of chromium being readily adsorbed on to clay surfaces; likewise, copper is strongly bonded to organic matter, likely to be present in the topsoil and the underlying clay strata. Furthermore, the micronutrient zinc is known to be present in clays. This is likely to explain the exceedance of the WFD EQS value.

Leachable dissolved aluminium concentrations exceeded the EU Drinking Water Standard (DWS) of 0.2 mg/l in all samples. The concentrations of leachable aluminium ranged from 0.54 mg/l to 1.68 mg/l in the clay samples and in the topsoil samples, the concentrations of leachable aluminium were recorded to be 0.29 mg/l and 1.07 mg/l. These exceedances are not considered to present a significant risk to controlled waters. The presence of leachable aluminium in the soil samples is considered to be natural, associated with the mineralogy of the clay and topsoil. Furthermore, the DWS is a conservative standard for a controlled waters risk assessment.

Leachable dissolved mercury was not detected in any of the samples. However, it should be noted that the laboratory's limit of detection of 0.0001 mg/l is greater than the WFD EQS for other surface waters of 0.00005mg/l.

With the exception of TPH C12 to C16, hydrocarbons were not reported above the laboratory limit of detection. TPH C12 to C16 was detected in two samples; comprising a clay sample obtained from BH1 at 1.0 m bgl, at a concentration of 0.025 mg/l and a topsoil sample obtained from location 2 at 0.1 m bgl at a concentration of 0.012 mg/l. There is no apparent correlation between the concentrations of the TPH C12 to C16. One detect (0.025 mg/l) was noted in the clay at the top of the slope, the other detect (0.012 mg/l) was observed in topsoil taken from the hand dug pit. These concentrations are considered to be low and not of significant risk to controlled waters.



Leachable polycyclic aromatic hydrocarbons (PAH) were detected in several samples, however, all concentrations were reported below the most stringent WFD EQS of 0.1 µg/l. The leachable PAHs are therefore considered to be of low concentrations and not a significant risk to controlled waters.

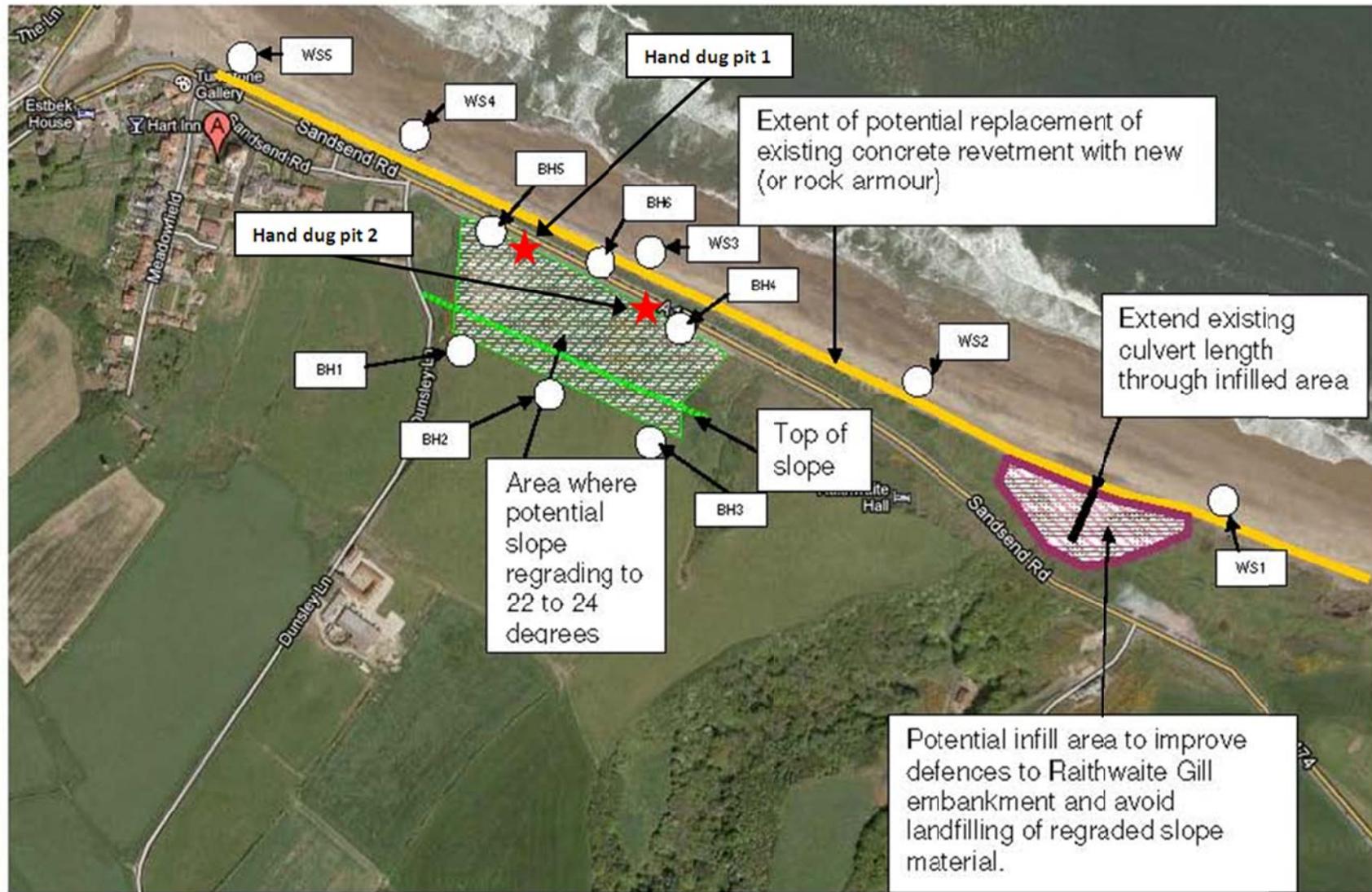
Conclusions and Recommendations

On the basis of this preliminary investigation, as described above, it is considered likely that the excavated soils will be suitable for re-use at Raithwaite Gill. It should be noted that this assessment is based on the re-use of soil at Raithwaite Gill only. If soil is to be re-used at another location, further assessment is likely to be required. Furthermore, if there is excess material that needs to be taken off site to landfill, Waste Acceptance Criteria testing will be required.

If any previously unidentified olfactory or visual evidence of contamination is observed during the construction phase of the project, work should be stopped; the material stockpiled; and appropriate number of samples taken to send to the laboratory for analysis. At this time, liaison with a contaminated land and waste expert should be undertaken.

We recommend that discussions be undertaken with the contaminated land officer at the local authority and a technical specialist in the groundwater and contaminated land team of the Environment Agency. We recommend that this work is undertaken prior to submission of planning permission to avoid the need for planning conditions to be imposed.

In line with current best practice and in accordance with the CL:AIRE (Contaminated Land: Applications in Real Environments) Code of Practice, it is recommended that a Materials Management Plan (MMP) is developed covering the re-use of materials at Raithwaite Gill. The MMP should be based on appropriate risk assessments, which underpin the design statement, concluding that the objectives of preventing harm to human health and pollution of the environment will be met if materials are used in the proposed manner. This may incorporate recommendations for further testing during the construction phase to validate the soil quality. Ensuring that the materials have been appropriately used as set out in the MMP, should be subsequently demonstrated in a verification report.



WS5

Hand dug pit 1

Extent of potential replacement of existing concrete revetment with new (or rock armour)

WS4

Hand dug pit 2

BH5

BH6

WS3

BH4

Extend existing culvert length through infilled area

WS2

BH1

Top of slope

Area where potential slope regrading to 22 to 24 degrees

BH2

BH3

Sandsend Rd

WS1

Potential infill area to improve defences to Raithwaite Gill embankment and avoid landfilling of regraded slope material.

Dunsley Ln

The Ln

Estbek House

Hart Inn

Sandsend Rd

Meadowfield

White Hall

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Borehole Log

PRELIMINARY



Soil Mechanics

Drilled DC/CL Logged CH Checked		Start 05/10/2011 End 06/10/2011		Equipment, Methods and Remarks Dando 3000 and Beretta T51 Cable percussion boring followed by rotary core drilling (PWF size) using air mist flush. SPT: hammer ID CD1, rods BW.		Depth from 0.00m to 24.60m to 24.60m 34.10m Diameter 200mm Casing Depth 24.60m		Ground Level Coordinates National Grid Chainage	
Samples and Tests				Strata					
Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments	
0.10 0.10-0.50	D 1 B 2	0.00-1.20 m Hand excavated inspection pit.			Orangish and light brown sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular fine of coal and mudstone. (TOPSOIL)	(0.50)			
0.50 0.50-1.00	D 3 B 4					0.50			
1.00 1.20-1.65	ES 4A U 5				Firm orangish yellow and brown slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to medium of various lithologies. (SUB-SOIL)	(1.10)			
1.65-1.85	D 6					1.60			
2.00-2.45 2.00-2.45 2.00	D 7 B 8 ES 8A				Firm, becoming stiff below 6.00m, dark brown slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to medium, locally coarse, of various lithologies predominantly sandstone and quartzite. (TILL)				
3.00-3.45	U 9	400 mm rec							
3.45-3.65	D 10								
4.00-4.45 4.00-4.45	D 11 B 12								
4.45-4.90	SPT S	N=6 (1,1/1,2,2,1)	3.10	dry					
5.00-5.45	U 13	24 blows	3.40	dry					
5.45-5.65	D 14								
5.65-6.10 5.65-6.10 5.65-6.10	SPT S D 15 B 16	N=12 (1,2/2,3,3,4)	3.10	dry		(8.40)			
6.50-6.95	U 17	28 blows	6.10	dry					
6.95-7.15	D 18								
7.15-7.60 7.15-7.60 7.15-7.60	SPT S D 19 B 20	N=12 (5,3/2,3,3,4)	6.10	dry					7.00-7.15 m 1 No. sandstone cobble
8.00-8.45	U 21	27 blows 400 mm rec	7.60	dry					
8.45-8.65	D 22								
8.65-9.10 8.65-9.10 8.65-9.10	SPT S D 23 B 24	N=15 (2,2/3,3,4,5)	7.60	dry					
9.50-9.95	U 25	27 blows	9.10	dry					
9.95-10.15	D 26								
Depth	Type & No	Records	Date Casing	Time Water					
Groundwater Entries			Depth sealed (m)		Depth Related Remarks *		Chiselling Depths (m) Time Tools used		
No.	Struck (m)	Post strike behaviour			From to (m)				
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.			Project SANDSEND BOREHOLES, NORTH YORKSHIRE			Borehole			
Scale 1:50			Project No. A1077-11			BH1			
(c) Soil Mechanics www.soil-mechanics.com 426.48.24 14/10/2011 09:45:38			Carried out for Balfour Beatty Living Places			Sheet 1 of 4			

Borehole Log

PRELIMINARY



Soil Mechanics

Drilled DC/CL Logged CH Checked		Start 05/10/2011 End 06/10/2011		Equipment, Methods and Remarks Dando 3000 and Beretta T51. Cable percussion boring followed by rotary core drilling (PWF size) using air mist flush. SPT: hammer ID CD1, rods BW.		Depth from 0.00m 24.60m		to 24.60m 34.10m		Diameter 200mm 121mm		Casing Depth 24.60m		Ground Level Coordinates National Grid Chainage	
Samples and Tests					Strata										
Depth	Type & No	Records	Date Casing	Time Water	Description (Continued from Sheet 1)		Depth, Level (Thickness)	Legend	Backfill/ Instruments						
10.15-10.60 10.15-10.60 10.15-10.60	SPT S D 27 B 28	N=17 (2,2/3,4,4,6)	9.10	dry	Stiff reddish brown, locally greyish brown, slightly sandy slightly gravelly, locally grading to gravelly, CLAY. Gravel is angular to subrounded fine to medium of various lithologies predominantly mudstone. (TILL)		10.00								
11.00-11.45	U 29	33 blows	10.60	dry											
11.45-11.65	D 30				11.40 m 1 No. cobble of mudstone										
11.65-12.10 11.65-12.10 11.65-12.10	SPT S D 31 B 32	N=19 (2,3/4,4,5,6)	10.60	dry			(4.40)								
12.50-12.95	U 33	34 blows	12.10	dry											
12.95-13.15	D 34														
13.15-13.60 13.15-13.60 13.15-13.60	SPT S D 35 B 36	N=19 (2,3/3.5,5,6)	12.10	dry											
14.00-14.45	U 37	32 blows	13.60	dry											
14.45-14.65	D 38				Light brown silty fine to medium SAND. (GLACIAL DEPOSITS)		14.40								
14.65-15.10 14.65-15.10 14.65-15.10	SPT S D 39 B 40	N=24 (2,4/5,6,6,7)	13.60	dry			14.60								
15.50-15.95	U 41	41 blows	15.10	dry	Stiff dark brown thinly laminated fissured slightly sandy slightly gravelly CLAY. Fissures are very closely spaced, randomly orientated, smooth, polished. Gravel is angular to subrounded fine to medium of various lithologies with occasional 15mm pockets of light brown fine sand. (GLACIAL DEPOSITS)		(1.40)								
15.95-16.15	D 42														
16.15-16.60 16.15-16.60 16.15-16.60	SPT S D 43 B 44	N=24 (4,5/4,6,6,8)	15.10	15.70	Dark brown sandy very clayey angular to subrounded fine to medium GRAVEL of various lithologies predominantly mudstone. (Weathered MUDSTONE)		16.00 16.20								
17.00-17.45	U 45	45 blows	16.60	dry	Stiff dark brown very sandy slightly gravelly CLAY. Gravel is angular to subangular fine to medium, locally coarse, of various lithologies predominantly mudstone. (Weathered MUDSTONE)		(1.90)								
17.45-17.65	D 46														
17.65-18.10 17.65-18.10 17.65-18.10	SPT S D 47 B 48	N=33 (4,5/6,7,10,10)	16.60	dry											
18.10	D 49														
18.50-18.95 18.50-18.95 18.70	SPT C B 50 D 51	N=26 (3,4/5,6,6,9)	18.10	dry	Medium dense dark brown sandy clayey GRAVEL. Gravel is angular to rounded fine to coarse of various lithologies predominantly mudstone. (Weathered MUDSTONE)		18.10 18.70								
19.50-19.95	U 52	60 blows	19.40	dry	Stiff to very stiff dark brown, becoming greyish brown below 20.50m, slightly sandy slightly gravelly CLAY. Gravel is angular to rounded fine to medium of various lithologies predominantly mudstone and sandstone. (TILL)										
19.95-20.15	D 53														
Depth	Type & No	Records	Date Casing	Time Water	Stratum continues to 23.90 m										
Groundwater Entries					Depth Related Remarks *					Chiselling					
No.	Struck (m)	Post strike behaviour	Depth sealed (m)		From to (m)		Depths (m)	Time	Tools used						
1	16.00	Rose to 15.70 m after 20 minutes.													
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.					Project SANDSEND BOREHOLES, NORTH YORKSHIRE					Borehole					
Project No. A1077-11					Carried out for Balfour Beatty Living Places					BH1					
Scale 1:50					(c) Soil Mechanics www.soil-mechanics.com 426.48.24.14/10/2011 08:45:39					Sheet 2 of 4					

Borehole Log

PRELIMINARY



Soil Mechanics

Drilled DC/CL Logged CH Checked	Start 05/10/2011 End 06/10/2011	Equipment, Methods and Remarks Dando 3000 and Beretta T51. Cable percussion boring followed by rotary core drilling (PWF size) using air mist flush. SPT: hammer ID CD1. rds BW.	Depth from 0.00m 24.60m	to 24.60m 34.10m	Diameter 200mm 121mm	Casing Depth 24.60m 24.60m	Ground Level Coordinates National Grid Chainage
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Samples and Tests				Strata			Depth, Level/ (Thickness)	Legend	Backfill/ Instruments
Depth	Type & No	Records	Date Casing	Time Water	Description (Continued from Sheet 2)				
20.15-20.60 20.15-20.60 20.15-20.60	SPT S D 54 B 55	N=38 (4,6/8,9,10,11)	19.40	dry	Stiff to very stiff dark brown, becoming greyish brown below 20.50m, slightly sandy slightly gravelly CLAY. Gravel is angular to rounded fine to medium of various lithologies predominantly mudstone and sandstone. (TILL)				
21.00-21.45	U 56	70 blows	19.40	dry		(5.20)			
21.45-21.65	D 57								
21.65-22.10 21.65-22.10 21.65-22.10	SPT S D 58 B 59	N=29 (11,7/6,7,8,8)	19.40	dry					
22.50-23.95	U 60	60 blows 400 mm rec	19.40	dry					
22.95-23.15	D 61								
23.15-23.60 23.15-23.60 23.15-23.60	SPT S D 62 B 63	N=33 (4,6/7,8,9,9)	19.40	dry					
23.90	D 64						23.90		
24.60-24.86 24.60-24.86	SPT S D 55	50 (7,10/18,32 for 35mm)	05/10/2011 19.46 06/10/2011 19.40	dry dry 1030 22.30		Light grey, locally dark grey, thinly laminated silty MUDSTONE. Recovered as angular to subangular fine to coarse gravel.	(0.96)		
24.60-25.60	? N/A N/A						24.86		
25.60-26.60	? N/A N/A								
26.60-28.10	? N/A N/A								
28.10-29.60	? N/A N/A								

Depth	TCR SCR RCD	If	Records/Samples	Date Casing	Time Water	Depth Related Remarks *	Chiselling Depths (m)	Time	Tools used
Groundwater Entries						No. Struck (m)		Post strike behaviour	
						Depth sealed (m)		From to (m)	

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.	Project SANDSEND BOREHOLES, NORTH YORKSHIRE	Borehole BH1
Scale 1:50	Project No. A1077-11	Sheet 3 of 4
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Borehole Log

PRELIMINARY



Soil Mechanics

Drilled Logged Checked	DC/CL CH	Start 05/10/2011 End 06/10/2011	Equipment, Methods and Remarks Dando 3000 and Beretta T51. Cable percussion boring followed by rotary core drilling (PWF size) using air mist flush. SPT: hammer ID CD1, rods BW.		Depth from 0.00m 24.60m	to 24.60m 34.10m	Diameter 200mm 121mm	Casing Depth 24.60m 24.60m	Ground Level Coordinates National Grid Chainage		
Samples and Tests					Strata						
Depth	TCR SCR ROD	If	Records/Samples	Date Casing	Time Water	Description (Continued from Sheet 3)			Depth, Level (Thickness)	Legend	Backfill/ Instruments
29.60-31.10	? N/A N/A					EXPLORATORY HOLE ENDS AT 34.10 m					
31.10-32.60	? N/A N/A										
32.60-34.10	? N/A N/A			06/10/2011 24.60							
Depth	TCR SCR ROD	If	Records/Samples	Date Casing	Time Water						
Groundwater Entries				Depth sealed (m)		Depth Related Remarks *			Chiselling		
No.	Struck (m)	Post strike behaviour				From to (m)			Depths (m)	Time	Tools used
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.				Project		SANDSEND BOREHOLES, NORTH YORKSHIRE			Borehole		
Scale 1:50				Project No.		A1077-11			BH1		
(c) Soil Mechanics www.soil-mechanics.com 426.46.24.14/10/2011 09:45:41				Carried out for		Balfour Beatty Living Places			Sheet 4 of 4		

Borehole Log

PRELIMINARY



Soil Mechanics

Drilled Logged Checked	DC/CL CH	Start 03/10/2011 End 05/10/2011	Equipment, Methods and Remarks Dando 3000 and Beretta T51. Cable percussion boring followed by rotary core drilling (PWF size) using air mist flush SPT: hammer ID CD1, rods BW.			Depth from 0.00m 17.00m 26.20m	to 17.00m 26.20m 40.20m	Diameter 200mm 150mm 121mm	Casing Depth 17.00m 26.20m 26.20m	Ground Level Coordinates National Grid	Chainage
Samples and Tests				Strata							
Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level/ (Thickness)	Legend	Backfill/ Instruments			
0.10	D 1	0.00-1.20 m Hand excavated inspection pit.			Orangish brown slightly sandy CLAY. Sand is fine to coarse. (TOPSOIL)	(0.50)					
0.50	D 2				Stiff orangish brown, becoming dark brown below 3.00m, slightly sandy slightly gravelly CLAY. Gravel is angular to rounded fine to coarse of various lithologies. (TILL)	0.50					
0.50-1.00	B 3										
1.00	ES 3A										
1.20-1.65	U 4	38 blows		dry							
1.65-1.85	D 5										
2.00-2.45	SPT S	N=7 (1,1/1,2,2,2)	1.60	dry							
2.00-2.45	D 6										
2.00-2.45	ES 6A										
2.00-2.45	B 7										
3.00-3.45	U 8	50 blows		dry							
3.45-3.65	D 9										
4.00-4.45	SPT S	N=11 (1,2/3,2,3,3)	3.10	dry							
4.00-4.45	D 10										
4.00-4.45	B 11										
5.00-5.45	U 12	30 blows 400 mm rec	4.60	dry							
5.45-5.65	D 13										
6.00-6.45	SPT S	N=11 (1,2/2,2,3,4)	5.80	dry							
6.00-6.45	D 14										
6.00-6.45	B 15				5.45-5.60 m pocket of dark brown very sandy slightly gravelly clay. Gravel is subangular to subrounded fine to medium of various lithologies						
7.00-7.45	U 16	38 blows	5.80	dry							
7.45-7.65	D 17										
8.00-8.45	U 18	29 blows	7.60	dry							
8.45-8.65	D 19										
9.00-9.45	U 20	35 blows	7.60	dry							
9.45-9.65	D 21										
Depth	Type & No	Records	Date Casing	Time Water	Stratum continues to 15.70 m						
Groundwater Entries No. Struck (m) Post strike behaviour			Depth sealed (m)	Depth Related Remarks * From to (m)			Chiselling Depths (m) Time Tools used				
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.			Project SANDSEND BOREHOLES, NORTH YORKSHIRE			Borehole BH2					
Scale 1:50 (c) Soil Mechanics www.soil-mechanics.com 426.48.24 14/10/2011 09.45.44			Project No. A1077-11			Sheet 1 of 5					
AGS			Carried out for Balfour Beatty Living Places								

Borehole Log

PRELIMINARY



Soil Mechanics

Drilled DC/CL Logged CH Checked		Start 03/10/2011 End 05/10/2011		Equipment, Methods and Remarks Dando 3000 and Beretta T51. Cable percussion boring followed by rotary core drilling (PWF size) using air mist flush. SPT: hammer ID CD1, rods BW.			Depth from 0.00m to 17.00m 17.00m to 26.20m 26.20m to 40.20m		Diameter 200mm 150mm 121mm		Casing Depth 17.00m 26.20m 26.20m		Ground Level Coordinates National Grid Chainage		
Samples and Tests					Strata					Depth, Level (Thickness)		Legend		Backfill/ Instruments	
Depth	Type & No	Records	Date Casing	Time Water	Description (Continued from Sheet 1)										
10.00-10.45	U 22	35 blows	7.60	dry	Stiff orangish brown, becoming dark brown below 3.00m, slightly sandy slightly gravelly CLAY. Gravel is angular to rounded fine to coarse of various lithologies. (TILL)			10.50 m very sandy							
10.45-10.65	D 23														
11.00-11.45	U 24	30 blows	7.60	dry				12.00 m very sandy							
11.45-11.65	D 25														
12.00-12.45	U 26	36 blows	7.60	dry											
12.45-12.65	D 27														
13.00-13.65 13.00-13.45	B 28 U NR	55 blows No recovery	7.60	dry											
14.00-14.45	U 29	35 blows	7.60	dry											
14.45-14.65	D 30														
15.00-15.45	U 31	40 blows 400 mm rec	7.60	dry											
15.45-15.65	D 32														
15.70	D 33														
15.90	W 36				Dark brown sandy very clayey GRAVEL. Gravel is angular to rounded fine to coarse of various lithologies predominantly mudstone and sandstone. (GLACIAL DEPOSITS)			15.70 15.90							
16.00-16.45	U 34	40 blows 400 mm rec													
16.45-16.65	D 35		03/10/2011 7.60	dry	Stiff dark brown, locally orange and brown, sandy slightly gravelly CLAY. Gravel is subangular to rounded fine to medium of various lithologies. (TILL)			(2.00)							
17.00-17.45	U 37	30 blows 400 mm rec	04/10/2011 7.60	0800 13.70 17.00											
17.45-17.65	D 38														
17.90	W 39														
18.00-18.45 18.00-18.45 18.00-18.45	SPT S D 40 B 41	N=37 (3,5/9,9,10,9)	18.00	14.50	Orange brown slightly gravelly clayey SAND. Gravel is angular to subrounded fine to medium of various lithologies predominantly quartzite and flint. (GLACIAL DEPOSITS)			17.90 (0.60)							
18.50	D 42														
19.00-19.45	U 43	55 blows	18.80	dry	Dark brown thinly laminated fissured slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to medium of various lithologies. Fissures are very closely spaced, randomly orientated, smooth, polished. (GLACIAL DEPOSITS)			18.50 (0.50) 19.00							
19.45-19.65	D 44														
Stratum continues to 25.40 m															
Groundwater Entries			Depth sealed (m)		Depth Related Remarks *			Chiselling Depths (m)		Time		Tools used			
No.	Struck (m)	Post strike behaviour			From to (m)										
1	15.90	Rose to 14.90 m after 20 minutes.													
2	17.90	Rose to 14.30 m after 20 minutes. Medium inflow.													
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.					Project SANDSEND BOREHOLES, NORTH YORKSHIRE					Borehole BH2					
Scale 1:50					Project No. A1077-11					Sheet 2 of 5					
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Borehole Log

PRELIMINARY



Soil Mechanics

Drilled DC/CL Logged CH Checked		Start 03/10/2011 End 05/10/2011		Equipment, Methods and Remarks Dando 3000 and Beretta T51. Cable percussion boring followed by rotary core drilling (PWF size) using air mist flush. SPT: hammer ID CD1, rods BW.		Depth from 0.00m 17.00m 26.20m		to 17.00m 26.20m 40.20m		Diameter 200mm 150mm 121mm		Casing Depth 17.00m 26.20m 26.20m		Ground Level Coordinates National Grid Chainage	
Samples and Tests					Strata					Depth, Level/ (Thickness)		Legend	Backfill/ Instruments		
Depth	Type & No	Records	Date Casing	Time Water	Description (Continued from Sheet 2)										
20.00-20.45	U 45	43 blows 400 mm rec	19.60	dry	Stiff, locally very stiff, dark brown slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to medium, occasionally coarse, of various lithologies predominantly mudstone. (GLACIAL DEPOSITS)					(6.40)		SPIE			
20.45-20.65	D 46														
21.00-21.45	U 47	50 blows 400 mm rec	19.60	dry											
21.45-21.65	D 48														
22.00-22.45	U 49	60 blows 350 mm rec	19.60	dry											
22.45-22.65	D 50														
23.00-23.45	U 51	70 blows 400 mm rec	19.60	dry											
23.45-23.65	D 52														
24.00-24.45	U 53	65 blows	19.60	dry											
24.45-24.65	D 54														
25.00-25.45	U 55	65 blows 400 mm rec	19.60	dry	Very weak light grey and green, locally weathered orange, thinly laminated MUDSTONE. Recovered as angular to subangular fine to coarse gravel. (Weathered MUDSTONE)					25.40					
25.45-25.65	D 56														
26.10-26.29	SPT S	50 (16,9 for 40mm/50)	04/10/2011 19.60	dry						26.30					
26.10-26.30	D 57		05/10/2011 19.60	0800 dry											
26.20-27.20	? N/A N/A														
27.20-28.50	? N/A N/A														
28.50-30.20	? N/A N/A														
Depth	TCR SCR RGD	If	Records/Samples	Date Casing	Time Water										
Groundwater Entries			No. Struck (m)		Post strike behaviour		Depth sealed (m)		Depth Related Remarks *			Chiselling Depths (m)		Time	Tools used
												25.90 -26.10		30 mins	
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.			Project		SANDSEND BOREHOLES, NORTH YORKSHIRE					Borehole		BH2			
Scale 1:50			Project No.		A1077-11					Carried out for		Balfour Beatty Living Places			
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Borehole Log

PRELIMINARY



Soil Mechanics

Drilled DC/CL Logged CH Checked	Start 03/10/2011 End 05/10/2011	Equipment, Methods and Remarks Dando 3000 and Beretta T51. Cable percussion boring followed by rotary core drilling (PWF size) using air mist flush. SPT: hammer ID CD1, rods BW.	Depth from 0.00m to 17.00m Diameter 200mm Casing Depth 17.00m 17.00m 26.20m 150mm 26.20m 26.20m 40.20m 121mm 26.20m	Ground Level Coordinates National Grid Chainage
---------------------------------------	--	--	--	--

Samples and Tests				Strata			Depth, Level (Thickness)	Legend	Backfill/ Instruments
Depth	TCR SCR RCD	If	Records/Samples	Date Casing	Time Water	Description (Continued from Sheet 3)			
30.20-31.70	? N/A N/A								
31.70-33.20	? N/A N/A								
33.20-34.70	? N/A N/A								
34.70-37.20	? N/A N/A								
37.20-38.70	? N/A N/A								
38.70-40.20	? N/A N/A								

Flush: 26.20-40.20
air mist, 100 %

Groundwater Entries No. Struck (m) Post strike behaviour	Depth sealed (m)	Depth Related Remarks * From to (m)	Chiselling Depths (m) Time Tools used
--	------------------	--	--

Borehole Log

PRELIMINARY



Soil Mechanics

Drilled DC/CL Logged CH Checked		Start 05/10/2011 End 10/10/2011	Equipment, Methods and Remarks Dando 3000 and Beretta T51 Cable percussion boring followed by rotary core drilling (PWF size) using air mist flush. SPT: hammer ID CD1, rods BW.		Depth from 0.00m 21.10m	to 21.10m 40.10m	Diameter 200mm 121mm	Casing Depth 21.10m 21.10m	Ground Level Coordinates National Grid Chainage	
Samples and Tests					Strata					
Depth	Type & No	Records	Date Casing	Time Water	Description			Depth, Level/ (Thickness)	Legend	Backfill/ Instruments
0.10 0.10-0.50 0.30	D 1 B 2 ES 2A	0.00-1.20 m Hand excavated inspection pit.			Orangish brown very sandy CLAY. (TOPSOIL)			(0.50)		
0.50-1.00	B 3				Light brownish and orange slightly sandy CLAY. (SUB-SOIL)			0.50		
1.20-1.65	U 4	31 blows		dry				(0.90)		
1.65-1.85	D 5				Stiff, becoming firm below 4.50m, reddish brown, locally dark brown, slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to medium, occasionally coarse, of various lithologies predominantly mudstone. (TILL)			1.40		
1.85-2.30 1.85-2.30 1.85-2.30 2.00	SPT S D 6 B 7 ES 7A	N=11 (1,1/2,2,3,4)		dry						
2.50-2.95	U 8	38 blows	1.60	dry						
2.95-3.95	D 9									
3.15-3.60 3.15-3.60 3.15-3.60	SPT S D 10 B 11	N=18 (2,3/4,4,5,5)	1.60	dry						
4.00-4.45	U 12	28 blows	3.10	dry						
4.45-4.65	D 13									
4.65-5.10 4.65-5.10 4.65-5.10	SPT S D 14 B 15	N=10 (1,2/2,2,3,3)	3.10	dry						
5.50-5.95	U 16	28 blows	4.50	dry						
5.95-6.15	D 17									
6.15-6.60 6.15-6.60 6.15-6.60	SPT S D 18 B 19	N=10 (1,2/2,2,3,3)	4.50	dry				(9.40)		
7.00-7.45	U 20									
7.45-7.65	D 21									
7.65-8.10 7.65-8.10 7.65-8.10	SPT S D 22 B 23	N=10 (1,2/2,2,3,3)	6.10	dry						
8.50-8.95	U 24	28 blows	7.60	dry						
8.95-9.15	D 25									
9.15-9.60 9.15-9.60 9.15-9.60	SPT S D 26 B 27	N=15 (1,2/3,3,4,5)	7.60	dry	9.15 m 1 No. quartzite cobble					
Depth	Type & No	Records	Date Casing	Time Water	Stratum continues to 10.80 m					
Groundwater Entries			Depth sealed (m)		Depth Related Remarks *			Chiselling		
No.	Struck (m)	Post strike behaviour			From to (m)			Depths (m)	Time	Tools used
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.			Project		SANDSEND BOREHOLES, NORTH YORKSHIRE			Borehole		
Scale 1:50			Project No.		A1077-11			BH3		
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Borehole Log

PRELIMINARY



Soil Mechanics

Drilled DC/CL Logged CH Checked		Start 06/10/2011 End 10/10/2011		Equipment, Methods and Remarks Dando 3000 and Beretta T51. Cable percussion boring followed by rotary core drilling (PWF size) using air mist flush. SPT: hammer ID CD1, rods BW.		Depth from 0.00m to 21.10m to 21.10m 40.10m Diameter 200mm Casing Depth 21.10m		Ground Level Coordinates National Grid Chainage						
Samples and Tests					Strata									
Depth	Type & No	Records	Date Casing	Time Water	Description (Continued from Sheet 1)	Depth, Level/ (Thickness)	Legend	Backfill/ Instruments						
10.00-10.45	U 28	34 blows	9.10	dry	Stiff, becoming firm below 4.50m, reddish brown, locally dark brown, slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to medium, occasionally coarse, of various lithologies predominantly mudstone. (TILL)	10.80								
10.45-10.65	D 29	50 (2,18/25,25 for 50mm)	9.10	dry						10.60 m 1 No. sandstone cobble				
10.65-10.93	SPT S													
10.65-10.90	D 30													
10.65-10.90	B 31													
11.20	D 32				Orangish light grey slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to medium of mudstone and siltstone. (Weathered SILTSTONE)	(3.10)								
11.50-11.95	SPT S	N=26 (3,4/4,6,8,8)	10.60	dry										
11.50-11.95	D 33				Below 12.50m, becoming dark grey with bands up to 15mm thick of weathered black vitreous coal.									
11.50-11.95	B 34													
12.50-12.95	SPT S	N=26 (3,5/5,6,7,8)	10.60	dry										
12.50-12.95	D 35													
12.50-12.95	B 36													
13.50-13.95	SPT S	N=31 (3,4/5,8,8,10)	10.60	dry										
13.50-13.95	D 37													
13.50-13.95	B 38													
14.50-14.95	U 39	45 blows	13.60	dry	Stiff to very stiff dark brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of various lithologies predominantly mudstone. (TILL)	(1.00)								
14.95-15.15	D 40				Dark brownish grey silty slightly gravelly CLAY. Gravel is subangular to subrounded fine of mudstone. (GLACIAL DEPOSITS)	14.90 15.20								
15.15-15.60	SPT S	N=26 (3,5/7,6,6,7)	13.60	14.40										
15.15-15.60	D 41													
15.15-15.60	B 42													
16.00-16.45	U 43	45 blows	15.80	dry	Very stiff dark brown slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to medium, rarely coarse, of various lithologies predominantly mudstone. (TILL)	(4.90)								
16.45-16.55	D 44													
16.65-17.10	SPT S	N=28 (3,4/6,6,7,9)	15.80	dry	16.50 m 1 No. cobble of limestone									
16.65-17.10	D 45													
16.65-17.10	B 46													
17.50-17.95	U 47	60 blows	16.60	dry										
17.95-18.15	D 48													
18.15-18.60	SPT S	N=35 (4,5/7,9,9,10)	16.60	dry										
18.15-18.60	D 49													
18.15-18.60	B 50													
19.00-19.45	U 51	62 blows	18.10	dry										
19.45-19.65	D 52													
19.65-20.10	SPT S	N=35 (4,5/7,8,9,11)	18.10	dry										
19.65-20.10	D 53													
19.65-20.10	B 54			06/10/2011										
Depth	Type & No	Records	Date Casing	Time Water	Stratum continues to 20.10 m									
Groundwater Entries					Depth Related Remarks *					Chiselling				
No.	Struck (m)	Post strike behaviour	Depth sealed (m)		From	to (m)	Depths (m)	Time	Tools used					
1	14.90	Rose to 14.40 m after 20 minutes. Slow inflow.	-				10.90-11.10	30 mins						
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.					Project SANDSEND BOREHOLES, NORTH YORKSHIRE					Borehole BH3				
Scale 1:50					Project No. A1077-11					Sheet 2 of 5				
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Borehole Log

PRELIMINARY



Soil Mechanics

Drilled DC/CL Logged CH Checked		Start 06/10/2011 End 10/10/2011		Equipment, Methods and Remarks Dando 3000 and Beretta T51. Cable percussion boring followed by rotary core drilling (PWF size) using air mist flush SPT: hammer ID CD1, rods BW.		Depth from 0.00m 21.10m		to 21.10m 40.10m		Diameter 200mm 121mm		Casing Depth 21.10m 21.10m		Ground Level Coordinates National Grid Chainage	
Samples and Tests						Strata									
Depth	Type & No	Records	Date Casing	Time Water	Description (Continued from Sheet 2)	Depth, Level/ (Thickness)	Legend	Backfill/ Instruments							
20.10	D 55	SPT S 50 (8,8/ 12,13,15,10 for 45mm) D 57	19.60	dry	Very stiff dark brown slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to medium, rarely coarse, of various lithologies predominantly mudstone. (TILL)	20.10									
20.50-21.00	B 56		07/10/2011	0800		19.60			dry	(1.00)					
21.20-21.62	?		N/A	07/10/2011	dry	Very weak greyish yellow thinly laminated MUDSTONE. Generally recovered as angular to subangular fine to medium gravelly clay. (Weathered MUDSTONE)	21.10								
21.20-21.60				19.60	dry					10/10/2011	0800				
21.10-22.10	N/A			19.60	7.90										
22.10-23.60	?		N/A												
23.60-25.10	?		N/A												
25.10-26.60	?		N/A												
26.60-28.10	?		N/A												
28.10-29.60	?		N/A												
28.10-29.60	?	N/A													
Depth	TGR SCR RCD	If	Records/Samples	Date Casing	Time Water	Groundwater Entries									
						No. Struck (m)	Post strike behaviour	Depth sealed (m)	Depth Related Remarks * From to (m)	Chiselling Depths (m)	Time	Tools used			
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.						Project SANDSEND BOREHOLES, NORTH YORKSHIRE									
Scale 1:50						Project No. A1077-11									
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ACS						Sheet 3 of 5									

Borehole Log

PRELIMINARY



Soil Mechanics

Drilled DC/CL Logged CH Checked		Start 06/10/2011 End 10/10/2011		Equipment, Methods and Remarks Dando 3000 and Beretta T51. Cable percussion boring followed by rotary core drilling (PWF size) using air mist flush. SPT: hammer ID CD1, rods BW.		Depth from 0.00m 21.10m		to 21.10m 40.10m		Diameter 200mm 121mm		Casing Depth 21.10m 21.10m		Ground Level Coordinates National Grid Chainage			
Samples and Tests						Strata											
Depth	TCR SCR ROD	If	Records/Samples	Date Casing	Time Water	Description (Continued from Sheet 3)						Depth, Level/ (Thickness)	Legend	Backfill/ Instruments			
29.60-31.10	? N/A N/A		Flush: 21.10-40.10 air mist, 100 %														
31.10-32.60	? N/A N/A																
32.60-34.10	? N/A N/A																
34.10-35.60	? N/A N/A																
35.60-37.10	? N/A N/A																
37.10-38.60	? N/A N/A																
38.60-40.10	? N/A N/A																
				10/10/2011													
Depth	TCR SCR ROD	If	Records/Samples	Date Casing	Time Water												
Groundwater Entries				Depth sealed (m)		Depth Related Remarks *						Chiselling					
No.	Struck (m)	Post strike behaviour				From to (m)						Depths (m)	Time	Tools used			
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.				Project SANDSEND BOREHOLES, NORTH YORKSHIRE				Borehole									
Scale 1:50				Project No. A1077-11				BH3									
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AGS																	

Borehole Log

PRELIMINARY



Soil Mechanics

Drilled JD/PS Logged CH Checked		Start 04/10/2011 End 06/10/2011		Equipment, Methods and Remarks Dando 2000 and Geotech 6. Cable percussion boring followed by rotary core drilling (GBS size) using mud flush. SPT: hammer ID JB15, rods NWY.		Depth from 0.00m 5.00m		to 5.00m 12.00m		Diameter 150mm 146mm		Casing Depth 5.00m 5.30m		Ground Level Coordinates National Grid Chainage	
Samples and Tests						Strata									
Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level/ (Thickness)	Legend	Backfill/ Instruments							
0.10	D 1	0.00-1.20 m Hand excavated inspection pit.			MACADAM. (MADE GROUND) (Foreman's description)	0.10									
0.10-0.15	B 2					0.15									
0.20	D 3					(0.50)									
0.20-0.30	B 4														
0.35	D 5														
0.35-0.65	B 6				Dark grey sandy clayey GRAVEL. Gravel is angular to subangular fine to medium of ash, macadam and sandstone. Slight hydrocarbon odour. (FILL)	0.65									
0.70	D 7														
0.80-1.10	B 8														
1.00	ES 8A														
1.20	D 9														
1.20-1.65	U NR	70 blows No recovery	1.20	dry	Creamish yellow, becoming light grey, very sandy angular to subangular fine to medium GRAVEL of limestone. (FILL)										
1.70	D 11														
2.00-2.45	SPT S	N=4 (1,1/1,1,1,1)	2.00	dry	Firm orangish brown slightly sandy gravelly CLAY. Gravel is angular to subrounded fine to medium of various lithologies including coal, ash and clinker. (reworked GLACIAL TILL)	(2.65)									
2.00	D 12														
2.00-2.45	D 13														
2.00-2.50	B 14														
2.00	ES 14A														
3.00	D 15														
3.00-3.45	U 16														
3.50	D 17				Orangish dark grey sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone and sandstone. (Weathered MUDSTONE)	3.30									
4.00-4.45	SPT S	N=9 (1,2/2,2,3,2)	4.00	dry		(1.20)									
4.00	D 18														
4.00-4.45	D 19														
4.00-4.50	B 20														
4.50	D 21														
4.50-4.70	B 22														
4.70-5.00	B 23				Dark grey thinly laminated MUDSTONE. Recovered as angular to subangular fine to coarse gravel.	4.50									
5.00-5.40	SPT C	50 (7,10/10,13,16,11 for 29mm)	04/10/2011 4.50	dry		(0.50)									
5.00-5.40	D 24		05/10/2011 4.50	dry		5.00									
5.00-8.07	? N/A N/A	Flush: 5.00-8.07 mud, 95 %													
8.07-10.69	? N/A N/A	Flush: 8.07-10.69 mud, 90 %													
Depth	ICR SCR PCB	If	Records/Samples	Date Casing	Time Water	Groundwater Entries No. Struck (m) Post strike behaviour None observed (see Key Sheet)		Depth Related Remarks * From to (m)		Chiselling Depths (m) 4.70-5.00	Time 60 mins	Tools used			
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.															
Project			SANDSEND BOREHOLES, NORTH YORKSHIRE												
Project No.			A1077-11												
Carried out for			Balfour Beatty Living Places												
Borehole										BH4					
										Sheet 1 of 2					

Scale 1:50

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Borehole Log

PRELIMINARY



Soil Mechanics

Drilled Logged Checked		JB/PS CH		Start End		Equipment, Methods and Remarks		Depth from to		Diameter		Casing Depth		Ground Level Coordinates National Grid			
				05/10/2011 07/10/2011		Dando 2000 and Geotech 6. Cable percussion boring followed by rotary core drilling (GBS size) using mud flush SPT: hammer ID JB15, rods NWY.		0.00m 4.60m		4.60m 12.00m		150mm 146mm		4.60m 4.60m		Chainage	
Samples and Tests								Strata									
Depth	Type & No	Records	Date Casing	Time Water	Description			Depth, Level (Thickness)	Legend	Backfill/ Instruments							
0.10	D 1	0.00-1.20 m Hand excavated inspection pit.			MACADAM. (Foreman's description)			0.10									
0.10-0.20	B 2							0.20									
0.30	D 3																
0.40-0.80	B 4				Black very sandy angular to subangular fine to medium GRAVEL of ash and macadam. (FILL)			(0.60)									
0.90	D 5							0.60									
0.90-1.10	B 6																
1.20-1.65	SPT S	N=2 (1,1/0,1,1,0)		dry	Light grey very sandy angular to subangular fine to medium GRAVEL of limestone. (FILL)												
1.20	D 7																
1.20-1.65	D 8																
1.20-1.70	B 9																
2.00-2.45	SPT S	N=5 (1,1/1,1,2,1)	2.00	dry	Firm greyish brown slightly sandy gravelly CLAY. Gravel is angular to subangular fine to medium of various lithologies including ash, coal and sandstone. (FILL)			(2.30)									
2.00	D 10																
2.00-2.45	D 11																
2.00-2.50	B 12																
3.00	D 13																
3.00-3.45	U 14	75 blows 350 mm rec	3.00	dry	Very stiff orangish grey very gravelly CLAY. Gravel is angular to subangular fine to medium of mudstone. (Weathered MUDSTONE)			3.10									
3.50	D 15																
3.50-3.90	B 16																
4.00-4.44	SPT S	50 (8,11/12,17,21,- for 68mm)	3.00	dry				(1.50)									
4.00	D 17																
4.00-4.35	D 18																
4.00-4.60	B 19																
4.60-4.98	SPT S	50 (8,13/15,16,18,1 for 3mm)	05/10/2011 3.00	dry				4.60									
4.60-4.98	D 20		07/10/2011 0800 3.00	dry													
4.60-7.64	? N/A N/A	Flush: 4.60-7.60 mud flush, 100 %															
7.64-8.10	? N/A N/A	Flush: 7.60-8.10 mud flush, 0 %															
8.10-9.38	? N/A N/A																
Depth	TCR RCD	If	Records/Samples	Date Casing	Time Water												
Groundwater Entries				No. Struck		Post strike behaviour		Depth sealed (m)		Depth Related Remarks *							
None observed (see Key Sheet)										Chiselling Depths (m) 4.00-4.60 Time 60 mins Tools used							
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.				Project SANDSEND BOREHOLES, NORTH YORKSHIRE				Borehole BH5									
Scale 1:50				Project No. A1077-11				Sheet 1 of 2									
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Borehole Log

PRELIMINARY



Soil Mechanics

Drilled Logged Checked		JB/PS CH	Start 03/10/2011 End 06/10/2011	Equipment, Methods and Remarks Dando 2000 and Geotech 6. Cable percussion boring followed by rotary core drilling (GBS size) using mud flush. SPT: hammer ID JB15, rods NWY.			Depth from 0.00m 5.00m	to 5.00m 12.14m	Diameter 150mm 146mm	Casing Depth 5.00m	Ground Level Coordinates National Grid Chainage
Samples and Tests						Strata					
Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments			
0.10 0.10-0.25 0.30 0.40-0.70	D 1 B 2 D 3 B 4	0.00-1.20 m Hand excavated inspection pit.			MACADAM. (MADE GROUND) (Foreman's description)	0.20 0.25 (0.45)					
0.75 0.80-1.10 1.00	D 5 B 6 ES 6A		03/10/2011	dry	Black very sandy angular to subrounded fine to medium GRAVEL of ash, macadam and sandstone. (FILL)	0.70					
1.20-1.58 1.20 1.20-1.65 1.20-1.70	SPT S D 7 D 8 B 9	3 (1.0/1.1,0,1 for 1mm)	04/10/2011	0800 dry	Creamish grey very sandy angular to subangular fine to medium GRAVEL of limestone. (FILL)			1.20 m 1 No. sandstone cobble			
2.00-2.45 2.00 2.00 2.00-2.45 2.00-2.50	SPT S D 10 ES 10A D 11 B 12	N=4 (1,1/1,1,1,1)	2.00	dry	Soft to firm brownish orangish sandy slightly gravelly CLAY. Gravel is angular to subangular fine to medium of coal and burnt shale. (MADE GROUND)	(2.70)					
3.00 3.00-3.45	D 13 U 14										
3.50 3.50-3.90	D 15 B 16				Firm greyish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. (TILL)	3.40 3.50 (0.50)					
4.00-4.38 4.00 4.00-4.39 4.00-4.50	SPT S D 17 D 18 B 19	50 (7,11/14,17,19)	4.00	dry	Dark grey very gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone. (Weathered MUDSTONE)	(1.36)					
5.00-5.36 5.00-5.36	SPT S D 20	50 (8,14/17,17,16 for 55mm)	04/10/2011 4.50 06/10/2011 4.50	dry dry 0800 dry	Very weak grey thinly laminated MUDSTONE. Recovered as angular to subangular fine to medium gravel.	5.36					
5.00-6.17	? N/A N/A	Flush: 5.00-6.17 mud, 100 %									
6.17-9.14	? N/A N/A	Flush: 6.17-12.14 mud, 95 %									
Depth	TCR SCR RCD	If	Records/Samples	Date Casing	Time Water						
Groundwater Entries				Depth sealed (m)		Depth Related Remarks *		Chiselling Depths (m) Time Tools used			
No. Struck Post strike behaviour (m)				None observed (see Key Sheet)				4.00-5.00 60 mins			
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.			Project SANDSEND BOREHOLES, NORTH YORKSHIRE			Borehole					
Scale 1:50 (c) Soil Mechanics www.soil-mechanics.com 426 48 24 14/10/2011 09:46:07			Project No. A1077-11			BH6					
			Carried out for Balfour Beatty Living Places			Sheet 1 of 2					

Borehole Log

PRELIMINARY



Soil Mechanics

Drilled Logged Checked	JB/PS CH	Start 03/10/2011 End 06/10/2011	Equipment, Methods and Remarks Dando 2000 and Geotech 6. Cable percussion boring followed by rotary core drilling (GBS size) using mud flush. SPT: hammer ID JB15, rods NWY.	Depth from 0.00m 5.00m	to 5.00m 12.14m	Diameter 150mm 146mm	Casing Depth 5.00m 5.00m	Ground Level Coordinates National Grid Chainage		
Samples and Tests				Strata						
Depth	TCR SCR RCD	If	Records/Samples	Date Casing	Time Water	Description (Continued from Sheet 1)		Depth, Level/ (Thickness)	Legend	Backfill/ Instruments
9.14-12.14	? N/A N/A			06/10/2011 5.00	5.02	EXPLORATORY HOLE ENDS AT 12.14 m				
Depth	TCR SCR RCD	If	Records/Samples	Date Casing	Time Water					
Groundwater Entries No. Struck Post strike behaviour (m)				Depth sealed (m)		Depth Related Remarks * From to (m)		Chiselling Depths (m) Time Tools used		
None observed (see Key Sheet)										
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.				Project SANDSEND BOREHOLES, NORTH YORKSHIRE Project No. A1077-11 Carried out for Balfour Beatty Living Places				Borehole BH6 Sheet 2 of 2		
Scale 1:50 (c) Soil Mechanics www.soil-mechanics.com 426.48.24.14/10/2011 09:46:08										

PRELIMINARY Dynamic Sampler Hole Log



Soil Mechanics

Drilled Logged CH Checked	Start 11/10/2011 End 11/10/2011	Equipment, Methods and Remarks Windowless sampling. Rig ID: Rod type:	Depth from to Diameter Casing Depth	Ground Level Coordinates National Grid Chalnage				
Samples and Tests			Strata					
Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.30 0.30-1.00	D 1 B 2				Light brown fine to coarse SAND.	(1.30)		
1.30	D 3				EXPLORATORY HOLE ENDS AT 1.30 m	1.30		
					1.30 m 1 No. rounded sandstone cobble			
Depth	Type & No	Records	Date Casing	Time Water	Depth Related Remarks *	Chiselling Depths (m)	Time	Tools used
Groundwater Entries			Depth sealed (m)		From to (m)			
No.	Struck (m)	Post strike behaviour						
None observed (see Key Sheet)								
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.					Project SANDSEND BOREHOLES, NORTH YORKSHIRE Project No. A1077-11 Carried out for Balfour Beatty Living Places	Borehole <h2 style="text-align: center;">WS1</h2> Sheet 1 of 1		
Scale 1:50 (c) Soil Mechanics www.soil-mechanics.com 426.48.24 13/10/2011 10:56:56								

PRELIMINARY Dynamic Sampler Hole Log



Soil Mechanics

Drilled Logged CH Checked		Start 11/10/2011 End 11/10/2011		Equipment, Methods and Remarks Windowless sampling. Rig ID: Rod type:		Depth from to Diameter Casing Depth		Ground Level Coordinates National Grid Chainage	
Samples and Tests				Strata					
Depth	Type & No	Records	Date Casing	Time Water	Description		Depth, Level/ (Thickness)	Legend	Backfill/ Instruments
0.30 0.30-1.00 0.60-2.10	D 1 B 2 B 5				Light brown slightly gravelly fine to coarse SAND. Gravel is fine to medium, occasionally coarse, of sandstone.		(1.60)		
1.20 1.50	D 3 D 4				1.00-1.60 m increase in gravel content		1.60		
2.20	D 6				1.95-2.10 m band of firm dark brown sandy silt				
2.80	D 7				2.80-3.10 m band of firm dark brown sandy silt				
3.30	D 8				3.30-5.00 m NO RECOVERY		(3.40)		
					EXPLORATORY HOLE ENDS AT 5.00 m				
5.00									
Groundwater Entries		Depth sealed (m)		Depth Related Remarks *		Chiselling Depths (m) Time Tools used			
No. Struck (m)	Post strike behaviour			From to (m)					
None observed (see Key Sheet)									
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.			Project SANDSEND BOREHOLES, NORTH YORKSHIRE			Borehole			
Scale 1:50			Project No. A1077-11			WS2			
(c) Soil Mechanics www.soil-mechanics.com 426 48 24 13/10/2011 11:45:33			Carried out for Balfour Beatty Living Places			Sheet 1 of 1			

PRELIMINARY Dynamic Sampler Hole Log



Soil Mechanics

Drilled Logged CH Checked	Start 10/11/2011 End 10/11/2011	Equipment, Methods and Remarks Windowless sampling. Rig ID: Rod type:	Depth from to Diameter Casing Depth	Ground Level Coordinates National Grid Chainage				
Samples and Tests			Strata					
Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level/ (Thickness)	Legend	Backfill/ Instruments
0.30 0.30-1.00	D 1 B 2				Light brown fine to coarse SAND with occasional sand size shell fragments. (BEACH)	(1.80)		
1.30-1.50	D 3							
1.80-2.00	D 4				Multicoloured subrounded to rounded fine to coarse GRAVEL of sandstone. (BEACH)	1.80 (0.40)		
2.50	D 5				Dark grey and black very gravelly CLAY. Gravel is angular fine to medium of mudstone. (Weathered MUDSTONE) EXPLORATORY HOLE ENDS AT 2.50 m	2.20 (0.30) 2.50		
Depth	Type & No	Records	Date Casing	Time Water				
Groundwater Entries No. Struck Post strike behaviour (m)			Depth sealed (m)		Depth Related Remarks * From to (m)	Chiselling Depths (m) Time Tools used		
None observed (see Key Sheet)								
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.			Project SANDSEND BOREHOLES, NORTH YORKSHIRE Project No. A1077-11 Carried out for Balfour Beatty Living Places			Borehole WS3 Sheet 1 of 1		
Scale 1:50 (c) Soil Mechanics www.soil-mechanics.com 426.48.24.13/10/2011 10:56:58								

PRELIMINARY Dynamic Sampler Hole Log



Soil Mechanics

Drilled Logged CH Checked	Start 10/11/2011 End 10/11/2011	Equipment, Methods and Remarks Windowless sampling. Rig ID: Rod type:	Depth from to Diameter Casing Depth	Ground Level Coordinates National Grid Chainage				
Samples and Tests			Strata					
Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level/ (Thickness)	Legend	Backfill/ Instruments
0.40 0.40-0.90	D 1 B 2				Light brown gravelly fine to coarse SAND. Gravel is subrounded to rounded fine to medium of various lithologies including brick. (BEACH DEPOSIT)	(1.00)		
0.90	D 3				Extremely weak dark grey, becoming light brown and orange, thinly laminated MUDSTONE.	1.00		
1.50	D 4					(0.90)		
EXPLORATORY HOLE ENDS AT 1.90 m						1.90		
Depth	Type & No	Records	Date Casing	Time Water				
Groundwater Entries No. Struck Post strike behaviour (m)			Depth sealed (m)	Depth Related Remarks * From to (m)		Chiselling Depths (m) Time Tools used		
None observed (see Key Sheet)								
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.			Project SANDSEND BOREHOLES, NORTH YORKSHIRE Project No. A1077-11 Carried out for Balfour Beatty Living Places			Borehole <h2 style="text-align: center;">WS4</h2> Sheet 1 of 1		
Scale 1:50 (c) Soil Mechanics www.soil-mechanics.com 426.48.24 13/10/2011 10:56:59								

PRELIMINARY Dynamic Sampler Hole Log



Soil Mechanics

Drilled Logged CH Checked	Start 10/11/2011 End 10/11/2011	Equipment, Methods and Remarks Windowless sampling. Rig ID: Rod type:	Depth from to Diameter Casing Depth	Ground Level Coordinates National Grid Chainage				
Samples and Tests			Strata					
Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level/ (Thickness)	Legend	Backfill/ Instruments
0.40	D 1				Brown slightly sandy angular to rounded fine GRAVEL of various lithologies. (BEACH DEPOSIT)	(0.60)		
0.60-1.30	B 3				Light brown slightly gravelly fine to coarse SAND. Gravel is subangular to rounded fine to medium of various lithologies. (BEACH DEPOSIT)	0.60		
0.80	D 2					(0.95)		
1.70	D 4				Stiff, locally firm, orangish brown slightly sandy slightly gravelly CLAY. (TILL)	1.55		
2.20	D 5					(2.65)		
3.00-3.40	D 6					(2.65)		
					EXPLORATORY HOLE ENDS AT 4.20 m	4.20		
					1.80-1.90 m band of firm sandy silt			
					4.20 m fragments of medium mudstone gravel			
Depth	Type & No	Records	Date Casing	Time Water				
Groundwater Entries No. Struck Post strike behaviour (m)			Depth sealed (m)	Depth Related Remarks * From to (m)		Chiselling Depths (m)	Time	Tools used
None observed (see Key Sheet)								
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.			Project SANDSEND BOREHOLES, NORTH YORKSHIRE Project No. A1077-11 Carried out for Balfour Beatty Living Places			Borehole WS5 Sheet 1 of 1		
Scale 1:50 (c) Soil Mechanics www.soil-mechanics.com 426 48 24 13/10/2011 10:57:01								