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CONSTRUCTION CONSULTANTS

**Yeomans Limited
Worthing
Honda/Office/Peugeot**

Drainage Strategy
AKSW-XX-XX-RP-C-0005

Prepared for
Yeomans Ltd.

February 2018

Job No: S188010

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LONDON • HITCHIN • OXFORD • POOLE • SOUTHAMPTON

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Appendix F	SuDS Maintenance Schedule

Revision	Amendments	Prepared By	Checked	Date
P01	Preliminary	NJ	GT	09.02.18
P02	Minor amendments to car park surface	NJ	GT	15.02.18

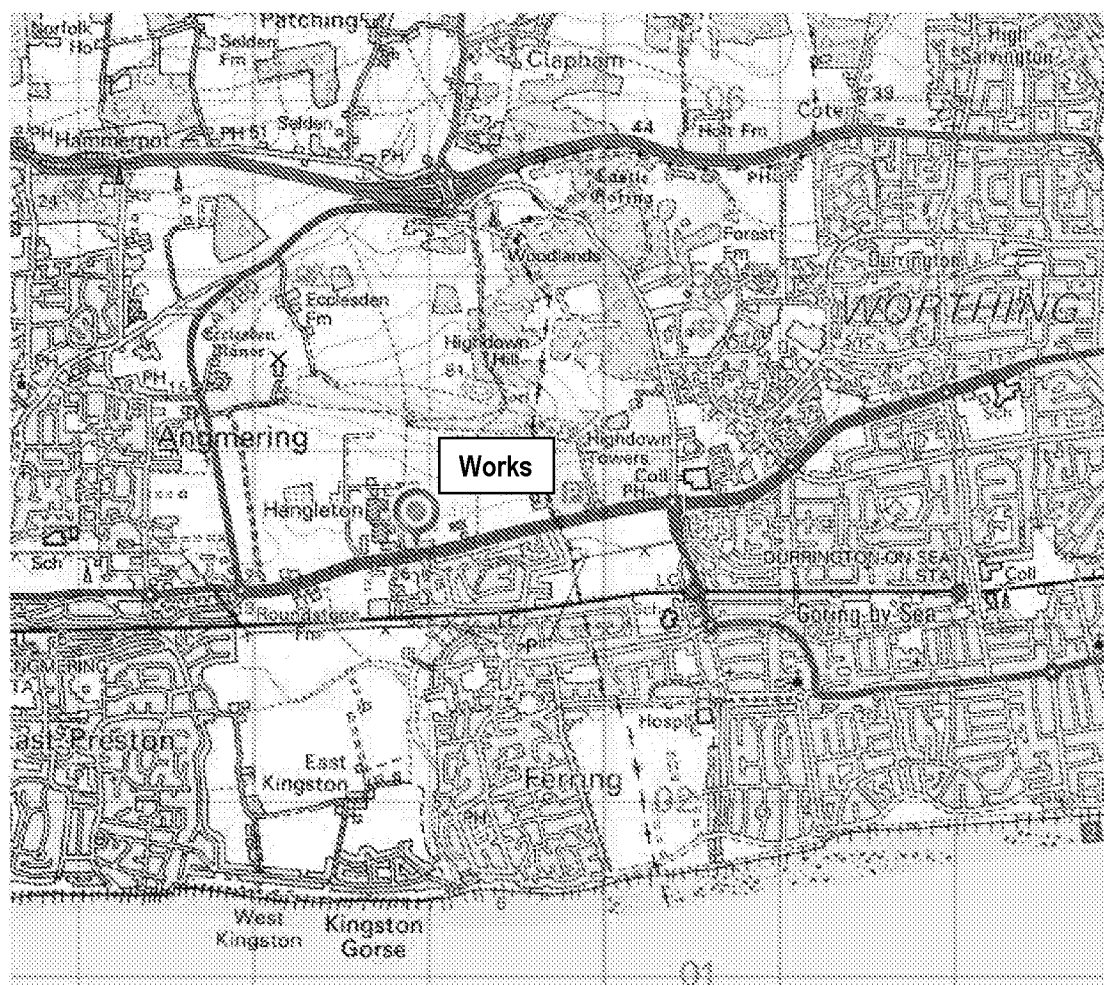
1.0 Introduction

- 1.1 AKS Ward have been commissioned to undertake a Drainage Strategy to support the planning application for the redevelopment of a new Honda Motor Dealership adjoining the existing Peugeot Dealership on site.
- 1.2 The proposals consist of a part 2-storey/part 1-storey building with associated external hard paving and car park.
- 1.3 The development is located at Littlehampton Rd, Ferring, Worthing and it is currently a developed site with 0.108 Hectares of impermeable area. The site is in Flood Zone 1 (low risk of fluvial flooding) and is 0.267 Hectares in area with 0.247 Hectares served by drainage therefore no flood risk assessment is required.
- 1.4 Proposed building will be bounded to the north by residential and industrial areas, to the west by Hangleton lane, to the south and east by the existing Peugeot Dealership.

2.0 Development Site Details

- 2.1 Development Description & Location
The site is located at NGR TQ 08916 03457.

The plans of the development are contained within Appendix B.



3.0 Site Drainage Strategy

3.1 Existing Surface Water

There is no information regarding the existing drainage on site therefore it has been assumed that current runoff water from the site soaks into the ground. During exceedance events when the ground is saturated, it is understood that the runoff volume would drain towards the east to Hangleton Lane.

BGS Boreholes near to the development indicate that the site is located on gravel and chalk layers. In addition, current parking areas within Peugeot Dealership are drained via permeable paving therefore it has been assumed infiltration is feasible on site.

Soakage tests will be carried out to confirm infiltration rates. A preliminary assumption of 1.39×10^{-5} m/s has been made for the design of the proposed surface water drainage.

Greenfield runoff rates and volumes have been calculated as follows:

Qbar: 1.0 l/s

Greenfield volume 1 in 100 year event: 58.681 m³

Topographical survey and BGS boreholes are contained in Appendix A. Microdrainage calculations are contained in Appendix B.

3.2 Proposed Surface Water

Surface water systems will be designed to agree with the National Standards for Sustainable Drainage.

A new cellular soakaway with capacity of 71m³ will be installed under parking areas to attenuate and infiltrate runoff volume from new roof and hard paving located to the north of the building..

In addition to this, 92m³ of storage in permeable sub-base under parking bays and access roads will drain and infiltrate runoff water from the new car park.

Surface water drainage has been designed with no flooding in the 30 year event and no flood water leaving the site for the 100 year + 40% climate change critical storm event.

Refer to drainage drawings and Microdrainage calculations in Appendix C and D. Surface Water Pro-forma has been completed with a copy contained in Appendix E to ensure that the design is in accordance with the current SuDS requirements.

3.2.1 Runoff Destination

Due to the ground condition obtained from BGS boreholes, existing soil is considered permeable and infiltration feasible on site.

Surface water drainage from the new building and hard paving area to the north of the building will connect under gravity to a new cellular soakaway located minimum 5 m away from existing and proposed buildings and public highway.

1028 m² of permeable sub-base under parking bays and access roads with drain the new car park and hard standing areas to the east of the building.

100 m² of new hard paving located to the south of the building will drain towards the existing permeable paving on site.

3.2.2 Peak flow control

SuDS will be utilised on site in the form of cellular soakaway and permeable paving. There will be no discharged flow from the site therefore peak runoff will not exceed the current flow rates for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event with an allowance for climate change.

3.2.3 Volume control

There is no additional discharged volume as the proposed impermeable areas will be drained into the permeable paving and cellular soakaway therefore it will not exceed the current volume for each storm.

3.2.4 Flood risk within the development.

The system will be designed in accordance with CIRIA SuDS manual with no flooding in the 30 year event and no flood water leaving the site for the 100 year + 40% climate change critical storm event.

3.2.5 Exceedance Events

In storm events exceeding the designed storm events above the 100 year + 40 % climate change the flow of water would run towards the west and discharge to Hangleton Lane.

3.2.6 Structural integrity and construction

Surface system will be designed and constructed using approved materials in line with Building Regulation's and current British Standards appropriate for the location and proposed use.

3.2.7 Maintenance and operation

The drainage system will be CCTV surveyed on completion to ensure that the system is fully operational and maintenance schedules provided in the O&M manual for the owner to maintain the dry swale and ring soakaways.

Maintenance schedules have been provided in Appendix F for the SuDS. The owner of the site will be responsible for maintaining the SuDS on site.

3.3 Existing and Proposed Foul Water.

New proposed foul drainage will connect to the existing private sewer located within the site. Workshop drains will be connected to the foul system via a Class II separator.

Foul water will discharge via gravity indirect connection into Southern Water foul sewer.

Any new foul drainage will be connected to public system and S106 connection applications made to Southern Water.

4.0 Water Quality Management

The surface system will be designed in order to not affect the water quality of the receiving groundwater.

CIRIA SuDS Manual Chapter 26 assigns pollution hazard indices for different land use types and SuDS mitigation index for every SuDS component depending on where the discharge is, surface or ground water.

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ¹	High	0.8 ²	0.8 ²	0.9 ²

TABLE 26.4 Indicative SuDS mitigation indices for discharges to groundwater				
Characteristics of the material overlying the proposed infiltration surface, through which the runoff percolates ^a	TSS	Metals	Hydrocarbons	
A layer of dense vegetation underlain by a soil with good contaminant attenuation potential ^a of at least 300 mm in depth ^a	0.6 ^a	0.5	0.6	
A soil with good contaminant attenuation potential ^a of at least 300 mm in depth ^a	0.4 ^a	0.3	0.3	
Infiltration trench (where a suitable depth of filtration material is included that provides treatment, ie graded gravel with sufficient smaller particles but not single size coarse aggregate such as 20 mm gravel) underlain by a soil with good contaminant attenuation potential ^a of at least 300 mm in depth ^a	0.4 ^a	0.4	0.4	
Constructed permeable pavement (where a suitable filtration layer is included that provides treatment, and including a geotextile at the base separating the foundation from the subgrade) underlain by a soil with good contaminant attenuation potential ^a of at least 300 mm in depth ^a	0.7	0.6	0.7	
Bioretention underlain by a soil with good contaminant attenuation potential ^a of at least 300 mm in depth ^a	0.8 ^a	0.6	0.8	
Proprietary treatment systems ^{a, b}	These must demonstrate that they can address each of the contaminant types to acceptable levels for inflow concentrations relevant to the contributing drainage area.			

CIRIA SuDS Manual states that 'To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index that equals or exceeds the pollution hazard index'

Total SuDS mitigation index ≥ pollution hazard index
(for each contaminant type) (for each contaminant type)

Pollution hazard indices for land use are as follows:

Roof and hard standing areas:	TTS 0.3	Metals 0.2	Hydrocarbons 0.05
Non-residential car parking:	TTS 0.7	Metals 0.6	Hydrocarbons 0.7

SuDS mitigation indices are determined by the material overlaying the proposed infiltration surface. The proposals for this site are gravel trenches therefore the indices are:

Permeable paving	TTS 0.7	Metals 0.6	Hydrocarbons 0.7
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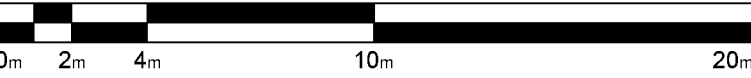
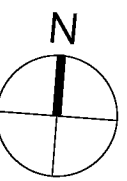
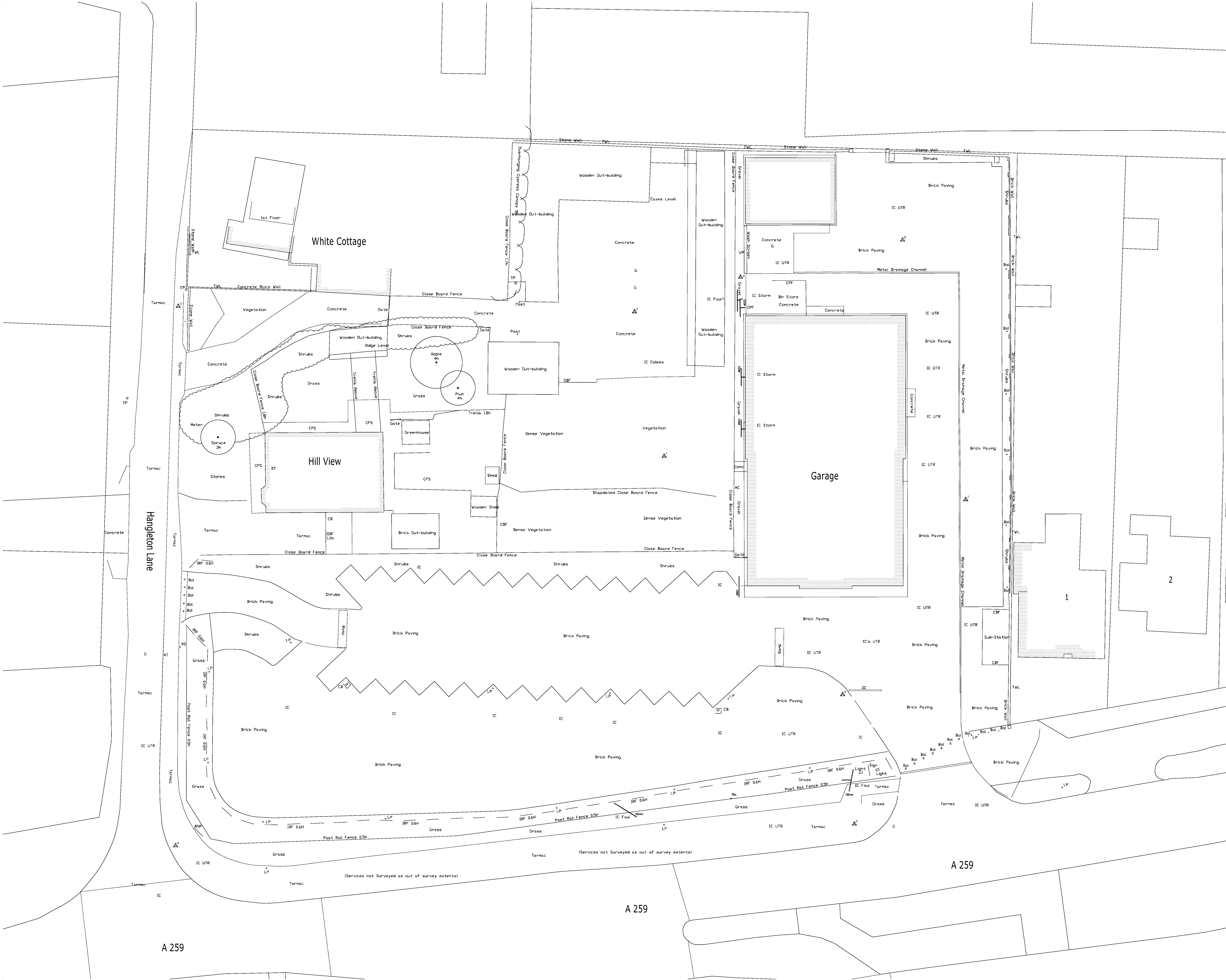
In addition to these SuDS, the channel drain sump boxes and two catchpits installed upstream of cellular soakaway will retain suspended sediments therefore providing enough treatment for the surface water drained from the roof areas and hard standing located to the north of the proposed building.

Workshop drains will be connected to the foul system via a Class II separator.

Appendix A

Surveys & Historic Information

Rev	Amendments	By	Chkd	Date



Scale 1:200

NOTES:

- Site information based on OS map data & Topographical survey from Yeomans ref. '1643'. Extent of Red Line still TBC.
- Preliminary layout for client discussion.
- Assumes existing power/services sufficient for new building footprint.
- All subject to full below ground services/utilities searches.

hnw
architects

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Project
**YEOMANS LIMITED
WORTHING
HONDA / OFFICE / PEUGEOT**

Drawing Title
**SITE PLAN
AS EXISTING**

Drawing Status
PRELIMINARY

HNW Project No.
17036

Scale
A1 - 1:200

Revision
-



Drawn By
RPN

Checked By
SD

Date
NOV 2017

Drawing Name
P151



EXISTING
DEVELOPMENT



PROPOSED
DEVELOPMENT

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GENERAL NOTES

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- Connections to Public sewers to be agreed and inspected by Water Authority.
- Invert level, size and cover levels to existing manholes and sewers to be checked prior to any construction. Any discrepancies to be reported immediately.
- Invert to base of soil stack bends to be 450mm below lowest branch connection for up to 3 storeys buildings. For buildings up to 5 storeys the invert to base of soil stack bends should be not less than 750mm.
- All RWP and Foul Water drain point setting out is to be confirmed by Architect.
- All RWP & SVP sizes & setting out by Architect / M&E Engineer. All below ground connections to match above ground outlet size, Min 100/110mm diameter.
- Foul drains to project 100mm above finished floor level.
- All internal Manholes and Inspection Chambers to have double sealed recessed covers to suit floor finishes by Architect.
- All external covers in footpaths and roads in non tarmac areas to have recessed trays to suit the paving material.
- Refer to drainage specification for pipe materials.
- All pipework to be 100/110Ø UNO. Refer to note 7 connection sizes.
- All foul and surface water drainage stacks to have above ground rodding access, refer to above ground drainage layout by others.
- This drawing has been produced in colour and should be reproduced in colour for clarity.
- A CCTV Survey and report in WINCAN format for all new drainage will be required before the "As Built" drawings will be issued.

IDENTIFIES RISKS DURING THE CONSTRUCTION PROCESS ON THE DRAWINGS:

NOTE: The list below and notes on the drawing identify risks which are deemed to be unusual, abnormal, residual or unexpected to a competent contractor carrying out the works. These notes relate to risks which we have been unable to design out.

P01	Preliminary Issue	NJ	GT	09.02.18
Rev.	Amendment	Dn	Chkd	Date

Dwg. Status	Suitability
Preliminary	S2

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Client **Yeomans Ltd**

Project **Yeomans Limited
Worthing
Honda/Office/Peugeot**

Title **Site Plan**

Reviewed Scheme	GT	Date	09.02.18
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Reviewed Final	Date
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Scales at A1	1:200	Project No.	S188010
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Project Ref.	Originator	Zone	Level	Type	Role	Dwg No.	Rev.
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AKSW XX GF DR C 9209 - P01

For Survey use only
 LK-63-00012
 CLASSIFICATION

NATURE OF STRATA

If measurements start below
 ground surface, state how far ...

Thickness

Depth

Feet Inches

Feet Inches

Dissected claystone

Brk. (lith. sand)

Upper Chalk

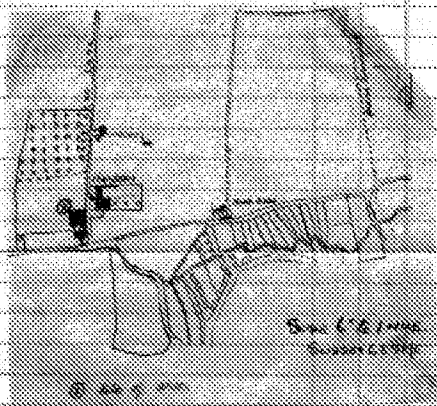
Middle Chalk

141 0 141 0

1918 Feb 13

DATE: 1918

NAME:



Appendix B

Existing Drainage Calculations

AKSWard		Page 1
Seacourt Tower	Yeomans Limited	
West Way	Worthing	
Oxford	Honda/Office/Peugeot	
Date 09/02/2018	Designed by NJ	
File	Checked by GT	
Micro Drainage		Source Control 2017.1.2
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 1 Soil 0.300 Area (ha) 0.267 Urban 0.400 SAAR (mm) 719 Region Number Region 7 Results l/s QBAR Rural 0.5 QBAR Urban 1.0 Q1 year 0.9 Q1 year 0.9 Q30 years 1.9 Q100 years 2.4		
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AKSWard		Page 1																										
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West Way	Worthing																											
Oxford	Honda/Office/Peugeot																											
Date 09/02/2018	Designed by NJ																											
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<u>Greenfield Runoff Volume</u> FSR Data <table> <tr> <td>Return Period (years)</td> <td>1</td> </tr> <tr> <td>Storm Duration (mins)</td> <td>360</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> </tr> <tr> <td>M5-60 (mm)</td> <td>19.200</td> </tr> <tr> <td>Ratio R</td> <td>0.350</td> </tr> <tr> <td>Areal Reduction Factor</td> <td>1.00</td> </tr> <tr> <td>Area (ha)</td> <td>0.267</td> </tr> <tr> <td>SAAR (mm)</td> <td>719</td> </tr> <tr> <td>CWI</td> <td>107.452</td> </tr> <tr> <td>Urban</td> <td>0.400</td> </tr> <tr> <td>SPR</td> <td>30.000</td> </tr> </table> Results <table> <tr> <td>Percentage Runoff (%)</td> <td>30.94</td> </tr> <tr> <td>Greenfield Runoff Volume (m³)</td> <td>18.474</td> </tr> </table>			Return Period (years)	1	Storm Duration (mins)	360	Region	England and Wales	M5-60 (mm)	19.200	Ratio R	0.350	Areal Reduction Factor	1.00	Area (ha)	0.267	SAAR (mm)	719	CWI	107.452	Urban	0.400	SPR	30.000	Percentage Runoff (%)	30.94	Greenfield Runoff Volume (m³)	18.474
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Appendix C

Proposed Site Plans

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Key

- Storm Polypropylene Inspection Chamber
- Storm Concrete Manhole
- Permeable Paving
- Impermeable Paving with Permeable Sub-base
- Foul Polypropylene Inspection Chamber
- Foul Concrete Manhole

- New Foul Sewer
- New Surface Water Sewer
- New Linear Drainage System

Existing Drainage

- Existing Manholes
- Existing Foul Sewer
- Existing Surface Water Sewer
- Existing Sewers to be abandoned and grouted up either end

P02	Car park surface amended	NJ	GT	15.02.18
P01	Preliminary Issue	NJ	GT	09.02.18
Rev.	Amendment	Dn	Chkd	Date

Dwg. Status	Suitability
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Project **Yeomans Limited
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Honda/Office/Peugeot**

Title **Drainage Layout**

Reviewed Scheme	GT	Date	09.02.18				
Reviewed Final		Date					
Scales at A1	1:200	Project No.	S188010				
Project Ref.	Originator	Zone	Level	Type	Role	Dwg No.	Rev.

AKSW XX-GF-DR C-9201 - P02

Appendix D

Proposed Drainage Calculations

AKSWard		Page 1																																																																																																																																																																																																																		
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K</td></tr><tr><td>600 min Summer</td><td>49.598</td><td>0.078</td><td>1.8</td><td>3.0</td><td>○ K</td></tr><tr><td>720 min Summer</td><td>49.593</td><td>0.073</td><td>1.7</td><td>2.6</td><td>○ K</td></tr><tr><td>960 min Summer</td><td>49.585</td><td>0.065</td><td>1.5</td><td>2.1</td><td>○ K</td></tr><tr><td>1440 min Summer</td><td>49.574</td><td>0.054</td><td>1.2</td><td>1.4</td><td>○ K</td></tr><tr><td>2160 min Summer</td><td>49.566</td><td>0.046</td><td>1.0</td><td>1.0</td><td>○ K</td></tr><tr><td>2880 min Summer</td><td>49.562</td><td>0.042</td><td>0.8</td><td>0.9</td><td>○ K</td></tr><tr><td>4320 min Summer</td><td>49.556</td><td>0.036</td><td>0.6</td><td>0.6</td><td>○ K</td></tr><tr><td>5760 min Summer</td><td>49.553</td><td>0.033</td><td>0.5</td><td>0.5</td><td>○ K</td></tr><tr><td>7200 min Summer</td><td>49.550</td><td>0.030</td><td>0.4</td><td>0.4</td><td>○ K</td></tr><tr><td>8640 min Summer</td><td>49.548</td><td>0.028</td><td>0.4</td><td>0.4</td><td>○ 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Summer</td><td>2.309</td><td>0.0</td><td>384</td></tr><tr><td>960 min Summer</td><td>1.894</td><td>0.0</td><td>502</td></tr><tr><td>1440 min Summer</td><td>1.433</td><td>0.0</td><td>738</td></tr><tr><td>2160 min Summer</td><td>1.083</td><td>0.0</td><td>1100</td></tr><tr><td>2880 min Summer</td><td>0.888</td><td>0.0</td><td>1468</td></tr><tr><td>4320 min Summer</td><td>0.672</td><td>0.0</td><td>2196</td></tr><tr><td>5760 min Summer</td><td>0.552</td><td>0.0</td><td>2880</td></tr><tr><td>7200 min Summer</td><td>0.474</td><td>0.0</td><td>3664</td></tr><tr><td>8640 min Summer</td><td>0.417</td><td>0.0</td><td>4336</td></tr><tr><td>10080 min Summer</td><td>0.374</td><td>0.0</td><td>5136</td></tr><tr><td>15 min Winter</td><td>28.417</td><td>0.0</td><td>17</td></tr></table>			Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	49.559	0.039	0.7	0.8	○ K	30 min Summer	49.582	0.062	1.4	1.9	○ K	60 min Summer	49.597	0.077	1.8	2.9	○ K	120 min Summer	49.608	0.088	2.0	3.8	○ K	180 min Summer	49.610	0.090	2.1	4.0	○ K	240 min Summer	49.611	0.091	2.1	4.1	○ K	360 min Summer	49.607	0.087	2.0	3.7	○ K	480 min Summer	49.602	0.082	1.9	3.4	○ K	600 min Summer	49.598	0.078	1.8	3.0	○ K	720 min Summer	49.593	0.073	1.7	2.6	○ K	960 min Summer	49.585	0.065	1.5	2.1	○ K	1440 min Summer	49.574	0.054	1.2	1.4	○ K	2160 min Summer	49.566	0.046	1.0	1.0	○ K	2880 min Summer	49.562	0.042	0.8	0.9	○ K	4320 min Summer	49.556	0.036	0.6	0.6	○ K	5760 min Summer	49.553	0.033	0.5	0.5	○ K	7200 min Summer	49.550	0.030	0.4	0.4	○ K	8640 min Summer	49.548	0.028	0.4	0.4	○ K	10080 min Summer	49.546	0.026	0.3	0.3	○ K	15 min Winter	49.572	0.052	1.2	1.3	○ K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	15 min Summer	28.417	0.0	18	30 min Summer	18.860	0.0	30	60 min Summer	12.227	0.0	46	120 min Summer	7.783	0.0	78	180 min Summer	5.952	0.0	112	240 min Summer	4.917	0.0	144	360 min Summer	3.727	0.0	206	480 min Summer	3.055	0.0	266	600 min Summer	2.619	0.0	326	720 min Summer	2.309	0.0	384	960 min Summer	1.894	0.0	502	1440 min Summer	1.433	0.0	738	2160 min Summer	1.083	0.0	1100	2880 min Summer	0.888	0.0	1468	4320 min Summer	0.672	0.0	2196	5760 min Summer	0.552	0.0	2880	7200 min Summer	0.474	0.0	3664	8640 min Summer	0.417	0.0	4336	10080 min Summer	0.374	0.0	5136	15 min Winter	28.417	0.0	17
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Seacourt Tower	Yeomans Limited				
West Way	Worthing				
Oxford	Honda/Office/Peugeot				
Date 09/02/2018	Designed by NJ				
File Permeable Paving.srcx	Checked by GT				
Micro Drainage	Source Control 2017.1.2				
<u>Summary of Results for 1 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	49.594	0.074	1.7	2.7	O K
60 min Winter	49.608	0.088	2.0	3.8	O K
120 min Winter	49.615	0.095	2.2	4.4	O K
180 min Winter	49.614	0.094	2.2	4.4	O K
240 min Winter	49.611	0.091	2.1	4.1	O K
360 min Winter	49.603	0.083	1.9	3.4	O K
480 min Winter	49.595	0.075	1.7	2.8	O K
600 min Winter	49.588	0.068	1.6	2.3	O K
720 min Winter	49.582	0.062	1.4	1.9	O K
960 min Winter	49.573	0.053	1.2	1.4	O K
1440 min Winter	49.565	0.045	0.9	1.0	O K
2160 min Winter	49.559	0.039	0.7	0.8	O K
2880 min Winter	49.555	0.035	0.6	0.6	O K
4320 min Winter	49.550	0.030	0.4	0.5	O K
5760 min Winter	49.547	0.027	0.3	0.4	O K
7200 min Winter	49.545	0.025	0.3	0.3	O K
8640 min Winter	49.543	0.023	0.2	0.3	O K
10080 min Winter	49.542	0.022	0.2	0.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	18.860	0.0	30		
60 min Winter	12.227	0.0	48		
120 min Winter	7.783	0.0	84		
180 min Winter	5.952	0.0	118		
240 min Winter	4.917	0.0	152		
360 min Winter	3.727	0.0	214		
480 min Winter	3.055	0.0	274		
600 min Winter	2.619	0.0	332		
720 min Winter	2.309	0.0	390		
960 min Winter	1.894	0.0	508		
1440 min Winter	1.433	0.0	734		
2160 min Winter	1.083	0.0	1092		
2880 min Winter	0.888	0.0	1424		
4320 min Winter	0.672	0.0	2204		
5760 min Winter	0.552	0.0	2928		
7200 min Winter	0.474	0.0	3664		
8640 min Winter	0.417	0.0	4400		
10080 min Winter	0.374	0.0	5048		
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<u>Summary of Results for 30 year Return Period</u> Half Drain Time : 44 minutes. <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>49.650</td><td>0.130</td><td>3.0</td><td>8.4</td><td>O K</td></tr><tr><td>30 min Summer</td><td>49.673</td><td>0.153</td><td>3.5</td><td>11.6</td><td>O K</td></tr><tr><td>60 min Summer</td><td>49.687</td><td>0.167</td><td>3.8</td><td>13.8</td><td>O K</td></tr><tr><td>120 min Summer</td><td>49.695</td><td>0.175</td><td>4.0</td><td>15.1</td><td>O K</td></tr><tr><td>180 min Summer</td><td>49.694</td><td>0.174</td><td>4.0</td><td>14.9</td><td>O K</td></tr><tr><td>240 min Summer</td><td>49.690</td><td>0.170</td><td>3.9</td><td>14.2</td><td>O K</td></tr><tr><td>360 min Summer</td><td>49.680</td><td>0.160</td><td>3.6</td><td>12.6</td><td>O K</td></tr><tr><td>480 min Summer</td><td>49.670</td><td>0.150</td><td>3.4</td><td>11.1</td><td>O 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Summer</td><td>4.877</td><td>0.0</td><td>398</td></tr><tr><td>960 min Summer</td><td>3.929</td><td>0.0</td><td>520</td></tr><tr><td>1440 min Summer</td><td>2.893</td><td>0.0</td><td>754</td></tr><tr><td>2160 min Summer</td><td>2.127</td><td>0.0</td><td>1120</td></tr><tr><td>2880 min Summer</td><td>1.708</td><td>0.0</td><td>1472</td></tr><tr><td>4320 min Summer</td><td>1.253</td><td>0.0</td><td>2200</td></tr><tr><td>5760 min Summer</td><td>1.005</td><td>0.0</td><td>2888</td></tr><tr><td>7200 min Summer</td><td>0.846</td><td>0.0</td><td>3672</td></tr><tr><td>8640 min Summer</td><td>0.736</td><td>0.0</td><td>4384</td></tr><tr><td>10080 min Summer</td><td>0.654</td><td>0.0</td><td>5136</td></tr><tr><td>15 min Winter</td><td>69.605</td><td>0.0</td><td>17</td></tr></table>			Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	49.650	0.130	3.0	8.4	O K	30 min Summer	49.673	0.153	3.5	11.6	O K	60 min Summer	49.687	0.167	3.8	13.8	O K	120 min Summer	49.695	0.175	4.0	15.1	O K	180 min Summer	49.694	0.174	4.0	14.9	O K	240 min Summer	49.690	0.170	3.9	14.2	O K	360 min Summer	49.680	0.160	3.6	12.6	O K	480 min Summer	49.670	0.150	3.4	11.1	O K	600 min Summer	49.661	0.141	3.2	9.8	O K	720 min Summer	49.653	0.133	3.0	8.7	O K	960 min Summer	49.639	0.119	2.7	7.0	O K	1440 min Summer	49.618	0.098	2.2	4.8	O K	2160 min Summer	49.598	0.078	1.8	3.0	O K	2880 min Summer	49.586	0.066	1.5	2.1	O K	4320 min Summer	49.570	0.050	1.1	1.2	O K	5760 min Summer	49.565	0.045	0.9	1.0	O K	7200 min Summer	49.561	0.041	0.8	0.8	O K	8640 min Summer	49.558	0.038	0.7	0.7	O K	10080 min Summer	49.556	0.036	0.6	0.6	O K	15 min Winter	49.663	0.143	3.3	10.1	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	15 min Summer	69.605	0.0	17	30 min Summer	46.335	0.0	30	60 min Summer	29.553	0.0	46	120 min Summer	18.298	0.0	80	180 min Summer	13.667	0.0	114	240 min Summer	11.055	0.0	148	360 min Summer	8.183	0.0	212	480 min Summer	6.606	0.0	276	600 min Summer	5.592	0.0	338	720 min Summer	4.877	0.0	398	960 min Summer	3.929	0.0	520	1440 min Summer	2.893	0.0	754	2160 min Summer	2.127	0.0	1120	2880 min Summer	1.708	0.0	1472	4320 min Summer	1.253	0.0	2200	5760 min Summer	1.005	0.0	2888	7200 min Summer	0.846	0.0	3672	8640 min Summer	0.736	0.0	4384	10080 min Summer	0.654	0.0	5136	15 min Winter	69.605	0.0	17
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Date 09/02/2018	Designed by NJ				
File Permeable Paving.srcx	Checked by GT				
Micro Drainage	Source Control 2017.1.2				
<u>Summary of Results for 30 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	49.687	0.167	3.8	13.7	O K
60 min Winter	49.700	0.180	4.1	16.0	Flood Risk
120 min Winter	49.704	0.184	4.2	16.8	Flood Risk
180 min Winter	49.700	0.180	4.1	16.0	O K
240 min Winter	49.693	0.173	3.9	14.8	O K
360 min Winter	49.678	0.158	3.6	12.3	O K
480 min Winter	49.664	0.144	3.3	10.2	O K
600 min Winter	49.652	0.132	3.0	8.5	O K
720 min Winter	49.641	0.121	2.8	7.2	O K
960 min Winter	49.624	0.104	2.4	5.3	O K
1440 min Winter	49.601	0.081	1.8	3.2	O K
2160 min Winter	49.581	0.061	1.4	1.8	O K
2880 min Winter	49.570	0.050	1.1	1.2	O K
4320 min Winter	49.562	0.042	0.8	0.9	O K
5760 min Winter	49.558	0.038	0.7	0.7	O K
7200 min Winter	49.555	0.035	0.6	0.6	O K
8640 min Winter	49.552	0.032	0.5	0.5	O K
10080 min Winter	49.550	0.030	0.4	0.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	46.335	0.0	30		
60 min Winter	29.553	0.0	50		
120 min Winter	18.238	0.0	86		
180 min Winter	13.667	0.0	124		
240 min Winter	11.055	0.0	158		
360 min Winter	8.183	0.0	224		
480 min Winter	6.606	0.0	288		
600 min Winter	5.592	0.0	350		
720 min Winter	4.877	0.0	412		
960 min Winter	3.929	0.0	530		
1440 min Winter	2.893	0.0	764		
2160 min Winter	2.127	0.0	1108		
2880 min Winter	1.708	0.0	1464		
4320 min Winter	1.253	0.0	2168		
5760 min Winter	1.005	0.0	2904		
7200 min Winter	0.846	0.0	3624		
8640 min Winter	0.736	0.0	4360		
10080 min Winter	0.654	0.0	5104		
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<u>Summary of Results for 100 year Return Period</u> Half Drain Time : 51 minutes. <table><thead><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr></thead><tbody><tr><td>15 min Summer</td><td>49.678</td><td>0.158</td><td>3.6</td><td>12.4</td><td>O K</td></tr><tr><td>30 min Summer</td><td>49.705</td><td>0.185</td><td>4.2</td><td>16.9</td><td>Flood Risk</td></tr><tr><td>60 min Summer</td><td>49.721</td><td>0.201</td><td>4.6</td><td>19.9</td><td>Flood Risk</td></tr><tr><td>120 min Summer</td><td>49.729</td><td>0.209</td><td>4.8</td><td>21.6</td><td>Flood Risk</td></tr><tr><td>180 min Summer</td><td>49.728</td><td>0.208</td><td>4.7</td><td>21.3</td><td>Flood Risk</td></tr><tr><td>240 min Summer</td><td>49.723</td><td>0.203</td><td>4.6</td><td>20.3</td><td>Flood Risk</td></tr><tr><td>360 min Summer</td><td>49.711</td><td>0.191</td><td>4.4</td><td>18.1</td><td>Flood Risk</td></tr><tr><td>480 min Summer</td><td>49.700</td><td>0.180</td><td>4.1</td><td>16.0</td><td>O K</td></tr><tr><td>600 min Summer</td><td>49.690</td><td>0.170</td><td>3.9</td><td>14.2</td><td>O K</td></tr><tr><td>720 min Summer</td><td>49.680</td><td>0.160</td><td>3.7</td><td>12.7</td><td>O K</td></tr><tr><td>960 min Summer</td><td>49.664</td><td>0.144</td><td>3.3</td><td>10.3</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>49.640</td><td>0.120</td><td>2.7</td><td>7.1</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>49.616</td><td>0.096</td><td>2.2</td><td>4.6</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>49.600</td><td>0.080</td><td>1.8</td><td>3.2</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>49.581</td><td>0.061</td><td>1.4</td><td>1.8</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>49.570</td><td>0.050</td><td>1.1</td><td>1.2</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>49.565</td><td>0.045</td><td>0.9</td><td>1.0</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>49.562</td><td>0.042</td><td>0.8</td><td>0.9</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>49.559</td><td>0.039</td><td>0.7</td><td>0.8</td><td>O K</td></tr><tr><td>15 min Winter</td><td>49.692</td><td>0.172</td><td>3.9</td><td>14.6</td><td>O K</td></tr></tbody></table> <table><thead><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Time-Peak (mins)</th></tr></thead><tbody><tr><td>15 min Summer</td><td>90.053</td><td>0.0</td><td>17</td></tr><tr><td>30 min Summer</td><td>60.532</td><td>0.0</td><td>31</td></tr><tr><td>60 min Summer</td><td>38.834</td><td>0.0</td><td>48</td></tr><tr><td>120 min Summer</td><td>24.053</td><td>0.0</td><td>82</td></tr><tr><td>180 min Summer</td><td>17.903</td><td>0.0</td><td>116</td></tr><tr><td>240 min Summer</td><td>14.414</td><td>0.0</td><td>150</td></tr><tr><td>360 min Summer</td><td>10.599</td><td>0.0</td><td>216</td></tr><tr><td>480 min Summer</td><td>8.517</td><td>0.0</td><td>280</td></tr><tr><td>600 min Summer</td><td>7.181</td><td>0.0</td><td>342</td></tr><tr><td>720 min Summer</td><td>6.244</td><td>0.0</td><td>404</td></tr><tr><td>960 min Summer</td><td>5.002</td><td>0.0</td><td>522</td></tr><tr><td>1440 min Summer</td><td>3.653</td><td>0.0</td><td>764</td></tr><tr><td>2160 min Summer</td><td>2.662</td><td>0.0</td><td>1124</td></tr><tr><td>2880 min Summer</td><td>2.124</td><td>0.0</td><td>1472</td></tr><tr><td>4320 min Summer</td><td>1.542</td><td>0.0</td><td>2204</td></tr><tr><td>5760 min Summer</td><td>1.227</td><td>0.0</td><td>2928</td></tr><tr><td>7200 min Summer</td><td>1.027</td><td>0.0</td><td>3616</td></tr><tr><td>8640 min Summer</td><td>0.889</td><td>0.0</td><td>4384</td></tr><tr><td>10080 min Summer</td><td>0.787</td><td>0.0</td><td>4984</td></tr><tr><td>15 min Winter</td><td>90.053</td><td>0.0</td><td>17</td></tr></tbody></table>			Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	49.678	0.158	3.6	12.4	O K	30 min Summer	49.705	0.185	4.2	16.9	Flood Risk	60 min Summer	49.721	0.201	4.6	19.9	Flood Risk	120 min Summer	49.729	0.209	4.8	21.6	Flood Risk	180 min Summer	49.728	0.208	4.7	21.3	Flood Risk	240 min Summer	49.723	0.203	4.6	20.3	Flood Risk	360 min Summer	49.711	0.191	4.4	18.1	Flood Risk	480 min Summer	49.700	0.180	4.1	16.0	O K	600 min Summer	49.690	0.170	3.9	14.2	O K	720 min Summer	49.680	0.160	3.7	12.7	O K	960 min Summer	49.664	0.144	3.3	10.3	O K	1440 min Summer	49.640	0.120	2.7	7.1	O K	2160 min Summer	49.616	0.096	2.2	4.6	O K	2880 min Summer	49.600	0.080	1.8	3.2	O K	4320 min Summer	49.581	0.061	1.4	1.8	O K	5760 min Summer	49.570	0.050	1.1	1.2	O K	7200 min Summer	49.565	0.045	0.9	1.0	O K	8640 min Summer	49.562	0.042	0.8	0.9	O K	10080 min Summer	49.559	0.039	0.7	0.8	O K	15 min Winter	49.692	0.172	3.9	14.6	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	15 min Summer	90.053	0.0	17	30 min Summer	60.532	0.0	31	60 min Summer	38.834	0.0	48	120 min Summer	24.053	0.0	82	180 min Summer	17.903	0.0	116	240 min Summer	14.414	0.0	150	360 min Summer	10.599	0.0	216	480 min Summer	8.517	0.0	280	600 min Summer	7.181	0.0	342	720 min Summer	6.244	0.0	404	960 min Summer	5.002	0.0	522	1440 min Summer	3.653	0.0	764	2160 min Summer	2.662	0.0	1124	2880 min Summer	2.124	0.0	1472	4320 min Summer	1.542	0.0	2204	5760 min Summer	1.227	0.0	2928	7200 min Summer	1.027	0.0	3616	8640 min Summer	0.889	0.0	4384	10080 min Summer	0.787	0.0	4984	15 min Winter	90.053	0.0	17
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Micro Drainage	Source Control 2017.1.2				
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	49.720	0.200	4.6	19.7	Flood Risk
60 min Winter	49.736	0.216	4.9	23.0	Flood Risk
120 min Winter	49.741	0.221	5.1	24.2	Flood Risk
180 min Winter	49.737	0.217	5.0	23.1	Flood Risk
240 min Winter	49.728	0.208	4.8	21.4	Flood Risk
360 min Winter	49.711	0.191	4.4	18.1	Flood Risk
480 min Winter	49.695	0.175	4.0	15.2	O K
600 min Winter	49.681	0.161	3.7	12.8	O K
720 min Winter	49.669	0.149	3.4	10.9	O K
960 min Winter	49.649	0.129	2.9	8.2	O K
1440 min Winter	49.621	0.101	2.3	5.0	O K
2160 min Winter	49.596	0.076	1.7	2.8	O K
2880 min Winter	49.581	0.061	1.4	1.8	O K
4320 min Winter	49.567	0.047	1.0	1.1	O K
5760 min Winter	49.562	0.042	0.8	0.9	O K
7200 min Winter	49.558	0.038	0.7	0.7	O K
8640 min Winter	49.555	0.035	0.6	0.6	O K
10080 min Winter	49.553	0.033	0.5	0.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	60.532	0.0	30		
60 min Winter	38.834	0.0	50		
120 min Winter	24.053	0.0	88		
180 min Winter	17.903	0.0	126		
240 min Winter	14.414	0.0	160		
360 min Winter	10.599	0.0	228		
480 min Winter	8.517	0.0	292		
600 min Winter	7.181	0.0	356		
720 min Winter	6.244	0.0	418		
960 min Winter	5.002	0.0	538		
1440 min Winter	3.653	0.0	776		
2160 min Winter	2.662	0.0	1124		
2880 min Winter	2.124	0.0	1472		
4320 min Winter	1.542	0.0	2152		
5760 min Winter	1.227	0.0	2936		
7200 min Winter	1.027	0.0	3584		
8640 min Winter	0.889	0.0	4400		
10080 min Winter	0.787	0.0	5040		
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Micro Drainage	Source Control 2017.1.2				
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Half Drain Time : 62 minutes.					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	49.719	0.199		4.6	19.6 Flood Risk
30 min Summer	49.750	0.230		5.2	26.1 Flood Risk
60 min Summer	49.769	0.249		5.7	30.5 Flood Risk
120 min Summer	49.778	0.258		5.9	32.9 Flood Risk
180 min Summer	49.777	0.257		5.9	32.6 Flood Risk
240 min Summer	49.772	0.252		5.8	31.4 Flood Risk
360 min Summer	49.760	0.240		5.5	28.4 Flood Risk
480 min Summer	49.748	0.228		5.2	25.6 Flood Risk
600 min Summer	49.736	0.216		4.9	23.1 Flood Risk
720 min Summer	49.726	0.206		4.7	20.9 Flood Risk
960 min Summer	49.707	0.187		4.3	17.3 Flood Risk
1440 min Summer	49.679	0.159		3.6	12.5 O K
2160 min Summer	49.650	0.130		3.0	8.3 O K
2880 min Summer	49.630	0.110		2.5	5.9 O K
4320 min Summer	49.604	0.084		1.9	3.5 O K
5760 min Summer	49.588	0.068		1.6	2.3 O K
7200 min Summer	49.577	0.057		1.3	1.6 O K
8640 min Summer	49.570	0.050		1.1	1.2 O K
10080 min Summer	49.567	0.047		1.0	1.1 O K
15 min Winter	49.734	0.214		4.9	22.6 Flood Risk
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
15 min Summer	126.074	0.0	17		
30 min Summer	84.745	0.0	31		
60 min Summer	54.368	0.0	52		
120 min Summer	33.674	0.0	84		
180 min Summer	25.065	0.0	118		
240 min Summer	20.180	0.0	152		
360 min Summer	14.839	0.0	220		
480 min Summer	11.923	0.0	284		
600 min Summer	10.054	0.0	348		
720 min Summer	8.741	0.0	410		
960 min Summer	7.003	0.0	530		
1440 min Summer	5.114	0.0	776		
2160 min Summer	3.727	0.0	1128		
2880 min Summer	2.973	0.0	1496		
4320 min Summer	2.159	0.0	2204		
5760 min Summer	1.718	0.0	2936		
7200 min Summer	1.438	0.0	3672		
8640 min Summer	1.245	0.0	4400		
10080 min Summer	1.102	0.0	5136		
15 min Winter	126.074	0.0	17		
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Micro Drainage	Source Control 2017.1.2				
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	49.767	0.247	5.6	30.1	Flood Risk
60 min Winter	49.787	0.267	6.1	35.1	Flood Risk
120 min Winter	49.794	0.274	6.2	37.1	Flood Risk
180 min Winter	49.790	0.270	6.2	36.0	Flood Risk
240 min Winter	49.782	0.262	6.0	33.8	Flood Risk
360 min Winter	49.764	0.244	5.6	29.3	Flood Risk
480 min Winter	49.746	0.226	5.2	25.2	Flood Risk
600 min Winter	49.730	0.210	4.8	21.8	Flood Risk
720 min Winter	49.716	0.196	4.5	19.0	Flood Risk
960 min Winter	49.692	0.172	3.9	14.6	O K
1440 min Winter	49.657	0.137	3.1	9.3	O K
2160 min Winter	49.625	0.105	2.4	5.5	O K
2880 min Winter	49.605	0.085	1.9	3.6	O K
4320 min Winter	49.582	0.062	1.4	1.9	O K
5760 min Winter	49.570	0.050	1.1	1.2	O K
7200 min Winter	49.566	0.046	1.0	1.0	O K
8640 min Winter	49.562	0.042	0.8	0.9	O K
10080 min Winter	49.560	0.040	0.7	0.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	84.745	0.0	31		
60 min Winter	54.368	0.0	56		
120 min Winter	33.674	0.0	90		
180 min Winter	25.065	0.0	128		
240 min Winter	20.180	0.0	164		
360 min Winter	14.839	0.0	234		
480 min Winter	11.923	0.0	300		
600 min Winter	10.054	0.0	364		
720 min Winter	8.741	0.0	426		
960 min Winter	7.003	0.0	550		
1440 min Winter	5.114	0.0	792		
2160 min Winter	3.727	0.0	1144		
2880 min Winter	2.973	0.0	1496		
4320 min Winter	2.159	0.0	2204		
5760 min Winter	1.718	0.0	2832		
7200 min Winter	1.438	0.0	3608		
8640 min Winter	1.245	0.0	4264		
10080 min Winter	1.102	0.0	5000		
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File Permeable Paving.srcx	Checked by GT																															
Micro Drainage		Source Control 2017.1.2																														
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>19.200</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.350</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.115 <table> <tr> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To: (ha)</th> </tr> <tr> <td>0</td> <td>4 0.115</td> </tr> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	19.200	Shortest Storm (mins)	15	Ratio R	0.350	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+40	Time (mins)	Area	From:	To: (ha)	0	4 0.115
Rainfall Model	FSR	Winter Storms	Yes																													
Return Period (years)	100	Cv (Summer)	0.750																													
Region	England and Wales	Cv (Winter)	0.840																													
M5-60 (mm)	19.200	Shortest Storm (mins)	15																													
Ratio R	0.350	Longest Storm (mins)	10080																													
Summer Storms	Yes	Climate Change %	+40																													
Time (mins)	Area																															
From:	To: (ha)																															
0	4 0.115																															
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Micro Drainage	Network 2017.1.2	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.200	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.800
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.200	Storm Duration (mins)	30
Ratio R	0.350		

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<u>Online Controls for Storm</u> <u>Weir Manhole: Soakaway, DS/PN: S1.005, Volume (m³): 2.3</u> Discharge Coef 0.544 Width (m) 0.100 Invert Level (m) 49.850		
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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.200 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
720, 960, 1440, 2160, 2880, 4320, 5760,
7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S01	15 Winter	1	+0%	100/15 Summer			
S1.001	S02	15 Winter	1	+0%	100/15 Summer			
S1.002	S03	15 Winter	1	+0%	100/360 Winter			
S2.000	S04	15 Winter	1	+0%	100/480 Winter			
S1.003	S_JT	15 Winter	1	+0%	100/360 Winter			
S1.004	S05	15 Winter	1	+0%	100/15 Summer			
S3.000	S06	15 Winter	1	+0%	100/15 Summer			
S3.001	S07	15 Winter	1	+0%	100/15 Summer			
S3.002	S08	15 Winter	1	+0%	100/15 Summer			
S1.005	Soakaway	360 Winter	1	+0%	100/240 Winter			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S01	49.091	-0.109	0.000	0.16		2.7	OK	
S1.001	S02	48.950	-0.089	0.000	0.34		5.5	OK	
S1.002	S03	48.750	-0.156	0.000	0.20		6.1	OK	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S2.000	S04	49.078	-0.122	0.000	0.08	2.5	OK	
S1.003	S_JT	48.700	-0.156	0.000	0.20	8.6	OK*	
S1.004	S05	48.591	-0.152	0.000	0.23	8.6	OK	
S3.000	S06	49.097	-0.103	0.000	0.21	3.6	OK	
S3.001	S07	48.931	-0.087	0.000	0.37	6.1	OK	
S3.002	S08	48.754	-0.091	0.000	0.32	6.1	OK	
S1.005	Soakaway	47.952	-0.701	0.000	0.00	0.0	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.200 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
720, 960, 1440, 2160, 2880, 4320, 5760,
7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S01	15 Winter	30	+0%	100/15 Summer			
S1.001	S02	15 Winter	30	+0%	100/15 Summer			
S1.002	S03	15 Winter	30	+0%	100/360 Winter			
S2.000	S04	15 Winter	30	+0%	100/480 Winter			
S1.003	S_JT	15 Winter	30	+0%	100/360 Winter			
S1.004	S05	15 Winter	30	+0%	100/15 Summer			
S3.000	S06	15 Winter	30	+0%	100/15 Summer			
S3.001	S07	15 Winter	30	+0%	100/15 Summer			
S3.002	S08	15 Winter	30	+0%	100/15 Summer			
S1.005	Soakaway	360 Winter	30	+0%	100/240 Winter			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S01	49.116	-0.084	0.000	0.40		6.5	OK	
S1.001	S02	49.005	-0.034	0.000	0.94		15.2	OK	
S1.002	S03	48.804	-0.102	0.000	0.56		16.9	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S2.000	S04	49.095	-0.105	0.000	0.20	6.1	OK	
S1.003	S_JT	48.750	-0.106	0.000	0.54	22.8	OK*	
S1.004	S05	48.647	-0.095	0.000	0.63	23.0	OK	
S3.000	S06	49.128	-0.072	0.000	0.52	8.7	OK	
S3.001	S07	48.989	-0.028	0.000	0.98	16.2	OK	
S3.002	S08	48.804	-0.042	0.000	0.86	16.3	OK	
S1.005	Soakaway	48.222	-0.431	0.000	0.00	0.0	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.200 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
720, 960, 1440, 2160, 2880, 4320, 5760,
7200, 8640, 10080
Return Period(s) (years) 100
Climate Change (%) 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S01	15 Winter	100	+0%				
S1.001	S02	15 Winter	100	+0%	100/15 Summer			
S1.002	S03	15 Winter	100	+0%				
S2.000	S04	15 Winter	100	+0%				
S1.003	SJT	15 Winter	100	+0%				
S1.004	S05	15 Winter	100	+0%				
S3.000	S06	15 Winter	100	+0%				
S3.001	S07	15 Winter	100	+0%	100/15 Summer			
S3.002	S08	15 Winter	100	+0%	100/15 Winter			
S1.005	Soakaway	480 Winter	100	+0%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Pipe Flow / Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S01	49.139	-0.061	0.000	0.51	8.4	OK	
S1.001	S02	49.096	0.057	0.000	1.19	19.2	SURCHARGED	
S1.002	S03	48.824	-0.082	0.000	0.71	21.4	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water		Surcharged		Flooded		Pipe		Status	Level Exceeded
		Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)				
S2.000	S04	49.101	-0.099	0.000	0.25		7.9			OK	
S1.003	S_JT	48.769	-0.087	0.000	0.69		29.1			OK*	
S1.004	S05	48.669	-0.074	0.000	0.79		28.8			OK	
S3.000	S06	49.185	-0.015	0.000	0.67		11.1			OK	
S3.001	S07	48.102	0.085	0.000	1.22		20.1			SURCHARGED	
S3.002	S08	48.852	0.007	0.000	1.03		19.5			SURCHARGED	
S1.005	Soakaway	48.380	-0.274	0.000	0.00		0.0			OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
 Number of Online Controls 1 Number of Time/Area Diagrams 0
 Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.200 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
 Analysis Timestep Fine Inertia Status ON
 DTS Status OFF

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S01	15 Winter	100	+40%	100/15 Summer			
S1.001	S02	15 Winter	100	+40%	100/15 Summer			
S1.002	S03	600 Winter	100	+40%	100/360 Winter			
S2.000	S04	600 Winter	100	+40%	100/480 Winter			
S1.003	S_JT	480 Winter	100	+40%	100/360 Winter			
S1.004	S05	600 Winter	100	+40%	100/15 Summer			
S3.000	S06	15 Winter	100	+40%	100/15 Summer			
S3.001	S07	15 Winter	100	+40%	100/15 Summer			
S3.002	S08	600 Winter	100	+40%	100/15 Summer			
S1.005	Soakaway	600 Winter	100	+40%	100/240 Winter			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S01	49.361	0.161	0.000	0.73	12.0	SURCHARGED	
S1.001	S02	49.286	0.241	0.000	1.64	26.5	SURCHARGED	
S1.002	S03	49.275	0.369	0.000	0.10	3.1	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S2.000	S04	49.275	0.075	0.000	0.04	1.1	SURCHARGED	
S1.003	S_JT	48.873	0.017	0.000	0.12	5.0	SURCHARGED*	
S1.004	S05	49.274	0.531	0.000	0.12	4.3	SURCHARGED	
S3.000	S06	49.587	0.387	0.000	0.88	14.6	SURCHARGED	
S3.001	S07	49.446	0.429	0.000	1.59	26.2	SURCHARGED	
S3.002	S08	49.274	0.429	0.000	0.16	3.0	SURCHARGED	
S1.005	Soakaway	49.273	0.619	0.000	0.00	0.0	SURCHARGED	

Appendix E

Surface Water Drainage Pro-Forma

Surface Water Drainage Pro-forma for new developments

This pro-forma accompanies our “Surface Water Drainage; Local Guidance for Planning Applications” note. It is expected that applicants/developers should complete and submit the pro-forma to present a summary of the surface water drainage strategy for the site and demonstrate compliance with the National Planning Policy Guidance and Non-Statutory Technical Standards. The pro-forma will then be used to support the LPA in making a decision on the suitability of the proposal and, if the LPA is minded to find the completed pro-forma acceptable, then it may be used as an evidence base for a relevant surface water condition to be appended to the decision notice, stating that the developments drainage proposal will be constructed in accordance with the details set out in the relevant pro-forma.

It must however be noted that this pro-forma submitted alone, will not be considered a suitable surface water drainage strategy. It should be clearly referenced within the pro-forma where in the other submission documents the details provided are taken from.

The pro-forma is supported by the [Defra/EA guidance on Rainfall Runoff Management](#), and uses the storage calculator on www.UKsuds.com. The pro-forma should be considered alongside other supporting SuDS Guidance, but focuses on ensuring flood risk is not made worse elsewhere. This proforma is based upon current industry standard practice.

1. Site Details

Site	Yeomans Limited, Honda/Office/Peugeot. Worthing
Address & post code or LPA reference	Littlehampton Road, Ferring, Worthing BN12 6PB
Grid reference	TQ 08916 03457
Is the existing site developed or Greenfield?	Developed
Total Site Area	0.2668 Hectares
Total Site Area served by drainage system (excluding open space) (Ha)*	0.2466 Hectares
Pre-application sought? (Ref)	

* The Greenfield runoff off rate from the development which is to be used for assessing the requirements for limiting discharge flow rates and attenuation storage from a site should be calculated for the area that forms the drainage network for the site whatever size of site and type of drainage technique. Please refer to the Rainfall Runoff Management document or CIRIA manual for detail on this.

2. Impermeable Area

	Existing	Proposed	Difference (Proposed-Existing)	Notes for developers
Impermeable area (ha)	0.1084 Hectares	0.2466 Hectares	0.1382 Hectares	If proposed > existing, then runoff rates and volumes will be increasing. Section 6 must be filled in. If proposed ≤ existing, then section 6 can be skipped & section 7 filled in.
Drainage Method (infiltration/sewer/watercourse)	Infiltration (Assumed)	Infiltration	N/A	If different from the existing, please fill in section 3. If existing drainage is by infiltration and the proposed is not, discharge volumes may increase. Fill in section 6.

3. Proposing to Discharge Surface Water via

	Yes	No	Justification and Evidence that this is possible	Notes for developers
Infiltration	X		Soakage tests will be carried out. Assumed Infiltration rate: 1.39×10^{-5} m/s	Soakage tests will need to be provided and results included in drainage strategy. Section 7 (infiltration) must be filled in if infiltration is proposed.
To watercourse		X		If infiltration is not possible - is there a watercourse nearby? Have the EA or IDB provided input where necessary?
To surface water sewer		X		This should be a last resort. If required, has sewer provider confirmed that sufficient capacity exists for this connection? Has an appropriate connection detail been agreed?
Combination of above		X		e.g. part infiltration, part discharge to sewer or watercourse. Provide evidence as above.

4. Peak Discharge Rates – This is the maximum flow rate at which storm water runoff leaves the site during a particular storm event.

	Existing Rates (l/s)	Proposed Rates (l/s)	Difference (l/s) (Proposed-Existing)	Notes for developers
Greenfield QBAR	1 l/s	N/A	N/A	QBAR is approx. 1 in 2 storm event. Provide this if Section 7 (QBAR) is proposed.
1 in 1	0.9 l/s	0 l/s	-0.9 l/s	Proposed discharge rates (with mitigation) should be no greater than existing rates for all corresponding storm events. E.g. discharging all flow from site at
1 in 30	1.9 l/s	0 l/s	-1.9 l/s	

1 in 100	2.4 l/s	0 l/s	-2.4 l/s	the existing 1 in 100 event increases flood risk during smaller events.
1 in 100 plus climate change	N/A	0 l/s	-2.4 l/s	To mitigate for climate change the proposed 1 in 100 +CC must be no greater than the existing 1 in 100 runoff rate. If not, flood risk increases under climate change. - Where lifetime of development is 100 years (residential) 30% should be added to the peak rainfall intensity. - Where lifetime of development is 60 years (residential) 20% should be added to the peak rainfall intensity.

5. Calculate additional volumes for storage –The total volume of water leaving the development site. New hard surfaces potentially restrict the amount of storm water that can go to the ground, so this needs to be controlled so not to make flood risk worse to properties downstream.

	Existing Volume (m³)	Proposed Volume (m³)	Difference (m³) (Proposed-Existing)	Notes for developers
1 in 1	18.474 m ³	0 m ³	-18.474 m ³	Proposed discharge volumes (without mitigation) should be no greater than existing volumes for all corresponding storm events. Any increase in volume increases flood risk elsewhere. Where volumes are increased section 6 must be filled in.
1 in 30	42.997 m ³	0 m ³	-42.997 m ³	
1 in 100	58.681 m ³	0 m ³	-58.681 m ³	
1 in 100 plus climate change	N/A	0 m ³	-58.681 m ³	To mitigate for climate change the volume discharge from site must be no greater than the existing 1 in 100 storm event. If not, flood risk will increase under climate change.

6. Calculate attenuation storage – Attenuation storage is provided to enable the rate of runoff from the site into the receiving watercourse to be limited to an acceptable rate to protect against erosion and flooding downstream. The attenuation storage volume is a function of the degree of development relative to the greenfield discharge rate.

		Notes for developers
What Storage Attenuation volume (Flow rate control) is required to retain rates as existing (m³) Where is the storage to be accommodated on site?	New cellular soakaway will be installed under parking area to attenuate and infiltrate runoff volume from roof areas.	Volume of water to attenuate on site if discharging at existing rates. Can't be used where discharge volumes are increasing

	In addition, permeable sub-base in car park will drain and infiltrate runoff water from this area.	
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7. How is Storm Water stored on site?

Storage is required for the additional volume from site but also for holding back water to slow down the rate from the site. This is known as attenuation storage and long term storage. The idea is that the additional volume does not get into the watercourses, or if it does it is at an exceptionally low rate. You can either infiltrate the stored water back to ground, or if this isn't possible hold it back with on site storage. Firstly, can infiltration work on site?

			Notes for developers
Infiltration	State the Site's Geology and known Source Protection Zones (SPZ)	Outside SPZ	- Infiltration rates are highly variable, soakage tests should be comprehensive. - Avoid infiltrating in made ground. - Refer to Environment Agency website to identify and source protection zones (SPZ)
	Infiltration Rate (m/s)?	Assumed 1.39×10^{-5}	Infiltration rates should be no lower than 1×10^{-6} m/s.
	State the distance between a proposed infiltration device base and the ground water (GW) level	No recorded	Need 1m (min) between the base of the infiltration device & the water table to protect Groundwater quality & ensure GW doesn't enter infiltration devices. Avoid infiltration where this isn't possible.
	Were infiltration rates obtained by desk study or infiltration test?	Infiltration test will be carried out to confirm infiltration rates	Infiltration rates can be estimated from desk studies at most stages of the planning system if a back up attenuation scheme is provided.
	Is the site contaminated? If yes, consider advice from others on whether infiltration can happen.	Assumed no. Testing to be carried out to confirm	Water should not be infiltrated through land that is contaminated. The Environment Agency may provide bespoke advice in planning consultations for contaminated sites that should be considered.
In light of the above, is infiltration feasible?	Yes/No? If the answer is No, please identify how the storm water will be stored prior to release	If the site is contaminated the storage will be impermeable with restricted discharge to the public sewer	If infiltration is not feasible how will the additional volume be stored? The applicant should consider the following options in the next section.

Storage requirements

The developer must confirm one of the two methods for dealing with the amount of water that needs to be stored on site.

Option 1 Simple – Store both the additional volume and attenuation volume in order to make a final discharge from site at **QBAR** (Mean annual flow rate). This is preferred if no infiltration can be made on site. This very simply satisfies the runoff rates and volume criteria.

Option 2 Complex – If some of the additional volume of water can be infiltrated back into the ground, the remainder can be discharged at a very low rate of 2 l/sec/hectare. A combined storage calculation using the partial permissible rate of 2 l/sec/hectare and the attenuation rate used to slow the runoff from site.

		Notes for developers
Please confirm what option has been chosen and how much storage is required on site.	Drainage system has been designed to infiltrate 100% of surface water volume. It is required a storage of 71 m ³ in cellular soakaway and 92m ³ in permeable sub-base in order to achieve an overflow of 0 l/s for all storms.	The developer at this stage should have an idea of the site characteristics and be able to explain what the storage requirements are on site and how it will be achieved.

8. Please confirm

		Notes for developers
1. Which Drainage Systems measures have been used? Provide an overview of the SuDS design scheme used? - Is the runoff managed at, or close to, the surface wherever possible. - Where the system serves more than one property, is public space used and integrated with the drainage system in an appropriate and beneficial way?	- Permeable paving - Cellular Soakaway	SUDS can be adapted for most situations even where infiltration isn't feasible e.g. impermeable liners beneath some SUDS devices allows treatment but not infiltration. See CIRIA SUDS Manual C697.
2. Functionality Are the design features sufficiently durable to ensure structural integrity over the system design life (residential 100 years and commercial 60 years), with reasonable maintenance requirements?	Yes	
Are all parts of the SuDS system outside any areas of flood	Yes	If not, provide justification and evidence that performance

risk?		will not be adversely affected.
Has runoff and flooding from all sources (both on and off site) been considered and taken into account in the design?	Yes	
Has residual risk been addressed?	Yes refer Drainage strategy	- Does the drainage system contain the 1 in 30 storm event without any flooding (include description of how any exceedance of surface water systems will be routed exceptional rain fall away from property)? - Are 1 in 100 year flows contained or stored on-site within safe exceedance storage areas and flow paths? - Is any flooding between 1 in 30 and 100 +CC storm events safely contained on site, without causing property flooding or a hazard to site users? - Has it been ensured that there is no flooding from the system to downstream property or access routes for the 100 year + climate change event?
How are rates being restricted (hydro brakes etc.)?	No rates to be restricted	- Hydrobrakes to be used where rates are between 2l/s to 5l/s - Orifices not to be used below 5l/s as the pipes may block. - Pipes with flows < 2l/s are prone to blockage.
3. Please confirm the owners/adopters of the entire drainage systems throughout the development. Please list all the owners.	Yeomans Ltd.	If these are multiple owners then a drawing illustrating exactly what features will be within each owner's remit must be submitted with this Proforma.
How is the entire drainage system to be maintained? An acceptable maintenance plan, clearly defining the operating and maintenance requirements of the drainage system will need to be submitted and approved.	The drainage drawings and schedules will form part of the O&M manual along with a post completion CCTV survey to ensure the system is fully operational at handover.	If the features are to be maintained directly by the owners as stated in answer to the above question please answer yes to this question and submit the relevant maintenance schedule for each feature. If it is to be maintained by others than those above, please give details of each feature and the maintenance schedule. Clear details of the maintenance proposals of all element of the proposed drainage system must be provided. Poorly maintained drainage can lead to increased flooding problems in the future.

9. Evidence Please identify where the details quoted in the sections above were taken from. i.e. Plans, reports etc. Please also provide relevant drawings that need to accompany your pro-forma, in particular exceedance routes, ownership and location of SuDS (maintenance access strips etc.)

Pro-forma Section	Document reference where details quoted above are taken from	Page Number
Section 2	Drainage Strategy	1, Appendix A & C
Section 3	Drainage Strategy	Appendix C
Section 4	Drainage Strategy	Appendix B & D
Section 5	Drainage Strategy	Appendix B & D
Section 6	Drainage Strategy	Appendix C
Section 7	Drainage Strategy	Appendix A & C

The above form is completed using factual information and evidence from the Surface Water Drainage Strategy, Flood Risk Assessment and site plans and can be used as a summary of the surface water drainage strategy on this site, clearly showing that the proposed surface water rate and volume will not be increasing as a result of the development. Where an increase in rate or volume is shown the appropriate sections of the pro-forma have been completed setting out how the additional rate/volume is being dealt with, to ensure no increased flood risk on or off site.

Where the pro-forma is found to be acceptable to the Local Planning Authority then the surface water drainage system design must be built in accordance with the details provided here.

Form completed by: Graham Taylor

Qualification of person responsible for signing of this pro-forma: IEng MICE

Company: AKS Ward

On behalf of (Client's details): Yeomans Ltd.

Date 09.02.18

Appendix F

SuDS Maintenance Schedule

Cellular Tanks Operation & Maintenance Requirements

Regular inspection and maintenance is required to ensure the effective long-term operation of below ground modular storage systems.

Specific maintenance needs of the system should be monitored, and maintenance schedules adjusted to suit requirements.

Modular systems – operation and maintenance requirements

Maintenance schedule	Required action	Recommended Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for three months then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae, or other matter; remove and replace surface infiltration medium as necessary	Annually
	Remove sediment from pretreatment structures and/or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlets, overflows, and vents	As required
Monitoring	Inspect/check all inlets, outlets, overflows, and vents to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment buildup and remove if necessary	Every five years or as required

Maintenance activities should be detailed in the health and safety plan and a risk assessment should be undertaken.

Permeable Paving Operation & Maintenance Requirements

Regular inspection and maintenance is important for the effective operation of pervious pavements. The facility should be inspected regularly, preferably during and after heavy rainfall to check effective operation and to identify any areas of ponding.

Pervious surfaces need to be regularly cleaned of silt and other sediments to preserve their infiltration capability. Manufacturers' recommendations should always be followed.

A brush cleaner, which can be a lorry-mounted device or a smaller precinct sweeper, should be used and the sweeping regime should be as follows:

1. End of winter (April) – to collect winter debris.
2. Mid-summer (July/August) – to collect dust, flower and grass-type deposits.
3. After autumn leaf fall (November).

Care should be taken in using vacuuming equipment to avoid removal of jointing material. Any lost material should be replaced.

If reconstruction is necessary, the following procedure should be followed:

1. Lift surface layer and laying course.
2. Remove any geo-textile filter layer.
3. Inspect sub-base and remove, and replace if required.
4. Renew any geo-textile layers.
5. Renew laying course, jointing material and concrete block paving.

The reconstruction of failed areas of concrete block pavement should be less costly and disruptive than the rehabilitation of continuous concrete or asphalt porous surfaces due to the reduced area that is likely to be affected. Materials removed from the voids or the layers below the surface may contain heavy metals and hydrocarbons and may need to be disposed of as controlled waste. Sediment testing should be carried out before disposal to confirm its classification and appropriate disposal methods.

Pervious pavement operation and maintenance requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Brushing	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilize and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosphate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements

Maintenance schedule	Required action	Frequency
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
	Remedial work to any depressions, rutting, and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every ten to fifteen years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48hrs after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Maintenance activities should be detailed in the Health and Safety Plan and a risk assessment should be undertaken.

Soakaways Operation & Maintenance Requirements

The useful life and effective operation of a soakaway is related to the frequency of maintenance and the risk of sediment being introduced into the system. An easement should be considered where multiple properties discharge to a single soakaway, to ensure long-term access for maintenance purposes.

Operation and maintenance requirements for soakaways are described below.

Soakaway operation and maintenance requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Remove sediment and debris from pre-treatment devices and floor of inspection tube or chamber.	Annually.
	Cleaning of gutters and any filters on downpipes.	Annually.
	Trimming any roots that may be causing blockages.	Annually (or as required).
Occasional maintenance		
Remedial actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs.	As required.
	Replacement of clogged geo-textile.	As required.
Monitoring	Inspect silt traps and note rate of sediment accumulation.	Monthly in the first year and then annually.
	Check soakaway to ensure emptying is occurring.	Annually.

Maintenance will usually be carried out manually, although a suction tanker can be used for sediment/debris removal for large systems. If maintenance is not undertaken for long periods, deposits can become hard-packed and require considerable effort to remove.

Replacement of the void fill will be necessary if the device becomes blocked with silt. Monitoring will give information on changes in infiltration rate and provide a warning of potential failure in the long-term.

Roads and/or parking areas draining to soakaways should be regularly swept to prevent silt being washed off the surface. This will minimize the need for ongoing maintenance.