



Ref: 1CO102896/180911/L1

Date: 11th September 2018

Ziyad Thomas
Renaissance Group
12 Headlands Business Park
Salisbury Road
Ringwood
Hampshire
BH24 3PB

By email only to – zt@renaissancgroup.co.uk

Dear Ziyad,

**Supplementary Ground Investigation Works (Soakaway Testing) –
Former Hares Daihatsu, Station Road, Littlehampton, Rustington, BN16 3BH.**

1.0 INTRODUCTION

Resource and Environmental Consultants Ltd (REC) was commissioned by Arch Associates on behalf of Renaissance Group ('the Client') to undertake soil infiltration testing in accordance with BRE 365 at Former Hares Daihatsu, Station Road, Littlehampton, Rustington, BN16 3BH ('the Site'). It is understood that this investigation is required to support a proposed drainage design at the above site. A site location plan (Drawing ref. 1CO102896-001) is presented within Attachment II.

REC has previously completed a number of phases of work on the site. These include the following:

- Phase I & II Geo-Environmental Site Assessment and Investigation Report (Ref.: 1CO100632/P2R1);
- Remediation Method Statement (RMS) (Ref.: 1CO100632/P3R1);
- Detailed Quantitative Risk Assessment for Controlled Waters (Ref.: 1CO100632/P3R0); and,
- Watching Brief & Validation Works (Ref.: 1CO100632).

The above phases of works identified the following conditions:

- Made Ground thickness circa 0.80mbgl,
- Superficial River Terrace Deposit encountered at depths ranging from 0.35m to 0.80mbgl;

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- Bedrock Seaford, Newhaven, Lewes, Portsdown and Culver Chalk Formation encountered at depths between 2.90m and 7.70mbgl; and,
- Return monitoring visits indicated a groundwater level ranging from 2.22mbgl to 3.75mbgl.

REC understands that the local planning authority have requested soil infiltration tests at 1.00m, 2.00m and 3.00mbgl in order to confirm shallow drainage suitability for the scheme.

2.0 SCOPE OF WORK

REC attended site on 22nd and 23rd August 2018 to undertake soil infiltration testing in accordance with BRE 365. Upon arrival, 3no. trial pits (SA401, SA402 and SA403) had been excavated to depths specified by the Local Authority. Details of these locations can be found in the engineers logs, included as Attachment III, and summarised in Section 4.2

An exploratory hole and test location plan (Drawing ref: 1CO102896 – 002) is included within Attachment II.

A selection of site photographs is included as Attachment V.

3.0 LIMITATIONS AND CONFIDENTIALITY

The limitations to this report are presented as Attachment I.

REC has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from REC. A charge may be levied against such approval.

4.0 GROUND CONDITIONS AND GROUNDWATER CONDITIONS

4.1 Summary of Ground Conditions

The trial pits advanced generally confirmed the ground conditions encountered in the previous ground investigation reports. Findings of this investigation are summarised in Table 4.1 overleaf:





Table: 4.1 Summary of Ground Conditions Encountered

Stratum	Minimum Depth to top of Stratum (m bgl)	Maximum Depth to top of Stratum (m bgl)	Maximum Thickness (m)
Made Ground	GL	GL	1.67 (SA403)
River Terrace Deposits	0.30	1.67	1.40 (SA402) *NP

Key: GL – Ground Level; *NP – Not Proven

4.1.1 Made Ground

Made Ground was encountered within all exploratory hole locations and comprised heterogeneous soft to firm grey to brown slightly sandy gravelly CLAY. Sand was fine to coarse grained. Gravels were generally angular to rounded fine to coarse flint, brick, ceramic, chalk, glass, asphalt, concrete, wood, plastic, chalk and metal. A total thickness of 1.67m was recorded within SA403.

No visual or olfactory evidence of gross contamination was identified within this stratum.

4.1.2 River Terrace Deposits

River Terrace Deposits were encountered within all exploratory hole locations and comprised soft to firm yellowish to brown slightly gravelly sandy CLAY with low cobble content. Sand was fine to coarse grained. Gravels and cobbles were angular to subrounded fine to coarse flint. The full thickness of the stratum was not proven.

No visual or olfactory evidence of gross contamination was identified within this stratum.

Exploratory hole logs are presented as Attachment III.

4.2 Soil Infiltration (Soakaway) Results

Soil infiltration testing was commenced within SA403 and SA401 on the first day. Testing within SA402 could not be commenced as ongoing remediation works were limiting access to the location.

SA401 and SA403 were left open to infiltrate overnight. On the second day, testing continued within SA401 and SA403 while testing was started within SA402. Three repeat tests were completed within SA401 (at 1.00mbgl), whilst slow rates of infiltration within SA402 and SA403 resulted in no tests being fully completed in these locations.





Soil infiltration test certificates are included within Attachment IV and the results are summarised as Table 4.2.

Table 4.2 Summary of Soil Infiltration Testing

Location	Test Depth (m bgl)	Receiving Stratum	Test No.	Soil Infiltration Rate (m/s)	
SA401	1.00	River Terrace Deposits	1	2.44×10^{-05}	
			2	2.44×10^{-05}	
			3	2.51×10^{-05}	
SA402	2.00		1	75% effective storage not reached	
SA403	2.70		1		
			2		

5.0 CONCLUSION

The results indicate that the superficial soils encountered within SA401 to a depth of 1.00mbgl are of low to medium permeability and as such have the potential to be utilised for permeable paving. The soils at greater depth are noted to be practically impermeable and as such would not be suitable for the adoption of shallow soakaways. It is recommended that a qualified drainage engineer is consulted to determine the most appropriate drainage solution.

We trust this letter and its enclosures are clear. Should you have any further queries, please contact the undersigned.

Yours sincerely,

For and on behalf of REC

Michael Nworah
Geo-Environmental Consultant

Ross Lawton
Senior Consultant





Enclosed:

Attachment I – Limitations

Attachment II – Drawings

1CO102896-001 Site Location Plan

1CO102896-002 Exploratory Hole & Test Locations Plan

Attachment III – Exploratory Hole Logs

Attachment IV – Soil Infiltration Test Certificates

Attachment V – Site Photographs

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Attachment I
Limitations

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1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between REC Ltd and the Client as indicated.
2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information it has been assumed it is correct. No attempt has been made to verify the information.
3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.
4. During the site walkover reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.
5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.
6. In addition to the above REC Ltd note that when investigating, or developing, potentially contaminated land it is important to recognise that sub-surface conditions may vary spatially and also with time. The absence of certain ground, ground gas, and contamination, or groundwater conditions at the positions tested is not a guarantee that such conditions do not exist anywhere across the site. Due to the presence of existing buildings and structures access could not be obtained to all areas. Additional contamination may be identified following the removal of the buildings or hard standing.
7. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.
8. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials this is for indicative purposes only and do not constitute or replace full and proper surveys.
9. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
10. This report presents an interpretation of the geotechnical information established by excavation, observation and testing. Whilst every effort is made in interpretative reporting to assess the soil conditions over the Site it should be noted that natural strata vary from point to point and that man-made deposits are subject to an even greater diversity. Groundwater conditions are dependent on seasonal and other factors. Consequently there may be conditions present not revealed by this investigation.
11. REC cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by REC is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by REC in this connection without their explicit written agreement there to by REC.
12. Rather, this investigation has been undertaken to provide a preliminary characterisation of the existing sub-surface geotechnical characteristics and make up and the findings of this study are our best interpretation of the data collected, within the scope of work and agreed budget. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.
13. This investigation has been undertaken to reasonably characterise existing sub-surface conditions and the findings of this study are our best interpretation of the data collected, within the scope of work and agreed budget. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.





Attachment II
Drawings

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KEY:



Site Location

The client must not amend any drawing, design or other intellectual property produced by REC Ltd, without permission in writing from REC Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, REC Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or other intellectual property



REC



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Job No. & Title:

1CO102896
Station Road, Rustington

Client:

Renaissance Retirement

Drawn by: MN
Approved by: RL
Date: August 2018

Notes:
Map extracted from
OpenStreet Map

NOT TO SCALE

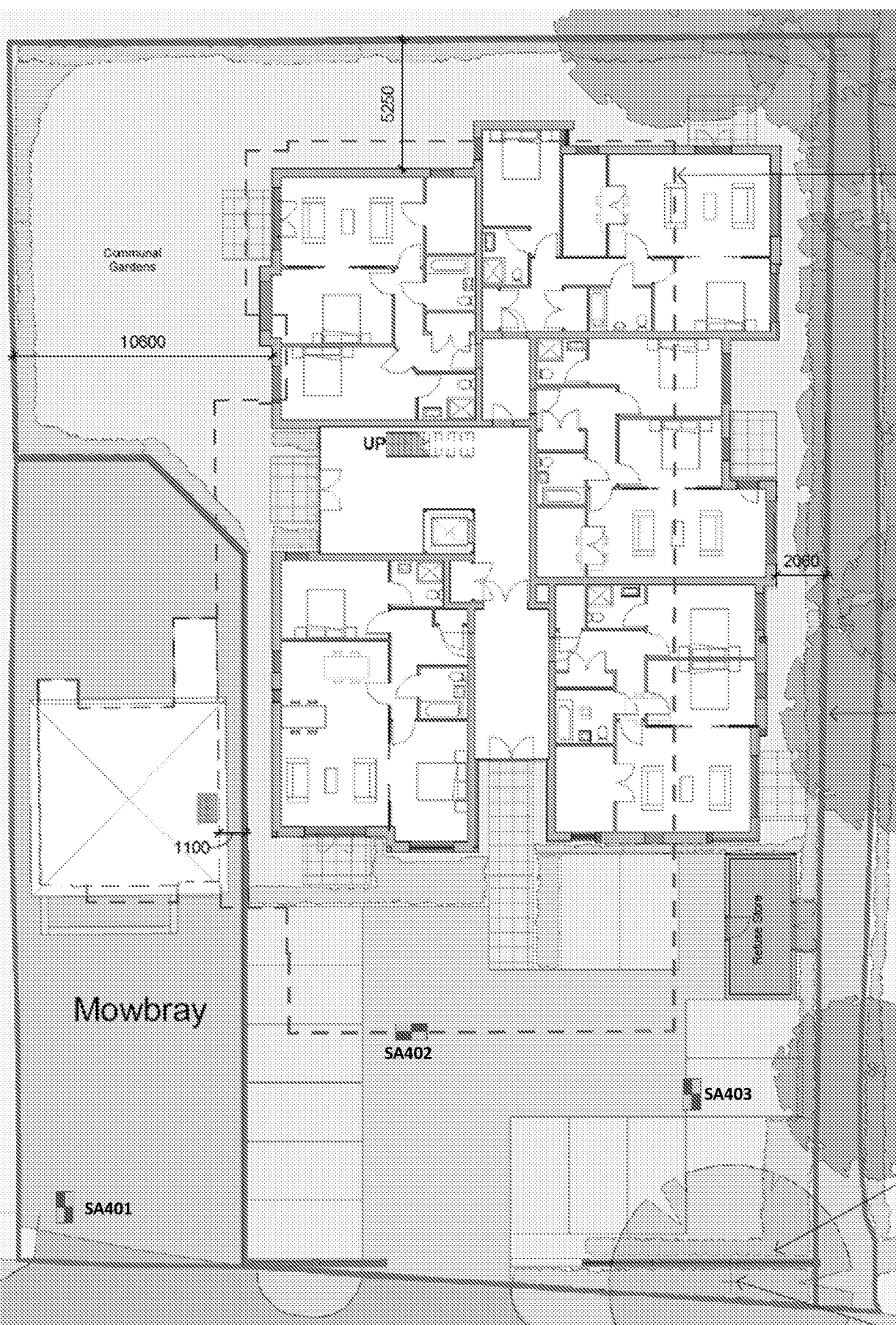
Drawing Title:

1CO102896 – 001
Site Location Plan

KEY:



 Trial Pit &
Soakaway Test
Location



The client must not amend any drawing, design or other intellectual property produced by REC Ltd, without permission in writing from REC Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, REC Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or other intellectual property.

Job No. & Title:

1CO102896
Station Road, Rustington

Client:

Renaissance Retirement

Drawn by:

MN

Approved by:

RL

Date:

August 2018

Notes:

Plan supplied by the client

NOT TO SCALE

Drawing Title:

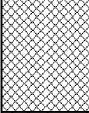
1CO102896 – 002
Exploratory Hole and Test
Location Plan

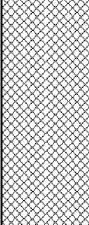
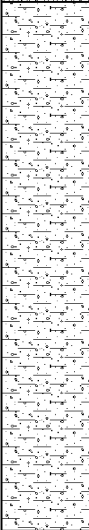


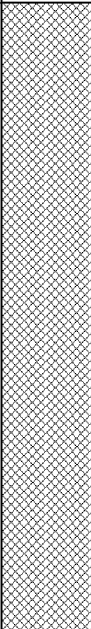
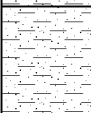
Attachment III
Exploratory Hole Logs

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   		Trial Pit Log			Borehole No. SA401				
Project Name: Rustington		Proj. ID: 1CO102896		Easting: Northing:		Hole Type TP			
Location: Station Road, Rustington, BN16 3BH		Plant: 2.5t Excavator		Level (m AOD): Final Depth (m): 1.00		Scale: 1:20			
Client: Renaissance Retirement		Crew: Hackwood Homes Group Ltd		Start Date: 22/08/2018 End Date: 22/08/2018		REC Engineer: AB			
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30		 Soft to firm brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to rounded fine to coarse asphalt, concrete, brick, flint, ceramic, wood and metal. [MADE GROUND]		
					1.00		 Soft to firm yellowish brown slightly silty slightly gravelly CLAY with low cobble content. Gravel is angular to subrounded flint. Cobbles are subrounded flint. [RIVER TERRACE DEPOSITS]		
							End of Borehole at 1.00m		
								1	
								2	
								3	
								4	
Remarks: Trial pit excavated prior to REC attending site. No groundwater encountered. Location utilised for soil infiltration testing broadly in accordance with BRE 365. Location backfilled with arisings in reverse order and made safe upon completion. Stability: Stable								Pit Dimensions Length: 1.80 Width: 0.80 Depth: 1.00	 CONCEPT LIFE SCIENCES ULTIMATE SOLUTIONS

   		Trial Pit Log			Borehole No. SA402					
Project Name: Rustington		Proj. ID: 1CO102896		Easting: Northing:		Hole Type TP				
Location: Station Road, Rustington, BN16 3BH		Plant: 2.5t Excavator		Level (m AOD): Final Depth (m): 2.00		Scale: 1:20				
Client: Renaissance Retirement		Crew: Hackwood Homes Group Ltd		Start Date: 22/08/2018 End Date: 22/08/2018		REC Engineer: AB				
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					0.60			Firm brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to rounded fine to coarse flint, brick, concrete, plastic, metal and chalk. [MADE GROUND]		
					2.00			Soft to firm brown slightly gravelly sandy CLAY. Sand is fine to medium. Gravel is subangular to subrounded fine flint. [RIVER TERRACE DEPOSITS]	1	
								End of Borehole at 2.00m	2	
									3	
									4	
Remarks: Trial pit excavated prior to REC attending site. No groundwater encountered. Location utilised for soil infiltration testing broadly in accordance with BRE 365. Location backfilled with arisings in reverse order and made safe upon completion. Stability: Stable								Pit Dimensions Length: 1.90 Width: 0.80 Depth: 2.00		 CONCEPT LIFE SCIENCES ESTABLISHED 2012

   			Trial Pit Log			Borehole No. SA403 Sheet 1 of 1			
Project Name: Rustington			Proj. ID: 1CO102896		Easting: Northing:		Hole Type TP		
Location: Station Road, Rustington, BN16 3BH			Plant: 2.5t Excavator		Level (m AOD): Final Depth (m): 2.70		Scale: 1:20		
Client: Renaissance Retirement			Crew: Hackwood Homes Group Ltd		Start Date: 22/08/2018 End Date: 22/08/2018		REC Engineer: AB		
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.67			Soft to firm grey slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to rounded fine to coarse flint, brick, ceramic, chalk, glass and plastic. [MADE GROUND]	1
					2.40			Soft to firm brown slightly sandy CLAY. [RIVER TERRACE DEPOSITS]	2
					2.70			Soft to firm yellowish brown sandy CLAY. [RIVER TERRACE DEPOSITS]	
								End of Borehole at 2.70m	3
									4
Remarks: Trial pit excavated prior to REC attending site. No groundwater encountered. Location utilised for soil infiltration testing broadly in accordance with BRE 365. Location backfilled with arisings in reverse order and made safe upon completion. Stability: Stable							Pit Dimensions Length: 1.80 Width: 0.80 Depth: 2.70	 CONCEPT LIFE SCIENCES QUALITY AND SAFETY	

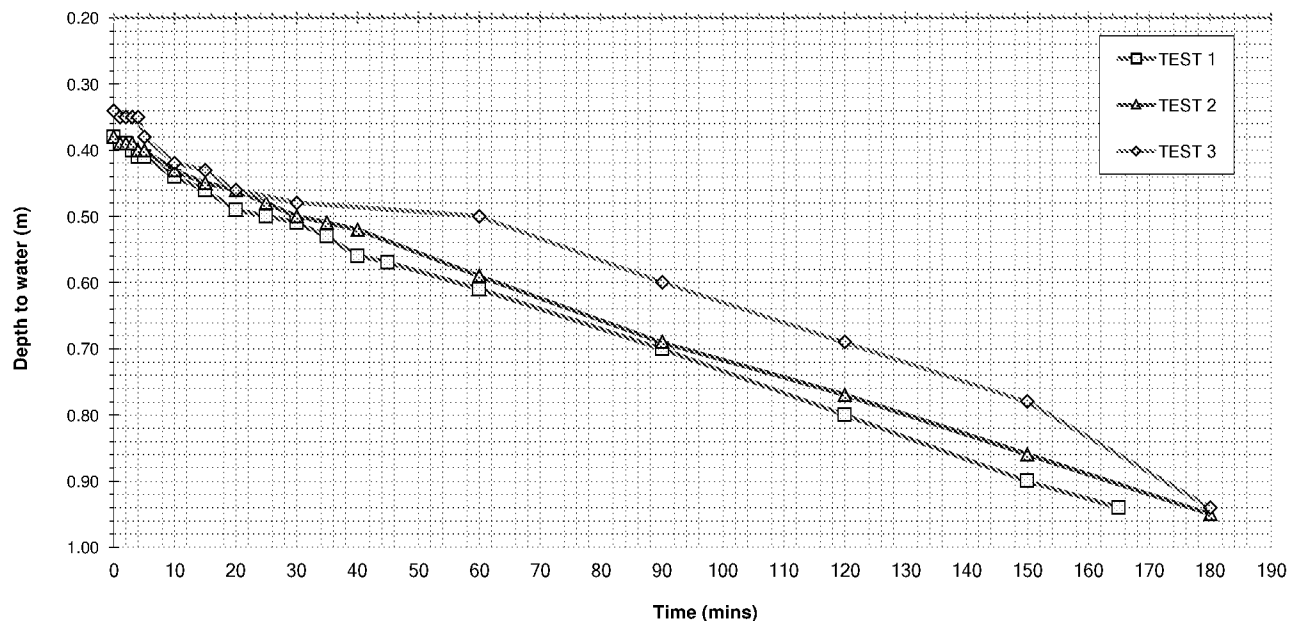


Attachment IV
Infiltration (Soakaway) Test Results



Remarks	TEST 1		TEST 2		TEST 3	
	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
Ground Description:	0	0.38	0	0.38	0	0.34
	1	0.39	1	0.39	1	0.35
0.00-0.30 MADE GROUND:	2	0.39	2	0.39	2	0.35
Soft to Firm brown slightly sandy gravelly CLAY.	3	0.40	3	0.39	3	0.35
Sand is fine to coarse. Gravel is angular to	4	0.41	4	0.40	4	0.35
rounded fine to coarse asphalt, concrete, brick,	5	0.41	5	0.40	5	0.38
flint, ceramic, wood and metal.	10	0.44	10	0.43	10	0.42
	15	0.46	15	0.45	15	0.43
	20	0.49	20	0.46	20	0.46
0.30-1.00 RIVER TERRACE DEPOSITS: Soft	25	0.50	25	0.48	30	0.48
to Firm yellowish brown slightly silty slightly	30	0.51	30	0.50	60	0.50
gravelly CLAY with low cobble content. Gravel is	35	0.53	35	0.51	90	0.60
angular to subrounded fine to coarse flint.	40	0.56	40	0.52	120	0.69
Cobbles are subrounded flint.	45	0.57	60	0.59	150	0.78
	60	0.61	90	0.69	180	0.94
	90	0.70	120	0.77		
	120	0.80	150	0.86		
	150	0.90	180	0.95		
	165	0.94				

DESIGN SOIL INFILTRATION RATE, f 2.44E-05



		Site Job Number Date of Test	Rustington 1CO102896 23/08/2018	Trial Pit Number..... Length..... Width..... Depth..... Groundwater Level.....	SA102 1.90 m 0.80 m 2.00 m Not encountered m
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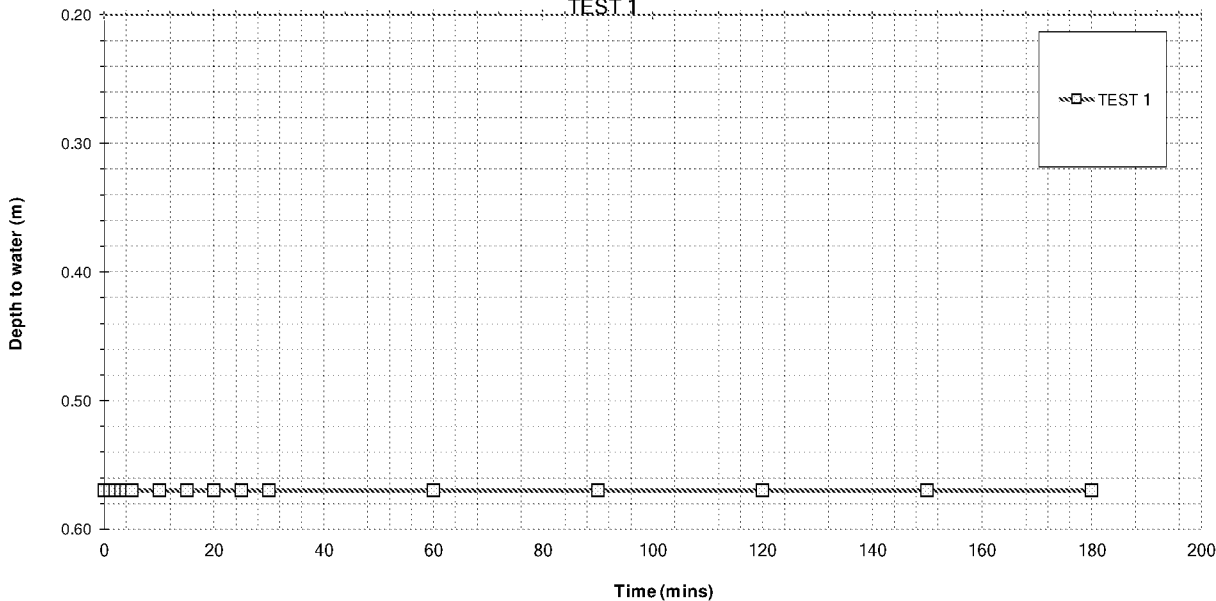
Remarks - Ground Description: 0.00-0.60 MADE GROUND: Firm brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to rounded fine to coarse flint, brick, concrete, plastic, metal and chalk. 0.60-2.00 RIVER TERRACE DEPOSITS: Soft to Firm brown slightly gravelly sandy CLAY. Sand is fine to medium. Gravel is subangular to subrounded fine flint.	TEST 1		TEST 2		TEST 3	
	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
	0.0	0.57				
	1.0	0.57				
	2.0	0.57				
	3.0	0.57				
	4.0	0.57				
	5.0	0.57				
	10.0	0.57				
	15.0	0.57				
20.0	0.57					
25.0	0.57					
30.0	0.57					
60.0	0.57					
90.0	0.57					
120.0	0.57					
150.0	0.57					
180.0	0.57					

Effective Storage Depth	m	1.43			
75% Effective Storage Depth	m	1.07			
(i.e. depth below GL)	m	0.80			
25% Effective Storage Depth	m	0.36			
(i.e. depth below GL)	m	3.58			
Effective Storage Depth 75%-25%	m	0.72			
Time to fall to 75% effective depth	mins	N/A			
Time to fall to 25% effective depth	mins	N/A			
V (75%-25%)	m3	1.09			
a (50%)	m2	5.38			
t (75%-25%)	mins	N/A			

SOIL INFILTRATION RATE	m/s	N/A
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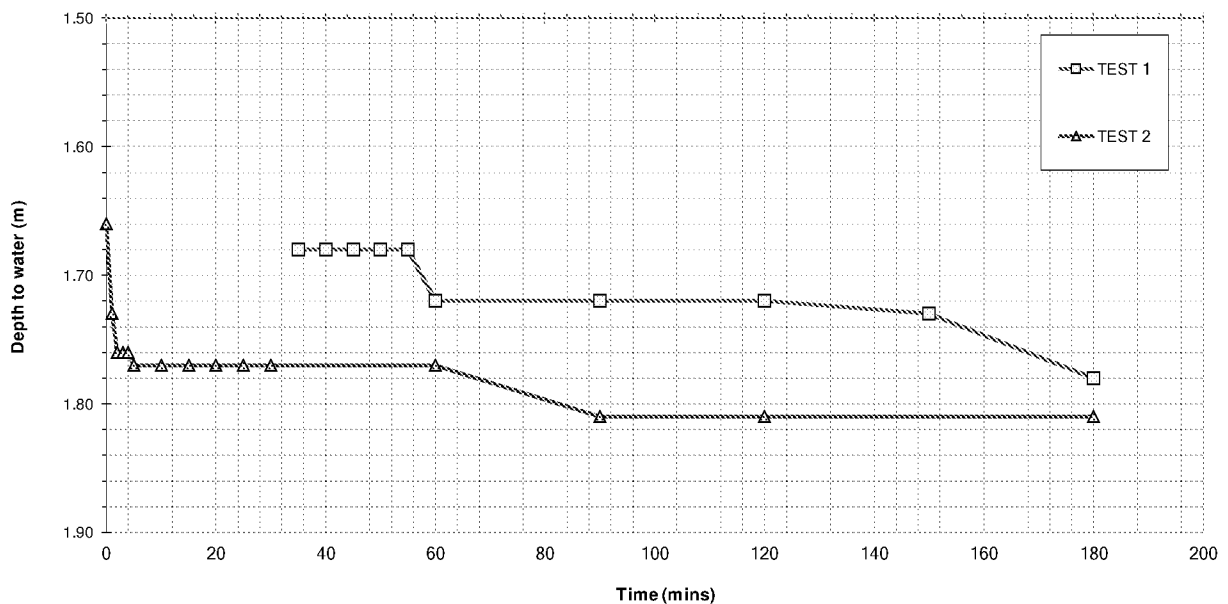
DESIGN SOIL INFILTRATION RATE, f	75% Effective Storage not reached
----------------------------------	-----------------------------------

TEST 1



Remarks -	TEST 1		TEST 2		TEST 3	
	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
Ground Description:	0.0	1.61	0.0	1.68		
0.00-1.67 MADE GROUND:	1.0	1.66	1.0	1.73		
Soft to firm grey slightly sandy gravelly CLAY.	2.0	1.69	2.0	1.76		
Sand is fine to coarse. Gravel is angular to	3.0	1.69	3.0	1.76		
rounded fine to coarse flint, brick, ceramic,	4.0	1.65	4.0	1.76		
chalk, glass and plastic.	5.0	1.68	5.0	1.77		
	10.0	1.69	10.0	1.77		
1.67-2.40 RIVER TERRACE DEPOSITS: Soft	15.0	1.69	15.0	1.77		
to Firm brown slightly sandy CLAY.	20.0	1.68	20.0	1.77		
	25.0	1.66	25.0	1.77		
2.40-2.70 RIVER TERRACE DEPOSITS: Soft	30.0	1.68	30.0	1.77		
to firm yellowish brown sandy CLAY.	35.0	1.68	60.0	1.77		
	40.0	1.68	90.0	1.81		
	45.0	1.68	120.0	1.81		
	50.0	1.68	180.0	1.81		
	55.0	1.68				
	60.0	1.72				
	90.0	1.72				
	120.0	1.72				
	150.0	1.73				
	180.0	1.78				
	Data in red obtained within Made Ground and are not to be considered		Data in red obtained within Made Ground and are not to be considered			
Effective Storage Depth m		1.02		0.97		
75% Effective Storage Depth m		0.77		0.73		
(i.e. depth below GL) m		1.94		1.97		
25% Effective Storage Depth m		0.26		0.24		
(i.e. depth below GL) m		2.05		2.06		
Effective Storage Depth 75%-25% m		0.51		0.49		
Time to fall to 75% effective depth mins		N/A		N/A		
Time to fall to 25% effective depth mins		N/A		N/A		
V (75%-25%) m3		0.73		0.70		
a (50%) m2		4.09		3.96		
t (75%-25%) mins		N/A		N/A		
SOIL INFILTRATION RATE m/s						

DESIGN SOIL INFILTRATION RATE, f 75% Effective Storage not reached





Attachment V
Site Photographs

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Plate 1: Excavated trial pit (SA401) showing Made Ground overlying River Terrace Deposits.



Plate 2: Excavated soil from trial pit (SA402) showing brown slightly gravelly sandy CLAY.



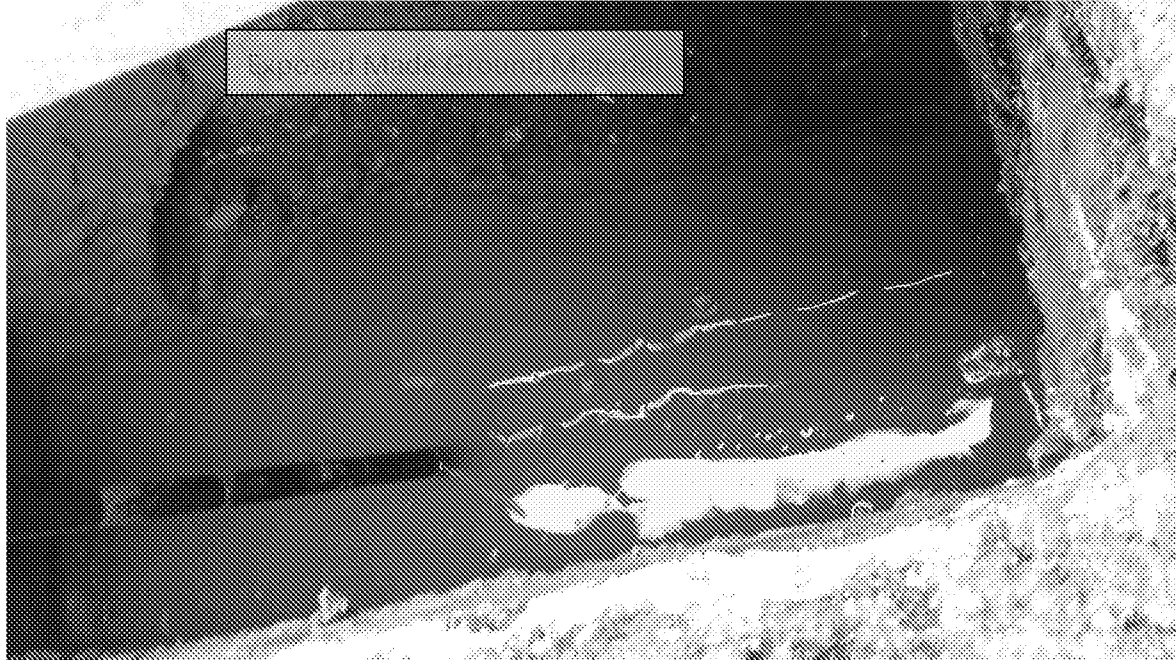


Plate 3: Soil infiltration (soakaway) testing set-up with exposed deep Made Ground (SA403) and left open overnight.

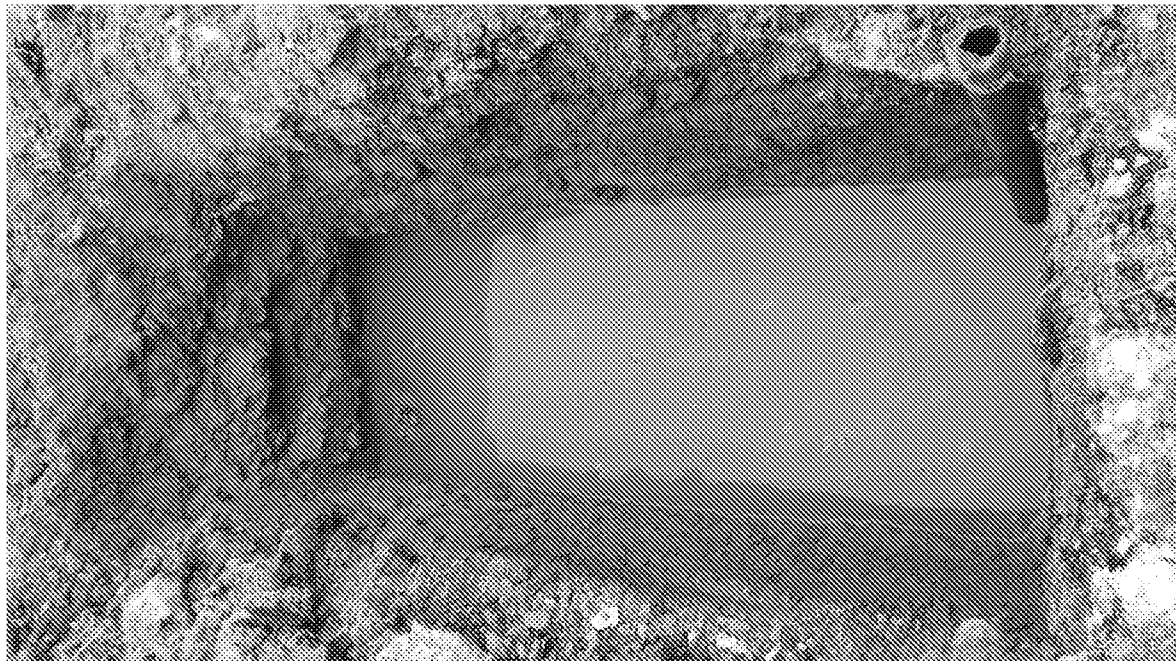


Plate 4: Soil infiltration (soakaway) testing set-up (SA401) and left open overnight.

