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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH404**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 08/10/2014 - 09/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL/* DEPTH (Thickness)	Sample Details			Test Results	Backfill Details
					TYPE	REF	Depth	SPT N Value/Drive mm	
Borehole complete at 20.00m bgl.									

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 40.00m bgl.

CHISELLING

Depth From	Depth To	Time Taken
NO CHISELLING UNDERTAKEN:		

WATER LEVEL OBSERVATIONS

Date	Time	Water Strike	Standing Level	Casing Depth
NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 20.00m	150mm to 13.40m	

All measurements in metres unless otherwise stated

10m/page Scale: 1:62.50

Coordinates to National Grid
Ground Level to Ordnance Datum

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524197.53 N: 212743.84 Level: 84.46	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH405**

CABLE PERCUSSION BOREHOLE LOG

Date: 02/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL* / DEPTH (Thickness)	Sample Details TYPE	REF	Depth	Test Results SPT N Value/Drive mm	Backfill Details
MADE GROUND: Concrete.				*84.48* 0.20					
MADE GROUND: Orangey brown sandy gravelly clay. Gravel is angular to rounded fine to coarse of flint and rare brick. Sand is fine to coarse.					D	1	0.50		
					D	2	1.00		
					B	1	1.50 - 1.95 1.50 - 1.95	CPT N=50/265mm (4,6/10,13,15,12/40mm)	
				(3.30)					
					D	3	2.50 - 2.95 2.50 - 2.95	CPT N=22 3,3/4,4,6,8	
				81.18 3.50	D	4	3.50 - 3.95 3.50 - 3.95	CPT N=11 5,4/3,3,2,3	
Firm orangey brown slightly gravelly sandy CLAY. Gravel is angular to rounded fine to coarse flint. Sand is fine to coarse. Rare flint cobbles. (LOWESTOFT FORMATION)				(1.60)	D	5	4.50 - 4.95 4.50 - 4.95	CPT N=11 1,1/2,3,3,3	
			(150mm)	*79.58* 5.10	B	2	5.10 - 5.50		
Stiff brown slightly sandy slightly gravelly CLAY. Gravel is subangular to rounded fine to medium flint and rare sandstone. Rare fine gravel sized organic patches.(LOWESTOFT FORMATION)				(0.80)					
				78.78 5.90	D	6	6.00 - 6.45 6.00 - 6.45	CPT N=23 3,3/4,5,6,8	
Medium dense orange sandy angular to rounded fine to coarse flint GRAVEL. Sand is fine to coarse. (KESGRAVE CATCHMENT SUBGROUP)					D	7	7.50 - 7.95 7.50 - 7.95	CPT N=29 2,3/5,7,7,10	
				(4.30)					
					B	3	9.00 - 9.45 9.00 - 9.45	CPT N=22 2,3/3,5,6,8	

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 20.00m bgl.

CHISELLING

Depth From	Depth To	Time Taken
NO CHISELLING UNDERTAKEN:		

WATER LEVEL OBSERVATIONS

Date	Time	Water Strike	Standing Level	Casing Depth
NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 20.00m	150mm to 10.20m	

All measurements in metres unless otherwise stated

10m/page Scale: 1:62.50

Coordinates to National Grid
Ground Level to Ordnance Datum

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524109.81 N: 212731.43 Level: 84.68	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH405**

CABLE PERCUSSION BOREHOLE LOG

Date: 02/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL* / DEPTH (Thickness)	Sample Details TYPE	REF	Depth	Test Results SPT N Value/Drive mm	Backfill Details
			10.20	*74.48* 10.20	D	8	10.20		
Recovered as structureless chalk composed of cream with rare orange veins slightly gravelly slightly sandy silt. Gravel is angular fine to coarse extremely weak low density cream. Rare subrounded rinded flint cobbles.Grade Dm.(LEWES NODULAR/ SEAFORD CHALK FORMATION)					D	9	10.50 - 10.95 10.50 - 10.95	SPT N=24 1,2/2,4,8,10	
					D	10	12.00 - 12.45 12.00 - 12.45	SPT N=15 1,2/4,5,3,3	
					U	1	13.50 - 13.95	U=100/225mm	
					D	11	13.95 - 14.05		
				(9.80)	D	12	15.00 - 15.45 15.00 - 15.45	SPT N=12 1,1/2,2,3,5	
					U	2	16.50 - 16.95	U=100/180mm	
					D	13	16.95 - 17.05		
					D	14	18.00 - 18.45 18.00 - 18.45	SPT N=20 5,2/5,5,4,6	
					B D	4 15	19.50 - 19.95 19.50 - 19.95	SPT N=34 4,6/7,8,9,10	
				64.68 20.00					

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 20.00m bgl.

CHISELLING			WATER LEVEL OBSERVATIONS				
Depth From	Depth To	Time Taken		Date	Time	Water Strike	Standing Level	Casing Depth
NO CHISELLING UNDERTAKEN:				NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 20.00m	150mm to 10.20m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum | Page 2 of 3

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524109.81 N: 212731.43 Level: 84.68	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH405**

CABLE PERCUSSION BOREHOLE LOG

Date: 02/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL/* DEPTH (Thickness)	Sample Details			Test Results	Backfill Details
					TYPE	REF	Depth	SPT N Value/Drive mm	
Borehole complete at 20.00m bgl.									

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 20.00m bgl.

CHISELLING

Depth From	Depth To	Time Taken
NO CHISELLING UNDERTAKEN:		

WATER LEVEL OBSERVATIONS

Date	Time	Water Strike	Standing Level	Casing Depth
NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 20.00m	150mm to 10.20m	

All measurements in metres unless otherwise stated

10m/page Scale: 1:62.50

Coordinates to National Grid
Ground Level to Ordnance Datum

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524109.81 N: 212731.43 Level: 84.68	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH406**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 03/10/2014 - 06/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL* / DEPTH (Thickness)	Sample Details TYPE	REF	Depth	Test Results SPT N Value/Drive mm	Backfill Details
MADE GROUND: Concrete.				*84.77* 0.20					
MADE GROUND: Stiff orangey brown sandy gravelly clay. Gravel is angular to rounded fine to coarse of flint and rare brick (no evidence of brick from 1.90 m bgl) Sand is fine to coarse. Assumed to be reworked to 1.90 m bgl. (LOWESTOFT FORMATION)					D	1	0.50		
					D	2	1.00		
					D	3	1.50 - 1.95 1.50 - 1.95	CPT N=33 5,6/7,7,9,10	
					B	1	2.50 - 2.95 2.50 - 2.95	CPT N=26 2,3/5,6,7,8	
				(5.10)					
					D	4	3.50 - 3.95 3.50 - 3.95	CPT N=20 3,4/4,5,5,6	
					D	5	4.50 - 4.95 4.50 - 4.95	CPT N=13 1,2/2,3,4,4	
			(150mm)	*79.67* 5.30	D	6	5.30		
Stiff orangey brown slightly sandy slightly gravelly CLAY. Gravel is subangular to rounded fine to coarse flint. Sand is fine to coarse.(LOWESTOFT FORMATION)					D	7	6.00 - 6.45 6.00 - 6.45	SPT N=33 2,4/5,6,10,12	
				(3.30)					
					U	1	7.50 - 7.95	U=100/405mm	
					D	8	7.95 - 8.05		
				76.37 8.60					
Very dense to medium orangey brown sandy angular to rounded fine to coarse flint GRAVEL. Sand is fine to coarse. Rare flint cobbles.(KESGRAVE CATCHMENT SUBGROUP)					B	2	9.00 - 9.45 9.00 - 9.45	CPT N=50/265mm (3,5/6,14,17,13/40mm)	
				(2.10)					

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 25.00m bgl.

CHISELLING

Depth From	Depth To	Time Taken
NO CHISELLING UNDERTAKEN:		

WATER LEVEL OBSERVATIONS

Date	Time	Water Strike	Standing Level	Casing Depth
NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 25.00m	150mm to 10.70m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum | Page 1 of 3

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524122.39 N: 212763.62 Level: 84.97	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH406**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 03/10/2014 - 06/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL/* DEPTH (Thickness)	Sample Details TYPE	REF	Depth	Test Results SPT N Value/Drive mm	Backfill Details
					D	9	10.50 - 10.95 10.50 - 10.95	CPT N=27 4,6/8,6,6,7	
			10.70	*74.27* 10.70					
Recovered as structureless CHALK composed of cream with rare orange veins slightly gravelly silt. Gravel is angular fine to medium extremely weak low density cream. Bands of very thinly to thinly bedded fine to coarse sand. Grade Dm.(LEWES NODULAR/ SEAFORD CHALK FORMATION)				(1.20)					
				73.07 11.90	D	10	12.00 - 12.45 12.00 - 12.45	SPT N=10 8,6/4,2,2,2	
Recovered as structureless CHALK composed of cream with rare orange veins slightly gravelly silt. Gravel is subangular fine to medium extremely weak low density cream. Rare subangular to subrounded coarse rinded flint gravel and rinded flint cobbles. Slightly grey from 21.0 m bgl.Grade Dm.(LEWES NODULAR/ SEAFORD CHALK FORMATION)					D	11	13.50 - 13.95 13.50 - 13.95	SPT N=10 3,3/2,2,3,3	
					D	12	15.00 - 15.45 15.00 - 15.45	SPT N=14 2,3/4,5,3,2	
					D	13	16.50 - 16.95 16.50 - 16.95	SPT N=12 2,5/2,3,3,4	
					D	14	18.00 - 18.45 18.00 - 18.45	SPT N=26 3,4/7,7,6,6	
				(13.10)					
					D	15	19.50 - 19.95 19.50 - 19.95	SPT N=26 2,3/5,6,7,8	
					B	3	20.00 - 20.50		

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 25.00m bgl.

CHISELLING			WATER LEVEL OBSERVATIONS				
Depth From	Depth To	Time Taken		Date	Time	Water Strike	Standing Level	Casing Depth
NO CHISELLING UNDERTAKEN:				NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 25.00m	150mm to 10.70m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum |

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524122.39 N: 212763.62 Level: 84.97	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH406**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 03/10/2014 - 06/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL* / DEPTH (Thickness)	Sample Details TYPE	Sample Details REF	Sample Details Depth	Test Results SPT N Value/Drive mm	Backfill Details
Recovered as structureless CHALK composed of cream with rare orange veins slightly gravelly silt. Gravel is subangular fine to medium extremely weak low density cream. Rare subangular to subrounded coarse rinded flint gravel and rinded flint cobbles. Slightly grey from 21.0 m bgl.Grade Dm.(LEWES NODULAR/ SEAFORD CHALK FORMATION)*(BH Continued)*					D	16	21.00 - 21.45 21.00 - 21.45	SPT N=32 6,8/7,8,7,10	
					D	17	22.50 - 22.95 22.50 - 22.95	SPT N=50/235mm (6,7/8,12,20,10/10mm)	
					D	18	24.00 - 24.45 24.00 - 24.45	SPT N=50/180mm (6,8/12,22,16/30mm)	
				59.97 25.00					
Borehole complete at 25.00m bgl.									

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 25.00m bgl.

CHISELLING

Depth From	Depth To	Time Taken
NO CHISELLING UNDERTAKEN:		

WATER LEVEL OBSERVATIONS

Date	Time	Water Strike	Standing Level	Casing Depth
NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 25.00m	150mm to 10.70m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum |

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524122.39 N: 212763.62 Level: 84.97	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH407**

CABLE PERCUSSION BOREHOLE LOG

Date: 01/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL/* DEPTH (Thickness)	Sample Details TYPE	REF	Depth	Test Results SPT N Value/Drive mm	Backfill Details
MADE GROUND: Brown sandy gravelly clay. Gravel is angular to subrounded fine to coarse flint. Sand is fine to coarse.				(2.10)	D	1	0.50		
					D	2	1.00		
					D	3	1.50 - 1.95 1.50 - 1.95	CPT N=50/255mm (2,7/9,14,18,9/30mm)	
				82.23 2.10					
MADE GROUND: Brown sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies including flint brick and concrete. Sand is fine to coarse. Occasional anthropogenic material including metal and glass.				(0.90)	D	4	2.50 - 2.95 2.50 - 2.95	CPT N=50/265mm (7,9/10,13,14,13/40mm)	
				81.33 3.00					
MADE GROUND: Firm sandy gravelly clay. Gravel is subangular to subrounded fine to coarse flint. Sand is fine to coarse.(POSSIBLY REWORKED LOWESTOFT FORMATION)				(1.20)	D	5	3.50 - 3.95 3.50 - 3.95	CPT N=15 3,5/6,4,3,2	
				80.13 4.20	D	6	4.20		
Firm brown sandy gravelly CLAY. Gravel is subangular to rounded fine to coarse flint. Sand is fine to coarse. Sand and gravel become slight at 6.45 m bgl.(LOWESTOFT FORMATION)			(150mm)		D	7	4.50 - 4.95 4.50 - 4.95	CPT N=12 1,2/2,3,3,4	
				(3.20)	U	1	6.00 - 6.45	U=32/405mm	
					D	8	6.45 - 6.55		
				76.93 7.40	D	9	7.50 - 7.95 7.50 - 7.95	CPT N=31 3,4/6,7,9,9	
Soft orange brown sandy gravelly CLAY. Gravel is subangular to subrounded fine to coarse flint. Sand is fine to coarse.(LOWESTOFT FORMATION)				(1.00)					
				75.93 8.40					
Loose to medium dense orange brown gravelly SAND. Gravel is subrounded to rounded fine to coarse flint. Sand is fine to coarse. (KESGRAVE CATCHMENT SUBGROUP)					D	10	9.00 - 9.45 9.00 - 9.45	CPT N=10 1,1/2,2,3,3	

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 20.00m bgl.

CHISELLING

Depth From	Depth To	Time Taken
NO CHISELLING UNDERTAKEN:		

WATER LEVEL OBSERVATIONS

Date	Time	Water Strike	Standing Level	Casing Depth
NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 20.00m	150mm to 13.80m	

All measurements in metres unless otherwise stated

10m/page Scale: 1:62.50

Coordinates to National Grid
Ground Level to Ordnance Datum

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524086.6 N: 212766.25 Level: 84.33	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH407**

CABLE PERCUSSION BOREHOLE LOG

Date: 01/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL/* DEPTH (Thickness)	Sample Details TYPE	REF	Depth	Test Results SPT N Value/Drive mm	Backfill Details
Loose to medium dense orange brown gravelly SAND. Gravel is subrounded to rounded fine to coarse flint. Sand is fine to coarse. (KESGRAVE CATCHMENT SUBGROUP)*(BH Continued)*				(5.40)	D	11	10.50 - 10.95 10.50 - 10.95	CPT N=15 1,2/2,4,4,5	
					D	12	12.00 - 12.45 12.00 - 12.45	CPT N=16 3,4/6,4,3,3	
			13.80	*70.53* 13.80	D	13	13.50 - 13.95 13.50 - 13.95	CPT N=6 3,2/1,3,0,2	
Recovered as structureless CHALK composed of cream with rare orange veins slightly gravelly silt. Gravel is subangular fine to medium extremely weak low density cream. Grade Dm. with approximatelly 50% loose fine to coarse SAND and angular to rounded fine to coarse flint GRAVEL occurring in irregularly sized and spaced pockets. (POSSIBLE DISSOLUTION FEATURE)				(3.30)	D	14	16.00		
					B U	1 2	16.50 - 16.95	U=100/0mm	
				67.23 17.10	D	15	17.00 - 17.45 17.00 - 17.45	CPT N=13 2,2/4,3,3,3	
Recovered as structureless CHALK of cream with rare orange veins composed of slightly sandy gravelly silt. Gravel is angular fine to coarse extremely weak low density cream.Sand is fine to coarse cream. Rare rinded flint cobble.Grade Dc.(LEWES NODULAR/ SEAFORD CHALK FORMATION				(2.90)	U	3	18.00 - 18.45	U=51/405mm	
					D	16	18.45 - 18.55		
					D	17	19.50 - 19.95 19.50 - 19.95	SPT N=20 3,4/4,5,5,6	
				64.33 20.00					

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 20.00m bgl.

CHISELLING			WATER LEVEL OBSERVATIONS				
Depth From	Depth To	Time Taken	Date	Time	Water Strike	Standing Level	Casing Depth
NO CHISELLING UNDERTAKEN:			NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 20.00m	150mm to 13.80m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum | Page 2 of 3

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524086.6 N: 212766.25 Level: 84.33	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH407**

CABLE PERCUSSION BOREHOLE LOG

Date: 01/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL/* DEPTH (Thickness)	Sample Details			Test Results	Backfill Details
					TYPE	REF	Depth	SPT N Value/Drive mm	
Borehole complete at 20.00m bgl.									

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 20.00m bgl.

CHISELLING			WATER LEVEL OBSERVATIONS				
Depth From	Depth To	Time Taken	Date	Time	Water Strike	Standing Level	Casing Depth
NO CHISELLING UNDERTAKEN:			NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 20.00m	150mm to 13.80m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum | Page 3 of 3

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524086.6 N: 212766.25 Level: 84.33	WC	WC	SS

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deltasimons

Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH408**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 15/10/2014 - 16/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL* / DEPTH (Thickness)	Sample Details TYPE	REF	Depth	Test Results SPT N Value/Drive mm	Backfill Details
MADE GROUND: Concrete.				*85.23* 0.40	D	1	0.50		
MADE GROUND: Brown slightly sandy slightly gravelly clay. Gravel is subangular to subrounded fine to coarse flint and brick. Sand is fine to coarse.				(0.60) *84.63* 1.00	D	2	1.00		
Stiff orange brown slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. Sand is fine to coarse.(LOWESTOFT FORMATION)					D	3	1.50 - 2.00 1.50 - 1.95	CPT N=15 2,3/4,4,3,4	
					B U	1	2.50 - 3.00 2.50 - 2.95	U=50/0mm	
				(5.40)	D	4	3.50 - 4.00 3.50 - 3.95	CPT N=13 2,3/2,3,4,4	
					U	2	4.50 - 4.95	U=40/383mm	
					D	5	5.00		
					D	6	6.00 - 6.50 6.00 - 6.45	SPT N=25 2,3/4,6,6,9	
				79.23 6.40	B	2	6.40		
Loose to medium dense orange brown sandy angular to subrounded fine to coarse flint GRAVEL. Sand is medium to coarse. Occasional flint cobbles.(KESGRAVE CATCHMENT SUBGROUP)			(150mm)		D	7	7.50 - 8.00 7.50 - 7.95	CPT N=8 2,2/2,2,2,2	
					D	8	9.00 - 9.50 9.00 - 9.45	CPT N=17 2,3/4,4,4,5	

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 20.00m bgl.
5. Coordinates estimated due to no GPS signal.

CHISELLING			WATER LEVEL OBSERVATIONS				
Depth From	Depth To	Time Taken	Date	Time	Water Strike	Standing Level	Casing Depth
NO CHISELLING UNDERTAKEN:			NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 20.00m	150mm to 14.90m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum |

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524161 N: 212906 Level: 85.63	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH408**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 15/10/2014 - 16/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL/* DEPTH (Thickness)	Sample Details TYPE	REF	Depth	Test Results SPT N Value/Drive mm	Backfill Details
Loose to medium dense orange brown sandy angular to subrounded fine to coarse flint GRAVEL. Sand is medium to coarse. Occasional flint cobbles.(KESGRAVE CATCHMENT SUBGROUP)*(BH Continued)*				(8.50)	D	9	10.50 - 11.00 10.50 - 10.95	CPT N=20 3,4/4,5,5,6	
					D	10	12.00 - 12.50 12.00 - 12.45	CPT N=23 4,4/5,5,6,7	
					D	11	13.50 - 14.00 13.50 - 13.95	CPT N=17 3,4/4,5,4,4	
			14.90	*70.73* 14.90	B	3	14.90		
Recovered as structureless CHALK composed of cream with rare orange veins sandy gravelly silt. Gravel is angular to subangular fine to medium extremely weak low density cream. Sand is fine to coarse. Rare subrounded coarse gravels and cobbles of rinded flint throughout.Grade Dm. (LEWES NODULAR/SEAFORD CHALK FORMATION)					D	12	15.00 - 15.45 15.00 - 15.45	CPT N=3 1,0/1,0,2,0	
					D	13	16.50 - 17.00 16.50 - 16.95	SPT N=7 1,1/1,2,2,2	
				(5.10)					
					D	14	18.00 - 18.50 18.00 - 18.45	SPT N=10 1,1/2,2,3,3	
					D	15	19.50 - 20.00 19.50 - 19.95	SPT N=8 2,3/2,2,2,2	
				65.63 20.00					

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 20.00m bgl.
5. Coordinates estimated due to no GPS signal.

CHISELLING

Depth From	Depth To	Time Taken
NO CHISELLING UNDERTAKEN:		

WATER LEVEL OBSERVATIONS

Date	Time	Water Strike	Standing Level	Casing Depth
NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 20.00m	150mm to 14.90m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum |

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524161 N: 212906 Level: 85.63	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH408**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 15/10/2014 - 16/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL/* DEPTH (Thickness)	Sample Details			Test Results	Backfill Details
					TYPE	REF	Depth	SPT N Value/Drive mm	
Borehole complete at 20.00m bgl.									

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 20.00m bgl.
5. Coordinates estimated due to no GPS signal.

CHISELLING			WATER LEVEL OBSERVATIONS				
Depth From	Depth To	Time Taken	Date	Time	Water Strike	Standing Level	Casing Depth
NO CHISELLING UNDERTAKEN:			NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 20.00m	150mm to 14.90m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum | Page 3 of 3

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524161 N: 212906 Level: 85.63	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH409**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 10/10/2014 - 13/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL* / DEPTH (Thickness)	Sample Details TYPE	REF	Depth	Test Results SPT N Value/Drive mm	Backfill Details
MADE GROUND: Concrete.				*82.83* 0.30					
Stiff orangey brown slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. Sand is fine to coarse. Possibly reworked to 1.5 m bgl. (LOWESTOFT FORMATION)					D	1	0.50		
					D	2	1.00		
					D	3	1.50 - 1.95 1.50 - 1.95	SPT N=5 1,0/1,0,2,2	
				(2.90)					
					U	1	2.50 - 2.95	U=50/383mm	
					D	4	3.00		
				79.93 3.20	B	1	3.20		
Vey to medium dense orange brown gravelly fine to coarse SAND. Gravel is subangular to rounded fine to coarse flint. (KESGRAVE CATCHMENT SUBGROUP)					D	5	3.50 - 4.00 3.50 - 3.95	CPT N=12 1,2/2,3,3,4	
			(150mm)						
					D	6	4.50 - 5.00 4.50 - 4.95	CPT N=50/155mm (7,13/17,23,10/5mm)	
				(5.20)					
					D	7	6.00 - 6.50 6.00 - 6.45	CPT N=32 4,6/7,7,9,9	
					D	8	7.50 - 8.00 7.50 - 7.95	CPT N=36 5,7/8,8,10,10	
			8.40	*74.73* 8.40	B	2	8.40		
Recovered as structureless CHALK composed of cream with rare orange veins slightly gravelly silt. Gravel is angular to subangular fine to medium extremely to very weak low to medium density cream. Rare subrounded coarse rinded flint gravel throughout grade Dm. (LEWES NODULAR/SEAFORD CHALK FORMATION)					D	9	9.00 - 9.50 9.00 - 9.45	SPT N=5 2,3/2,1,1,1	

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 20.00m bgl.
5. Coordinates estimated due to no GPS signal.

CHISELLING

Depth From	Depth To	Time Taken
NO CHISELLING UNDERTAKEN:		

WATER LEVEL OBSERVATIONS

Date	Time	Water Strike	Standing Level	Casing Depth
NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 20.00m	150mm to 8.40m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum |

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524255 N: 212891 Level: 83.13	WC	WC	SS

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deltasimons

Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH409**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 10/10/2014 - 13/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL/* DEPTH (Thickness)	Sample Details TYPE	REF	Depth	Test Results SPT N Value/Drive mm	Backfill Details
Recovered as structureless CHALK composed of cream with rare orange veins slightly gravelly silt. Gravel is angular to subangular fine to medium extremely to very weak low to medium density cream. Rare subrounded coarse rinded flint gravel throughout grade Dm. (LEWES NODULAR/SEAFORD CHALK FORMATION)*(BH Continued)*				(11.60)	D	10	10.50 - 11.00 10.50 - 10.95	SPT N=8 2,2/3,3,1,1	
					D	11	12.00 - 12.50 12.00 - 12.45	SPT N=13 2,3/4,3,3,3	
					D	12	13.50 - 14.00 13.50 - 13.95	SPT N=15 2,3/4,4,4,3	
					D	13	15.00 - 15.50 15.00 - 15.45	SPT N=16 3,3/4,4,4,4	
					D	14	16.50 - 17.00 16.50 - 16.95	SPT N=19 3,4/4,5,5,5	
					D	15	18.00 - 18.50 18.00 - 18.45	SPT N=15 3,4/4,3,4,4	
				63.13 20.00	D	16	19.50 - 20.00 19.50 - 19.95	SPT N=19 3,4/5,5,5,4	

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 20.00m bgl.
5. Coordinates estimated due to no GPS signal.

CHISELLING

Depth From	Depth To	Time Taken
NO CHISELLING UNDERTAKEN:		

WATER LEVEL OBSERVATIONS

Date	Time	Water Strike	Standing Level	Casing Depth
NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 20.00m	150mm to 8.40m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum |

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524255 N: 212891 Level: 83.13	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH409**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 10/10/2014 - 13/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL/* DEPTH (Thickness)	Sample Details			Test Results	Backfill Details
					TYPE	REF	Depth	SPT N Value/Drive mm	
Borehole complete at 20.00m bgl.									

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 20.00m bgl.
5. Coordinates estimated due to no GPS signal.

CHISELLING

Depth From	Depth To	Time Taken
NO CHISELLING UNDERTAKEN:		

WATER LEVEL OBSERVATIONS

Date	Time	Water Strike	Standing Level	Casing Depth
NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 20.00m	150mm to 8.40m	

All measurements in metres unless otherwise stated

10m/page Scale: 1:62.50

Coordinates to National Grid
Ground Level to Ordnance Datum

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524255 N: 212891 Level: 83.13	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH410**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 16/10/2014 - 20/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL* / DEPTH (Thickness)	Sample Details TYPE	REF	Depth	Test Results SPT N Value/Drive mm	Backfill Details
MADE GROUND: Asphalt.				*84.79* 0.15					
MADE GROUND: Brown sandy clayey gravel. Gravel is angular to rounded fine to coarse of mixed lithologies including brick, concrete and flint. Sand is fine to coarse. Frequent brick cobbles.				*84.49* 0.45	D	1	0.50		
					D	2	1.00		
Stiff orangey brown sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. Sand is fine to coarse. Rare flint cobbles. (LOWESTOFT FORMATION)					D	3	1.50 - 2.00 1.50 - 1.95	CPT N=15 2,2/3,3,4,5	
					D	4	2.50 - 3.00 2.50 - 2.95	CPT N=20 2,3/4,5,5,6	
				(4.65)					
					D	5	3.50 - 4.00 3.50 - 3.95	CPT N=22 3,3/4,4,7,7	
					D	6	4.50 - 5.00 4.50 - 4.95	CPT N=15 4,5/4,3,4,4	
				79.84 5.10	B	1	5.10		
Stiff orangey brown slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. Sand is fine to coarse. (LOWESTOFT FORMATION)				(0.80)					
			(150mm)	*79.04* 5.90	B	2	6.00 - 6.50 6.00 - 6.45	CPT N=19 3,4/4,4,5,6	
Medium dense to dense orangey brown slightly sandy angular to subrounded fine to coarse flint GRAVEL. Sand is fine to coarse. Occasional flint cobbles.(KESGRAVE CATCHMENT SUBGROUP)					D	7	7.50 - 8.00 7.50 - 7.95	CPT N=29 4,5/6,6,7,10	
				(5.80)					
					D	8	9.00 - 9.50 9.00 - 9.45	CPT N=31 4,6/7,7,8,9	

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Groundwater encountered at 22.35m bgl.
4. Installed with HDPE standpipe to 25.00m bgl.

CHISELLING

Depth From	Depth To	Time Taken
NO CHISELLING UNDERTAKEN:		

WATER LEVEL OBSERVATIONS

	Date	Time	Water Strike	Standing Level	Casing Depth
1	20-10-14		22.35		

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 25.00m	150mm to 11.70m	

All measurements in metres unless otherwise stated

10m/page Scale: 1:62.50

Coordinates to National Grid
Ground Level to Ordnance Datum

Plant Used: Dando 2000

Coordinates / Level (mAOD): E: 524279.09 N: 212972.11 Level: 84.94

Logged By: WC

Checked By: WC

Approved By: SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH410**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 16/10/2014 - 20/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL* / DEPTH (Thickness)	Sample Details TYPE	REF	Depth	Test Results SPT N Value/Drive mm	Backfill Details
Medium dense to dense orangey brown slightly sandy angular to subrounded fine to coarse flint GRAVEL. Sand is fine to coarse. Occasional flint cobbles.(KESGRAVE CATCHMENT SUBGROUP)*(BH Continued)*					D	9	10.50 - 11.00 10.50 - 10.95	CPT N=31 4,6/7,7,8,9	
			11.70	*73.24* 11.70	B	3	11.70		
Recovered as structureless CHALK composed of cream with rare orange veins slightly gravelly silt. Gravel is angular to subangular fine to medium extremely weak low density cream. Rare subrounded coarse gravels and cobbles of rinded flint throughout grade Dm. (LEWES NODULAR/SEAFORD CHALK FORMATION)					D	10	12.00 - 12.50 12.00 - 12.45	SPT N=2 1,1/0,1,1,0	
					D	11	13.50 - 14.00 13.50 - 13.95	SPT N=5 1,1/2,1,1,1	
					D	12	15.00 - 15.50 15.00 - 15.45	SPT N=7 1,2/2,1,2,2	
					D	13	16.50 - 17.00 16.50 - 16.95	SPT N=8 2,2/2,2,2,2	
					D	14	18.00 - 18.50 18.00 - 18.45	SPT N=13 2,2/3,3,3,4	
				(13.30)					
					D	15	19.50 - 20.00 19.50 - 19.95	SPT N=16 3,4/3,3,4,6	

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Groundwater encountered at 22.35m bgl.
4. Installed with HDPE standpipe to 25.00m bgl.

CHISELLING

Depth From	Depth To	Time Taken
NO CHISELLING UNDERTAKEN:		

WATER LEVEL OBSERVATIONS

	Date	Time	Water Strike	Standing Level	Casing Depth
1	20-10-14		22.35		

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 25.00m	150mm to 11.70m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum |

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524279.09 N: 212972.11 Level: 84.94	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH410**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 16/10/2014 - 20/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL* / DEPTH (Thickness)	Sample Details: TYPE	Sample Details: REF	Sample Details: Depth	Test Results: SPT N Value/Drive mm	Backfill Details
Recovered as structureless CHALK composed of cream with rare orange veins slightly gravelly silt. Gravel is angular to subangular fine to medium extremely weak low density cream. Rare subrounded coarse gravels and cobbles of rinded flint throughout grade Dm. (LEWES NODULAR/SEAFORD CHALK FORMATION)*(BH Continued)*					D	16	21.00 - 21.50 21.00 - 21.45	SPT N=26 4,4/6,6,6,8	
					D	17	22.50 - 23.00 22.50 - 22.95	SPT N=25 3,4/5,6,7,7	
					D	18	24.00 - 24.50 24.00 - 24.45	SPT N=34 1,0/6,7,14,7	
				59.94 25.00					
Borehole complete at 25.00m bgl.									

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Groundwater encountered at 22.35m bgl.
4. Installed with HDPE standpipe to 25.00m bgl.

CHISELLING			WATER LEVEL OBSERVATIONS				
Depth From	Depth To	Time Taken		Date	Time	Water Strike	Standing Level	Casing Depth
NO CHISELLING UNDERTAKEN:			1	20-10-14		22.35		

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 25.00m	150mm to 11.70m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum | Page 3 of 3

Plant Used: Dando 2000

Coordinates / Level (mAOD): E: 524279.09 N: 212972.11 Level: 84.94

Logged By: WC

Checked By: WC

Approved By: SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH411**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 21/10/2014 - 22/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL* / DEPTH (Thickness)	Sample Details TYPE	REF	Depth	Test Results SPT N Value/Drive mm	Backfill Details
MADE GROUND: Asphalt.				*83.77* 0.15					
MADE GROUND: Brown slightly sandy gravelly clay. Gravel is angular to subrounded fine to coarse brick and flint. Sand is fine to coarse. Rare brick cobbles.				(1.05)	D	1	0.50		
					D	2	1.00		
				82.72 1.20					
Stiff brown slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. Sand is fine to coarse. (LOWESTOFT FORMATION)					D	3	1.50 - 2.00 1.50 - 1.95	CPT N=8 2,1/2,2,2,2	
					D	4	2.50 - 3.00 2.50 - 2.95	CPT N=8 2,2/2,2,2,2	
					B U	1	3.50 - 4.00 3.50 - 3.95	U=35/0mm	
					D	5	4.50 - 5.00 4.50 - 4.95	SPT N=7 1,1/2,1,2,2	
				(8.10)					
			(150mm)		D	6	6.00 - 6.50 6.00 - 6.45	SPT N=7 1,0/1,2,2,2	
					D	7	7.50 - 8.00 7.50 - 7.95	SPT N=8 2,2/2,2,2,2	
					D	8	9.00 - 9.50 9.00 - 9.45	SPT N=20 1,2/2,4,7,7	
				74.62 9.30	B	2	9.30		
Very demse brown slightly clayey sandy angular to subrounded fine to coarse flint GRAVEL. Sand is fine to coarse. (KESGRAVE CATCHMENT SUBGROUP)									

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 20.00m bgl.

CHISELLING

Depth From	Depth To	Time Taken
NO CHISELLING UNDERTAKEN:		

WATER LEVEL OBSERVATIONS

Date	Time	Water Strike	Standing Level	Casing Depth
NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 20.00m	150mm to 11.50m	

All measurements in metres unless otherwise stated

10m/page Scale: 1:62.50

Coordinates to National Grid
Ground Level to Ordnance Datum

Plant Used: Dando 2000

Coordinates / Level (mAOD): E: 524170.02 N: 213045.29 Level: 83.92

Logged By: WC

Checked By: WC

Approved By: SS

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deltasimons

Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH411**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 21/10/2014 - 22/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL/* DEPTH (Thickness)	Sample Details TYPE	REF	Depth	Test Results SPT N Value/Drive mm	Backfill Details
Very demse brown slightly clayey sandy angular to subrounded fine to coarse flint GRAVEL. Sand is fine to coarse. (KESGRAVE CATCHMENT SUBGROUP)*(BH Continued)*				(2.20)	D	9	10.50 - 11.00 10.50 - 10.95	CPT N=54/165mm (7,12/14,18,22/15mm)	
			11.50	*72.42* 11.50	B	3	11.50		
Recovered as structureless CHALK composed of cream with rare orange veins sandy very gravelly silt. Gravel is angular to subangular fine to medium extremely to very weak low to medium density cream. Sand is fine to coarse. Rare subrounded coarse gravels and cobbles of rinded flint throughout. Grade Dm. (LEWES NODULAR/ SEAFORD CHALK FORMATION)					D	10	12.00 - 12.50 12.00 - 12.45	SPT N=1 1,0/0,1,0,0	
					D	11	13.50 - 14.00 13.50 - 13.95	SPT N=4 1,0/1,1,1,1	
					D	12	15.00 - 15.50 15.00 - 15.45	SPT N=7 1,1/1,2,2,2	
				(8.50)					
					D	13	16.50 - 17.00 16.50 - 16.95	SPT N=5 2,1/2,2,1,0	
					D	14	18.00 - 18.50 18.00 - 18.45	SPT N=9 2,2/2,2,2,3	
					D	15	19.50 - 20.00 19.50 - 19.95	SPT N=11 2,2/2,3,3,3	
				63.92 20.00					

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 20.00m bgl.

CHISELLING			WATER LEVEL OBSERVATIONS				
Depth From	Depth To	Time Taken	Date	Time	Water Strike	Standing Level	Casing Depth
NO CHISELLING UNDERTAKEN:			NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 20.00m	150mm to 11.50m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum |

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524170.02 N: 213045.29 Level: 83.92	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH411**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 21/10/2014 - 22/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL/* DEPTH (Thickness)	Sample Details			Test Results	Backfill Details
					TYPE	REF	Depth	SPT N Value/Drive mm	
Borehole complete at 20.00m bgl.									

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 20.00m bgl.

CHISELLING

Depth From	Depth To	Time Taken
NO CHISELLING UNDERTAKEN:		

WATER LEVEL OBSERVATIONS

Date	Time	Water Strike	Standing Level	Casing Depth
NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 20.00m	150mm to 11.50m	

All measurements in metres unless otherwise stated

10m/page Scale: 1:62.50

Coordinates to National Grid
Ground Level to Ordnance Datum

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524170.02 N: 213045.29 Level: 83.92	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH412**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 17/10/2014 - 20/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL* / DEPTH (Thickness)	Sample Details TYPE	REF	Depth	Test Results SPT N Value/Drive mm	Backfill Details
MADE GROUND: Asphalt.				*84.75* 0.10					
MADE GROUND: Reddy brown clayey sandy gravel. Gravel is angular to subangular fine to coarse brick. Sand is fine to coarse. Frequent brick cobbles.				*84.45* 0.40	D	1	0.50		
					D	2	1.00		
Stiff orangey brown slightly gravelly sandy CLAY. Gravel is angular to subrounded fine to coarse flint. Sand is fine to coarse. (LOWESTOFT FORMATION)				(1.90)	D	3	1.50 - 1.95 1.50 - 1.95	SPT N=13 1,1/2,3,4,4	
				82.55 2.30					
Dense brown clayey gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse flint. (LOWESTOFT FORMATION)				(1.10)	B	1	2.50 - 2.95 2.50 - 2.95	CPT N=33 3,5/7,8,9,9	
				81.45 3.40	U	1	3.50 - 3.95	U=41/338mm	
Stiff orangey brown slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. Sand is fine to coarse. (LOWESTOFT FORMATION)			(150mm)	(1.30)	D	4	3.95 - 4.05		
				80.15 4.70	D	5	4.50 - 4.95 4.50 - 4.95	SPT N=48 4,5/8,10,14,16	
Very dense to dense orange brown gravelly fine to medium SAND. Gravel is angular to subrounded fine to coarse flint. (KESGRAVE CATCHMENT SUBGROUP)				(3.90)	B	2	6.00 - 6.45 6.00 - 6.45	CPT N=49 7,8/11,12,12,14	
					D	6	7.50 - 7.95 7.50 - 7.95	CPT N=50/85mm (11,14/30mm/41,9/10mm)	
			8.60	*76.25* 8.60					
Recovered as structureless CHALK composed of cream with rare orange veins slightly gravelly silt. Gravel is angular to subangular fine to medium extremely weak low density cream. Rare subrounded coarse gravels and cobbles of rinded flint throughout. Grade Dm. (LEWES NODULAR/ SEAFORD CHALK FORMATION)					D	7	9.00 - 9.45 9.00 - 9.45	SPT N=32 4,5/6,7,9,10	

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 20.00m bgl.

CHISELLING

Depth From	Depth To	Time Taken
NO CHISELLING UNDERTAKEN:		

WATER LEVEL OBSERVATIONS

Date	Time	Water Strike	Standing Level	Casing Depth
NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 20.00m	150mm to 8.60m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum |

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524118.88 N: 212945.31 Level: 84.85	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH412**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 17/10/2014 - 20/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL/* DEPTH (Thickness)	Sample Details TYPE	REF	Depth	Test Results SPT N Value/Drive mm	Backfill Details
Recovered as structureless CHALK composed of cream with rare orange veins slightly gravelly silt. Gravel is angular to subangular fine to medium extremely weak low density cream. Rare subrounded coarse gravels and cobbles of rinded flint throughout. Grade Dm. (LEWES NODULAR/ SEAFORD CHALK FORMATION)*(BH Continued)*					D	8	10.50 - 10.95 10.50 - 10.95	SPT N=34 4,5/7,7,9,11	
					D	9	12.00 - 12.45 12.00 - 12.45	SPT N=21 2,3/5,6,4,6	
					D	10	14.00		
				(11.40)					
					D	11	15.00 - 15.45 15.00 - 15.45	SPT N=27 3,2/3,6,10,8	
					D	12	16.50 - 16.95 16.50 - 16.95	SPT N=13 3,3/2,3,4,4	
					D	13	18.00 - 18.45 18.00 - 18.45	SPT N=50/235mm (4,7/13,15,17,5/10mm)	
					D	14	19.50 - 19.95 19.50 - 19.95	SPT N=41 3,6/9,10,10,12	
				64.85 20.00					

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 20.00m bgl.

CHISELLING			WATER LEVEL OBSERVATIONS				
Depth From	Depth To	Time Taken	Date	Time	Water Strike	Standing Level	Casing Depth
NO CHISELLING UNDERTAKEN:			NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 20.00m	150mm to 8.60m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum |

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524118.88 N: 212945.31 Level: 84.85	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH412**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 17/10/2014 - 20/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL/* DEPTH (Thickness)	Sample Details			Test Results	Backfill Details
					TYPE	REF	Depth	SPT N Value/Drive mm	
Borehole complete at 20.00m bgl.									

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 20.00m bgl.

CHISELLING			WATER LEVEL OBSERVATIONS				
Depth From	Depth To	Time Taken	Date	Time	Water Strike	Standing Level	Casing Depth
NO CHISELLING UNDERTAKEN:			NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 20.00m	150mm to 8.60m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum | Page 3 of 3

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524118.88 N: 212945.31 Level: 84.85	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH413**

CABLE PERCUSSION BOREHOLE LOG

Date: 16/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL* / DEPTH (Thickness)	Sample Details TYPE	REF	Depth	Test Results SPT N Value/Drive mm	Backfill Details
MADE GROUND: Asphalt.				*83.78* 0.10					
MADE GROUND: Brown clayey slightly sandy gravel. Gravel is angular to rounded fine to coarse of mixed lithologies including brick, flint and concrete. Sand is fine to coarse. Frequent brick cobbles.				*83.48* 0.40	D	1	0.50		
					D	2	1.00		
Stiff orangey brown slightly sandy CLAY. Sand is fine to medium. Medium to coarse sand sized organic patches throughout. (LOWESTOFT FORMATION)					U	1	1.50 - 1.95	U=36/360mm	
					D	3	1.95 - 2.05		
					D	4	2.50 - 2.95 2.50 - 2.95	SPT N=4 1,0/1,1,1,1	
					B	1	3.00 - 3.40		
				(5.50)					
					U	2	3.50 - 3.95	U=52/360mm	
					D	5	3.95 - 4.05		
					D	6	4.50 - 4.95 4.50 - 4.95	SPT N=12 1,1/2,3,3,4	
				77.98 5.90					
Stiff light brown mottled orange and black slightly sandy CLAY. Sand is fine to medium. Potentially high organic content. (LOWESTOFT FORMATION)					U	3	6.00 - 6.45	U=61/360mm	
				(1.30)	D	7	6.45 - 6.55		
				76.68 7.20					
Stiff brown mottled black slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse flint. Sand is fine to coarse. Potentially high organic content. (LOWESTOFT FORMATION)			(150mm)		B	2	7.50 - 7.95 7.50 - 7.95	CPT N=40 4,6/8,9,10,13	
				(1.60)					
				75.08 8.80					
Dense to very dense brown clayey sandy angular to rounded fine to coarse flint GRAVEL. Sand is fine to coarse. Rare flint cobbles. (KESGRAVE CATCHMENT SUBGROUP)					B	3	9.00 - 9.45 9.00 - 9.45	CPT N=50/295mm (5,7/9,11,14,16/70mm)	

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 20.00m bgl.

CHISELLING			WATER LEVEL OBSERVATIONS				
Depth From	Depth To	Time Taken		Date	Time	Water Strike	Standing Level	Casing Depth
NO CHISELLING UNDERTAKEN:					NO WATER ENCOUNTERED:			

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 20.00m	150mm to 16.60m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum |

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524096.58 N: 212991.55 Level: 83.88	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH413**

CABLE PERCUSSION BOREHOLE LOG

Date: 16/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL/* DEPTH (Thickness)	Sample Details TYPE	REF	Depth	Test Results SPT N Value/Drive mm	Backfill Details
Dense to very dense brown clayey sandy angular to rounded fine to coarse flint GRAVEL. Sand is fine to coarse. Rare flint cobbles. (KESGRAVE CATCHMENT SUBGROUP)*(BH Continued)*				(7.80)	B	4	10.50 - 10.95 10.50 - 10.95	CPT N=50/275mm (4,6/10,10,14,16/50mm)	
					D	8	12.00 - 12.45 12.00 - 12.45	CPT N=40 4,7/8,9,10,13	
					D	9	13.50 - 13.95 13.50 - 13.95	CPT N=41 5,8/8,10,11,12	
					D	10	15.00 - 15.45 15.00 - 15.45	CPT N=42 3,5/9,9,10,14	
			16.60	*67.28* 16.60	B	5	16.50 - 16.95 16.50 - 16.95	CPT N=9 9,8/3,2,2,2	
Recovered as structureless CHALK composed of cream with rare orange veins slightly gravelly silt. Gravel is angular to subangular fine to medium extremely to very weak low to medium density cream. Rare subrounded coarse gravels and cobbles of rinded flint throughout. Grade Dm. (LEWES NODULAR/ SEAFORD CHALK FORMATION)				(3.40)	D	11	18.00 - 18.45 18.00 - 18.45	SPT N=13 2,3/4,3,3,3	
					D	12	19.50 - 19.95 19.50 - 19.95	SPT N=14 2,3/2,3,4,5	
				63.88 20.00					

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 20.00m bgl.

CHISELLING			WATER LEVEL OBSERVATIONS				
Depth From	Depth To	Time Taken	Date	Time	Water Strike	Standing Level	Casing Depth
NO CHISELLING UNDERTAKEN:			NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 20.00m	150mm to 16.60m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum |

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524096.58 N: 212991.55 Level: 83.88	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH413**

CABLE PERCUSSION BOREHOLE LOG

Date: 16/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL/* DEPTH (Thickness)	Sample Details			Test Results	Backfill Details
					TYPE	REF	Depth	SPT N Value/Drive mm	
Borehole complete at 20.00m bgl.									

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 20.00m bgl.

CHISELLING			WATER LEVEL OBSERVATIONS				
Depth From	Depth To	Time Taken	Date	Time	Water Strike	Standing Level	Casing Depth
NO CHISELLING UNDERTAKEN:			NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 20.00m	150mm to 16.60m	

All measurements in metres unless otherwise stated

10m/page Scale: 1:62.50

Coordinates to National Grid
Ground Level to Ordnance Datum

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524096.58 N: 212991.55 Level: 83.88	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH414**

CABLE PERCUSSION BOREHOLE LOG

Date: 14/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL* / DEPTH (Thickness)	Sample Details TYPE	REF	Depth	Test Results SPT N Value/Drive mm
MADE GROUND: Asphalt.				*85.04* 0.15				
MADE GROUND: Brown clayey slightly sandy gravel. Gravel is angular to rounded fine to coarse of mixed lithologies including brick, flint and concrete. Sand is fine to coarse. Frequent brick cobbles.				(0.85)	D	1	0.50	
				84.19 1.00	D	2	1.00	
Stiff orangey brown slightly sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. Sand is fine to coarse. (LOWESTOFT FORMATION)					D	3	1.50 - 2.00 1.50 - 1.95	CPT N=19 2,3/4,4,5,6
				(3.20)	U	1	2.50 - 2.95	U=35/225mm
					D	4	3.50 - 4.00 3.50 - 3.95	SPT N=10 2,3/2,4,2,2
				80.99 4.20	B	1	4.20	
Medium dense orangey brown slightly gravelly fine to medium SAND. Gravel is angular to subrounded fine to medium SAND. Gravel is angular to subrounded fine to coarse flint. (POSSIBLE LOWESTOFT FORMATION)					D	5	4.50 - 5.00 4.50 - 4.95	CPT N=13 2,3/4,3,3,3
				(1.50)				
				79.49 5.70	B	2	5.70	
Stiff orange brown slightly gravelly sandy CLAY. Gravel is angular to subrounded fine to coarse flint. Sand is fine to coarse. (LOWESTOFT FORMATION)					D	6	6.00 - 6.50 6.00 - 6.45	SPT N=25 2,3/4,5,7,9
				(2.20)				
					U	2	7.50 - 7.95	U=45/315mm
				77.29 7.90	B D	3 7	8.00	
Medium dense orange brown gravelly fine to coarse SAND. Gravel is angular to rounded fine to coarse flint. Rare cobble sized clay pockets.(KESGRAVE CATCHMENT SUBGROUP)					D	8	9.00 - 9.50 9.00 - 9.45	CPT N=26 4,5/6,6,7,7
				(3.90)				

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Backfilled with arisings.

CHISELLING			WATER LEVEL OBSERVATIONS				
Depth From	Depth To	Time Taken	Date	Time	Water Strike	Standing Level	Casing Depth
NO CHISELLING UNDERTAKEN:			NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED

All measurements in metres unless otherwise stated

10m/page Scale: 1:62.50

Coordinates to National Grid
Ground Level to Ordnance Datum

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524052.85 N: 212879.17 Level: 85.19	WC	WC	SS

Delta-Simons
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Fax: +44 (0) 1522 698393
Email: info@deltasimons.com

Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH414**

CABLE PERCUSSION BOREHOLE LOG

Date: 14/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL* / DEPTH (Thickness)	Sample Details TYPE	Sample Details REF	Sample Details Depth	Test Results SPT N Value/Drive mm
Medium dense orange brown gravelly fine to coarse SAND. Gravel is angular to rounded fine to coarse flint. Rare cobble sized clay pockets.(KESGRAVE CATCHMENT SUBGROUP)*(BH Continued)*					D	9	10.50 - 11.00 10.50 - 10.95	CPT N=27 5,6/6,7,7,7
				73.39 11.80	B	4	11.80	
Recovered as structureless CHALK composed of cream with rare orange veins slightly gravelly silt. Gravel is angular to subangular fine to medium extremely weak low density cream. Rare subrounded coarse gravels and cobbles of rinded flint throughout.Grade Dm. (LEWES NODULAR/SEAFORD CHALK FORMATION)					D	10	12.00 - 12.50 12.00 - 12.45	SPT N=1 1,0/1,0,0,0
				(1.15)				
				72.24 12.95				
VOID								
				(3.35)				
				68.89 16.30				
Loose orange brown gravelly fine to coarse clayey SAND. Gravel is subangular to subrounded fine to coarse flint. (DISSOLUTION SOILS)					D	11	16.50	
				(1.20)				
				67.69 17.50			17.50 - 17.95	CPT N=2 1,0/0,1,0,1
Borehole terminated due to difficult drilling associated with the void at 17.50m bgl.								

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Backfilled with arisings.

CHISELLING

Depth From	Depth To	Time Taken
NO CHISELLING UNDERTAKEN:		

WATER LEVEL OBSERVATIONS

Date	Time	Water Strike	Standing Level	Casing Depth
NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED

All measurements in metres unless otherwise stated

10m/page Scale: 1:62.50

Coordinates to National Grid
Ground Level to Ordnance Datum

Plant Used: Dando 2000

Coordinates / Level (mAOD): E: 524052.85 N: 212879.17 Level: 85.19

Logged By: WC

Checked By: WC

Approved By: SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH415**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 13/10/2014 - 14/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL* / DEPTH (Thickness)	Sample Details TYPE	REF	Depth	Test Results SPT N Value/Drive mm	Backfill Details
MADE GROUND: Concrete.				*84.72* 0.20					
MADE GROUND: Brown clayey slightly sandy gravel. Gravel is angular to rounded fine to coarse of mixed lithologies including brick, flint and concrete. Sand is fine to coarse. Frequent brick cobbles.				*84.32* 0.60	D	1	0.50		
					D	2	1.00		
Stiff orange brown sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. Sand is fine to coarse.(LOWESTOFT FORMATION)					B	1	1.50 - 1.95 1.50 - 1.95	CPT N=50/170mm (7,11/19,24,7/20mm)	
				(2.80)					
					D	3	2.50 - 2.95 2.50 - 2.95	CPT N=27 4,5/5,6,7,9	
				81.52 3.40	D	4	3.50 - 3.95 3.50 - 3.95	CPT N=23 3,4/4,5,7,7	
Stiff orange brown sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. Sand is fine to coarse. Hydrocarbon odour throughout. (LOWESTOFT FORMATION)				(1.20)					
				80.32 4.60	B	2	4.50 - 4.95 4.50 - 4.95	CPT N=24 3,4/5,6,6,7	
Stiff orangey brown slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. Sand is fine to medium. (LOWESTOFT FORMATION)				(1.30)					
			(150mm)	*79.02* 5.90	B	3	6.00 - 6.45 6.00 - 6.45	CPT N=43 4,6/7,10,12,14	
Dense orange brown gravelly fine to coarse SAND. Gravel is angular to rounded fine to coarse flint. Rare flint cobbles. (KESGRAVE CATCHMENT SUBGROUP)					D	5	7.50 - 7.95 7.50 - 7.95	CPT N=42 3,5/9,9,11,13	
				(5.60)					
					D	6	9.00 - 9.45 9.00 - 9.45	CPT N=37 3,5/7,8,10,12	

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Groundwater encountered at 27.00m bgl.
4. Installed with HDPE standpipe to 30.00m bgl.

CHISELLING			WATER LEVEL OBSERVATIONS				
Depth From	Depth To	Time Taken		Date	Time	Water Strike	Standing Level	Casing Depth
NO CHISELLING UNDERTAKEN:			1	14-10-14		27.00	25.00	

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 30.00m	150mm to 11.50m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum | Page 1 of 4

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524101.97 N: 212899.63 Level: 84.92	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH415**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 13/10/2014 - 14/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL/* DEPTH (Thickness)	Sample Details TYPE	REF	Depth	Test Results SPT N Value/Drive mm	Backfill Details
Dense orange brown gravelly fine to coarse SAND. Gravel is angular to rounded fine to coarse flint. Rare flint cobbles. (KESGRAVE CATCHMENT SUBGROUP)*(BH Continued)*					D	7	10.50 - 10.95 10.50 - 10.95	CPT N=42 4,6/8,9,11,14	
			11.50	*73.42* 11.50					
Recovered as structureless CHALK composed of cream with rare orange veins slightly gravelly silt. Gravel is angular to subangular fine to medium extremely to very weak low to medium density cream. Rare subrounded coarse gravels and cobbles of rinded flint throughout. Grade Dm. (LEWES NODULAR/ SEAFORD CHALK FORMATION)					D	8	12.00 - 12.45 12.00 - 12.45	CPT N=28 1,2/4,8,11,5	
					D	9	13.50 - 13.95 13.50 - 13.95	SPT N=14 1,2/4,4,3,3	
					D	10	15.00 - 15.45 15.00 - 15.45	SPT N=21 3,4/4,5,6,6	
					D	11	16.50 - 16.95 16.50 - 16.95	SPT N=12 2,2/3,2,4,3	
					D	12	18.00 - 18.45 18.00 - 18.45	SPT N=34 2,3/6,8,9,11	
					D	13	19.50 - 19.95 19.50 - 19.95	SPT N=18 2,2/3,5,6,4	

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Groundwater encountered at 27.00m bgl.
4. Installed with HDPE standpipe to 30.00m bgl.

CHISELLING

Depth From	Depth To	Time Taken
NO CHISELLING UNDERTAKEN:		

WATER LEVEL OBSERVATIONS

	Date	Time	Water Strike	Standing Level	Casing Depth
1	14-10-14		27.00	25.00	

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 30.00m	150mm to 11.50m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum |

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524101.97 N: 212899.63 Level: 84.92	WC	WC	SS

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Email: info@deltasimons.com

deltasimons

Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH415**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 13/10/2014 - 14/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL/* DEPTH (Thickness)	Sample Details TYPE	REF	Depth	Test Results SPT N Value/Drive mm	Backfill Details
Recovered as structureless CHALK composed of cream with rare orange veins slightly gravelly silt. Gravel is angular to subangular fine to medium extremely to very weak low to medium density cream. Rare subrounded coarse gravels and cobbles of rinded flint throughout. Grade Dm. (LEWES NODULAR/ SEAFORD CHALK FORMATION)*(BH Continued)*				(18.50)	D	14	21.00 - 21.45 21.00 - 21.45	SPT N=37 4,5/7,8,10,12	
					D	15	22.50 - 22.95 22.50 - 22.95	SPT N=37 4,5/8,12,9,8	
					D	16	24.00 - 24.45 24.00 - 24.45	SPT N=40 5,8/9,9,10,12	
		1			D	17	25.50 - 25.95 25.50 - 25.95	SPT N=50/275mm (4,7/9,10,15,16/50mm)	
					D	18	27.00 - 27.45 27.00 - 27.45	SPT N=43 5,9/9,12,9,13	
					D	19	28.50 - 28.95 28.50 - 28.95	SPT N=42 5,6/7,9,12,14	
				54.92 30.00	D	20	30.00 - 30.45		

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Groundwater encountered at 27.00m bgl.
4. Installed with HDPE standpipe to 30.00m bgl.

CHISELLING

Depth From	Depth To	Time Taken
NO CHISELLING UNDERTAKEN:		

WATER LEVEL OBSERVATIONS

	Date	Time	Water Strike	Standing Level	Casing Depth
1	14-10-14		27.00	25.00	

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 30.00m	150mm to 11.50m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum |

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524101.97 N: 212899.63 Level: 84.92	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH415**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 13/10/2014 - 14/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL/* DEPTH (Thickness)	Sample Details			Test Results	Backfill Details
					TYPE	REF	Depth	SPT N Value/Drive mm	
Borehole complete at 30.00m bgl.							30.00 - 30.45	SPT N=41 4,6,8,9,11,13	

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Groundwater encountered at 27.00m bgl.
4. Installed with HDPE standpipe to 30.00m bgl.

CHISELLING			WATER LEVEL OBSERVATIONS					
Depth From	Depth To	Time Taken		Date	Time	Water Strike	Standing Level	Casing Depth
NO CHISELLING UNDERTAKEN:			1	14-10-14		27.00	25.00	

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 30.00m	150mm to 11.50m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum |

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524101.97 N: 212899.63 Level: 84.92	WC	WC	SS

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Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH416**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 21/10/2014 - 22/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL* / DEPTH (Thickness)	Sample Details TYPE	REF	Depth	Test Results SPT N Value/Drive mm	Backfill Details
MADE GROUND: Dark brown sandy slightly gravelly clay. Gravel is angular to rounded fine to coarse flint and rare brick. Sand is fine to coarse. Abundant rootlets in top 200mm.				(0.60) *83.72 0.60*	D	1	0.50		
					D	2	1.00		
Stiff orangey brown slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. Sand is fine to coarse. (LOWESTOFT FORMATION)					U	1	1.50 - 1.95	U=90/225mm	
				(2.50)	D	3	1.95 - 20.50		
					B	1	2.50 - 2.95 2.50 - 2.95	CPT N=30 3,4/4,7,9,10	
				81.22 3.10	D	4	3.10		
Stiff brown slightly sandy CLAY. Sand is fine to medium. (LOWESTOFT FORMATION)					U	2	3.50 - 3.95	U=79/450mm	
				(1.50)	D	5	3.95 - 4.05		
				79.72 4.60	D	6	4.50 - 4.95 4.50 - 4.95	SPT N=31 3,4/4,6,9,12	
Dense orangey brown fine to coarse SAND. Rare subangular fine to medium flint gravel. (LOWESTOFT FORMATION)			(150mm)	(3.00)	B	2	6.00 - 6.45 6.00 - 6.45	CPT N=45 5,7/8,10,13,14	
				76.72 7.60	B	3	7.50 - 7.95 7.50 - 7.95	CPT N=28 4,5/6,6,7,9	
Medium dense to dense yellowy brown fine to medium SAND. Rare subangular fine to coarse flint gravel. (KESGRAVE CATCHMENT SUBGROUP)				(1.80)					
				74.92 9.40	D	7	9.00 - 9.45 9.00 - 9.45	SPT N=41 4,4/6,9,12,14	

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 13.50m bgl.

CHISELLING

Depth From	Depth To	Time Taken
NO CHISELLING UNDERTAKEN:		

WATER LEVEL OBSERVATIONS

Date	Time	Water Strike	Standing Level	Casing Depth
NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 13.40m	150mm to 12.60m	

All measurements in metres unless otherwise stated | 10m/page Scale: 1:62.50 | Coordinates to National Grid Ground Level to Ordnance Datum |

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524065.76 N: 213041.5 Level: 84.32	WC	WC	SS

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Email: info@deltasimons.com

Project: **Broadwater Road, Welwyn Garden City**

Project No: **2342.18**

Hole ID: **BH416**

CABLE PERCUSSION BOREHOLE LOG

Date From / To: 21/10/2014 - 22/10/2014

Client: **Spen Hill Developments Ltd**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	*REDUCED LEVEL/* DEPTH (Thickness)	Sample Details TYPE	Sample Details REF	Sample Details Depth	Test Results SPT N Value/Drive mm	Backfill Details
Medium dense orangey brown sandy angular to subrounded fine to coarse flint GRAVEL. Sand is fine to coarse. Rare flint cobbles.(KESGRAVE CATCHMENT SUBGROUP)*(BH Continued)*				(3.20)	B	4	10.50 - 10.95 10.50 - 10.95	CPT N=28 3,4/4,6,8,10	
					D	8	12.00 - 12.45 12.00 - 12.45	CPT N=22 4,5/4,6,6,6	
			12.60	*71.72* 12.60					
No recovery pushing flint cobble.				(0.80)					
				70.92 13.40					
Borehole terminated due to difficult conditions at 13.40m bgl.									

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Borehole remained dry on completion.
4. Installed with HDPE standpipe to 13.50m bgl.

CHISELLING

Depth From	Depth To	Time Taken
NO CHISELLING UNDERTAKEN:		

WATER LEVEL OBSERVATIONS

	Date	Time	Water Strike	Standing Level	Casing Depth
NO WATER ENCOUNTERED:					

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
150mm to 13.40m	150mm to 12.60m	

All measurements in metres unless otherwise stated

10m/page Scale: 1:62.50

Coordinates to National Grid
Ground Level to Ordnance Datum

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
Dando 2000	E: 524065.76 N: 213041.5 Level: 84.32	WC	WC	SS

Appendix II

deltasimons

SPT Calibration Report

www.equipegroup.com

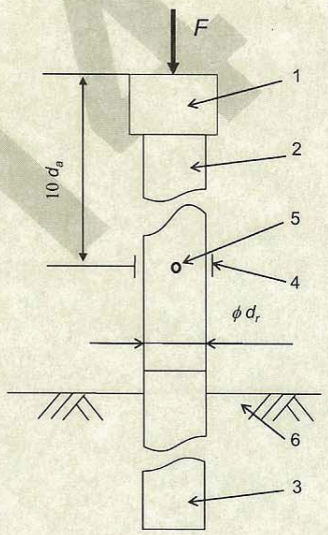
Hammer Energy Measurement Report

Type of Hammer	SPT HAMMER
Client	SI DRILLING
Test No	EQU938
Test Depth (m)	6.95
Date of Test	23 December 2013
Valid until	23 December 2014
Hammer ID	EQU438

Mass of the hammer	m =	63.5kg
Falling height	h =	0.76m
E_{theor} =	$m \times g \times h$ =	473J

Characteristics of the instrumented rod

Diameter	d_r =	0.052 m
Length of the instrumented rod		0.558 m
Area	A =	11.61 cm^2
Modulus	E_a =	206843 MPa

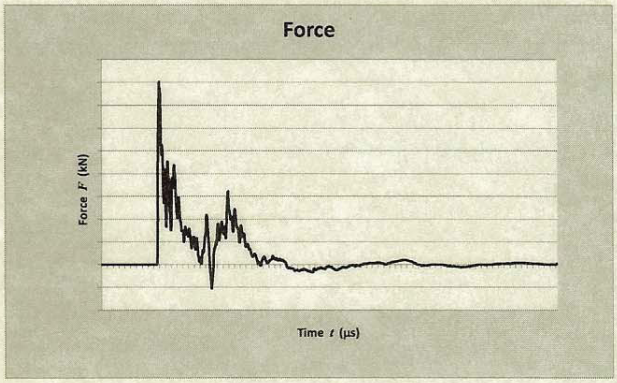


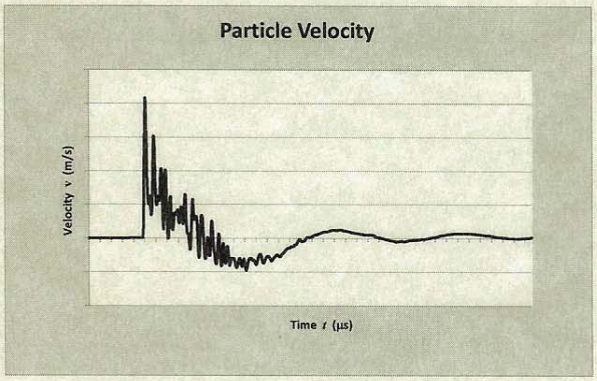
Key

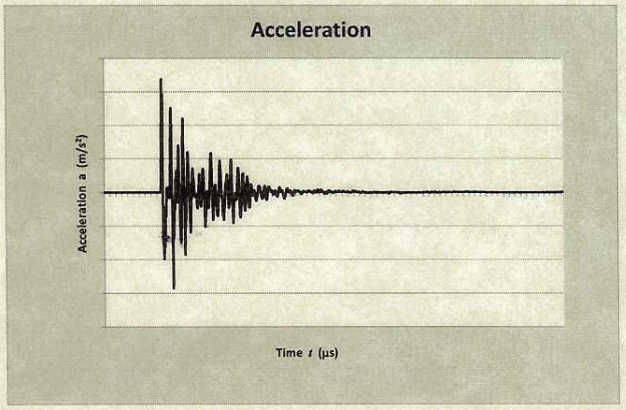
1 Anvil
2 Part of instrumented rod
3 Drive Rod
4 Strain Gauge
5 Accelerometer
6 Ground

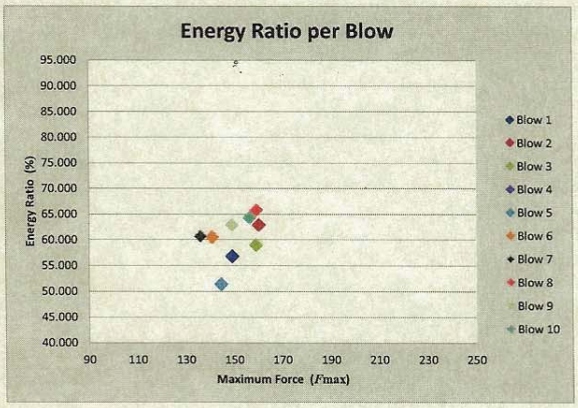
F Force
d_r Diameter of rod

Fig. B.1 and B.2 BS EN ISO 22476-3 : 2005 + A1 : 2011









Observations:
1.

E_{meas} = **0.281** kN-m

E_{theor} = **0.473** kN-m

Energy Ratio (E_r) = $\frac{E_{meas}}{E_{theor}}$ = **59.30%**

Equipe SPT Analyzer Operators: KS

Prepared by:		Checked by:		Date	09/01/2014

 Equipe Group, The Paddocks, Home Farm Offices, The Upton Estate, Banbury, Oxfordshire, OX15 6HU
Tel: 01295 670990 Fax: 01295 678232 Email: info@equipegroup.com

SPT Calibration Report

www.equipegroup.com

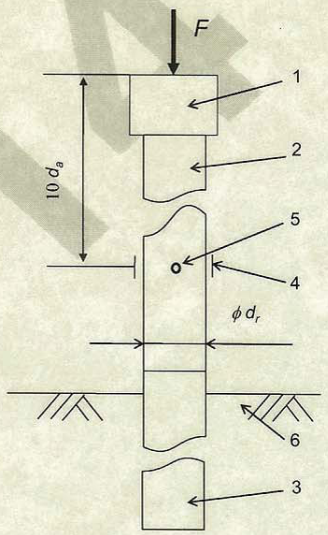
Hammer Energy Measurement Report

Type of Hammer	SPT HAMMER
Client	SI DRILLING
Test No	EQU936_1
Test Depth (m)	6.80
Date of Test	23 December 2013
Valid until	23 December 2014
Hammer ID	EQU756

Mass of the hammer	m =	63.5kg
Falling height	h =	0.76m
E_{theor} =	$m \times g \times h$ =	473J

Characteristics of the instrumented rod

Diameter	d_r =	0.052 m
Length of the instrumented rod		0.558 m
Area	A =	11.61 cm^2
Modulus	E_a =	206843 MPa

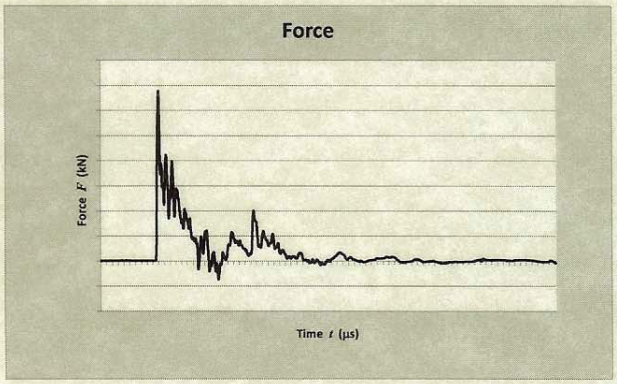


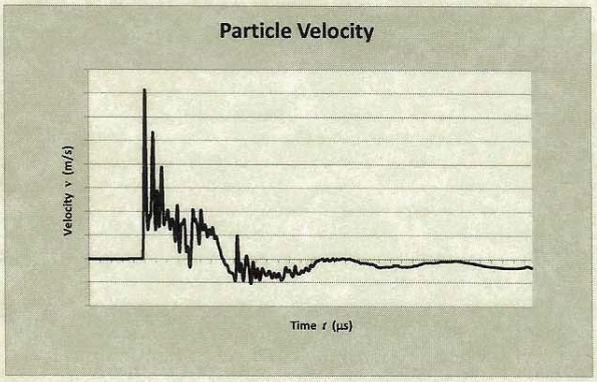
Key

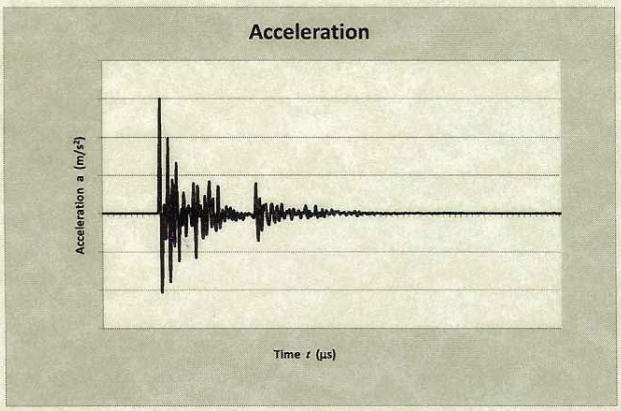
1 Anvil
2 Part of instrumented rod
3 Drive Rod
4 Strain Gauge
5 Accelerometer
6 Ground

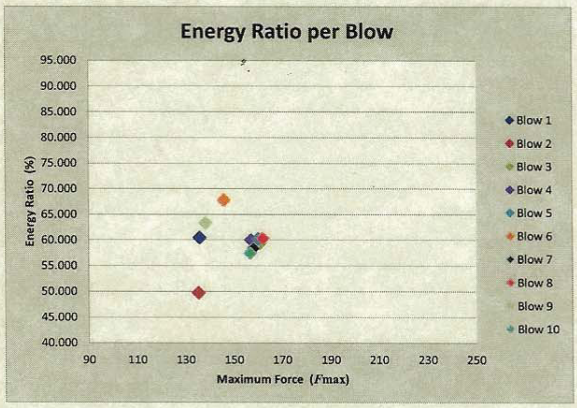
F Force
d_r Diameter of rod

Fig. B.1 and B.2 BS EN ISO 22476-3 : 2005 + A1 : 2011









Observations:
1.

E_{meas} = **0.281** kN-m

E_{theor} = **0.473** kN-m

Energy Ratio (E_r) = $\frac{E_{meas}}{E_{theor}}$ = **59.45%**

Equipe SPT Analyzer Operators: KS

Prepared by:	Checked by:	Date	09/01/2014

 Equipe Group, The Paddocks, Home Farm Offices, The Upton Estate, Banbury, Oxfordshire, OX15 6HU
Tel: 01295 670990 Fax: 01295 678232 Email: info@equipegroup.com

Appendix III

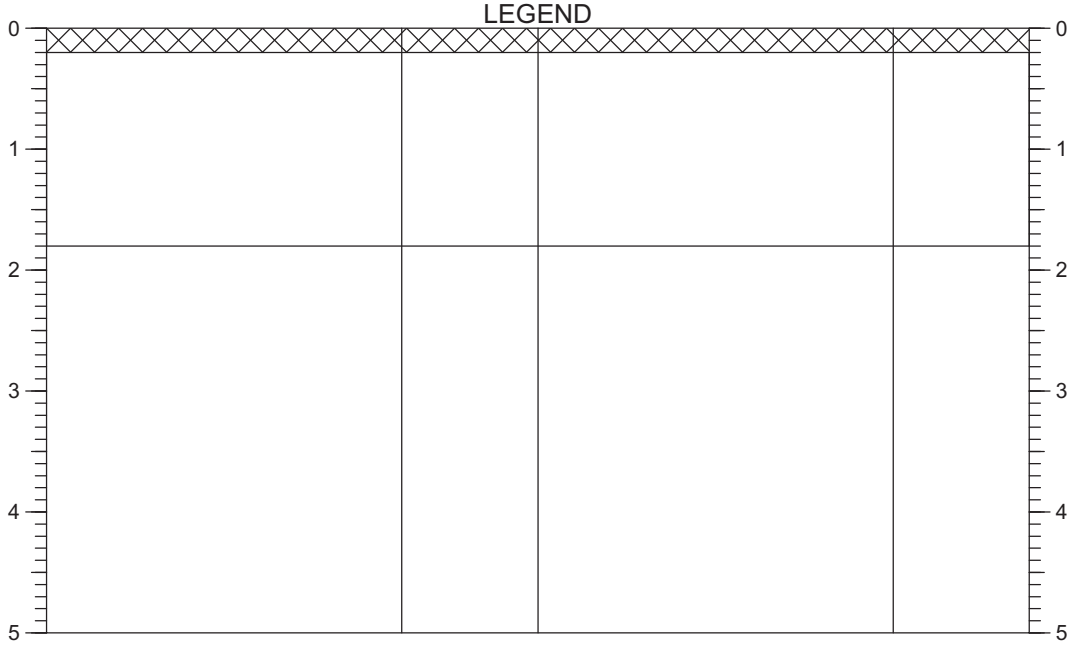
deltasimons

Delta-Simons
3 Henley Office Park, Doddington Road,
Lincoln, LN6 3QR
Tel: +44 (0) 870 0400 012
Fax: +44 (0) 1522 698393
Email: info@deltasimons.com

deltasimons

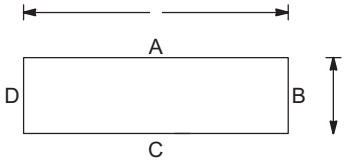
Project:	Project No:	Hole ID:
Broadwater Road, Welwyn Garden City	**2342.18**	**TP401**
TRIAL PIT LOG	Date: 09/10/2014	Client: **Spen Hill Developments Ltd**

LEGEND



STRATA			SAMPLES		TESTS	
Depth	No	DESCRIPTION	Depth	No	Depth	Results
84.26 0.20		MADE GROUND: Reinforced concrete.				
		VOID. Service corridor.				
(1.60)						
82.66 1.80		Trial pit terminated at 1.80m due to difficult escavation through gravels.				

Shoring/Support:
Stability:



Bearing: °

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Trial pit remained dry on completion.
4. Backfilled with arisings.

All measurements in metres unless otherwise stated	5m/page Scale: 1:62.5	Coordinates to National Grid Ground Level to Ordnance Datum

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
JCB 3CX	E: 524102.75 N: 212642.01 Level: 84.46	WC	WC	SS

Delta-Simons
3 Henley Office Park, Doddington Road,
Lincoln, LN6 3QR
Tel: +44 (0) 870 0400 012
Fax: +44 (0) 1522 698393
Email: info@deltasimons.com

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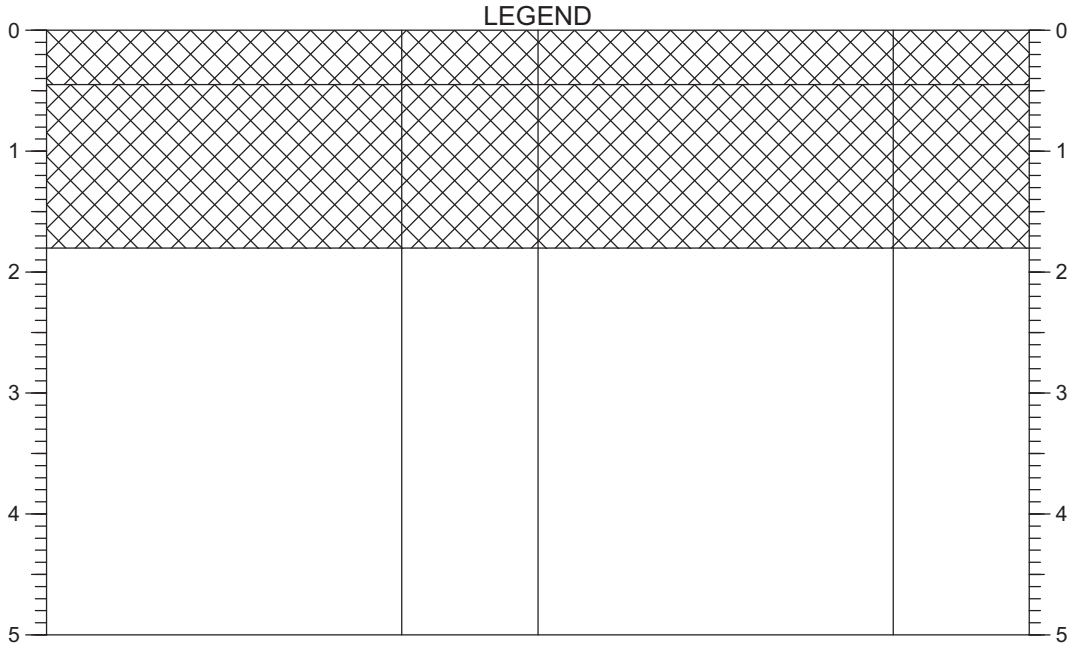
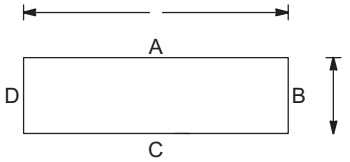
Project:	Project No:	Hole ID:
Broadwater Road, Welwyn Garden City	**2342.18**	**TP401a**
TRIAL PIT LOG	Date: 21/10/2014	Client: **Spen Hill Developments Ltd**



STRATA			SAMPLES		TESTS	
Depth	No	DESCRIPTION	Depth	No	Depth	Results
84.44 0.45		MADE GROUND: Reinforced concrete.				
(1.35)		MADE GROUND: Orange brown sandy gravelly clay. Gravel is subangular to subrounded fine to coarse flint and rare brick. Sand is fine to coarse. Rare brick cobbles.				
83.09 1.80		Trial pit terminated at 1.80m bgl due to difficult escavation through gravels.				

Shoring/Support:
Stability:



Bearing: °

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Trial pit remained dry on completion.
4. Backfilled with arisings.

All measurements in metres unless otherwise stated	5m/page Scale: 1:62.5	Coordinates to National Grid Ground Level to Ordnance Datum

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
JCB 3CX	E: 524110.81 N: 212639.54 Level: 84.89	WC	WC	SS

Delta-Simons
3 Henley Office Park, Doddington Road,
Lincoln, LN6 3QR
Tel: +44 (0) 870 0400 012
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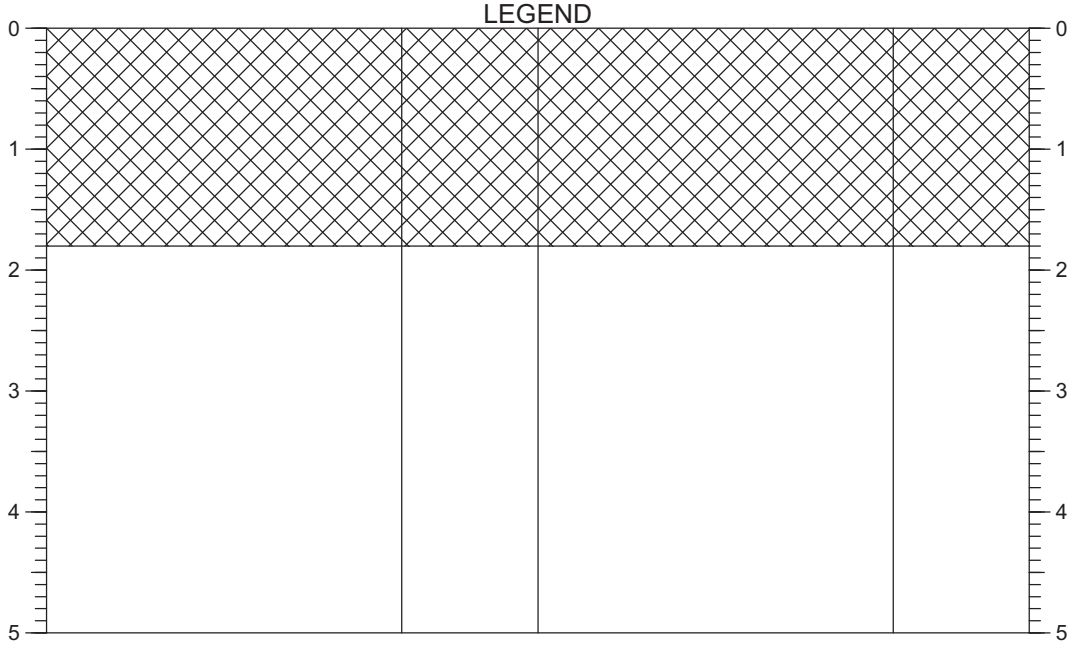
deltasimons

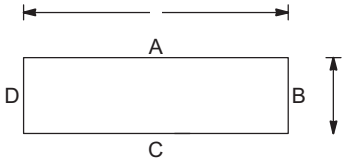
Project:	Project No:	Hole ID:
Broadwater Road, Welwyn Garden City	**2342.18**	**TP402**
TRIAL PIT LOG	Date: 21/10/2014	Client: **Spen Hill Developments Ltd**

LEGEND



STRATA			SAMPLES		TESTS	
Depth	No	DESCRIPTION	Depth	No	Depth	Results
		MADE GROUND: Brownish grey sandy gravel. Gravel is angular to subrounded fine to coarse brick, concrete and flint. Sand is fine to coarse. Abundant brick and concrete cobbles.				
(1.80)						
82.66 1.80		Trial pit terminated at 1.80m bgldue to difficult escavation through gravels.				

Shoring/Support:
Stability:



Bearing: °

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Trial pit remained dry on completion.
4. Backfilled with arisings.

All measurements in metres unless otherwise stated	5m/page Scale: 1:62.5	Coordinates to National Grid Ground Level to Ordnance Datum

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
JCB 3CX	E: 524197.53 N: 212743.84 Level: 84.46	WC	WC	SS

Delta-Simons
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Tel: +44 (0) 870 0400 012
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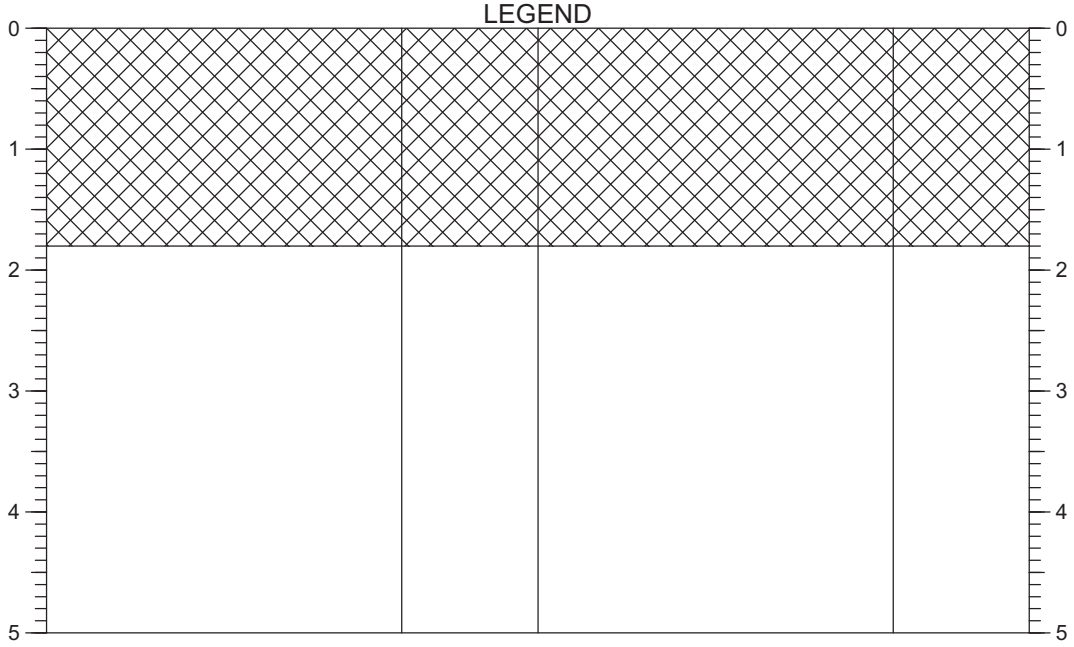
Email: info@deltasimons.com

deltasimons

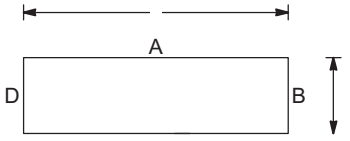
Project:	Project No:	Hole ID:
Broadwater Road, Welwyn Garden City	**2342.18**	**TP403**
TRIAL PIT LOG	Date: 21/10/2014	Client: **Spen Hill Developments Ltd**

LEGEND



STRATA			SAMPLES		TESTS	
Depth	No	DESCRIPTION	Depth	No	Depth	Results
		MADE GROUND: Brownish grey sandy gravel. Gravel is angular to subrounded fine to coarse brick, concrete and flint. Sand is fine to coarse. Abundant brick and concrete cobbles. Suspected basement access.				
(1.80)						
83.25 1.80		Trial pit terminated at 1.80m bgl due to difficult escavation through gravels.				

Shoring/Support:
Stability:



Bearing: °

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Trial pit remained dry on completion.
4. Backfilled with arisings.

All measurements in metres unless otherwise stated	5m/page Scale: 1:62.5	Coordinates to National Grid Ground Level to Ordnance Datum

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
JCB 3CX	E: 524096.26 N: 212681.44 Level: 85.05	WC	WC	SS

Delta-Simons
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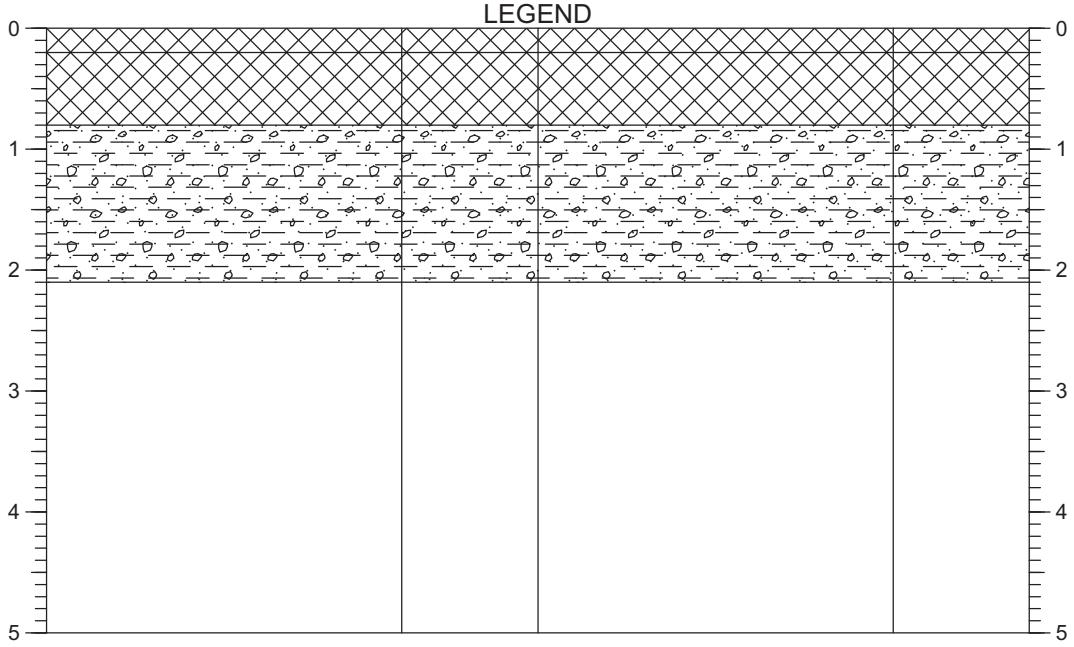
deltasimons

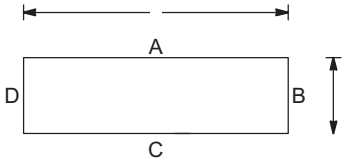
Project:	Project No:	Hole ID:
Broadwater Road, Welwyn Garden City	**2342.18**	**TP405**
TRIAL PIT LOG	Date: 21/10/2014	Client: **Spen Hill Developments Ltd**

LEGEND



STRATA			SAMPLES		TESTS	
Depth	No	DESCRIPTION	Depth	No	Depth	Results
83.68 0.20		MADE GROUND: Dark brown slightly sandy gravelly clay. Gravel is angular to rounded fine to coarse of mixed lithologies including flint, brick and concrete. Abundant roolets within top 200mm				
(0.60)			0.50	B1		
83.08 0.80		MADE GROUND: Brown slightly sandy gravelly clay. Gravel is angular to rounded fine to coarse of mixed lithologies including flint, brick and concrete. Rare fragments of pottery.	1.00	B2		
(1.30)		Orange brown sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. Sand is fine to coarse. (LOWESTOFT FORMATION).	1.50	B3		
81.78 2.10		Trial pit terminated at 2.10m bgl due to difficult escavation through gravels.				

Shoring/Support:
Stability:



Bearing: °

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Trial pit remained dry on completion.
4. Backfilled with arisings.

All measurements in metres unless otherwise stated	5m/page Scale: 1:62.5	Coordinates to National Grid Ground Level to Ordnance Datum

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
JCB 3CX	E: 524110.92 N: 213053.28 Level: 83.88	WC	WC	SS

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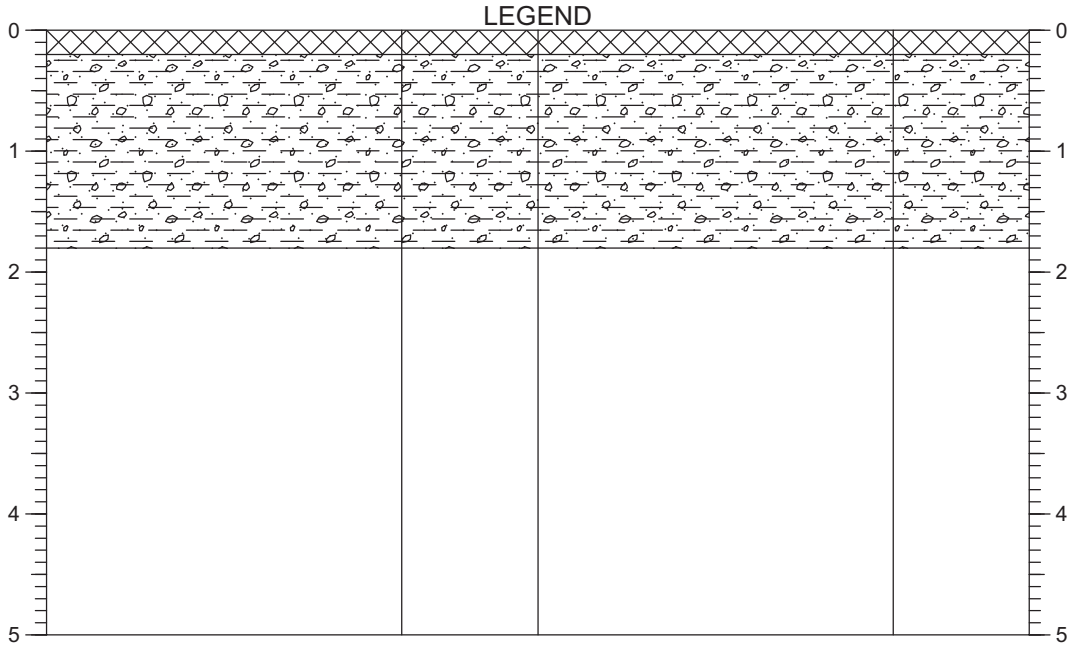
Project:	Project No:	Hole ID:
Broadwater Road, Welwyn Garden City	**2342.18**	**TP406**

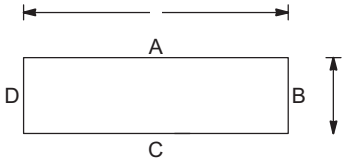
TRIAL PIT LOG

Date:	Client:
21/10/2014	**Spen Hill Developments Ltd**



STRATA			SAMPLES		TESTS	
Depth	No	DESCRIPTION	Depth	No	Depth	Results
83.41 0.20		MADE GROUND: Dark brown slightly sandy gravelly clay. Gravel is angular to rounded fine to coarse of mixed lithologies including flint, brick and concrete. Abundant roolets within top 200mm				
		Orange brown sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. Sand is fine to coarse. (LOWESTOFT FORMATION).	0.50	B1		
(1.60)			1.00	B2		
81.81 1.80			1.50	B3		
		Trial pit terminated at 1.80m bgl due to difficult escavation through gravels.				

Shoring/Support:
Stability:



Bearing: °

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Trial pit remained dry on completion.
4. Backfilled with arisings.

All measurements in metres unless otherwise stated	5m/page Scale: 1:62.5	Coordinates to National Grid Ground Level to Ordnance Datum

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
JCB 3CX	E: 524077.54 N: 213067.26 Level: 83.61	WC	WC	SS

Delta-Simons
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Lincoln, LN6 3QR
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Fax: +44 (0) 1522 698393
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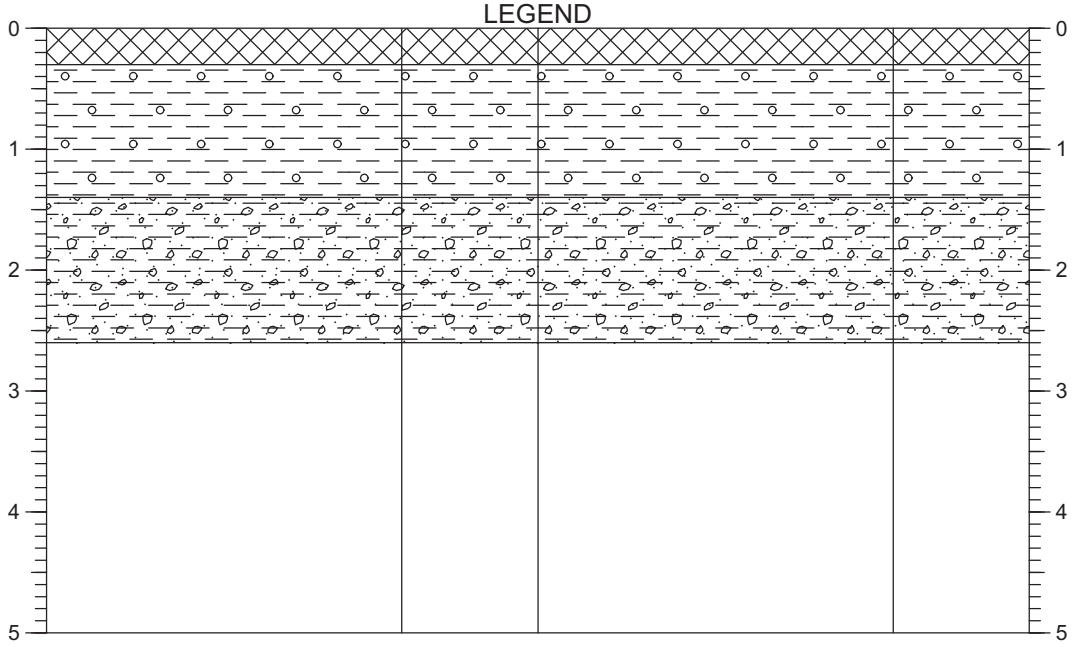
deltasimons

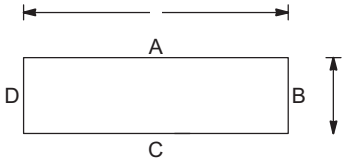
Project:	Project No:	Hole ID:
Broadwater Road, Welwyn Garden City	**2342.18**	**TP407**
TRIAL PIT LOG	Date: 21/10/2014	Client: **Spen Hill Developments Ltd**

LEGEND



STRATA			SAMPLES		TESTS	
Depth	No	DESCRIPTION	Depth	No	Depth	Results
84.1 0.30		MADE GROUND: Dark brown slightly sandy gravelly slightly organic clay. Gravel is angular to rounded fine to coarse of mixed lithologies including flint brick and concrete. Abundant roolets within top 200mm				
(1.10)		Brown slightly sandy gravelly CLAY. Gravel is angular to rounded fine to coarse flint.	0.50	B1		
83 1.40			1.00	B2		
(1.20)		Orange brown sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. Sand is fine to coarse. (LOWESTOFT FORMATION).	1.50	B3		
81.8 2.60		Trial pit terminated at 2.60m bgl due to difficult escavation through gravels.				

Shoring/Support:
Stability:



Bearing: °

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Trial pit remained dry on completion.
4. Backfilled with arisings.

All measurements in metres unless otherwise stated	5m/page Scale: 1:62.5	Coordinates to National Grid Ground Level to Ordnance Datum

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
JCB 3CX	E: 524052.62 N: 213018.48 Level: 84.4	WC	WC	SS

Delta-Simons
3 Henley Office Park, Doddington Road,
Lincoln, LN6 3QR
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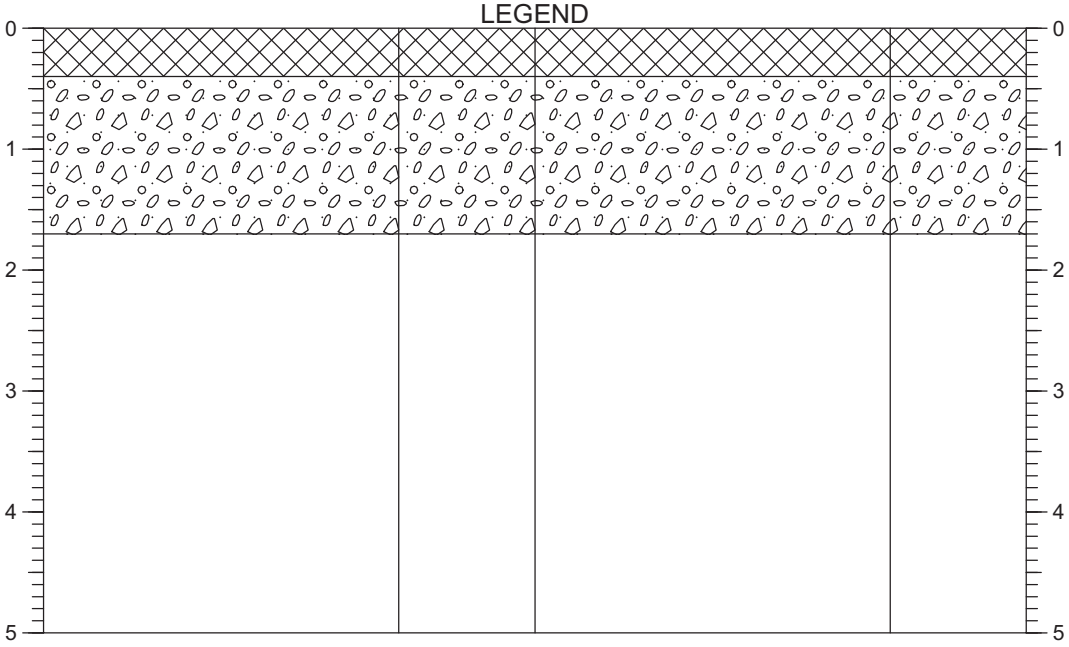
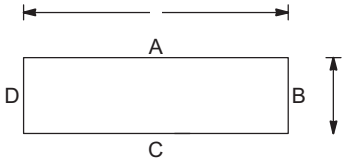
Project:	Project No:	Hole ID:
Broadwater Road, Welwyn Garden City	**2342.18**	**TP408**
TRIAL PIT LOG	Date: 21/10/2014	Client: **Spen Hill Developments Ltd**

LEGEND



STRATA			SAMPLES		TESTS	
Depth	No	DESCRIPTION	Depth	No	Depth	Results
85.14 0.40		MADE GROUND: Dark brown slightly sandy slightly gravelly clay. Gravel is angular to rounded fine to coarse of mixed lithologies including flint, brick and concrete. Sand is fine to coarse. Abundant rootlets in the top 200mm				
(1.30)		Orange brown sandy angular to subrounded fine to coarse flint GRAVEL. Sand is fine to coarse.				
83.84 1.70		Trial pit terminated at 1.70m bgl due to difficult escavation through gravels.				

Shoring/Support:
Stability:



Bearing: °

REMARKS :

1. Engineer verified logged in general accordance to BS 5930:2010.
2. Area CAT scanned prior to excavation.
3. Trial pit remained dry on completion.
4. Backfilled with arisings.

All measurements in metres unless otherwise stated	5m/page Scale: 1:62.5	Coordinates to National Grid Ground Level to Ordnance Datum

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
JCB 3CX	E: 524085.61 N: 212864.61 Level: 85.54	WC	WC	SS

Appendix IV

GROUNDWATER AND GROUND GAS MONITORING RECORD SHEET

Sheet: 1 of 1

Project Name:	Broadwater Rd, Welwyn Garden City	Weather Conditions:	Sunny, Windy,15.2 degrees celcius, windspeed 2.6m/s
Project Number:	3242.18	Gas Kit Model:	GFM 436
Personnel:	DP+WC	Gas Kit Serial No:	

Date: 22/10/2014

LOCATION	Flow Peak (L/hr)	Flow Steady (L/hr)	CH_4 Peak (%v/v)	CH_4 Steady (%v/v)	CO_2 Peak (%v/v)	CO_2 Steady (%v/v)	O_2 Min. (%v/v)	O_2 Steady (%v/v)	Atmospheric Pressure (mb)	PID (ppm)	Well I.D. (mm)	Depth to Product (DTP) (m)	Product Thickness (m)	Depth to Water (DTW) (m)	Depth to Base (DTB) (m)	Height of Water Column (m)	NOTES
BH404	0.0	0.0	0.0	0.0	0.0	0.0	20.3	20.3	1013	-	50	-		DRY	19.41		
BH403	0.0	0.0	0.0	0.0	0.9	0.9	8.0	8.0	1013	-	50	-		22.10	24.48	2.38	
BH401	0.0	0.0	0.0	0.0	3.2	3.2	15.4	15.4	1012	-	50	-		DRY	20.00		
BH405	0.0	0.0	0.0	0.0	4.9	4.9	13.2	13.2	1012		50			DRY	19.94		
BH407	-3.0	-3.0	0.0	0.0	3.8	3.8	2.2	2.2	1012		50			DRY	20.00		
BH406	0.0	0.0	0.0	0.0	4.1	4.1	7.0	7.0	1012		50			21.57	25.07	3.50	
BH402	0.0	0.0	0.0	0.0	1.1	1.1	19.0	19.0	1012		50			21.23	23.82	2.59	
BH415	0.0	0.0	0.0	0.0	0.0	0.0	20.0	20.0	1012		50			22.12	24.34	2.22	
BH412	0.0	0.0	0.0	0.0	0.0	0.0	20.1	20.1	1012		50			DRY	19.29		
BH413	0.0	0.0	0.0	0.0	0.1	0.1	19.9	19.9	1012		50			DRY	19.38		
BH408	0.0	0.0	0.0	0.0	1.6	1.6	18.3	18.3	1012		50			DRY	19.67		
BH409	0.0	0.0	0.0	0.0	0.0	0.0	20.1	20.1	1012		50			DRY	14.73		
BH410	0.0	0.0	0.0	0.0	0.0	0.0	20.1	20.1	1012		50			22.62	24.08	1.46	
BH411	0.0	0.0	0.0	0.0	0.0	0.0	20.3	20.3	1012		50			DUMP	19.62		
BH416	0.0	0.0	0.0	0.0	2.7	2.7	17.4	17.4	1012		50			DUMP	13.12		

GUIDE TO PURGING VOLUMES

To calculate the number of litres to be purged from a well with a different diameter, use the formula $3\pi r^2 h$ (where r = radius of the well and h = height of the water column). Use the formula $\pi r^2 h$ to calculate the volume of a bailer. Please note that the standard bailers Delta-Simons use are typically 0.95 m in length.

Diameter of Casing (mm	19	35	50	50	75	100
Diameter of Bailer (mm)	18	19	19	38	38	38
No. bails per m	4	12	22	6	13	23

GROUNDWATER AND GROUND GAS MONITORING RECORD SHEET

Sheet: 1 of 1

Project Name:	Broadwater Rd, Welwyn Garden City	Weather Conditions:	Dull, Windy,11.4 degrees celcius, windspeed 3.7m/s
Project Number:	3242.18	Gas Kit Model:	GFM 436
Personnel:	RM	Gas Kit Serial No:	

Date: 29.10/14

LOCATION	Flow Peak (L/hr)	Flow Steady (L/hr)	CH_4 Peak (%v/v)	CH_4 Steady (%v/v)	CO_2 Peak (%v/v)	CO_2 Steady (%v/v)	O_2 Min. (%v/v)	O_2 Steady (%v/v)	Atmospheric Pressure (mb)	PID (ppm)	Well I.D. (mm)	Depth to Product (DTP) (m)	Product Thickness (m)	Depth to Water (DTW) (m)	Depth to Base (DTB) (m)	Height of Water Column (m)	NOTES
BH404	0.1	0.1	0.0	0.0	0.1	0.1	20.3	20.3	1008	-	50	-		DRY	19.41		
BH403	0.0	0.0	0.0	0.0	0.2	0.1	20.2	20.2	1008	-	50	-		22.40	24.48	2.08	
BH401	0.0	0.0	0.0	0.0	0.5	0.4	20.3	20.3	1008	-	50	-		DRY	20.00		
BH405	0.0	0.0	0.0	0.0	0.0	0.0	20.6	20.6	1008		50			DRY	19.94		
BH407											50			0.40	20.00	19.60	Sucked water from hole
BH406	0.0	0.0	0.1	0.1	4.3	4.3	6.5	6.5	1008		50			21.58	25.07	3.49	
BH402	0.0	0.0	0.1	0.1	0.0	0.0	20.2	20.2	1008		50			21.43	23.82	2.39	
BH415	0.0	0.0	0.0	0.0	0.0	0.0	20.1	20.1	1008		50			22.32	24.34	2.02	
BH412	0.0	0.0	0.0	0.0	0.2	0.2	20.0	20.0	1008		50			DRY	19.29		
BH413	0.0	0.0	0.0	0.0	0.1	0.1	20.2	20.2	1008		50			DRY	19.38		
BH408	0.0	0.0	0.0	0.0	0.5	0.5	19.3	19.3	1008		50			DRY	19.67		
BH409	0.0	0.0	0.0	0.0	0.2	0.2	20.1	20.1	1008		50			DRY	14.73		
BH410	0.0	0.0	0.0	0.0	0.2	0.2	20.1	20.1	1008		50			22.62	24.08	1.46	
BH411	0.0	0.0	0.1	0.1	0.1	0.1	20.1	20.1	1008		50			DAMP	19.62		
BH416	0.0	0.0	0.0	0.0	0.4	0.4	19.9	19.9	1008		50			DAMP	13.12		

GUIDE TO PURGING VOLUMES

To calculate the number of litres to be purged from a well with a different diameter, use the formula $3\pi r^2 h$ (where r = radius of the well and h = height of the water column). Use the formula $\pi r^2 h$ to calculate the volume of a bailer. Please note that the standard bailers Delta-Simons use are typically 0.95 m in length.

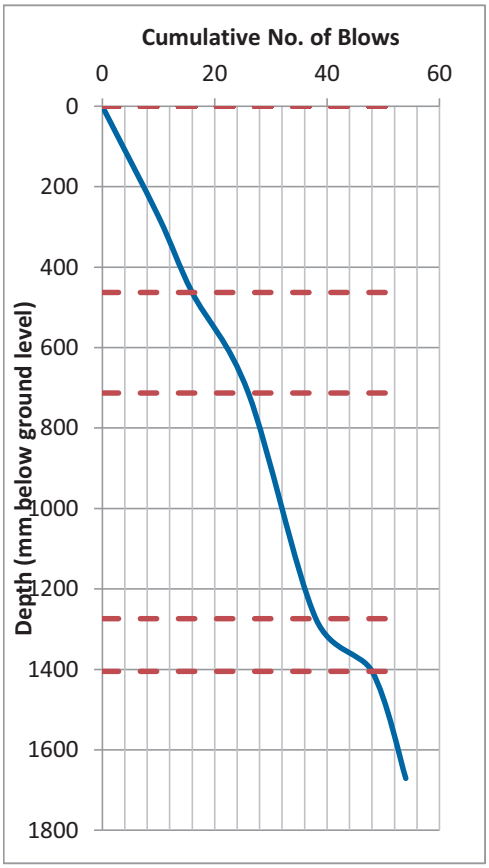
Diameter of Casing (mm	19	35	50	50	75	100
Diameter of Bailer (mm)	18	19	19	38	38	38
No. bails per m	4	12	22	6	13	23

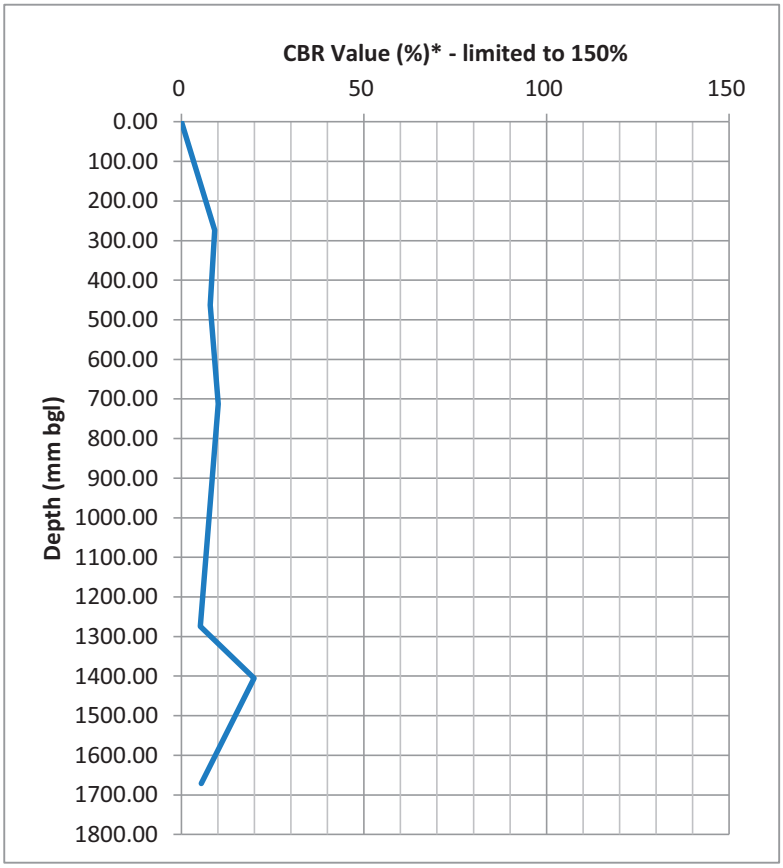
Appendix V

TRL Dynamic Cone Penetrometer - Determination of CBR Value (%)*

Site Name	Broadwater Rd, WGC	**Starting Depth (mm bgl)**	0.00
Job Number	2342-18	**Surface Level (m AOD)**	84.89
Test No.	DCP-TP401A	**Easting**	524110.814
Date of Test	21-Oct-14	**Northing**	212639.541

Layer	Blows	Cumulative Blows	Layer Thickness (mm)	Total Depth (mm bgl)	CBR (%)*
1	16	16	463	463	**8.6**
2	10	26	250	713	**10.1**
3	12	38	561	1274	**5.2**
4	10	48	131	1405	**19.9**
5	6	54	686	2091	**2.0**



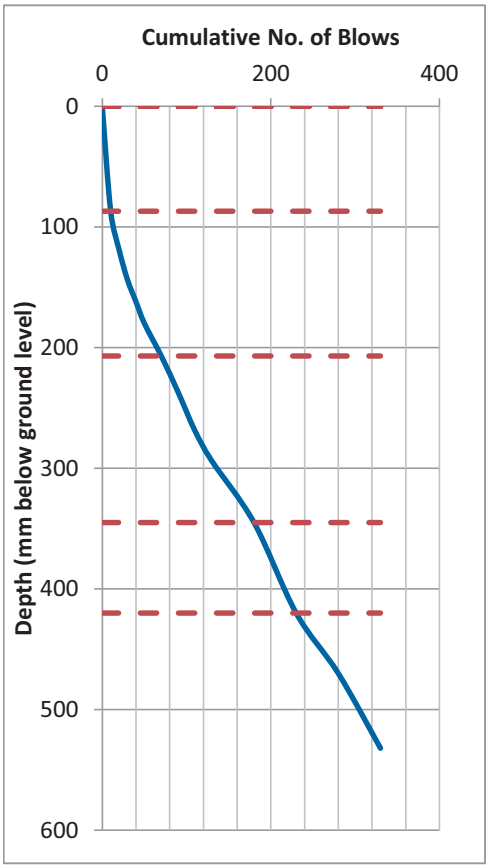


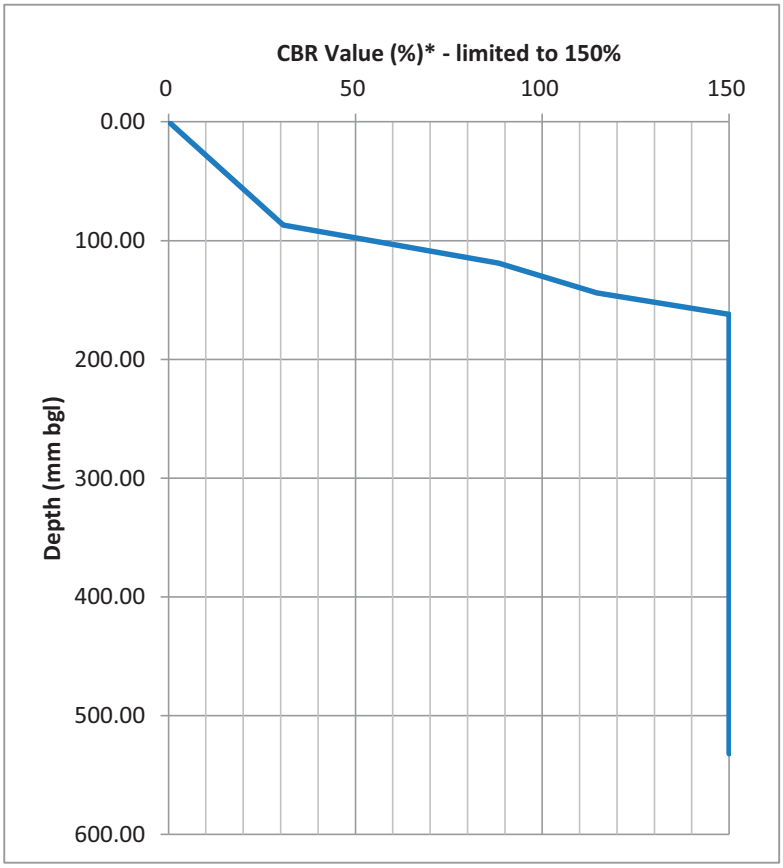
* CBR Interpretation in accordance with DMRB. Vol 7. Sec. 3 Chap.7 Clause 7.31 equation: CBR = 10((2.48 - 1.057 x Log 10(mm/blow))

TRL Dynamic Cone Penetrometer - Determination of CBR Value (%)*

Site Name	Broadwater Rd, WGC	**Starting Depth (mm bgl)**	0.00
Job Number	2342-18	**Surface Level (m AOD)**	84.462
Test No.	DCP-TP402	**Easting**	524197.529
Date of Test	09-Sep-14	**Northing**	212743.842

Layer	Blows	Cumulative Blows	Layer Thickness (mm)	Total Depth (mm bgl)	CBR (%)*
1	10	10	87	87	**30.7**
2	60	70	120	207	**>100**
3	110	180	138	345	**>100**
4	50	230	75	420	**>100**
5	100	330	232	652	**>100**



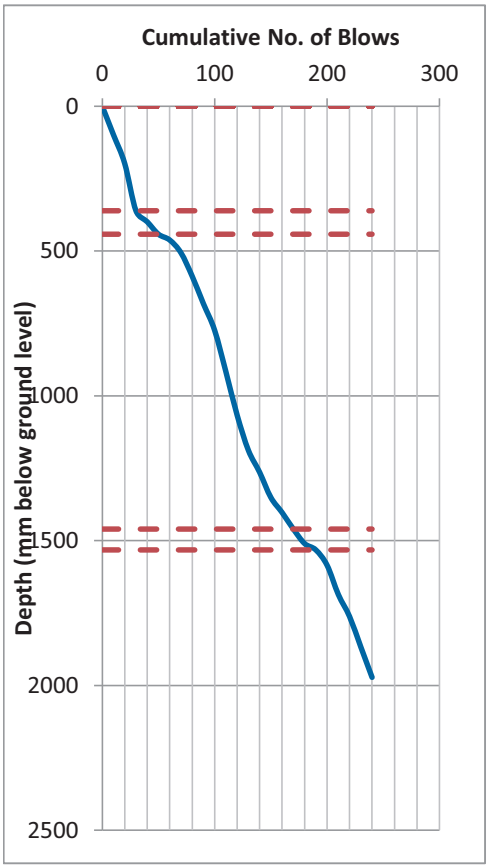


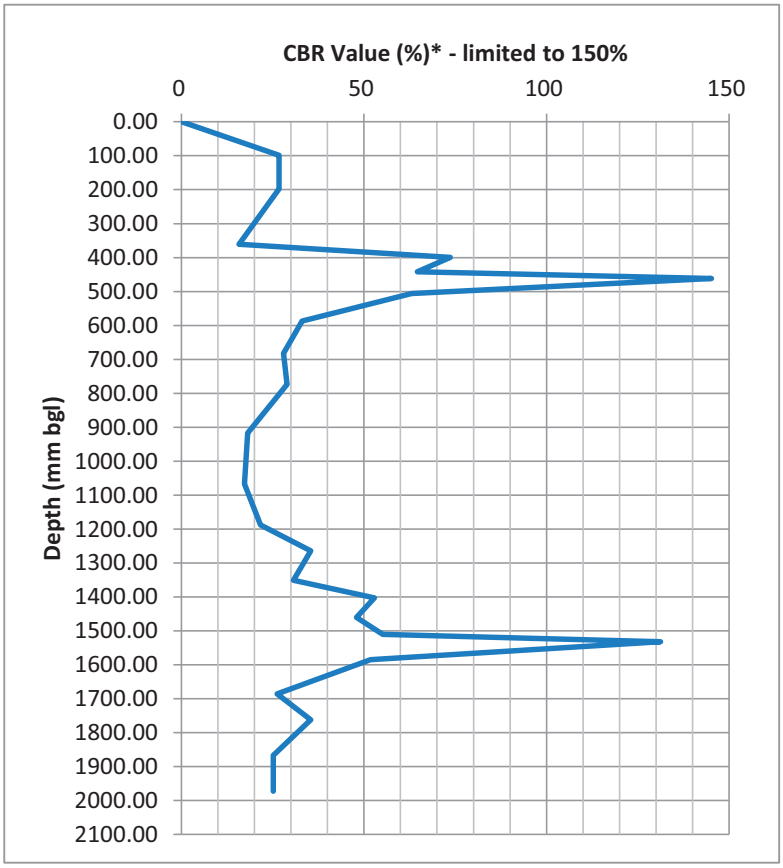
* CBR Interpretation in accordance with DMRB. Vol 7. Sec. 3 Chap.7 Clause 7.31 equation: CBR = 10((2.48 - 1.057 x Log 10(mm/blow))

TRL Dynamic Cone Penetrometer - Determination of CBR Value (%)*

Site Name	Broadwater Rd, WGC	**Starting Depth (mm bgl)**	0.00
Job Number	2342-18	**Surface Level (m AOD)**	83.88
Test No.	DCP-TP405	**Easting**	524110.92
Date of Test	21-Sep-14	**Northing**	213053.28

Layer	Blows	Cumulative Blows	Layer Thickness (mm)	Total Depth (mm bgl)	CBR (%)*
1	30	30	361	361	**21.8**
2	20	50	81	442	**68.9**
3	120	170	1018	1460	**31.5**
4	20	190	72	1532	**78.0**
5	50	240	440	1972	**30.3**



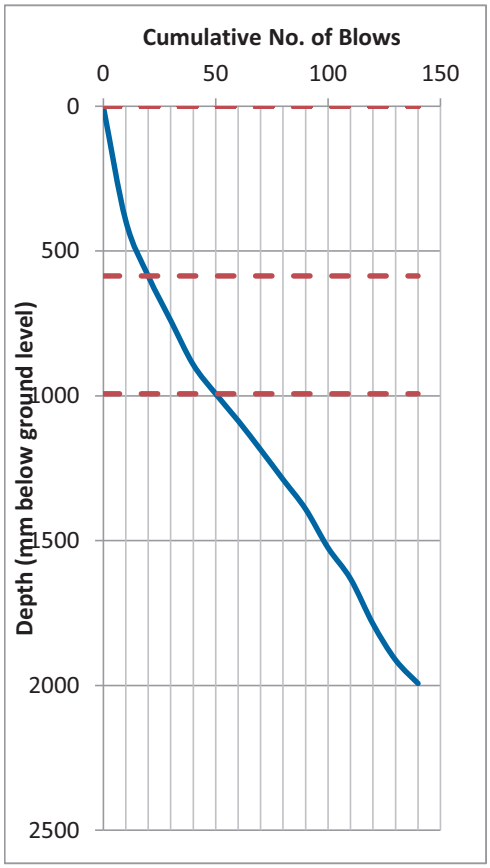


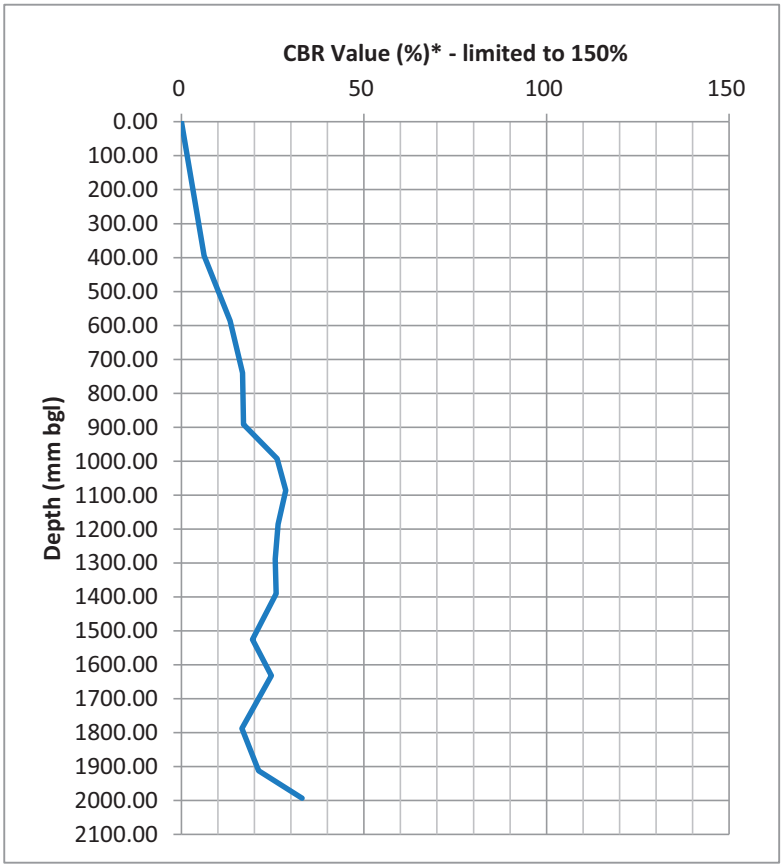
* CBR Interpretation in accordance with DMRB. Vol 7. Sec. 3 Chap.7 Clause 7.31 equation: CBR = 10((2.48 - 1.057 x Log 10(mm/blow))

TRL Dynamic Cone Penetrometer - Determination of CBR Value (%)*

Site Name	Broadwater Rd, WGC	**Starting Depth (mm bgl)**	0.00
Job Number	2342-18	**Surface Level (m AOD)**	83.61
Test No.	DCP-TP406	**Easting**	524077.54
Date of Test	21-Sep-14	**Northing**	213067.26

Layer	Blows	Cumulative Blows	Layer Thickness (mm)	Total Depth (mm bgl)	CBR (%)*
1	20	20	586	586	**8.5**
2	30	50	407	993	**19.2**
3	90	140	1000	1993	**23.7**



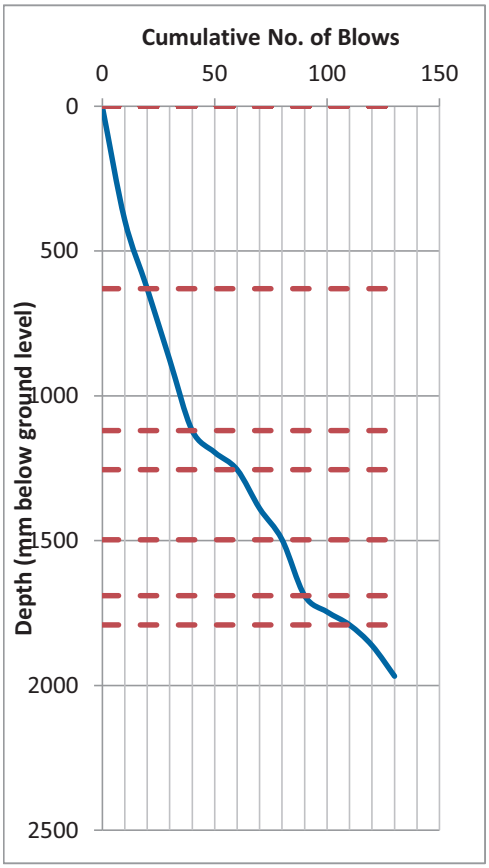


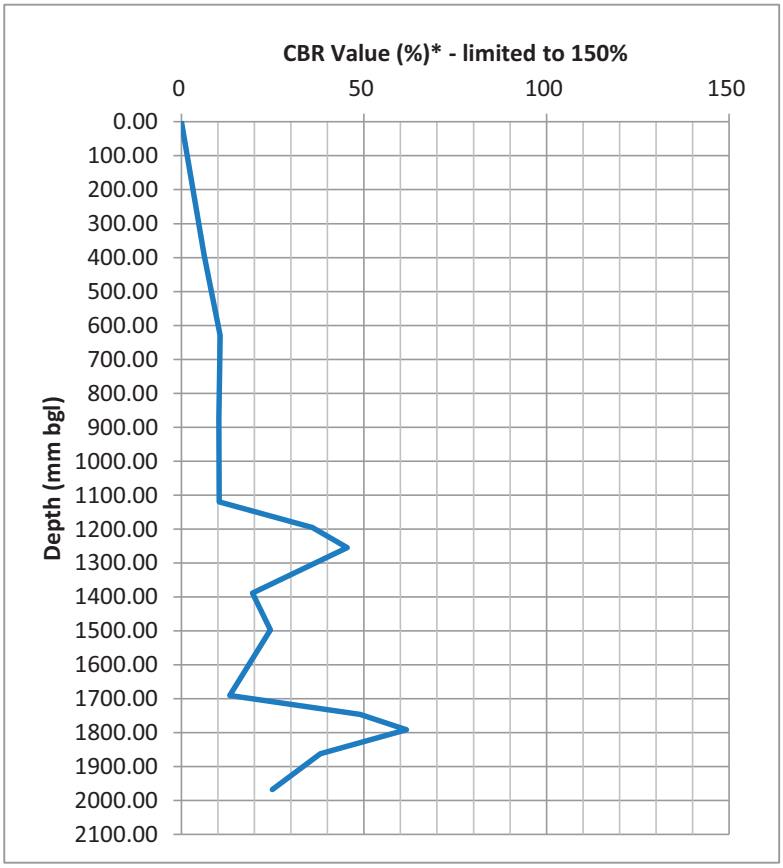
* CBR Interpretation in accordance with DMRB. Vol 7. Sec. 3 Chap.7 Clause 7.31 equation: CBR = 10((2.48 - 1.057 x Log 10(mm/blow))

TRL Dynamic Cone Penetrometer - Determination of CBR Value (%)*

Site Name	Broadwater Rd, WGC	**Starting Depth (mm bgl)**	0.00
Job Number	2342-18	**Surface Level (m AOD)**	84.4
Test No.	DCP-TP407	**Easting**	524052.62
Date of Test	21-Sep-14	**Northing**	213018.48

Layer	Blows	Cumulative Blows	Layer Thickness (mm)	Total Depth (mm bgl)	CBR (%)*
1	20	20	630	630	**7.9**
2	20	40	490	1120	**10.3**
3	20	60	135	1255	**40.1**
4	20	80	242	1497	**21.7**
5	10	90	193	1690	**13.2**
6	20	110	101	1791	**54.5**
7	20	130	177	1968	**30.1**



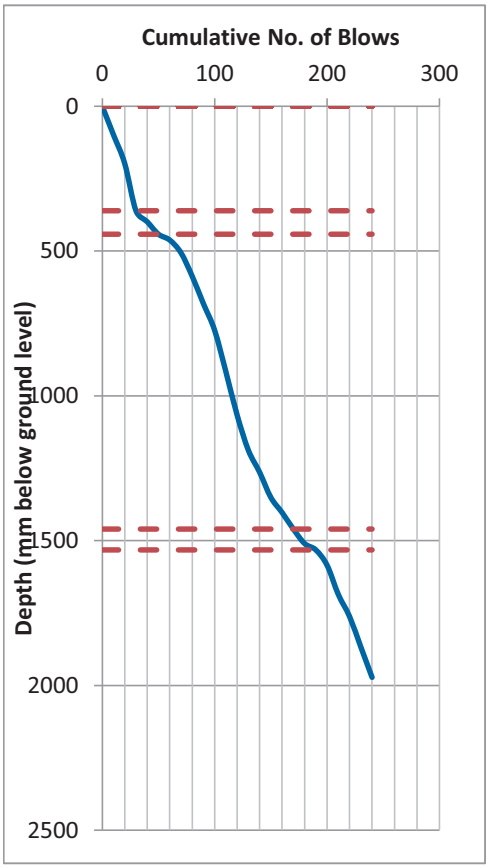


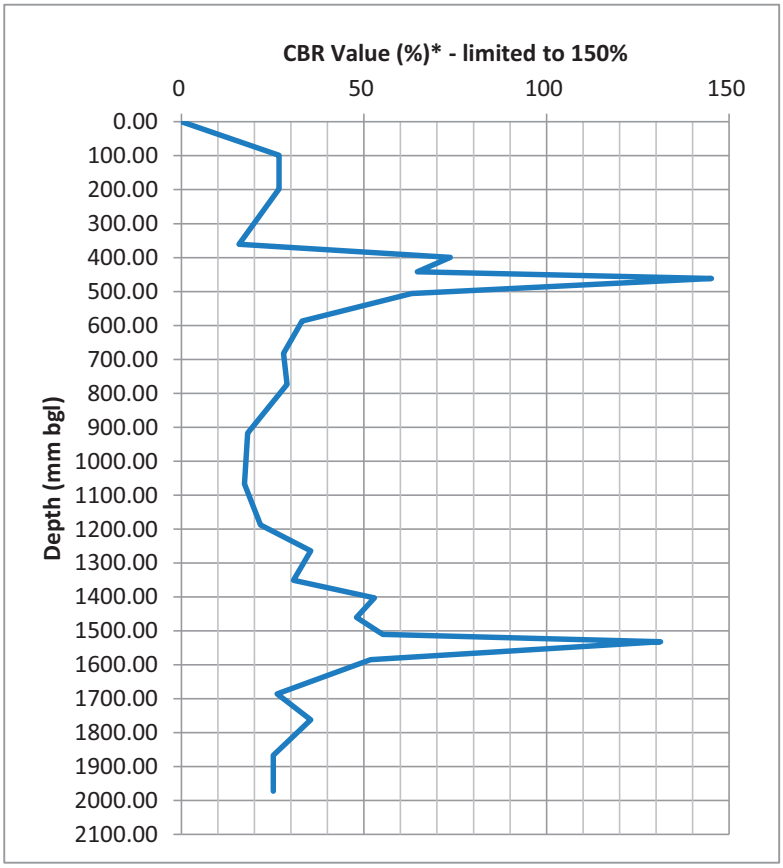
* CBR Interpretation in accordance with DMRB. Vol 7. Sec. 3 Chap.7 Clause 7.31 equation: CBR = $10^{((2.48 - 1.057 \times \text{Log}_{10}(\text{mm/blow}))}$

TRL Dynamic Cone Penetrometer - Determination of CBR Value (%)*

Site Name	Broadwater Rd, WGC	**Starting Depth (mm bgl)**	0.00
Job Number	2342-18	**Surface Level (m AOD)**	84.978
Test No.	DCP-TP405	**Easting**	524081.032
Date of Test	21-Sep-14	**Northing**	212804.633

Layer	Blows	Cumulative Blows	Layer Thickness (mm)	Total Depth (mm bgl)	CBR (%)*
1	30	30	361	361	**21.8**
2	20	50	81	442	**68.9**
3	120	170	1018	1460	**31.5**
4	20	190	72	1532	**78.0**
5	50	240	440	1972	**30.3**



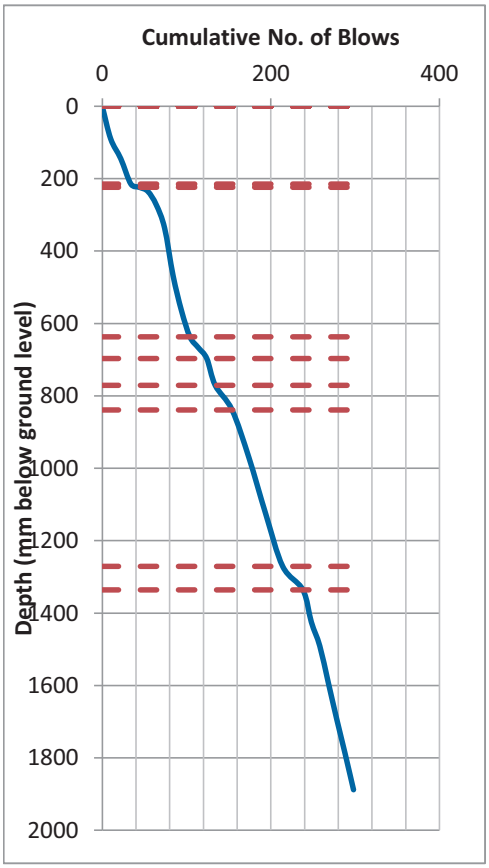


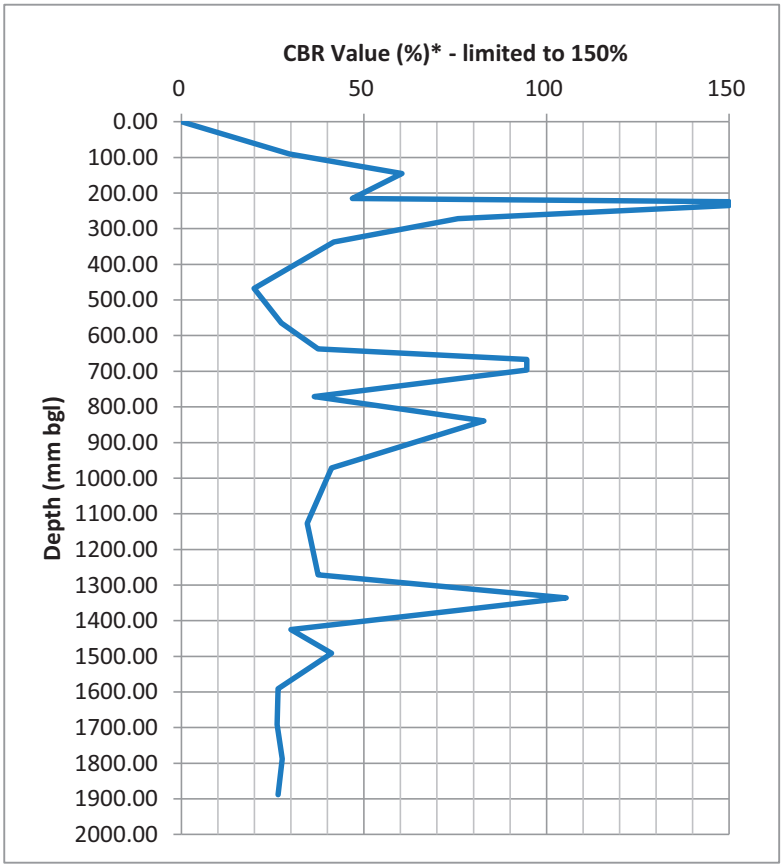
* CBR Interpretation in accordance with DMRB. Vol 7. Sec. 3 Chap.7 Clause 7.31 equation: CBR = 10((2.48 - 1.057 x Log 10(mm/blow))

TRL Dynamic Cone Penetrometer - Determination of CBR Value (%)*

Site Name	Broadwater Rd, WGC	**Starting Depth (mm bgl)**	0.00
Job Number	2342-18	**Surface Level (m AOD)**	84.978
Test No.	DCP-BH402	**Easting**	524081.032
Date of Test	09-Oct-14	**Northing**	212804.633

Layer	Blows	Cumulative Blows	Layer Thickness (mm)	Total Depth (mm bgl)	CBR (%)*
1	34	34	215	215	**43.0**
2	10	44	9	224	**>100**
3	60	104	413	637	**39.3**
4	20	124	60	697	**94.6**
5	10	134	74	771	**36.4**
6	20	154	68	839	**82.8**
7	60	214	432	1271	**37.5**
8	24	238	65	1336	**>100**
9	60	298	660	1996	**23.9**





* CBR Interpretation in accordance with DMRB. Vol 7. Sec. 3 Chap.7 Clause 7.31 equation: CBR = 10((2.48 - 1.057 x Log 10(mm/blow))

Appendix VI

WELWYN GARDEN CITY

SOIL INVESTIGATION

REPORT

Piezocone Test

Standard Data Interpretation

Project Ref.: 106006-1	Lankelma Limited Cold Harbour Lane Iden TN31 7UT East Sussex, UK Telephone: +44(0)1797280050 Email: info@lankelma.com Website: www.lankelma.com




PROJECT:	Welwyn Garden City

CLIENT:	Delta Simons

FIELDWORK

CPT Rig	20.5 tonne track-truck mounted CPT unit (UK15)
Date Fieldwork Started	23/10/2014
Date Fieldwork Completed	23/10/2014
Lankelma's Representative	Emma Stickland
Client's Representative	Simon Steele

REPORT

Status	Revision	Action	Date	Name
Final	0	**Completed**	27/10/14	Callum Davidson
		Checked	28/10/14	Emma Stickland
		Approved	28/10/14	Chris Dimelow

CONTENTS

SUMMARY TABLES

APPENDICES

1 INTRODUCTION

At the request of Delta Simons, a CPT led soils investigation was carried out on project *Welwyn Garden City*.

Site location:

Hyde Way
Welwyn Garden City
Hertfordshire
AL7 3AX

1.1 COMPLETED WORKS

- 10 nr. Piezocone Tests (CPTu); and
- Factual report plus standard geotechnical data interpretation.

The *Summary Tables* section details the field records.

2 FIELDWORK

2.1 CONE PENETRATION TESTING

Cone Penetration Tests were performed with a 20.5 tonne track-truck mounted CPT unit (UK15) equipped with an 18 tonne capacity hydraulic ram set.

An electric penetrometer of a type conforming to the requirements of clause 3.1 of BS1377: 1990: Part 9 was used on this project. Cone measurements included cone tip resistance, friction sleeve resistance and dynamic pore water pressure (Piezometer) sampled at a 10mm resolution. Cone maintenance, checks and calibrations were carried out in accordance with recommendations of the International Reference Procedure for CPTU (ISSMGE, 1999). Copies of all calibration certificates for the cones used are presented in Appendix A. Refer to the cone calibration certificates for the cone type and dimensional data.

The filter element was located in the u_2 position between the cone and friction sleeve and was replaced after every test. The pore pressure system was saturated with 1000cSt silicone fluid.

2.2 FIELD LOGISTICS

The client was responsible for the positioning and re-survey of all investigative locations.

Target depth for the investigation was 20m. Table 1 details the final test depths and reasons for test termination (*Refusal Factor)*. Termination depths were advised to, and agreed with, the client's on-site representative.

3 RAW DATA REDUCTION AND PRESENTATION

The CPT results are presented in Appendix B. The corrected cone resistance (qt), local side friction, pore water pressure, friction ratio and inclination are all presented against depth and elevation in accordance with recommendations of the International Reference Procedure for CPTU (ISSMGE, 1999). CPT data and the associated derived geotechnical parameters are included in the AGS 3.1 data file provided.

Penetration length readings are corrected for inclination and sleeve readings are depth corrected for the dimensional offset between cone tip and sleeve during post processing. An additional shift of -80mm is applied to the sleeve to account for tip failure zone offset (see 'CPT Interpretation Notes'). 'Rod spikes' (artefacts of the 1m interval pause for rod string addition) are filtered from the cone tip and sleeve data.

4 INTERPRETATIVE DATA

4.1 IN-SITU STRESS CONDITIONS

The in-situ total and effective stress states are calculated based on an assumed total unit weight of soil (17 kN/m^3 above the inferred piezometric surface and 18 kN/m^3 below) and a hydrostatic pore pressure state. The depth of the piezometric surface has been assumed at a generic 2mBGL across the site based on interpretation of piezocone measurements or other observations by Lankelma. The data are applied in calculation of stress normalised geotechnical parameters.

4.2 SOIL BEHAVIOUR TYPE

The Soil Behaviour Type (SBT) is presented as the Soil Behaviour Type Index, I_c, for both stress-normalised and non-normalised evaluations according to the charts of Robertson (1998 & 2010) applicable to predominantly silicate soils.

The I_c provides a continuous profile of SBT variation with depth such that the end user may choose appropriate stratigraphic subdivisions. The basis of I_c and its approximation of the original chart classification zones may be seen from Appendix A figure 'CPT Soil Behaviour Type Chart'. The loss of fidelity is dominantly in zones 1 (*sensitive fine grained)* and zones 8 & 9 (*overconsolidated or cemented*). To account for this approximation a profile of sensitivity and OCR is provided in the Standard Interpretation Results (see section 'Geotechnical Parameters').

Non-stress normalised SBT index I_c:

$$I_c = \left[\left(3.47 - \log\left(\frac{q_c}{\sigma_{atm}}\right)^2\right)^2 + (\log R_f + 1.22)^2\right]^{0.5}$$

Stress-normalised SBT index I_c:

$$I_c = ((3.47 - \log Q_t)^2 + (\log F_r + 1.22)^2)^{0.5}$$

(See glossary of terms and symbols Appendix A)

The results are presented on the plots of Appendix C – *Standard Interpretation Results*.

4.3 GEOTECHNICAL PARAMETERS

4.3.1 RELATIVE DENSITY

The relative density of sands is calculated based on an empirical relationship proposed by Jamiolkowski *et al.* (2001) based on a large database of undisturbed frozen samples and calibration chamber tests. The expected accuracy may be evaluated from the distribution of calibration data in the figures presented below. The relationship has the following form:

$$D_r = 100\left[0.268 \cdot \ln\left(\frac{q_t/\sigma_{atm}}{\sqrt{\sigma_{vo}'/\sigma_{atm}}}\right) - k\right]$$

(See glossary of terms and symbols Appendix A – *General Information*)

K = Compressibility dependant constant. For medium compressibility = -0.675 (applied generic value), for high compressibility and sands with significant carbonate or calcareous composition <=1, for low compressibility >=-2.0

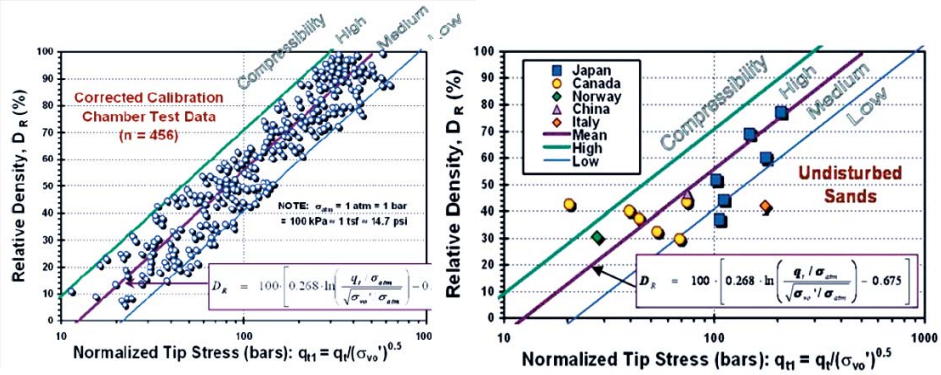


Figure 4-1 Relative density with normalised tip stress and sand compressibility from calibration chamber tests (left) and undisturbed frozen samples (right). Jamiolkowski *et al.* (2001) (Reproduced from NCHRP Synthesis 368 (2007)).

The results are presented on the plots of Appendix C – *Standard Interpretation Results*.

4.3.2 UNDRAINED SHEAR STRENGTH

S_u is estimated from the net cone tip resistance using the following equation:

$$s_u = \frac{(q_c - \sigma_{vo})}{N_k}$$ (Lunne *et al.* (1981))

where N_k is an empirical cone factor.

Research has shown that the cone factor N_k varies between 11 and 21 for normally to moderately overconsolidated soils with an average value of 15. For moderately to heavily overconsolidated soils the N_k factor may range from 20 to 30+. S_U values are presented for N_k factors of 15 and 20.

The results are presented on the plots of Appendix C – *Standard Interpretation Results*.

4.3.3 OVERCONSOLIDATION RATIO

The preconsolidation stress of clays is calculated based on the method proposed by Mayne (1995) and Demers and Leroueil (2002) and has the following form:

$$\sigma_p' = k \cdot (q_t - \sigma_{vo}) = 0.33(q_t - \sigma_{vo})$$

$$OCR = \sigma_p'/\sigma_{v0}'$$

(See glossary of terms and symbols Appendix A)

The factor k may be expected to lie in the range 0.2 to 0.5 with 0.33 representing the average.

Higher values of k are recommended for aged heavily overconsolidated clays (Robertson, 2009) and may be calibrated accordingly. The figure below demonstrates the expected accuracy of the above methods in prediction of preconsolidation stress, of particular note is the under prediction for fissured clays.

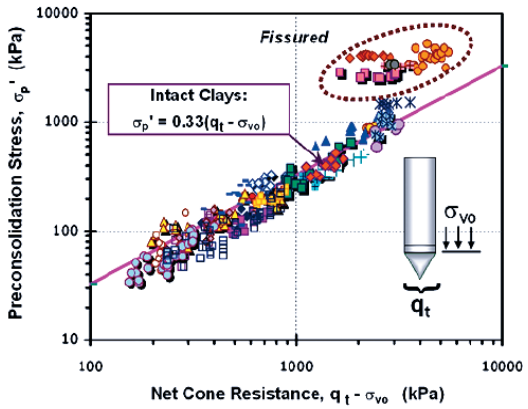


Figure 4-2 Preconsolidation stress from net cone resistance in clays (Reproduced from Mayne (2007)).

4.3.4 SENSITIVITY

The sensitivity of the soil, as defined by the ratio of undrained shear strength to remoulded shear strength, is calculated using the factored normalised cone resistance (S_u) and remoulded shear strength taken as equal to the direct friction sleeve measurement. The relationship has the following form (Mayne, 2007):

$$s_t = 0.073 \cdot (q_t - \sigma_{vo})/f_s$$

(See glossary of terms and symbols Appendix A – *General Information*)

The results are presented on the plots of Appendix C – *Standard Interpretation Results*.

5 CPT DATA INTERPRETATION NOTES

Provided below is an inexhaustive set of cautionary notes on interpretation of the acquired CPT data with reference to examples within the dataset where appropriate.

SOIL BEHAVIOUR TYPE

The soil behaviour type (SBT) as defined by Robertson *et al.* (1986) is not intended to replace soil classification based on particle size fractions. Rather, the SBT will generally show bias in the classification towards the soil fraction that dominates soil behaviour in response to cone penetration (Cone tip: analogous to bearing capacity failure, friction sleeve: analogous to remoulded S_u or simple shear). In general the stress-normalised SBT will be more accurate, but may be less reliable at very shallow depths (1-2m) due to the particular stress normalisation procedure applied.

DRAINED AND UNDRAINED SOIL BEHAVIOUR

Geotechnical parameters appropriate for drained and undrained cone penetration conditions are derived for drained and undrained soil behaviour types (SBTs) respectively, however to account for uncertainty in the SBT correlation with drainage behaviour, all parameters are derived over the range of mixed soil types 'Silt Mixtures' and 'Sand Mixtures' or *Ic* 2.05-2.95 (Robertson, 2010). For partially drained conditions, or for partially saturated low permeability soils, error will be introduced within derived parameters.

Piezocone dynamic pore water pressures behaviour, dissipations or other site specific observations may be used to identify the appropriate limits of application. Dissipations to t_{50} exceeding 30 seconds indicate undrained penetration behaviour (Kim *et al.*, 2010).

DYNAMIC PORE PRESSURE DATA

During penetration, strong dilation in shear at the cone shoulder may result in cavitation and desaturation of the piezo system and may take time to recover (up to 1m penetration). Penetration through soils of partial saturation will provide unrepresentative readings and may desaturate the piezo system introducing variable error.

CONE TIP AND SLEEVE OFFSET

The accuracy of the SBT is sensitive to offset error in the friction ratio. Penetration through zones of anisotropic soil stiffness may lead to offset of the cone tip and sleeve readings due to variation in the tip failure zone shape/depth. For low to moderate risk projects this is generally insignificant. The friction ratio is often inaccurate in heavily disturbed soils with a 'blocky' macro fabric.

For this investigation a friction sleeve depth offset correction of -80mm was applied together with a 5 data point moving average on the friction ratio to minimise the influence of this effect on derived parameters.

CONE TYPE

The reference cone type has a 10cm^2 projected cone tip area and 150cm^2 friction sleeve area (S10 cone). In practice it is common to use an alternative cone having a 15cm^2 tip area with a 200 – 225cm^2 sleeve area (S15 cone) for improved sensitivity and penetration depth potential. Use of the S15 cone will have the following known influences on data with respect to the reference S10:

- More pronounced transitions zones and thin layer effects (larger zone of influence and failure zone).
- Possible marginal increase in u_2 position dynamic pore pressures in undrained/partially drained penetration.

TRANSITION ZONES AND THIN LAYER EFFECTS

During penetration at the boundary between soils of contrasting stiffness, a transition zone is often evident prior to mobilization of the true soil stiffness. These should be cautiously ignored in assessment of soil behaviour type and parameter evaluation. Where the stiff layer is thin (<~0.5m) the true stiffness will not be fully mobilised. The effect for thin low stiffness layers is less significant. Procedures for thin-layer effect correction are provided by Robertson and Wride (1998). In choosing characteristic values of the tip, sleeve and derived parameter results, large scale peak and trough values may be more representative of the local value.

GRAVELS

The presence of gravel or larger clasts in a soil is often characterised by short peaks in the CPT tip and sleeve readings, possibly with associate inclinometer ‘shake’ and/or sharp reductions in pore water readings due to dilation effects. Frequent gravels in soft or loose soils may generate highly erroneous friction ratio values. Where gravels are matrix supported the tip and sleeve peaks may be ignored or filtered in choosing characteristic values for bulk behaviour.

6 REFERENCES

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SUMMARY TABLES

Table 1 CPT Test Summary

TEST ID	FINAL DEPTH (mBGL)	Cone ID {C=Cone tip; F=Friction Sleeve; I= Inclination; P = Piezo; S=Subtraction cone; 15/10 = cone projected area (cm2))}	CPT RIG	PRE DRILLED / INSPECTION PIT (m)	CASING DEPTH (m)	REFUSAL FACTOR	DISSIPATIONS	SEISMIC CONE	SAMPLES	EASTING	NORTHING	ELEVATION (m)	DATE OF TEST	REMARKS
CPT401	19.70	S15-CFIP.843	UK15	8.00		Target depth				524113.58	212667.21	84.56	23/10/2014	
CPT402	10.71	S15-CFIP.843	UK15	8.00		Lateral support				524164.75	212638.96	84.46	23/10/2014	
CPT403	20.20	S15-CFIP.843	UK15	8.00		Target depth				524176.08	212732.72	84.47	23/10/2014	
CPT404	20.21	S15-CFIP.843	UK15			Target depth				524256.84	213021.70	84.15	23/10/2014	
CPT405	19.82	S15-CFIP.843	UK15	6.00		Total reaction load				524141.44	213021.46	84.66	23/10/2014	
CPT406	8.09	S15-CFIP.843	UK15	8.00		Lateral support				524054.08	212913.08	85.08	23/10/2014	
CPT407	6.47	S15-CFIP.843	UK15			Total cone load				524192.11	212866.79	85.14	23/10/2014	
CPT408	8.33	S15-CFIP.843	UK15	8.00		Lateral support				524056.30	212880.65	85.69	23/10/2014	
CPT408A	8.33	S15-CFIP.843	UK15	8.00		Lateral support				524056.30	212880.65	85.69	23/10/2014	
CPT408B	20.21	S15-CFIP.843	UK15	8.00		Target depth				524056.30	212880.65	85.69	23/10/2014	

CPT Test Plots are presented in Appendices B and C

APPENDIX A GENERAL INFORMATION

LIST OF FIGURES

LANKELMA

Cone Calibration Certificate

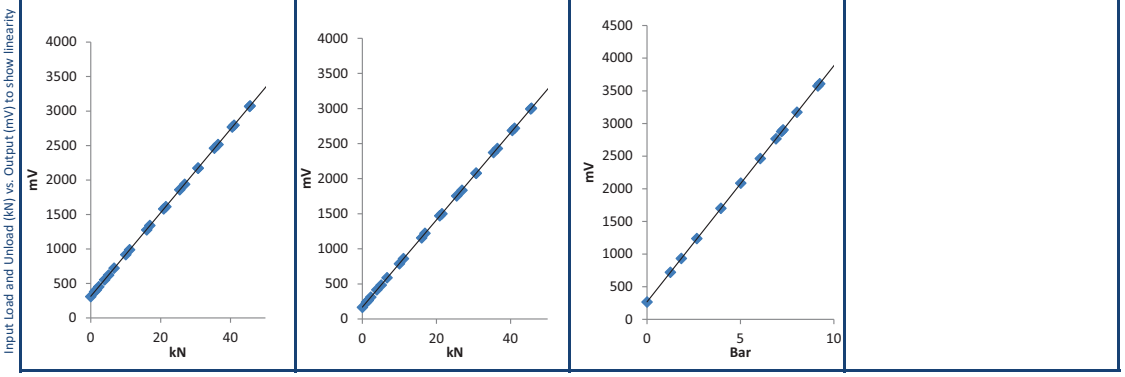
Cone number	S15-CFIP.843
Type	Subtraction 150kN, 1500mm²
Calibration date	02/09/2014
Calibration expiry	01/12/2014
Engineer	A Harman

Digitally signed by Alastair Harman
DN: cn=Alastair Harman, o=Lankelma Ltd, ou=Instrument Engineer, email=Alastairharman@lankelma.com, c=GB
Date: 2014.09.02 16:26:54 +01'00'

Signed and dated by: | Checked and dated by:

	Serial number	Last Calibration Date	Max error	Error unit
Load cell	1171080	22/04/2014	0.1	% of rec value
DMM (load cell)	096526	03/12/2013	0.017@ 200mV	% of rec value
DMM (cone)	097936	03/12/2013	0.020@ 20V	% of rec value
DMM (sleeve)	224837	02/07/2014	0.020@ 20V	% of rec value
Power supply	326B026G2	06/12/2013	≤0.01 Regulation	% of rec value
Pressure meter	4009509	03/12/2013	+/- 0.01 bar	@ Full range

Load qc [kN]	Output qc [mV]	Load fs [kN]	Output fs [mV]	Load pp [bar]	Output pp [mV]	Inclination [degrees]	Output inc [mV]
0.000	311.1	0.000	166.0	0.002	263.9		*X*
1.077	380.9	1.077	238.3	1.253	720.0	0	2646
2.298	453.3	2.298	312.1	1.839	933.6		
5.100	620.8	5.100	483.8	2.671	1235.6		
9.984	917.2	9.984	788.1	3.956	1700.3		*Y*
16.002	1276.3	16.002	1156.6	5.022	2086.4	0	2521
21.490	1612.9	21.490	1500.1	6.062	2462.2		
26.886	1937.5	26.886	1835.2	7.206	2876.0		
30.704	2171.4	30.704	2075.2	8.025	3170.7		
36.412	2514.4	36.412	2428.9	9.144	3573.8		
41.029	2795.7	41.029	2717.2	10.190	3950.4		
45.623	3076.5	45.623	3003.4	9.243	3607.0		
52.364	3481.2	52.364	3418.4	7.285	2902.2		
45.439	3067.0	45.439	2993.5	6.903	2764.5		
40.466	2767.8	40.466	2686.8	6.196	2508.5		
35.381	2461.2	35.381	2372.4	4.929	2049.1		
30.659	2175.1	30.659	2078.8	4.303	1823.1		
25.438	1858.9	25.438	1754.2	3.246	1438.8		
20.872	1582.3	20.872	1470.8	2.218	1066.9		
16.878	1340.8	16.878	1222.3	0.868	577.5		
11.075	988.1	11.075	861.2	0.002	264.5		
6.677	721.5	6.677	586.7				
3.922	552.7	3.922	414.4				
1.569	408.4	1.569	266.1				
0.000	311.1	0.000	166.4				
Zeroshift mV	**311**		**166**		**263**		
Zeroshift Difference mV	0.0		-0.4		-0.6		
mV at Nominal	3339		3273		7501		
Best Fit Slope	60.55453974		62.13628398		361.8687038		
Linearity Load	0.999996		0.999996		0.999997		
Linearity Unload	0.999995		0.999995		0.999998		
% Max Hysteresis Error	0.0770		0.1590		-0.0487		
Nominal *F* kN	**50**		**50**		**20**		**25**
Maximum *F* kN	150		150		30		25
Calibration No.	**3028**		**3107**		**7237**		

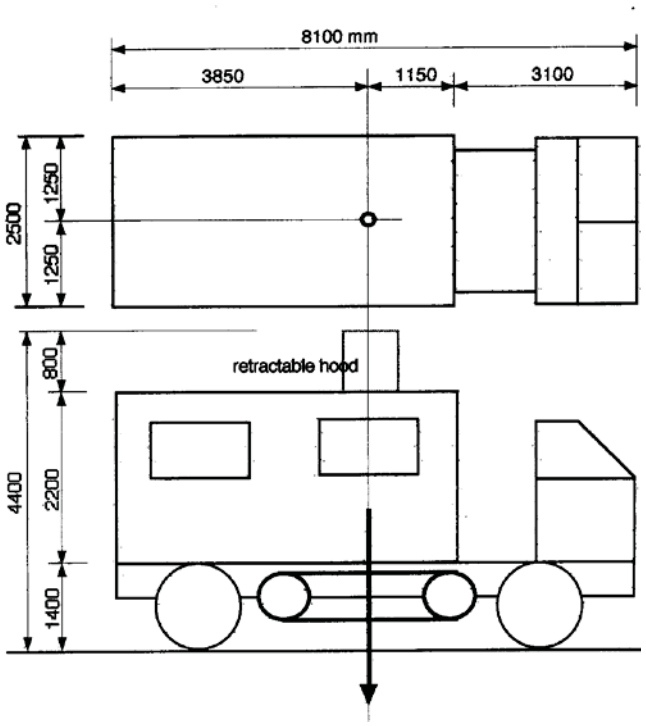


	Dimensional Values in mm					
	Straightness	Sleeve Ø	Sleeve T/B Ødiff	Tip Ø	Tip Definition	Crosstalk MΩ
Tolerance	0.5mm	43.6 Min.	0.3 Max	43.4 Min.	Qualitative Ass.	Must be None
Actual	0.34	43.8	0.08	43.5	pass	pass
Replaced						

Note : Check all dimensions before testing as the tip and sleeve are consumable items.

UK15-Track-Truck CPT Unit

Technical Detail	
Specification	**Dimensions**
Weight	20.5 tonnes
Maximum Ram Capacity	18 Tonnes
Maximum Operating Capacity	17 Tonnes
Maximum Travelling Speed	86.4 km/h
Track Material	Steel
Length of Tracks	3.30m
Width of Tracks	0.65m
Jack Plate Dimensions	Tracks act as jacks
Jack Length	-
Jack Arrangements	1 on each side
Maximum Ground Clearance when Jacks Deployed	0.21m
Maximum Ground Bearing Pressure (Tracking/Pushing)	51kPa
Maximum Bearing Pressure when Pulling	95kPa
Maximum Testing Gradient	10°
Maximum Traversing Gradient	30° Assessed by Operator
Noise Output at 2m	Testing – 81dBA
	Driving 89dBA
Fuel	Diesel
Hydraulics	Non Biodegradable
Clamp Arrangement	Hydraulic Dial Clamp
Data Acquisition System	Fixed Geo-Explorer
Ram Stroke	1.24m
Casing Size	Up to 60mm



Special Features

- Ability to work on marginal sites
- Highly versatile
- Ability to drive from the back and front
- Traverse over public highway and soft ground

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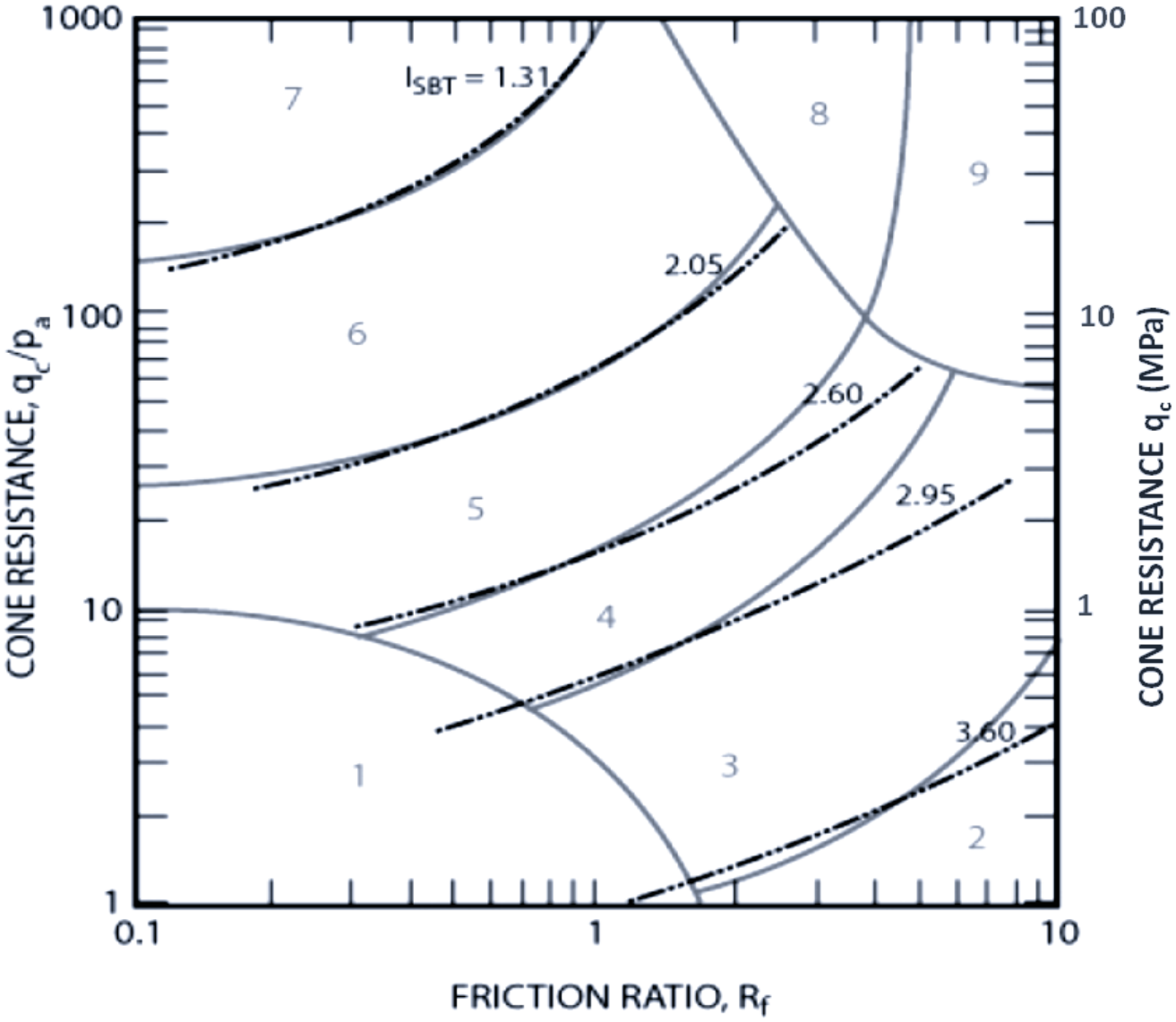
Issue 1 – March 2014

CPT SOIL BEHAVIOUR TYPE CHART



Non-normalised SBT chart by Robertson *et al.* (2010) based on dimensionless cone resistance (qc/Pa) and friction ration, Rf, showing contours of *Ic* index. The chart is also applicable to stress-normalised tip/sleeve values Q_t and F_r.

Zone	Soil Behaviour Type (SBT)		
1	Sensitive fine-grained	6	Sands: clean sand to sandy silt
2	Clay – organic soil	7	Dense sand to gravelly sand
3	Clays: Clay to silty clay	8	Stiff sand to clayey sand*
4	Silt mixtures: clayey silt to silty clay	9	Stiff fine grained*
5	Sand mixtures: Silty sand to sandy silt	*Overconsolidated or cemented	

GLOSSARY OF CPT TERMS AND SYMBOLS

SYMBOLS

q_c :- **Cone resistance.** The total force acting on the cone Q_c, divided by the projected area of the cone, A_c; **(q_c=Q_c/A_c)**.

f_s :- **Friction sleeve resistance.** The total frictional force acting on the friction sleeve, F_s, divided by its surface area, A_s.**f_s= F_s/A_s**.

q_t :- **Corrected cone resistance.** The cone resistance q_c corrected for unequal pore water pressure effects on the cone face and shoulder.

R_f :- **Friction ratio** The ratio, expressed as a percentage, of the sleeve friction, f_s, to the cone resistance, q_c, both measured at the same depth; **[R_f= (f_s/q_c) · 100].**

Q_t :- **Stress normalised cone resistance** (Method 1) **= (q_c – σ_v)/σ'_v**

q_{t1}:- **Stress normalised cone resistance** (Method 2) **= (q_t)/(σ'_v)$^{0.5}$**

F_r:- **Normalised friction sleeve resistance = f_s /(q_c- σ_v)**

σ_v:- **Total overburden stress**

σ'_v:- **Effective overburden stress**

σ_{atm}, or, P_a:- **Reference atmospheric stress = 100kPa**

***I_c*:-** **Soil Behaviour Type Index**

B_q :- **Pore pressure ratio.** The net pore pressure normalized with respect to the net cone resistance. = **(u_2 – u_0)/(q_t -σ_v)**

TERMS

Cone Tip:- The conical tip section of the cone penetrometer.

Friction sleeve:- The section of the cone penetrometer upon which the sleeve friction is measured, located behind the cone tip.

Piezocone:- A cone penetrometer with a pore pressure measurement system.

Dynamic pore pressure:- The pore pressure generated during penetration and measured by a pore pressure sensor. u_1 when measured on the conical tip face, u_2 when measured just behind the conical tip.

APPENDIX B CONE PENETRATION TEST RESULTS

RAW DATA PLOTS

LIST OF FIGURES:

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

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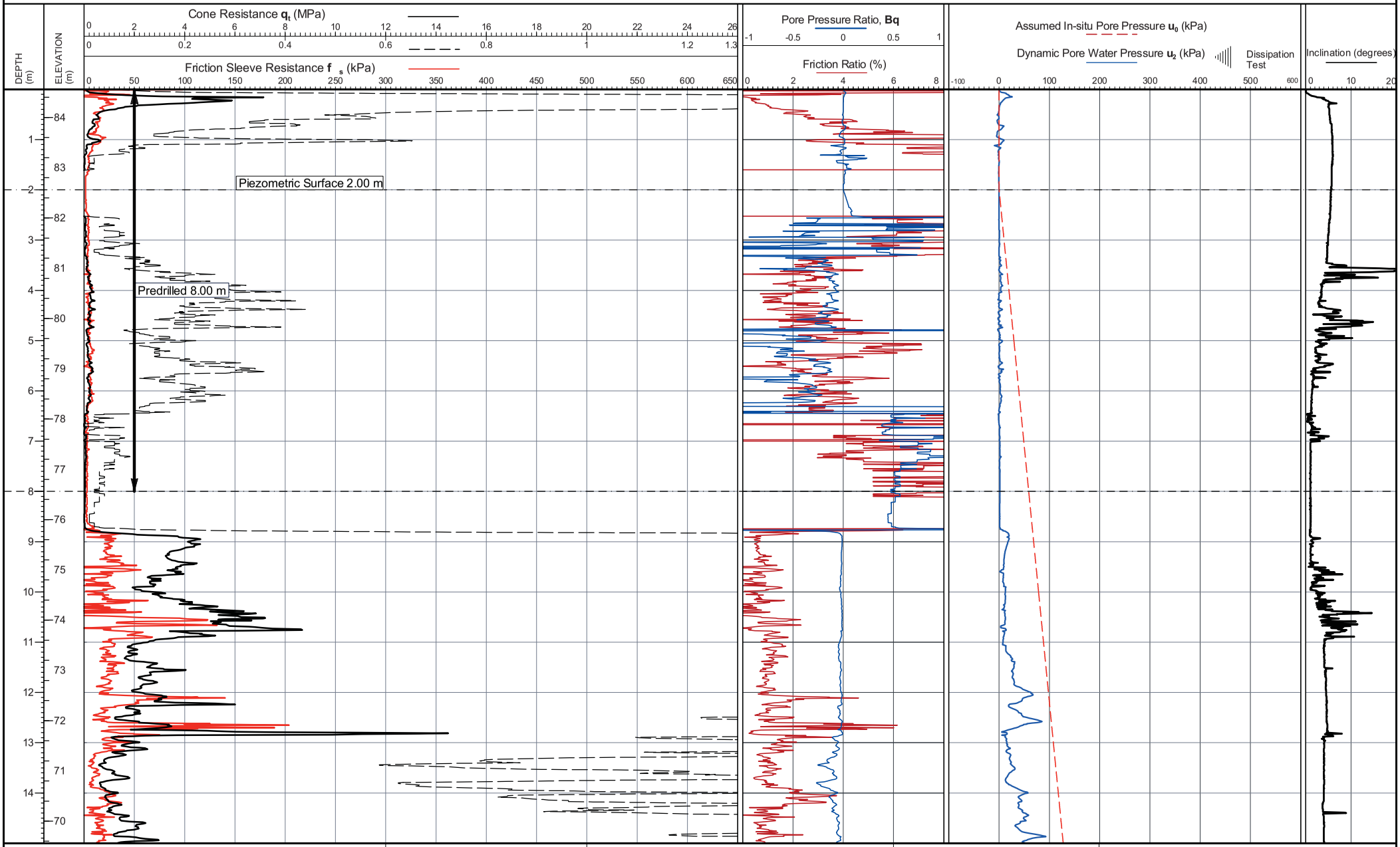


Cone area (mm2):1500
Cone ID: S15-CFIP.843
Operator: Ben Ranson
Rig Used: UK15
Date of test: 23/10/2014 10:48:27

Location: Hertfordshire
Coordinates: 524113.58, 212667.21
Elevation: 84.56
Coordinate system:

Remarks:
*Piezometric surface origin: Est. from u2 piezo data

Termination Remark: Target depth

Date of plot: 27-10-14
Lankelma Project Ref: P-106006-1

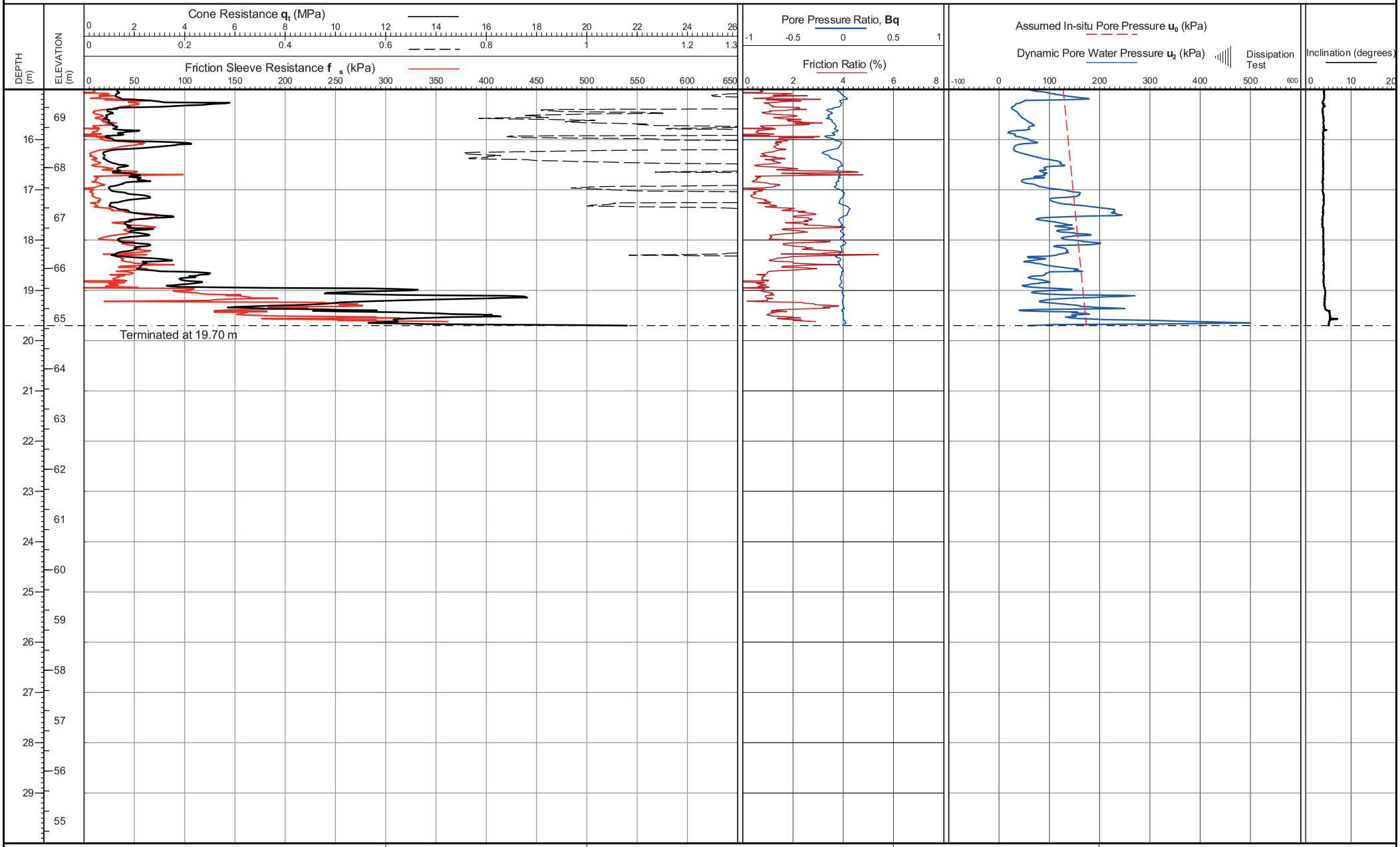
Checked by:
Emma Stickland

TEST ID: CPT401

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



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Operator: Ben Ranson
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Date of test: 23/10/2014 10:48:27

Location: Hertfordshire
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Remarks:
*Piezometric surface origin: Est. from u2 piezo data

Termination Remark: Target depth

Date of plot: 27-10-14
Lankelma Project Ref: P-106006-1

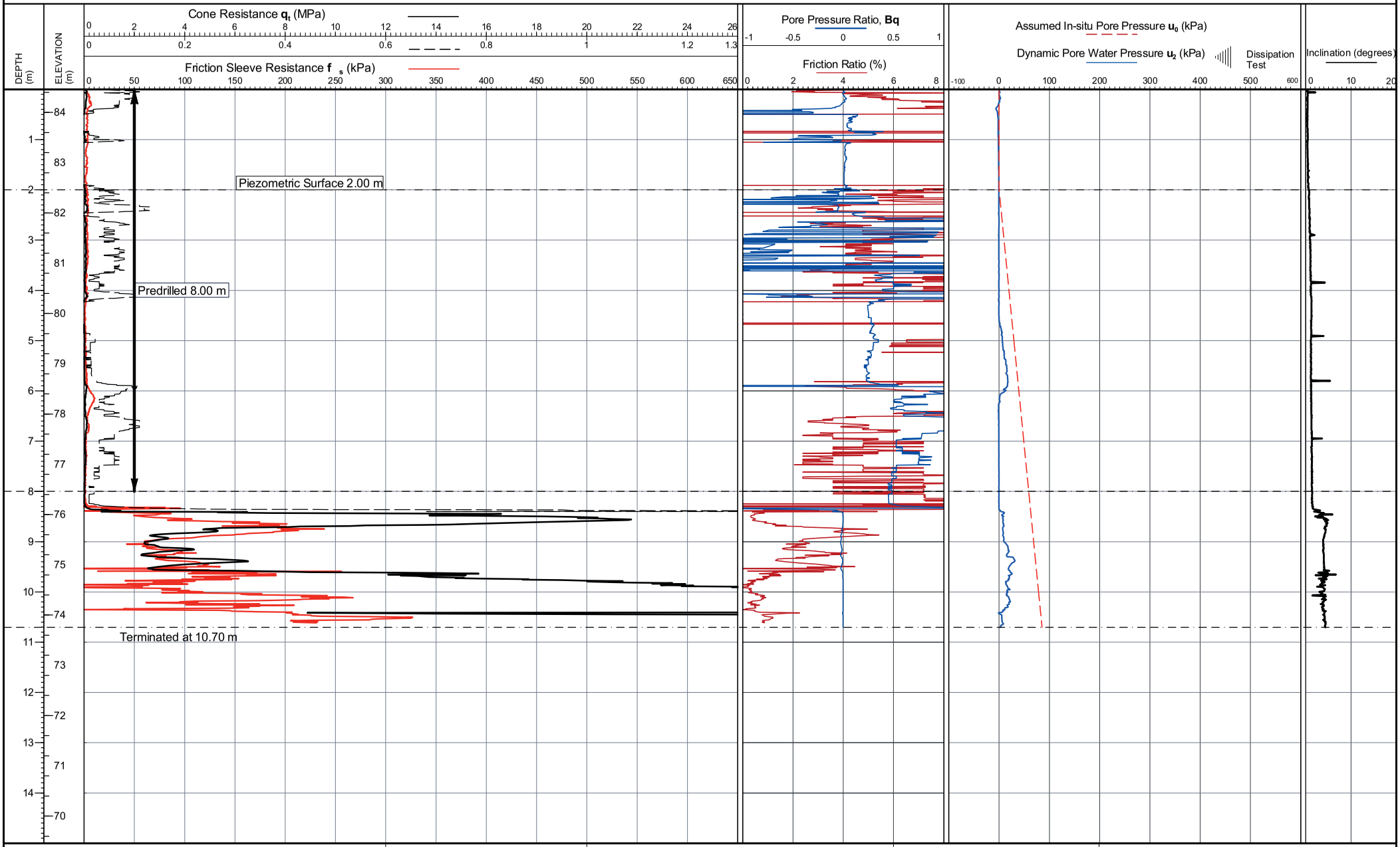
Checked by:
Emma Stickland

TEST ID: CPT401

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



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Operator: Ben Ranson
Rig Used: UK15
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Location: Hertfordshire
Coordinates: 524164.75, 212638.96
Elevation: 84.46
Coordinate system:

Remarks:
*Piezometric surface origin: Est. from u2 piezo data

Termination Remark: Lateral support

Date of plot: 27-10-14
Lankelma Project Ref: P-106006-1

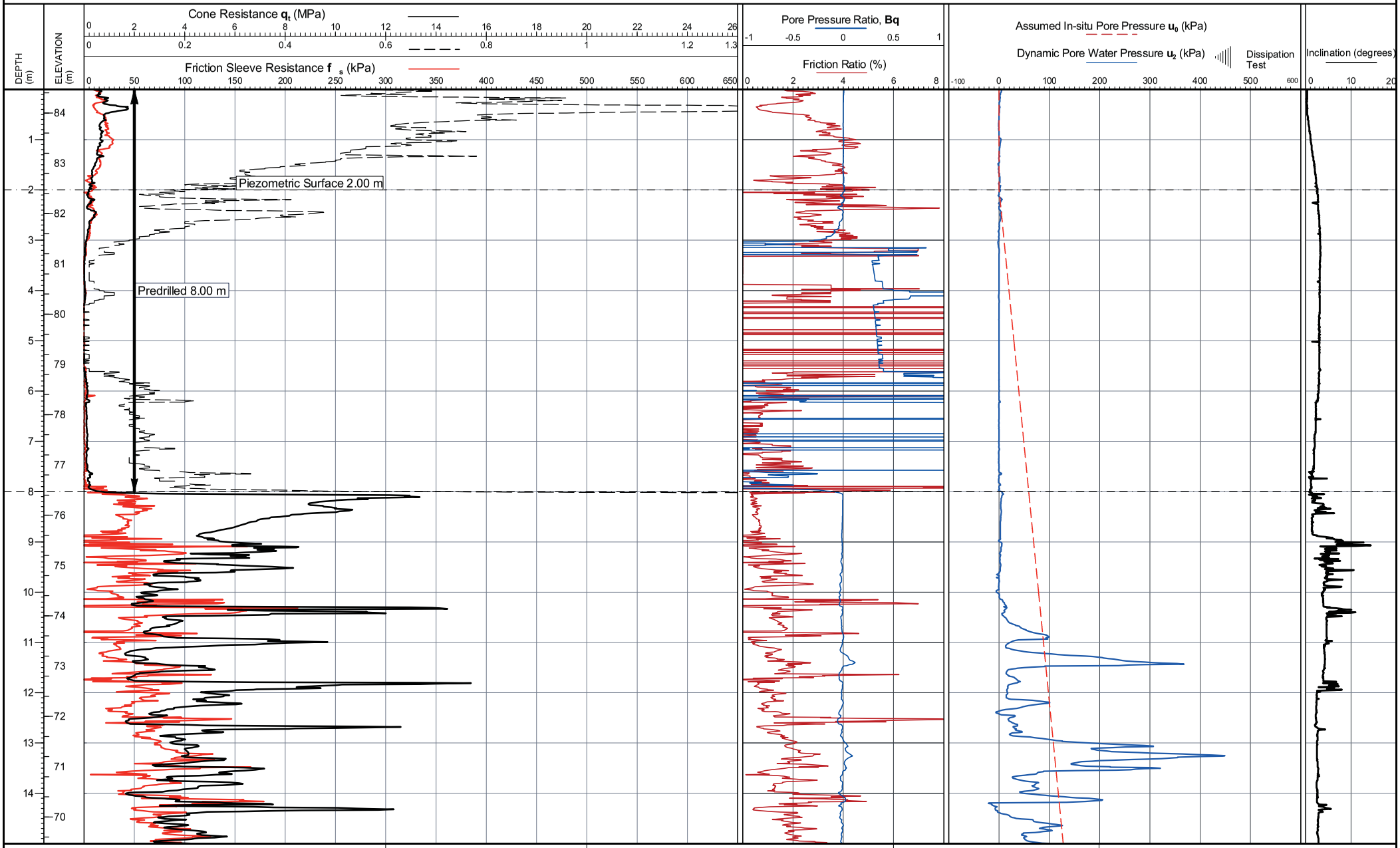
Checked by:
Emma Stickland

TEST ID: CPT402

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.843
Operator: Ben Ranson
Rig Used: UK15
Date of test: 23/10/2014 09:05:10

Location: Hertfordshire
Coordinates: 524176.08, 212732.72
Elevation: 84.47
Coordinate system:

Remarks:
*Piezometric surface origin: Est. from u2 piezo data

Termination Remark: Target depth

Date of plot: 27-10-14
Lankelma Project Ref: P-106006-1

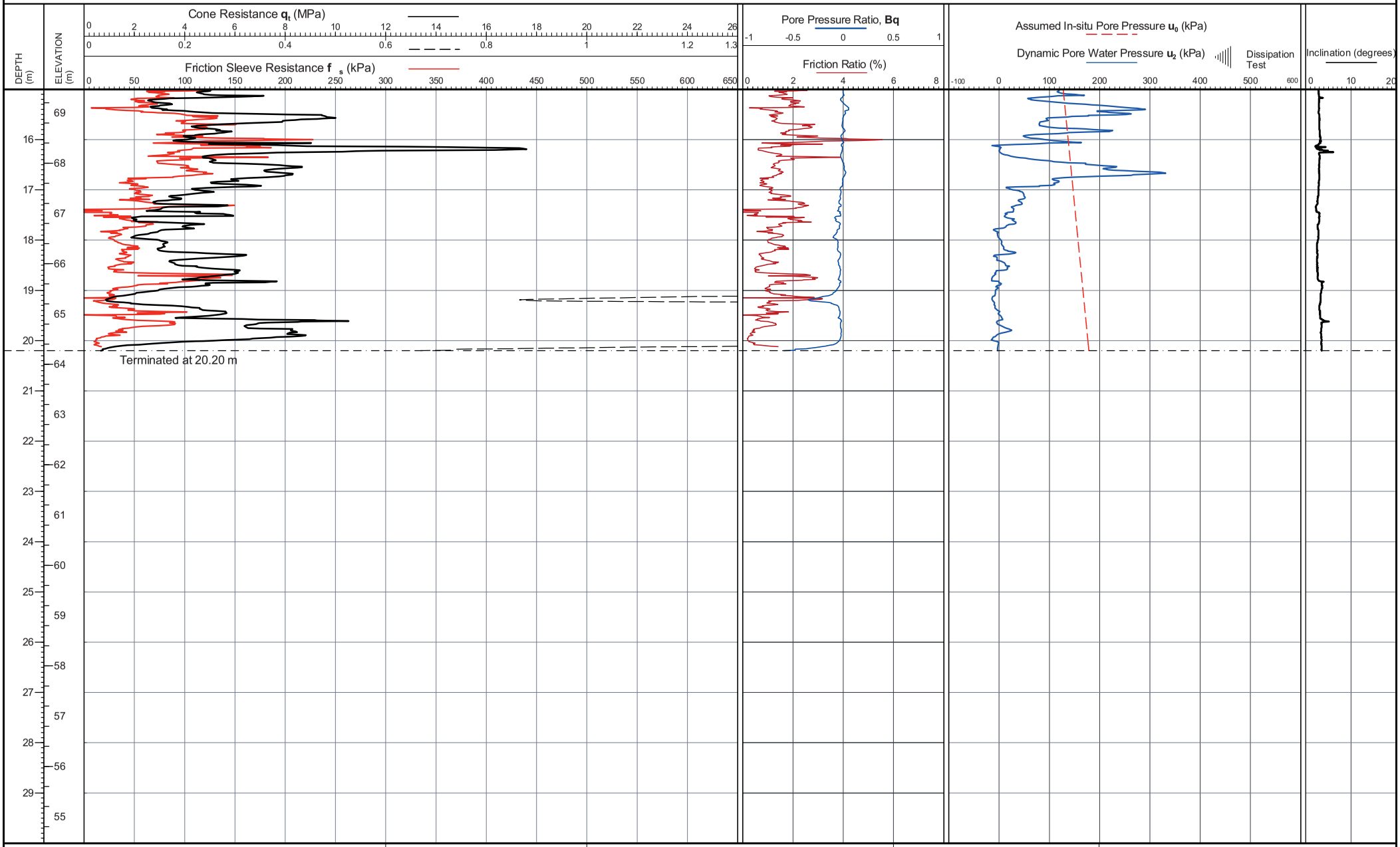
Checked by:
Emma Stickland

TEST ID: CPT403

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



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Coordinates: 524176.08, 212732.72
Elevation: 84.47
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Termination Remark: Target depth

Date of plot: 27-10-14
Lankelma Project Ref: P-106006-1

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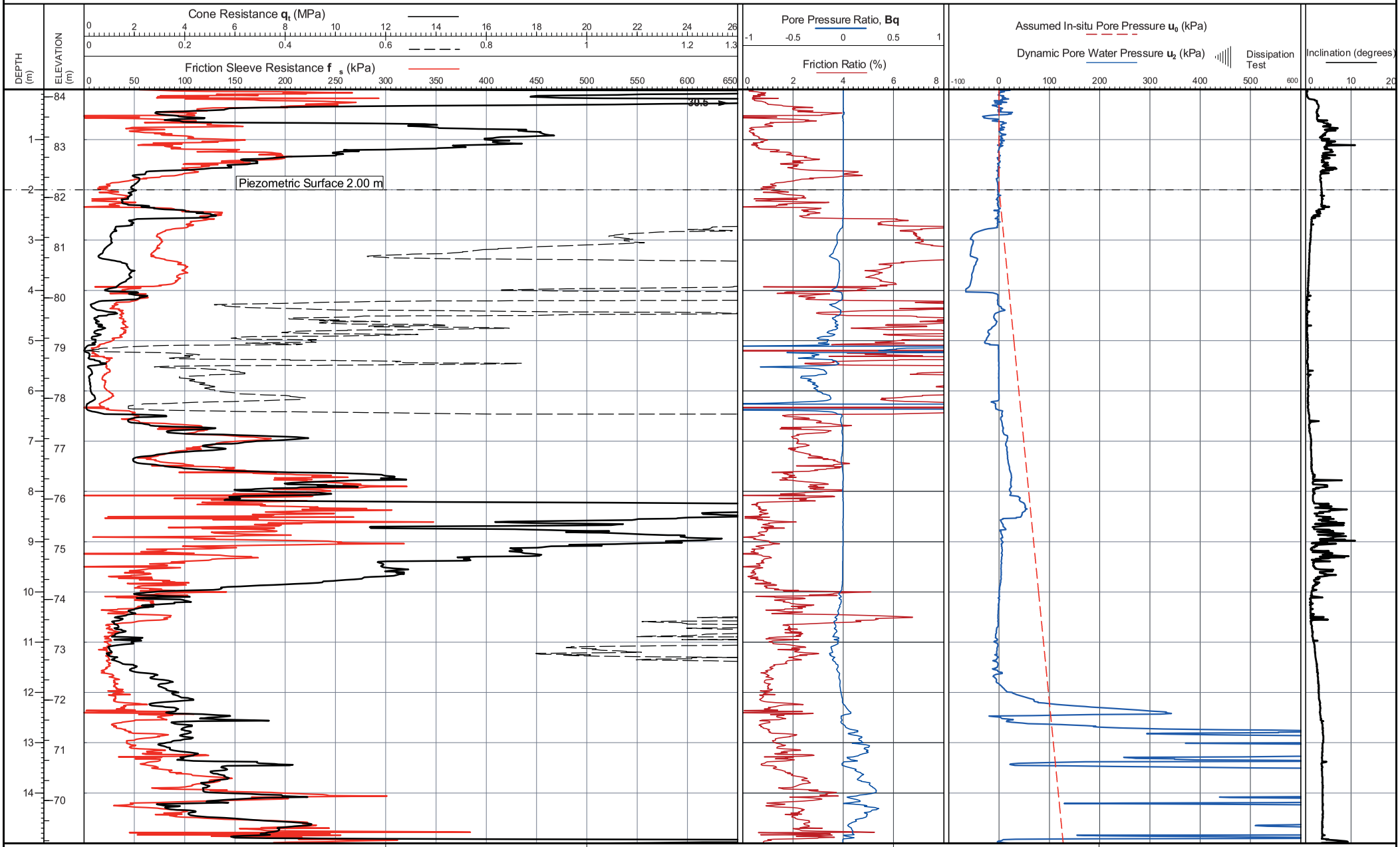
Emma Stickland

TEST ID: CPT403

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



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Cone ID: S15-CFIP.843
Operator: Ben Ranson
Rig Used: UK15
Date of test: 23/10/2014 14:31:58

Location: Hertfordshire
Coordinates: 524256.84, 213021.7
Elevation: 84.15
Coordinate system:

Remarks:
*Piezometric surface origin: Est. from u2 piezo data

Termination Remark: Target depth

Date of plot: 27-10-14
Lankelma Project Ref: P-106006-1

Checked by:
Emma Stickland

TEST ID: CPT404

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

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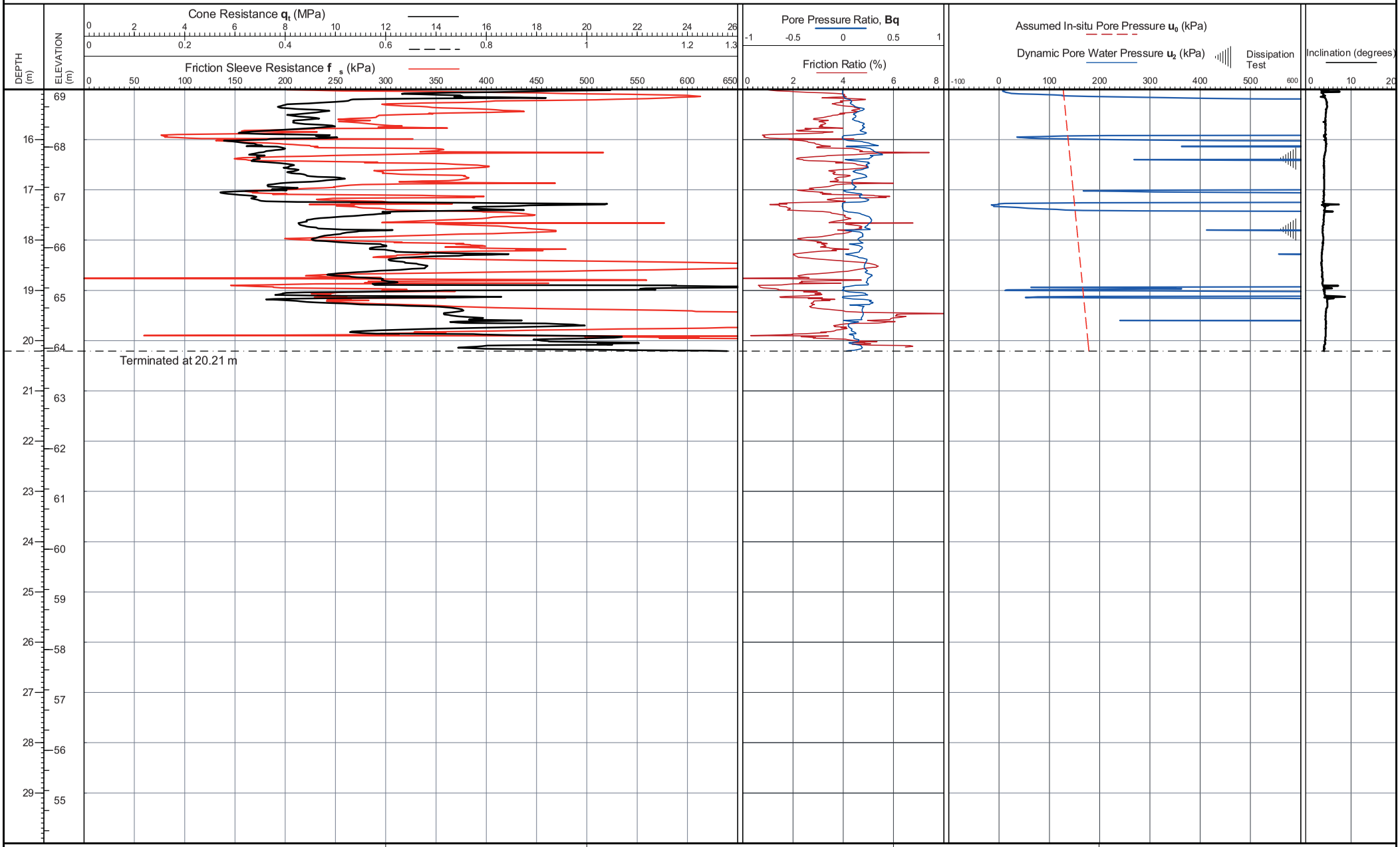

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Cone ID: S15-CFIP.843
Operator: Ben Ranson
Rig Used: UK15
Date of test: 23/10/2014 14:31:58

Location: Hertfordshire
Coordinates: 524256.84, 213021.7
Elevation: 84.15
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Date of plot: 27-10-14
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Emma Stickland

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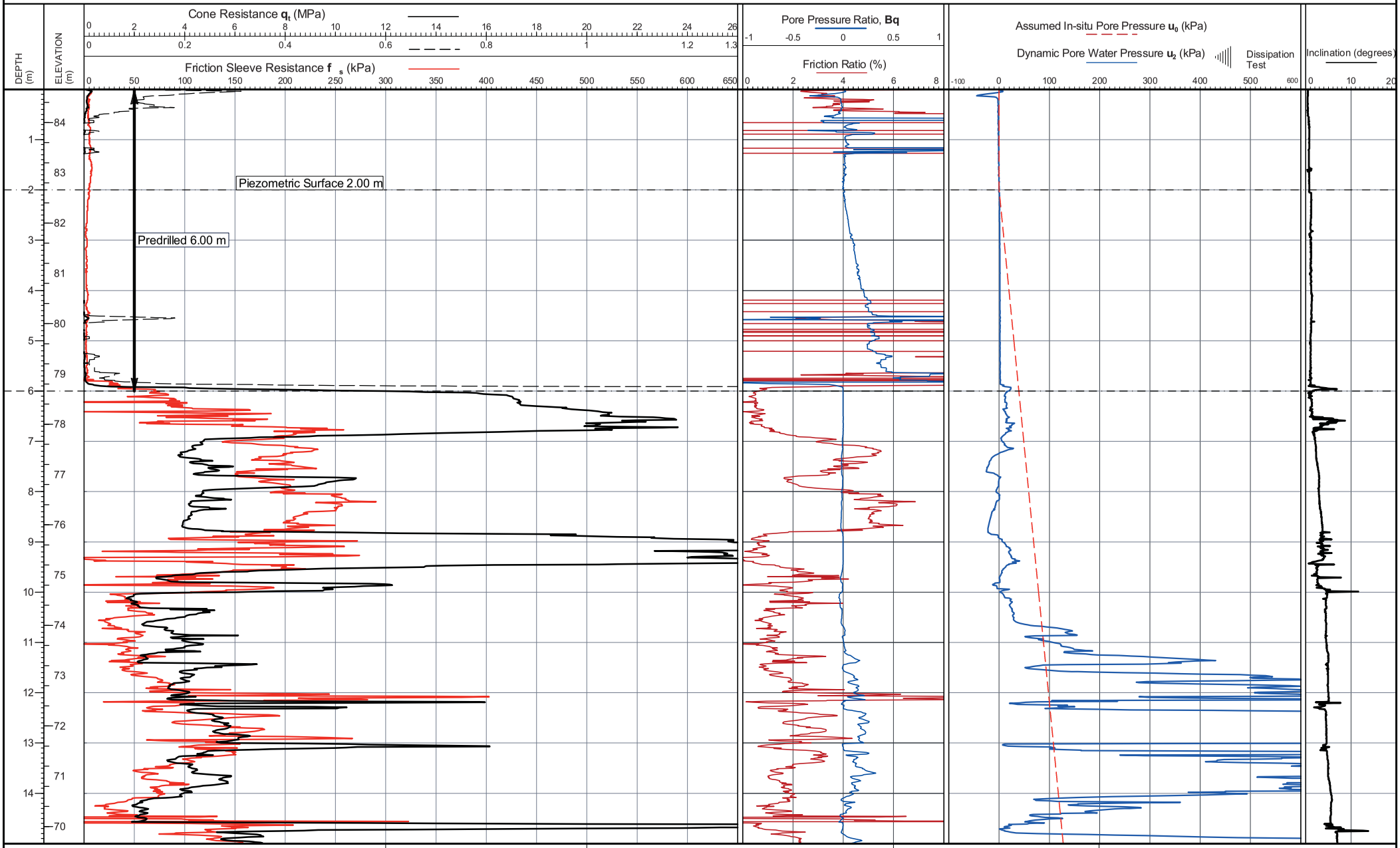

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Cone ID: S15-CFIP.843
Operator: Ben Ranson
Rig Used: UK15
Date of test: 23/10/2014 15:33:32

Location: Hertfordshire
Coordinates: 524141.44, 213021.46
Elevation: 84.66
Coordinate system:

Remarks:
*Piezometric surface origin: Est. from u2 piezo data

Termination Remark: Total reaction load

Date of plot: 27-10-14
Lankelma Project Ref: P-106006-1

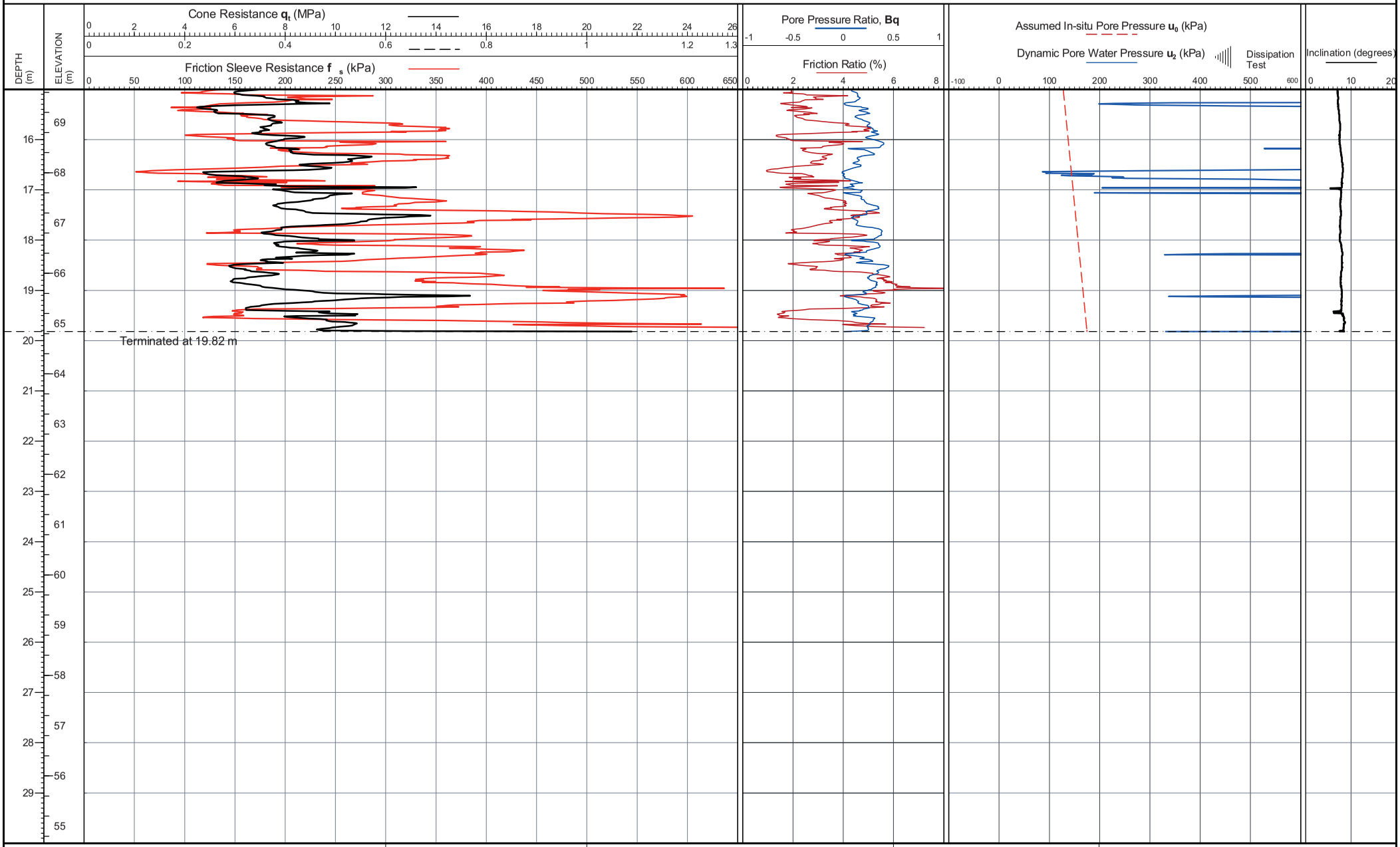
Checked by:
Emma Stickland

TEST ID: CPT405

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.843
Operator: Ben Ranson
Rig Used: UK15
Date of test: 23/10/2014 15:33:32

Location: Hertfordshire
Coordinates: 524141.44, 213021.46
Elevation: 84.66
Coordinate system:

Remarks:
*Piezometric surface origin: Est. from u2 piezo data

Termination Remark: Total reaction load

Date of plot: 27-10-14
Lankelma Project Ref: P-106006-1

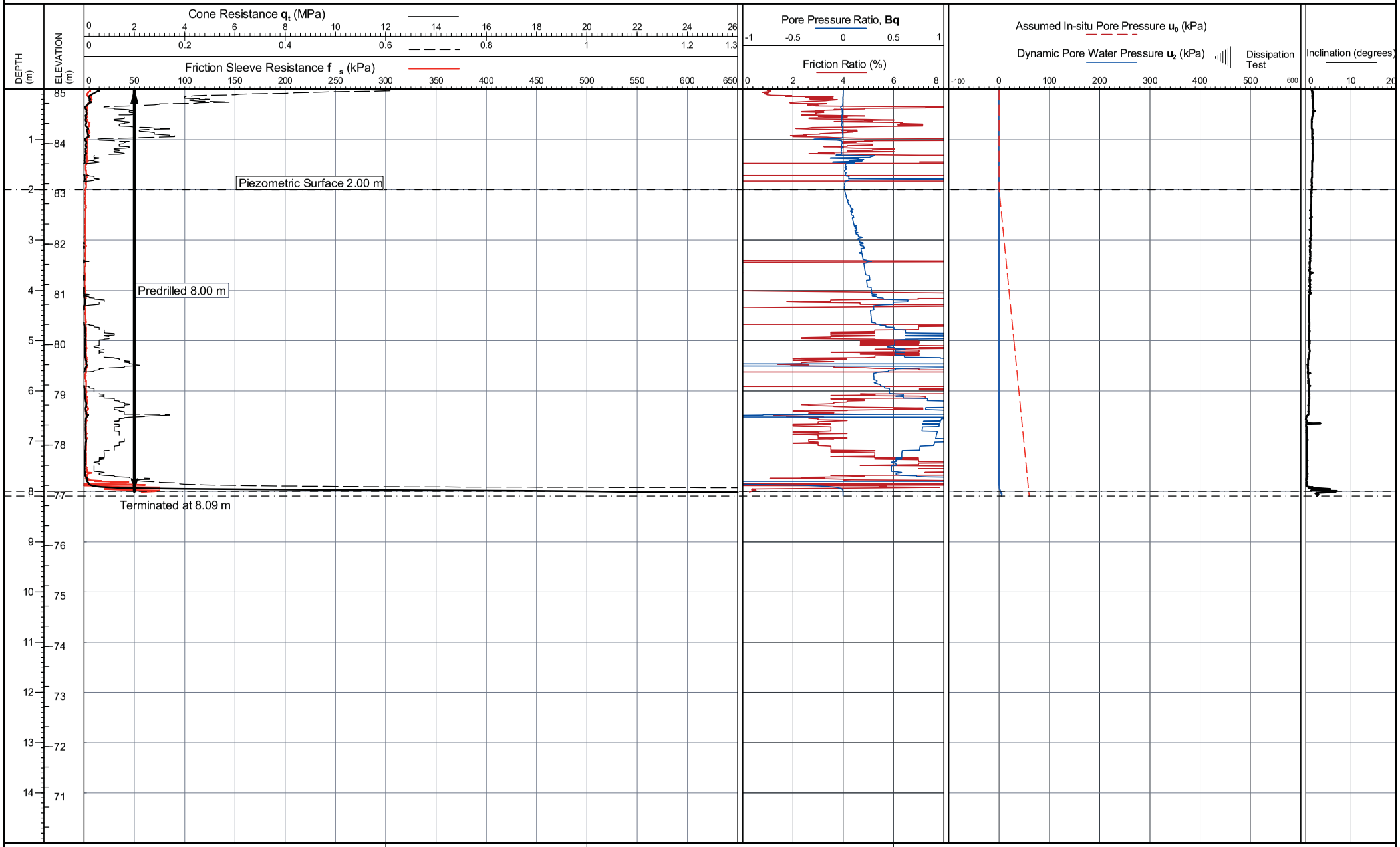
Checked by:
Emma Stickland

TEST ID: CPT405

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.843
Operator: Ben Ranson
Rig Used: UK15
Date of test: 23/10/2014 12:25:58

Location: Hertfordshire
Coordinates: 524054.08, 212913.08
Elevation: 85.08
Coordinate system:

Remarks:
*Piezometric surface origin: Est. from u2 piezo data

Termination Remark: Lateral support

Date of plot: 27-10-14
Lankelma Project Ref: P-106006-1

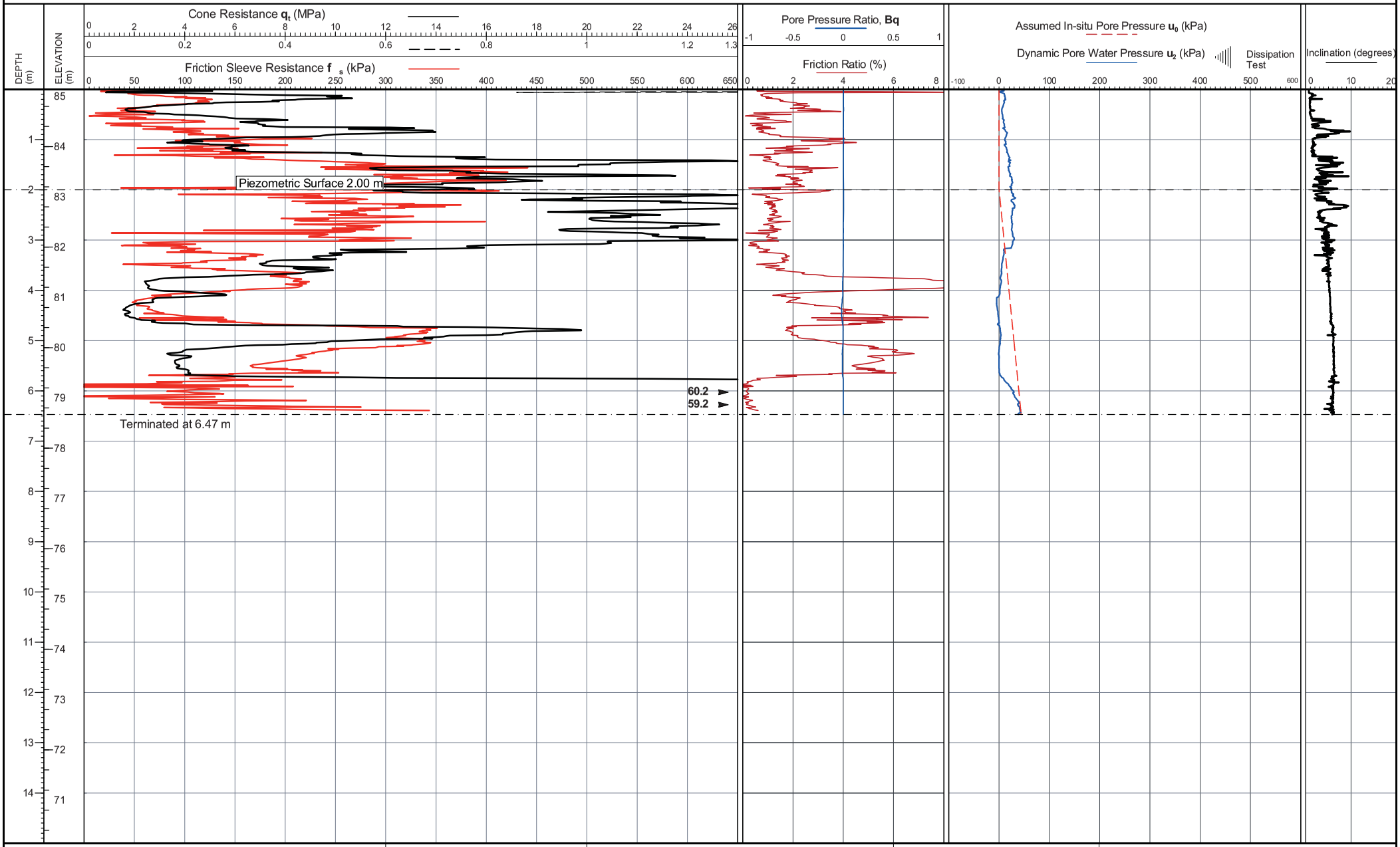
Checked by:
Emma Stickland

TEST ID: CPT406

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.843
Operator: Ben Ranson
Rig Used: UK15
Date of test: 23/10/2014 13:42:58

Location: Hertfordshire
Coordinates: 524192.11, 212866.79
Elevation: 85.14
Coordinate system:

Remarks:
*Piezometric surface origin: Est. from u2 piezo data

Termination Remark: Total cone load

Date of plot: 27-10-14
Lankelma Project Ref: P-106006-1

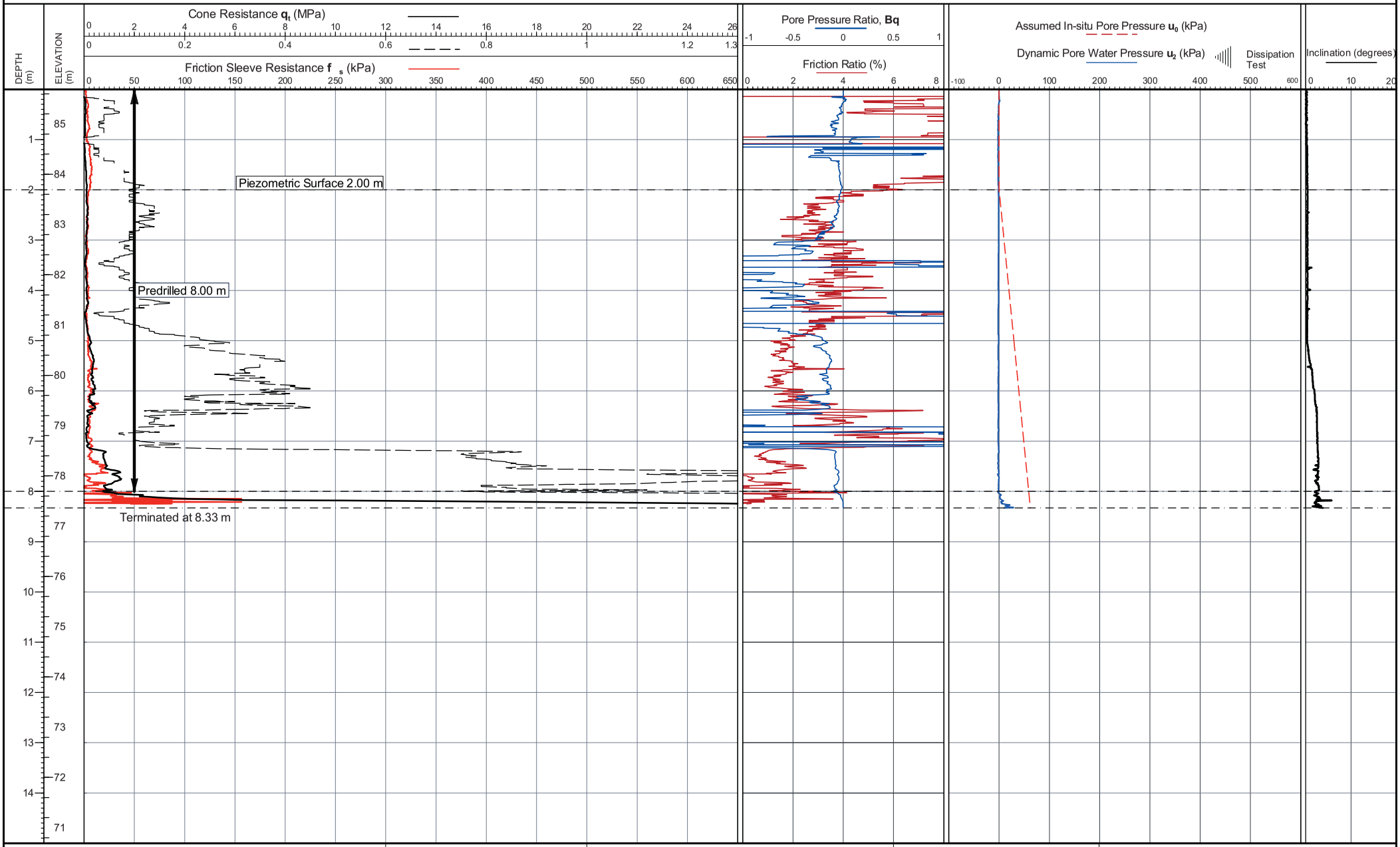
Checked by:
Emma Stickland

TEST ID: CPT407

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



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Operator: Ben Ranson
Rig Used: UK15
Date of test: 23/10/2014 11:40:39

Location: Hertfordshire
Coordinates: 524056.3, 212880.65
Elevation: 85.69
Coordinate system:

Remarks:
*Piezometric surface origin: Est. from u2 piezo data

Termination Remark: Lateral support

Date of plot: 27-10-14
Lankelma Project Ref: P-106006-1

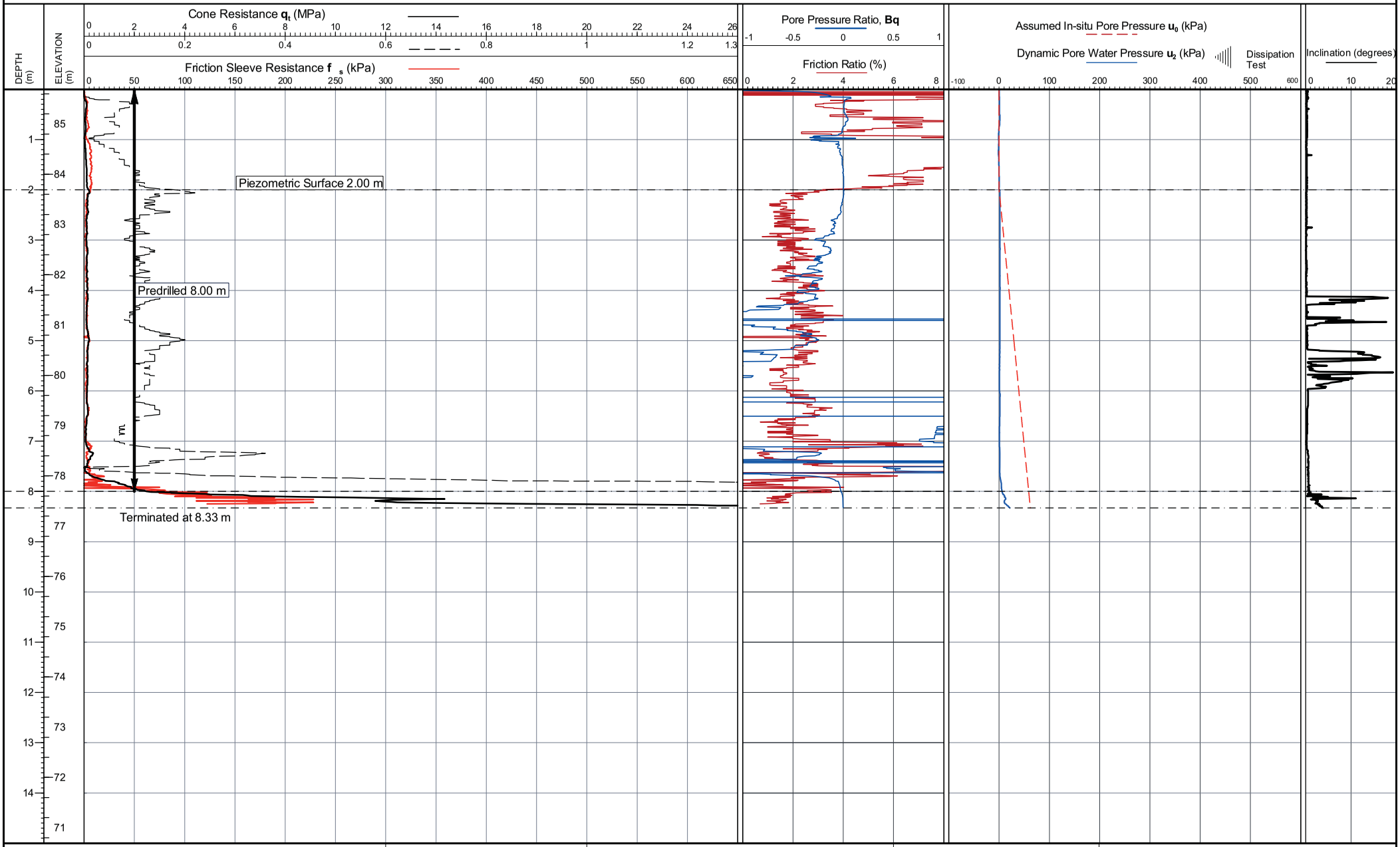
Checked by:
Emma Stickland

TEST ID: CPT408

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.843
Operator: Ben Ranson
Rig Used: UK15
Date of test: 23/10/2014 12:03:01

Location: Hertfordshire
Coordinates: 524056.3, 212880.65
Elevation: 85.69
Coordinate system:

Remarks:
*Piezometric surface origin: Est. from u2 piezo data

Termination Remark: Lateral support

Date of plot: 27-10-14
Lankelma Project Ref: P-106006-1

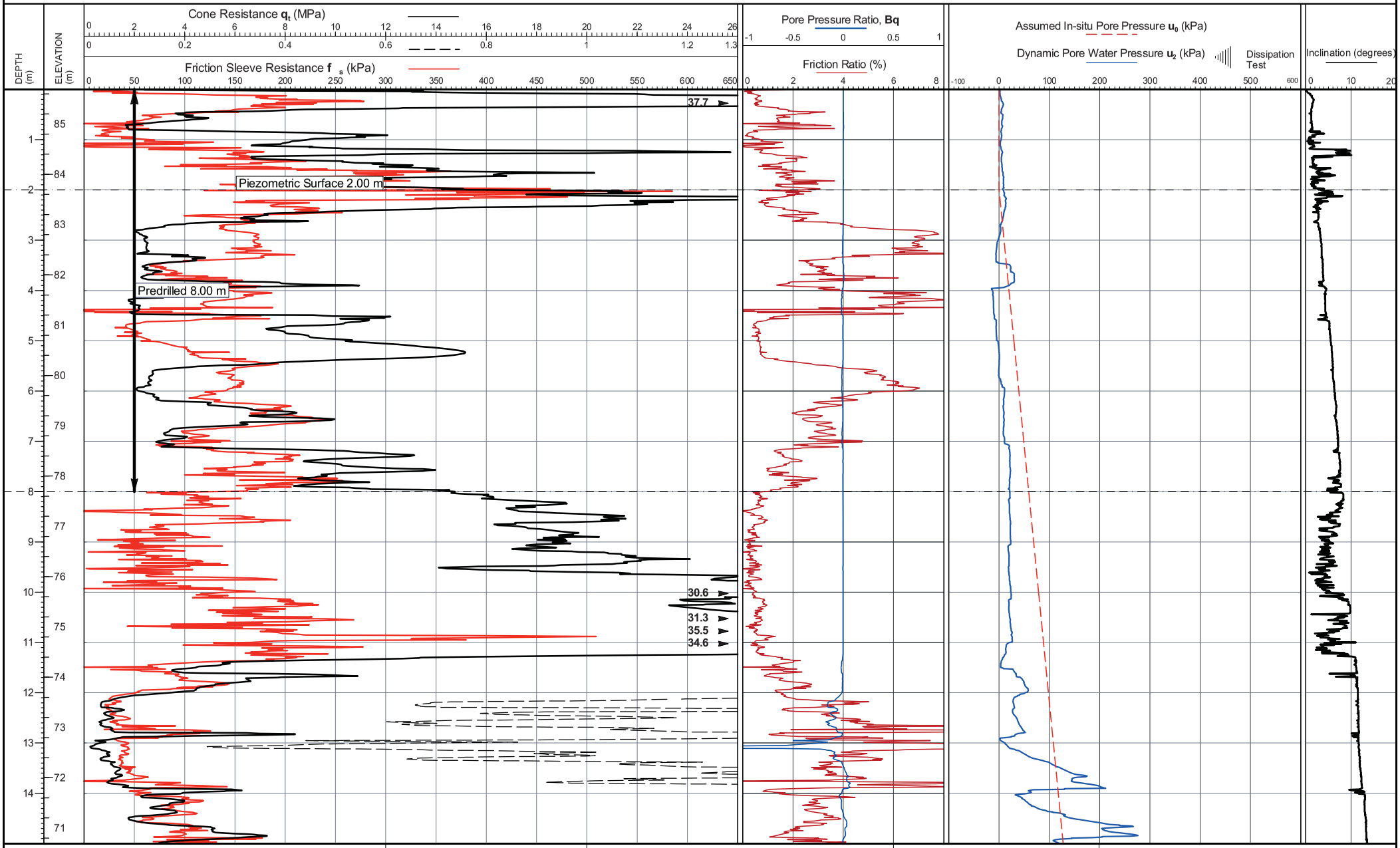
Checked by:
Emma Stickland

TEST ID: CPT408A

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



Cone area (mm2):1500
Cone ID: S15-CFIP.843
Operator: Ben Ranson
Rig Used: UK15
Date of test: 23/10/2014 12:46:36

Location: Hertfordshire
Coordinates: 524056.3, 212880.65
Elevation: 85.69
Coordinate system:

Remarks:
*Piezometric surface origin: Est. from u2 piezo data

Termination Remark: Target depth

Date of plot: 27-10-14
Lankelma Project Ref: P-106006-1

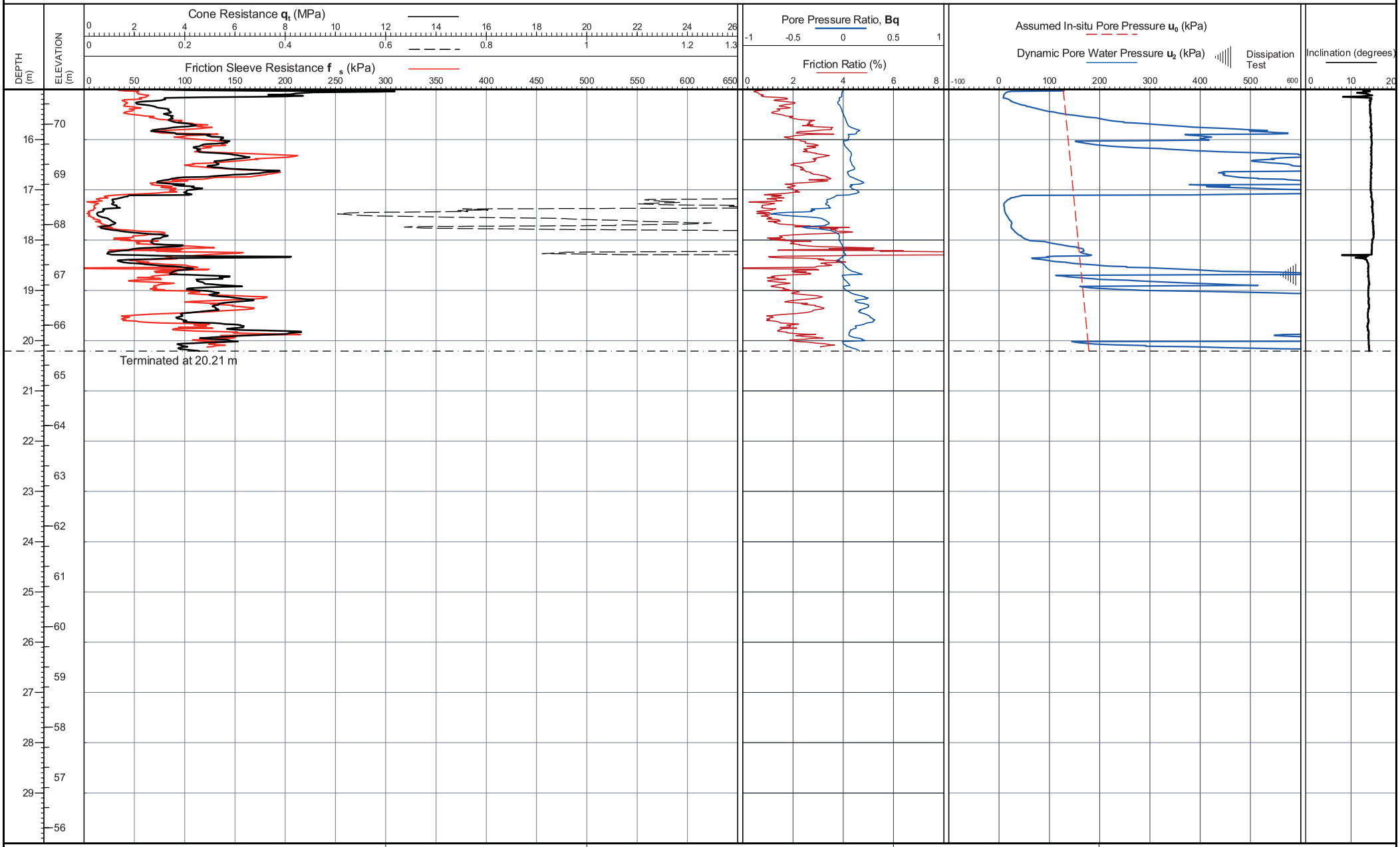
Checked by:
Emma Stickland

TEST ID: CPT408B

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



Cone area (mm2):1500
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Operator: Ben Ranson
Rig Used: UK15
Date of test: 23/10/2014 12:46:36

Location: Hertfordshire
Coordinates: 524056.3, 212880.65
Elevation: 85.69
Coordinate system:

Remarks:
*Piezometric surface origin: Est. from u2 piezo data

Termination Remark: Target depth

Date of plot: 27-10-14
Lankelma Project Ref: P-106006-1

Checked by:
Emma Stickland

TEST ID: CPT408B

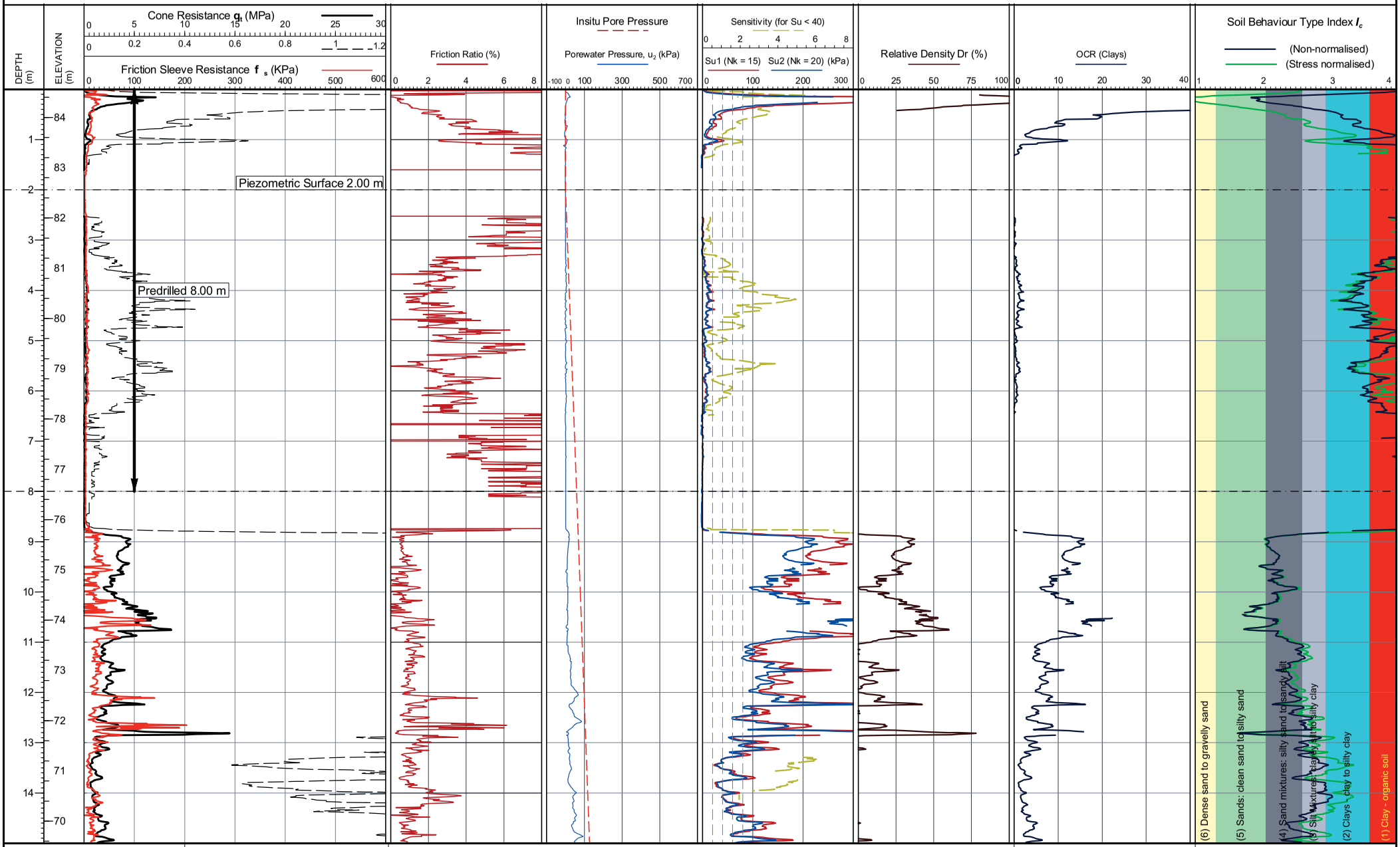
APPENDIX C STANDARD INTERPRETATION RESULTS

LIST OF FIGURES:

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.843
Operator: Ben Ranson
Rig Used: UK15
Date of test: 23/10/2014 10:48:27

Location: Hertfordshire
Coordinates: 524113.58, 212667.21
Elevation: 84.56
Coordinate system:

Remarks: *Piezometric surface origin: Est. from u2 piezo data

Termination Remark:
Target depth

Dissipation Test

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 28-10-14
Lankelma Project Ref: P-106006-1

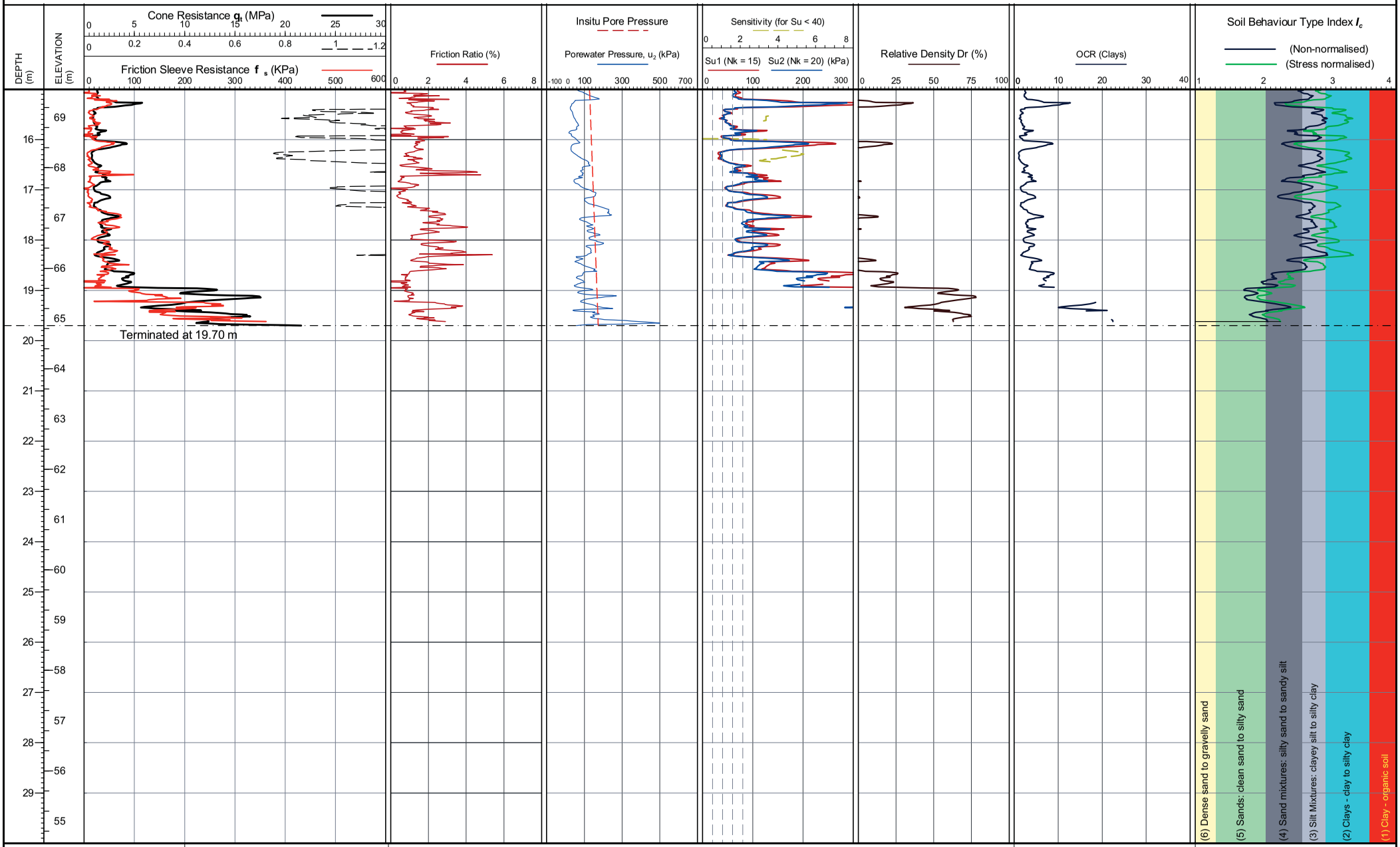
Checked by:
Emma Stickland

TEST ID: CPT401

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



Cone area (mm2):1500
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Operator: Ben Ranson
Rig Used: UK15
Date of test: 23/10/2014 10:48:27

Location: Hertfordshire
Coordinates: 524113.58, 212667.21
Elevation: 84.56
Coordinate system:

Remarks: *Piezometric surface origin: Est. from u2 piezo data

Termination Remark:
Target depth

Dissipation Test

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 28-10-14
Lankelma Project Ref: P-106006-1

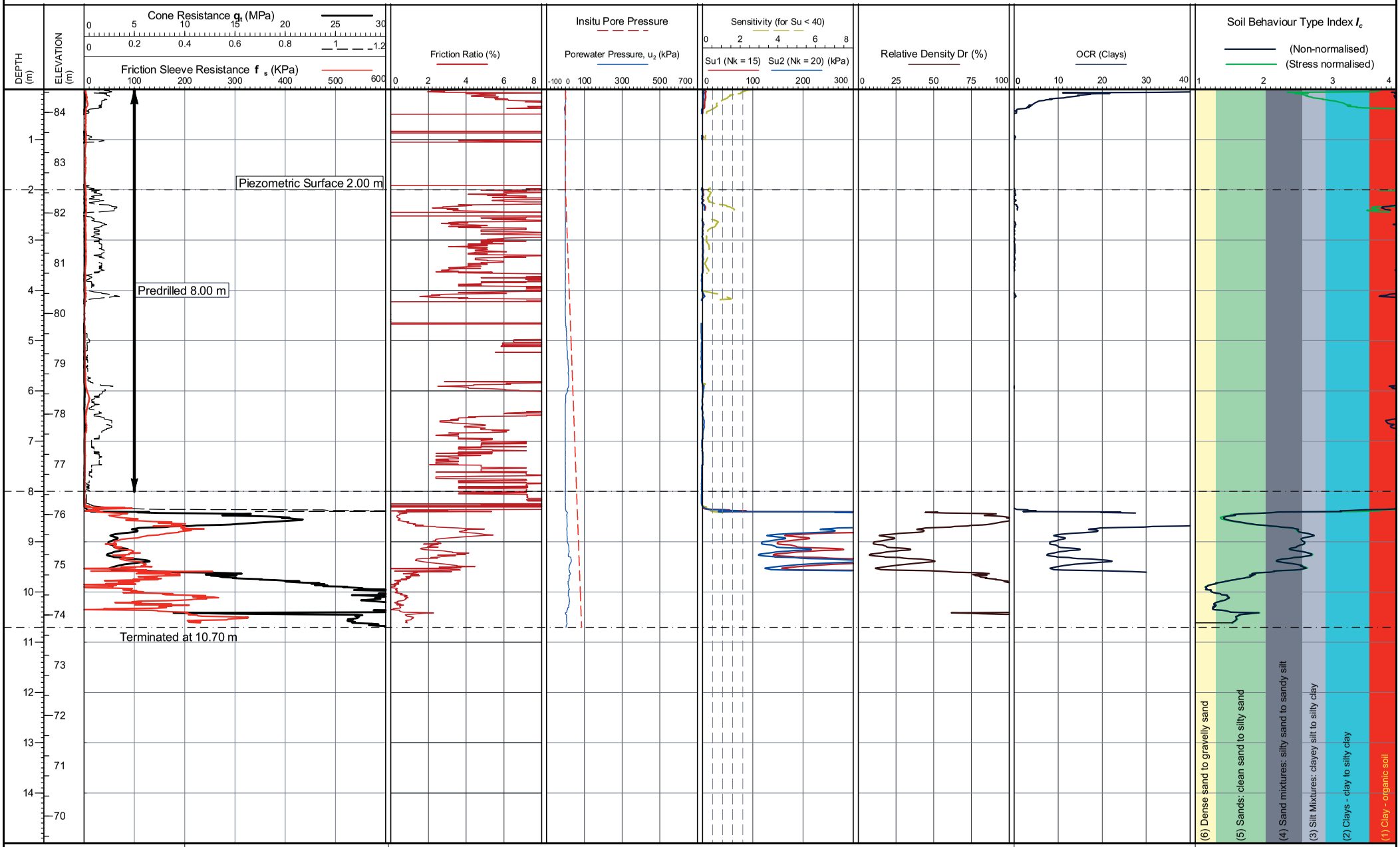
Checked by:
Emma Stickland

TEST ID: CPT401

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



Cone area (mm2):1500
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Operator: Ben Ranson
Rig Used: UK15
Date of test: 23/10/2014 09:59:20

Location: Hertfordshire
Coordinates: 524164.75, 212638.96
Elevation: 84.46
Coordinate system:

Remarks: *Piezometric surface origin: Est. from u2 piezo data

Termination Remark:
Lateral support

Dissipation Test

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 28-10-14
Lankelma Project Ref: P-106006-1

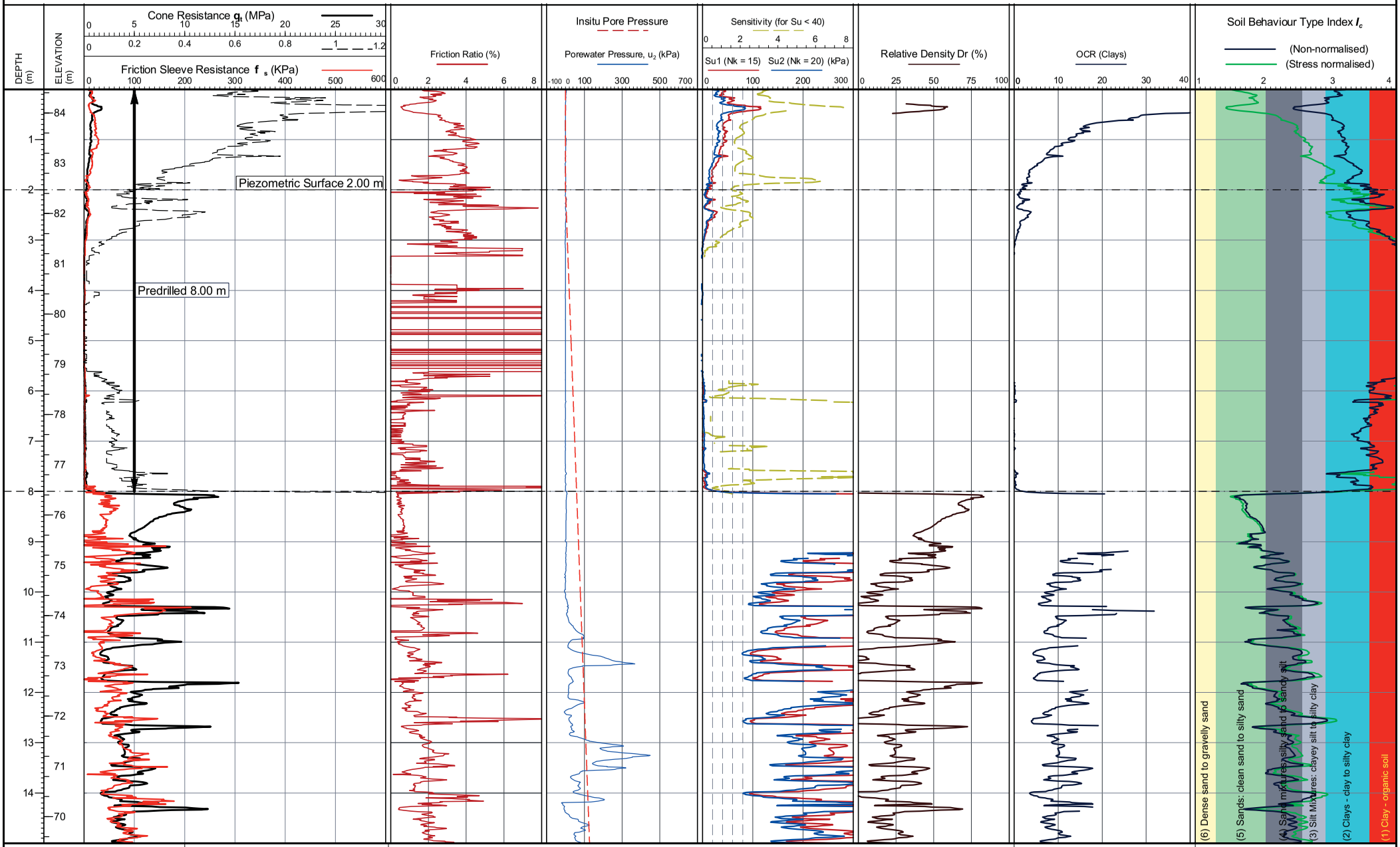
Checked by:
Emma Stickland

TEST ID: CPT402

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



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ConeID: S15-CFIP.843
Operator: Ben Ranson
Rig Used: UK15
Date of test: 23/10/2014 09:05:10

Location: Hertfordshire
Coordinates: 524176.08, 212732.72
Elevation: 84.47
Coordinate system:

Remarks: *Piezometric surface origin: Est. from u2 piezo data

Termination Remark:
Target depth

Dissipation Test

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 28-10-14

Lankelma Project Ref: P-106006-1

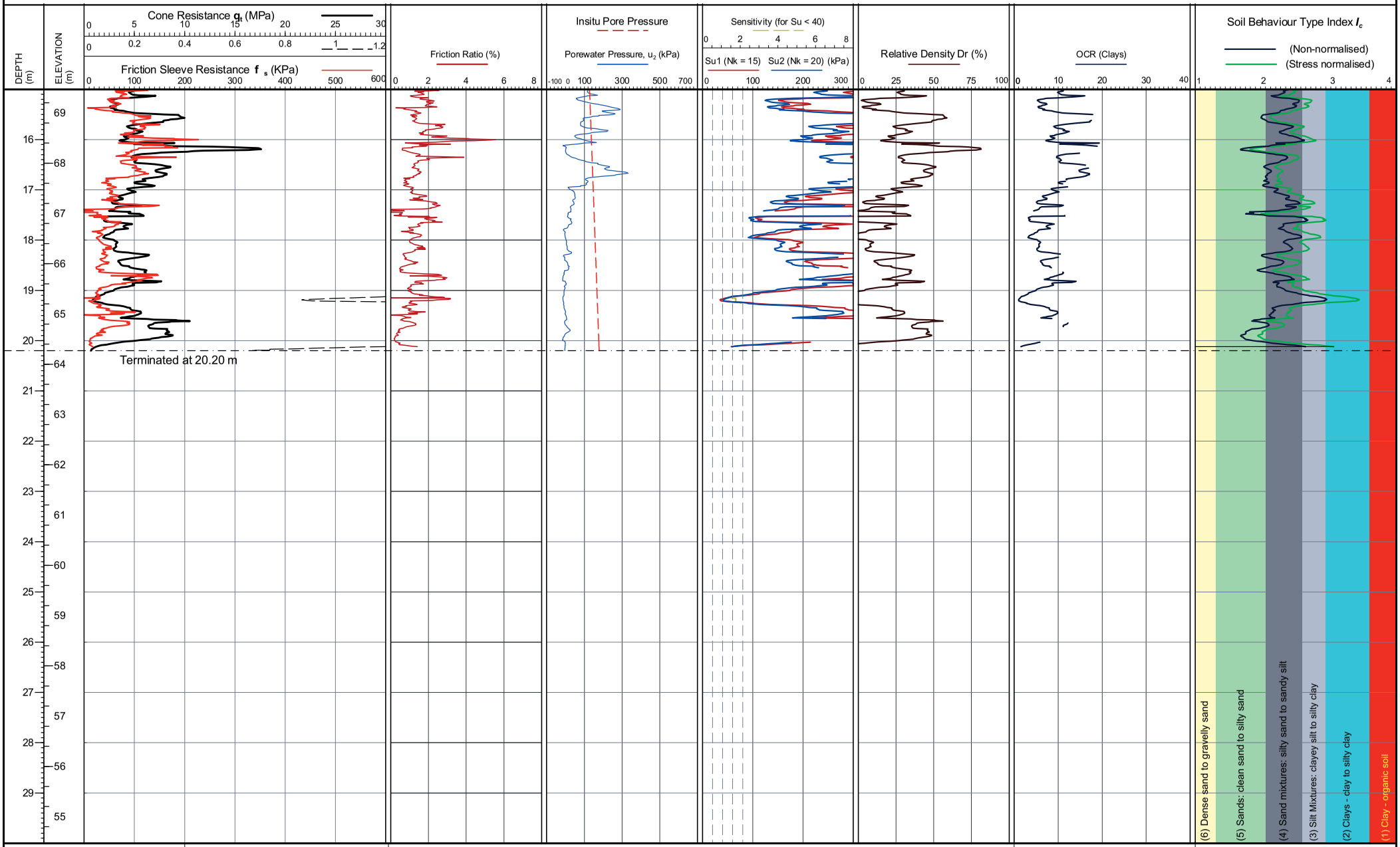
Checked by:
Emma Stickland

TEST ID: CPT403

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.843
Operator: Ben Ranson
Rig Used: UK15
Date of test: 23/10/2014 09:05:10

Location: Hertfordshire
Coordinates: 524176.08, 212732.72
Elevation: 84.47
Coordinate system:

Remarks: *Piezometric surface origin: Est. from u2 piezo data

Termination Remark:
Target depth

Dissipation Test

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 28-10-14
Lankelma Project Ref: P-106006-1

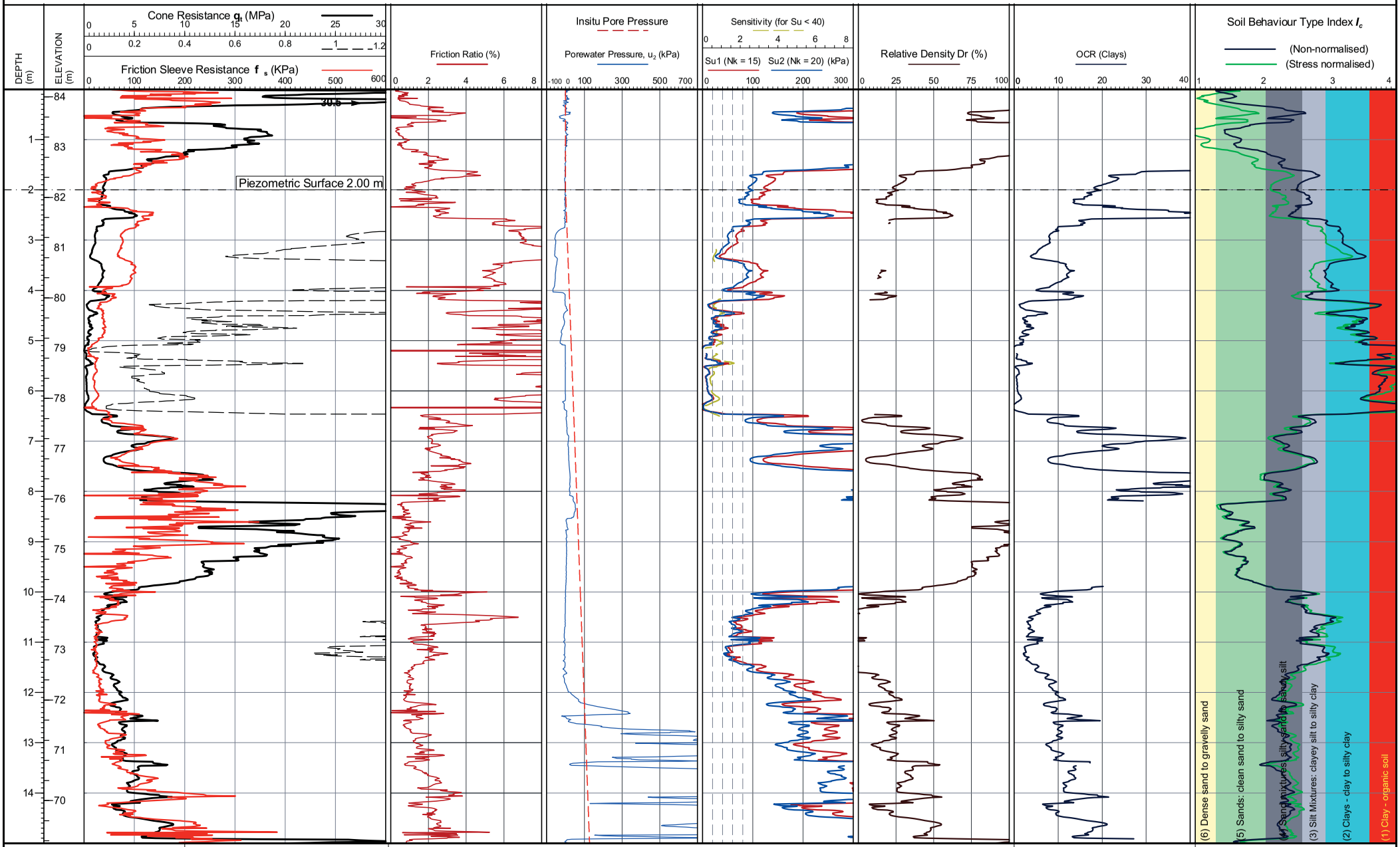
Checked by:
Emma Stickland

TEST ID: CPT403

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



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Operator: Ben Ranson
Rig Used: UK15
Date of test: 23/10/2014 14:31:58

Location: Hertfordshire
Coordinates: 524256.84, 213021.7
Elevation: 84.15
Coordinate system:

Remarks: *Piezometric surface origin: Est. from u2 piezo data

Termination Remark:
Target depth

Dissipation Test

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 28-10-14

Lankelma Project Ref: P-106006-1

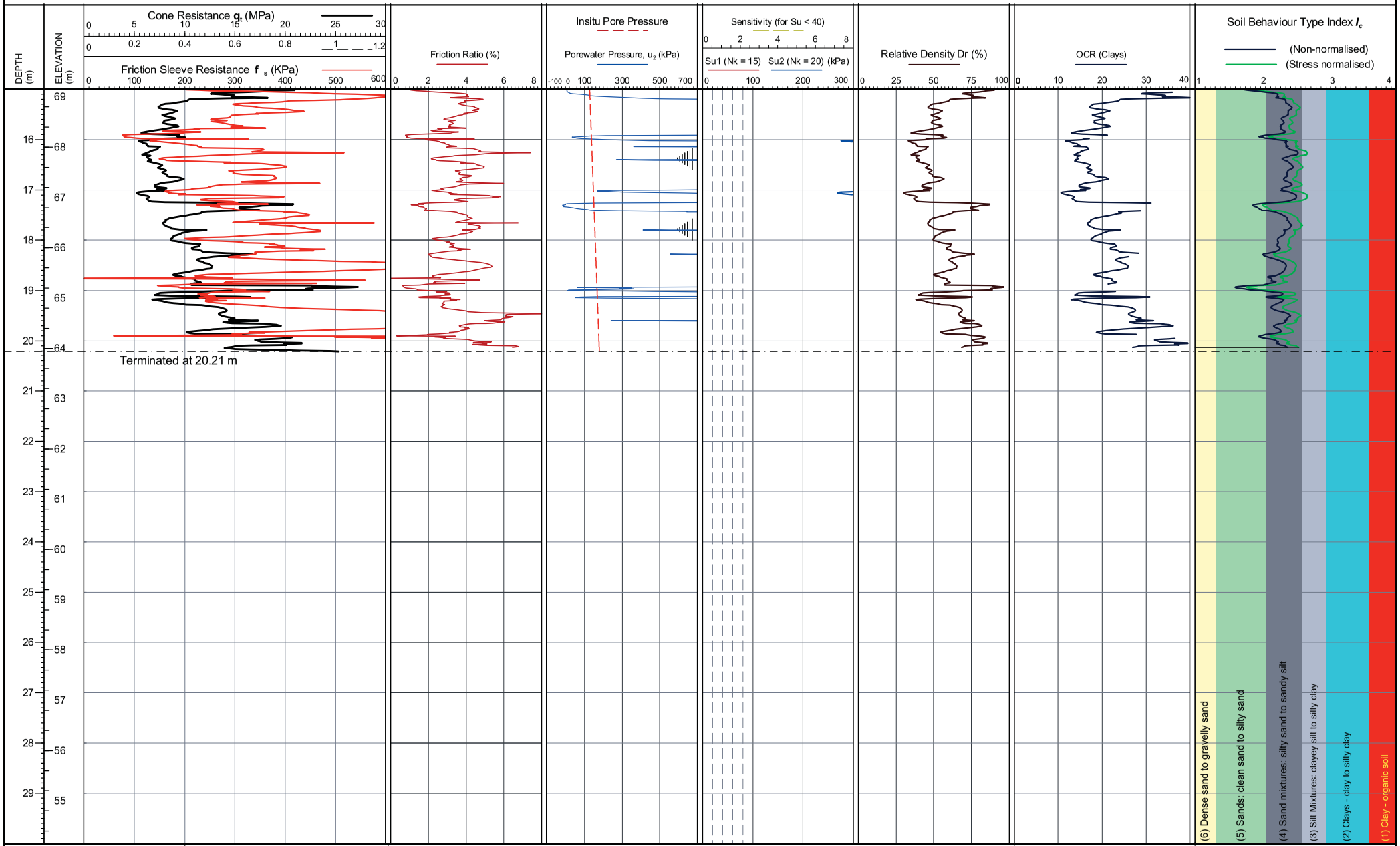
Checked by:
Emma Stickland

TEST ID: CPT404

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



Cone area (mm2):1500
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Operator: Ben Ranson
Rig Used: UK15
Date of test: 23/10/2014 14:31:58

Location: Hertfordshire
Coordinates: 524256.84, 213021.7
Elevation: 84.15
Coordinate system:

Remarks: *Piezometric surface origin: Est. from u2 piezo data

Termination Remark:
Target depth

Dissipation Test

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 28-10-14

Lankelma Project Ref: P-106006-1

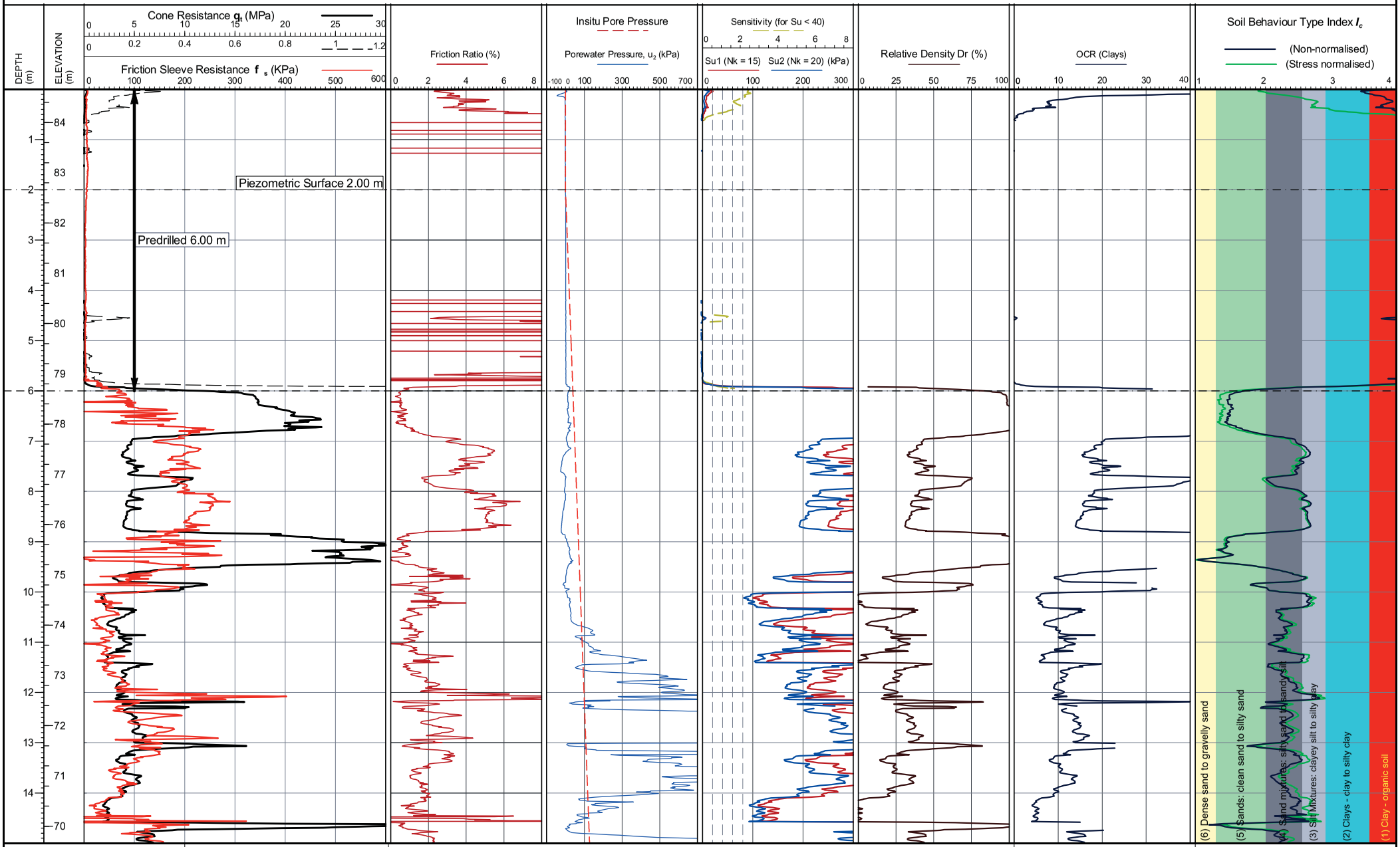
Checked by:
Emma Stickland

TEST ID: CPT404

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



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Operator: Ben Ranson
Rig Used: UK15
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Location: Hertfordshire
Coordinates: 524141.44, 213021.46
Elevation: 84.66
Coordinate system:

Remarks: *Piezometric surface origin: Est. from u2 piezo data

Termination Remark:
Total reaction load

Dissipation Test

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 28-10-14
Lankelma Project Ref: P-106006-1

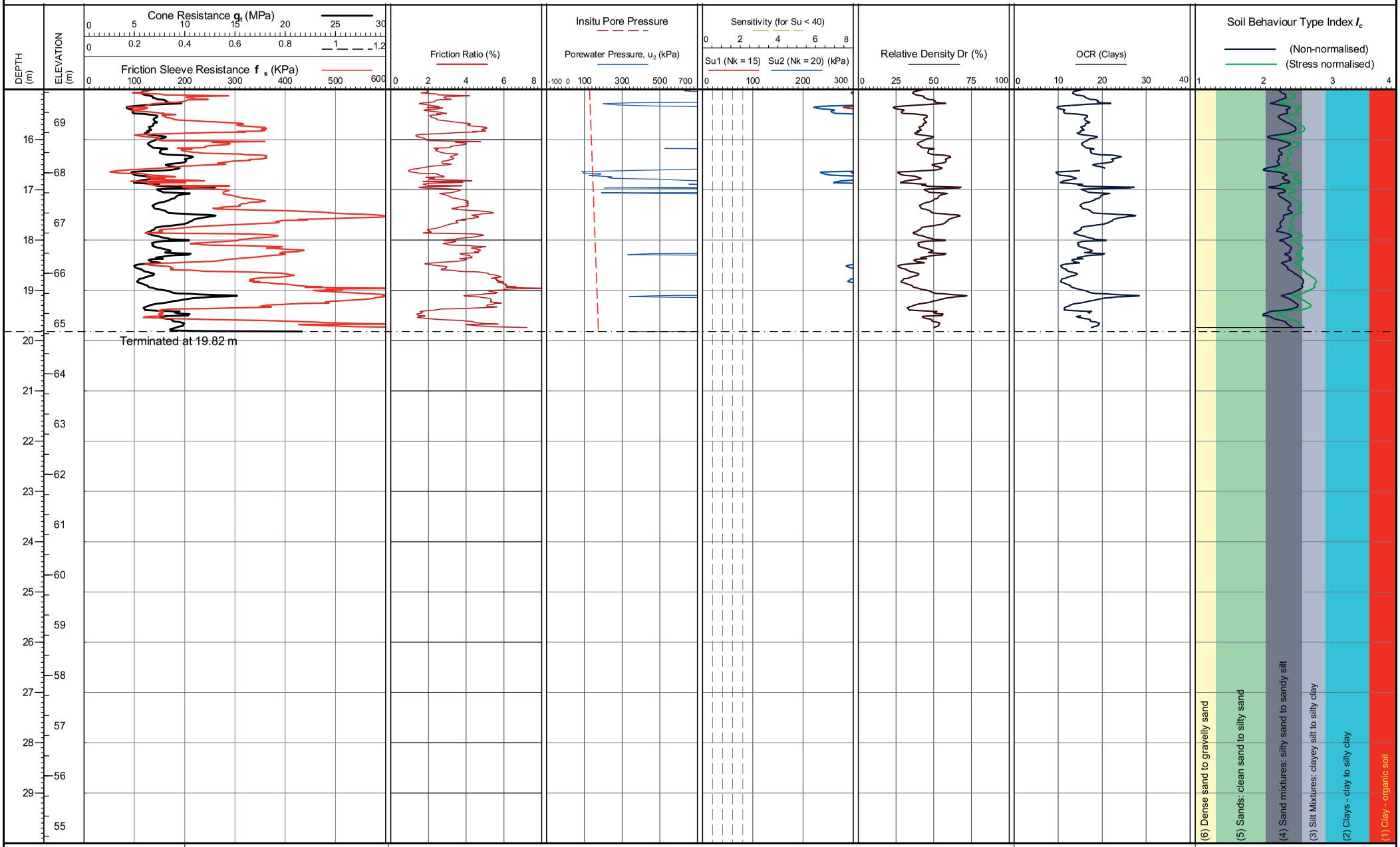
Checked by:
Emma Stickland

TEST ID: CPT405

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.843
Operator: Ben Ranson
Rig Used: UK15
Date of test: 23/10/2014 15:33:32

Location: Hertfordshire
Coordinates: 524141.44, 213021.46
Elevation: 84.66
Coordinate system:

Remarks: *Piezometric surface origin: Est. from u2 piezo data

Termination Remark:
Total reaction load

Dissipation Test

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 28-10-14
Lankelma Project Ref: P-106006-1

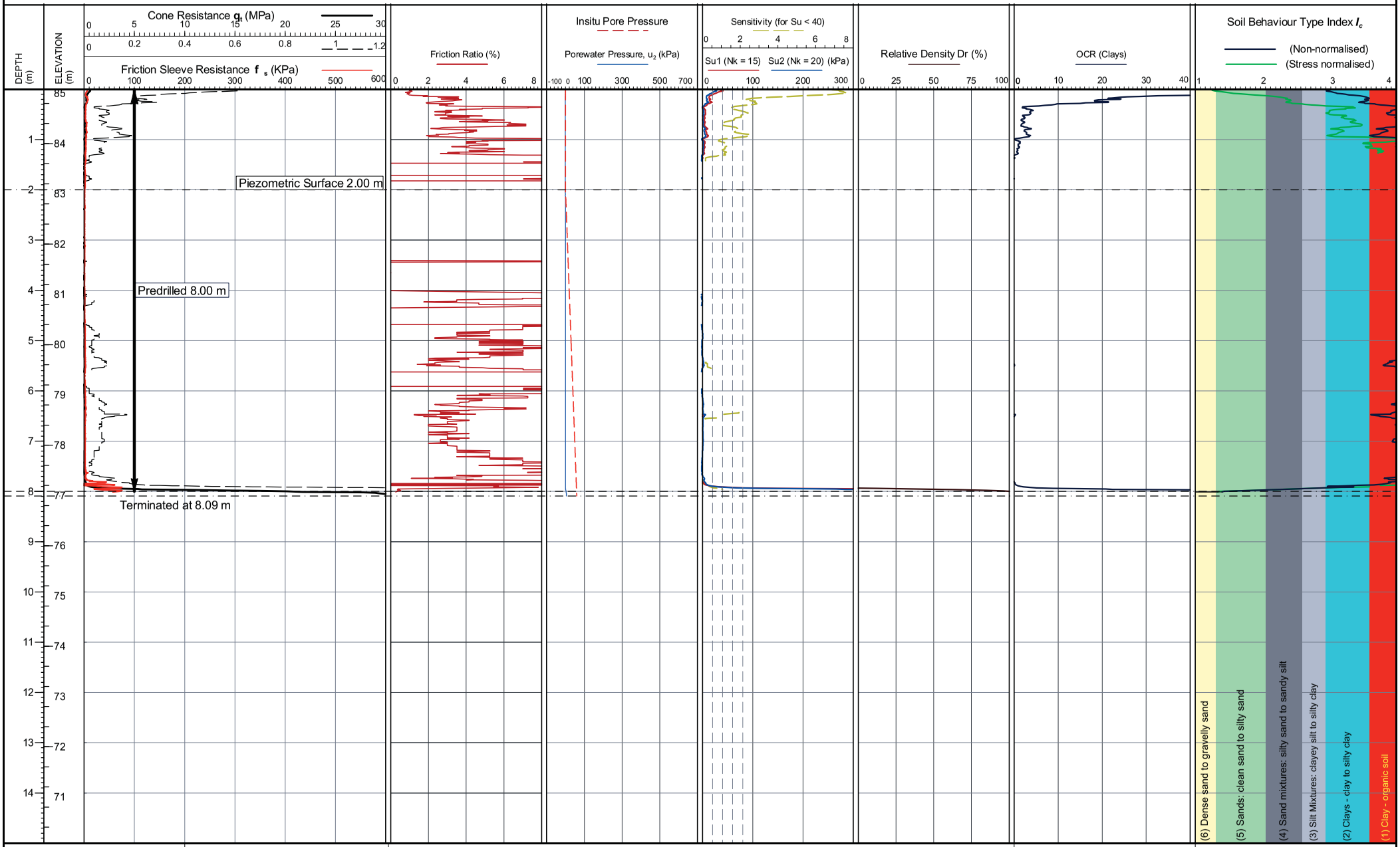
Checked by:
Emma Stickland

TEST ID: CPT405

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



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Rig Used: UK15
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Elevation: 85.08
Coordinate system:

Remarks: *Piezometric surface origin: Est. from u2 piezo data

Termination Remark:
Lateral support

Dissipation Test

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 28-10-14
Lankelma Project Ref: P-106006-1

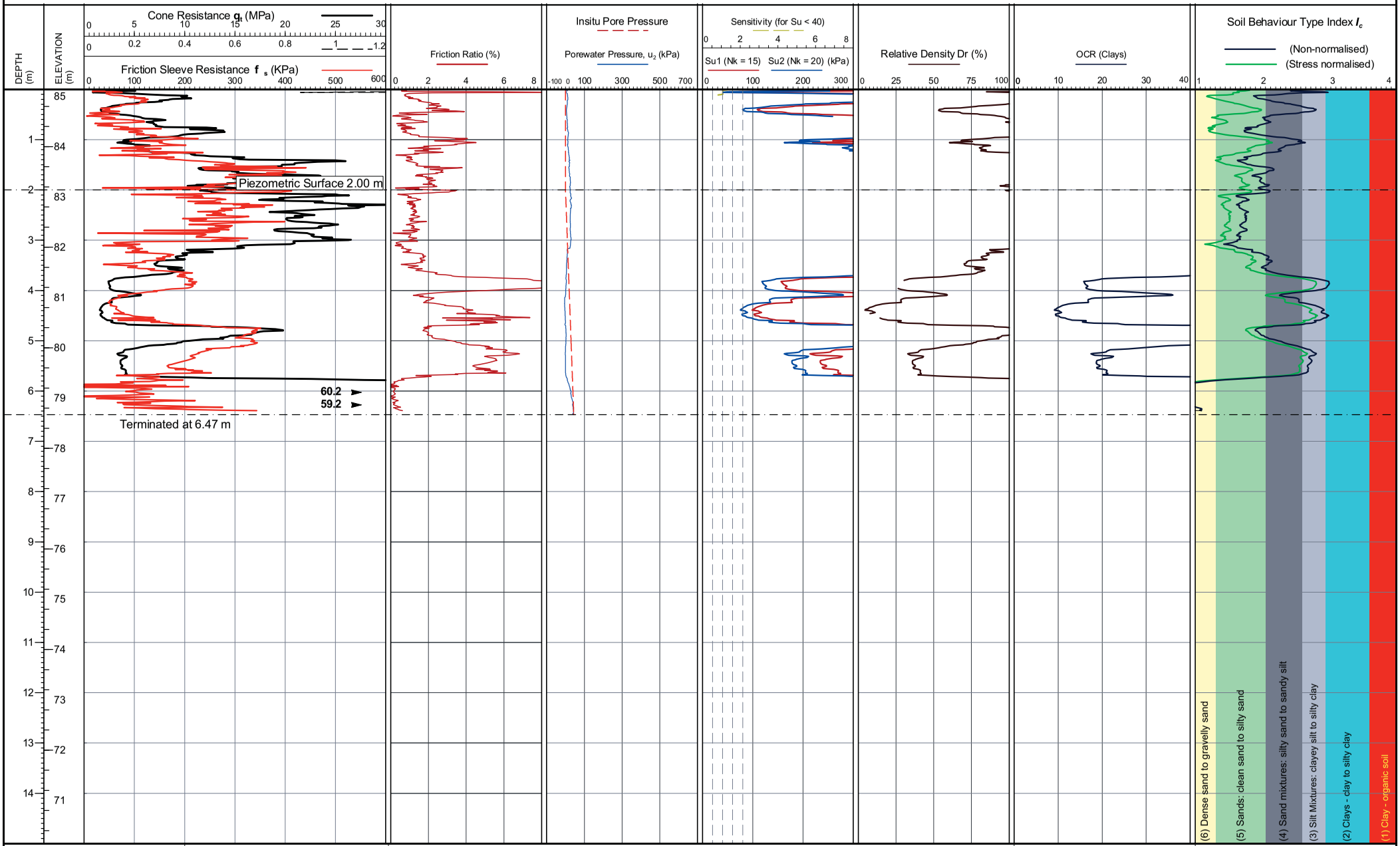
Checked by:
Emma Stickland

TEST ID: CPT406

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



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Operator: Ben Ranson
Rig Used: UK15
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Elevation: 85.14
Coordinate system:

Remarks: *Piezometric surface origin: Est. from u2 piezo data

Termination Remark:
Total cone load

Dissipation Test

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 28-10-14
Lankelma Project Ref: P-106006-1

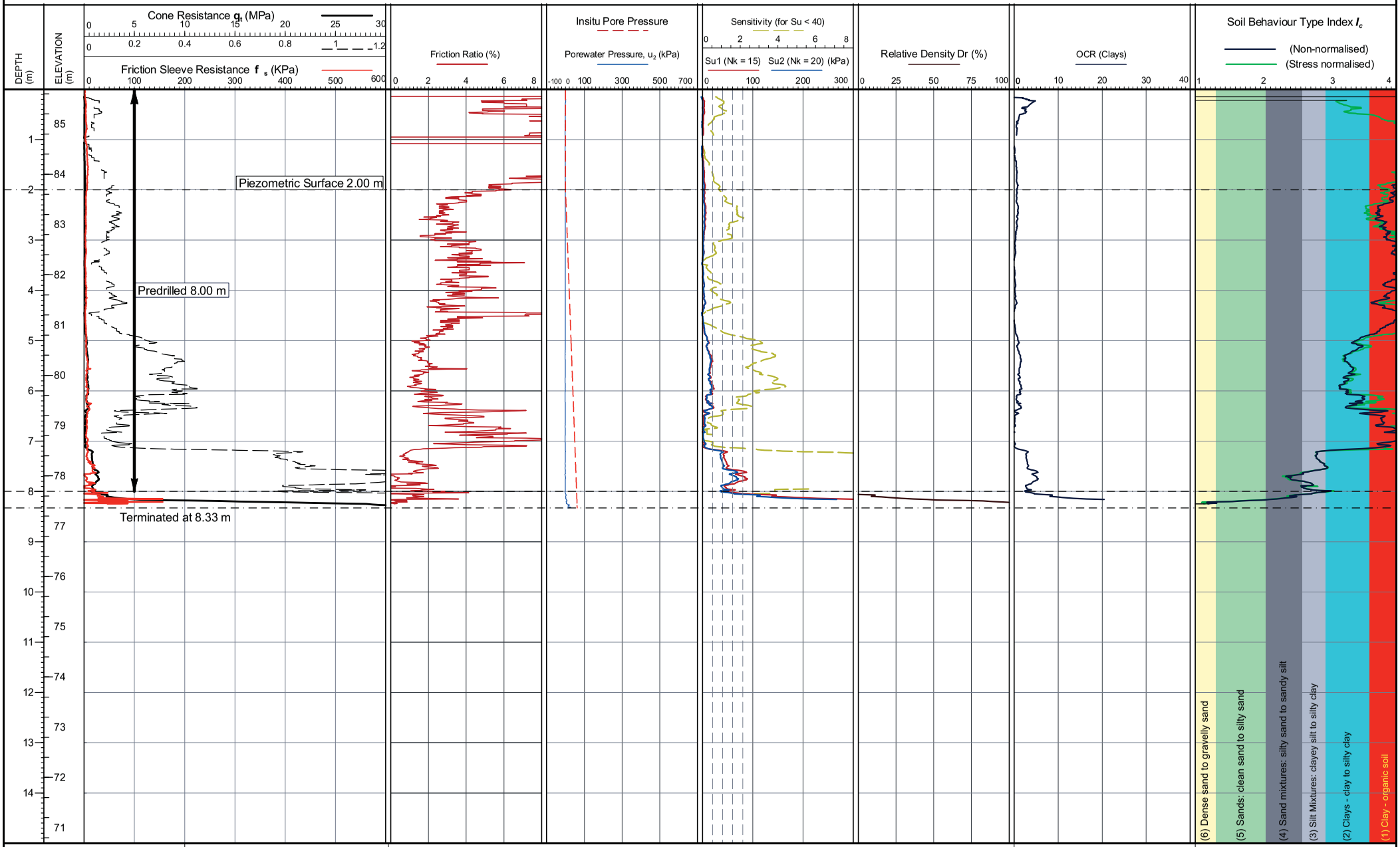
Checked by:
Emma Stickland

TEST ID: CPT407

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.843
Operator: Ben Ranson
Rig Used: UK15
Date of test: 23/10/2014 11:40:39

Location: Hertfordshire
Coordinates: 524056.3, 212880.65
Elevation: 85.69
Coordinate system:

Remarks: *Piezometric surface origin: Est. from u2 piezo data

Termination Remark:
Lateral support

Dissipation Test

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 28-10-14
Lankelma Project Ref: P-106006-1

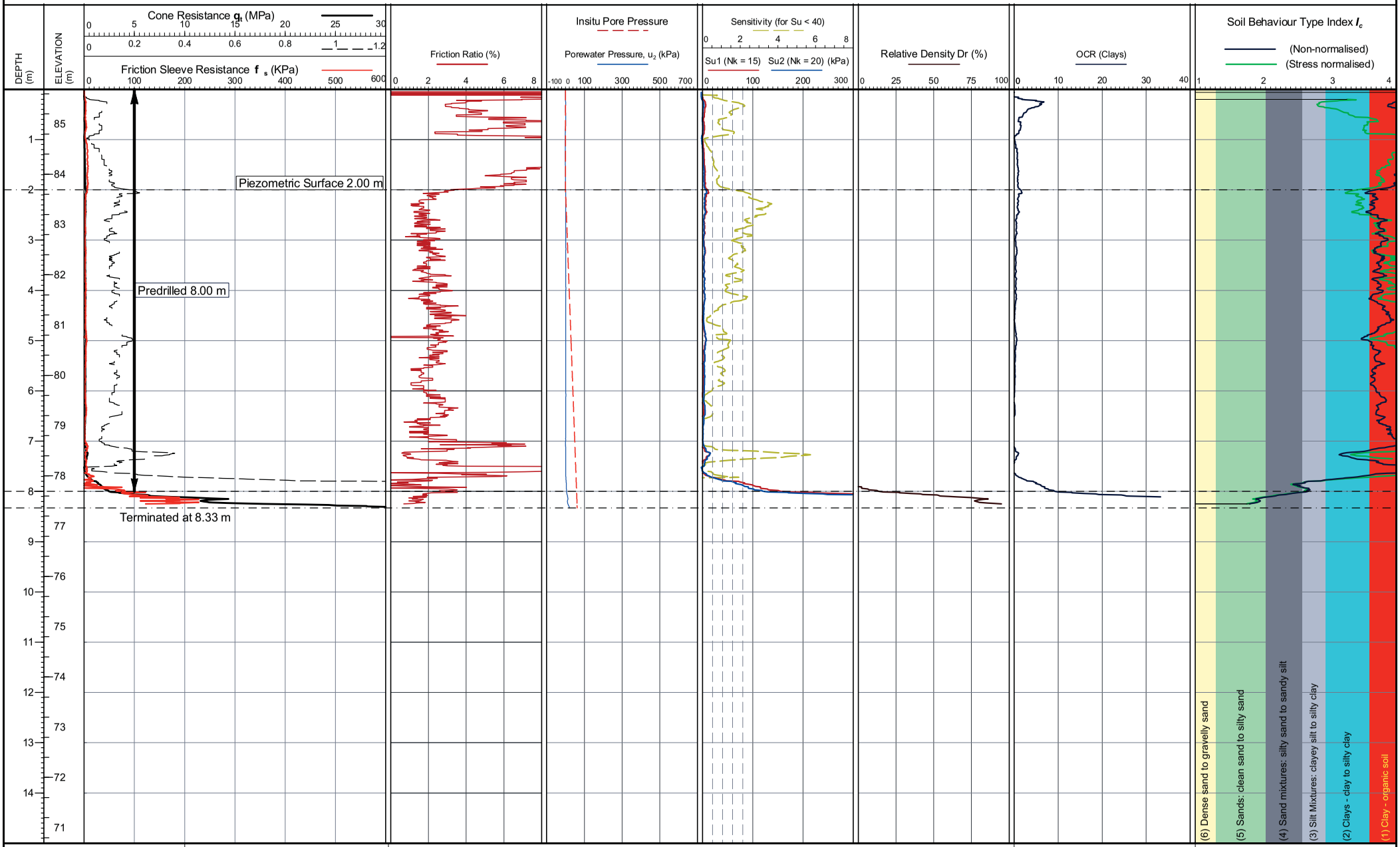
Checked by:
Emma Stickland

TEST ID: CPT408

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.843
Operator: Ben Ranson
Rig Used: UK15
Date of test: 23/10/2014 12:03:01

Location: Hertfordshire
Coordinates: 524056.3, 212880.65
Elevation: 85.69
Coordinate system:

Remarks: *Piezometric surface origin: Est. from u2 piezo data

Termination Remark:
Lateral support

Dissipation Test

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 28-10-14
Lankelma Project Ref: P-106006-1

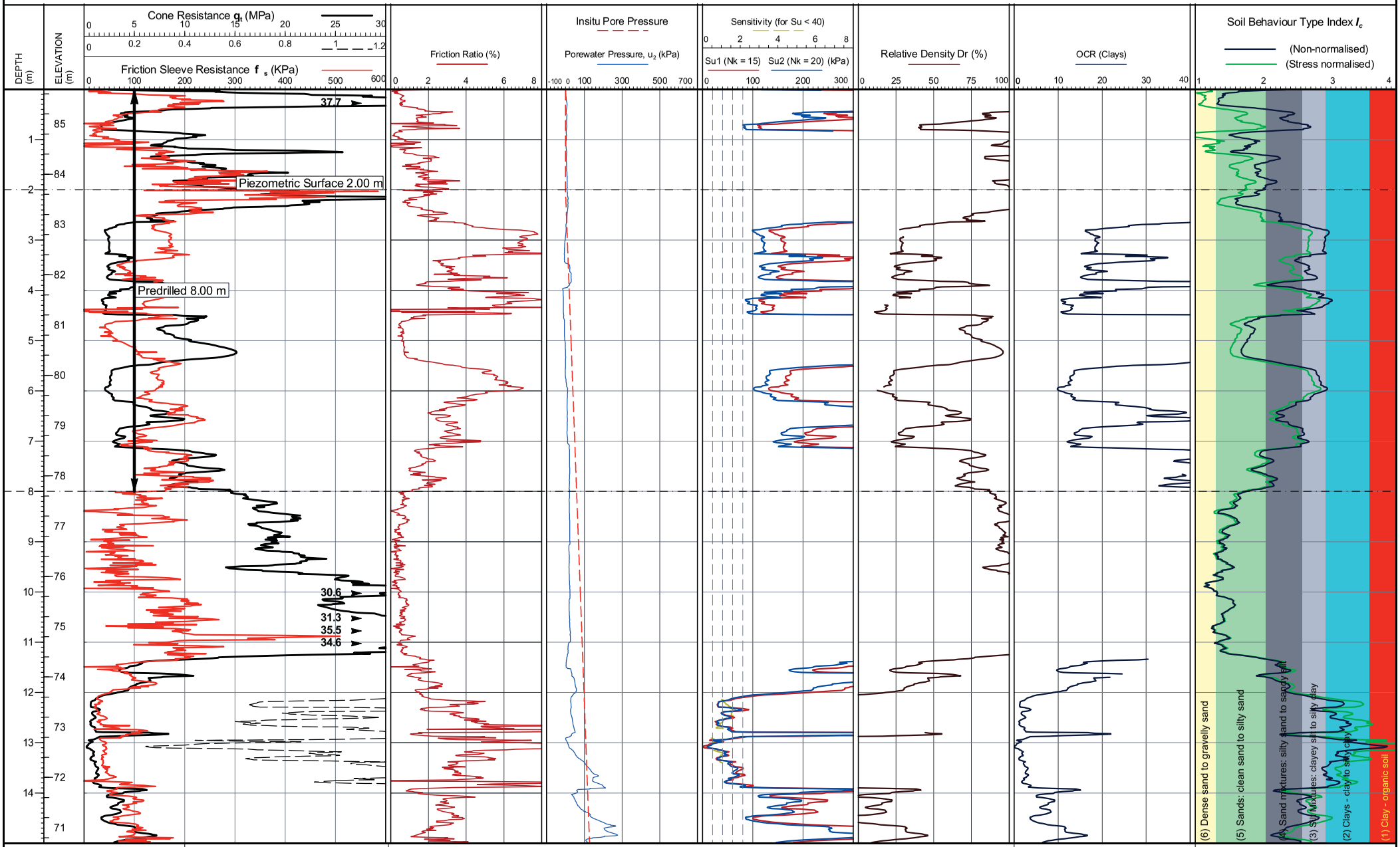
Checked by:
Emma Stickland

TEST ID: CPT408A

Client: DELTA SIMONS

Project: WELWYN GARDEN CITY

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.843
Operator: Ben Ranson
Rig Used: UK15
Date of test: 23/10/2014 12:46:36

Location: Hertfordshire
Coordinates: 524056.3, 212880.65
Elevation: 85.69
Coordinate system:

Remarks: *Piezometric surface origin: Est. from u2 piezo data

Termination Remark:
Target depth

Dissipation Test

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 28-10-14
Lankelma Project Ref: P-106006-1

Checked by:
Emma Stickland

TEST ID: CPT408B

APPENDIX 14.3 – SITE INVESTIGATION SCHEME

Mr. John West
Plutus Estates (WGC) Limited
7 St John's Road
Harrow
Middlesex
United Kingdom
HA1 2EY

Friday 29th September 2017

Our ref: MJS/SPR/016-1512 Plutus Estates Welwyn Garden City – Planning Condition 1 LETTER REV00

Dear John,

Re: N6/2015/0294/PP – Planning Condition No. 1 – A site investigation scheme, based on the submitted phase 1 Environmental Assessment (Delta-Simons ref 2342.17 V2) to provide information for a detailed assessment of the risk to all receptors that may be affected, including those off site.

Introduction

EAME are pleased to present our outline site investigation scheme in relation to planning application reference N6/2015/0294/PP (Former Shredded Wheat Factory, Bridge Road, Welwyn Garden City, AL8 6UN). The Site comprises the disused Shredded Wheat Factory (northern site) and an open derelict area that was a former confectionary factory and Polycell Factory (southern site) (*Figure 1* and *Figure 2*).

Figure 1: *Site layout (northern and southern areas)*

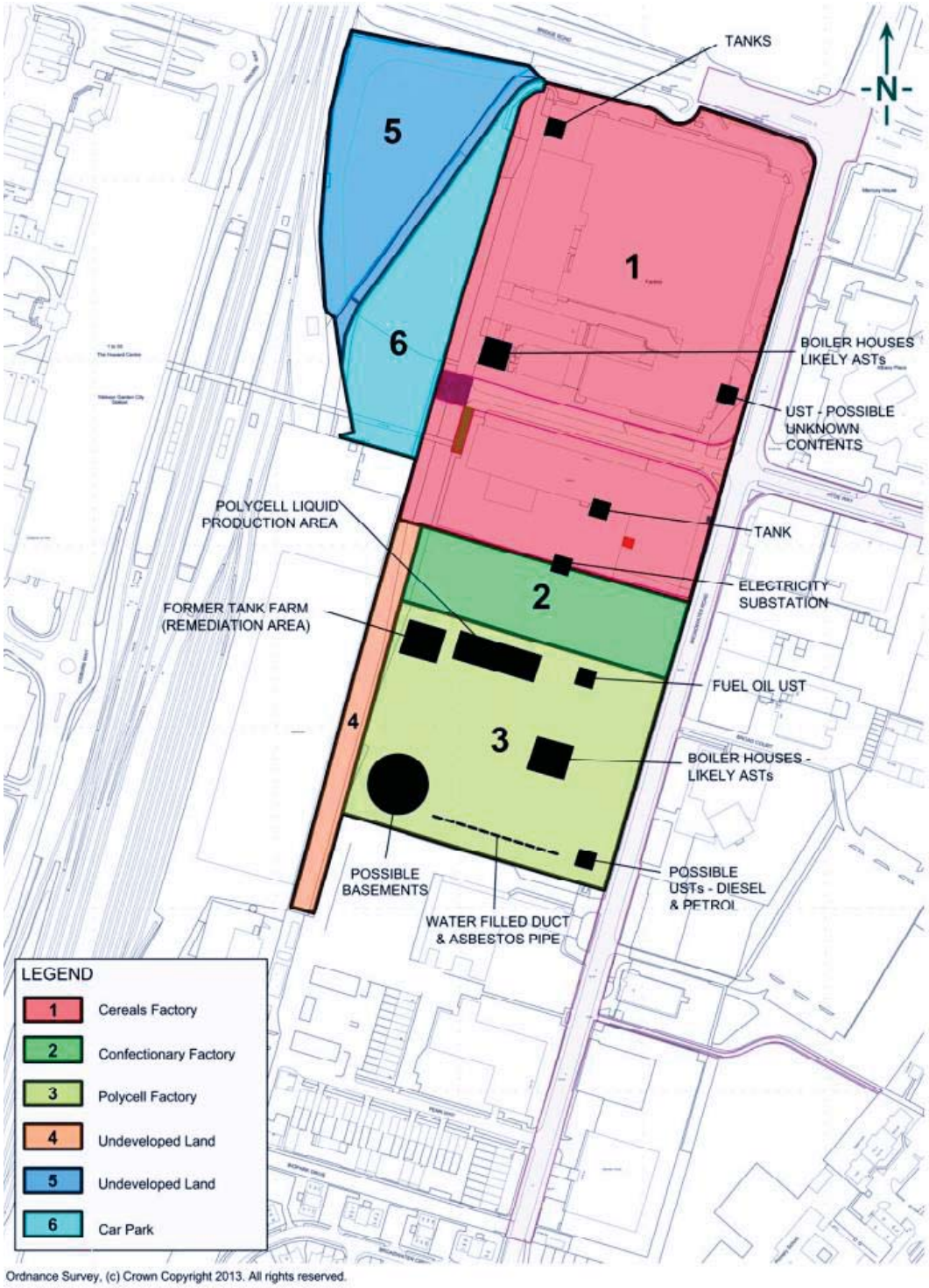


Figure 2: *Previous landuses and reported sources of contamination*

Source: Phase I Environmental Assessment, Former Shredded Wheat Factory, Broadwater Road, Welwyn Garden City, For Spen Hill Developments Ltd, Delta-Simons Project No. 2342.17 V2, January 2015

Previous Works

Several phases of investigation have been completed at the site which had identified significant solvent contamination of the groundwater in the underlying chalk aquifer and localised contamination associated with the former tank farm of the Polycell Factory.

Remedial works have been undertaken around the Polycell tank farm to remove 13 underground tanks. The impacted soils were removed and bioremediated on-site. A pump and treat groundwater remediation system was installed to remove free product followed by an on-going period of Monitored Natural Attenuation (MNA) of the dissolved phase contamination. Results appear to suggest that the remediation scheme has resulted in significant reductions in dissolved phase contaminant concentrations.

Widespread or significant contamination has not been identified elsewhere at the site, however, it is acknowledged that the site investigation was focussed on the tank farm area and the southern site and further investigation works are required, particularly across the former Shredded Wheat Factory to the north.

According to Delta-Simons (Ref. *Final Post-Remediation Groundwater Monitoring Report, Project No. 2342-10, March 2016*) the following additional works are required:

- **Basements/Service Ducts** – It is understood that the south-west of the Site may be underlain in part by a basement, the exact location of which is unknown. However, during the remediation works several service ducts/voids beneath the remaining slabs were noted, raising potential safety concerns with regards to tracking of plant over these areas. Most notably, a deep (>2m) partially water filled service duct was noted in the south-east of the Site parallel to the southern boundary of the Site. Currently the duct is protected by a large metal cover. However, should this become damaged or be removed this would represent a significant safety risk. Furthermore, labels warning of asbestos containing materials (ACM) were present within the ducts, and it is considered this may relate to pipe lagging noted in the side of the duct. The locations of these ducts have been previously notified, and are also detailed in Delta-Simons Remediation and Groundwater Monitoring Report, dated June 2012.

- **Asbestos** – In addition to the ACM noted within the service duct, small quantities of asbestos cement sheet fragments were noted on the Site surface.

- **Additional Investigations** – Prior to the redevelopment of the Site, additional investigation of the shallow soils and ground gas monitoring is likely to be required to confirm that the Site is suitable for the proposed end use. Additionally, further site investigation is required on the adjacent CPUK area of the Site.

Proposed Works

The letter relates to planning condition No.1 i.e.

N6/2015/0294/PP – Planning Condition No. 1 – A site investigation scheme, based on the submitted phase 1 Environmental Assessment (Delta-Simons ref 2342.17 V2) to provide information for a detailed assessment of the risk to all receptors that may be affected, including those off site.

Bearing the above narrative in mind, the scope of works has been split into two phases and we would see the northern site works as a later and distinct phase from the southern site works:

- Southern Site (Polycell and Confectionery Site)
- Northern Site (Cereal Partners Site)

Scope of Works – Southern Site

The EAME proposed scope of works is as follows:

Stage 1 – Existing data review

Review of all existing information, data and reports including the Detailed Quantitative Risk assessments (DQRAs). Request any further information from Delta-Simons and identify data gaps that need to be addressed in the light of the new proposals.

STATUS: This task has been completed.

Stage 2 – Investigate and sample existing groundwater wells (Chalk Aquifer)

The works would include the locating, marking, cleaning-out, purging and sampling of all available groundwater wells on the southern site. In September 2015, the last round of monitoring, Delta-Simons sampled from up to 23 available wells (BH2, BHA, BHB, BHC, BHE/BH37, BHF, BH302(s), BH302(d), DS01/BH31, DS02, DS03, DS04, R1, R2, BH202, BH206, BH208, BH209/BH39, BH304, BH303(d), BH303(d), BH38 and BH8).

EAME attended Site w/c 18/09/17 to locate and mark available wells and to clear vegetation. During this process we informed the Environment Agency (EA) that we were on-site and if they would like to come and visit to discuss the proposed scope of works. The EA attended Site during the activities lead by Mr. Kai Mitchell (EA Planning Advisor - Sustainable Places) and two other colleagues.

EAME then attended the Site w/c 25/09/17 to purge and sample (using low-flow techniques) available groundwater wells. In total 22 groundwater samples were obtained and submitted to i2 Laboratories (UKAS/ISO17025) for analysis (29/09/17).

This stage will produce an interim data report that will provide an update on the groundwater contamination status and whether it has continued to improve since 2015 or deteriorated.

STATUS: Work started.

Stage 3 – Service tracing

This will be necessary to identify the location of underground services and enable the 'safe' drilling of new exploratory locations (in-line with Health and Safety Executive Guidance Note HS(G) 47 Avoiding Danger from Underground Services). During this process, all existing accessible wells will be GPS located and levelled in to an appropriate benchmark so that groundwater gradients can be determined.

STATUS: Not started.

Stage 4 – Preparation of detailed Site Investigation Plan

Based on the above stages, a detailed investigation plan suitable for submission to the Local Authority will be prepared designed to meet the requirements of the planning conditions. This plan will be submitted to update this letter report (i.e. post service tracing to confirm the exact investigation points).

STATUS: Not started.

Stage 5 – Consultation with Regulators

Due to the extensive previous works, particularly relating to the remediation of the Polycell Factory, EAME would discuss with the Environment Agency (EA) and Local Authority Environmental Health Officer (EHO) the works undertaken so far and the relationship with the proposed current works to ensure that unnecessary duplication or data collection is avoided.

STATUS: Not started.

Stage 6 – Window Sampling (Shallow Soils)

EAME proposes to undertake three day's window sampling (24 locations) at selected positions to a depth of approximately 4.5 m below ground level (bgl), with installation in 15 locations for subsequent ground gas and (shallow) groundwater monitoring (if present). The Window Samples will also include the previously excavated and remediated tank farm area. Collection of up to 48 soil

samples (2 per window sample) will be undertaken and submitted for appropriate chemical analysis (UKAS ISO17025 Laboratory).

Collection of 10 groundwater samples (on one occasion) will be undertaken from the new locations (if shallow groundwater is encountered within the soil and gravel units) and submitted for appropriate chemical analysis (UKAS ISO17025 Laboratory) including inorganic and organic species (particularly VOCs and SVOCs which would indicate solvent contamination).

STATUS: Not started.

Stage 7 – Soil Vapour Survey (SVS)

EAME would propose to undertake an SVS across the southern site to assess the shallow soil conditions. The SVS would be undertaken by drilling multiple small diameter holes (16 - 25mm diameter) into the ground using a Hilti drill to allow a hand-held gas Photoionization Detector (PID) to take readings of any gas traces (volatile organic compounds) that are present and which have built up beneath the site surface.

STATUS: Not started.

Stage 8 – Ground gas monitoring

Monitoring of land gases (CO, CO_2, CH_4, H_2S, O_2) will be undertaken on all available monitoring wells (up to 35 locations). One round has been included but we appreciate that up to 6 rounds (under differing atmospheric conditions) may be required if the initial round shows significantly positive results for land gas. The monitoring shall also include volatile vapour monitoring using a PID for which one round should be sufficient.

STATUS: Not started.

Stage 10 – Reporting and Risk Assessment

Reporting in-line with CLR11 and addressing the environmental risks and pollutant linkages with the new proposals with provision of an updated DQRA assessment (e.g. Chalk aquifer and proposed residential end site use).

In our opinion, it would be difficult for the EA to accept the current DQRA that dates from 2005/2006. Although it might have been suitable then the river basin typology directions came out in 2010 and the Environment Agency document GP3 (Groundwater protection: Principles and practice) was issued/updated in 2013. Our initial review of the Delta-Simons assessment is that the compliance point distance is set at 300 metres which for the Contaminants of Concern (CoC) would usually be 50 metres. Although the compliance points etc. are more stringent these days the

guidance does allow more flexibility in terms of applying environmental betterment rather than attempting wholesale remediation.

The report would also include a remediation options appraisal setting out where remedial actions may be required and what these might be.

STATUS: Not started.

Scope of Works – Northern Site

The northern site, although forming part of the same development is quite different to the southern Site, not least because the site is still intensively covered with buildings and structures and there are limited investigation opportunities pre-demolition. Delta-Simons has previously conducted limited investigations on the northern site, as outlined in *Table 1*. These were designed to target known potential sources of contamination.

Table 1: Northern Site – Boreholes associated with previous investigations

Location	Comments
BHA	Former Print Works (central eastern area of the main factory).
BHB	Railway tracks
BHC	Transformers associated with historic boiler house
BHD	Former engine shed – now within car park area
BHF	Boiler house
BHG	UST (down vehicle entrance ramp)
BHH	General site coverage
Notes: According to the Delta-Simons report (Ref. 05-3046.01 COMBINED PHASE I II.pdf) all 7 boreholes were installed to facilitate groundwater and gas monitoring. The logs have been requested from Delta-Simons. In addition, 7 window samples were drilled on the northern site (WS10B, WS9, WS8B, WS6B, WS7B).	

EAME recommends the following scope of work split across the pre--demolition and post-demolition phases as follows:

Pre-Demolition (in tandem with Southern Site Works)

Stage 1 – Existing data review

Review of all existing information, data and reports. Request any further information from Delta-Simons and identify data gaps in the light of the current proposals.

STATUS: This task has been completed.

Stage 2 – Investigate and sample existing groundwater wells (Chalk Aquifer)

The works would include the locating, marking, cleaning-out, purging and sampling of all available groundwater wells on the northern site. In June 2006, the last round of monitoring, Delta-Simons sampled from 7 available wells (BHA, BHB, BHC, BHD, BHF, BHG, BHH).

EAME attended Site w/c 18/09/17 to locate and mark available wells and to clear vegetation during which 3 of the 7 wells were located. During this process we informed the Environment Agency (EA) that we were on-site and if they would like to come and visit to discuss the proposed scope of works. The EA did not express any concerns with the northern site and did not visit it.

EAME then attended the Site w/c 25/09/17 to purge and sample (using low-flow techniques) available groundwater wells. In total 3 groundwater samples were obtained from wells and submitted to i2 Laboratories (UKAS/ISO17025) for analysis (29/09/17).

STATUS: Work started.

Post-Demolition Works

Due to the heavily congested nature of the current site and the lack of available investigation points further ground investigation is recommended to occur post-demolition.

Stage 3 – Oversight of demolition activities in key risk areas

During the demolition phase EAME shall have oversight of the demolition activities in key areas where previous historic activities could have led to ground contamination issues i.e. boiler house, substations, underground storage tank, historic above ground tanks etc. Where suspected ground contamination is identified (during the demolition phase) EAME would require the principal demolition contractor to provide temporary access to an excavator (and driver) to enable the collection of shallow soil samples from a trial pit within the vicinity of the suspected ground contamination.

STATUS: Not started.

Stage 4 – Service tracing

Identify the location of underground services for the 'safe' drilling of exploratory locations (in-line with Health and Safety Executive Guidance Note HS(G) 47 Avoiding Danger from Underground Services). During this process, all existing accessible wells will be GPS located and levelled in to an appropriate benchmark.

STATUS: Not started.

Stage 5 – Preparation of detailed Site Investigation Plan

A detailed layout plan will be prepared suitable for submission to the Local Authority to meet the requirements of the draft planning conditions (i.e. an update to this letter report).

STATUS: Not started.

Stage 6 – Window Sampling (Shallow Soils)

Two day's window sampling (16 locations) at selected locations to a depth of approximately 4.5 m below ground level (bgl), with installation in 8 locations for subsequent ground gas and (shallow) groundwater monitoring (if present). Collection of up to 32 soil samples (2 per window sample) submitted for appropriate chemical analysis (UKAS ISO17025 Laboratory) including organic and inorganic species.

Collection of up to 8 groundwater samples (on one occasion) from the new locations (if shallow groundwater is encountered within the soil and gravel units) submitted for appropriate chemical analysis (UKAS ISO17025 Laboratory).

STATUS: Not started.

Stage 8 – Ground gas monitoring

Monitoring of land gases (CO, CO_2, CH_4, H_2S, O_2) will be undertaken on all available monitoring wells (up to 10 locations). One round has been included but we appreciate that up to 6 rounds (under differing atmospheric conditions) may be required if the initial round shows significantly positive results for land gas. The monitoring shall also include volatile vapour monitoring using a PID for which one round should be sufficient.

STATUS: Not started.

Stage 9 – Reporting and Risk Assessment

Reporting will be undertaken in-line with CLR11 addressing all credible environmental risks and pollutant linkages. A Detailed Quantitative Risk Assessments (DQRA) may be required where contamination is encountered on site, to determine whether the contamination presents an actual risk to an identified receptor (e.g. end users of a site or the Chalk aquifer). Where remedial works are needed, the DQRA can also be used to derive clean-up concentrations for levels of contamination which can remain in the ground following any remedial works which have been undertaken. A remediation options appraisal addressing the risks will be included in the final report.

STATUS: Not started.

I hope the information provided is useful. If you have any queries, on the proposed scope of work, please do not hesitate to contact me.

Yours sincerely,

Steve Rowan
EAME Managing Director
(steve.rowan@eame.co.uk)

APPENDIX 15

ARCHAEOLOGY AND HERITAGE

APPENDIX 15.1 – HERITAGE STATEMENT

Former Nabisco Shredded Wheat Factory

Bridge Road, Welwyn Garden City, Hertfordshire

Heritage Statement

Januarty 2018

Consultancy for the Historic Built Environment

KMHeritage

Contents

1 Introduction

1.1 This report has been prepared to support the applications for planning permission and listed building consent for the former Shredded Wheat Factory, Bridge Road, Welwyn Garden City.

1.2 The purpose of this report is to set out the history and heritage significance of the site, and to assess the impact of the development proposals. The report should be read in conjunction with the other documents that make up this application.

1.3 The drafting of this statement was undertaken by Nick Collins BSc (Hons) MSc MRICS IHBC. Nick has been a Principal Inspector of Historic Buildings & Areas in the London Region of English Heritage. Most recently he was a Director of Conservation at Alan Baxter & Associates. Nick has extensive experience in dealing with proposals that affect the historic environment and also has a background in research, in policy analysis and in understanding historic buildings and places.

1.4 Historical research for this report was undertaken by Dr Ann Robey FSA, a conservation and heritage professional with over twenty years experience. She has worked for leading national bodies as well as smaller local organizations and charities. She is a researcher and writer specialising in architectural, social and economic history, with a publication record that includes books, articles, exhibitions and collaborative research.

1.5 The buildings form part of a larger, partly vacant site, to the east of the main north-south railway line that runs through Welwyn Garden City. The site is located in close proximity to the rail overbridge that provides pedestrian access to the railway station and on to the town centre.

Notes on research, analysis and sources

1.6 It should be noted that in common with many historic buildings and sites, it is not always possible to provide a

truly comprehensive analysis of the historic development of a building. The research and analysis set out in this report is as thorough as possible given the type and number of archival resources available.

1.7 This desk-based and archival research has been combined with a visual assessment and appraisal of the building. Further sources and evidence that add to our knowledge and understanding of the building and its history may become available at a future date The report has also been informed by the Historic Building Recording Report carried out by Archaeological Solutions Ltd in April 2014.

2 Site Location & Description

2.1 The site lies within Welwyn Garden City in the centre of Hertfordshire. It occupies a central position, to the east of the A1 (M) motorway and main railway line bounded by Broadwater Road, Bridge Road and Hyde Way and land adjoining the railway.

2.2 At the time of writing previously consented demolition works are being carried out which will considerably reduce the amount of development on the site.

2.3 The site is rectangular in plan and the topography is mainly flat. Until recently approximately half of the site was developed, with the original factory complex facing the railway line.

2.4 The complex is built in a predominantly functional architecture of painted concrete/rendered walls and metal windows. The most important, original, element of the site was largely enclosed in views from Broadwater Road and Bridge Road by the more mediocre additions to the complex in the 1930s and 1950s. Between 1937 and 1939 a new single storey production hall and an additional 27 silos were added. In the 1950s there were further extensions to the production facilities and office accommodation added fronting Bridge Road.

2.5 The term 'designations' relates to the level of statutory protection that applies to a site or building. A designated heritage asset can be a listed building or a conservation area. The extent of a designated conservation area is straightforward to determine given that the boundary is set at the date of designation or later extension. The extent of a listed building can be less clear as listing often applies to other lesser elements that are attached to a listed building or form part of its curtilage. Determining whether other structures form part of the listing involves consideration of whether structures are fixed, whether these are ancillary to the main building and whether these formed part of the land before 1 July 1948.

Designations

2.6 The grade II listed former factory forms one element of a wider site, currently occupying roughly its northern half. The factory building was listed in 1981. As a listed building, consent may be required in order to undertake certain works to the building which could affect the building's architectural or historic interest.

2.7 The full list description for the complex reads as follows:

1925. Architect Louis de Soissons. Two concrete ranges, at right angles with links. Southern range consists of giant range of cylindrical concrete drums 15 bays long with flat oversailing capping with railings right over the whole top. Behind this is a plain attic storey with 28 plain windows with plain capping over. On one end elevation is a 3 bay projecting tower rising just above the main roof level.

At the west end of the range is a 2 bay wing with large windows, the southern bay of 3 storeys and the northern of 4. Flatroofs. Adjacent is a 7 bay, 4 storey block, with large windows divided by narrow piers and small scale structural divisions between the storeys, making it almost wholly glass. Flat oversailing capping at roof level.

2.8 The list description is intended to provide sufficient detail for identification purposes only. It does not for example provide the history of the building or identify any particular features as having a greater or lesser significance.

2.9 The site is not situated within a conservation area but is in close proximity to the Welwyn Garden City Conservation Area. This conservation area covers a large area of the town centre to the west of the site and its residential hinterlands. Whilst the impact of the scheme on its character and appearance will be considered within this report, as far as this site is concerned, there is something of a barrier between the site and the conservation area caused by the breadth of the railway lines and siding and the Howard Centre to the west.

2.10 The closest listed building to the site is located to the south of the Shredded Wheat Factory (figure 1). This is the grade II listed former office block to the Roche Factory (now demolished). This building was constructed in the late 1930s.

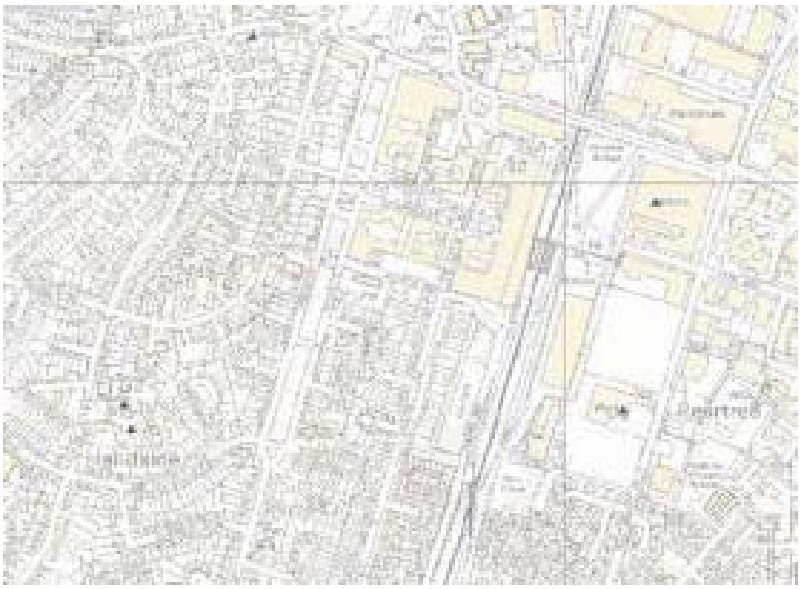


Figure 1: Plan showing listed buildings within close proximity to the site. The blue triangles indicate a listed building.

3 Historical Development

3.1 The following section provides an overview of the historic development of the former Shredded Wheat Factory Site.

Overview

3.2 For almost ninety years the distinctive white silos of the Grade II listed former Shredded Wheat Factory have been a prominent landmark to rail travellers passing the station in Welwyn Garden City. The factory was designed by Canadian-born Louis de Soissons (1890-1962), the principal architect of Welwyn – the country's second Garden City, which was established on agricultural land just twenty-one miles from London by planning pioneer Ebenezer Howard in 1919-20. In April 1920, Welwyn Garden City Limited was formally established as the owner and developer of the 2,378 acre estate, as a new garden city for 40-50,000 inhabitants. Louis de Soissons was appointed as the principal architect and planner in April 1920 and he presented a 'master plan' for the new 'city' in June of the same year (figures 2&3)[1]. It was the first major commission of the Louis de Soissons Partnership, the practice he had set up with George Grey Wornum. Louis de Soissons and the partnership were actively involved in Welwyn's planning, architectural design and growth for over 60 years.

3.3 The development company – Welwyn Garden City Limited – allocated land for industrial and business purposes, as well as for privately owned houses, granting leases with restrictive covenants[2]. De Soissons had total control of the plan of Welwyn Garden City – all plans of buildings had to be submitted to him under the provisions of the *Building and Other Regulations in Force on the Welwyn Garden City Estate* of 1923. Welwyn Garden

[1] Welwyn Garden City Conservation Area Appraisal, Conservation Architecture & Planning Ltd. (2006)
[2] J. Tyrwhitt, *Life and Works in Welwyn*, (1939), p.2

City Limited successfully controlled the appearance of the town, and built about 40% of the buildings themselves.

3.4 The new Garden City was to be self-sufficient; it was to be a carefully planned settlement combining industry and agriculture into a distinct whole, a self-contained community with an industrial area providing jobs in 'clean' manufacturing industries. This was to prevent the town becoming merely a dormitory town for London. The limits on its growth were ultimately set by the surrounding green-belt and any trees already in the landscape were retained in the initial plan. A follower of garden city philosophy wrote in 1911 'The object of a Garden City is to draw away from overcrowded localities or to intercept the ever-increasing flow from the country by establishing new industrial towns in the country: towns which shall always stand in their belt of agricultural land'[3].

Figure 2: OS Map of 1898 showing the site of the future Welwyn Garden City

[3] Sir Ralph Neville, 'Garden City and Garden Suburb', in *Garden Cities and Town Planning*, n.s. Vol. 1, No. 1 (1911)

3.5 To the west and north of the town centre were residential districts, and to the east of the railway line were areas reserved for industry and business, beyond which were further areas of housing. (Figure 4). The industrial area was beside the London and North Eastern Railway (LNER) and the branch line to Hertford which swept north-eastwards (now closed). This fairly level land close to the railway was recognised as the best site for industry. Most of the factories were eventually located off Broadwater Road, which ran in a north-south axis (figures 5,6 & 7).

Figure 3: Louis de Soissons' Master Plan of June 1920

Figure 4: A town plan by de Soissons dating from 1921

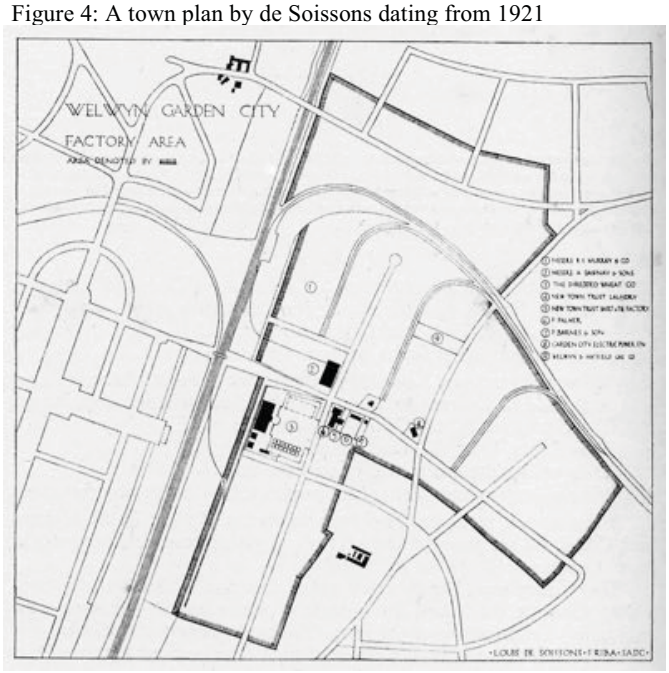


Figure 5: Plan by Louis de Soissons of the Factory Area in 1925

Shredded Wheat

3.6 The first firm to occupy a site in the new Factory Area at Welwyn was Archibald D. Dawnay & Sons Ltd, constructional engineers and structural steel fabricators who took a site near Hunter's Bridge which crossed the railway (No.2 on figure 5). They were quickly followed by the American company Shredded Wheat which leased seven acres just to the south in an excellent position right by the railway line[4] (No.3 on figure 5). Shredded Wheat was attracted to the town for several reasons – the close proximity to London, but without the 'smoke, grime and fog, that London is apt to indulge in'; the convenience of getting 'suitable railway siding accommodation for receiving goods to other parts of the country'[5]. But of equal importance was the prospect of having a factory in a new healthy environment where the workforce could profit from all the social and economic benefits of 'the happy Shredded Wheat Family'[6]. The company believed that 'all food for human consumption should be manufactured under the most rigid sanitary conditions and amidst surroundings that are cleanly, healthy and pleasant'. Welwyn Garden City was chosen as 'more nearly conforming to these ideals than any of the other sites offered'[7].

3.7 De Soissons drew up plans for the new Shredded Wheat factory between March and July 1924 and construction work on the factory started in May in the same year[8]. The Shredded Wheat Company of America was established in the 1890s by Henry Perky, a health food enthusiast and the inventor of Shredded Wheat.

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[4] Maurice de Soissons, *Welwyn Garden City: A town designed for healthy living* (1988), p.58

[5] Hertford Local Studies Library, *Industry Moves Out* (n/d), p.19

[6] Shredded Wheat publicity brochure on Welwyn Garden City Heritage Trust website

[7] *Industry Moves Out*, (n/d), p.19

[8] Herts Archives & Local Studies UDC/21/77/130; UDC/21/77 132 (1&)

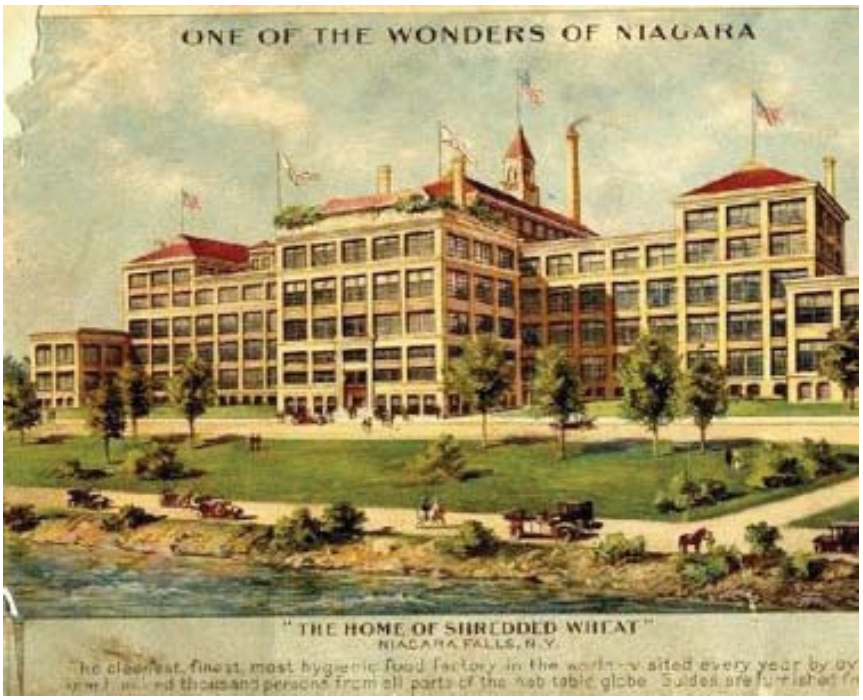


Figure 6: Shredded Wheat Factory in Buffalo, close to Niagara Falls, (demolished in the 1950s)

3.8 Perky's bright, ultra-modern factory, opened in Niagara Falls in 1901, and was an exemplar in architecture of the healthy lifestyle promoted by its product and was regarded as a model factory.

3.9 Much was made about the cleanliness of the factory and manufacturing process and the factory was built there to take advantage of the hydroelectric power supplied by the Niagara River. The five-storey factory was called the 'Palace of Light' because of the vast numbers of windows and because it was clean and modern (figure 6). Over 100,000 tourists a year visited the factory to admire its hygienic operations, its employee showers and reading rooms, the fine recreational and social facilities offered to staff and to sample the product. The tour demonstrated 'both the wonders of technology and the benefits of enlightened management'[9].

[9] William Irwin, *The New Niagara: Tourism, Technology and the Landscape of Niagara Falls 1776-1917*, (1996), p.181; The employees, who were mainly female, received four breaks during the day and were the first known recipients of 'coffee-breaks'.

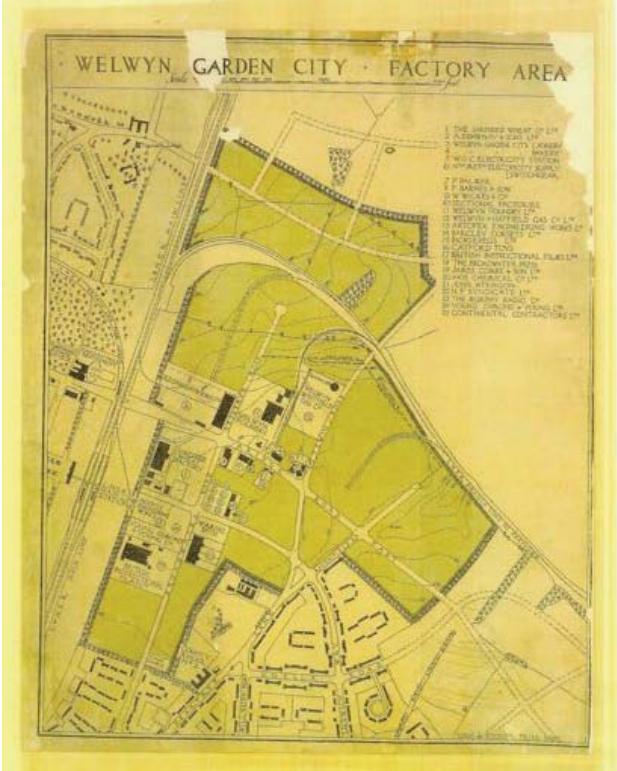


Figure 7: Plan of Factory Area in 1929

3.10 The growth in demand for 'cereal-based' breakfast foods in the early 20th century saw the company expand to England, setting up offices in Aldwych, London in 1908. After looking at many locations, they chose to build their first European factory in Welwyn Garden City[10] because the company wished to come to a new town in order to provide ideal working and living conditions for their employees[11].

3.11 From the very start Welwyn Garden City did all it could to attract industrial manufacturers to the town, placing adverts in 1920 in magazines such as Punch and in the daily newspapers, and covering huge hoardings with adverts. An undated promotional brochure produced by Welwyn Garden City Ltd. Entitled *Industry Moves Out* stated 'factory sites in Welwyn Garden City must appeal

[10] *The Times*, 28 Jun 1924

[11] Maurice de Soissons, *Welwyn Garden City: A town designed for healthy living* (1988), p.58

strongly to firms who want their products made in the healthiest and cleanest atmosphere right away from the smoke and fog, by workers living under conditions which make for both well-being and contentment'[12]. In fact the Shredded Wheat Company stated that 'we expect both our office and factory staff to live in Welwyn Garden City, so that they and their families may have the benefit of the new and ideal housing conditions in the town, and also that the cost of transportation to and from work should be minimised[13].

3.12 Work began on the original three-storey Production Hall block fronting the railway line of the Shredded Wheat Factory in May 1924[14]. There was a boiler house, garage and wheat elevator, all designed by de Soissons (see plan of 1924 in figure 8). De Soissons submitted the official building application for the factory on 28th July 1924[15]. The foundation, footings, external party and cross walls were all built in reinforced concrete with a damp course of Bituminous felt (figure 9)[16]. The flat roof was covered in Asphalt. The factory was built by the flat-slab construction method, a technique that had been developed in Europe and America which had flat floor plates resting on columns without any down stand beams, its structural behaviour depending upon the arrangement of reinforcing within the slab. American clients in Britain were amongst the first to accept this construction method in the mid-1920s. The Shredded Wheat Factory was amongst the first buildings to use it, the work being undertaken by the Trussed Concrete Steel Company, who at the same time were working for Wallis Gilbert and Partner on the Wrigley Factory at Wembley[17]

[12] *Industry Moves Out*, (n/d), p.17
[13] *Industry Moves Out*, (n/d) p.19
[14] Roger Fuller, *A History of Welwyn Garden City*, (1986), p.130
[15] Herts Archives, UDC/21/77/132 (1)
[16] *ibid*
[17] David Yeomans, *Owen Williams*, (2001), p.88

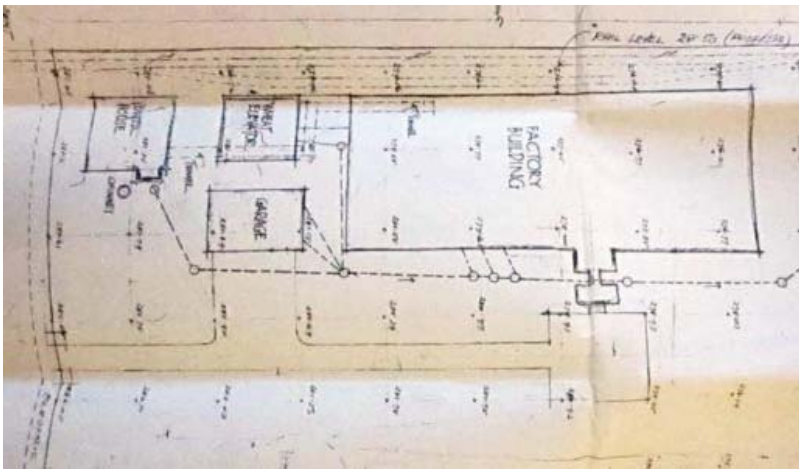


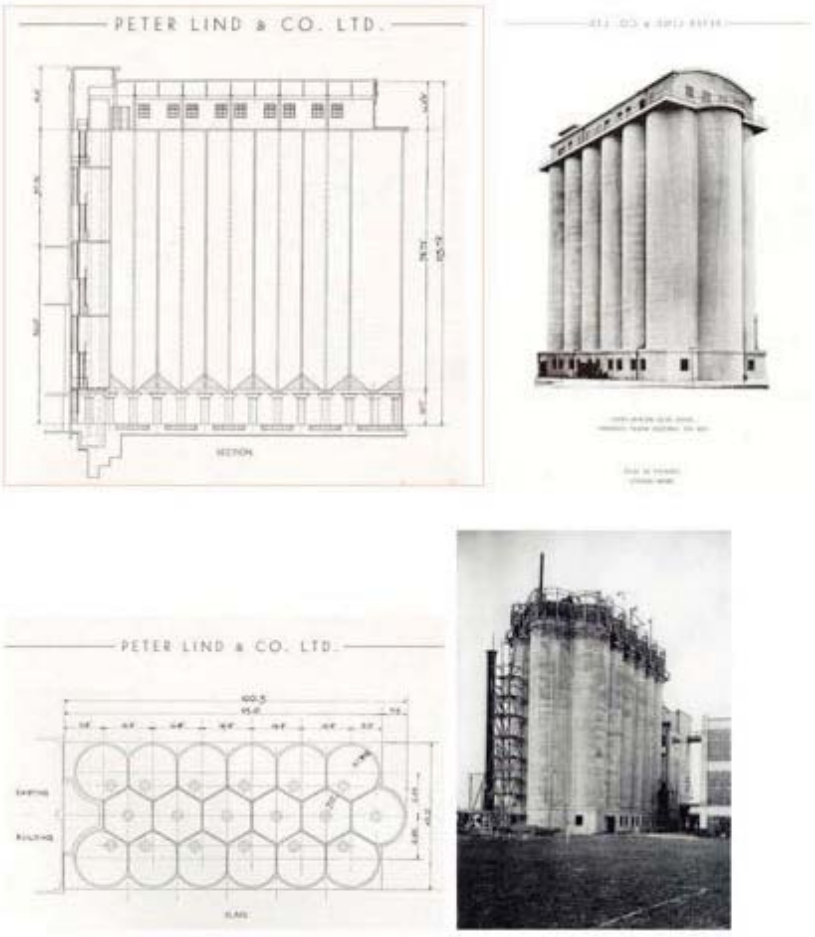
Figure 8: Plan of new Shredded Wheat Factory in 1924 [© Hertfordshire Archives & Local Studies]

Figure 9: Showing the construction of the reinforced concrete Shredded Wheat Factory c.1924 [© Welwyn Garden City Heritage Trust website]

3.13 The Shredded Wheat Factory became almost a symbol of Welwyn, being one of the first new factories built there in a modern style – a dramatic contrast to the neo-Georgian that de Soissons used for the design of housing and civic buildings elsewhere in Welwyn[18]. De Soissons showed

[18] Roger Fuller, *A History of Welwyn Garden City*, (1986), p.127

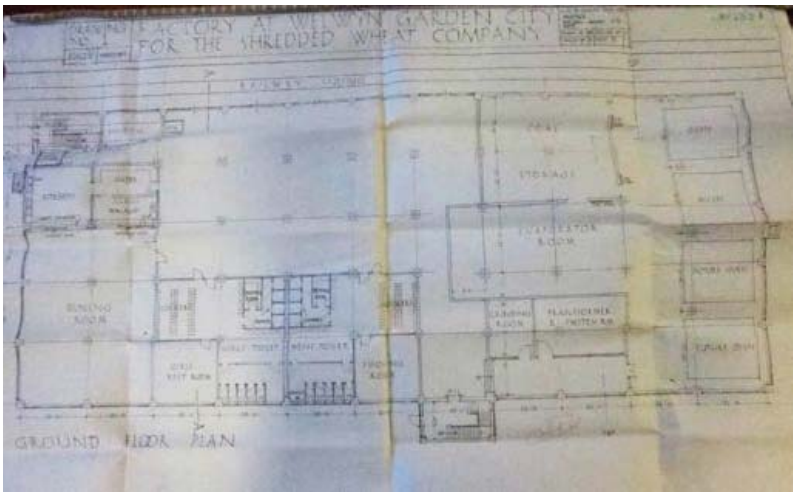
that he could work in a Modernist idiom with the Shredded Wheat Factory[19].

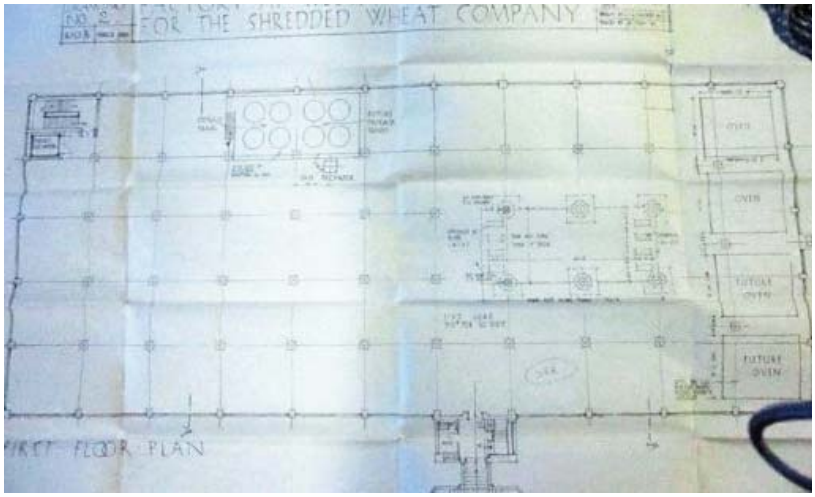


Figures 10-13: The silos under construction and the design by Peter Lind & Co. Ltd. [© Welwyn Garden City Heritage Trust website]

3.14 Much of the machinery such as shredding machines were housed on the first floor, including the heavy ovens that were located at the northern end (see figures 14 & 15) – and probably accounts for the extra thickness of floor slab at this end of the building.

[19] Elsewhere in Welwyn, there were a few architect-designed homes in the Moderne style including properties in Coneydale and Pentley Park by Eugene Kauffman and Paul Mauger.





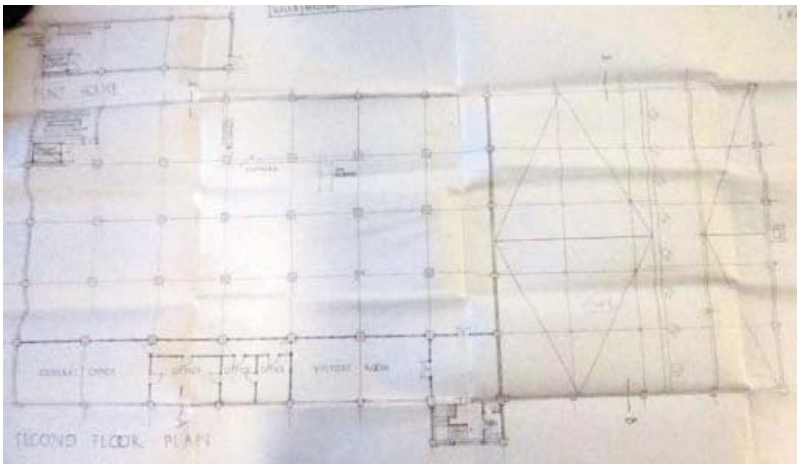


Figure 14 and 15: Ground and first floor plan of the original factory building.
Figure 16: Second floor plan of the original factory building.

3.15 The opening ceremony brochure stated that 'the factory has been constructed by Messrs. F.P. Henderson, Ltd, the

well-known building contractors of London, from plans and under the direction of the architect Mr. Louis de Soissons, OBE, FRIBA of Welwyn Garden City, assisted by Mr. Arthur Kenyon, FRIBA, of 22 Surrey Street, Strand'[20]. The 18 grain silos were designed and built by Peter Lind & Co. of London (figures 10,11,12,13).

3.16 The building was described as a 'model factory' with a clean healthy image, enhanced by the use of the white ceramic tiles in which the building was encased 'like ivory' and the vast clear windows that sparkled like 'clusters of diamonds' (see figure 17). Inside, the white-painted reinforced concrete workrooms and offices were flooded with sunlight and it was said that it 'was impossible to imagine workrooms more airy, bright and pleasant'[21].

Figure 17: Shredded Wheat Factory showing the original factory with projecting main entrance and canopied entrance, with the silos beyond [© Welwyn Garden City Heritage Trust website]

3.17 The new factory began production in 1926. At the 5th Ordinary Meeting of Welwyn Garden City Ltd, it was reported that 'the factory of the Shredded Wheat Co., with its extraordinary efficient equipment will be brought

[20] Shredded Wheat Factory Opening Souvenir Brochure (1925) on Welwyn Garden City Heritage Trust website
[21] *ibid*

into operation as their first European plant'[22]. It was officially opened by Lord Salisbury on 12 March 1926.[23] So striking and modern was the new building, that the company used an image of the factory on every packet of the cereal, on their delivery vans and in all their printed publicity and advertisements.

3.18 The design of the Shredded Wheat Factory was so unashamedly modern (especially with the white concrete silos) that it was perhaps the most avant-garde building in Britain at the time of its completion in 1925. The influence of American design at the factory was clear. The mammoth reinforced concrete elevators or silos were first built in Buffalo (the home of Shredded Wheat) in 1906. Architect Walter Gropius wrote in his 1913 essay *The Development of Industrial Design*, that 'The grain elevators of Canada and South America...are almost as impressive in their monumental power as the buildings of ancient Egypt'. [24] Gillian Darley's book *Factory* states that the nearest English replication of the monumental silos of Buffalo was Welwyn Garden City's Shredded Wheat Factory with its concrete, white-rendered simple geometry.[25]

3.19 When building the grain silos, Peter Lind & Co. Ltd had to use innovative methods of construction. They used sliding shutters that enabled concreting to go on continuously day and night until the work was finished. Night shifts worked under floodlights, and the operation called for a high degree of organization and supervision. Shredded Wheat had a 5,700 tons capacity silo, with

[22] *The Times*, 20 June 1925
[23] *The Times* 13 Mar 1926
[24] Early 20th century architects were mesmerised by concrete silos both in America and in Europe. Concrete had been used to construct grain silos in Europe as early as the 1890s and the Belgian reinforced concrete pioneer Francois Hennebique was well known for his silos. In 1927, le Corbusier called "American grain elevators and factories, the magnificent first-fruits of the new age", in *Towards a New Architecture* and praised the engineers that built them and admired the concrete structures that combined form and function.
[25] Gillian Darley, *Factory,* (2004)

eighteen storage bins that towered above the factory. Which at a total height of over one hundred feet, was a dramatic sight.

3.20 In 1928 the Shredded Wheat Co. Ltd. became associated with the National Biscuit Company of America (Nabisco) which produced not only Shredded Wheat but also numerous varieties of branded biscuits and wrapped bread.

Figure 18: The factory in its recreation grounds

3.21 Extensions took place to the factory between 1937 and 1939. These included a new single storey production hall fixed to the east of the multi-storey original production hall and an increase in the number of silos from 18 to 45. The additional 27 storage bins were designed by Louis Wirsching Jnr (the Nabisco company architect) and constructed by Peter Lind & Co. Ltd. The capacity increased by 8,500 tons. The new silos, whilst at first glance appearing to be fully integrated to the original ones are actually separate, independent, structures that simply 'butt up against' the originals. A conveyor system was also introduced. In 1937 a penthouse was added to the top of the main building in reinforced concrete.

3.22 1941 to 1947 were difficult business years, because, under the Government zoning scheme, the Shredded Wheat Company was excluded from selling in certain areas where sales were strongly established. Zoning came to an end early in 1947 and from then onwards the

company steadily increased its share of the cereal market. In the early 1950s there was a large extension towards Broadwater Road that increased production facilities, but reduced the recreation ground. Another extension in 1957 improved production and increased administrative facilities. The factory was extended again in 1959 and these extensions covered the whole site with buildings and obscured the silos from the view of the road that passes the factory.

3.23 In 1960 the company bought a further 5.5 acres and Cromac House was built for the research, sales development and warehousing departments.[26] In 1961 Charles W Fox FRIBA drew plans for renovations to the west elevation of the original factory building. This work involved the addition of Seaporcel panels (green). The columns that originally rose above the roof were cut down to be level with the top of a new parapet.

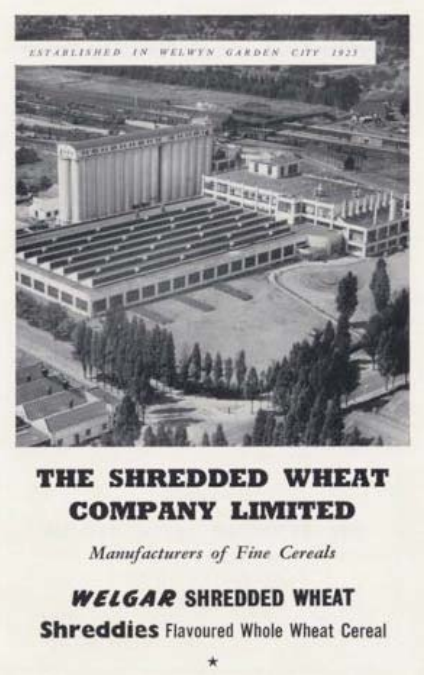


Figure 19: The factory as shown in the Welwyn Garden City – The official handbook & Directory 1953/54

[26] Roger Fuller, *A History of Welwyn Garden City*, (1986), p.133

Figure 20: The Folly Arch – the entrance to the 'Home of Shredded Wheat'

The Site Today

3.24 Production at the site stopped in 2008 and since then the factory complex has been shut.

3.25 Some of the original process flows for the production of Shredded Wheat and other products may be discerned in the existing layout and minor components of redundant plant remain, but essentially the northern half of the complex is largely derelict. The southern half is a cleared site.

3.26 The northern site today comprises the accumulation of the three main phases of development, with the majority of the land now filled with buildings. Much of the original factory is hidden behind the later, less interesting buildings, including the 1930s production hall and the 1950s range of administrative offices along Bridge Road.

3.27 In 2015, Spen Hill Developments Ltd (then the owner of the site) submitted a planning application for the redevelopment of the site. The scheme, which was consented, comprised:

- New build and change of use to include up to 850 dwellings, workspace, a healthcare facility, a hotel, Class A1, A3 and A4 units and a community building;
- The demolition of non-original silos and factory and the refurbishment and change of use of the original

silos, Production Building, Grain Store and Boiler House.

- The provision of landscaping to include a linear park, a Multi-Use Games Area (MUGA), allotments, green walls and a neighbourhood square; and
- Highways works, to include the widening of footway and the provision of cycleways to Broadwater Road, and Bridge Road, together with works to Hyde Way and the erection of a new footbridge from Bridge Road leading directly into the scheme.

3.28 In more detail, with regards the listed complex, consent was granted for:

- Restoration of the eastern elevation with the reinstatement of the original grand entrance stair.
- Repair, restoration and redecoration of the main concrete structure. This includes reinstating the original glazed tiles and painted brickwork and the removal of the 1960s Seaporcel green panels. Replacement of the existing mix and match of windows with new double-glazed uniform metal units to the original proportions.
- Removal of extraneous and redundant industrial equipment that remained in the external elevations, including the external fire escape to the north – returning the building to its simple original modernist form.
- Permission was granted for the eastern wall of the second floor to be moved out to the east to enable the insertion of a new circulation lightwell, with plant consolidated and located above this and hidden by a metal plant screen.
- Internally an open plan layout was consented with demolition of more recent partitions and sub-divisions allowing a better appreciation of the space as conceived and in particular the architectural columns holding up each floor. A new circulation core – providing access to all floors and light to the centre of

the building was permitted and a new stair added to the western side of the building to provide access from the west and necessary circulation and fire escape routes.

- With regards the Grain House, Boiler House and Silos, permission was granted for the removal of internal partitions and structures that related specifically to now-redundant processes to enable viable future uses for the spaces and the single storey connection between the Grain House and Production Hall was approved.
- Permission was granted for the reduction in number of the silos to the original eighteen. As part of the consented scheme, the remaining silos would be converted to hotel use, with floors inserted and metal windows inserted in the recesses between each silo. The top floor was to be converted to residential use.

3.29 Consent was granted for the demolition of all other buildings on the site – and this has now taken place.

4 Assessment of Significance

4.1 Assessing 'significance' is the means by which the cultural importance of a place and its component parts are identified and compared, both absolutely and relatively. This is essential for effective conservation and management. The identification of areas and aspects of higher and lower significance, based on a thorough understanding of a heritage asset, enables policies and proposals to be developed which protect, respect and, where possible, enhance its character and cultural values.

The relevant heritage assets

4.2 In terms of the assessment of the proposals for the site, the heritage assets most relevant to considering the effect of the scheme are the listed building itself, other nearby listed buildings and the setting of the Welwyn Garden City Conservation Area. The effect of the proposed scheme on these assets will be first and foremost on the special architectural and historic interest of the building itself, and then secondly on the setting of other listed buildings and conservation area. The site is not located within a Site of Archaeological Importance, nor an Archaeological Priority Area

Assessing heritage significance

4.3 The Grade II listed former Shredded Wheat factory, the listed buildings nearby and the Acton Town Centre Conservation Area are 'designated heritage assets', as defined by the National Planning Policy Framework (the NPPF). Other buildings and structures that make a positive contribution to the conservation area can be considered as 'undesignated heritage assets'.

4.4 'Significance' is defined in the NPPF as 'the value of a heritage asset to this and future generations because of its heritage interest. That interest may be archaeological, architectural, artistic or historic'. The Historic England

'Planning for the Historic Environment Practice Guide' puts it slightly differently – as 'the sum of its architectural, historic, artistic or archaeological interest'.

4.5 'Conservation Principles, Policies and Guidance for the sustainable management of the historic environment' (Historic England, April 2008) describes a number of 'heritage values' that may be present in a 'significant place'. These are evidential, historical, aesthetic and communal value.

4.6 Archaeological Significance

4.7 Until the creation of Welwyn Garden City in 1920, Figure 2, an OS map of 1898, shows that the land upon which the Factory is built was farmland. The site lies between two areas designated on the Welwyn Hatfield Local Plan as Areas of Archaeological Significance (AAS). These include AAS 26, (centred on Church Road) and AAS 30 (Salisbury Gardens/Shotlands Green). Both designated due to potential for evidence relating to Iron Age/Roman occupation. This site is not in a designated area, it is therefore unlikely that there will be any evidence of past human activity worthy of expert investigation lying below the site.

4.8 Architectural & Artistic (Aesthetic Interest)

4.9 Despite the piecemeal development of the site throughout much of the middle of the 20th century, each new additional development left the previous phase remarkably intact. There is no longer any plant remaining in any of the buildings and the site is now largely derelict.

4.10 The original (and remaining) part of the Factory complex, designed by Louis de Soissons and built between1924-1926 remains largely as built – including the main factory, boilerhouse, and first 18 wheat elevators (silos). Architecturally this element of the complex is regarded as being of the highest significance.

- Designed by an architect of note, and particularly associated with Welwyn Garden City, Louis de Soissons

showed with this factory, that he could design in the Moderne as well as neo-Georgian styles.

- Most of the original 1920s buildings remain largely complete, including details such as staircases, railings, and the silo 'shoots'.
- The factory was built using a pioneering flat-slab construction method with American clients such as Shredded Wheat and Wrigley being the first to accept and use it in Britain from the mid 1920s.
- The architecture and materials reflected the clean and hygienic principles of the Shredded Wheat Company – regarded at the time as a 'model factory'. The sense of bright, light and airy spaces remains today within the original factory building.
- The monumental nature and form of the first 18 silos made these an instant landmark and required an innovative construction approach by Peter Lind & Co.

4.11 By virtue of the architectural style, the internal finishes, where these remain, are utilitarian and simple. Those that do remain, however are of significance – such as the staircases. As all the buildings have been stripped of their content and machinery, where elements do remain these are significant as evidence of the former use of the buildings however their interest is lessened by their 'unconnected' nature.

4.12 In places alterations and additions have taken place which have lessened the significance of these original buildings. Most noticeably where the later single storey production hall addition was built directly against what was, originally, the front elevation of the factory building. This led to the blocking of some windows and the loss of the formal entrance. The staircase, internally, however still remains. The consented scheme provides the opportunity to better reveal the significance of the building following the removal of elements of lesser significance.

Historical Interest

4.13 As one of the first factories to be built in Welwyn Garden City, the former Shredded Wheat factory is historically important. The original 1924-1926 factory complex is of especially high significance historically:

- The factory was one of the first to be built in the newly designated 'industrial zone' in Welwyn Garden City.
- As well as locational benefits, Welwyn was chosen because the principles of the Garden City Movement matched those of the Shredded Wheat Company. The Company believed that food should be produced in an environment that was 'clean, healthy and pleasant' and it was felt that the new Garden City conformed to these ideals.
- The factory was built of historically pioneering construction methods as previously mentioned.

Communal & Social Interest

4.14 The Shredded Wheat factory complex has played a significant part in the physical and employment life of Welwyn Garden City since its inception in the 1920s. This significance is derived from a number of key factors:

- One of the first factories, and therefore large-scale employers in the newly created Welwyn Garden City.
- Built in a new and 'avant-garde' architectural style, deemed so 'modern' that the factory appeared on cereal packets, delivery vans and printed publicity.
- The company encouraged staff to live healthily in a healthy environment – hence the original provision for open space and gardens around the factory. This was not lost totally until the 1950s.
- The silos are a local landmark visible for many miles.
- The factory complex has been part of architectural landscape of Welwyn Garden City for nearly 90 years, located as it is, directly next one of the principal link routes from east to west across the railway and next to the station.

4.15 As mentioned above, the later phases of development subsumed the former recreation ground, which had been an important element of the original concept. These more recent parts of the complex have therefore weakened the communal and social significance of both Shredded Wheat and Louis de Soissons' vision over the past 80 years.

5 The policy context

5.1 This section of the report briefly sets out the range of national and local policy and guidance relevant to the consideration of change in the historic built environment.

The National Planning Policy Framework

5.2 The legislation governing listed buildings and conservation areas is the Planning (Listed Buildings and Conservation Areas) Act 1990. In 2012, the Government published the new National Planning Policy Framework (NPPF), which replaced Planning Policy Statement 5: 'Planning for the Historic Environment' (PPS5) with immediate effect.

5.3 The NPPF says at Paragraph 128 that:

> In determining applications, local planning authorities should require an applicant to describe the significance of any heritage assets affected, including any contribution made by their setting. The level of detail should be proportionate to the assets' importance and no more than is sufficient to understand the potential impact of the proposal on their significance.

5.4 A detailed description and analysis of the heritage significance of the site is provided earlier in this report.

5.5 The NPPF also requires local planning authorities to 'identify and assess the particular significance of any heritage asset that may be affected by a proposal (including by development affecting the setting of a heritage asset) taking account of the available evidence and any necessary expertise. They should take this assessment into account when considering the impact of a proposal on a heritage asset, to avoid or minimise conflict between the heritage asset's conservation and any aspect of the proposal'.

5.6 At Paragraph 131, the NPPF says that:

In determining planning applications, local planning authorities should take account of:

- the desirability of sustaining and enhancing the significance of heritage assets and putting them to viable uses consistent with their conservation;
- the positive contribution that conservation of heritage assets can make to sustainable communities including their economic vitality; and
- the desirability of new development making a positive contribution to local character and distinctiveness.

5.7 Paragraph 132 advises local planning authorities that 'When considering the impact of a proposed development on the significance of a designated heritage asset, great weight should be given to the asset's conservation. The more important the asset, the greater the weight should be. Significance can be harmed or lost through alteration or destruction of the heritage asset or development within its setting'.

5.8 The NPPF says at Paragraph 133 'Good design ensures attractive, usable, durable and adaptable places and is a key element in achieving sustainable development. Good design is indivisible from good planning.' Paragraph 133 says:

Where a proposed development will lead to substantial harm to or total loss of significance of a designated heritage asset, local planning authorities should refuse consent, unless it can be demonstrated that the substantial harm or loss is necessary to achieve substantial public benefits that outweigh that harm or loss, or all of the following apply:

- the nature of the heritage asset prevents all reasonable uses of the site; and
- no viable use of the heritage asset itself can be found in the medium term through appropriate marketing that will enable its conservation; and

- conservation by grant-funding or some form of charitable or public ownership is demonstrably not possible; and
- the harm or loss is outweighed by the benefit of bringing the site back into use.

5.9 Paragraph 134 says that 'Where a development proposal will lead to less than substantial harm to the significance of a designated heritage asset, this harm should be weighed against the public benefits of the proposal, including securing its optimum viable use.

5.10 Further advice within Section 12 of the NPPF urges local planning authorities to take into account the effect of an application on the significance of a non-designated heritage asset when determining the application. It says that 'In weighing applications that affect directly or indirectly non designated heritage assets, a balanced judgement will be required having regard to the scale of any harm or loss and the significance of the heritage asset'.

5.11 Paragraph 137 of the NPPF advises local planning authorities to 'look for opportunities for new development within Conservation Areas and World Heritage Sites and within the setting of heritage assets to enhance or better reveal their significance. Proposals that preserve those elements of the setting that make a positive contribution to or better reveal the significance of the asset should be treated favourably'.

5.12 Paragraph 138 says that:

> Not all elements of a World Heritage Site or Conservation Area will necessarily contribute to its significance. Loss of a building (or other element) which makes a positive contribution to the significance of the Conservation Area or World Heritage Site should be treated either as substantial harm under paragraph 133 or less than substantial harm under paragraph 134, as appropriate, taking into account the relative significance of the element affected and its contribution

to the significance of the Conservation Area or World Heritage Site as a whole.

Welwyn Hatfield Borough Council: Local Policy

5.13 The current planning policies for Welwyn Hatfield are set out in the statutory development plan which comprises: saved policies of the Welwyn Hatfield District Plan adopted 2005, the Hertfordshire Waste Core Strategy and Development Management Policies Document adopted 2012, Hertfordshire Minerals Local Plan adopted 2007, and the saved policies of the Hertfordshire Waste Local Plan adopted 1999.

5.14 A Local Plan is currently being prepared, which will replace the District Plan and will set out the planning framework for the Borough for the period up to 2031.

5.15 The saved Polices of the District Plan of relevance include:

R27 Demolition of Listed Buildings: Listed Building Consent for the complete or partial demolition of any building of special architectural or historic interest will not be granted other than in the following exceptional circumstances:

i) Clear and convincing evidence has been provided that it is not practicable to continue to use the building for its present or previous use and that no viable alternative uses can be found, and that preservation in some form of charitable or community ownership is not possible; ii) The physical condition of the building has deteriorated, to a point that it can be demonstrated that demolition is essential in the interests of public safety. A comprehensive structural report will be required to support this criterion; iii) demolition or major alteration will not be considered without acceptable detailed plans for the site's development. Conditions will be imposed in order to ensure a contractual obligation has been entered into for the construction of the replacement building(s) and/or the landscaping of the site prior to the commencement of demolition; and (iv) where,

exceptionally, consent is granted for the demolition or major alteration to a listed building, before any demolition or major alteration takes place, applicants will be required to record details of the building by measured drawings, text and photographs, and this should be submitted to and agreed by the Council.

D1 Quality of Design: The Council will require the standard of design in all new development to be of a high quality. The design of new development should incorporate the design principles and policies in the Plan and the Guidance contained in the Supplementary Design Guidance.

D2 Character & Context: The Council will require all new development to respect and relate to the character and context of the area in which it is proposed. Development proposals should as a minimum maintain, and where possible enhance or improve the character of the existing area.

D4 Quality of the Public Realm: The Council will expect new development where appropriate to either create or enhance public areas and the public realm.

6 The proposed scheme and its effect on heritage significance

6.1 This section of the report should be read alongside the other documentation submitted as part of the application, in particular the Design & Access Statement prepared by Collado Collins and the Planning Statement prepared by Iceni Projects.

6.2 In summary, the proposals are for the:

Creation of a mixed-use quarter comprising the erection of up to 1,340 residential dwellings including 414 (31%) affordable dwellings; 114 extra care homes (Use Class C2); the erection of a civic building comprising 494 sq.m of health (Use Class D1), 1,232 sq.m of office (Use Class B1) and 646 sq.m of retail (Class A1/A2/A3/A4/A5); alterations, additions and change of use of Grade II Listed Building and retained Silos to provide 5,096 sq.m of flexible business floorspace (Use Class B1), 265 sq.m Combined Heat and Power (Sui Generis), 2,494 sq.m International Art Centre (Use Class D1), 1,226 sq.m Gymnasium (Use Class D2), 1, 576 sq.m of restaurant/coffee shop/bar (Use A1/A3/A4/A5), Creche/Day Nursery of 644 sq.m as well as a Network Rail TOC Building of 364 sq.m; plus associated car parking, access, landscaping, public art and other supporting infrastructure.

Production Hall, Silos, Grain House, Boiler House and associated buildings

6.3 As described in Section 3, planning and listed building consent has been granted for the demolition of the later structures that formed the factory complex as well as the restoration and conversion of the remaining, most significant, listed buildings.

6.4 These proposals build upon the principles established in that consent in order to enhance areas and facilitate new uses. As well as commercial, community and leisure uses

within the former factory building, a new Energy Centre is proposed on the site of the former garages and it is proposed that the Boiler House and Grain House are converted into a unique Art/Museum Hub with multidisciplinary indoor and outdoor space.

Production Hall/Former Factory Building

6.5 Externally, it is proposed to introduce a ramp and stair along Reiss Walk to provide a main entrance into the new central atrium on the west elevation. This will provide more flexibility without impacting on the unencumbered views of this elevation.

6.6 Internally, the majority of the proposed subdivision is located on the ground floor. Partitions relate to the existing column grid to ensure the structural and architectural integrity of the building can still be read. This floor is also where, amongst other facilities the swimming pool will be located.

6.7 A degree of subdivision is vital to achieve the multitude of uses necessary to give the building a sustainable future. This scheme focusses the majority of the necessary subdivision on a single floor – that which for the past 80 years this floor had very little natural light with most windows bricked up, and a considerable amount of industrial sub-division.

6.8 On the upper floors, the full open plan nature of the spaces can be fully appreciated. The office spaces will be separated by the atrium space with full height glazed walls ensuring noise but not visual separation.

6.9 On the second floor art studios will be created at the southern end that will connect with the proposed art centre via a new glass bridge.

6.10 The central atrium space will contain a feature stair and lift core. The proposed atrium stair construction will be a contemporary blend of glass treads and metal runners in order to create an open and light environment. It will also minimise the visual impact internally, allowing occupiers and visitors to read the open office floor plate.

The lifts, which provide access to all floors, will also provide panoramic views of the space when moving up through the building.

6.11 As consented in the previous permission, it is proposed that the facades of the building will be carefully restored and/or reinstated. It is also proposed that internally the building will receive an insulated lining in order to improve thermal efficiency. This will be painted white which will ensure it has no visual impact on the character of the space.

6.12 The proposed glass bridge link between the Grain Store and Factory building has been inspired by that of the Royal Opera House in Covent Garden. It is proposed to add a modern twist to the building that is obviously an addition, but that does not detract from the architectural importance of the original building. Its purpose is to give the Arts Centre the capacity to expand from one building to the other – an important part of providing a sustainably flexible future for the listing buildings.

6.13 It should be remembered that the factory building has never been entirely without division or heavy equipment and was always a utilitarian, working space. The effect of the proposed works to the Production Hall will be to restore and better reveal the most important historic and architectural elements of the building, whilst providing services, circulation and modern accommodation that will give the building a viable long term future.

The Grain House and Silos

6.14 Unlike the previously consented scheme, it is proposed to convert the Grain House and Silos into an Art/Museum Hub. It is proposed that the existing machinery still remaining in the Grain House will be renovated and cleaned to retain the building's industrial character and could be used within exhibitions as well as serving as a visual reminder of the history of the building.

6.15 The silos will be repaired and restored and the base of them opened up allowing the hollow space to be used for

art installations. It is proposed that the building on top of the silos will be converted to a restaurant and bar with views across Welwyn Garden City. Access will be by a stair and lift located within two of the silos.

6.16 The structure between the Grain House and Silos (previously consented for removal) will be retained – providing at ground floor, the entrance to the Arts Centre.

6.17 This use is a considerably more light-touch approach to that previously consented and will allow for the retention of much more historic fabric within these buildings. It will also allow for a fuller appreciation of the scale and nature of the space and should be regarded as a major heritage benefit in comparison to the previous scheme.

The former Garages

6.18 The former garages, previously consented for replacement, will still be replaced, and house a restaurant/café, facing out onto the newly created Goodman Square and also the Energy Centre – which will be glazed so that passers-by can look in and see the various parts of the plant at work. The energy centre will make use of the existing chimney.

6.19 Behind the new building will be a covered courtyard which will link to the silos and provide a more open indoor space to appreciate the scale of the adjacent silos.

The Wider Proposals

6.20 In heritage terms, the wider proposals have been designed to ensure that the remaining listed structures are better revealed both architecturally and in terms of use and ensure that they become a key focal point of the masterplan.

6.21 The building heights and their distribution in the proposed scheme are broadly similar to those of the consented scheme and to the north of the listed buildings are lower. Where it has been deemed necessary, an additional storey has been added to the proposed

buildings along the western and eastern edges of the site – furthest from the listed buildings.

6.22 The importance of the dominance of the silos continues to be recognised, with new buildings being located so as to give selected views of the silos from strategic and carefully considered points around the site. Their pre-eminence will be fully respected.

6.23 The spaces around the listed buildings have been designed to give visitors, users and occupiers a better appreciation of the complex and the use of these spaces designed to create activity and vibrancy. This is an important benefit with the scheme, as much of the communal significance of the complex relates to the 'healthy living' approach promoted both by the founders of Shredded Wheat and the Garden City.

6.24 The proposed new Goodman Square adjacent to the Boiler House/Grain House and silos at the end of Hydeway will be a key public space linking the east and west of the town, with the listed structures forming the principal backdrop to the north.

6.25 The proposed Louis de Soissons Civic Building will be one of the first buildings seen by pedestrians approaching the new residential and cultural quarter from the town centre and train centre. The appointment of Louis de Soissons Architects to design it further provides a historical link between the past and the future.

6.26 The De Soissons Gardens to the eastern front of the Production Hall will reinstate a formal open space providing a suitable setting for the reinstated grand entrance to the building and restoring the integrity of the 'front' of the building back to its original place as illustrated in the historical photographs in figures 17 & 20.

6.27 To the west of the listed former Production Hall, Reiss Walk will incorporate the historic railway lines and provide a hard landscaped access to this elevation of the

listed building – appropriate to its industrial past – as well as a thoroughfare through the development.

6.28 The design rationale articulated in the Design & Access Statement and Landscape Strategy demonstrates how the architecture and landscape have drawn from the historic Garden City principles as well as more recent guidance and strategy and the consented scheme. The heights of the buildings have been carefully considered to ensure the continued dominance of the listed factory complex and opened up views not experienced since the 1930s. As described earlier, the heights of the buildings have been re-configured and in many cases reduced since previous iterations of the scheme better revealing both the silos and Production Hall building.

6.29 The wider scheme offers huge community benefits to the town. As an integral part of this wider proposal these benefits are symbiotic for the listed complex – with the buildings playing a part in providing the mix of uses and facilities that contribute to additional community facilities – such as the creche and workspace – and also benefiting from a restoration and repair of its modernist architecture and a long term sustainable and viable use.

6.30 The integration of public art throughout the site is also a considerable public benefit – increasing the cultural importance of Welywn Garden City as well as the site and historic complex.

6.31 Similar to the consented scheme, the visibility of the proposals from Grade I listed Hatfield House has been investigated and it has been concluded that the primary element of the scheme that is visible are the already standing silos. It is therefore felt that the proposals will not have a detrimental impact on the views from the House.

6.32 In terms of the impact on the Welywn Garden City Conservation Area, the proposals will be negligible and will not affect the special character of the area. The railway line provides (and always has done) a very definite

divide from east to west, and the back of the Howard Centre creates a dominant 'back' to the town centre. Just as the proposed development has been designed to respect the setting of the listed buildings from the site itself, this approach was key when considering how it will be seen from glimpsed views from the conservation area.

7 Compliance with policy and guidance

7.1 This report has provided a detailed description and analysis of the significance of the former Shredded Wheat factory site and its heritage context as required by Paragraph 128 of the National Planning Policy Framework. In addition, the report also describes in Section 6 how the proposed scheme will affect that heritage significance.

The level of 'harm' caused by the proposed scheme

7.2 As outlined in Section 5, the NPPF identifies two levels of potential 'harm' that might be caused to a heritage asset by a development: 'substantial harm...or total loss of significance' or 'less than substantial'. Both levels of harm must be caused to a *designated* heritage asset – in this instance, the listed former Shredded Wheat Factory and the conservation area, and its setting.

7.3 The proposed scheme, in our considered view, preserves the special architectural and historic interest of the listed building and thus complies with s.66(1) and s.72(1) of the Planning (Listed Buildings and Conservation Areas) Act 1990. It does not lead to 'substantial' harm to the listed building. The changes to the listed building, individually or cumulatively, do not reach the threshold of harm that would cause the scheme to fail to preserve the special interest of the listed building or conservation area.

The National Planning Policy Framework

7.4 In respect of Paragraph 131 of the NPPF, the proposed scheme can be described as 'sustaining and enhancing the significance of heritage assets and putting these to viable uses consistent with their conservation'.

7.5 The proposed scheme complies with Paragraph 133 of the NPPF – it does not lead to 'substantial harm to or total loss of significance of a designated heritage asset'. It also complies with Paragraph 134 for the reasons given earlier in this report. The proposals enable the restoration of the

most important remaining elements of the Shredded Wheat factory, reinstating its most important elevational features, removing utilitarian elements that detract from an appreciation of the architecture and using high quality, contextual materials.

7.6 The interventions – individually and taken as a whole – help secure the 'optimum viable use' of the listed building. The scheme very definitely strikes the balance suggested by Paragraph 134 of the NPPF – it intervenes in the listed complex in a manner commensurate to its significance as a listed building.

Local Policy: Welwyn Hatfield Borough Council

7.7 In positively addressing the requirement of the National Planning Policy Framework, the works should also meet the policy requirements of Welwyn Hatfield Borough Council.

7.8 In addressing Policy R27, the elements of the listed building that make up its special architectural or historic interest have been clearly identified. These proposals aim to retain and adapt these elements of the complex for new sustainable future uses. The factory complex has now been redundant for many years. The proposals represent alternative uses that will give the most significant elements of the site a viable and sustainable future. The physical condition of the buildings has deteriorated considerably and the proposals offer the opportunity to repair and restore the main elements of the retained buildings.

7.9 The proposals for the listed buildings can be seen in the context of the wider development proposals for new buildings and landscaping and a full recording of all of the buildings to be demolished will be undertaken.

8 Conclusions

8.1 The proposed scheme builds upon that already consented to provide a viable and considered scheme that will repair, restore and help secure the future of the most significant parts of the former Shredded Wheat complex in sustainable and viable uses, and this represents a great benefit in heritage terms. The proposal overall will still deliver substantial public benefits to the community and the works to the listed buildings are an integral part of that. The scheme will re-stitch this derelict part of the town centre back into full use, joining the two halves of the town back again.

8.2 The proposed development will not harm the character or appearance or the setting of the adjacent Conservation Area, which very clearly 'turns its back' on the site with the Howard Centre development and railway line. Where there are glimpsed views of the site from within the conservation area, no harm to its setting will be caused by the proposals.

8.3 The proposals offer substantial public benefits overall. These benefits relate not just to giving the remaining factory complex a future use and better revealing its significance, but also the wider public benefits to be delivered by the whole scheme.

8.4 Overall, the scheme offers a unique opportunity to re-invigorate the site and better reveal the significance of the original buildings and wider site. For this and the reasons given in the report, the proposed scheme complies with the law, and national and local policy and guidance for listed buildings and conservation areas.

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