



3rd March 2014
Our Ref: 14.7982

Mark Coates
Housing Project Development Officer,
Arun District Council
Arun Civic Centre,
Maltravers Road,
Littlehampton, BN17 5LF

RE: Soil Infiltration Testing- Arun District Council

Dear Mark,

I write following the completion of additional soil infiltration investigation undertaken on the 27th and 28th February 2014 at four locations within the residential area of Wick, Littlehampton. The works have been carried out to assist with assessment of the soil soakage potential for each location in respect to the proposed planning applications for the area.

The letter report follows on from the previous soil infiltration works carried in February 2014 (ref: lett/13.7841/Soil Infiltration Testing/13th Feb '14) that included the completion of testing within deep machine excavated trial pits. The results from this testing proved the soils at depths of the order of 2.50mbgl (meters below ground level) having general 'poor' soil soakage characteristics. As a result further testing was requested by the client within shallower trial pits at nominal 0.45m and 1.20mbgl to examine the potential for alternative drainage designs.

Site Status

As described in the previous letter (referenced above) the five proposed redevelopments are located within the residential area of Wick in Littlehampton. These areas are currently occupied by a mixture of hardstanding/grass verges and largely utilised for car parking area by the local residents. Four of the five sites are located along the northern boundary of the housing area and parallel to the A259 to the north. These

sites are referred to as Joyce Close, Land west of Joyce Close, Greenfields and Land West of Greenfields. The fifth site is located to the south within White Acre Road and referenced as Clun Road, however Constructive Evaluation has subsequently been instructed that no further assessment was required at this location.

Investigation Works

The soil infiltration testing was carried out within hand excavated trial pits of approximately 0.45m x 0.45m size at depths of 0.45m and 1.20mbgl (approximately). Thus an additional two trial pits, referenced A and B, were carried out at each of the four sites, i.e. one at 0.45mbgl and one nearer 1.20mbgl respectively. It was requested by the client that the trial holes were located away from hardstanding areas where possible and sited on grass verge locations, but also not too closer to where the previous trial pit tests had been completed.

Prior to any excavations taking place a CAT (Cable Avoidance Tool) was used to check for any underlying electrical services. In addition the service plans provided to CE were consulted prior to commencing works.

Testing was completed in accordance with the methods described in BRE Digest 365 and after trimming and shaping the trial pit sides the pit were rapidly filled with clean potable water from a water bowser.

The result sheets are enclosed showing the fall in water level with time for locations TP1A and TP1B to TP4A and TP4B.

Geology and Ground Conditions

The relevant 1:50,000 British Geological Survey (BGS) Map 317/337 (Chichester and Bognor) indicates the site to be underlain by Brickearth overlying the Upper Chalk deposits of the Cretaceous.

- **Brickearth** – The composition of this unit is commonly determined by the formation on which it rests and the formation of the unit is controlled either by solifluction, flood deposits or as wind-blown loess. As a result the unit is comprised largely as an unstratified mixture of fine-grained sand or flint with clay.
- **Upper Chalk** - The upper Chalk of the Cretaceous Period consists mainly of soft, smooth, white massively bedded Chalk with flint nodules generally lying within distinct beds; thin beds of tabular flint and marl also occur.

The results have shown that improved soils infiltrations rates have been observed within these more shallow tests compared to those carried out within the previous deeper (nominal 2.50m depth) trial pits.

Improvements were seen largely within the upper natural soils to nominal 1.20mbgl depth compared to the shallower tests generally within Topsoil and Made Ground soils to a depth of 0.45mbgl.

Again (as in the previous infiltration testing) the best results were seen towards the east of the housing area at the Joyce Close site where ‘good’ soil infiltrations to 1.20m depth were recorded (TP1B).

Subsequently it was possible to repeat the test within TP1B for second and third time with a final infiltration rate of 4.6×10^{-5} m/s calculated.

Within TP2B to the west of Joyce Close a lower infiltration rate of 1.3×10^{-5} m/s was recorded for the single test completed.

However, within the Greenfields and Land west of Greensfields sites, again further to the west, further slower infiltrations were observed at 1.20m depth. At these sites it was not possible for the water to fall below the 25% fill depth (within the BRE guidance) in TP3B and TP4B within the time available and as such only fall levels to between 39% and 44% were recorded.

In conclusion at shallow levels the superficial natural soils have shown improved soil infiltration characteristics, however this ability is seen to vary across the site.

Kind Regards,

Constructive Evaluation Limited

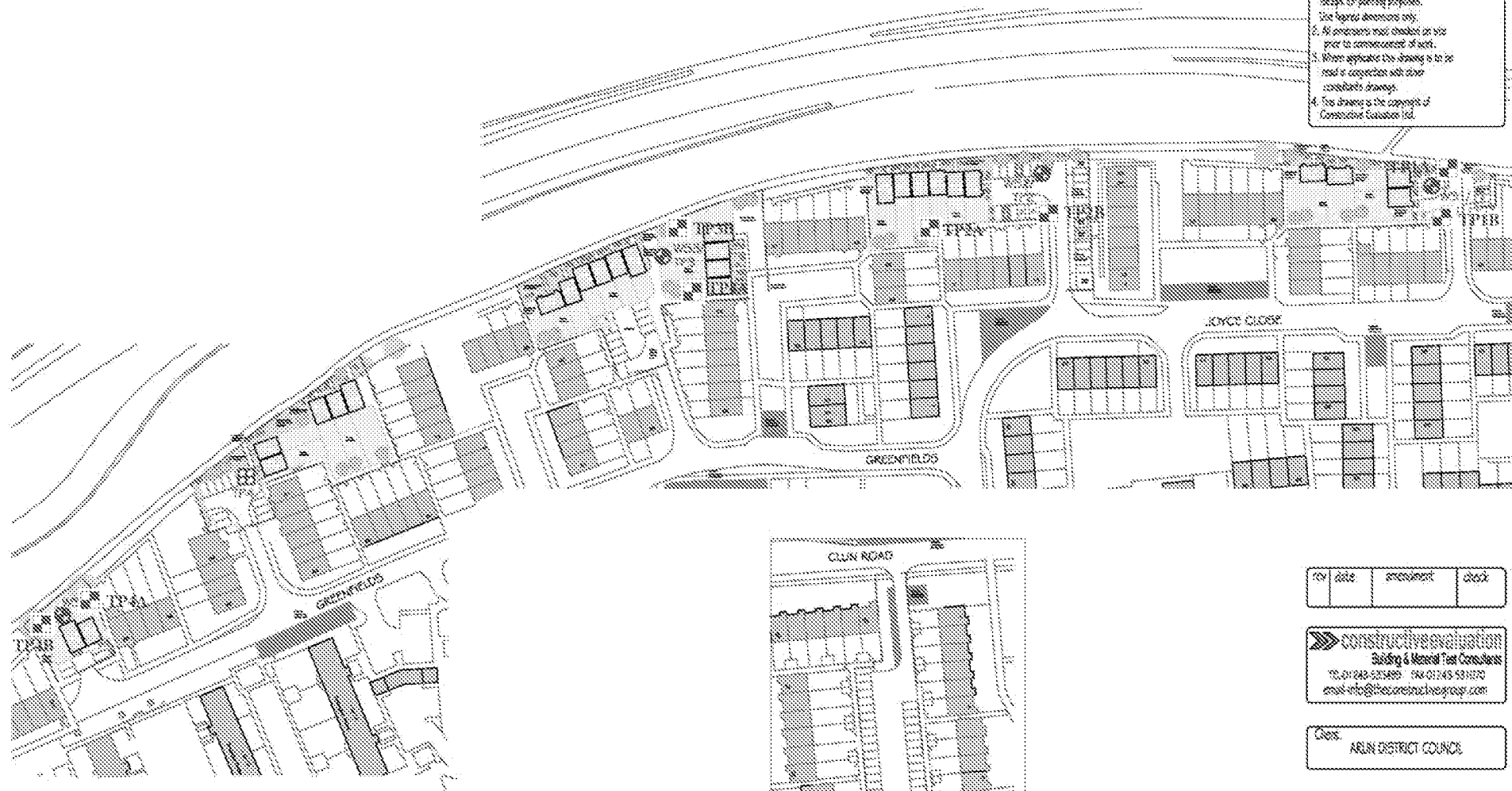
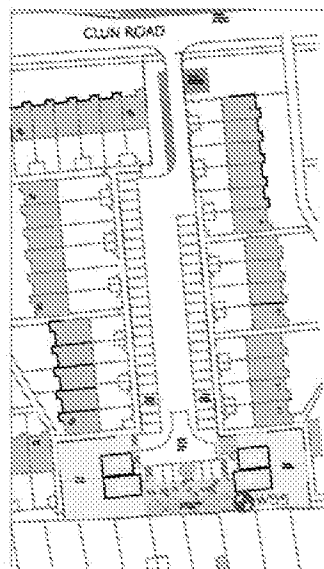
.....
Dave Crellin MSc BSc, FGS
Engineering Geologist

Enclosed:

- Exploratory Hole Plan
- Soil Logs
- Infiltration Test Readings
- Investigation Images

NOTES

1. Do not scale from this drawing except for planning purposes. Use figure dimensions only.
2. All dimensions must be checked on site prior to commencement of work.
3. When applicable this drawing is to be read in conjunction with other construction drawings.
4. This drawing is the copyright of Constructive Evaluation Ltd.



rev	date	amendment	check

Constructive Evaluation
 Building & Material Test Consultants
 Tel: 01243 523489 Fax: 01243 531070
 email: info@theconstructivegroup.com

Client:
 ARLIN DISTRICT COUNCIL

Project:
 WICK ESTATE, LITTLEHAMPTON

Drawing:
 TEST LOCATION PLAN

Scale:
 NTS

Date: FEB 13 | Drawn: D.Y. | checked:
 drawing number: 14.7982 | revision:



Project Name

Percolation Testing Arun District Council

Project No.

13.7841

Co-ords: -

Level: -

Date

27/02/2014

Location: Wick, Littlehampton

Dimensions: 0.40m

Depth

1.20m

0.40m

Scale

1:25

Client:

Hastoe Housing Association

Logged By

DC

Samples & In Situ Testing

Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description	
			0.15			MADE GROUND: Dark brown silty Clay with occasional fine to coarse gravel of flint (Topsoil).	
			0.56			MADE GROUND: Light brown / orange brown slightly sandy silty Clay. Occasional fine flint gravels and chalk clasts up to cobble sized.	
			1.20			Light brown / orange brown slightly sandy silty Clay. Occasional fine flint gravels and chalk clasts up to cobble sized.	1
						Trialpit Complete at 1.20 m	
							2
							3
							4

Remarks: Kerb level 100mm

Groundwater: None



Project Name

Percolation Testing Arun District Council

Project No.

13.7841

Co-ords: -

Level: -

Date

27/02/2014

Location: Wick, Littlehampton

Dimensions: 0.50m

Depth

0.45m

0.50m

 Scale
1:25

 Logged By
DC

Client: Hastoe Housing Association

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
			0.20			MADE GROUND: Dark brown silty Clay with occasional fine to coarse gravel of flint (Topsoil).	
			0.40			Light brown / orange brown slightly sandy silty Clay. Occasional fine flint gravels and chalk clasts up to cobble sized.	
			0.45			Cream brown silty slightly sandy gravelly CLAY. Occasional subangular to subrounded fine to coarse and cobbles sized fragmentgs of flintflint gravels and chalk clasts up to cobble sized.	
Trialpit Complete at 0.45 m							
							1
							2
							3
							4

Remarks:

Groundwater: None







Project Name
 Percolation Testing Arun District Council

 Project No.
 13.7841

 Co-ords: -
 Level: -

 Date
 27/02/2014

Location: Wick, Littlehampton

Dimensions: 0.45m

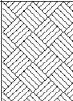
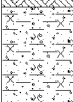
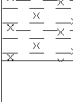
 Depth
 1.20m

0.40m

 Scale
 1:25

 Logged By
 DC

Client: Hastoe Housing Association

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
			0.35			MADE GROUND: (soft) light brown silty slightly sandy Clay. Sand is fine to coarse. Occasional fine to coarse gravel of chalk and rare plastic (Topsoil).	
						(soft) light brown silty sandy CLAY. Sand is fine to medium.	
			0.85			(soft) light brown silty CLAY.	1
			1.20			Trialpit Complete at 1.20 m	
							2
							3
							4

Remarks:

Groundwater: None



Date
27/02/2014

Scale
1:25

Logged By
DC

-4

HoleBASE 3.1 (Bld 426.72) Standard Trialpit Log v2 dated 27th Nov 03



Project Name
Percolation Testing Arun District Council

Project No.
13.7841

Co-ords: -
Level: -

Date
27/02/2014

Location: Wick, Littlehampton

Dimensions: 0.40m

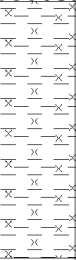
Depth
1.15m

0.40m

Scale
1:25

Logged By
DC

Client: Hastoe Housing Association

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
			0.30			MADE GROUND: Dark brown / brown silty slightly sandy Clay. Occasional subangular to subrounded fine to coarse gravels of brick chalk and rare flint (Topsoil).	
			1.15			Light brown silty CLAY.	1
						Trialpit Complete at 1.15 m	
							2
							3
							4

Remarks:

Groundwater: None



Contract Evaluation
Nothing is more important than the contract

Trial Hole: TP1 a

test 1

[illegible]

INFILTRATION CALCULATED FROM 75%-25% WATER DEPTH RANGE

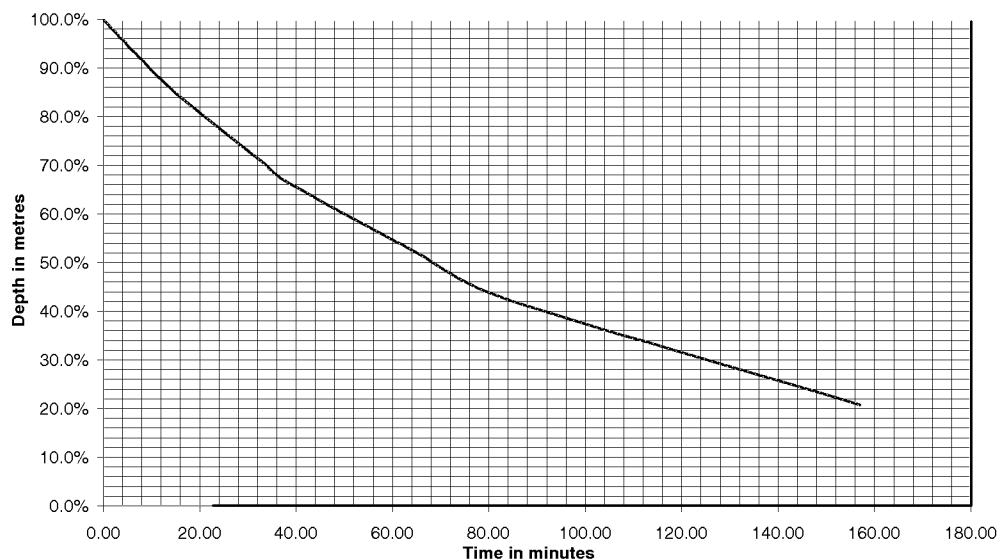
Pit Size		Time in mins
Length	0.50	28 75%
Width	0.50	142 25%
Depth	0.60	

Infiltration Rate

from 75%-25%

1.20163E-05

Permeability Graph TP1a test 1



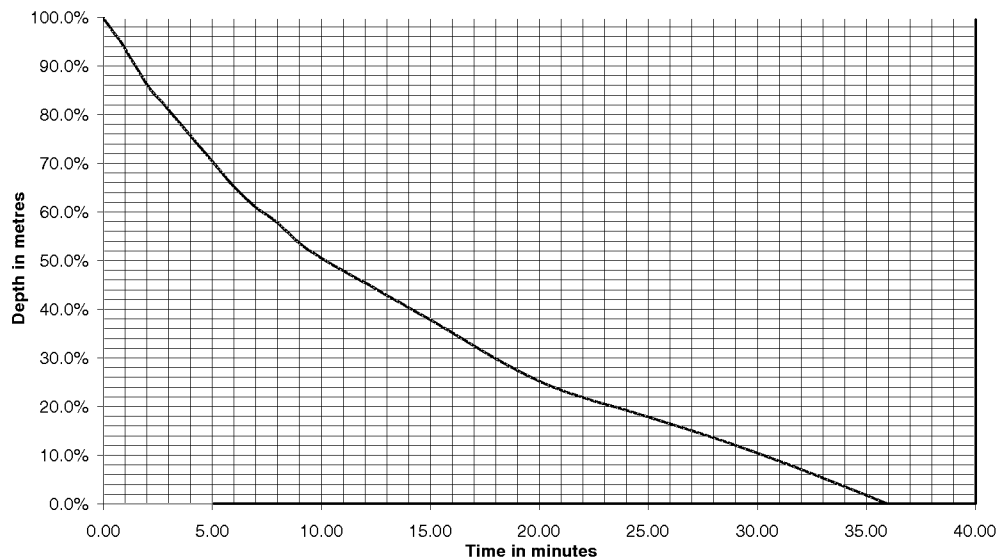
construction evaluation
Building & Material Test Solutions

Trial Hole: TP1 test 1

test 1

INFILTRATION CALCULATED FROM 75%-25% WATER DEPTH RANGE

<u>Infiltration Rate</u>	<u>from75%-25%</u>	8.714E-05
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construction
adding & deleting the structure

Trial Hole: TP1 test 2

INFILTRATION CALCULATED FROM 75%-25% WATER DEPTH RANGE

<u>Infiltration Rate</u>	<u>from75%-25%</u>	<u>0.0000625</u>
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A line graph showing the relationship between Depth in metres (Y-axis) and Time in minutes (X-axis) for a 100m depth. The Y-axis ranges from 0.0% to 100.0% in 10.0% increments. The X-axis ranges from 0.00 to 60.00 in 10.00 increments. The curve starts at (0, 100.0%) and decreases rapidly, reaching approximately 80.0% at 5.00 minutes, 60.0% at 10.00 minutes, 40.0% at 20.00 minutes, 20.0% at 30.00 minutes, and 10.0% at 40.00 minutes. The curve continues to decrease slowly, reaching approximately 8.0% at 50.00 minutes.

Time in minutes	Depth in metres (%)
0.00	100.0%
5.00	80.0%
10.00	60.0%
20.00	40.0%
30.00	20.0%
40.00	10.0%
50.00	8.0%

construction evaluation
adding a window that doesn't

Trial Hole: TP1

Trial Hole: TP1

constructive evaluation
Doing it Right Not Just Sometimes

~~XXXXXXXXXXXXXXXXXXXX~~

Trial Hole: TP2a

WARNING DOES NOT FALL TO 25% OF START DEPTH-Refer to graph sheet for calculation

<u>Infiltration Rate</u>	<u>from 75%-25%</u>	not valid
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The graph illustrates the depth of a vessel over time. The Y-axis, labeled 'Depth in metres', ranges from 0.0% to 100.0% in 10.0% increments. The X-axis, labeled 'Time in minutes', ranges from 0.00 to 200.00 in 20.00-minute increments. Two data series are plotted: 'Actual' (solid black line) and 'Predicted' (dashed black line). Both series show a decreasing trend, starting at 100.0% depth at 0.00 minutes and reaching approximately 48.0% depth at 135.00 minutes. The predicted depth is slightly higher than the actual depth for most of the duration.

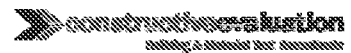
Time in minutes	Actual Depth (%)	Predicted Depth (%)
0.00	100.0	100.0
5.00	90.0	90.0
10.00	90.0	90.0
15.00	85.0	85.0
20.00	82.0	82.0
30.00	75.0	75.0
40.00	70.0	70.0
50.00	70.0	70.0
60.00	65.0	65.0
70.00	62.0	62.0
80.00	60.0	60.0
90.00	55.0	55.0
100.00	52.0	52.0
110.00	50.0	50.0
120.00	48.0	48.0
130.00	48.0	48.0
135.00	48.0	48.0

Soakaway Test Results & Soil Infiltration Rate

Site: SK08 West of Joyce Close

Job No: 14.7982

Trial Hole: TP2b



Time in minutes	Depth in meters to water surface	Depth in metres of water	Percentage of water depth at start
0.00	0.190	1.01	100.0%
1.00	0.210	0.99	98.0%
2.00	0.230	0.97	96.0%
3.00	0.240	0.96	95.0%
4.00	0.260	0.94	93.1%
5.00	0.280	0.92	91.1%
7.00	0.290	0.91	90.1%
8.00	0.300	0.90	89.1%
10.00	0.320	0.88	87.1%
15.00	0.360	0.84	83.2%
21.00	0.410	0.79	78.2%
45.00	0.550	0.65	64.4%
56.00	0.600	0.60	59.4%
60.00	0.620	0.58	57.4%
70.00	0.660	0.54	53.5%
80.00	0.700	0.50	49.5%
90.00	0.750	0.45	44.6%
102.00	0.800	0.40	39.6%
116.00	0.870	0.33	32.7%
127.00	0.920	0.28	27.7%
137.00	0.960	0.24	23.8%
147.00	1.000	0.20	19.8%
158.00	1.030	0.17	16.8%
168.00	1.060	0.14	13.9%
178.00	1.100	0.10	9.9%
188.00	1.200	0.00	0.0%
188.00	1.200	0.00	0.0%

INFILTRATION CALCULATED FROM 75%-25% WATER DEPTH RANGE

Pit Size	Time in mins
Length	0.40
Width	0.40
Depth	1.20

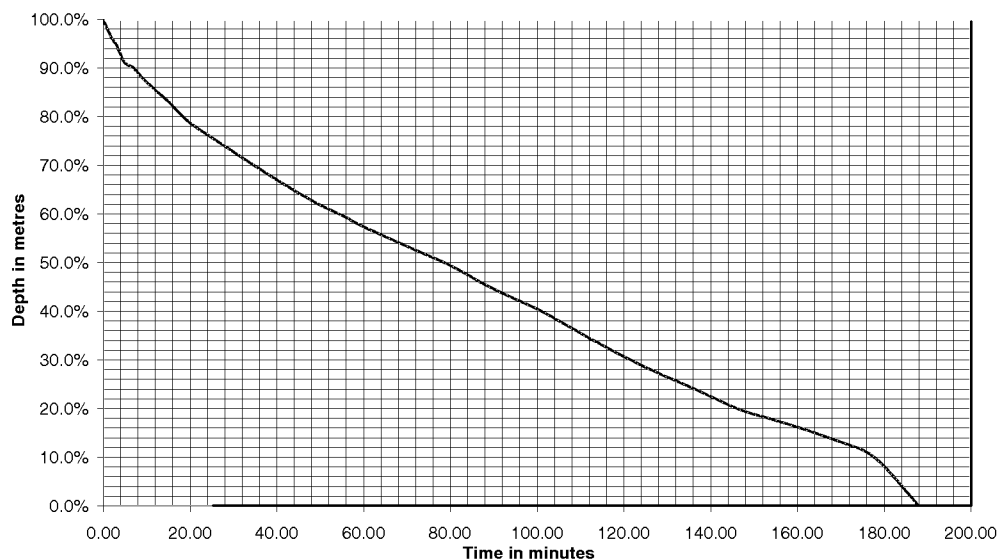
26	75%
134	25%

Infiltration Rate

from 75%-25%

1.28813E-05

Permeability Graph TP2b test 1



construction evaluation
Building & Material Test Solutions

Trial Hole: TP3a

Trial Hole: TP3a

WARNING DOES NOT FALL TO 25% OF START DEPTH-Refer to graph sheet for calculation

<u>Infiltration Rate</u>	<u>from 75%-25%</u>	not valid
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The graph displays the percentage of depth remaining over time for a 100m depth test. The y-axis represents 'Depth in metres' from 0.0% to 100.0% in 10.0% increments. The x-axis represents 'Time in minutes' from 0.00 to 500.00 in 50.00 increments. A single data series is plotted as a solid black line, showing a gradual decline from 100.0% at 0 minutes to approximately 84.0% at 425 minutes.

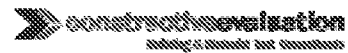
Time in minutes	Depth in metres (%)
0.00	100.0
50.00	99.0
100.00	97.0
150.00	94.0
200.00	91.0
250.00	89.0
300.00	87.0
350.00	86.0
400.00	84.5
425.00	84.0

Soakaway Test Results & Soil Infiltration Rate

Site: Wick, SK07 Greenfields

Job No: 14.7982

Trial Hole: TP3b



Time in minutes	Depth in meters to water surface	Depth in metres of water	Percentage of water depth at start
0.00	0.120	1.03	100.0%
1.00	0.140	1.01	98.1%
2.00	0.150	1.00	97.1%
3.00	0.155	1.00	96.6%
4.00	0.160	0.99	96.1%
5.00	0.170	0.98	95.1%
6.00	0.177	0.97	94.5%
7.00	0.185	0.97	93.7%
8.00	0.190	0.96	93.2%
9.00	0.195	0.96	92.7%
10.00	0.200	0.95	92.2%
15.00	0.220	0.93	90.3%
20.00	0.250	0.90	87.4%
25.00	0.265	0.89	85.9%
30.00	0.280	0.87	84.5%
35.00	0.290	0.86	83.5%
45.00	0.310	0.84	81.6%
65.00	0.350	0.80	77.7%
80.00	0.380	0.77	74.8%
95.00	0.400	0.75	72.8%
124.00	0.470	0.68	66.0%
169.00	0.500	0.65	63.1%
194.00	0.520	0.63	61.2%
214.00	0.550	0.60	58.3%
238.00	0.560	0.59	57.3%
277.00	0.590	0.56	54.4%
314.00	0.620	0.53	51.5%
375.00	0.660	0.49	47.6%
416.00	0.690	0.46	44.7%
435.00	0.700	0.45	43.7%
435.00	0.700	0.45	43.7%

WARNING DOES NOT FALL TO 25% OF START DEPTH-Refer to graph sheet for calculation

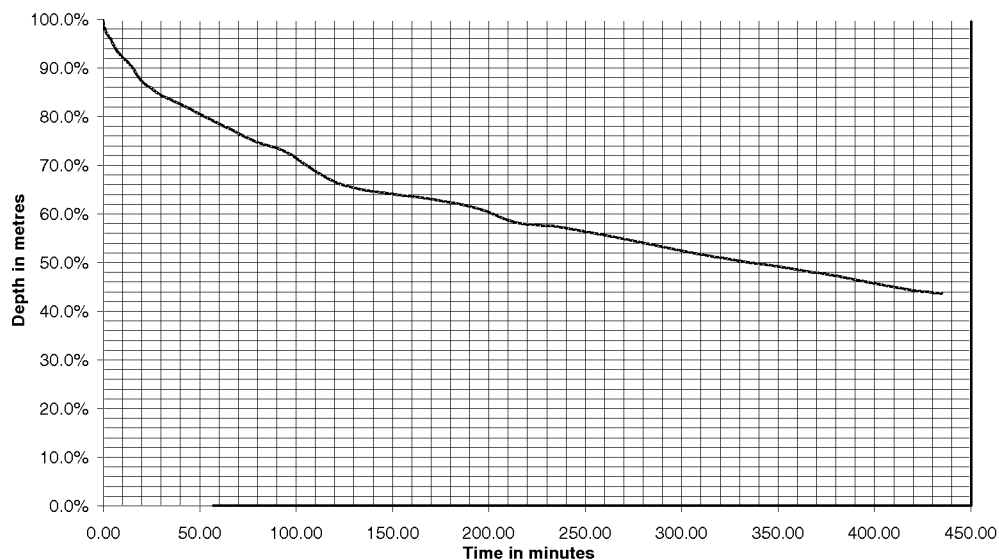
Pit Size	Time in mins
Length	0.45
Width	0.40
Depth	1.15

Infiltration Rate

from75%-25%

not valid

Permeability Graph TP3



construction solution
Building & Material Best Practices

~~CONFIDENTIAL~~

Trial Hole: TP4a

WARNING DOES NOT FALL TO 25% OF START DEPTH-Refer to graph sheet for calculation

<u>Infiltration Rate</u>	<u>from 75%-25%</u>	not valid
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The graph displays the depth in metres over a 600-minute period. The y-axis represents 'Depth in metres' from 0.0% to 100.0% in 10.0% increments. The x-axis represents 'Time in minutes' from 0.00 to 600.00 in 100.00-minute increments. A single data series is plotted as a solid black line. The depth is constant at 100.0% until approximately 150 minutes, then decreases to about 95.0% by 370 minutes.

Time in minutes	Depth in metres (%)
0.00	100.0
100.00	100.0
150.00	100.0
200.00	98.0
250.00	95.0
300.00	95.0
350.00	95.0
370.00	95.0

Structural evaluation

Trial Hole: TP4b

WARNING DOES NOT FALL TO 25% OF START DEPTH-Refer to graph sheet for calculation

<u>Infiltration Rate</u>	<u>from 75%-25%</u>	not valid
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A line graph showing the relationship between Depth in metres (Y-axis) and Time in minutes (X-axis) for a 100m depth. The Y-axis ranges from 0.0% to 100.0% in 10.0% increments. The X-axis ranges from 0.00 to 200.00 in 20.00 increments. The curve starts at (0, 100.0%) and decreases exponentially, reaching approximately 43.0% at 170 minutes.

Time in minutes	Depth in metres (%)
0.00	100.0%
10.00	90.0%
20.00	80.0%
30.00	72.0%
40.00	65.0%
50.00	59.0%
60.00	54.0%
70.00	50.0%
80.00	47.0%
90.00	44.5%
100.00	42.5%
110.00	40.8%
120.00	39.3%
130.00	38.0%
140.00	36.8%
150.00	35.7%
160.00	34.6%
170.00	33.6%

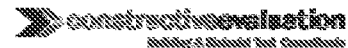
Soakaway Test Results & Soil Infiltration Rate

Site: Wick, SK06, Land West of Greenfields

Job No: 14.7982

Trial Hole: TP4b

Test 2



Time in minutes	Depth in meters to water surface	Depth in metres of water	Percentage of water depth at start
0.00	0.100	1.00	100.0%
1.00	0.120	0.98	98.0%
2.00	0.130	0.97	97.0%
3.00	0.140	0.96	96.0%
4.00	0.150	0.95	95.0%
5.00	0.160	0.94	94.0%
6.00	0.170	0.93	93.0%
7.00	0.180	0.92	92.0%
8.00	0.190	0.91	91.0%
9.00	0.200	0.90	90.0%
10.00	0.210	0.89	89.0%
15.00	0.250	0.85	85.0%
20.00	0.280	0.82	82.0%
25.00	0.310	0.79	79.0%
33.00	0.350	0.75	75.0%
42.00	0.400	0.70	70.0%
52.00	0.440	0.66	66.0%
61.00	0.480	0.62	62.0%
77.00	0.520	0.58	58.0%
92.00	0.550	0.55	55.0%
122.00	0.600	0.50	50.0%
139.00	0.620	0.48	48.0%
153.00	0.640	0.46	46.0%
163.00	0.650	0.45	45.0%
187.00	0.680	0.42	42.0%
213.00	0.700	0.40	40.0%
226.00	0.710	0.39	39.0%
226.00	0.710	0.39	39.0%

WARNING DOES NOT FALL TO 25% OF START DEPTH-Refer to graph sheet for calculation

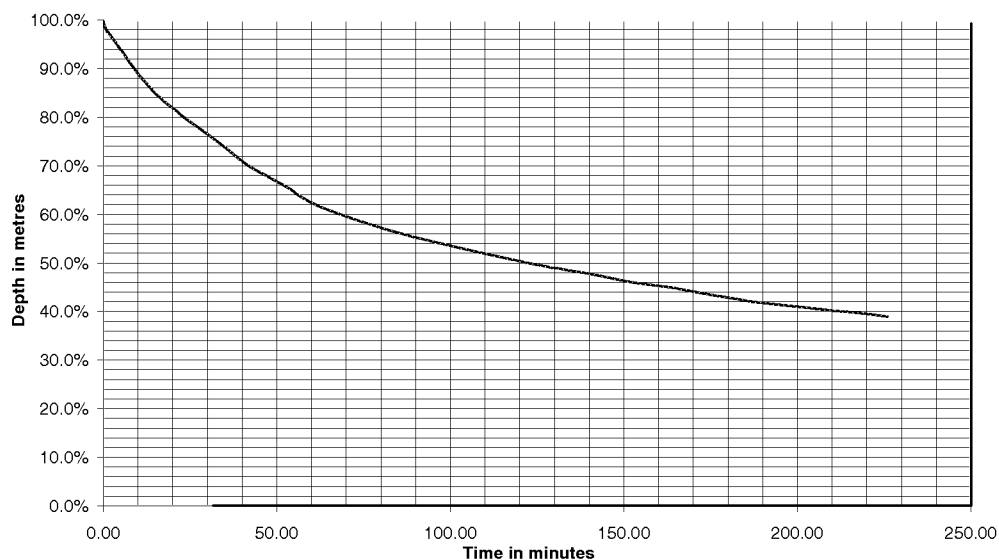
Pit Size	Time in mins
Length	0.40
Width	0.40
Depth	1.10

Infiltration Rate

from75%-25%

not valid

Permeability Graph TP4b Test 2



Investigation Photographs – Joyce Close SK09

A.



B.



C.



D.



- A. TP1A Joyce Close
- B. TP1A Joyce Close
- C. TP1B Joyce Close
- D. TP1B Joyce Close

 **constructiveevaluation**
Soil & Material Test Consultants

Date of Site Works:

27-28th Feb 2014

Site Address:

Wick, Littlehampton

Client:

ADC

Job/ref no.

14.7982

Investigation Photographs – West of Joyce Close SK08

E.



F.



G.



H.



- E. TP2A West of Joyce Close
- F. TP2A West of Joyce Close
- G. TP1B West of Joyce Close
- H. TP1B West of Joyce Close

constructiveevaluation
Soil & Material Test Consultants

Date of Site Works:

27-28th Feb 2014

Site Address:

Wick, Littlehampton

Client:

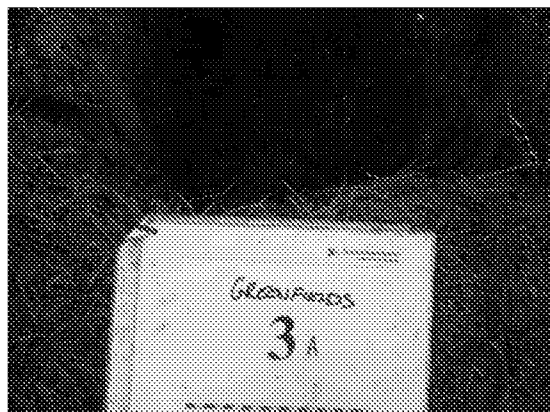
ADC

Job/ref no.

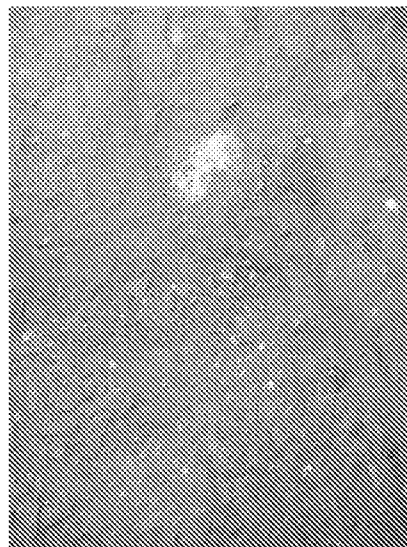
14.7982

Investigation Photographs – Greenfields SK07

I.



J.



K.



L.



- I. TP3A Greenfields
- J. TP3A Greenfields
- K. TP3B Greenfields
- L. TP3B Greenfields

 **constructiveevaluation**
Soil & Material Test Consultants

Date of Site Works:

27-28th Feb 2014

Site Address:

Wick, Littlehampton

Client:

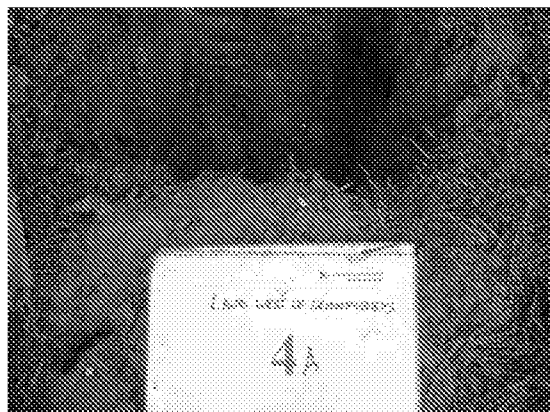
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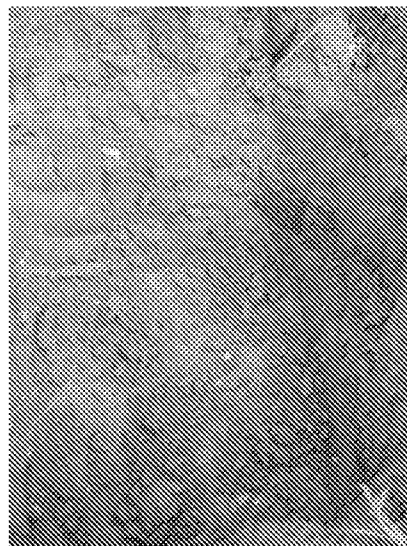
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Investigation Photographs Land West of Greenfields SK06

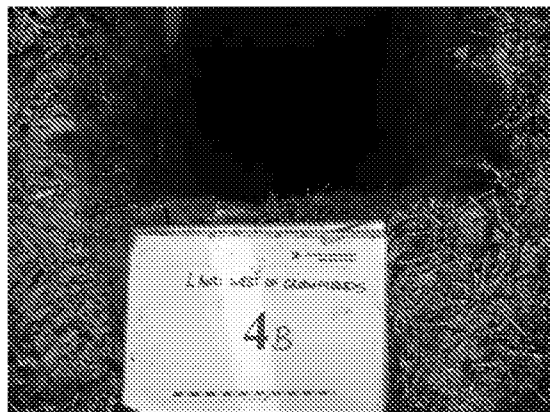
M.



N.



O.



P.



- M. TP4A Land West of Greenfields
- N. TP4A Land West of Greenfields
- O. TP4B Land West of Greenfields
- P. TP4B Land West of Greenfields

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14.7982