Foundation House
St.Johns Road
Meadowfield Industrial Estate
Durham
DH7 8TZ

Our Ref: D7702

DTA Consulting Engineers
Parsons House
Parsons Road
Washington
Tyne and Wear
NE37 1EZ

FAO Kevin Hands

Date: 04th January 2017

SOAKAWAY AND CBR TESTING – SOUTER LIGHTHOUSE

Please find below our results from the recently completed soakaway and CBR testing at the above site.

The following tests were undertaken at locations indicated to us by DTA. The test locations are indicated on drawing no. D7702/02.

- Soakaway - TP1-3
- CBR - PL1-3

SOAKAWAY TESTS

The results of the soakaway testing are attached and indicate infiltration rates ranging from 4.36 x 10-4m/s in to 9.81 x 10-5m/s.

CBR TESTS

Tests were undertaken at locations indicated to Dunelm on site by DTA. The results of the CBR tests indicated values of between 2.11 and >15%.

Copies of the exploratory hole records, test locations and in-situ test results are included within this report.

We trust that the enclosed are sufficient for your present needs, however, please do not hesitate to get in touch should you require any further information.

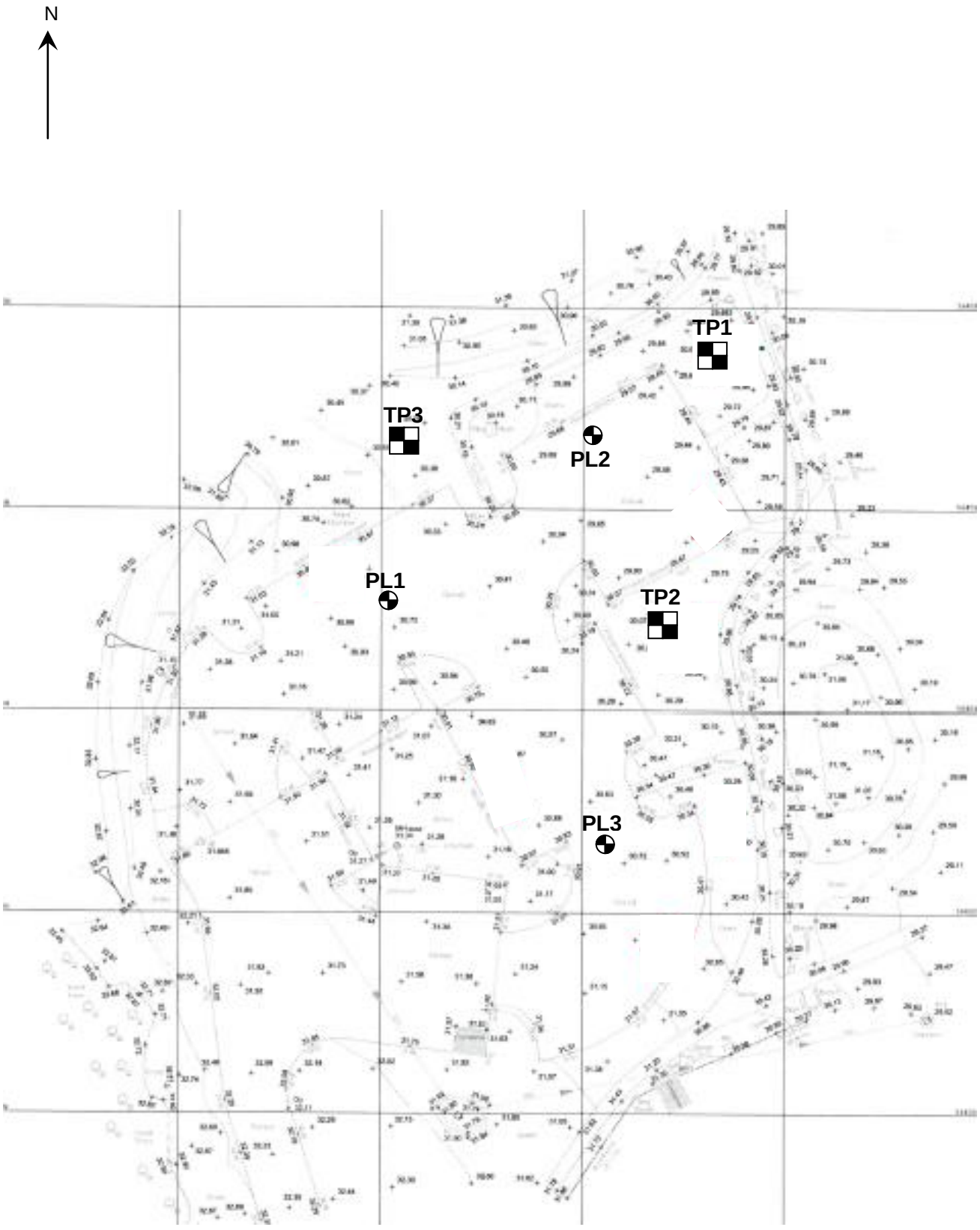
Yours sincerely,

Paddy Muir
On behalf of Dunelm Geotechnical and Environmental Ltd

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DUNELM GEOTECHNICAL & ENVIRONMENTAL	**Contract:** Souter Lighthouse			**Contract No:** D7702
	Client: DTA Consulting Engineers LLP			
TEL: 0191 378 3151 FAX: 0191 378 3157	**Drawing Title:** Site Location Plan			
Drawing No: D7702/01	**Date:** November 2016	**Scale:** NTS	**Status:** Final	**Drawn by:** AB



DUNELM GEOTECHNICAL & ENVIRONMENTAL	**Contract:** Souter Lighthouse			**Contract No:** D7702
	Client: DTA Consulting Engineers LLP			
TEL: 0191 378 3151 FAX: 0191 378 3157	**Drawing Title:** Exploratory Hole Location Plan			
Drawing No: D7702/02	**Date:** November 2016	**Scale:** NTS	**Status:** Final	**Drawn by:** AB

DUNELM GEOTECHNICAL & ENVIRONMENTAL

TRIAL PIT RECORD

TP No. PL1

Contract No.: D7702

Site: Souter Lighthouse

Scale 1:25

Client: National Trust

Logged By: AB

Sheet 1 of 1

Method: JCB 3CX

Checked By: PM

Dates: 30/11/2016

SAMPLE DETAILS			Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
Type	Depth From-To (m)	Insitu Testing						
				MADE GROUND: Red fine to coarse gravel.	0.08			
				MADE GROUND: Dark brown grey, gravelly clay. Gravel is angular to subrounded, fine to coarse of brick and occasional concrete.				
				Dark orangey brown, gravelly CLAY. Gravel is subangular to subrounded, fine to coarse of limestone.	0.45			
				End of Trial Pit at 0.50 m	0.50			

1 2 3 4 5

Remarks	Ground Water (m)		Excavation Details	Orientation
1. No groundwater encountered. 2. CBR test carried out at 0.50m.	Depth Strike	Remarks	Dimensions: m x m Stability: Weather: Remarks: JCB 3CX	A B C D °

DUNELM GEOTECHNICAL & ENVIRONMENTAL

TRIAL PIT RECORD

TP No. PL2

Contract No.: D7702

Site: Souter Lighthouse

Scale 1:25

Client: National Trust

Logged By: AB

Sheet 1 of 1

Method: JCB 3CX

Checked By: PM

Dates: 30/11/2016

SAMPLE DETAILS			Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
Type	Depth From-To (m)	Insitu Testing						
				MADE GROUND: Red brown clayey, sandy gravel. Gravel is angular to subangular, fine to coarse of sandstone.	0.05			
				MADE GROUND: Dark brown grey, gravelly clay. Gravel is angular to subrounded, fine to coarse of brick and occasional concrete.	0.30			
				MADE GROUND: Dark blackish grey, gravelly sand. Gravel is angular to subrounded, fine to coarse of brick, coal, metal, occasional concrete and limestone.	0.50			
				End of Trial Pit at 0.50 m				

1 2 3 4 5

Remarks	Ground Water (m)		Excavation Details	Orientation
1. No groundwater encountered. 2. CBR test carried out at 0.50m.	Depth Strike	Remarks	Dimensions: m x m Stability: Weather: Remarks: JCB 3CX	A B C D °

DUNELM GEOTECHNICAL & ENVIRONMENTAL

TRIAL PIT RECORD

TP No. PL3

Contract No.: D7702

Site: Souter Lighthouse

Scale 1:25

Client: National Trust

Logged By: AB

Sheet 1 of 1

Method: JCB 3CX

Checked By: PM

Dates: 30/11/2016

SAMPLE DETAILS			Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
Type	Depth From-To (m)	Insitu Testing						
				MADE GROUND: Red fine to coarse gravel.	0.05			
				MADE GROUND: Grey clay with cobbles of basalt, limestone and coal.				
				End of Trial Pit at 0.60 m	0.60			

1 2 3 4 5

Remarks	Ground Water (m)		Excavation Details	Orientation
1. No groundwater encountered. 2. CBR test carried out at 0.50m.	Depth Strike	Remarks	Dimensions: m x m Stability: Weather: Remarks: JCB 3CX	D A C B °

DUNELM GEOTECHNICAL & ENVIRONMENTAL

TRIAL PIT RECORD

TP No. TP1

Contract No.: D7702

Site: Souter Lighthouse

Scale 1:25

Client: National Trust

Logged By: AB

Sheet 1 of 1

Method: JCB 3CX

Checked By: PM

Dates: 30/11/2016

SAMPLE DETAILS			Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
Type	Depth From-To (m)	Insitu Testing						
				MADE GROUND: Dark brown gravelly sand (topsoil). Gravel is angular to subrounded, fine to coarse of brick, mudstone, limestone and occasional concrete, glass and metal.				
				MADE GROUND: Yellowish brown, gravelly sand with frequent cobbles. Gravel is angular to subrounded, fine to coarse of concrete, brick and wood. Cobbles are of concrete and bricks.	0.40			
				Firm dark orange brown, slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded, fine to coarse of limestone.	1.20			
				Light yellowish brown LIMESTONE recovered as sandy gravel. Gravel angular to subangular, fine to coarse of limestone.	1.40			
				End of Trial Pit at 1.50 m	1.50			

Remarks	Ground Water (m)		Excavation Details	Orientation
1. No groundwater encountered. 2. Large concrete slab encountered in east of pit at 0.90m (former foundation).	Depth Strike	Remarks	Dimensions: 1.80m x 0.40m Stability: Stable Weather: Cold/Dry Remarks: JCB 3CX	D A C B °

DUNELM GEOTECHNICAL & ENVIRONMENTAL

TRIAL PIT RECORD

TP No. TP2

Contract No.: D7702

Site: Souter Lighthouse

Scale 1:25

Client: National Trust

Logged By: AB

Sheet 1 of 1

Method: JCB 3CX

Checked By: PM

Dates: 30/11/2016

SAMPLE DETAILS			Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
Type	Depth From-To (m)	Insitu Testing						
				MADE GROUND: Dark brown slightly gravelly sand. Gravel is angular to subrounded, fine to coarse of brick and occasional concrete.				
				MADE GROUND: Dark grey and dark reddish brown, slightly clayey gravelly sand. Gravel is angular to subrounded, fine to coarse of brick, occasional concrete and frequent mudstone.	0.30			
				Firm dark grey gravelly CLAY. Gravel is angular to subrounded, fine to coarse of mudstone with occasional mudstone cobbles.	0.80			
			1					
			2					
				Light yellowish brown LIMESTONE recovered as slightly sandy gravel. Gravel is angular to subangular, fine to coarse of limestone.	2.30			
				End of Trial Pit at 2.42 m	2.42			
			3					
			4					
			5					

Remarks	Ground Water (m)		Excavation Details	Orientation
1. No groundwater encountered.	Depth Strike	Remarks	Dimensions: 2.20m x 0.40m	D A C B °
			Stability: Stable	
			Weather: Cold/Dry	
			Remarks: JCB 3CX	

DUNELM GEOTECHNICAL & ENVIRONMENTAL

TRIAL PIT RECORD

TP No. TP3

Contract No.: D7702

Site: Souter Lighthouse

Scale 1:25

Client: National Trust

Logged By: AB

Sheet 1 of 1

Method: JCB 3CX

Checked By: PM

Dates: 30/11/2016

SAMPLE DETAILS			Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
Type	Depth From-To (m)	Insitu Testing						
				MADE GROUND: Dark brown red slightly clayey, gravelly sand. Gravel is angular to subrounded, fine to coarse of brick, mudstone and occasional limestone.	0.10			
				MADE GROUND: Dark greyish brown, sandy gravelly clay. Gravel is subangular to subrounded, fine to coarse of brick, mudstone and occasional limestone.	0.50			
				Firm, dark orangey brown, slightly gravelly CLAY. Gravel is angular to subrounded, fine to coarse of limestone.	0.60			
				Light yellowish brown, highly weathered LIMESTONE. Recovered as sandy gravel. Gravel is angular to subrounded, fine to coarse of limestone.				
				End of Trial Pit at 1.20 m	1.20			

1 2 3 4 5

Remarks	Ground Water (m)		Excavation Details	Orientation
1. No groundwater encountered.	Depth Strike	Remarks	Dimensions: 2.10m x 0.40m	D A C B °
			Stability: Stable	
			Weather: Windy/Cold	
			Remarks: JCB 3CX	

SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 1991
BRE Digest 365, Figure 2, Page 5

Client:	**DTA Consulting Engineers LLP**				
Site:	**Souter Lighthouse**				
Job No:	**D7702**				
Pit No:	**TP1**		**Test No:**	**1**	

CALCULATION OF SOIL INFILTRATION RATE

Time (min)	Depth (m)
0	0.91
0.5	0.92
1	0.94
2	0.97
3	0.99
4	1.00
5	1.01
6	1.02
7	1.03
8	1.04
9	1.05
10	1.05
15	1.07
20	1.09
25	1.10
30	1.13
40	1.15
50	1.18
60	1.19
90	1.30
120	1.35
180	1.36

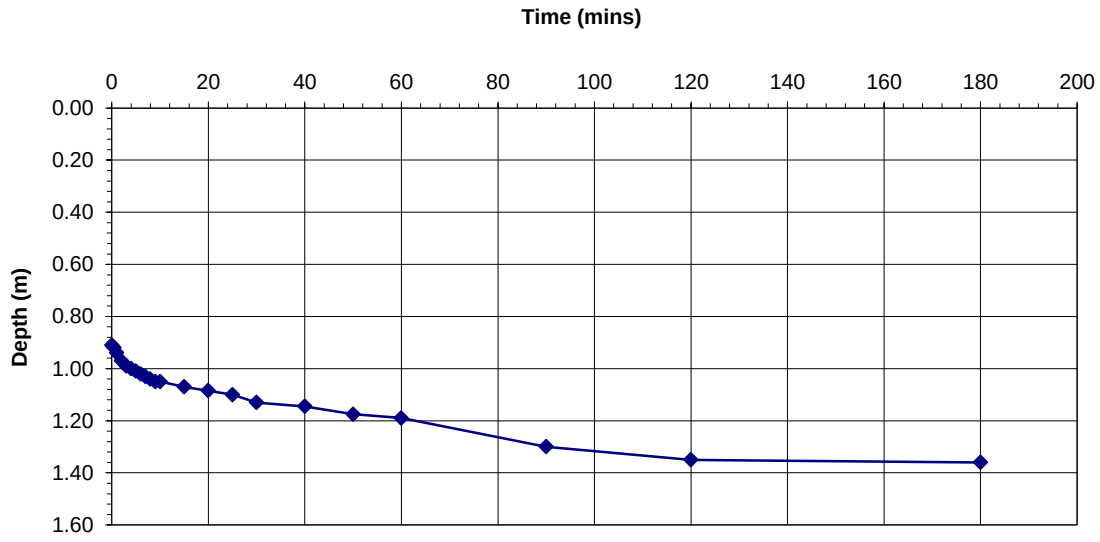
Pit Dimensions		
	Length (m) =	2.20
	Width (m) =	0.40
	Depth (m) =	2.42

Depth at start of test (m) =	0.910
Depth at end of test (m)=	1.360
75% level (m)=	N/A
50% Effective Depth	1.285
25% level (m)=	N/A
Base area of pit (m^2) =	0.880
Vp_{75-25} (m^3) =	N/A
α_{p50} (m^2) =	7.562

V	0.396
T	120

Soil infiltration rate, f, (m/s) =	**4.36E-04**	**Inferred value**

Input by:	**AB**	**Date:**	**01.12.16**
Checked by:	**PM**	**Date:**	**02.12.16**



SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 1991
BRE Digest 365, Figure 2, Page 5

Client:	**DTA Consulting Engineers LLP**				
Site:	**Souter Lighthouse**				
Job No:	**D7702**				
Pit No:	**TP2**		**Test No:**	**1**	

CALCULATION OF SOIL INFILTRATION RATE

Time (min)	Depth (m)
0	1.69
0.5	1.69
1	1.69
2	1.695
3	1.695
4	1.7
5	1.7
6	1.705
7	1.71
8	1.715
9	1.72
10	1.73
15	1.74
20	1.755
25	1.77
30	1.78
40	1.8
50	1.82
60	1.84
90	1.88
120	1.95
180	2.02

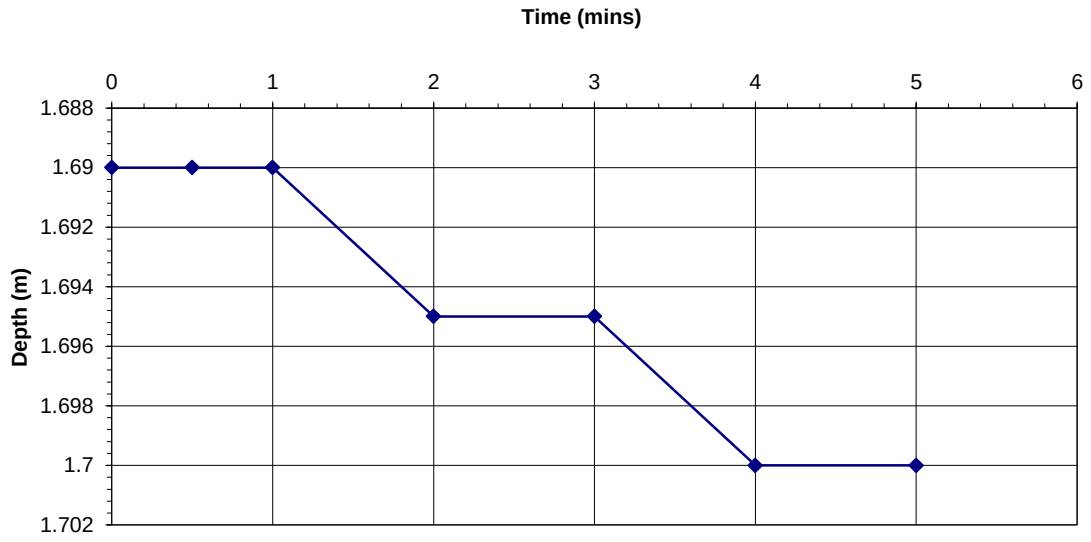
Pit Dimensions	
Length (m) =	2.20
Width (m) =	0.40
Depth (m) =	2.42

Depth at start of test (m) =	1.690
Depth at end of test (m)=	2.020
75% level (m)=	N/A
50% Effective Depth	0.565
25% level (m)=	N/A
Base area of pit (m^2) =	0.880
Vp_{75-25} (m^3) =	N/A
α_{p50} (m^2) =	3.818

V	0.2904
T	180

Soil infiltration rate, f, (m/s) =	**4.23E-04**	**Inferred value**

Input by:	**AB**		**Date:**	**01.12.16**	
Checked by:	**PM**		**Date:**	**02.12.16**	



SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 1991
BRE Digest 365, Figure 2, Page 5

Client:	**DTA Consulting Engineers LLP**				
Site:	**Souter Lighthouse**				
Job No:	**D7702**				
Pit No:	**TP3**		**Test No:**	**1**	

CALCULATION OF SOIL INFILTRATION RATE

Time (min)	Depth (m)
0	0.53
0.5	0.56
1	0.58
2	0.59
3	0.62
4	0.64
5	0.66
6	0.68
7	0.70
8	0.72
9	0.74
10	0.77
15	0.85
20	0.93
25	1.01
30	1.08
40	1.20

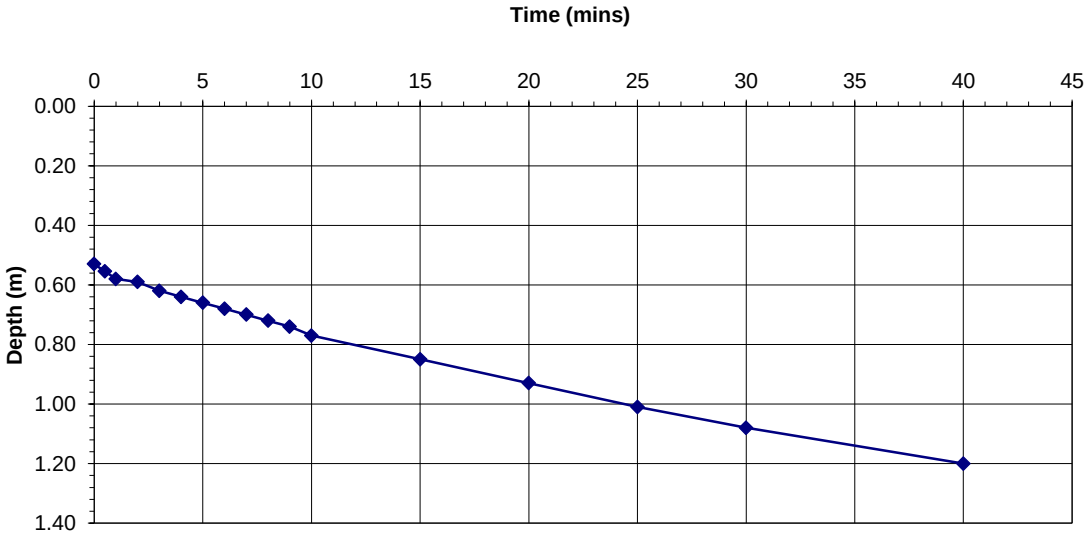
Pit Dimensions		
	Length (m) =	2.10
	Width (m) =	0.40
	Depth (m) =	1.20

Depth at start of test (m) =	0.530
Depth at end of test (m)=	1.200
75% level (m)=	0.698
50% Effective Depth	0.335
25% level (m)=	1.033
Base area of pit (m^2) =	0.840
Vp_{75-25} (m^3) =	0.281
α_{p50} (m^2) =	2.515

From the graph:	
tp 75 (min) =	7
tp 25 (min) =	26

Soil infiltration rate, f, (m/s) =	**9.81E-05**	**normal test**

Input by:	**AB**	**Date:**	**01.12.16**
Checked by:	**PM**	**Date:**	**02.12.16**



SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 1991
BRE Digest 365, Figure 2, Page 5

Client:	**DTA Consulting Engineers LLP**				
Site:	**Souter Lighthouse**				
Job No:	**D7702**				
Pit No:	**TP3**		**Test No:**	**2**	

CALCULATION OF SOIL INFILTRATION RATE

Time (min)	Depth (m)
0	0.52
0.5	0.53
1	0.55
2	0.56
3	0.58
4	0.60
5	0.62
6	0.64
7	0.65
8	0.67
9	0.69
10	0.70
15	0.77
20	0.83
25	0.89
30	0.94
40	1.03
50	1.12
60	1.20

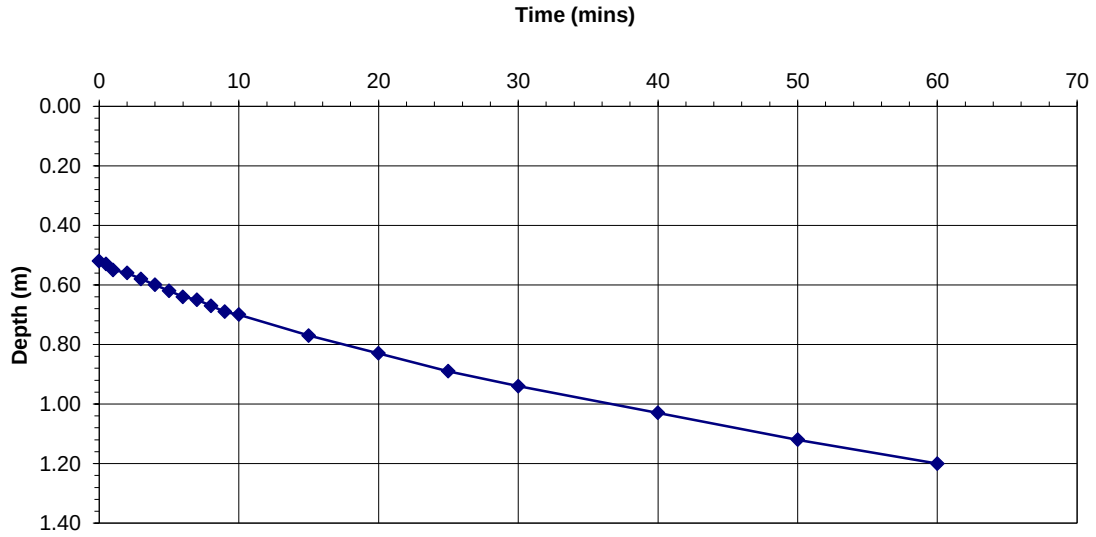
Pit Dimensions		
	Length (m) =	2.10
	Width (m) =	0.40
	Depth (m) =	1.20

Depth at start of test (m) =	0.520
Depth at end of test (m)=	1.200
75% level (m)=	0.690
50% Effective Depth	0.340
25% level (m)=	1.030
Base area of pit (m^2) =	0.840
Vp_{75-25} (m^3) =	0.286
α_{p50} (m^2) =	2.540

From the graph:	
tp 75 (min) =	9
tp 25 (min) =	40

Soil infiltration rate, f, (m/s) =	**6.05E-05**	**normal test**

Input by:	**AB**	**Date:**	**01.12.16**
Checked by:	**PM**	**Date:**	**02.12.16**

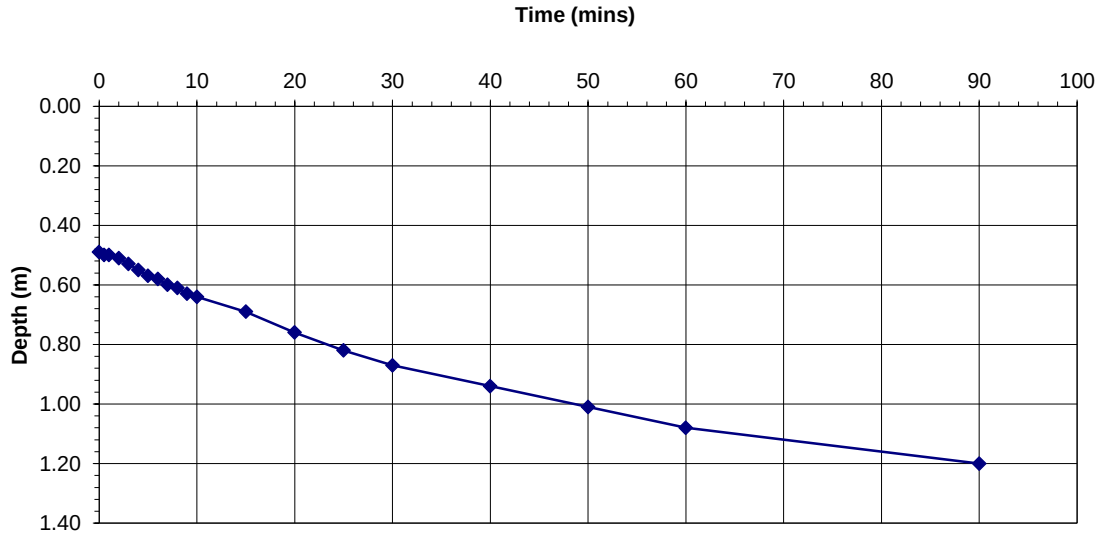


SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 1991
BRE Digest 365, Figure 2, Page 5

Client:	**DTA Consulting Engineers LLP**				
Site:	**Souter Lighthouse**				
Job No:	**D7702**				
Pit No:	**TP3**		**Test No:**	**3**	

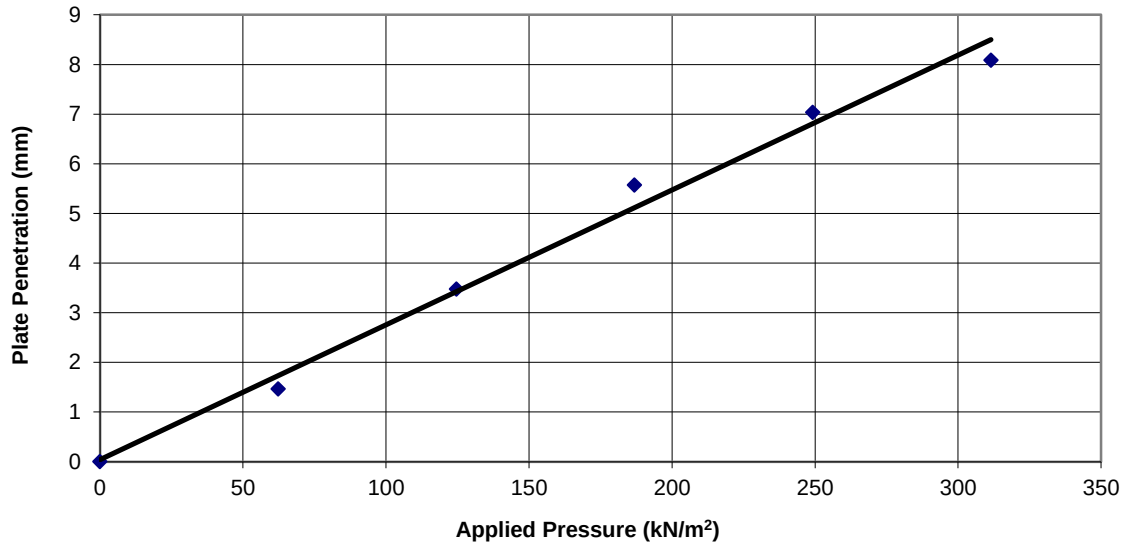
CALCULATION OF SOIL INFILTRATION RATE

Time (min)	Depth (m)				
0	0.49		**Pit Dimensions**	Length (m) =	2.10
0.5	0.50			Width (m) =	0.40
1	0.50			Depth (m) =	1.20
2	0.51		**Depth at start of test (m) =**		0.490
3	0.53		**Depth at end of test (m)=**		1.200
4	0.55		**75% level (m)=**		0.668
5	0.57		**50% Effective Depth**		0.355
6	0.58		**25% level (m)=**		1.023
7	0.60				
8	0.61		**Base area of pit (m^2) =**		0.840
9	0.63		**Vp_{75-25} (m^3) =**		0.298
10	0.64		**α_{p50} (m^2) =**		2.615
15	0.69				
20	0.76		**From the graph:**		
25	0.82		**tp 75 (min) =**		12
30	0.87		**tp 25 (min) =**		39
40	0.94				
50	1.01	**Soil infiltration rate, f, (m/s) =**		**7.04E-05**	**normal test**
60	1.08				
90	1.20				
		Input by:	**AB**	**Date:**	**01.12.16**
		Checked by:	**PM**	**Date:**	**02.12.16**



DUNELM GEOTECHNICAL AND ENVIRONMENTAL
GEOTECHNICAL TESTING LABORATORY

PLATE BEARING TEST		**Date:**	30/11/2016
Location:	Souter Lighthouse	**Test No:**	Plate Load 1
	D7702	**Test Level:**	0.50mbgl
Test Method: BS 1377 : Part 9 : 1990 (Incremental Method)		**Weather:**	Cold/Dry
Plate Diameter:	0.455 m	**Load Applied:**	311kN/m2
Kentledge Type:	8T JCB 3CX	**Start Time of Test:**	1pm

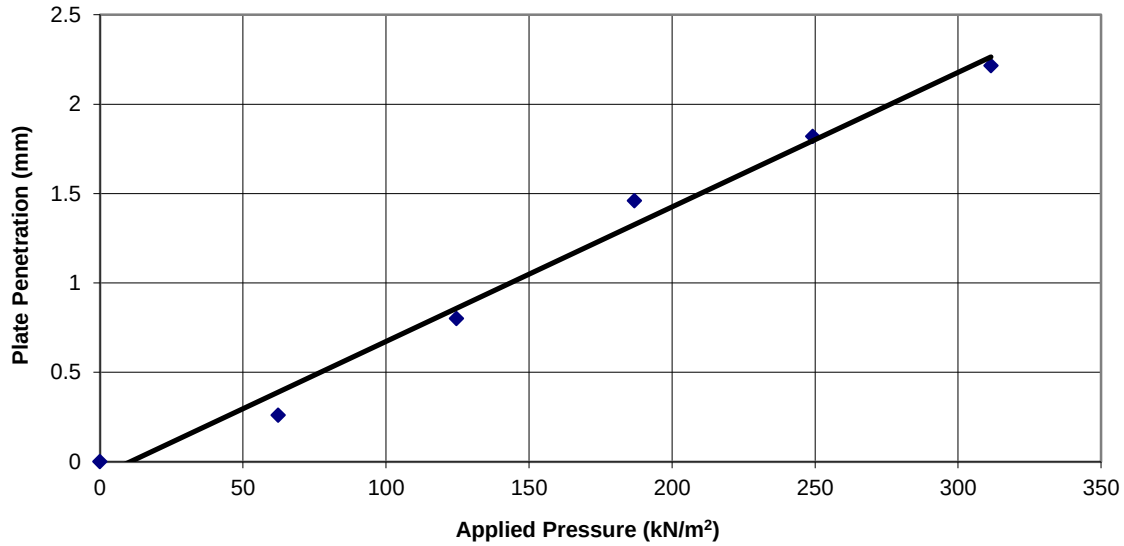


	Pressure (kN/m^2)	Plate Pentration (mm)
Initial	0	0
Stage 1	62	1.47
Stage 2	125	3.48
Stage 3	187	5.57
Stage 4	249	7.04
Stage 5	312	8.09

Conversion Factor	0.63	Produced by:	AB
Stress Applied @ 1.25mm	44.51 kN/m^2	Date:	01/12/2016
Total Plate Deflection	8.09 mm	Checked by:	PM
Plate Diameter	455 mm	Date:	02/12/2016
k455	35609		
k762	22402		
CBR	2.11 %		

DUNELM GEOTECHNICAL AND ENVIRONMENTAL
GEOTECHNICAL TESTING LABORATORY

PLATE BEARING TEST		**Date:**	30/11/2016
Location:	Souter Lighthouse	**Test No:**	Plate Load 2
	D7702	**Test Level:**	0.50mbgl
Test Method: BS 1377 : Part 9 : 1990 (Incremental Method)		**Weather:**	Cold/Dry
Plate Diameter:	0.455 m	**Load Applied:**	311kN/m2
Kentledge Type:	8T JCB 3CX	**Start Time of Test:**	2pm

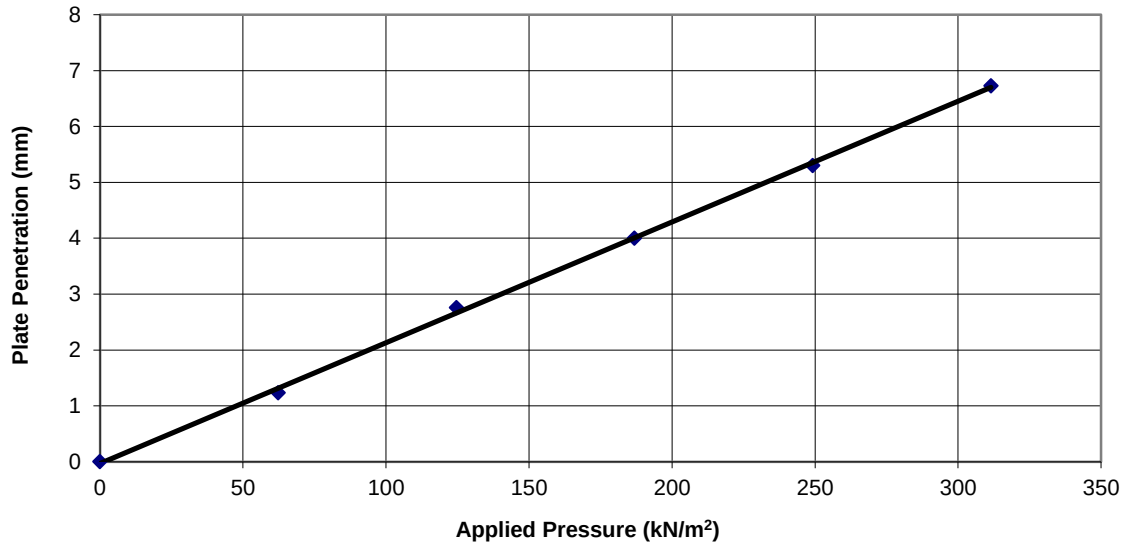


	Pressure (kN/m^2)	Plate Pentration (mm)
Initial	0	0
Stage 1	62	0.26
Stage 2	125	0.80
Stage 3	187	1.46
Stage 4	249	1.82
Stage 5	312	2.22

Conversion Factor	0.63	Produced by:	AB
Stress Applied @ 1.25mm	176.68 kN/m^2	Date:	01/12/2016
Total Plate Deflection	2.22 mm	Checked by:	PM
Plate Diameter	455 mm	Date:	02/12/2016
k455	141342		
k762	88918		
CBR	>15 %		

DUNELM GEOTECHNICAL AND ENVIRONMENTAL
GEOTECHNICAL TESTING LABORATORY

PLATE BEARING TEST		**Date:**	30/11/2016
Location:	Souter Lighthouse	**Test No:**	Plate Load 3
	D7702	**Test Level:**	0.45mbgl
Test Method: BS 1377 : Part 9 : 1990 (Incremental Method)		**Weather:**	Cold/Dry
Plate Diameter:	0.455 m	**Load Applied:**	311kN/m2
Kentledge Type:	8T JCB 3CX	**Start Time of Test:**	3pm



	Pressure (kN/m^2)	Plate Pentration (mm)
Initial	0	0
Stage 1	62	1.23
Stage 2	125	2.76
Stage 3	187	4.00
Stage 4	249	5.30
Stage 5	312	6.73

Conversion Factor	0.63	Produced by:	AB
Stress Applied @ 1.25mm	59.19 kN/m^2	Date:	01/12/2016
Total Plate Deflection	6.73 mm	Checked by:	PM
Plate Diameter	455 mm	Date:	02/12/2016
k455	47354		
k762	29790		
CBR	3.46 %		