	TECHNICAL NOTE	
	Pringuer-James Consulting Engineers (Structural & Civil Engineers) Overseas House, Elm Grove, London SW19 4HE 	
Project: Tudor Cottage, Sea Road	Project No. L2340	
By: Vlad Myrsikov	Date: 17.12.2018	
Title: Drainage Design Cover Note	No. L2340-TN-002	

Planning Application Reference: APP/C3810/W/17/3183667 and EP/136/18/PL

1. Introduction

Following the submission of L2340-TN-001 for planning conditions discharge several comments discussion have taken place with Arun Council. Section 73 planning application has been submitted and approved and a new consent issued under planning reference EP/136/18/PL.

This Technical Note L2340-TN-002 provides a summary of all documentation and presents final solution for the development. The surface water run-off will be reduced from the existing situation through the introduction of permeable pavements (reduction in areas) and SUDS (reduction in peak flow).

2. Documents Summary

- A. Drawing L2340-C-52-750 Revision 04.
- B. L2340-TN-001 – Technical Note, which includes the following:
 - o Existing Site calculations
 - o Proposed Site Calculations
 - o Maintenance Plan
- C. Geotechnical Investigation Report
- D. Soakaway and Permeability test results
- E. Southern Water S106 Approval Letter
- F. Southern Water capacity calculations.
- G. Non-engineered permeable pavements design by contractor.
- H. Site-Wide levels plan.
- I. Correspondence with Arun Council.

3. Surface Water Calculations

Summary Points, and Council discussions/requests and resolutions are summarised below:

- Summer groundwater level was found to be 1.7m (4.1mAOD) in the summer.
 - o Council agreed that no soakaway infiltration is possible for the site.
- Permeability and Soakaway tests results were found to be highly variable.
 - o Council agreed that formally engineered permeable pavement would be Type B and would increasing overall flow to the sewer which is undesirable.
 - o Council agreed to the solution of non-engineered permeable pavement, which do not have a connection to the sewer or detention basin, preventing flow from pavements into the sewer and maximising infiltration potential into the soil.
- Southern Water have approved PJCE drainage design and issued S106 approval.
 - o Telephone discussion has taken place regarding the Detention Basin. The approved Detention Basin design meets CIRIA753, and the base is minimum 1.0m above known summer groundwater level (minimum 5.1mAOD).
- The site had only a combined sewer connection. Overall flow to this connection has reduced and there's no impact on the sewer.

4. Clarifications on design

This section summarises Council comments and PJCE response to those comments:

- The proposed development reduced run-off rate to 3x Greenfield Rate which is the standard expected for brownfield sites.
- Council has requested additional levels information for the Detention Basin.
 - PJCE provided detailed set-out for the Detention Basin including levels and sections.
- The Council expressed desire to change “off-line” Detention Basin to “on-line” Detention basin, on an assumption that latter would decrease water run-off into the sewer through infiltration.
 - Detention Basin function is identical to attenuation tank. It’s designed to hold excess water for as short of period as possible as possible. SuDS Management Train prefers detention basin due to added biodiversity and amenity benefits.
 - The Detention Basin is within 2.5m of structural foundations. Creating “on-line” Detention Basin would effectively create an “Infiltration Basin”, which would need to be minimum 5.0m clear from foundations of the building. Therefore, “off-line” Detention Basin can only be replaced with “on-line” below ground sealed Attenuation Tank.
 - It’s not possible to create “on-line” system as the Detention Basin is higher than pipework levels. Raising pipework is not possible, lowering the Detention Basin will trigger requirement to introduce impermeable membrane to satisfy Southern Water requirements, removing limited infiltration benefits altogether.
 - The water discharged to sewers would be identical for both off-line and on-line systems due to poor infiltration figures and because Detention Basin contact time is minimal.
 - PJCE has added water levels to Detention Basin cross-section to demonstrate water entering the basin even during average annual 1-in-1year storm. Off-line arrangement would be beneficial to landscaping and plant species.
- The Council requested additional inlets and outlets to be provided into the basin.
 - PJCE increase the number of pipes entering and exiting the Detention Basin.
- The council has requested that car park levels are such that a gentle fall to Detention Basin is created, and construction details for the pavement are provided.
 - This request is contrary to previously agreed strategy. Any fall to the Detention Basin would increase volume of water draining to sewer. As such the car park is separated from Detention Basin to maximise infiltration for the car park.
 - Because car park only accepts water falling on-to it – its infiltration behaviour would be equivalent to natural grass and all water will find a way to infiltrate into the ground.
 - Attached architectural drawing show bunding around the site, so all water is retained on-site and will not drain to surrounding land.
 - Construction details have been provided.

5. Design summary

The design demonstrated on drawing L2340-C-52-750 Revision 04 by PJCE meets CIRIA753 SuDS guidance and achieves 3x Greenfield Rate for the brownfield sites, while maximising biodiversity, water quality, amenity and attenuating run-off.

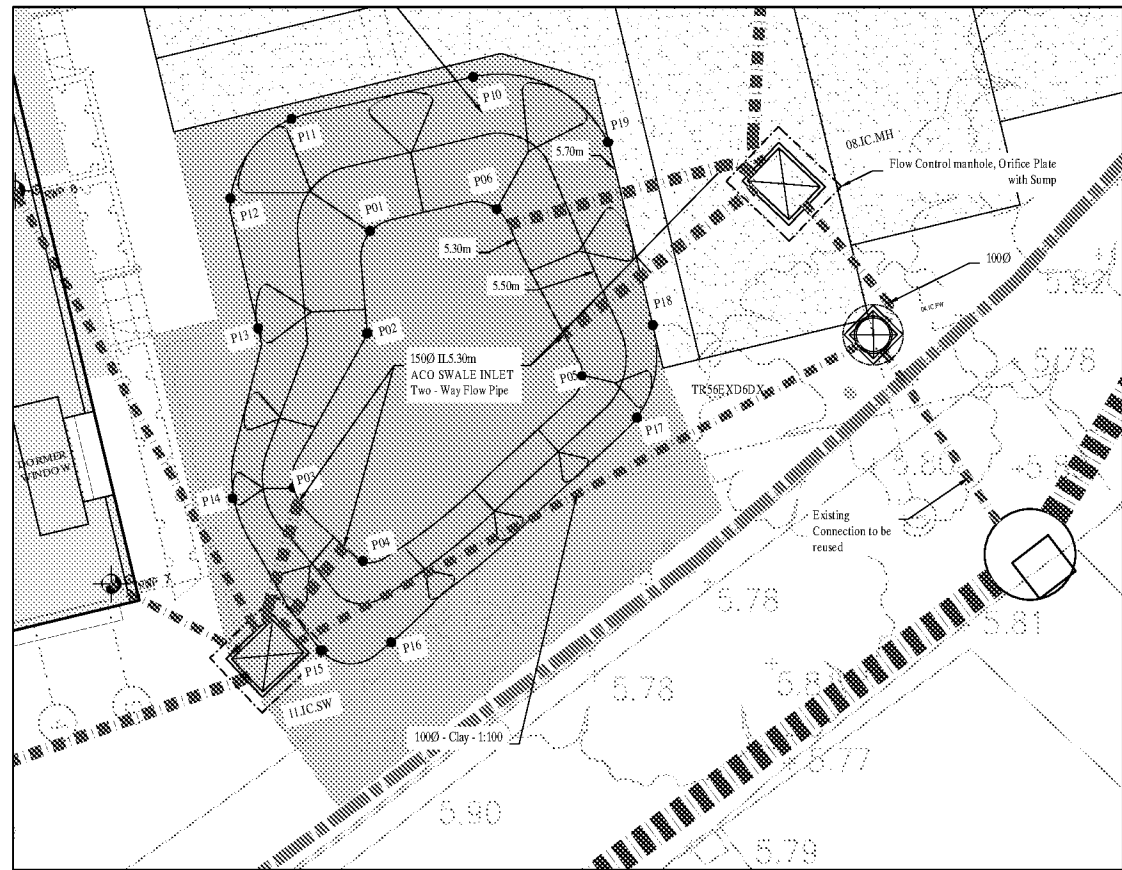
Run-off reduction is achieved by replacing non-permeable surfaces with permeable pavement, which reduced short term run-off into the sewers. Addition of Detention Basin and Flow-Controls further reduced overall impact on the existing sewer.



SITE LAYOUT
Scale 1:100

Ref.	FFL	IL	Internal size	Specification	Cover Size	Cover Type	Notes:
04.IC.FW	5.80	5.025	4500	SFA Type 3 - B.16	450 x 450	Type 1	
05.IC.SW	5.90	5.230	4500	SFA Type 3 - B.16	450 x 450	Type 1	
06.IC.SW	5.95	5.400	4500	SFA Type 3 - B.16	450 x 450	Type 1	
07.IC.SW	5.75	5.170	4500	SFA Type 3 - B.16	450 x 450	Type 1	
08.MH.SW	5.80	See Notes	750 x 600	SFA Type 4 - B.21	750 x 600	Type 1	Sump - IL4.800 Outfall - IL5.100 Basin two-way pipe IL - 5.25 Flow Control - Specification 1
09.IC.SW	5.95	5.405	4500	SFA Type 3 - B.16	450 x 450	Type 2	
10.IC.SW	5.85	5.230	4500	SFA Type 4 - B.21	450 x 450	Type 2	
11.MH.SW	5.90	See Notes	750 x 600	SFA Type 3 - B.18	750 x 600	Type 2	Sump - IL4.800 Outfall - IL5.157 Basin two-way pipe IL - 5.25 Flow Control - Specification 2

- Notes:
- All chamber to be to adoptable standards, SFA - Sewers for Adoption, 7th Edition.
 - Check existing sewer invert levels on site prior to start.
 - Confirm FFL with Architect before installation



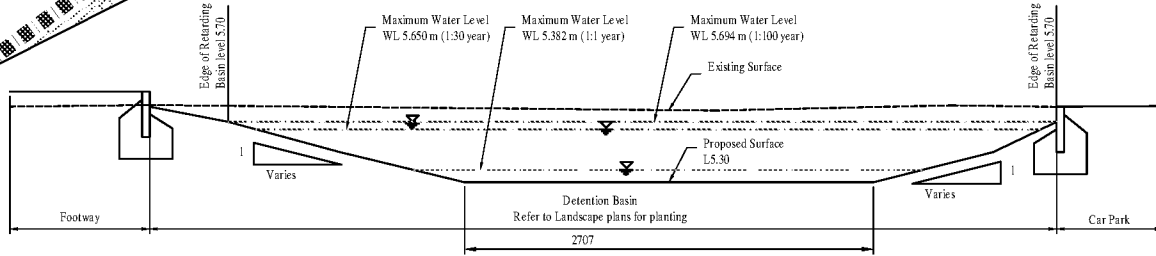
DETENTION BASIN SETTING OUT
Scale 1:50

Ref.	Eastern [m]	Northern [m]	Datum [m]
P01	507.138	101630	5.3
P02	507.138	101628	5.3
P03	507.138	101627	5.3
P04	507.138	101626	5.3
P05	507.141	101628	5.3
P06	507.140	101631	5.3

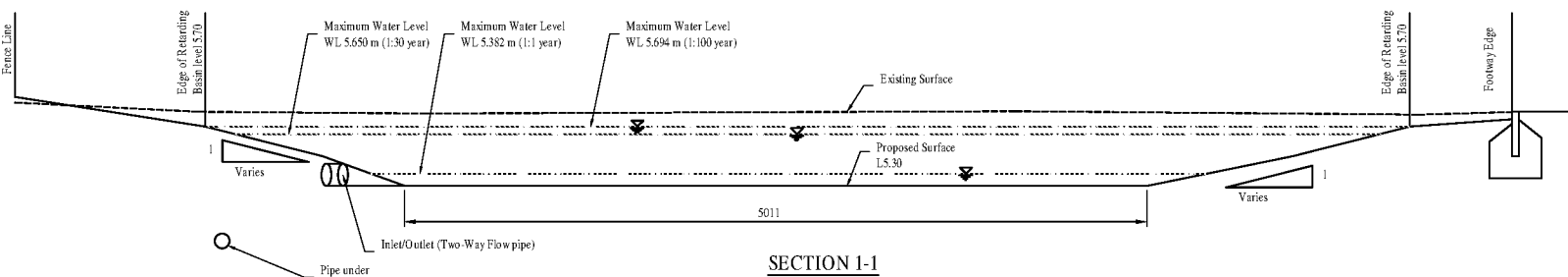
Ref.	Eastern [m]	Northern [m]	Datum [m]
P10	507.140	101632	5.7
P11	507.138	101632	5.7
P12	507.137	101631	5.7
P13	507.137	101629	5.7
P14	507.137	101627	5.7
P15	507.138	101625	5.7
P16	507.139	101625	5.7
P17	507.142	101628	5.7
P18	507.142	101629	5.7
P19	507.142	101631	5.7

FLOW CONTROL SPECIFICATION	
Downstream Manhole - 11.IC.SW	
Control Mechanism - Orifice Plate	
Specification - ACO Q-Plate	
Size - 0.026 m	
Outfall pipe size - 100mm	
Outfall I.L. - 5.156 m	
Hydraulic Head - 0.544 m	
Discharge Rate - 1.0 l/s	
Overflow Pipe - 100mm	
Overflow Pipe I.L. - 5.90m	

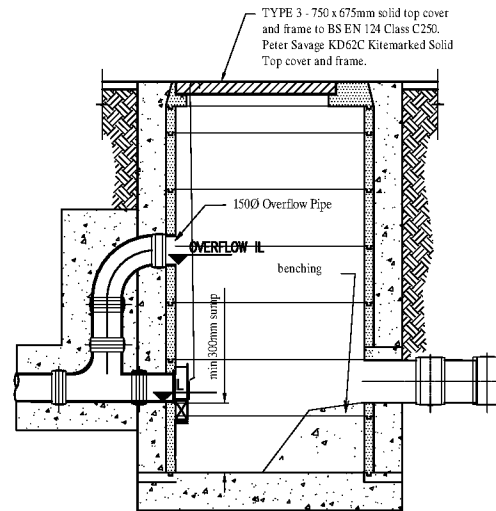
FLOW CONTROL SPECIFICATION	
Manhole - 08.IC.SW	
Control Mechanism - Orifice Plate	
Specification - ACO Q-Plate	
Size - 0.029 m	
Outfall pipe size - 100mm	
Outfall I.L. - 5.100 m	
Hydraulic Head - 0.6 m	
Discharge Rate - 1.3 l/s	
Overflow Pipe - 100mm	
Overflow Pipe I.L. - 5.90m	



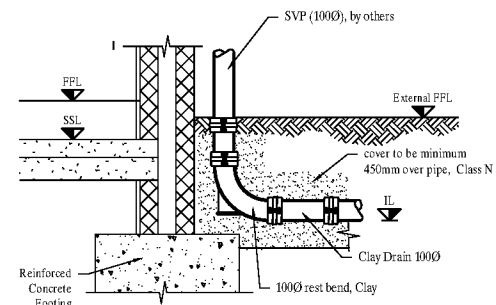
SECTION 2-2
Scale 1:25



SECTION 1-1
Scale 1:25



FLOW CONTROL CHAMBER DETAIL
Scale 1:20



EXTERNAL RWP DETAIL
Scale 1:20

- Notes:
- This drawing is for planning conditions discharge and is not for construction.
 - All dimensions are in millimetres unless otherwise stated. All levels are in metres unless otherwise stated.
 - This drawing should be read in conjunction with all relevant architects, structural engineers and m&e engineers drawings and specification.
 - Minimum Clay Pipe cover depth for use of Class ND bedding and surround to be as following. Where minimum cover cannot be met the pipe to be concrete encased.
Grass area: 300mm minimum
Footways: 400mm minimum
Roads: 800mm minimum
 - All stacks/svp/cwp are 1000 U.N.O. All pipes are 1000 unless noted otherwise.
 - All 1000 pipes to have minimum gradient 1:100 U.N.O.
 - All drains are to be laid in a constant gradient between manhole chambers.
 - New connection onto existing sewer to be in accordance with Southern Water requirements.
 - All road openings within the public highway to be agreed with the local authority.
 - All buried concrete products and mortars are to contain class 2 sulphate resisting cement.



KEY PLAN
Scale 1:1000

Key	
	Surface Water Pipe
	Inspection Chamber - Flexible To Adoptable Standards
	Inspection Chamber, Concrete
	RWP stack
	Rodding eye

Rev.	Date	Drawn	Amendment
04	08.11.2018	MA	Added Basin Setting out
03	19.10.2018	KK	Updated Site Boundary, added 5m line
02	20.06.2018	DA	Issued for Council Approval
01	30.05.2018	DA	Issued for Council Approval

PRINGER-JAMES
CONSULTING ENGINEERS
Overseas House, Elm Grove, London, SW19 4HE
Phone/Fax : 020 8940 4159
Email : mail@pjpe.com Website : www.pjpe.com

ROCCO HOMES

TUDOR COTTAGE, SEA ROAD,
EAST PRESTON

DRAINAGE FOR PLANNING

Status : APPROVAL	
Scale: as noted @ A1	Date: MAY.2018
Drawn: MA	Engineer: VM
Checked: DL	Revision
Drawing No. L2340-C-52-750	04

	TECHNICAL NOTES	
	Pringuer-James Consulting Engineers (Structural & Civil Engineers) Overseas House, Elm Grove, London, SW19 4HE 	
Project: Tudor Cottage, Sea Road	Project No. L2340	
Engineer: Vlad Myrsikov	Date: 20 June 2018	
Title: Drainage Strategy for Planning	No. L2340-TN-001_Rev01	

Planning Application Reference: APP/C3810/W/17/3183667

1. Introduction

This technical note provides drawings, calculations and other details to satisfy Planning Condition 9 and 10 as described below.

9) No building hereby permitted shall be occupied until surface water drainage works shall have been implemented in accordance with details that shall first have been submitted to and approved in writing by the local planning authority. Before any details are submitted to the local planning authority an assessment shall be carried out of the potential for disposing of surface water by means of a sustainable drainage system, having regard to Defra's non-statutory technical standards for sustainable drainage systems (or any subsequent version), and the results of the assessment shall have been provided to the local planning authority.

10) Where a sustainable drainage scheme is to be provided, the submitted details shall:
i) provide information about the design storm period and intensity, the method employed to delay and control the surface water discharged from the site and the measures taken to prevent pollution of the receiving groundwater and/or surface waters;
ii) include a timetable for its implementation; and,
iii) provide a management and maintenance plan for the lifetime of the development which shall include the arrangements for adoption by any public authority or statutory undertaker and any other arrangements to secure the operation of the scheme throughout its lifetime.

2. Surface Water Scheme

The following drawings, included in Appendix D, provide details of the surface water scheme for the development.

- L2340-C-52-750

3. Existing Site

Existing site surface water drainage consisted of building roofs and impermeable car park pavements to the front of the building. The overall area of 410m² was drainage un-attenuated into Southern Water sewer. The remaining areas were grass or small footpaths which were draining to adjoining grass areas. Appendix D contains a sketch showing existing areas.

Pre-development run-off calculations were completed using FEH data for all major rainfall events. Due to small nature of the site, T_c would be between 15 and 30 mins for peak events. 60mins event was included as this is critical for sewerage undertaker. The calculations are provided in Appendix A, and the results are summarised in Table 1 below:

	Pre-development site:		
	15 minute	30 minute	60 minute
Q_{ex} (1-in-1 year)	3.60 l/s	2.30 l/s	1.51 l/s
Q_{ex} (1-in-30 year)	8.90 l/s	5.80 l/s	4.52 l/s
Q_{ex} (1-in-100 year)	11.37 l/s	9.11 l/s	5.82 l/s

Table 1 - Existing Site Runoff Rates

PJCE have also calculated peak run-off using Southern Water (Sewers for Adoption) Methodology. For existing site peak runoff rate using this methodology was found to be **4.56l/s**.

The proposed site discharge rate will not exceed existing.

4. Implemented SuDS

The aim of SuDS is to identify “at source” water management measures to reduce surface water runoff. The most appropriate means of surface water control and discharge has been determined based on the hierarchy as set out in the non-statutory technical standards: CIRIA SuDS Manual (C753).

Systems considered and not implemented

- *Swales, bioretention systems, ponds*
There is insufficient space to include swales and it was impractical to implement bioretention system or to included for permanent pond.
- *Green Roofs*
Green roofs were not implemented as these are not practical on pitched roofs.
- *Soakaways*
Groundwater was found to be relatively high: around 1.7m and is sandy clay in nature. Thus soakaway is unlikely to produce sufficient empty times for implementation.
- *Attenuation tanks*
Attenuation tanks are viable for this development, however they were not implemented as other SuDS elements with further benefits were implemented instead.

Implemented systems

- *Permeable paving*
All pavements on site will be permeable. Parking bays are proposed a non-engineered, natural gravel finish, which is the same finish as the adjoining properties on Palk Court Cottages. This type of approach showed to be successful in this area.

A major advantage of permeable pavements is catchment and treatment of hydrocarbons and other pollutants. As per CIRIA (C752) The SuDS manual, Simple Index Approach Methodology (26.7.1), Car Park for domestic dwellings exhibits pollution index of 0.4 (Table 26.2) while permeable pavements exhibits mitigation potential of 0.4 when discharging to groundwater (Table 26.4), which means no further mitigation is required.
- *Detention Basin*
Detention system was implemented with the development. This is offline system which would only flood fully during more extreme events. Majority of the time the basin will be landscaped and provide amenity benefits to the development as per The SuDS Manual.
- *Flow Control Devices*
The downstream surface water networks will benefit from reduction in peak run-off from site. As such hydrobrake device has been included within the development.

5. Proposed Site

The proposed site impermeable area would only consist of new building roofs. Car Park will be permeable. Any impermeable footways will drain to adjoining grass areas. Overall, the impermeable site draining to sewer has decreased from 410m² pre-development to 365m² post-development, through the replacement of existing impermeable asphalt pavement in favour of permeable gravel car park pavement.

To test realistic system behaviour, a complex micro drainage model has been built, which takes into account actual pipe network to be built on-site and includes the detention basin and hydrobrake.

The modelling aimed to minimise peak storm run-off from the site by increasing detention basin size, however there are practical limitation, such as side slopes and usability of the detention basin as an amenity space.

Based on practical limitations, the site peak discharge rate was limited to 2.3l/s for 1-in-100year + 40% Climate Change rainfall events, which is the same as 1-in-1 year event for existing site, thus limiting impact on existing sewers from the development.

Full calculations are included in Appendix B, and summary of results is provided below.

	Post-Development peak run-off rate		
	Peak run-off Rate	Detention Basin Volume	Total Storage Volume (basin + pipes + manholes)
Q_{pr} (1 year + 40% CC)	1.5 l/s	1.214 m ³	2.497 m ³
Q_{pr} (30 year + 40% CC)	2.1 l/s	8.049 m ³	10.491 m ³
Q_{pr} (100 year + 40% CC)	2.3 l/s	11.627 m ³	14.187 m ³

Table 2 – Post-development modelling results

6. Other Considerations

Pollution Control

For car park, CIRIA (C752) The SuDS manual, Simple Index Approach Methodology (26.7.1), Car Park for domestic dwellings exhibits pollution index of 0.4 (Table 26.2) while permeable pavements exhibits mitigation potential of 0.4 when discharging to groundwater (Table 26.4), which means no further mitigation, other than permeable pavement itself is required to prevent and mitigate pollution risks to groundwater.

Implementation Timetable

The drainage system and detention basin will be installed before first occupation of the building. The landscaping surrounding detention basin will be completed separately and is not required for the function of the detention basin.

Management and Maintenance Plan

There are three SuDS items that require regular maintenance:

- Permeable Pavement
- Detention Basin
- Hydro-brake

The proposed detention basin is an off-line system, as such typical maintenance that would normally be expected for the on-line detention system is not applicable here. Normal landscape maintenance regime is applicable.

Full maintenance plan for above is included in Appendix C. Maintenance will be undertaken by the management company for the building, and no elements will be offered for adoption.

Appendixes

- Appendix A – Existing Site Run-off Calculations
- Appendix B – Proposed Site Run-off Calculations
- Appendix C – Maintenance Plan
- Appendix D – Drawings and Sketches

Appendix A: Existing Site Run-off Calculations

Equations Used

GREENFIELD AREAS

IH124: Catchment descriptor equation

Peak Run-off

$$Q_{\text{BAR (rural)}} = 0.00108 \text{ AREA}^{0.89} \text{ SAAR}^{1.17} \text{ SOIL}^{2.17}$$

$Q_{\text{BAR (rural)}}$ = mean annual flood (a return period in the region of 2.3 years)

AREA = area of catchment in km^2

SAAR = Standard Average Annual Rainfall for the period 1941-1970 in mm
soil index, taken from FST soil maps or the WRAP map of the Wellington

SOIL = procedure

Calculation is completed for 50ha and linearly interpolated for required site area

DEVELOPED AREAS

Calculated using Modified Rational Method and FEH data

Peak Run-off Rate

$$Q_o = 2.78 C_v C_r i A$$

C_v = Volumetric Runoff coefficient

C_r = 1.3 (routing Coefficient)

i = Rainfall Intensity

A = Area

2.78 = Coefficient which accounts for the differences in units used for the inputs and the outputs of the equation

$$V = \frac{\text{PR}}{100} I A$$

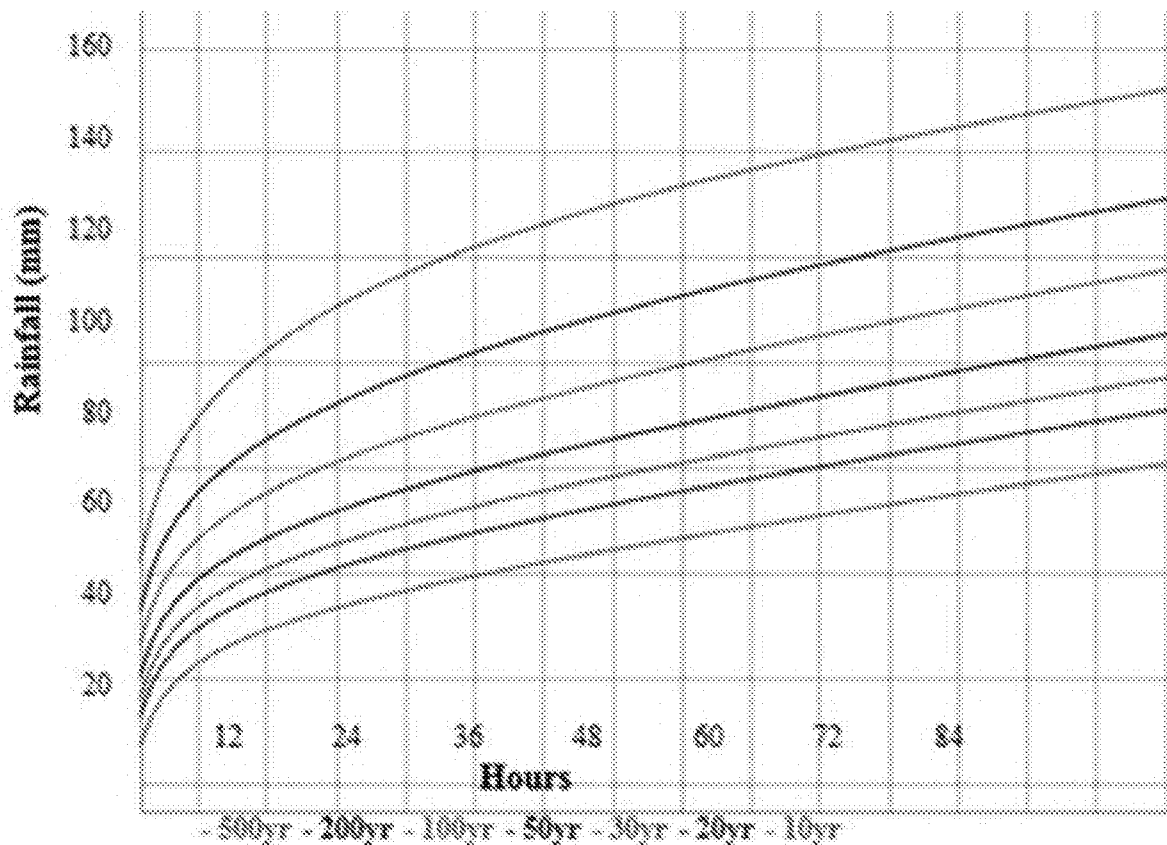
V = Volume of runoff

PR = Percentage of Run-off

I = rainfall depth (mm)

A = Area

Rainfall Data							
Location		507144	101633	125A Tudor Lodge, Sea Road, East Preston			
FEH data							
Return Period		1	2	10	30	100	100+CC (+40%)
Duration (mins)	Duration (hrs)	FSR rainfall depths (mm)	FEH Rainfall depths (mm)				
15	0.25	7.19	8.37	16.47	21.45	27.17	38.04
30	0.5	9.26	10.80	21.47	28.46	36.37	47.28
60	1	12.08	13.67	27.07	36.10	46.47	60.41
120	2	15.18	18.50	33.03	42.64	53.76	69.89
240	4	19.41	23.63	39.36	49.64	61.89	80.46
360	6	22.26	26.63	43.06	53.76	66.72	86.74
600	10	24.70	30.53	47.78	59.09	73.14	95.08
1440	24	33.40	37.86	56.92	69.67	86.07	111.89



Peak runoff rate calculations - Existing Site

IMPERMEABLE AREAS (Pre-development)			
Roofs	=	0.9	normal roofs
Pavements	=	0.75	hard standing
Surface	Area (ha)	Cv	Weighted Cv
Roofs	0.026	0.9	
Pavement	0.015	0.75	
TOTAL	0.041	0	0.85
Return Period			
1 in 1			
Duration (mins)	Rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (l/s)
15	7.19	28.75	3.60
30	9.26	18.53	2.32
60	12.08	12.08	1.51

Return Period			
1 in 30			
Duration (mins)	Rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (l/s)
15	17.93	71.72	8.98
30	23.16	46.33	5.80
60	36.10	36.10	4.52

Return Period			
1 in 100			
Duration (mins)	Rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (l/s)
15	22.70	90.80	11.37
30	36.37	72.74	9.11
60	46.47	46.47	5.82

Appendix B. Proposed Site Calculations

Summary of results:

1-in-100 year + 40% Climate Change

- Peak run-off rate
- Peak attenuation tank volumes

Duration	Peak Runoff	Water Level in Basin	Basin Attenuation Volume	Total Attenuation volume, inc basins, pipes and structures
15mins	2.1 l/s	5.597 m	7.915 m ³	10.319 m ³
30mins	2.3 l/s	5.665 m	10.256 m ³	12.765 m ³
60mins	2.3 l/s	5.694 m	11.627 m ³	14.187 m ³

1-in-30 year + 40% Climate Change

Duration Peak Runoff

15mins	-	2.0 l/s
30mins	-	2.1 l/s
60 mins	-	2.1 l/s

1-in-1 year + 40% Climate Change

- Calculated using FSR Data, as FEH cannot calculate less than 1-in-2 year events.

Duration Peak Runoff

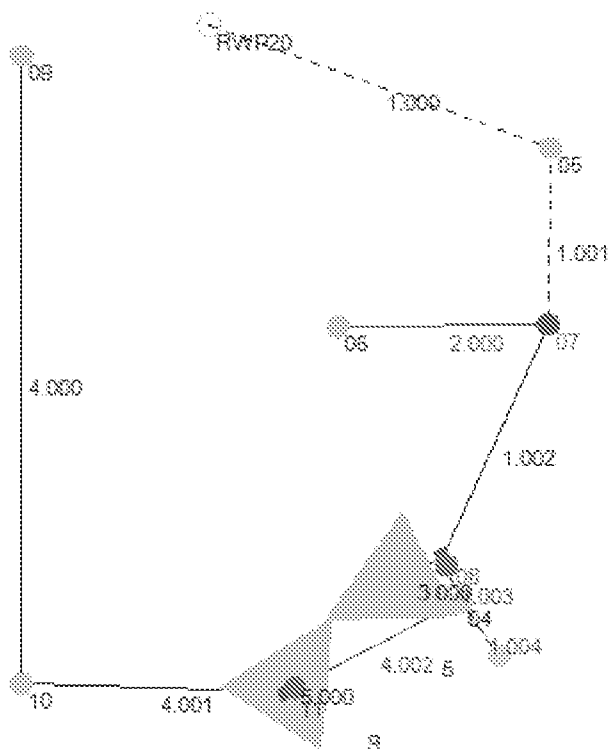
15mins	-	1.6 l/s
30mins	-	1.6 l/s
60 mins	-	1.5 l/s

PRINGUER-JANES
CONSULTING ENGINEERS



Designed by vlad
Checked by

Network 2017.1.2



Pringuer-James Consulting Engineers Limited		Page 2
Overseas House Elm Grove London SW19 4HE	PRINGUER-JAMES CONSULTING ENGINEERS	
Date 19/06/2018 11:11 File REDESIGN (REV D).MDX	Designed by vlad Checked by	
Innovyze	Network 2017.1.2	

Online Controls for Storm

Orifice Manhole: 08, DS/PN: 1.003, Volume (m³): 0.5

Diameter (m) 0.029 Discharge Coefficient 0.600 Invert Level (m) 5.100

Orifice Manhole: 11, DS/PN: 4.002, Volume (m³): 0.5

Diameter (m) 0.026 Discharge Coefficient 0.600 Invert Level (m) 5.156

©1982-2017 XP Solutions

Pringuer-James Consulting Engineers Limited		Page 3
Overseas House Elm Grove London SW19 4HE	PRINGUER-JAMES CONSULTING ENGINEERS	
Date 19/06/2018 11:11 File REDESIGN (REV D).MDX	Designed by vlad Checked by	
Innovyze	Network 2017.1.2	

Storage Structures for Storm

Tank or Pond Manhole: 5, DS/PN: 3.000

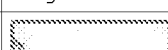
Invert Level (m) 5.300

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	7.9	0.200	14.9	0.400	23.5

Tank or Pond Manhole: 9, DS/PN: 5.000

Invert Level (m) 5.300

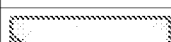
Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	7.9	0.200	14.9	0.400	23.5

Pringuer-James Consulting Engineers Limited		Page 1
Overseas House Elm Grove London SW19 4HE	PRINGUER-JAMES CONSULTING ENGINEERS	
Date 19/06/2018 11:13	Designed by vlad	
File REDESIGN (REV D).MDX	Checked by	
Innovyze	Network 2017.1.2	

Summary of Results for 30 minute 100 year Summer (Storm)

Margin for Flood Risk Warning (mm) 5.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	US/CL (m)	Water				Pipe		Status
			Level (m)	Flow / Cap.	Maximum Vol (m³)	Discharge Vol (m³)	Flow (l/s)		
1.000	RWP20	6.000	5.500	0.36	0.323	3.628	5.2	SURCHARGED*	
1.001	05	5.900	5.660	0.43	0.376	3.266	5.1	SURCHARGED	
2.000	06	6.000	5.767	1.18	0.958	4.667	7.1	SURCHARGED	
1.002	07	5.900	5.658	0.98	0.285	7.663	12.1	SURCHARGED	
3.000	5	5.700	5.642	-0.98	5.093	-3.382	-10.7	SURCHARGED*	
1.003	08	5.800	5.660	0.32	0.475	3.847	1.3	SURCHARGED	
4.000	09	6.000	5.659	0.57	0.040	5.113	7.6	SURCHARGED	
4.001	10	5.900	5.650	0.70	0.519	5.448	8.7	SURCHARGED	
5.000	9	5.700	5.645	-0.95	5.163	-3.777	-10.3	SURCHARGED*	
4.002	11	5.900	5.656	0.18	0.422	2.942	1.0	SURCHARGED	
1.004	04	5.800	5.070	0.42	0.011	6.760	2.3	OK	

Pringuer-James Consulting Engineers Limited		Page 1
Overseas House Elm Grove London SW19 4HE	PRINGUER-JAMES CONSULTING ENGINEERS	
Date 19/06/2018 11:13	Designed by vlad	
File REDESIGN (REV D).MDX	Checked by	
Innovyze	Network 2017.1.2	

Summary of Results for 60 minute 100 year Summer (Storm)

Margin for Flood Risk Warning (mm) 5.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	US/CL (m)	Water				Pipe		Status
			Level	Flow /	Maximum	Discharge	Flow		
			(m)	Cap.	Vol (m³)	Vol (m³)	(l/s)		
1.000	RWP20	6.000	5.500	0.26	0.351		4.983	3.7	SURCHARGED*
1.001	05	5.900	5.776	0.30	0.395		4.655	3.6	SURCHARGED
2.000	06	6.000	5.739	0.85	0.053		6.046	5.1	SURCHARGED
1.002	07	5.900	5.762	0.70	0.302		10.468	8.6	SURCHARGED
3.000	5	5.700	5.667	-0.69	5.668		-2.299	-7.5	SURCHARGED*
1.003	08	5.800	5.753	0.33	0.516		7.834	1.3	SURCHARGED
4.000	09	6.000	5.703	0.43	0.047		6.664	5.8	SURCHARGED
4.001	10	5.900	5.707	0.53	0.528		7.256	6.7	SURCHARGED
5.000	9	5.700	5.679	-0.69	5.938		-3.044	-7.5	SURCHARGED*
4.002	11	5.900	5.695	0.19	0.440		6.063	1.0	SURCHARGED
1.004	04	5.800	5.071	0.44	0.011		13.868	2.3	OK

Pringuer-James Consulting Engineers Limited		Page 1
Overseas House Elm Grove London SW19 4HE	PRINGUER-JAMES CONSULTING ENGINEERS	
Date 19/06/2018 11:16	Designed by vlad	
File REDESIGN (REV D).MDX	Checked by	
Innovyze	Network 2017.1.2	

Summary of Results for 15 minute 30 year Summer (Storm)

Margin for Flood Risk Warning (mm) 5.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status OFF
Inertia Status ON

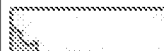
PN	US/MH Name	US/CL (m)	Water		Maximum Vol (m³)	Discharge Vol (m³)	Pipe		Status
			Level (m)	Flow / Cap.			Flow (l/s)		
1.000	RWP20	6.000	5.500	0.34	0.218	2.251	4.9	SURCHARGED*	
1.001	05	5.900	5.552	0.41	0.359	2.046	4.9	SURCHARGED	
2.000	06	5.900	5.556	1.04	0.640	2.808	6.3	SURCHARGED	
1.002	07	5.900	5.538	0.89	0.266	4.652	11.1	SURCHARGED	
3.000	5	5.700	5.525	-0.92	2.849	-0.881	-10.0	SURCHARGED*	
1.003	08	5.800	5.526	0.29	0.414	3.430	1.1	SURCHARGED	
4.000	09	6.000	5.552	0.51	0.023	3.054	6.9	OK	
4.001	10	5.900	5.535	0.64	0.497	3.236	8.0	SURCHARGED	
5.000	9	5.700	5.527	-0.88	2.889	-1.295	-9.5	SURCHARGED*	
4.002	11	5.900	5.533	0.16	0.366	2.615	0.8	SURCHARGED	
1.004	04	5.800	5.067	0.37	0.010	6.022	2.0	OK	

Pringuer-James Consulting Engineers Limited		Page 1
Overseas House Elm Grove London SW19 4HE	PRINGUER-JAMES CONSULTING ENGINEERS	
Date 19/06/2018 11:15 File REDESIGN (REV D).MDX	Designed by vlad Checked by	
Innovyze	Network 2017.1.2	

Summary of Results for 30 minute 30 year Summer (Storm)

Margin for Flood Risk Warning (mm) 5.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status OFF
Inertia Status ON

			Water			Pipe		
	US/MH	US/CL	Level	Flow /	Maximum	Discharge	Flow	
PN	Name	(m)	(m)	Cap.	Vol (m³)	Vol (m³)	(l/s)	Status
1.000	RWP20	6.000	5.500	0.32	0.229	2.890	4.6	SURCHARGED*
1.001	05	5.900	5.575	0.38	0.363	2.565	4.5	SURCHARGED
2.000	06	6.000	5.631	0.97	0.036	3.683	5.8	SURCHARGED
1.002	07	5.900	5.573	0.82	0.272	5.995	10.2	SURCHARGED
3.000	5	5.700	5.567	-0.83	3.591	-2.064	-9.0	SURCHARGED*
1.003	08	5.800	5.567	0.30	0.433	3.531	1.2	SURCHARGED
4.000	09	6.000	5.581	0.46	0.027	4.004	6.3	SURCHARGED
4.001	10	5.900	5.577	0.55	0.505	4.217	6.8	SURCHARGED
5.000	9	5.700	5.573	-0.77	3.697	-2.467	-8.3	SURCHARGED*
4.002	11	5.900	5.574	0.17	0.385	2.695	0.9	SURCHARGED
1.004	04	5.800	5.068	0.39	0.011	6.200	2.1	OK

Pringuer-James Consulting Engineers Limited		Page 1
Overseas House Elm Grove London SW19 4HE	PRINGUER-JAMES CONSULTING ENGINEERS	
Date 19/06/2018 11:14	Designed by vlad	
File REDESIGN (REV D).MDX	Checked by	
Innovyze	Network 2017.1.2	

Summary of Results for 60 minute 30 year Summer (Storm)

Margin for Flood Risk Warning (mm) 5.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	US/CL (m)	Water			Discharge Vol (m³)	Pipe	Status
			Level (m)	Flow / Cap.	Maximum Vol (m³)		Flow (l/s)	
1.000	RWP20	6.000	5.500	0.23	0.266	3.794	3.3	SURCHARGED*
1.001	05	5.900	5.683	0.26	0.380	3.607	3.2	SURCHARGED
2.000	06	6.000	5.633	0.70	0.036	4.725	4.2	SURCHARGED
1.002	07	5.900	5.677	0.59	0.288	8.138	7.3	SURCHARGED
3.000	5	5.700	5.587	-0.57	3.969	-0.769	-6.2	SURCHARGED*
1.003	08	5.800	5.696	0.31	0.491	7.036	1.2	SURCHARGED
4.000	09	6.000	5.620	0.32	0.033	5.220	4.3	SURCHARGED
4.001	10	5.900	5.644	0.40	0.518	5.739	5.0	SURCHARGED
5.000	9	5.700	5.593	-0.49	4.080	-1.575	-5.3	SURCHARGED*
4.002	11	5.900	5.649	0.17	0.419	5.468	0.9	SURCHARGED
1.004	04	5.800	5.069	0.40	0.011	12.479	2.1	OK

Pringuer-James Consulting Engineers Limited		Page 1
Overseas House Elm Grove London SW19 4HE	PRINGUER-JAMES CONSULTING ENGINEERS	
Date 19/06/2018 11:16 File REDESIGN (REV D).MDX	Designed by vlad Checked by	
Innovyze	Network 2017.1.2	

Summary of Results for 15 minute 1 year Summer (Storm)

Margin for Flood Risk Warning (mm) 5.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status OFF
 Inertia Status ON

		Water			Pipe			Status
PN	US/MH Name	US/CL (m)	Level (m)	Flow / Cap.	Maximum Vol (m ³)	Discharge Vol (m ³)	Flow (l/s)	
1.000	RWP20	6.000	5.405	0.12	0.050	0.754	1.7	OK*
1.001	05	5.900	5.400	0.10	0.230	0.754	1.2	SURCHARGED
2.000	06	6.000	5.441	0.35	0.006	0.919	2.1	OK
1.002	07	5.900	5.396	0.19	0.206	1.674	2.4	SURCHARGED
3.000	5	5.700	5.345	-0.13	0.425	-0.002	-1.5	OK*
1.003	08	5.800	5.387	0.23	0.333	1.670	0.9	SURCHARGED
4.000	09	6.000	5.446	0.17	0.006	1.003	2.3	OK
4.001	10	5.900	5.389	0.18	0.233	1.171	2.2	SURCHARGED
5.000	9	5.700	5.359	-0.19	0.570	-0.007	-2.0	OK*
4.002	11	5.900	5.381	0.12	0.288	1.491	0.6	SURCHARGED
1.004	04	5.800	5.062	0.29	0.009	3.162	1.6	OK

Pringuer-James Consulting Engineers Limited		Page 1
Overseas House Elm Grove London SW19 4HE	PRINGUER-JAMES CONSULTING ENGINEERS	
Date 19/06/2018 11:17 File REDESIGN (REV D).MDX	Designed by vlad Checked by	
Innovyze	Network 2017.1.2	

Summary of Results for 30 minute 1 year Summer (Storm)

Margin for Flood Risk Warning (mm) 5.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status OFF
Inertia Status ON

			Water			Pipe			
	US/MH	US/CL	Level	Flow /	Maximum	Discharge	Flow		
PN	Name	(m)	(m)	Cap.	Vol (m ³)	Vol (m ³)	(l/s)	Status	
1.000	RWP20	6.000	5.407	0.10	0.052	1.000	1.5	OK*	
1.001	05	5.900	5.402	0.09	0.236	1.001	1.1	SURCHARGED	
2.000	06	6.000	5.439	0.32	0.005	1.220	1.9	OK	
1.002	07	5.900	5.399	0.20	0.208	2.222	2.4	SURCHARGED	
3.000	5	5.700	5.354	-0.14	0.524	-0.021	-1.5	OK*	
1.003	08	5.800	5.389	0.23	0.335	2.184	0.9	SURCHARGED	
4.000	09	6.000	5.444	0.15	0.005	1.331	2.1	OK	
4.001	10	5.900	5.389	0.17	0.234	1.531	2.1	SURCHARGED	
5.000	9	5.700	5.368	-0.18	0.675	-0.060	-2.0	OK*	
4.002	11	5.900	5.382	0.12	0.288	1.782	0.7	SURCHARGED	
1.004	04	5.800	5.062	0.30	0.009	3.957	1.6	OK	

Pringuer-James Consulting Engineers Limited		Page 1
Overseas House Elm Grove London SW19 4HE	PRINGUER-JAMES CONSULTING ENGINEERS	
Date 19/06/2018 11:17	Designed by vlad	
File REDESIGN (REV D).MDX	Checked by	
Innovyze	Network 2017.1.2	

Summary of Results for 60 minute 1 year Summer (Storm)

Margin for Flood Risk Warning (mm) 5.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status OFF
Inertia Status ON

		Water			Pipe			Status
PN	US/MH Name	US/CL (m)	Level (m)	Flow / Cap.	Maximum Vol (m ³)	Discharge Vol (m ³)	Flow (l/s)	
1.000	RWP20	6.000	5.392	0.08	0.037	1.295	1.1	OK*
1.001	05	5.900	5.388	0.08	0.206	1.297	0.9	SURCHARGED
2.000	06	6.000	5.433	0.24	0.005	1.583	1.4	OK
1.002	07	5.900	5.385	0.17	0.199	2.879	2.1	SURCHARGED
3.000	5	5.700	5.354	-0.11	0.516	-0.005	-1.2	OK*
1.003	08	5.800	5.378	0.23	0.326	2.875	0.9	SURCHARGED
4.000	09	6.000	5.439	0.11	0.005	1.728	1.5	OK
4.001	10	5.900	5.380	0.13	0.209	2.020	1.7	OK
5.000	9	5.700	5.370	-0.14	0.696	-0.005	-1.5	OK*
4.002	11	5.900	5.375	0.12	0.284	2.592	0.6	SURCHARGED
1.004	04	5.800	5.062	0.29	0.009	5.466	1.5	OK

Appendix C - Maintenance plan

The following components will require maintenance over the lifetime of the development:

- Detention Basin
- Permeable Pavements
- Hydro-brake

All above elements will be maintained in accordance with CIRIA (C753) The SuDS Manual recommendation as detailed below. Reputable maintenance company will be commissioned to undertake maintenance once relevant products are installed.

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly
	Cut grass and manage other vegetation	Monthly during growing season
	Inspect inlets/outlets for blockages, inspect banksides, structures, pipework for evident of physical damage	Monthly
	Tidy up all dead growth before start of growing season	Annually
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years or as required.
	Remove sediment from inlets/outlets, and main basin when required	Every 5 years or as required.
Remedial Actions	Repair erosion or other damage by reseedling or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets/outlets	As required
	Relevel uneven surfaces and reinstate design levels.	As required

Permeable Pavements

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Check pavement for loose stone and re-instate where required.	Once a year or as required.
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds and management of any weeds in the pavement or adjacent.	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving	As required
	Rehabilitation of surface and upper structure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance reduced due to significant clogging)
Monitoring	Initial Inspection	Monthly for three month after installation
	Inspect for evidence of poor operation and/or weed growth – take remedial action if required.	Three-monthly, 48h after large storms in first six months.
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually
	Monitor inspection chambers	Annually

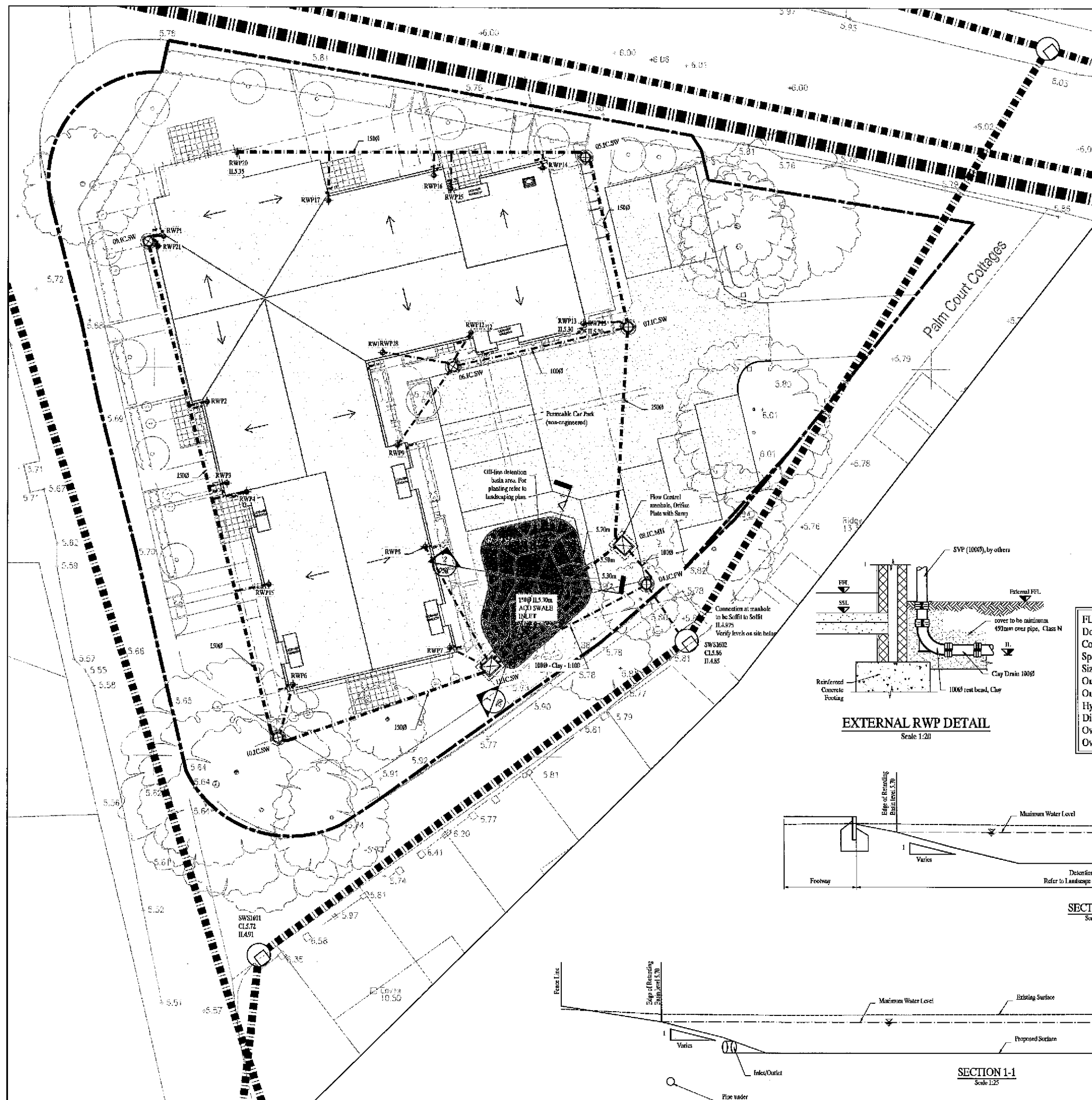
Orifice Plate

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Check and Empty sump pit. Check Orifice Plate for any blockages. If fault is identified during routine inspection/monitoring, undertake remedial action.	Every 6 month.
Remedial Action	Repair and/or replace orifice plate	As required
Monitoring	Inspection to check orifice performance, condition of the system and to identify any faults.	Every 3 to 6 month

Appendix D – Sketches and Drawings

L2340-SK-C-005 – Existing Site drainage areas

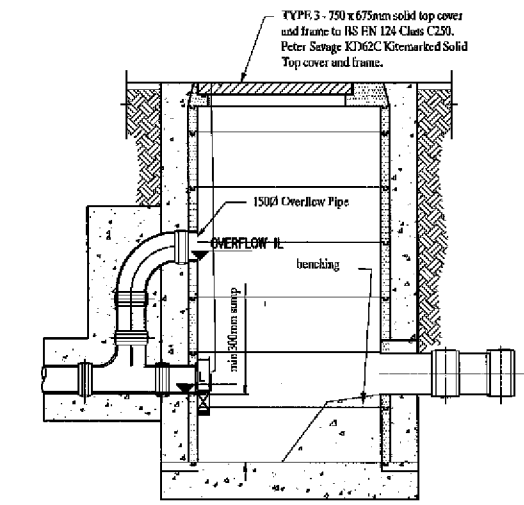
L2340-C-52-750 – Drainage for Planning



Ref.	FFL	IL	Internal size	Specification	Cover Size	Cover Type	Notes
04.IC.FW	TBC	5.025	450Ø	SA Type 3 - B.16	450 x 450	Type 1	-
05.IC.SW	TBC	5.234	450Ø	SA Type 3 - B.16	450 x 450	Type 1	-
06.IC.SW	TBC	5.408	450Ø	SA Type 3 - B.16	450 x 450	Type 1	-
07.IC.SW	TBC	5.178	450Ø	SA Type 3 - B.16	450 x 450	Type 1	-
08.MH.SW	TBC	See Notes	750 x 600	SA Type 4 - B.21	750 x 600	Type 1	Sump - IL 4.800 Overflow - IL 5.100 Basin two-way pipe IL - 5.25 Flow-Control - Specification 1
09.IC.SW	TBC	5.405	450Ø	SA Type 3 - B.16	450 x 450	Type 2	-
10.IC.SW	TBC	5.234	450Ø	SA Type 4 - B.21	450 x 450	Type 2	-
11.MH.SW	TBC	See Notes	750 x 600	SA Type 3 - B.18	750 x 600	Type 2	Sump - IL 4.800 Overflow - IL 5.157 Basin two-way pipe IL - 5.25 Flow-Control - Specification 2

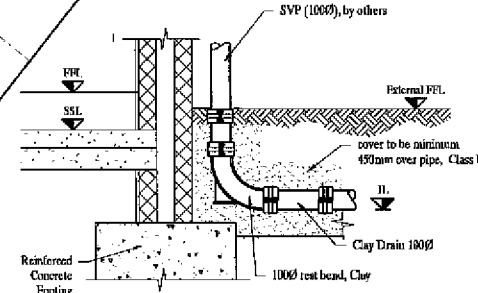
- Notes:
- All chamber to be to adoptable standards, SEA - Sewers for Adoption, 7th Edition.
 - Check existing sewer invert levels on site prior to start.
 - Confirm FFL with Architect before installation.

- Notes:
- This drawing is for planning conditions discharge and is not for construction.
 - All dimensions are in millimetres unless otherwise stated. All levels are in metres unless otherwise stated.
 - This drawing should be read in conjunction with all relevant architects, structural engineers and m/e engineers drawings and specification.
 - Minimum Clay Pipe cover depth for use of Class N10 bedding and surround to be as follows. Where minimum cover cannot be met the pipe to be concrete encased.
 - Grass areas: 300mm minimum
 - Footways: 400mm minimum
 - Roads: 800mm minimum
 - All stacks/drop pipes are 100Ø U.N.O. All pipes are 100Ø unless noted otherwise.
 - All 300Ø pipes to have minimum gradient 1:100 U.N.O.
 - All drains are to be laid in a constant gradient between manhole chambers.
 - New connection onto existing sewer to be in accordance with Southern Water requirements.
 - All road openings within the public highway to be agreed with the local authority.
 - All buried concrete products and mortars are to contain class 2 sulphate resisting cement.



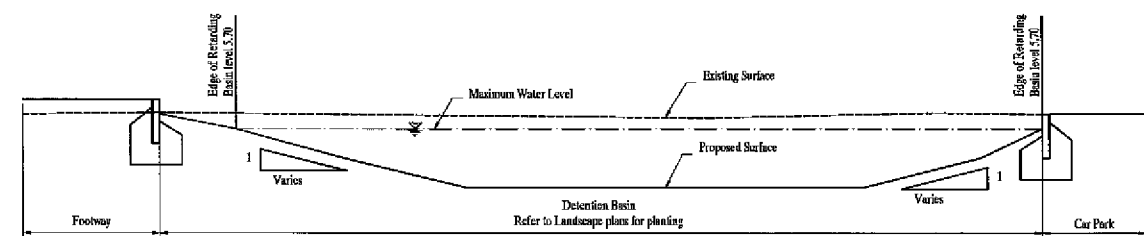
FLOW CONTROL CHAMBER DETAIL
Scale 1:20

Key	
Surface Water Pipe	
Inspection Chamber - Flexible To Adoptable Standards	
Inspection Chamber, Concrete	
RWP	RWP stock
RE	Redding eye

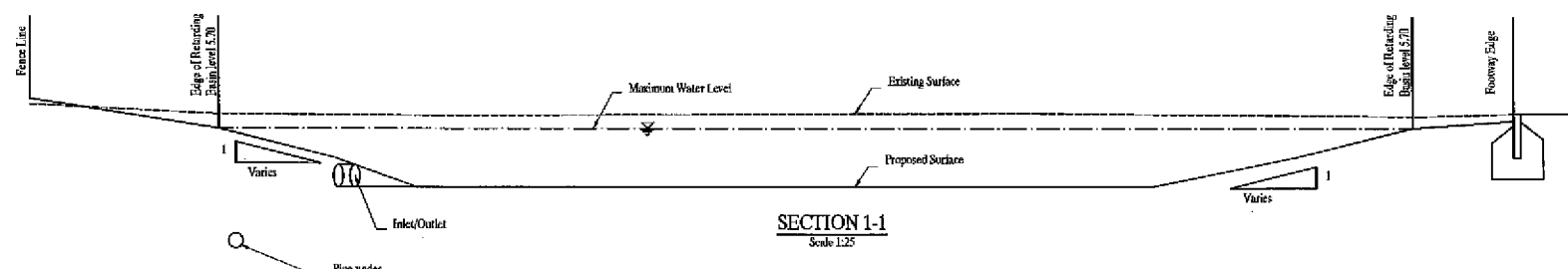


EXTERNAL RWP DETAIL
Scale 1:20

FLOW CONTROL SPECIFICATION	FLOW CONTROL SPECIFICATION
Downstream Manhole - 11.IC.SW	Manhole - 08.IC.SW
Control Mechanism - Orifice Plate	Control Mechanism - Orifice Plate
Specification - ACO Q-Plate	Specification - ACO Q-Plate
Size - 0.026 m	Size - 0.029 m
Outfall pipe size - 100mm	Outfall pipe size - 100mm
Outfall I.L. - 5.156 m	Outfall I.L. - 5.100 m
Hydraulic Head - 0.544 m	Hydraulic Head - 0.6 m
Discharge Rate - 1.0 l/s	Discharge Rate - 1.3 l/s
Overflow Pipe - 100mm	Overflow Pipe - 100mm
Overflow Pipe I.L. - 5.800m	Overflow Pipe I.L. - 5.800m



SECTION 2-2
Scale 1:25



SECTION 1-1
Scale 1:25

02 20.06.2018 DA Issued for Council Approval
01 30.05.2018 DA Issued for Council Approval
Rev Date Drawn Amendment

PRINGUER-JAMES
CONSULTING ENGINEERS
Overseas House, Elm Grove, London, SW19 4HE
Phone/Fax: 020 8940 4159
Email: mail@pj.com Website: www.pj.com

ROCCO HOMES
TUDOR COTTAGE, SEA ROAD,
EAST PRESTON

DRAINAGE FOR PLANNING

Status:	APPROVAL	
Sales: as noted @ A1	Date: MAY 2018	
Drawn: DA	Engineer: YM	Checked: DL
Drawing No. L2340-C-52-750	Revision 02	

**TUDOR COTTAGE,
125 SEA ROAD,
EAST PRESTON,
LITTLEHAMPTON**

Geoenvironmental Investigation

Client
Rocco Homes

Report No. 4706

21st February 2018



CONTENTS

	Section	Page
	SYNOPSIS	I
I	Site description	2
2	Development proposals	2
3	Geology	2
4	Field work	3
5	Laboratory testing	3
6	Ground conditions	
	6.1 Stratigraphy	4
	6.1.1 Made Ground	4
	6.1.2 Aeolian Deposits "Brickearth"	5
	6.1.3 Lewes Nodular Chalk Formation	5
	6.2 Groundwater	6
7	Discussion	
	7.1 General	6
	7.2 Ground floor slabs	7
	7.3 Excavations	7
	7.4 Contaminant analysis	
	7.4.1 Solid phase	8
	7.4.2 Waste Acceptance Criteria (WAC) analysis	10
	7.5 Buried concrete	11

Procedural Notes

APPENDICES

A	Figures
B	Borehole Records
C	Standpipe Records
D	Laboratory Test Results
E	Cover System

**TUDOR COTTAGE,
125 SEA ROAD,
EAST PRESTON,
LITTLEHAMPTON**

Geoenvironmental Investigation

Synopsis

An investigation has been carried out at a site on Sea Road in Littlehampton on the instructions of Rocco Homes.

The purpose of the investigation was to determine the ground conditions and to provide recommendations in respect of foundation design and other geotechnical matters for the construction of a two-storey residential block.

This report describes the work carried out in the field and the laboratory, presents the results and discusses their implications for the development.

The ground conditions revealed by the investigation comprise Made Ground underlain by Aeolian Deposits with Chalk at depth, which is suitable for piled foundations to be utilised. Their design will require further investigation.

Chemical analysis revealed some lead contamination and remediation options are discussed.

1

Site description

The site is located in a residential area of East Preston in Littlehampton, some 200m from the coast. It comprises a 1½-storey residential property with a driveway and garden on its western and eastern sides respectively. The site is bound on three sides by roads and a small car park is located just beyond its shorter, eastern boundary. At the time of investigation several mature and semi-mature trees were present within and surrounding the site. The existing site layout is shown in Figure 1 at Appendix A.

2

Development proposals

It is intended to demolish the existing property and construct a two-storey residential block and car park. The proposed layout is shown in Figure 2 at Appendix A.

Loading is not yet known but is expected to be typically light.

3

Geology

Published records of the British Geological Survey (BGS) indicate the site to be underlain by River Terrace Deposits overlying the Lewes Nodular Chalk Formation.

4

Field work

The extent of the field work was agreed with the Client and comprised four boreholes drilled by continuous dynamic (windowless) sampler techniques to between 4.5m and 5.5m depth.

The ground investigation layout is shown in Figure 1 at Appendix A.

Representative soil samples were recovered for subsequent laboratory examination and testing, while Standard Penetration Tests (SPT) were carried out as appropriate.

Details of the strata encountered are provided on the Borehole Records at Appendix B, together with particulars of the samples recovered, groundwater observations and SPT results. An SPT profile is provided in Figure 3 at Appendix A.

A standpipe was installed in borehole WS4 to permit monitoring of water levels. Readings were taken on four occasions and are provided at Appendix C.

5

Laboratory testing

The following laboratory tests were conducted on samples recovered during the field work:-

- Natural moisture content: to assess the in situ condition of the soil;
- Liquid and Plastic Limits: to classify cohesive soil into behavioral groups;
- Sulphate and pH value: for the specification of buried concrete; and

- Contamination: chemical analyses to detect the presence of common contaminants, viz:-

Metals & metalloids: Total arsenic, cadmium, chromium, hexavalent chromium, copper, lead, mercury, nickel, selenium, zinc and water soluble boron,

Organic: Total phenols, speciated Polycyclic Aromatic Hydrocarbons (PAH) and speciated Total Petroleum Hydrocarbons (TPH).

Others: Asbestos screen and Waste Acceptance Criteria (WAC)

Results of these tests are presented at Appendix D.

6

Ground conditions

6.1

Stratigraphy

The stratigraphy of the site as revealed in the exploratory holes is shown in detail on the Borehole Records at Appendix B and is described in general terms hereafter.

6.1.1

Made Ground

Made Ground was recorded at all exploratory positions under grass or tarmac and measured between 0.5m and 0.8m thick. Its composition was variable, with a brown sandy hardcore and brick gravel recorded in WS1 and WS3, a dark brown very sandy slightly gravelly silt described in WS3 and WS4, and a dark brown very silty slightly gravelly sand encountered in borehole WS2.

6.1.2

Aeolian Deposits "Brickearth"

Beneath the Made Ground, Aeolian Deposits were encountered at all locations, continuing to 4.8m and 4.3m in boreholes WS3 and WS4 and to the limit of investigation in boreholes WS1 and WS2 at 5.5m and 4.5m depth, respectively. The deposits were capped by a cohesive layer typically described as soft brownish grey, silty, sandy, slightly gravelly clay, recorded to between 1.3m and 2.95m depth in all boreholes. Underlying the clay were interbedded silt and sand and less frequent clay layers, deposited in variable sequences between boreholes. Generally however, the materials were orangeish brown and calcareous, and each layer measured between 0.2m and 1.0m thick. Stiffness and density also varied, with soft and firm clay, as well as loose and medium dense silt and sand recorded throughout the depth of investigation. For the purposes of this report, all these materials have been assumed to be Aeolian Deposits.

6.1.3

Lewes Nodular Chalk Formation

Material interpreted as part of the Lewes Nodular Chalk Formation was encountered beneath the Aeolian Deposits, at 4.8m and 4.3m depth in boreholes WS3 and WS4 respectively and continuing to the full depth of investigation at 5.5m depth. The material was described as light greyish white chalk. The samples produced by continuous dynamic (windowless) sampler techniques only permit basic descriptions since the fabric of the rock is destroyed.

6.2

Groundwater

Groundwater was encountered at all exploratory locations at between 3m and 4.5m depth. However, the speed of drilling and the use of casing to support the bore may have masked any small inflows and impinged on the accuracy of the observations.

Subsequent monitoring of a standpipe installed to 5m depth in borehole WS4 recorded groundwater at between 1.7m and 2.1m depth.

7

Discussion

7.1

General

Made Ground was encountered on site and it is therefore possible that other pockets of Made Ground are also present; perhaps deeper, of different character or associated with the remains of underground construction; despite not having been detected by this investigation. All remains of underground obstructions should be removed prior to redevelopment to enable the new foundations to be constructed without hindrance and to perform satisfactorily.

The ground conditions revealed by the investigation comprised Made Ground overlying Aeolian Deposits with Chalk at depth. Spread foundations are not recommended due to the variable ground conditions at shallow depth and presence of relatively shallow groundwater. Therefore piled foundations are recommended, the design of which will require further investigation.

7.2

Ground floor slabs

Made Ground is prone to large and unpredictable amounts of settlement and therefore does not provide a suitable bearing stratum. Laboratory testing has confirmed high plasticity of the cohesive aeolian deposits below. Therefore they also do not have satisfactory load carrying properties, due to the close proximity of trees. As such, suspended construction should be employed to accommodate the expected movement of the cohesive aeolian deposits upon changes in moisture content or swelling of the soil associated with death or removal of trees. A void of 300mm thickness should be incorporated beneath the suspended slab in accordance with NHBC recommendations, assuming pre-cast concrete flooring.

7.3

Excavations

Made Ground is inherently variable in both composition and compaction and should thus be regarded as unstable and be fully supported at all times. The shallow, cohesive aeolian deposits, present to at least 1.2m depth, are expected to remain stable in vertical cut of moderate depth for short periods of time. Any excavation exceeding 1.2m depth or required to stay open over longer periods, should be supported at all times or battered to a safe angle of repose. This is especially important for the safety of personnel when required to work in or close to excavations. Particular care should be exercised where excavations are close to existing structures including highways to ensure they do not experience any loss of support. Temporary and permanent works should be designed to resist the additional lateral earth pressures arising from any superimposed loads in addition to those generated by the soil itself, without significant deformation.

Standpipe monitoring indicated groundwater levels between 1.7m and 2.1m depth and therefore shallow excavations are expected to remain suitably dry.

No attempt should be made to lower the general groundwater level, as the cone of depression will extend beyond the site boundary and may well induce excessive settlement in surrounding properties and other structures.

7.4

Contaminant analysis

7.4.1

Solid phase

Contaminant testing was undertaken on three soil samples and the results compared with the limited number of CLEA¹ Soil Guideline Values (SGVs) for residential land use that have been published to date. Where not available from that source, reference has also been made to the LQM/CIEH Suitable 4 Use Levels (S4ULs)², and the C4SL Levels³ for lead. Appropriate trigger levels are given with the results at Appendix D.

Analysis for metals/metalloids revealed sample WS2 at 0.4m depth to exceed residential C4SL trigger values for lead, with a recorded concentration of 349mg/kg. All other determinands were below residential land use triggers. Since WS2 is located within an area of proposed soft landscaping, some remediation will be necessary.

¹ *The Contaminated Land Exposure Assessment Model, Department for Environment, Food and Rural Affairs, The Environment Agency, R & D Publications SGV 1 et al., March 2002*

² *The LQM/CIEH S4ULs for Human Health Risk Assessment, Nathanail, P. et al., Land Quality Press, 2015*

³ *Category 4 Screening Levels for assessment of land affected by contamination, Department for Environmentt Food and rural affairs., 2012*

To address the issue of lead contamination on site, reference has been made to the guidance on cover systems for contaminated land issued by BRE Press⁴. Based on the laboratory results, it specifies that a minimum soil cover thickness of some 310mm is required to mitigate the risk from lead contamination, assuming a lead concentration of no more than 50mg/kg in imported soils. Alternatively it may be preferable to excavate and remove the contaminated soils, carry out validation testing on the sides and base of the excavation and replace with imported clean soil. Details of the assessment are provided at Appendix E. In areas of hardstanding or below building footprints, contaminants can remain in situ, as the pathway in a source-pathway-receptor model will be blocked. Some additional soil testing is therefore recommended in the soft landscaping area between WSI and WS2 to delineate the area requiring remediation.

Analysis for total monohydric phenols recorded very low total phenol concentrations of less than 5mg/kg.

Petroleum hydrocarbons (TPH) analysis recorded a maximum total TPH of 4.5mg/kg occurring in sample WSI at 0.3m depth. Of this 3.3mg/kg was recorded in species group C21-35, which is well below the exceedance value of 890 mg/kg for either aromatic or aliphatic compounds. Such low concentrations are not considered to be significant.

Speciated polycyclic aromatic hydrocarbons (PAH) testing showed no samples to exceed S4ULs for any PAH species.

Analysis for asbestos recorded no asbestos fibres in any of the samples.

⁴ *Cover Systems for Land Regeneration, Thickness of Cover Systems for Contaminated Land, BRE Press BR465 2008*

In view of the foregoing, it is recommended that appropriate health and safety precautions, such as detailed in HS(G)66⁵ and elsewhere, should be followed by the construction workforce and others who may come into contact with potentially contaminated soil. They should be agreed with the Health and Safety Executive and are likely to include, but not be restricted to, the following:-

- maintenance of good standards of personal hygiene;
- wearing personal protective clothing that is changed and cleaned frequently to eliminate skin contact;
- prevention of ingestion by using washing and changing facilities at all break times;
- prohibition of eating, drinking or smoking between break times; and
- controlling the spread of dust and airborne mists to prevent inhalation.

7.4.2

Waste Acceptance Criteria (WAC) analysis

One sample was subject to the WAC full solid waste suite and single-stage leachate. The results have been compared with the Landfill Waste Acceptance Criteria and are presented at Appendix D.

Within the solid waste suite, all results were within the Inert classification. Parameters determined on the compliance leaching test were also within the Inert classification.

The results should be forwarded to the receiving facility to ensure correct disposal method. All transfer notes should be retained.

⁵ *Protection of workers and the general public during the development of contaminated land HS(G)66 Health and Safety Executive, 1991*

7.5

Buried concrete

Laboratory tests on soil samples yielded a characteristic soluble sulphate concentration of 0.53g/l which results in a Design Sulphate Class⁶ of DS-2.

Standpipe readings confirm the groundwater to be mobile and all pH determinations were greater than 6.5. Therefore the Aggressive Chemical Environment for Concrete, ACEC, is classed as AC-2.

S E Hoggard
AP GEOTECHNICS LTD.
21st February 2018

This report has been prepared for the sole and specific use of Rocco Homes for the purpose of the proposed development at Tudor Cottage and should not be relied upon by any third party. Any other persons who use any information contained herein without the written permission of AP GEOTECHNICS LTD. do so at their own risk. The copyright to this report remains the property of AP GEOTECHNICS LTD.

⁶ Concrete in aggressive ground. BRE Special Digest 1. Building Research Establishment, 2005

PROCEDURAL NOTES for GROUND INVESTIGATIONS

General

This report is based upon data obtained from field descriptions of the strata and examination of the samples by an engineer, together with the results of in situ and laboratory tests as appropriate. Responsibility cannot be accepted for variations in ground conditions between and around any of the exploratory points that is not revealed by the data. Whilst the report may offer an opinion on the ground conditions between exploratory points and below the depth of investigation, this is for guidance only and no liability is accepted for its accuracy. Unless specifically included in the report, it should be assumed that no testing has been carried out in respect of asbestos or Japanese Knotweed and no liability is inferred or will be accepted.

Drilling procedure

Boring by light cable percussion drilling allows the ground conditions to be reasonably well established. However, a certain amount of disturbance is inevitable and some mixing of soils can occur.

Sampling procedure

"Undisturbed" samples of predominantly cohesive soils are taken with a 100mm diameter open tube sampler, generally in accordance with BS 5930: 1999.

Where appropriate, or where an undisturbed sample is unsuccessful, disturbed samples are recovered and sealed into polythene bags.

Groundwater samples are taken when water is encountered in sufficient quantity.

Standard penetration tests

The test is conducted generally in accordance with BS 1377: Part 9: 1990. The sampler tube is subject to a seating drive of 150mm into the soil at the base of the borehole. Results are given on the Borehole Records as the number of blows required to drive the sampler tube a further 300mm and this is known as the "N" value. Where the driving resistance is such that full penetration is not achieved, the test is generally terminated after 50 blows and the actual distance penetrated is recorded.

Groundwater

Groundwater observations necessarily reflect the conditions encountered at the time of the exploratory work. Long term monitoring of standpipes is usually required to establish an equilibrium water level since the normal rate of boring is too fast to permit steady state conditions to be achieved.

Groundwater levels are subject to variations caused by changes in drainage conditions and seasonal climatic changes.

Water may necessarily be added to advance the bore whilst casing may be required to maintain an open hole. These can both mask subsequent groundwater observations and are therefore noted on the individual Borehole Record.

APPENDICES

A Figures

Figure 1: Ground Investigation

Figure 2: Proposed Layout

Figure 3: SPT Profile

B Borehole Records

Symbols and Abbreviations

Borehole Records

C Standpipe Records

Water Levels

D Laboratory Test Results

Summary of Geotechnical Tests

Contaminants in Soil

Waste Acceptance Criteria (WAC)

E Cover System

APPENDIX A

FIGURES

Tudor Cottage,
125 Sea Road,
East Preston,
BN16 1NX

**Ground
Investigation**

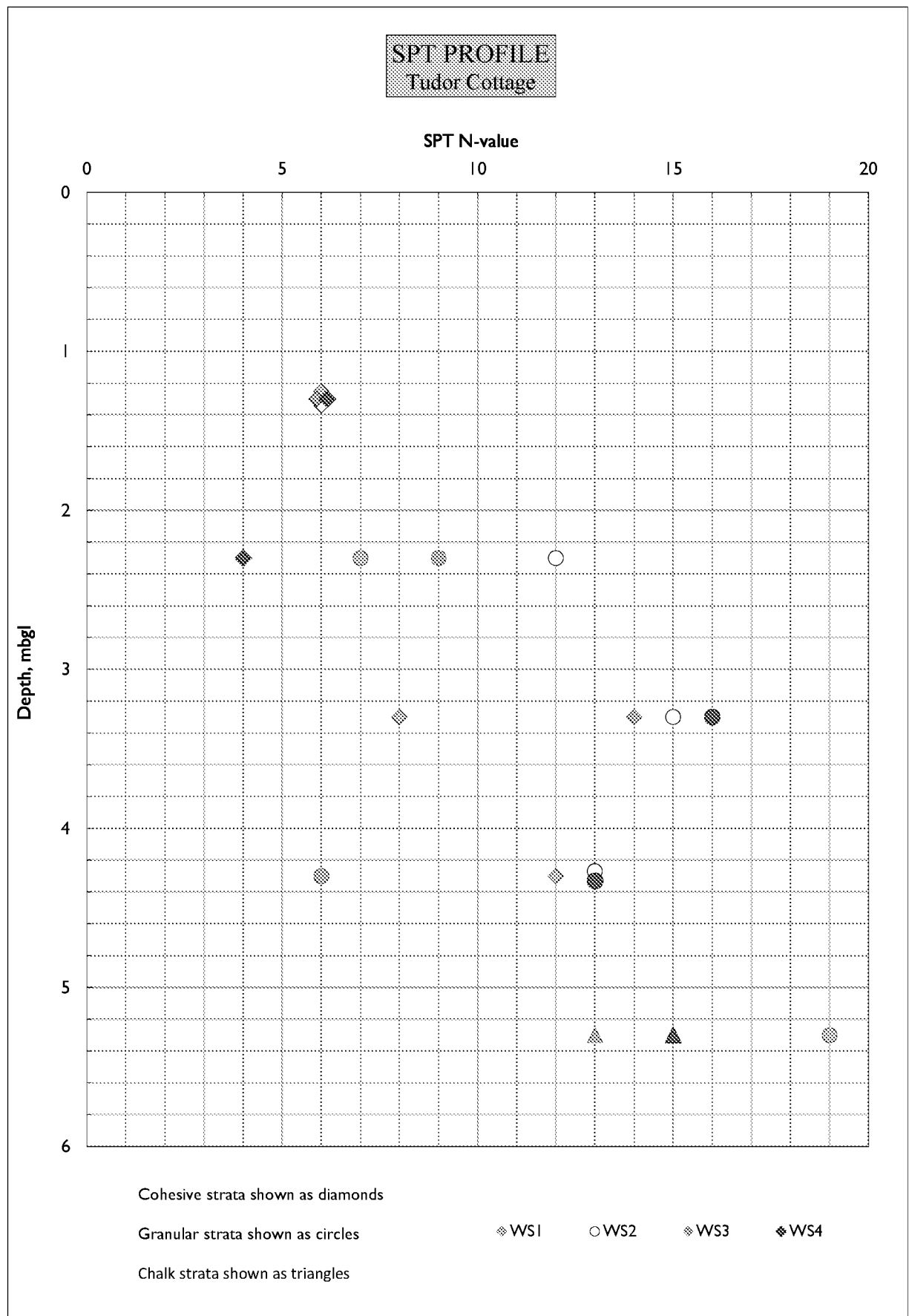


Figure 1

Proposed Layout



Figure 2



APPENDIX B

BOREHOLE RECORDS

SYMBOLS and ABBREVIATIONS

Samples

Undisturbed

U	Standard open drive "undisturbed" 102mm dia. in boreholes 38mm dia. in trial pits, window sampler and hand auger
T	Thin wall open drive
P	Piston
CBR	CBR mould
L	Windowless sampler liner

Disturbed

D	Small
B	Bulk
W	Water
C	Contaminants: plastic tub
J	Contaminants: brown glass jar

In situ tests

SPT	Standard Penetration Test, open shoe
CPT	solid cone
	N value is number of blows for 300mm penetration.
	Blow count also given as seating drive followed by four increments of 75mm.

V () Vane test (c_u kPa)

P () Hand penetrometer (c_u kg/cm²)

M () Mexe probe (CBR %)

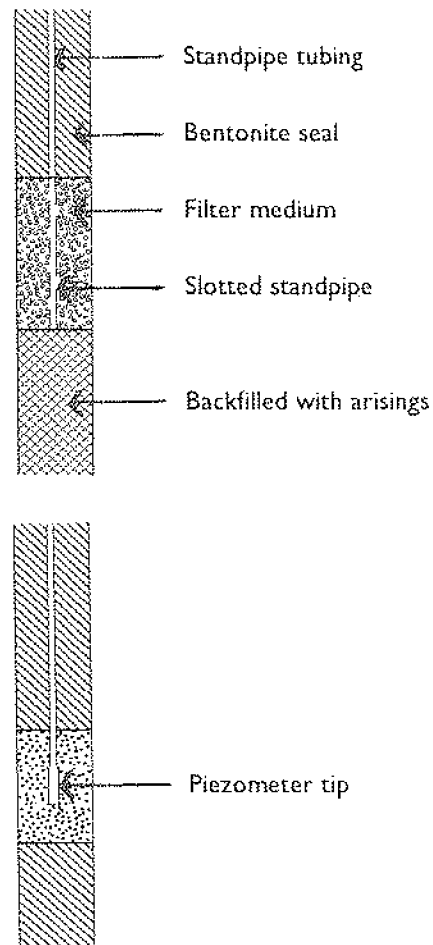
Water records

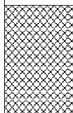
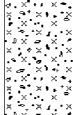
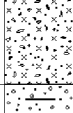
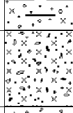
▼₂ Standing level

▼₂ Depth encountered

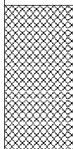
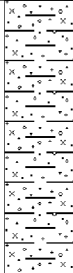
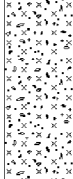
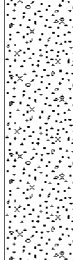
suffix identifies separate strikes

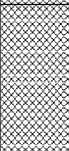
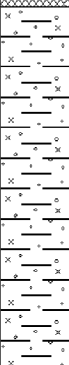
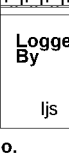
Standpipes



 AP GEOTECHNICS				T 01932 848460 F 01932 851255 E mail@apgeotechnics.co.uk		Site TUDOR COTTAGE, 125 SEA ROAD, EAST PRESTON, BN16 1NX		Number WS1	
Excavation Method Drive-in Window Sampler		Dimensions		Ground Level (mOD)		Client Rocco Homes		Job Number 4706	
		Location See site plan		Dates 22/06/2017		Engineer		Sheet 1/2	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
0.00-1.00	L1		90% recovery			MADE GROUND: Tarmac over brown mottled red and grey silty sandy gravel of hardcore and brick			
0.30	D1				(0.40)				
					0.40 (0.10) 0.50	MADE GROUND: Dark brown silty sandy topsoil			
						Soft dark greyish brown silty slightly sandy CLAY			
					(0.80)				
1.00 1.00-1.45 1.00-2.00	D2 SPT(C) N=6 L2	NIL	60% recovery 1/1,2,1,2		1.30 (0.30) 1.60	Light greyish orange very sandy slightly gravelly calcareous SILT			
					(0.40)	No core recovery			
2.00-3.00 2.00-2.45	L3 SPT(C) N=7	NIL	100% recovery 3/1,2,2,2		2.00 (0.20) 2.20	Orangeish brown silty very sandy calcareous CLAY			
						Loose orangeish brown very sandy slightly gravelly calcareous SILT			
					(0.80)	...becoming gravelly			
						...becoming very gravelly			
3.00-4.00 3.00-3.45	L4 SPT(C) N=8	NIL	100% recovery 3/1,2,2,3		3.00 (0.30) 3.30	Soft orangeish brown very sandy slightly gravelly calcareous CLAY			
						Light orangeish brown clayey sandy slightly gravelly calcareous SILT			
					(0.70)	...becoming light grey			
4.00-5.00 4.00-4.45	L5 SPT(C) N=12	NIL	70% recovery 5/2,3,3,4		4.00 (0.30) 4.30	Firm orangeish brown silty slightly sandy slightly gravelly calcareous CLAY			
					(0.25)	Light grey slightly sandy slightly gravelly calcareous SILT			
			Water strike(1) at 4.50m.		4.55 (0.30)	Light brownish grey silty sandy flint calcareous GRAVEL			
			22/06/2017:2.20m		4.85	Medium dense brown mottled white very sandy gravelly calcareous SILT			
Remarks Strata depths approximate where recovery <100%								Scale (approx) 1:25	Logged By ljs
								Figure No. 4706.WS1	

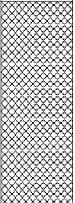
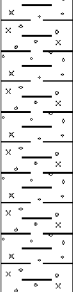
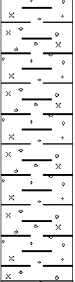
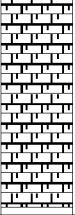
 AP GEOTECHNICS				T 01932 848460 F 01932 851255 E mail@apgeotechnics.co.uk		Site TUDOR COTTAGE, 125 SEA ROAD, EAST PRESTON, BN16 1NX		Number WS1	
Excavation Method Drive-in Window Sampler		Dimensions		Ground Level (mOD)		Client Rocco Homes		Job Number 4706	
		Location See site plan		Dates 22/06/2017		Engineer		Sheet 2/2	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
5.00-5.45	SPT(C) N=19	4.45	6/4,4,5,6		(0.65) 5.50				
						Complete at 5.50m			
Remarks								Scale (approx)	Logged By
								1:25	ljs
								Figure No. 4706.WS1	

 AP GEOTECHNICS				T 01932 848460 F 01932 851255 E mail@apgeotechnics.co.uk		Site TUDOR COTTAGE, 125 SEA ROAD, EAST PRESTON, BN16 1NX		Number WS2	
Excavation Method Drive-in Window Sampler		Dimensions		Ground Level (mOD)		Client Rocco Homes		Job Number 4706	
		Location See site plan		Dates 22/06/2017		Engineer		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
0.00-1.00	L1	NIL	90% recovery		(0.50)	MADE GROUND: Grass over dark brown very silty slightly gravelly sand. Gravel is of brick, concrete and tarmac			
0.40	D1				0.50	Soft brownish grey mottled orange silty slightly sandy slightly gravelly CLAY			
0.80	D2				(0.90)				
1.00-2.00 1.00-1.45	L2 SPT(C) N=6		50% recovery 1/1,1,2,2		1.40	No core recovery			
1.50	D3	NIL			(0.50)				
2.00-3.00 2.00-2.45	L3 SPT(C) N=12		100% recovery 2/2,2,4,4		1.90 (0.10) 2.00	Orangeish brown very silty calcareous SAND			
					(0.70)	Medium dense orangeish brown very sandy slightly gravelly calcareous SILT			
					2.70	Grey sandy flint calcareous GRAVEL			
3.00-4.00 3.00-3.45	L4 SPT(C) N=15	3.00	100% recovery 6/3,4,4,4 Water strike(1) at 3.10m.		2.95	Medium dense orangeish brown silty slightly gravelly fine to medium calcareous SAND			▽1
					(0.90)				
					3.85	Medium dense grey calcareous SILT with some shell fragments			
4.00-4.45	SPT(C) N=13	3.37	22/06/2017:2.77m 5/2,3,4,4		(0.65)				
					4.50	Complete at 4.50m			
Remarks Strata depths approximate where recovery <100% Borehole collapsed back @ 3.30m								Scale (approx) 1:25	Logged By ljs
								Figure No. 4706.WS2	

 AP GEOTECHNICS				T 01932 848460 F 01932 851255 E mail@apgeotechnics.co.uk		Site TUDOR COTTAGE, 125 SEA ROAD, EAST PRESTON, BN16 1NX		Number WS3	
Excavation Method Drive-in Window Sampler		Dimensions		Ground Level (mOD)		Client Rocco Homes		Job Number 4706	
		Location See site plan		Dates 22/06/2017		Engineer		Sheet 1/2	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
0.00-1.00	L1	NIL	90% recovery		(0.30)	MADE GROUND: Grass over dark brown very sandy slightly gravelly silt			
					0.30	MADE GROUND: Brown mottled red and grey silty sandy gravel of brick, concrete and manmade waste			
0.60	D1				(0.50)	Soft greyish brown silty slightly gravelly CLAY with occasional calcareous nodules			
					0.80				
1.00-2.00 1.00-1.45	L2 SPT(C) N=6	NIL	80% recovery 2/1,1,2,2		(1.20)				
1.50	D2				2.00	Loose greyish orangeish brown mottled light grey clayey sandy slightly gravelly calcareous SILT			
2.00-3.00 2.00-2.45	L3 SPT(C) N=9				(0.95)				
					2.95 (0.15)	Orangeish brown silty fine to medium calcareous SAND			
3.00-4.00 3.00-3.45	L4 SPT(C) N=14	3.00	Water strike(1) at 3.00m. 100% recovery 7/3,3,4,4		3.10	Firm brownish grey very sandy calcareous CLAY			▽1
3.50	D3				(0.80)	...becoming sandy gravelly clay			
					3.90	...becoming dark brownish grey very sandy slightly gravelly clay			
4.00-5.00 4.00-4.45	L5 SPT(C) N=6				(0.90)	Loose light orangeish brown slightly silty fine to medium calcareous SAND			
		3.10	70% recovery 3/1,1,2,2			...becoming gravelly			
					4.80	...becoming very gravelly			
			22/06/2017:2.50m			Light greyish white CHALK			
Remarks Strata depths approximate where recovery <100% Borehole collapsed back @ 3.10m								Scale (approx) 1:25	Logged By ljs
								Figure No. 4706.WS3	



Produced by the GEotechnical DATAbase SYstem (GEODASY) (C) all rights reserved

 AP GEOTECHNICS T 01932 848460 F 01932 851255 E mail@apgeotechnics.co.uk				Site TUDOR COTTAGE, 125 SEA ROAD, EAST PRESTON, BN16 1NX				Number WS4	
Excavation Method Drive-in Window Sampler		Dimensions		Ground Level (mOD)		Client Rocco Homes		Job Number 4706	
		Location See site plan		Dates 22/06/2017		Engineer		Sheet 1/2	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-1.00	L1		90% recovery			MADE GROUND: Grass over dark brown very sandy slightly gravelly silt			
0.50	D1				(0.70)				
1.00-1.45	D2				0.70	Soft brown mottled orange and grey silty slightly gravelly CLAY			
1.00-2.00	SPT(C) N=6 L2	NIL	100% recovery 2/1,1,2,2						
2.00-3.00	L3					...becoming very soft, greyish brown mottled black, slightly sandy slightly silty clay			
2.00-2.45	SPT(C) N=4	NIL	90% recovery 1/1,1,1,1		(2.25)				
3.00-4.00	L4				2.95	Medium dense light orangeish brown silty very gravelly calcareous SAND			
3.00-3.45	SPT(C) N=16	NIL	90% recovery 4/3,4,4,5		(1.00)				
4.00-5.00	L5				3.95	...with some chalk gravel			
4.00-4.45	SPT(C) N=13	NIL	90% recovery 7/3,3,4,3		(0.35)	Medium dense orangeish brown very sandy calcareous SILT			
			Water strike(1) at 4.20m.		4.30	White CHALK			
			22/06/2017:3.05m		(1.20)				
Remarks Strata depths approximate where recovery <100%							Scale (approx) 1:25	Logged By ljs	Figure No. 4706.WS4

 AP GEOTECHNICS				T 01932 848460 F 01932 851255 E mail@apgeotechnics.co.uk		Site TUDOR COTTAGE, 125 SEA ROAD, EAST PRESTON, BN16 1NX		Number WS4	
Excavation Method Drive-in Window Sampler		Dimensions		Ground Level (mOD)		Client Rocco Homes		Job Number 4706	
		Location See site plan		Dates 22/06/2017		Engineer		Sheet 2/2	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
5.00-5.45	SPT(C) N=15	4.30	6/3,4,4,4		(1.20) 5.50	Complete at 5.50m			
Remarks							Scale (approx) 1:25	Logged By ljs	
							Figure No. 4706.WS4		

APPENDIX C

STANDPIPE RECORDS

STANDPIPE RECORDS

WATER LEVELS

Project: Tudor Cottage, 125 Sea Road, East Preston, BN16 1NX
 Client: Rocco Homes

Project No: 4706
 Sheet No: 1/1

Location	WS4																	
Red. level																		
Date	Water level		Water level		Water level		Water level		Water level		Water level							
	m bgl	m OD	m bgl	m OD	m bgl	m OD	m bgl	m OD	m bgl	m OD	m bgl	m OD	m bgl	m OD				
3.7.17	2.10																	
13.7.17	1.73																	
5.9.17	2.02																	
26.9.17	1.83																	

Remarks

APPENDIX D

LABORATORY TEST RESULTS

SUMMARY OF GEOTECHNICAL TESTS

Project: Tudor Cottage, 125 Sea Road, East Preston, BN16 1NX
 Client: Rocco Homes

Project No: 4706
 Sheet No: 1/1

Location	Sample No	Depth m	Description	CLASSIFICATION							TRIAXIAL COMPRESSION - TOTAL STRESS							CHEMICAL		
				Natural Moisture Content	Liquid Limit	Plastic Limit	Plast. Index	Passing 425µm	Mod. Plast. Index	Class	Type	Moisture Content	Bulk Density	Radial Stress	Deviator Stress	Cohesion		Sulphate (SO ₄)		pH
				%	%	%	%	%	%			%	Mg/m ³	kPa	kPa	cu, kPa assuming Øu = 0	cu, kPa Øu, deg	Water g/l	Soil (Sol) g/l	
WS1	D2	1.0	Dark greyish brown silty slightly sandy CLAY	29	67	25	42	100		CH										
WS2	D2	0.8	Brownish grey mottled orange silty slightly sandy slightly gravelly CLAY	20	36	19	17	100		CI								0.53	7.81	
WS3	D2	1.5	Greyish brown silty slightly gravelly CLAY w/ occasional calcareous nodules	20	42	23	19	100		CI										
WS3	D3	3.5	Brownish grey sandy gravelly calcareous CLAY	17	23	9	14	95	13	CL								0.49	7.61	
WS4	D2	1.0	Brown mottled orange and grey silty slightly gravelly CLAY	27	67	34	33	100		CH										

Note: Soil Classification based upon unmodified Plasticity Index

CONTAMINANTS IN SOIL

Project: Tudor Cottage, 125 Sea Road, East Preston, BN16 1NX
Client: Rocco Homes

Project No: 4706
Sheet No: 1/1

Location	Sample	Depth m	Arsenic	Cadmium	Chromium invalent	Copper	Lead	Mercury inorganic	Nickel	Selenium	Zinc	Chromium hexavalent	Boron water sol.	Phenols tot. monohydric	Sulphate water sol.	TPH by GCMS							pH
																C8 - C10	C10 - C12	C12 - C16	C16 - C21	C21 - C35	C35 - C40	Total C8 - C40	
WS1	DI	0.3	11.5	< 0.5	22.4	31.6	104	< 0.5	17.0	< 1.0	89.7	< 0.8	< 0.5	< 5		< 1.0	< 1.0	< 1.0	< 1.0	3.3	1.2	4.5	
WS2	DI	0.4	16.2	0.6	27.8	44.6	349	< 0.5	24.4	< 1.0	289	< 0.8	0.7	< 5	0.02	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	8.0
WS3	DI	0.6	11.7	< 0.5	21.5	32.7	187	< 0.5	18.5	< 1.0	138	< 0.8	0.9	< 5		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
WS4	DI	0.5													0.03								8.1
S4UL ¹	residential ³		37	11	910	2400		40	180	250	3700	6	290	380									
	residential ^{3a}		40	85	910	7100		56	180	430	40000	6	11000	1200									
	commercial		640	190	8600	68000		1100	980	12000	730000	33	240000	1300									
CLEA ²	residential		32					170	130	350													
	commercial		640					3600	1800	13000													
C4SL	residential ¹						200																
	residential ^{3a}						300																
	commercial						2700																

Notes

- S4UL given at 6% soil organic matter
 - CLEA SGVs given at 6% soil organic matter
 - Residential with plant uptake
 - Residential without plant uptake
- © AP GEOTECHNICS LTD.

All units are mg/kg dry weight of soil unless otherwise stated, except for pH which is dimensionless

Exceptions denoted thus: Residential 
Commercial 

CONTAMINANTS IN SOIL

Project: Tudor Cottage, 125 Sea Road, East Preston, BN16 1NX
 Client: Rocco Homes

Project No: 4706
 Sheet No: 1/1

Speciated Polyaromatic Hydrocarbons by GCMS																
Location Sample Depth, m	WS1	WS2	WS3										LQM/CIEH S4UL ³			
	DI	DI	DI									residential ⁴	residential ⁵	allotments	commercial	
	0.3	0.4	0.6													
Determinand	Concentration, mg/kg															
PAH																
Naphthalene	<0.1	<0.1	<0.1									13	13	24	1100	
Acenaphthylene	<0.1	<0.1	<0.1									920	6000	160	100000	
Acenaphthene	<0.1	<0.1	<0.1									1100	6000	200	100000	
Fluorene	<0.1	<0.1	<0.1									860	4500	160	71000	
Phenanthrene	<0.1	<0.1	0.8									440	1500	90	23000	
Anthracene	<0.1	<0.1	0.2									11000	37000	2200	540000	
Fluoranthene	<0.1	<0.1	1.0									890	1600	290	23000	
Pyrene	0.1	<0.1	0.8									2000	3800	620	54000	
Benzo(a)anthracene	<0.1	<0.1	0.5									13	15	13	180	
Chrysene	0.2	0.1	0.6									27	32	19	350	
Benzo(b)fluoranthene	<0.1	<0.1	0.4									3.7	4.0	3.9	45	
Benzo(k)fluoranthene	0.2	0.1	0.5									100	110	130	1200	
Benzo(a)pyrene	<0.1	<0.1	0.4									3	3.2	3.5	36	
Indeno(123-cd)pyrene	0.1	0.1	0.4									41	46	39	510	
Dibenzo(ah)anthracene	<0.1	<0.1	0.2									0.3	0.32	0.43	3.6	
Benzo(ghi)perylene	<0.1	<0.1	0.4									350	360	640	4000	
Total PAH (16)	0.9	0.7	6.3													

Notes

- Total PAH = Sum of EPA16 identified components
 - The results are expressed as mg/kg dry weight soil after correction for moisture content
 - S4UL given at 6% soil organic matter
 - Residential with plant uptake
 - Residential without plant uptake
- © AP GEOTECHNICS LTD.

Exceptions denoted thus: Residential 
 Commercial 

CONTAMINANTS IN SOIL

Project: Tudor Cottage, 125 Sea Road, East Preston, BN16 1NX
Client: Rocco Homes

Project No: 4706
Sheet No: 1/1

Location	Sample	Depth m	Asbestos identification		
			Description of matrix	Overall percentage of asbestos identified (approx.)	Type of asbestos identified
WS1	DI	0.3	Brown soil, stones, concrete, clinker, brick		none detected
WS2	DI	0.4	Brown soil, stones, clinker		none detected
WS3	DI	0.6	Brown sandy soil, stones, clinker, brick, organics		none detected



2683

Results Summary

Report No.: 17-13199

WAC Analysis

Elab Ref:	106847				Landfill Waste Acceptance Criteria Limits		
Sample Date:	14/07/2017				Inert Waste Landfill	Stable Non-reactive Hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID:	WS4						
Depth (m)	0.5						
Site:	Tudor Cottage						
Determinand		Code	Units				
Total Organic Carbon		N	%	1.60	3	5	6
Loss on Ignition		M	%	2.3	--	--	10
Total BTEX		M	mg/kg	< 0.01	6	--	--
Total PCBs (7 congeners)		M	mg/kg	< 0.03	1	--	--
TPH Total WAC		M	mg/kg	9	500	--	--
Total (of 17) PAHs		N	mg/kg	4.0	100	--	--
pH		M		8.1	--	>6	--
Acid Neutralisation Capacity		N	mol/kg	< 0.1	--	To evaluate	To evaluate

Eluate Analysis

	Code	10:1	10:1	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg		
		mg/l	mg/kg			
Arsenic	N	0.006	0.06	0.5	2	25
Barium	N	0.039	0.39	20	100	300
Cadmium	N	< 0.001	< 0.01	0.04	1	5
Chromium	N	< 0.005	< 0.05	0.5	10	70
Copper	N	0.009	0.09	2	50	100
Mercury	N	< 0.005	< 0.01	0.01	0.2	2
Molybdenum	N	< 0.005	< 0.05	0.5	10	30
Nickel	N	0.002	< 0.05	0.4	10	40
Lead	N	0.013	0.13	0.5	10	50
Antimony	N	0.006	0.06	0.06	0.7	5
Selenium	N	< 0.005	< 0.05	0.1	0.5	7
Zinc	N	0.011	0.11	4	50	200
Chloride	N	< 5	< 50	800	15000	25000
Fluoride	N	< 5	< 10	10	150	500
Sulphate	N	4	39.40	1000	20000	50000
Total Dissolved Solids	N	220	2200.00	4000	60000	100000
Phenol Index	N	< 0.01	< 0.10	1	-	-
Dissolved Organic Carbon	N	36.300	363.00	500	800	1000

Leach Test Information

pH	N	8.0				
Conductivity (uS/cm)	N	247				
Dry mass of test portion (g)		100.000				
Dry Matter (%)		88				
Moisture (%)		14				
Eluent Volume (ml)		962				

Results are expressed on a dry weight basis, after correction for moisture content where applicable

Stated limits are for guidance only and ELAB cannot be held responsible for any discrepancies with current legislation

APPENDIX E

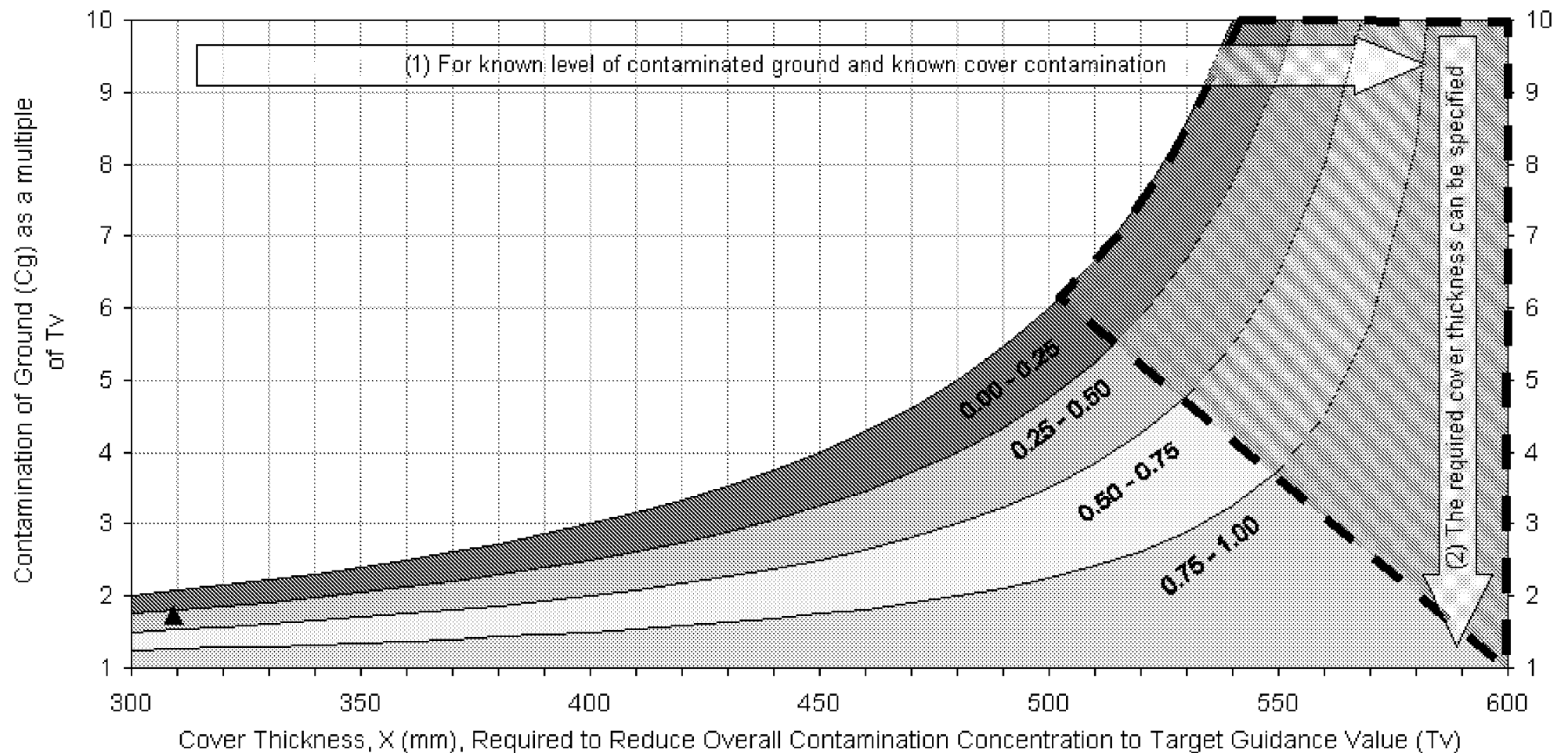
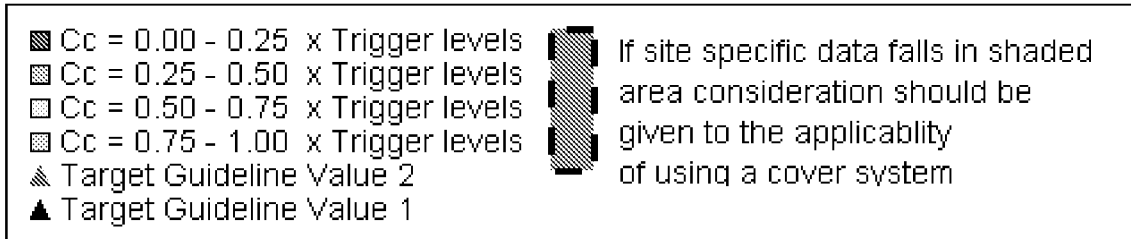
COVER SYSTEM

Calculations based on mixed zone (M)	600	mm
--------------------------------------	-----	----

[illegible]

Summary		
	Target Guideline Value 1	Target Guideline Value 2
Number of contaminants	17	17
Number of contaminants with no thickness calculation	16	17
Breakdown - Number for which no TV specified	16	17
Breakdown - Number for which no soil specified	16	16
Breakdown - Number for which no cover specified	16	16
Breakdown - Number for which cover > TV	0	0
Number of contaminants with thickness calculation	1	0
Breakdown - Number for which no cover required	0	0
Breakdown - Number for which cover required	1	0
Overall thickness of cover required	309	0

Design Chart



D Soakaway and Permeability test results

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: TUDOR COTTAGE, 125A SEA ROAD, EAST PRESTON, BN16 1NX
 Client: Rocco Homes

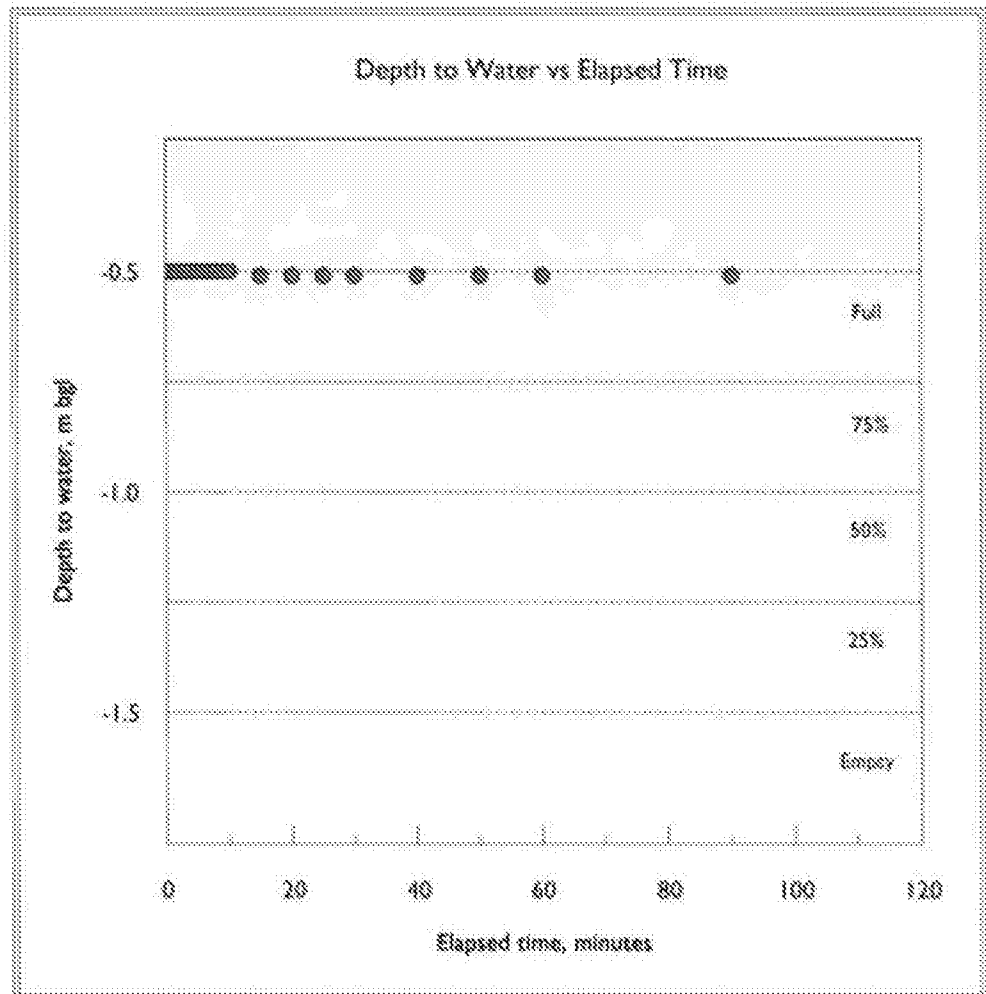
Project No: 4951
 Sheet No: 1/1

SA	1
Test No.	1
Depth, m	1.50
Length, m	2.00
Width, m	0.80

Description of stratum under test
Brown sandy CLAY

Depth in water prior to test, m below g.l.
pit dry

Elapsed Time min	Depth to Water m
0.0	0.500
1.0	0.500
2.0	0.500
3.0	0.500
4.0	0.500
5.0	0.500
6.0	0.500
7.0	0.500
8.0	0.500
9.0	0.500
10.0	0.500
15.0	0.510
20.0	0.510
25.0	0.510
30.0	0.510
40.0	0.510
50.0	0.510
60.0	0.510
90.0	0.510



$$f = (V75 - V25) / A50(T75 - T25)$$

$$V75 - V25 = 0.80 \text{ m}^3$$

$$A50 = 4.40 \text{ m}^2$$

$$T75 - T25 = \text{indeterminate min}$$

$$f = \text{indeterminate m/s}$$

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: TUDOR COTTAGE, 125A SEA ROAD, EAST PRESTON, BN16 1NX

Client: Rocco Homes

Project No: 4951

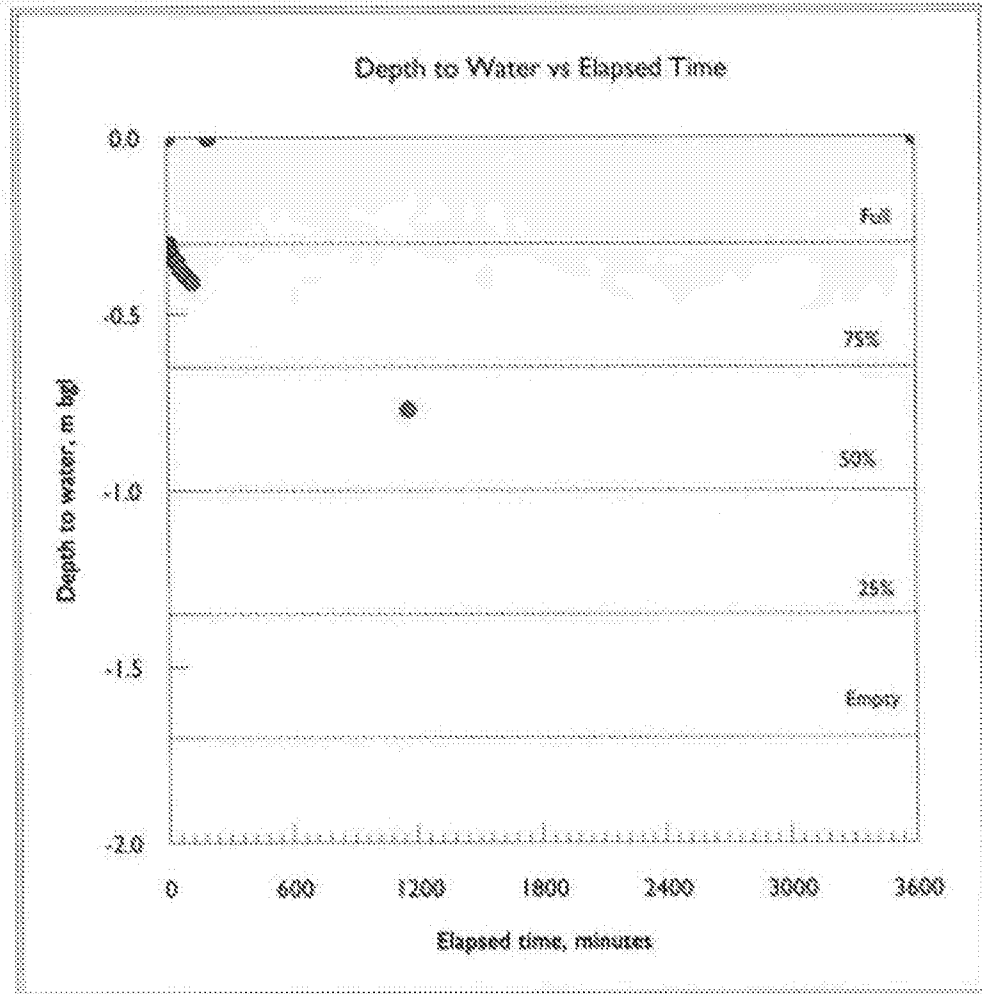
Sheet No: 1/3

SA	2
Test No.	1
Depth, m	1.70
Length, m	1.50
Width, m	0.80

Description of medium under test
Brown sandy clay with some flints

Depth to water prior to test, m below g.l.
pit dry

Elapsed Time min	Depth to Water m
0.0	0.300
1.0	0.300
2.0	0.300
3.0	0.300
4.0	0.300
5.0	0.300
6.0	0.300
7.0	0.300
8.0	0.300
9.0	0.310
10.0	0.310
15.0	0.320
20.0	0.330
25.0	0.330
30.0	0.340
40.0	0.350
50.0	0.350
60.0	0.370
90.0	0.390
120.0	0.410
1162.0	0.770



$$f = (V75-V25)/A50(T75-T25)$$

$$V75-V25 = 0.84 \text{ m}^3$$

$$A50 = 4.42 \text{ m}^2$$

$$T75-T25 = 3000 \text{ min extrapolated}$$

$$f = 1.06E-006 \text{ m/s extrapolated}$$

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: TUDOR COTTAGE, 125A SEA ROAD, EAST PRESTON, BN16 1NX

Client: Rocco Homes

Project No: 4951

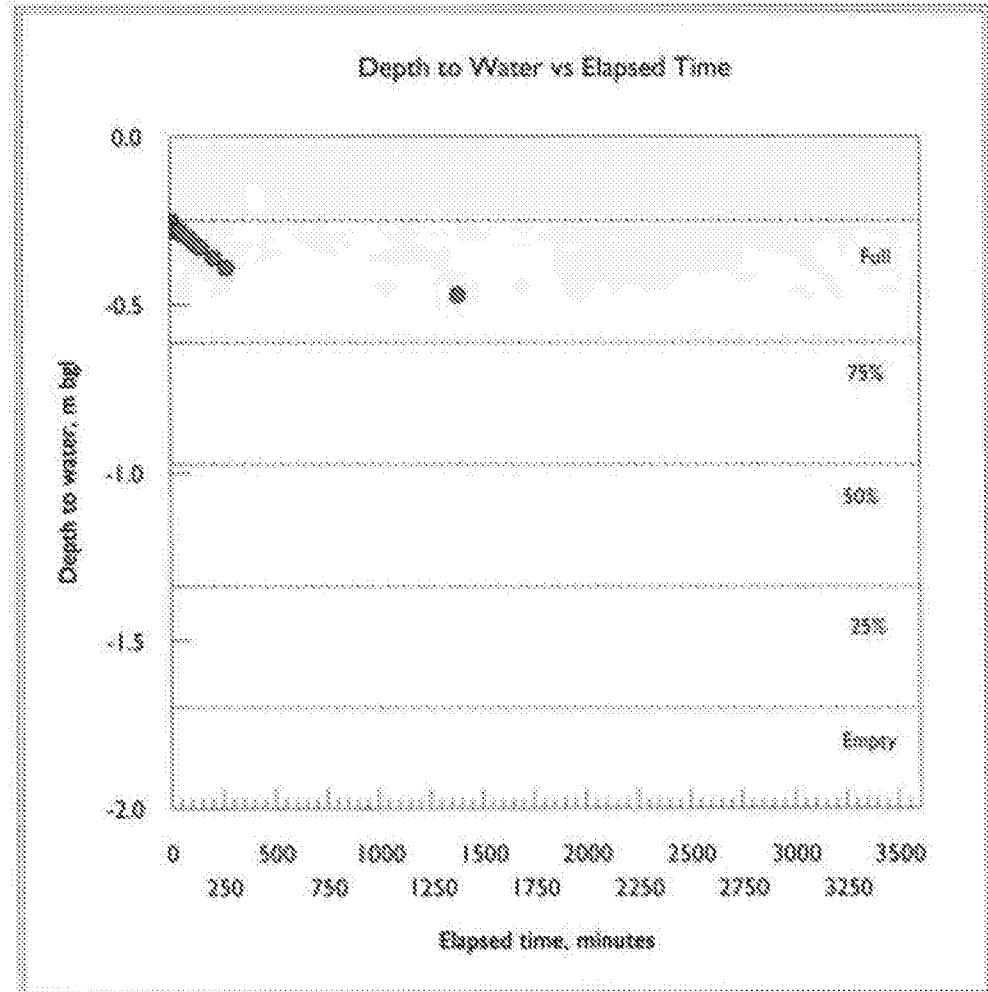
Sheet No: 2/3

SA	2
Test No.	2
Depth, m	1.70
Length, m	1.50
Width, m	0.80

Description of material under test
Brown sandy clay with some flints

Depth to water prior to test, as below g.l.
pit dry

Elapsed Time min	Depth to Water m
0.0	0.250
1.0	0.250
2.0	0.250
3.0	0.250
4.0	0.250
5.0	0.250
6.0	0.260
7.0	0.260
8.0	0.260
9.0	0.260
10.0	0.260
15.0	0.260
20.0	0.270
25.0	0.270
30.0	0.280
40.0	0.280
50.0	0.280
60.0	0.290
90.0	0.300
120.0	0.320
150.0	0.330
210.0	0.360
270.0	0.390
1385.0	0.470



$$f = (V75 - V25) / A50(T75 - T25)$$

$$V75 - V25 = 0.87 \text{ m}^3$$

$$A50 = 4.54 \text{ m}^2$$

$$T75 - T25 = \text{indeterminate min}$$

$$f = \text{indeterminate m/s}$$

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: TUDOR COTTAGE, 125A SEA ROAD, EAST PRESTON, BN16 1NX

Client: Rocco Homes

Project No: 4951

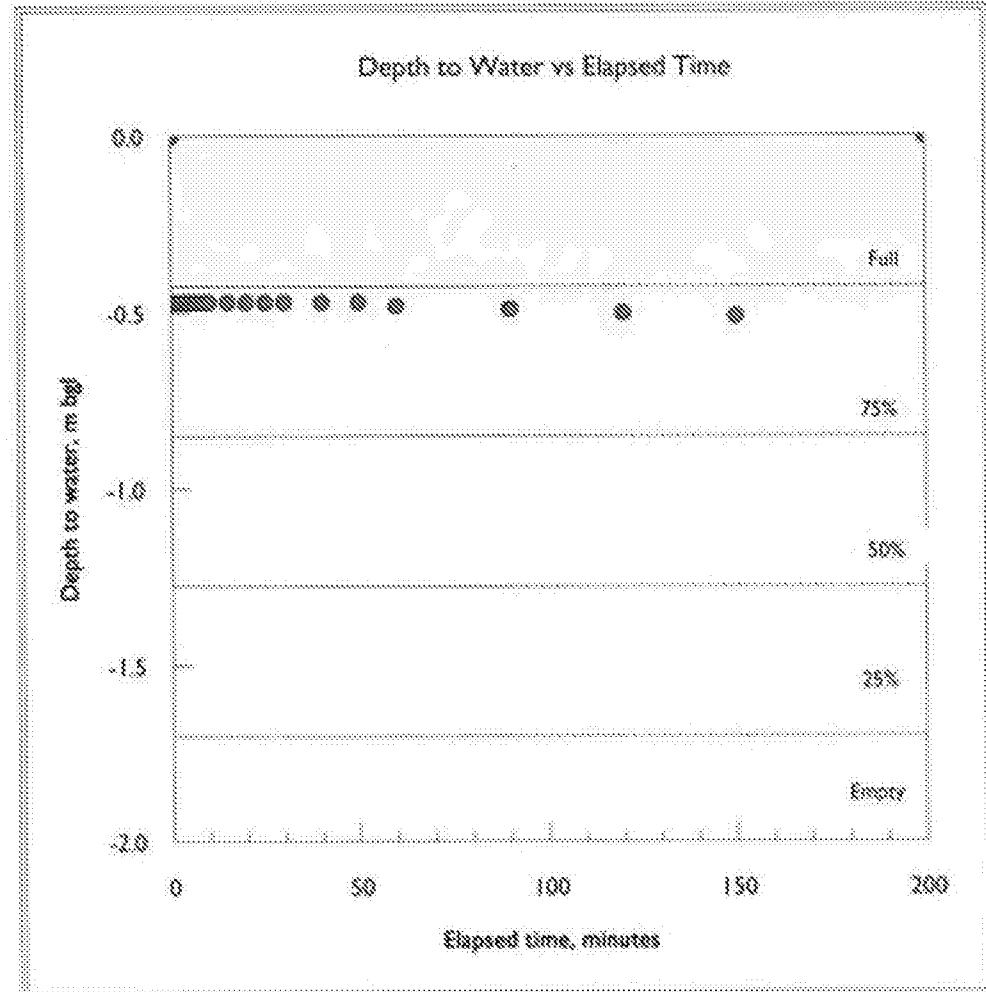
Sheet No: 3/3

SA	2
Test No.	3
Depth, m	1.70
Length, m	1.50
Width, m	0.80

Description of stratum under test
Brown sandy clay with some flints

Depth to water prior to test, m below g.l.
git dry

Elapsed Time min	Depth to Water m
0.0	
1.0	0.470
2.0	0.470
3.0	0.470
4.0	0.470
5.0	0.470
6.0	0.470
7.0	0.470
8.0	0.470
9.0	0.470
10.0	0.470
15.0	0.470
20.0	0.470
25.0	0.470
30.0	0.470
40.0	0.470
50.0	0.470
60.0	0.480
90.0	0.490
120.0	0.500
150.0	0.510



$$f = (V75 - V25) / A50(T75 - T25)$$

$$V75 - V25 = 1.02 \text{ m}^3$$

$$A50 = 5.11 \text{ m}^2$$

$$T75 - T25 = \text{indeterminate min}$$

$$f = \text{indeterminate m/s}$$

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: TUDOR COTTAGE, 125A SEA ROAD, EAST PRESTON, BN16 1NX
 Client: Rocco Homes

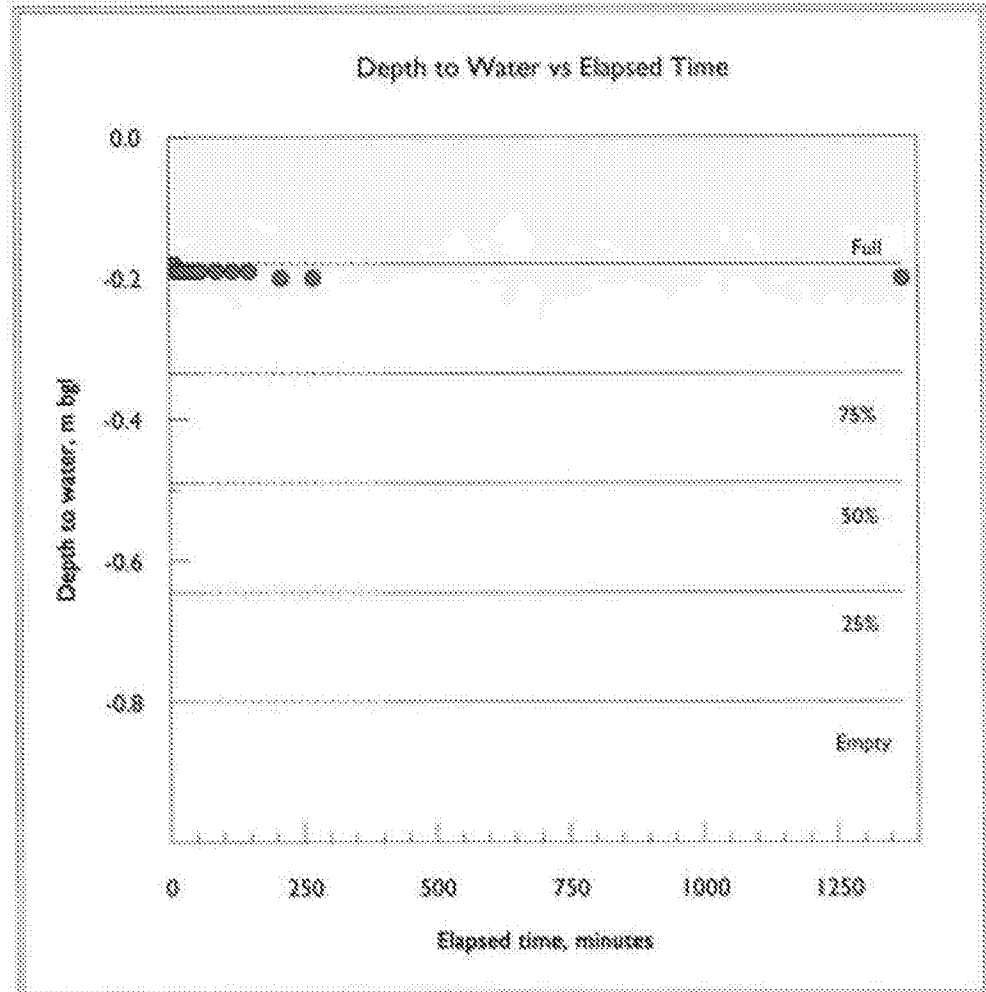
Project No: 4951
 Sheet No: 1/2

SA	3
Test No.	1
Depth, m	0.80
Length, m	1.00
Width, m	0.50

Description of stratum under test
Brown black clay and brick

Depth to water prior to test, m below g.l.
pit dry

Elapsed Time min	Depth to Water m
0.0	0.180
1.0	0.180
2.0	0.180
3.0	0.180
4.0	0.180
5.0	0.180
6.0	0.180
7.0	0.180
8.0	0.180
9.0	0.180
10.0	0.180
15.0	0.190
20.0	0.190
25.0	0.190
30.0	0.190
40.0	0.190
50.0	0.190
60.0	0.190
90.0	0.190
120.0	0.190
150.0	0.190
210.0	0.200
270.0	0.200
1371.0	0.200



$$f = (V75 - V25) / A50(T75 - T25)$$

$$V75 - V25 = 0.16 \text{ m}^3$$

$$A50 = 1.43 \text{ m}^2$$

$$T75 - T25 = \text{indeterminate min}$$

$$f = \text{indeterminate m/s}$$

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: TUDOR COTTAGE, 125A SEA ROAD, EAST PRESTON, BN16 1NX

Client: Rocco Homes

Project No: 4951

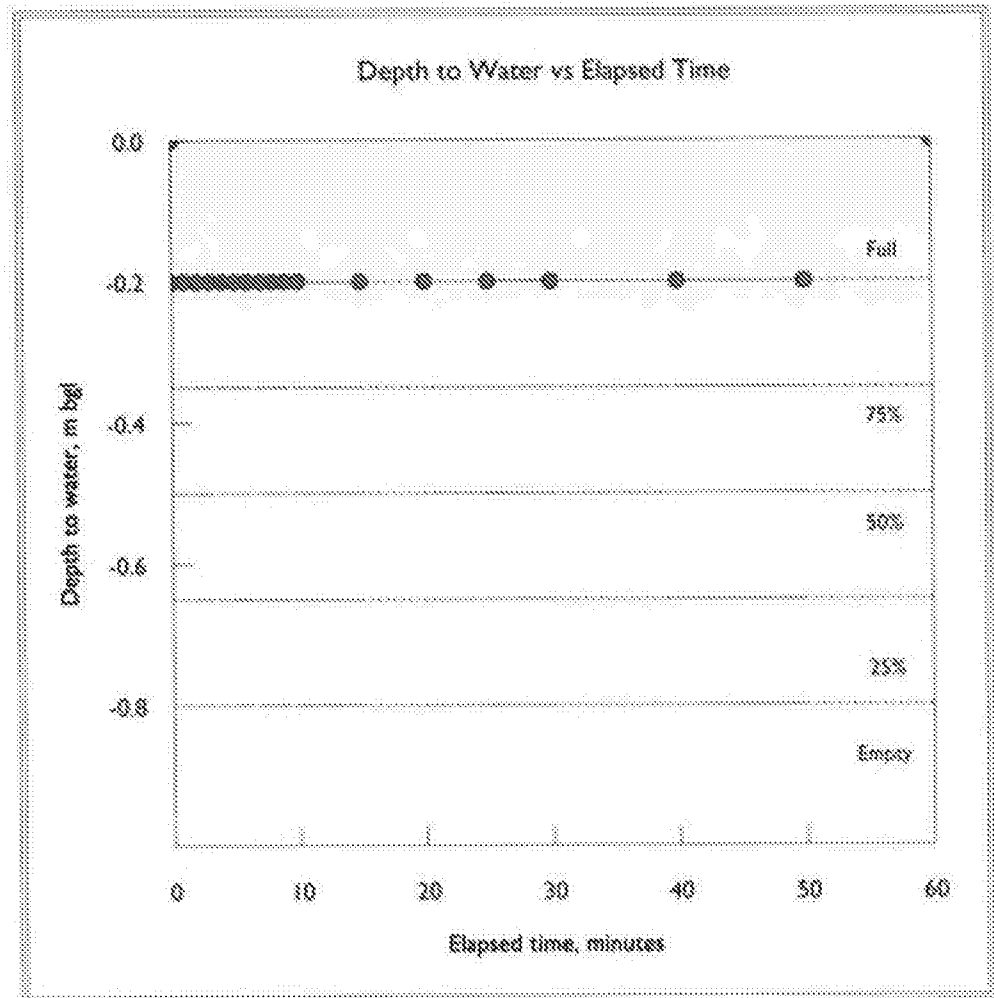
Sheet No: 2/2

SA	3
Test No.	2
Depth, m	0.80
Length, m	1.00
Width, m	0.50

Description of stratum under test
Brown black clay and brick

Depth to water prior to test, m below g.l.
pit dry

Elapsed Time min	Depth to Water m
0.0	0.200
1.0	0.200
2.0	0.200
3.0	0.200
4.0	0.200
5.0	0.200
6.0	0.200
7.0	0.200
8.0	0.200
9.0	0.200
10.0	0.200
15.0	0.200
20.0	0.200
25.0	0.200
30.0	0.200
40.0	0.200
50.0	0.200



$$f = (V75 - V25) / A50(T75 - T25)$$

$V75 - V25 = 0.15 \text{ m}^3$
 $A50 = 1.40 \text{ m}^2$
 $T75 - T25 = \text{indeterminate min}$

$$f = \text{indeterminate m/s}$$

Mr Vlad Myrsikov
PJCE
Overseas House
Elm Grove
Wimbledon
London
SW19 4HE

Developer Services
Southern Water
Sparrowgrove House
Sparrowgrove
Otterbourne
Hampshire
SO21 2SW

Your Reference:

Our Reference:
DS_CPS-101922

Date:
12/06/2018

Application to Connect to the Public Sewerage System - Section 106 Water Industry Act 1991. Location: 125A Tudor Lodge, Sea Road, East Preston, Littlehampton, West Sussex, BN16 1NX.

Dear Mr Myrsikov,

We refer to your recent application to connect to the combined sewer at the above location. We have reviewed the information that you have provided and regret that we are not able to approve the proposals shown on your drawing L2340-C-52-106 Revision 01 Dated 15/05/2018.

This review is for the purpose of approval to permit communication to be made to the public sewer, under Section 106 of the Water Industry Act 1991. **It is to the means and mode of construction only.**

- Please indicate the point of connection to the public sewers on the drainage plan as via a manhole. This is because where a connection is to be made that serves three or more properties the connection at the public sewers must be via an existing or a new manhole in accordance with Sewers for Adoption.

- Please note the fees for a new manhole will be an additional amount equal to £78.00.

- Our records indicate that there are no combined sewers near the premises, only a public foul sewer.

123A SEA ROAD, EXISTING PRE-DEVELOPMENT SITE

	Suggested dry weather flow rates			No	DWF	DWF + 10	Cut off - 0.93		
		Litres per day							
1	General Housing	600	per property	1	0.000	0.00	L/S		
2	School	80	per pupil		0.000	0.00	0.05		
3	Assembly Hall	10	per seat		0.000	0.00			
4	Cinema	10	per seat		0.000	0.00			
5	Theatre	10	per seat		0.000	0.00			
6	Sports Hall	50	per person		0.000	0.00			
7	Hotel	550	per room		0.000	0.00			
8	Guest House	200	per room		0.000	0.00			
9	Motel	300	per room		0.000	0.00			
10	Holiday apartments	150	per person		0.000	0.00			
11	Leisure park	220	per person		0.000	0.00			
12	Caravan park standard	250	per space		0.000	0.00			
13	Caravan park serviced	450	per space		0.000	0.00			
14	Camping Site standard	200	per space		0.000	0.00			
15	Camping Site serviced	350	per space		0.000	0.00			
16	Public house	150	per seat		0.000	0.00			
17	Restaurant	270	per seat		0.000	0.00			
18	Drive in restaurant	380	per seat		0.000	0.00			
19	Hospital	750	per bed		0.000	0.00	Total Foul	0.041	Hectares
20	Nursing Home	375	per bed		0.000	0.00	0.05	4.0002	
21	Offices	750	per 100 m ²		0.000	0.00			
22	Shopping centre	400	per 100 m ²		0.000	0.00			
23	Warehouse	150	per 100 m ²		0.000	0.00			
24	Commercial premises	300	per 100 m ²		0.000	0.00			
25	Manufacturing unit	550	per 100 m ²		0.000	0.00	FOUL	SURFACE	

123A SEA ROAD, PROPOSED DEVELOPMENT SITE

	Suggested dry weather flow rates			No	DWF	DWF + 10	Cut off - 0.93		
		Litres per day			L/S	L/S			
1	General Housing	600	per property	7	0.000	0.00	L/S	0.32	
2	School	80	per pupil		0.000	0.00			
3	Assembly Hall	10	per seat		0.000	0.00			
4	Cinema	10	per seat		0.000	0.00			
5	Theatre	10	per seat		0.000	0.00			
6	Sports Hall	50	per person		0.000	0.00			
7	Hotel	550	per room		0.000	0.00			
8	Guest House	200	per room		0.000	0.00			
9	Motel	300	per room		0.000	0.00			
10	Holiday apartments	150	per person		0.000	0.00			
11	Leisure park	220	per person		0.000	0.00			
12	Caravan park standard	250	per space		0.000	0.00			
13	Caravan park serviced	450	per space		0.000	0.00			
14	Camping Site standard	200	per space		0.000	0.00			
15	Camping Site serviced	350	per space		0.000	0.00			
16	Public house	150	per seat		0.000	0.00			
17	Restaurant	270	per seat		0.000	0.00			
18	Drive in restaurant	380	per seat		0.000	0.00			
19	Hospital	750	per bed		0.000	0.00	Total Foul	0.0365	Hectares
20	Nursing Home	375	per bed		0.000	0.00	0.32	4.0588	
21	Offices	750	per 100 m ²		0.000	0.00			
22	Shopping centre	400	per 100 m ²		0.000	0.00	FOUL	SURFACE (without attenuation)	
23	Warehouse	150	per 100 m ²		0.000	0.00			
24	Commercial premises	300	per 100 m ²		0.000	0.00			
25	Manufacturing unit	550	per 100 m ²		0.000	0.00			

Rishman Construction Ltd

Suite 6, Church House, 94 Felpham Road
Felpham, West Sussex, PO22 7PG

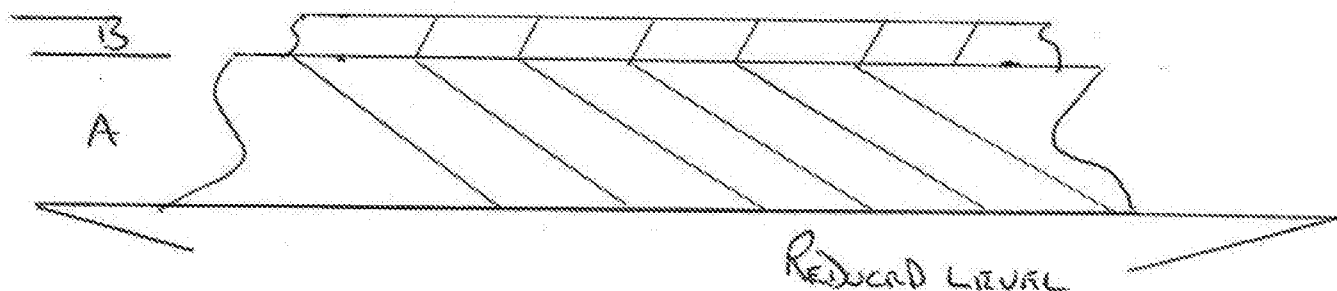
11th Dec 2018

Ref: RH 11

PERMEABLE PAVING AREAS

TUDOR LODGE

EAST PRESTON WORTHING



A = Min 200mm of 4-20mm washed Aggregate *

B = Min 50mm of 10mm Pea Shingle Surface

* Product data sheet attached, non bound drainage aggregate. Type 3.

Prepared BY: N. BAKER

Director RISHMAN CONSTRUCTION

10/1/2018



Producer: Torr Quarry

Material: 4/20mm Washed

Specific.: EN12620 4 / 20 GC90/15 GTc20/17,5 f4

Initiator:

Project:

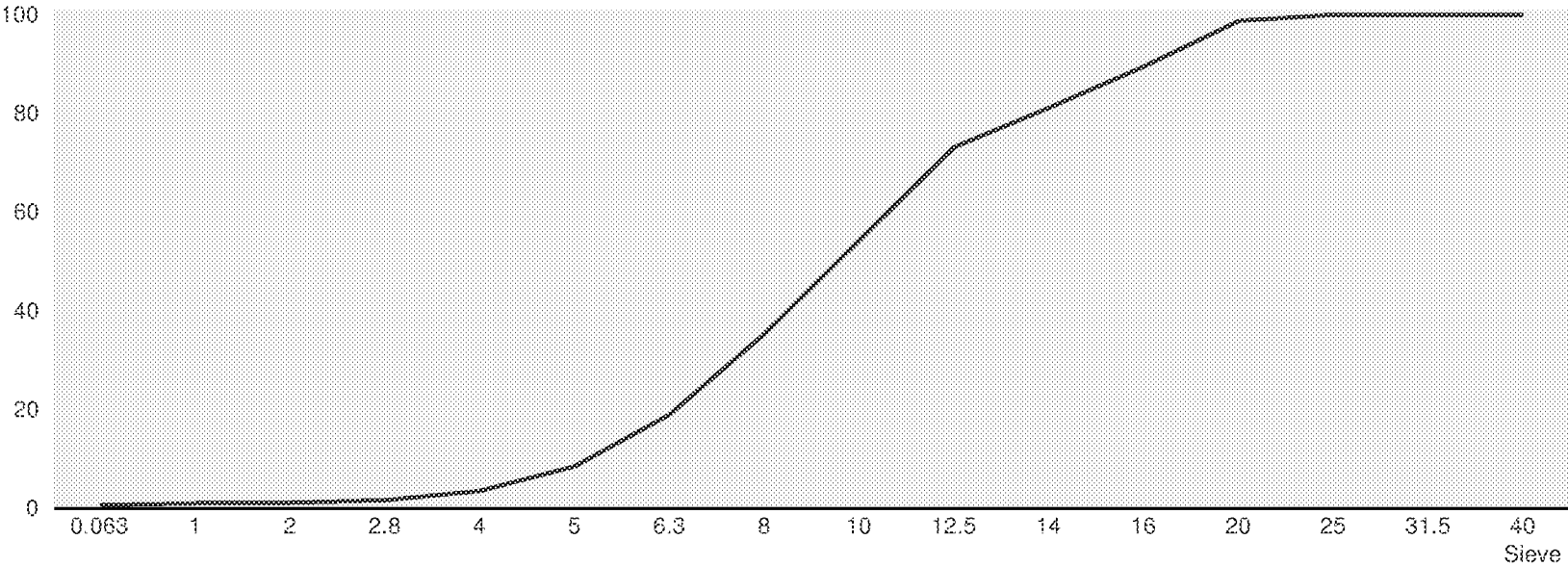
TestOrder No	Seq	Date	Specification	Moisture Content	Flakiness Index	40	31.5	25	20	16	14	12.5	10	8	6.3	5	4	2.8	2	1	0.063
tCOA/0007212	8	26-Sep-18	OK	2.1		100	100	100	99	91	83	74	55	37	21	9	3	1	1	1	0.3
tCOA/0007057	7	24-Sep-18	OK	3.2	18	100	100	100	100	98	92	84	68	48	25	10	3	1	1	1	0.3
tCOA/0006745	6	20-Sep-18	OK	2.2	22	100	100	100	99	86	78	69	48	27	12	4	2	1	1	1	0.4
tCOA/0006492	5	17-Sep-18	OK	2.7		100	100	100	96	88	80	75	58	40	24	11	4	2	1	1	0.6
tCOA/0006045	4	10-Sep-18	OK	2	18	100	100	100	97	86	76	67	51	34	19	8	3	1	1	1	0.5
tCOA/0006033	3	10-Sep-18	OK	0.6	12	100	100	100	99	89	78	66	43	25	11	5	3	2	2	2	1.2
tCOA/0005952	2	07-Sep-18	OK	2		100	100	100	98	87	77	66	44	29	16	7	3	1	1	1	0.4
tCOA/0005599	1	04-Sep-18	OK	2.1	22	100	100	100	99	90	79	68	46	26	13	6	2	1	1	1	0.3



Producer: Torr Quarry

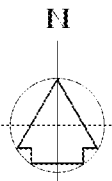
Material: 4/20mm Washed

Specific.: EN12620 4 / 20 GC90/15 GTc20/17,5 14

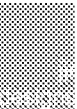


	Specif...	Moisture Content	Flakiness Index	40	31.5	25	20	16	14	12.5	10	8	6.3	5	4	2.8	2	1	0.063
Count	8	8	5	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Average		2.1	18	100	100	100	98	89	80	71	52	33	17	7	3	1	1	1	1
Max Value		3.2	22	100	100	100	100	98	92	84	68	48	25	11	4	2	2	2	1
Min Value		0.6	12	100	100	100	96	86	76	66	43	25	11	4	2	1	1	1	0

H Site-Wide levels plan



REV. A 28.11.18 -- EXTERNAL LEVELS UPDATED;
DETENSION BASIN ADDED.



Site 20
Church House,
64 Felpham Road
Felpham
West Sussex,
PO22 7PG
TEL: 01243 922081

Architectural
Services
Planning
Building Regs
On Site Supervision
Landscape Design

e-mail: info@jjrdesigns.com

Client:

ROOPE HOMES

Project:

TUDOR COTTAGE, SEA ROAD
EAST PRESTON
B

Drawing Title:

SITE PLAN

Issue status:	Outline proposal	Production Information	Some design
Tender drawing	Detail design	Contract drawing	

Scale:	Drawn:	Checked:	Approved:	Date:
1:100	V. Botezat	R. Stelarski		06.03.2018
Job No:	Drawing No:	Revision:		
1336	100	A		

SITE PLAN

From: Laura Gibbons [REDACTED]
Sent: 05 November 2018 13:31
To: Vlad Myrsikov
Cc: Sarah Hufford; Anita Gardner; Paul Cann
Subject: RE: EP/98/18/DOC - Tudor Cottage, 125A Sea Road

Hi Vlad,

Following Paul's email on the 29th it looks like infiltration via ring soakaways will not be possible due to the groundwater levels in the summer.

We will need to see Southern Water's formal approval to means and method of connection and rates of discharge before we approve the drainage proposals. Have you discussed with southern water lining requirements for the pond etc.?

Having had a look at the details you have sent through I have the following comments:

1. Please detail on the layout plan the pond invert levels and bank levels.
2. Please ensure all water goes through the pond before reaching the flow control device. I would advise two inlets to the pond and one outlet which has the flow control device. At the minute the water is being able to bypass the pond at flows which are less than the restricted rates, therefore whenever it was raining water would be going into the sewer. We would like to see the sewer connection used as more of an overflow.
3. Please provide calculations of this revised arrangement.
4. Please detail proposed levels of the car park area. As you have provided no quantifiable proof that your proposal for the car park would work can levels be set so that there is a gentle fall to the pond rather than surrounding land.
5. Please provide construction detail drawings of the non-engineered permeable pavement.

Regards,

Laura Gibbons, MEng, GMICE
Engineer (Drainage & Coastal)

[Laura Gibbons](#) | Engineer (Drainage & Coastal), Engineering Services, [Arun District Council](#) | Location: First Floor, Arun Civic Centre,
Maltravers Road, Littlehampton, BN17 5LF

[REDACTED]
Arun is Working in Partnership with Chichester District Council

Visit Arun's web site at <http://www.arun.gov.uk/> and www.chichester.gov.uk



Save the environment - think before you print.

From: Vlad Myrsikov [REDACTED]
Sent: 29 October 2018 12:40
To: Paul Cann
Cc: Sarah Hufford; Anita Gardner; Laura Gibbons
Subject: RE: EP/98/18/DOC - Tudor Cottage, 125A Sea Road

Hi Paul,

As discussed, please find enclosed geotechnical investigation, soakaway and permeability test results. Standing groundwater was at 1.7m and stratum is very variable with many lenses of clay, silt and some gravel.

We welcome your direction to finalise the project as we've reached technical potential outlined within British Standards with the scheme we submitted for approval (see attached drawing L2340-C-52-750 and refer to previously submitted Technical Note L2340-TN-001).

Kind Regards,

Vlad Myrsikov
Pringuer-James Consulting Engineers

Pringuer-James
Consulting Engineers

Pringuer-James Consulting Engineers
Overseas House, Elm Grove,
London, SW19 4HE

♣ Consider the environment. Do you really need to print this email?

This e-mail may contain confidential or legally privileged information intended only for the individual or entity named in the e-mail address. If you are not the intended recipient, any disclosure, copying, distribution or reliance upon its contents is strictly prohibited. If you have received this email in error, please reply to the sender so we can arrange for its correct delivery. Recipients should use their own up to date virus protection. e-Mails sent and received may be read by people other than the intended recipient and may be monitored to ensure efficient email systems.

Pringuer-James Consulting Engineers Limited is registered in England and Wales No. 05260933. Registered office Overseas House, Elm Grove, London, SW19 4HE

From: Vlad Myrsikov

Sent: 29 October 2018 12:01

To: Laura Gibbons [REDACTED]

Cc: Sarah Hufford <sarah@roccohomes.co.uk>; Paul Cann <Paul.Cann@arun.gov.uk>; Anita Gardner <Anita.Gardner@arun.gov.uk>

Subject: RE: EP/98/18/DOC - Tudor Cottage, 125A Sea Road

Hi Laura,

Groundwater on our site is at 1.7m and soakaway test was completed at Groundwater depth or nominally above it. At 2.0m we will be below groundwater table. I am not familiar with a drainage concept of soakaway below groundwater and what you are proposing appears to be similar to a water well, but in reverse. I would welcome your input, and thus please send through British design standards for such a facility and we would be happy to consider this.

Kind Regards,

From: Laura Gibbons <[REDACTED]>

Sent: 29 October 2018 11:51

To: Vlad Myrsikov [REDACTED]

Cc: Sarah Hufford [REDACTED]; Paul Cann [REDACTED]; Anita Gardner [REDACTED]

Subject: RE: EP/98/18/DOC - Tudor Cottage, 125A Sea Road

Hi Vlad,

I am not convinced that all possibilities have been fully investigated. In East Preston there is typically a gravel layer at approx. 2m down which offers good infiltration.

Have you considered formalising the permeable paving and having ring soakaways which take the roof water going down into the gravel layers. Linking the permeable paving and ring soakways would mean that all storage could be provided above the winter groundwater levels but you could still utilise the good strata for infiltration. Please demonstrate whether this type of solution works or not.

As stated previously we would not be happy with an informal paving arrangement that you are proposing as no supporting calculations, rates, etc. have been supplied that demonstrate that this would work.

Regards,

Laura Gibbons, MEng, GMICE
Engineer (Drainage & Coastal)

Laura Gibbons | Engineer (Drainage & Coastal), Engineering Services, Arun District Council | Location: First Floor, Arun Civic Centre, Maltravers Road, Littlehampton, BN17 5LF

Arun is Working in Partnership with Chichester District Council

Visit Arun's web site at <http://www.arun.gov.uk/> and www.chichester.gov.uk



Save the environment - think before you print.

From: Vlad Myrsikov [REDACTED]
Sent: 19 October 2018 16:28
To: Laura Gibbons
Cc: Sarah Hufford; Paul Cann; Anita Gardner
Subject: RE: EP/98/18/DOC - Tudor Cottage, 125A Sea Road

Hi Laura,

As per our telephone discussion, please find below information and my comments.

Please see attached:

- Drawing L2340-C-52-750_Rev03 with updated site boundary to reflect "no development" disputed land.
- Soakaway Test results
- Permeability Test results

Permeability tests and soakaway tests have been done in car park, 5.0m away from building. This 5.0m line is indicated by small magenta line on the drawings with 5.0m dimension shown.

Infiltration for the development

Based on attached results infiltration is not viable for this development. This is consistent with geotechnical investigation we completed earlier which showed variable ground on site with mix of sandy Clay and Clayey Sand and other variable ground conditions. Good ground was found below water table.

Permeable Pavements

As discussed, we completed permeability tests for an engineered permeable pavement system. These failed. If we introduce an engineered system it will be Type B system and will effectively add more storm water into the system. As alternative we propose non-engineered pavements for this site. These non-engineered pavements are functional at neighbouring properties and do appear to work by infiltrate some water in first 200mm of natural ground, and then drain through more permeable pockets.

Pond

We briefly discussed the pond – this cannot infiltrate as most of it is within 5.0m of structure and ground is not suitable for infiltration.

Southern Water

We have lodged a Pre-Development query with Southern Water. We will forward you their results as soon as possible. If there is insufficient capacity within the system, then Southern Water will look to undertake necessary works to improve capacity. As mentioned on the phone, previous site was connected to sewer and was draining at around 4.5l/s (please refer to PJCE report), and new site is restricted to 2.1l/s.

Please advise if above is sufficient to discharge planning conditions.

Kind Regards,

Vlad Myrsikov
Pringuer-James Consulting Engineers

Pringuer-James
Consulting Engineers

Pringuer-James Consulting Engineers
Overseas House, Elm Grove,
London, SW19 4HE

♻ Consider the environment. Do you really need to print this email?

This e-mail may contain confidential or legally privileged information intended only for the individual or entity named in the email address. If you are not the intended recipient, any disclosure, copying, distribution or reliance upon its contents is strictly prohibited. If you have received this email in error, please reply to the sender so we can arrange for its correct delivery. Recipients should use their own up to date virus protection. e-Mails sent and received may be read by people other than the intended recipient and may be monitored to ensure efficient email systems.

Pringuer-James Consulting Engineers Limited is registered in England and Wales No. 05260983. Registered office Overseas House, Elm Grove, London, SW19 4HE

From: Laura Gibbons [REDACTED]
Sent: 14 September 2018 11:05
To: Vlad Myrsikov [REDACTED]
Cc: Sarah Hufford [REDACTED]; Paul Cann [REDACTED]; Anita Gardner [REDACTED]
Subject: RE: EP/98/18/DOC - Tudor Cottage, 125A Sea Road

Hi Vlad,

Thanks for the email. I have provided responses to your points in *red* below.

Regards,

Laura Gibbons, MEng, GMICE
Engineer (Drainage & Coastal)

Laura Gibbons | Engineer (Drainage & Coastal), Engineering Services, [Arun District Council](#) | Location: First Floor, Arun Civic Centre,
Maltravers Road, Littlehampton, BN17 5LF

[REDACTED]
Arun is Working in Partnership with Chichester District Council

Visit Arun's web site at <http://www.arun.gov.uk/> and www.chichester.gov.uk



From: Vlad Myrsikov [REDACTED]
Sent: 10 September 2018 17:04
To: Laura Gibbons
Cc: Sarah Hufford; Paul Cann
Subject: RE: EP/98/18/DOC - Tudor Cottage, 125A Sea Road

Hi Laura,

I've left you a voicemail, and perhaps we can discuss the points below?

Southern Water

As mentioned in previous email, we already have permission from Southern Water to discharge storm water to foul sewer, and our discharge rate is less than 3xGreenfield rate. Not sure why Council is worried about 3-party approval of which we already obtained? *The permission from southern water is only regarding the means and method of connection, it does not provide approval regarding capacity within the system. Furthermore, historic flooding of the sewerage system you are proposing on connecting into has occurred. Southern Water will only accept discharge of surface water into sewers if all other methods of disposal have been sufficiently ruled out, which we provide comments on. You have not provided sufficient justification.*

Permeable Pavements

We have permeable pavements throughout our development and it's highlighted on the drawings and report we submitted. *Non-engineered permeable pavement with no construction details is not good enough. My suggestion is that you could increase the depth of subbase of the permeable paving, or locate tanks under the permeable paving so that roof water could go into this and infiltrate. The points of diffusion must be located 5m away from the buildings.*

Pollution Prevention

In terms of reduction in 1m clearance – this is required by CIRIA 753 as a means of pollution prevention. Roof water is considered polluted by the guidance is requires "treatment", which is normally achieved using 1.0m of unsaturated soil.

Could you please provide more details on how you would prevent pollution to groundwater, as required and provided by statutory guidance CIRIA 753? Our building control is very strict and it's not clear how we can achieve required pollution prevention from roofs, as required by statutory guidance? *CIRIA 753 actually states that only sediment and silt must be removed from roof water, this can be achieved by silt traps which you should be providing. My suggestion of using the sub base of permeable paving would provide further treatment beyond that required. The development is not within a source protection zone.*

Infiltrating Pond

We would be happy to make the pond infiltrating, however it is currently located within 2.5m of structure, and we would need to move it 5m away, making it impossible to infiltrate, and parking bays do not fit. Perhaps discussion can be had with Planners to remove requirement for 2 bays, and then we will have sufficient space for infiltrating pond, provided of course we understand how to prevent pollution and Building Control approves less than 1.0m of soil between infiltrating structure and groundwater level?

See comment above regarding use of the area under the permeable paving. This could remove the need for the pond. GW was recorded at 1.7m bgl, you have ample room to infiltrate.

In summary, we have followed the hierarchy outlined in Building Regulations and designed our systems to those outlined in CIRIA(753). Our final discharge rate is less than 3xGreenfield rate which is the same as would be expected from any new developments in more stricter enforcing boroughs, and we already have permission with Southern Water. As such, I see no further reason to delay approval of our drainage strategy.

Kind Regards,

From: Laura Gibbons [REDACTED]
Sent: 10 September 2018 16:29
To: Vlad Myrsikov [REDACTED]
Cc: Sarah Hufford [REDACTED]
Subject: RE: EP/98/18/DOC - Tudor Cottage, 125A Sea Road

Hi Vlad,

Infiltration needs to be fully investigated. The hierarchy for sustainable drainage means that infiltration should be fully investigated first. I would also note that Southern water expect us to ensure this occurs.

We do not require 1m clearance between the base of infiltration structures and maximum recorded winter groundwater levels. The base of infiltration structures must be sited above maximum recorded groundwater level. There is space for permeable paving, and for the pond to be infiltrating rather than attenuating.

Regards,

Laura Gibbons, MEng, GMICE
Engineer (Drainage & Coastal)

Laura Gibbons | Engineer (Drainage & Coastal), Engineering Services, Arun District Council | Location: First Floor, Arun Civic Centre, Maltravers Road, Littlehampton, BN17 5LF

[REDACTED]
Arun is Working in Partnership with Chichester District Council

Visit Arun's web site at <http://www.arun.gov.uk/> and www.chichester.gov.uk



Save the environment - think before you print.

From: Paul Cann
Sent: 10 September 2018 15:39
To: 'Vlad Myrsikov'
Cc: Sarah Hufford; Laura Gibbons
Subject: RE: EP/98/18/DOC - Tudor Cottage, 125A Sea Road

Hi Vlad

My colleague Laura will be dealing with this site so I have copied her in so she can respond to you directly.

Regards

Paul Cann
Senior Engineer (Drainage & Coastal)

Paul Cann | Senior Engineer (Drainage & Coastal), Engineering Services, Arun District Council | Location: First Floor, Arun Civic Centre, Maltravers Road, Littlehampton, BN17 5LF

[REDACTED]
Arun is Working in Partnership with Chichester District Council

Visit Arun's web site at <http://www.arun.gov.uk/> and www.chichester.gov.uk



From: Vlad Myrsikov [REDACTED]
Sent: 04 September 2018 14:50
To: Paul Cann
Cc: Sarah Hufford
Subject: EP/98/18/DOC - Tudor Cottage, 125A Sea Road

EP/98/18/DOC - Tudor Cottage, 125A Sea Road
Hi Paul,

I tried to reach you by phone, but I believe you are on holidays this week. When you are back, I would like to discuss above site with you to understand your expectations, thus would be great if you could call me back.

In advance of our discussion, below are some discussion points regarding the SuDS strategy we put together: I noted in the rejection letter that you would like to see "winter infiltration rates". We can certainly request the client to undertake infiltration tests, however it's unclear to me how this will change the scheme?

We have already implemented:

- Permeable pavements throughout (non-engineered gravel).
- Off-line Detention Basin
- Flow control at 2.5l/s (which is less than 3xGreenfield Rate, see attached)
- It should point out that the site already accepts/infiltrates storm water from both Sea Road, South Strand within the site boundary, as such the site is actually infiltrating a significantly larger overall area.

We are limited with any other infiltration features due to:

- Requirement for 1.0m clearance between water table and bottom of SuDS (pollution control)
- Site layout which prevents other infiltration SuDS, such as swales.
- Large number of tree protection zones around the site.

On a further note, Southern Water have accepted storm water going into their sewer, at 2.5l/s rate, as there are no other means to dispose of surface water for roof water.

I would appreciate a quick call so I can better understand your expectations for the SuDS on this site, given that undertaking "infiltration tests" represents limited additional value for the development.

Kind Regards,

<http://www.arun.gov.uk>

DX 57406 Littlehampton

You can view Arun District Council's Privacy Policy from <https://www.arun.gov.uk/privacy-policy>

Important Notice This e-mail is intended exclusively for the addressee and may contain information that is confidential and/or privileged. If you are not the intended recipient (or authorised to receive it for the addressee), please notify the sender and delete the e-mail immediately; using, copying, or disclosing it to anyone else, is strictly prohibited and may be unlawful. Any views, opinions or options presented are solely those of the author and do not necessarily represent those of Arun District Council. The information in this e-mail may be subject to public disclosure under the Freedom of Information Act 2000, therefore we cannot guarantee that we will not provide the whole or part of this e-mail to a third party. The Council reserves the right to monitor e-mails in accordance with relevant legislation. Whilst outgoing e-mails are checked for