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Foul & Surface Water Design Statement

For

New Residential Redevelopment

At

Highover Farm

Highover Way

Hitchin

Herts

SG4 0RQ

For

Gill Hudson Homes Ltd

Project 7219

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EAS Flood Risk Assessment Ref 6138/2025

Ground Science Solutions Desktop and Intrusive Investigation 2025/1534

Terratech Topographical Survey

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1. Introduction

Stuart Thomas Associates have been appointed by Gill Hudson Homes Ltd to provide civil and structural engineering services for the conversion and re-development of the Highover farm site to provide 14 New dwellings with associated parking, access and service buildings.

This drainage design statement has been prepared in support of a new full planning application ref 25/01420/FP and represents the final proposed design.

No previous strategy has been prepared prior to issue of this report.

2. Existing Site

The existing site is situated at the end of Highover Way, Hitchin, with a central co-ordinate of 519777,230688 (TL197306).

The existing site topography has been taken from the Terratech Topographical survey drawing.

The planning boundary measures 0.76 Hectares, with a high ground level of 75.74 to the North-East, and a low of 72.90 to the South

The site was previously a working farm, with many linked timber barns and masonry built cattle stalls. There is a Grade 2 listed timber framed threshing barn on site, and a smaller barn of the same age and construction. There is a two-storey farm house to the South of the site in part timber frame, part masonry construction.

There are 10 distinct buildings in total. The site has some concrete hardstanding around the barns but is mostly laid to rough landscape and hardcore.

Most barns had an electrical supply, but there are no known easements for services across the site. The farmhouse was habitable with water, electricity and a foul connection to the public sewer.

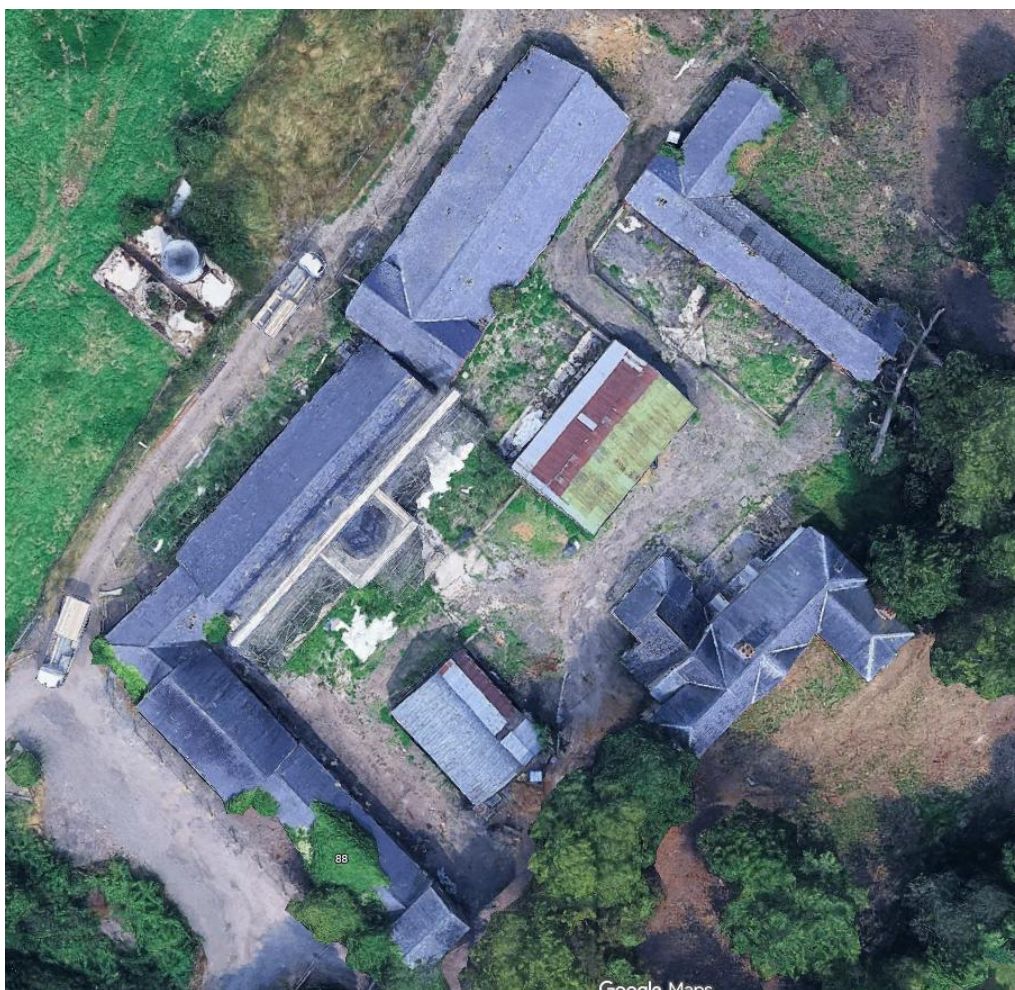


Figure 1 - Existing Site

3. Existing Site Geology

The site geology has been investigated by Ground Science Solutions under reference 2025/1534.

The survey carried out with 5 No. deep boreholes taken to 2m depth.

BGS records show the local area to be underlain with Lowestoft Diamicton Boulder Clay over the Hollywell and New Pit chalks.

The site is in flood zone 1, but there is a risk of Surface Water flooding in accordance with Government flood mapping due to LIDAR-led topography assessment whereby a low spot in the corner of two barns means water can accumulate.

A full flood risk assessment has been provided by EAS under reference 6138/2025.

All boreholes found Diamicton clays with chalky gravel down to depths of between 1.7m and 2.7m.

Sandy gravel was found below this in WS1 & WS2, with clay recorded to the full depth of the bore at 2m in the other three holes. No water was recorded on the borehole logs, but there was mention of perched water elsewhere in the report due to the relatively impermeable nature of the upper clays.

BRE365 Infiltration testing was carried out in three separate locations to the South Eastern and North side of the site into sandy gravel hoggin material at varying depths with percolation occurring too quickly to record a drop in water level. The infiltration testing is recorded in the appendix. The infiltration pits were all dry at the time of testing in August 2025.

There was a falling head test carried out previously in WS1 & WS2 at 0.5m to 1.0m above a perched water level with a worst case infiltration rate of 1×10^{-3} recorded.

4. Proposed Development

The existing farm buildings will be converted into 14 residential units. The two central barns will be demolished, and a new courtyard access road will be constructed through the site.

Each dwelling will have dedicated private gardens and parking.

There will be a new building constructed as a bin store and garages, and a new semi-detached pair of houses built in the South East corner of the site.

A barn will be demolished on the South-Western Boundary to provide access into the site. This will link with the existing farm access track which runs along South-West and North West boundaries.

There will be no net increase in roof area between the existing and proposed developments, with a slight increase in the formal undrained planted areas. The existing site impermeable area is difficult to quantify given the unmade nature of the ground.

5. Storm Water Design

5.1 Existing Site Drainage

There are very few manholes located on site. All barns have had formal rainwater gutters and downpipes, and it is assumed that these discharge into rough blind soakaways as would be expected of buildings of this age.

There is a foul drain run serving the farmhouse which has been proven to connect into the existing public sewer via CCTV. There is evidence that some storm water has been channelled into this from a single manhole.

5.2 Proposed Storm Drainage Scheme

In accordance with the requirements of Ciria C753 (the SUDs Manual), surface water run off should be discharged directly to ground should source re-use not be appropriate, and ground conditions allow.

In accordance with the Infiltration testing and ground investigation, Soakaways are deemed viable in the underlying granular hoggin material. This is proven to be free-draining and does not require any significant attenuation and therefore surface SUDs features such as swales or detention basins are not required.

The depth of the granular fill below the boulder clay varies across the site but was found at a viable depth to be used as the discharge medium in two of the three BRE test sites. The Hoggin was found at a depth below 2.5m in the North of the site, so the gravel horizon will vary across the site.

Water will be collected from all roofs and discharged to Geo-cellular soakaways where this is sufficient clearance from the proposed and existing buildings, and into the permeable central courtyard where there is insufficient room for a soakaway. The Soakaways will need to be taken into the head of the granular Hoggin material, and the depth of each will need to be confirmed on site.

The central courtyard is to be a Type A permeable surface, with SUDs aggregate taken to the head of the Hoggin sub-grade. Should the permeable granular soils be at depth within the courtyard, infiltration trenches will be utilised to engage the gravels below. The infiltration trenches will also offer additional storage volume.

Should gravels not be found in the central courtyard at a viable depth, the infiltration trenches will need to be extended into the South-East of the site.

The strategy for discharging roof water and permeable paving through the SuDS aggregate will provide a significant buffer to flow rates into the permeable sub-grade below. High intensity rainfall

events will see surface water run-off slowed through the aggregate with outflow slowed by perhaps 24 hours.

A Permafilter geotextile is to be used below the block paving to capture any potential contaminant spillages, providing a two stage interception in conjunction with the SUDs aggregate and grit laying course.

Polypipe rainwater diffusers have been specified to discharge roof water into the courtyard SUDs aggregate. These have been sized to accommodate the relevant catchment area, (100m² per Unit), as well as redundancy in the case of silting.

The soakaways have been designed in accordance with BRE365, including 40% climate change, 10% Urban Creep and only 600mm of the crate height used for infiltration to provide redundancy. Soakaways and Rainwater diffusers are all sited with a 5m stand-off from properties.

In the unlikely event granular material is not found at viable depths across the site, additional attenuation will be needed within the central courtyard to accommodate properties that cannot be served by soakaways and discharged to the public storm sewer in Highover Way at a rate of 2l/sec subject to Anglian Water approval.

5.3 Causeway Flow Analysis

Separate Soakaway calculations are provided for each location using a conservative value of 5x10⁻⁴ m/sec. The best infiltration rates of 5x10⁻³ were recorded.

Two separate hydraulic networks have been modelled using Causeway Flow Hydraulic Analysis software using FEH-22 data for the site.

Units 5-8 have a single combined network with the largest catchment, and discharges to the permeable paving through a diffuser. The analysis is used to assess the worst case 100mm and 150mm pipe design, and for the infiltration into the granular sub-base through a local dedicated area of the courtyard. A virtual weir is used to ensure no water leaves the system beyond the permeable paving.

Units 13 & 14 Have the largest catchment discharging to a single soakaway, and a network is generated to again test the pipe network and the capacity of the soakaway. A virtual weir is again used to ensure no water leaves the system beyond the soakaway.

A full range of return period storms has been considered, with 1:2, 1:30 and 1:100 events simulated with 35 and 40% climate change added appropriately. Storm durations range from 15 minutes to 1 week. 10% Urban creep has been added to all building catchments.

Analysis shows that there is surcharging in the units 5-8 network in the 1 in 2 year event. This is expected given the discharge to a permeable car park. There is no 1 in 2 year surcharge in the Units 13 & 14 network.

There is surcharging to both networks in the 1 in 30 and 1 in 100 year events, but no flooding recorded anywhere.

Pipe networks to smaller local soakaway and diffuser systems are deemed acceptable by default since the worst case scenario for hydraulic design is covered within the two 'FLOW' analyses.

5.4 Exceedance

The EAS flood risk assessment provides clear analysis of the risk of overland flows from upslope off-site catchments. Interception is to be provided offsite discharging to an infiltration pond. This effectively removes off-site risk.

Should any pipes or flow control become blocked within the site, or the performance of the soakaways or permeable paving become reduced due to silt build up, then surface flooding may occur. Pipes may also be overwhelmed by rainfall events in excess of those considered during the design.

External levels have been set to ensure that clear pathways exist to route water safely around all properties from the upper parts of the site to the lower. Water will generally accumulate within the courtyard area and exit through the entrance into the development before discharging to the Highover Way public highway, as currently happens due to topography.

The local low spot in front of barns 2 & 3 has effectively been removed and levels set to route water away from those units. The EA flood surface water flood risk has therefore been negated.

ACO drains have been added across the courtyard slope to capture water before it leaves site. The permeable paving will also capture exceedance flows.

The exceedance flow path is demonstrated on drawing 7219/05 – Exceedance Flood Path.

5.5 Storm Water Design Summary

The CIRIA SUDs requirements have been followed, with discharge to ground being the first compliant outfall.

Effective treatment of hardstanding surface water run-off has been carried out prior to discharge to the public sewer through the use of permeable paving and Hydrocarbon capturing membranes.

Should extensive site excavation prevent implementation of the proposed scheme, outline alternatives have been outlined that would also provide a viable and compliant design.

6. Foul Water Design

The new development will discharge foul water to an existing public sewer in Sturgeons Way via an existing lateral which terminates in front of Highover Cottages. The site has its own internal large diameter connection onto the Anglian Water 150mm diameter pipe. The existing private and

adopted outfall runs have been CCTV surveyed, root cleared, and a confirmed connection has been proven. The 150mm outfall pipe is suitably sized to take the flows from the proposed development.

7. Surface Water Maintenance and Management Plan

General

The maintenance and management plan has been prepared on the understanding that the site management company will be created and be responsible for the performance of the shared drainage and courtyard permeable surfaces. No part of the surface water system will be adopted.

Pipe networks have been designed where possible to have dedicated soakaways and drains that would remain the responsibility of the householder.

All new foul drainage will remain under private ownership.

At Handover

All apparatus is to be cleaned out thoroughly at completion. All drainage to be CCTV surveyed to confirm that there are no defects.

Post Completion

Each element of the drainage and flood prevention system should be inspected and maintained regularly as itemised below:

Drainage Generally

Inspect all chambers and rodding eyes for blockages and/or general silt build-up at least annually and clean out. Layout and location of whole surface water drainage system is shown on drawing 7219/01

Permavoid Diffuser

These are small geo-cellular structures surrounded by a geotextile to prevent silt ingress. Redundancy has already been built in for potential silt build up. These are buried and maintenance free.

Silt traps have been provided immediately before all Diffusers to prevent silt ingress. Maintenance of the silt traps is detailed below.

Geo-cellular Soakaways

The underground soakaways are specified as Polypipe Polystorm cellular crates. They are situated to the rear of private dwellings.

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly.
	Debris removal from catchment surface (where may cause risks to performance)	Monthly.
	Check immediately adjacent manholes for silt build up indicative of potential accumulation within soakaway.	Monthly (and after large storms)
	Remove sediment from pre-treatment structures.	Annually, or as required.
Remedial Actions	Repair / rehabilitation of inlets, outlet overflows and vents.	As required.
	Jet wash and vacuum desilt.	As required.
Monitoring	Inspect / check all inlet, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually and after large storms.

Permeable Block Paviour Car Surface

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Brushing and vacuuming	Three times / year at end of winter, mid-summer, after autumn leaf fall, or as required based on site specific observations of clogging or manufactures recommendations.
Occasional Maintenance	Stabilise and mow contributing and adjacent areas.	As Required.
	Remediate any landscaping which through vegetation maintenance or soil slip, has been raised to within 50mm of level of the paving.	As Required.
	Removal of weed.	As Required.
Remedial Actions	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users.	As required.
	Rehabilitation of surface and upper sub structure	As required (if infiltration performance is reduced as a result of significant clogging)
	Initial inspection	Monthly for 3 months after installation.
Monitoring	Inspect for evidence of poor operation and / or weed growth. If required, take remedial action.	3-monthly, 48 after large storms.
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually.
	Monitor inspection chambers.	Annually.

SILT TRAPS AND CATCHPITS

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly.
	Debris removal from catchment surface (where may cause risk to performance)	Monthly.
	Inspection of silt traps and catch pits to assess silt accumulation.	Monthly (and after large storms)
	Removal of accumulated silt from silt trap and catch pit sumps.	Annually, or as required.
Remedial Actions	Repair / rehabilitation of inlets, outlets, overflows and vents.	As required.
Monitoring	Inspect / check all inlets, outlets, and overflows to ensure that they are in good condition and operating as designed.	Annually and after large Storms.

Malcolm Thomas

For Stuart Thomas Associates Ltd

Date: 10/12/25

Appendix

Storm Drainage Calculations – Units 5-8

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.950	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
RE5	0.018	5.00	74.600	280	0.600
S11			75.100	450	1.307
S12			74.900	450	1.243
S13	0.008	5.00	75.050	450	1.486
S14	0.007	5.00	74.600	450	1.177
S15	0.012	5.00	74.250	450	0.915
S16			74.150	450	0.916
PermPav	0.014	120.00	74.150	450	0.936
VirtWeir			74.150	1000	0.946

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	RE5	S11	20.689	0.600	74.000	73.793	0.207	100.0	150	5.34	50.0
1.001	S11	S12	13.637	0.600	73.793	73.657	0.136	100.0	150	5.57	50.0
1.002	S12	S13	9.313	0.600	73.657	73.564	0.093	100.0	150	5.72	50.0
1.003	S13	S14	14.058	0.600	73.564	73.423	0.141	100.0	150	5.96	50.0
1.004	S14	S15	8.781	0.600	73.423	73.335	0.088	100.0	150	6.10	50.0
1.005	S15	S16	10.129	0.600	73.335	73.234	0.101	100.0	150	6.27	50.0
1.006	S16	PermPav	2.000	0.600	73.234	73.214	0.020	100.0	150	6.30	50.0
1.007	PermPav	VirtWeir	1.000	0.600	73.214	73.204	0.010	100.0	150	30.00	19.5

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.005	17.8	3.1	0.450	1.157	0.018	0.0	42	0.757
1.001	1.005	17.8	3.1	1.157	1.093	0.018	0.0	42	0.757
1.002	1.005	17.8	3.1	1.093	1.336	0.018	0.0	42	0.757
1.003	1.005	17.8	4.5	1.336	1.027	0.026	0.0	51	0.838
1.004	1.005	17.8	5.7	1.027	0.765	0.033	0.0	58	0.895
1.005	1.005	17.8	7.7	0.765	0.766	0.045	0.0	69	0.972
1.006	1.005	17.8	7.7	0.766	0.786	0.045	0.0	69	0.972
1.007	1.005	17.8	3.9	0.786	0.796	0.059	0.0	48	0.807

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
RE5	74.600	0.600	280					
				0	1.000	74.000	150	
S11	75.100	1.307	450		1	1.000	73.793	150
				0	1.001	73.793	150	
S12	74.900	1.243	450		1	1.001	73.657	150
				0	1.002	73.657	150	
S13	75.050	1.486	450		1	1.002	73.564	150
				0	1.003	73.564	150	
S14	74.600	1.177	450		1	1.003	73.423	150
				0	1.004	73.423	150	
S15	74.250	0.915	450		1	1.004	73.335	150
				0	1.005	73.335	150	
S16	74.150	0.916	450		1	1.005	73.234	150
				0	1.006	73.234	150	
PermPav	74.150	0.936	450		1	1.006	73.214	150
				0	1.007	73.214	150	
VirtWeir	74.150	0.946	1000		1	1.007	73.204	150

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	0.950	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.950	Drain Down Time (mins)	5760	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	35	10	0
100	40	10	0

Node VirtWeir Online Weir Control

Flap Valve	x	Design Depth (m)	0.900	Discharge Coefficient	0.590
Replaces Downstream Link	✓	Design Flow (l/s)	1.0		
Invert Level (m)	74.140	Width (m)	0.001		

Node PermPav Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.36000	Invert Level (m)	73.600	Slope (1:X)	25.0
Side Inf Coefficient (m/hr)	0.36000	Time to half empty (mins)	58	Depth (m)	0.450
Safety Factor	2.0	Width (m)	13.000	Inf Depth (m)	
Porosity	0.30	Length (m)	10.000		

**Results for 2 year Critical Storm Duration. Lowest mass balance: -3048.64%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	RE5	10	74.042	0.042	3.0	0.0026	0.0000	OK
15 minute summer	S11	11	73.835	0.042	3.0	0.0068	0.0000	OK
180 minute summer	S12	104	73.733	0.076	1.2	0.0121	0.0000	OK
180 minute summer	S13	104	73.733	0.169	1.5	0.0269	0.0000	SURCHARGED
180 minute summer	S14	104	73.732	0.309	1.9	0.0492	0.0000	SURCHARGED
180 minute summer	S15	104	73.732	0.397	2.7	0.0631	0.0000	SURCHARGED
180 minute summer	S16	104	73.730	0.496	2.6	0.0788	0.0000	SURCHARGED
180 minute summer	PermPav	104	73.729	0.515	2.7	0.9073	0.0000	SURCHARGED
180 minute summer	VirtWeir	104	73.729	0.525	0.3	0.4123	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	RE5	1.000	S11	3.0	0.732	0.168	0.0842	
15 minute summer	S11	1.001	S12	3.0	0.724	0.167	0.0560	
180 minute summer	S12	1.002	S13	1.0	0.378	0.057	0.1239	
180 minute summer	S13	1.003	S14	1.4	0.347	0.080	0.2475	
180 minute summer	S14	1.004	S15	1.9	0.342	0.105	0.1546	
180 minute summer	S15	1.005	S16	2.6	0.350	0.146	0.1783	
180 minute summer	S16	1.006	PermPav	2.5	0.269	0.142	0.0352	
180 minute summer	PermPav	1.007	VirtWeir	0.3	0.328	0.016	0.0176	
180 minute summer	PermPav	Infiltration		2.2				
180 minute summer	VirtWeir	Weir		0.0				0.0

Results for 30 year +35% CC +10% A Critical Storm Duration. Lowest mass balance: -3048.64%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	RE5	20	74.234	0.234	9.9	0.0145	0.0000	SURCHARGED
30 minute summer	S11	20	74.196	0.403	9.7	0.0640	0.0000	SURCHARGED
30 minute summer	S12	20	74.169	0.512	7.0	0.0814	0.0000	SURCHARGED
30 minute summer	S13	20	74.151	0.587	10.0	0.0933	0.0000	SURCHARGED
30 minute summer	S14	20	74.097	0.674	12.5	0.1072	0.0000	SURCHARGED
30 minute summer	S15	20	74.039	0.704	17.7	0.1119	0.0000	FLOOD RISK
60 minute summer	S16	41	73.967	0.733	14.1	0.1165	0.0000	FLOOD RISK
60 minute summer	PermPav	43	73.961	0.747	14.4	6.4916	0.0000	FLOOD RISK
60 minute summer	VirtWeir	43	73.961	0.757	1.5	0.5943	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	RE5	1.000	S11	9.7	0.934	0.548	0.3642	
30 minute summer	S11	1.001	S12	7.0	0.820	0.394	0.2401	
30 minute summer	S12	1.002	S13	7.0	0.587	0.392	0.1640	
30 minute summer	S13	1.003	S14	9.7	0.623	0.548	0.2475	
30 minute summer	S14	1.004	S15	12.3	0.701	0.695	0.1546	
30 minute summer	S15	1.005	S16	17.1	0.972	0.964	0.1783	
60 minute summer	S16	1.006	PermPav	13.8	0.783	0.776	0.0352	
60 minute summer	PermPav	1.007	VirtWeir	1.5	0.433	0.086	0.0176	
60 minute summer	PermPav	Infiltration		6.3				
60 minute summer	VirtWeir	Weir		0.0				0.0

Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: -3048.64%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	RE5	20	74.578	0.578	13.4	0.0358	0.0000	FLOOD RISK
30 minute summer	S11	20	74.506	0.713	11.1	0.1134	0.0000	SURCHARGED
30 minute summer	S12	20	74.458	0.801	9.4	0.1274	0.0000	SURCHARGED
30 minute summer	S13	20	74.426	0.862	13.3	0.1370	0.0000	SURCHARGED
30 minute summer	S14	20	74.332	0.909	16.7	0.1445	0.0000	FLOOD RISK
30 minute summer	S15	20	74.229	0.894	23.7	0.1421	0.0000	FLOOD RISK
60 minute summer	S16	44	74.089	0.855	18.9	0.1360	0.0000	FLOOD RISK
60 minute summer	PermPav	43	74.085	0.871	19.3	9.9280	0.0000	FLOOD RISK
60 minute summer	VirtWeir	44	74.084	0.880	1.5	0.6910	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	RE5	1.000	S11	11.1	0.933	0.623	0.3642	
30 minute summer	S11	1.001	S12	9.4	0.766	0.529	0.2401	
30 minute summer	S12	1.002	S13	9.3	0.598	0.526	0.1640	
30 minute summer	S13	1.003	S14	13.1	0.742	0.736	0.2475	
30 minute summer	S14	1.004	S15	16.4	0.933	0.925	0.1546	
30 minute summer	S15	1.005	S16	22.8	1.294	1.283	0.1783	
60 minute summer	S16	1.006	PermPav	18.5	1.052	1.043	0.0352	
60 minute summer	PermPav	1.007	VirtWeir	-1.6	0.544	-0.089	0.0176	
60 minute summer	PermPav	Infiltration		7.1				
60 minute summer	VirtWeir	Weir		0.0				0.0

Storm Drainage Calculations – Units 13 & 14

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.950	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
RE8	0.009	5.00	73.400	280	0.450
S27			73.400	450	0.738
S28	0.006	5.00	73.400	450	0.937
RE9	0.002	5.00	73.400	450	0.450
S29			73.400	450	1.122
SA7			73.400	450	1.400
VirtWeir			73.400	1000	1.410

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
2.000	RE8	S27	15.815	0.600	72.950	72.662	0.288	55.0	100	5.25	50.0
2.001	S27	S28	10.964	0.600	72.662	72.463	0.199	55.0	100	5.43	50.0
2.002	S28	S29	7.416	0.600	72.463	72.328	0.135	55.0	100	5.55	50.0
2.003	RE9	S29	10.412	0.600	72.950	72.690	0.260	40.0	100	5.14	50.0
2.004	S29	SA7	5.710	0.600	72.278	72.000	0.278	20.5	150	5.59	50.0
2.005	SA7	VirtWeir	1.000	0.600	72.000	71.990	0.010	100.0	150	5.61	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
2.000	1.041	8.2	1.5	0.350	0.638	0.009	0.0	29	0.796
2.001	1.041	8.2	1.5	0.638	0.837	0.009	0.0	29	0.796
2.002	1.041	8.2	2.6	0.837	0.972	0.015	0.0	39	0.923
2.003	1.223	9.6	0.3	0.350	0.610	0.002	0.0	13	0.566
2.004	2.232	39.4	2.9	0.972	1.250	0.017	0.0	28	1.319
2.005	1.005	17.8	2.9	1.250	1.260	0.017	0.0	41	0.746

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
RE8	73.400	0.450	280					
				0	2.000	72.950	100	
S27	73.400	0.738	450		1	2.000	72.662	100
				0	2.001	72.662	100	

**Manhole Schedule**

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S28	73.400	0.937	450	1	2.001	72.463	100
				0	2.002	72.463	100
RE9	73.400	0.450	450	0	2.003	72.950	100
S29	73.400	1.122	450	1	2.003	72.690	100
				2	2.002	72.328	100
				0	2.004	72.278	150
SA7	73.400	1.400	450	1	2.004	72.000	150
				0	2.005	72.000	150
VirtWeir	73.400	1.410	1000	1	2.005	71.990	150

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m ³ /ha)	0.0
Summer CV	0.950	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.950	Drain Down Time (mins)	5760	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	10	0
30	35	10	0
100	40	10	0

Node VirtWeir Online Weir Control

Flap Valve	x	Design Depth (m)	0.800	Discharge Coefficient	0.590
Replaces Downstream Link	✓	Design Flow (l/s)	1.0		
Invert Level (m)	73.390	Width (m)	0.001		

Node SA7 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	1.80000	Invert Level (m)	72.000	Depth (m)	
Side Inf Coefficient (m/hr)	1.80000	Time to half empty (mins)	0	Inf Depth (m)	0.600
Safety Factor	2.0	Pit Width (m)	2.000	Number Required	1
Porosity	0.95	Pit Length (m)	5.000		

Results for 2 year +10% A Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	RE8	10	72.980	0.030	1.6	0.0019	0.0000	OK
15 minute summer	S27	11	72.692	0.030	1.6	0.0047	0.0000	OK
15 minute summer	S28	11	72.503	0.040	2.6	0.0064	0.0000	OK
15 minute summer	RE9	12	72.962	0.012	0.3	0.0020	0.0000	OK
15 minute summer	S29	10	72.307	0.029	2.9	0.0046	0.0000	OK
15 minute summer	SA7	13	72.039	0.039	2.9	0.3722	0.0000	OK
15 minute summer	VirtWeir	13	72.038	0.048	0.3	0.0376	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	RE8	2.000	S27	1.6	0.803	0.193	0.0310	
15 minute summer	S27	2.001	S28	1.6	0.639	0.190	0.0268	
15 minute summer	S28	2.002	S29	2.6	0.895	0.313	0.0212	
15 minute summer	RE9	2.003	S29	0.3	0.550	0.031	0.0057	
15 minute summer	S29	2.004	SA7	2.9	1.463	0.073	0.0153	
15 minute summer	SA7	2.005	VirtWeir	0.3	0.403	0.019	0.0042	
15 minute summer	SA7	Infiltration		2.1				
15 minute summer	VirtWeir	Weir		0.0				0.0

**Results for 30 year +35% CC +10% A Critical Storm Duration. Lowest mass balance: 100.00%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute summer	RE8	10	73.015	0.065	5.8	0.0040	0.0000	OK
15 minute summer	S27	11	72.729	0.067	5.8	0.0107	0.0000	OK
15 minute summer	S28	11	72.629	0.166	9.5	0.0265	0.0000	SURCHARGED
15 minute summer	RE9	10	72.975	0.025	1.3	0.0040	0.0000	OK
15 minute summer	S29	11	72.330	0.052	10.3	0.0083	0.0000	OK
30 minute summer	SA7	23	72.245	0.245	9.2	2.3647	0.0000	SURCHARGED
30 minute summer	VirtWeir	23	72.245	0.255	0.6	0.2000	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
15 minute summer	RE8	2.000	S27	5.8	1.104	0.704	0.0853	
15 minute summer	S27	2.001	S28	5.6	0.814	0.685	0.0736	
15 minute summer	S28	2.002	S29	9.1	1.161	1.112	0.0571	
15 minute summer	RE9	2.003	S29	1.3	0.835	0.132	0.0158	
15 minute summer	S29	2.004	SA7	10.3	1.547	0.261	0.0656	
30 minute summer	SA7	2.005	VirtWeir	0.6	0.384	0.034	0.0176	
30 minute summer	SA7	Infiltration		3.4				
30 minute summer	VirtWeir	Weir		0.0				0.0

**Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 100.00%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	RE8	12	73.072	0.122	7.6	0.0076	0.0000	SURCHARGED
15 minute summer	S27	12	72.864	0.202	7.3	0.0322	0.0000	SURCHARGED
15 minute summer	S28	11	72.716	0.253	11.0	0.0402	0.0000	SURCHARGED
15 minute summer	RE9	10	72.979	0.029	1.7	0.0046	0.0000	OK
30 minute summer	S29	23	72.362	0.084	11.6	0.0134	0.0000	OK
30 minute summer	SA7	24	72.362	0.362	11.6	3.4922	0.0000	SURCHARGED
30 minute summer	VirtWeir	24	72.362	0.372	0.8	0.2917	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	RE8	2.000	S27	7.3	1.116	0.889	0.1237	
15 minute summer	S27	2.001	S28	6.8	0.868	0.831	0.0858	
15 minute summer	S28	2.002	S29	10.8	1.378	1.319	0.0574	
15 minute summer	RE9	2.003	S29	1.7	0.902	0.174	0.0193	
30 minute summer	S29	2.004	SA7	11.6	1.457	0.294	0.0792	
30 minute summer	SA7	2.005	VirtWeir	0.8	0.431	0.043	0.0176	
30 minute summer	SA7	Infiltration		3.8				
30 minute summer	VirtWeir	Weir		0.0				0.0

BRE 365 Soakaway Design



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Highover Farm - Hitchin

Revision

Job No:

7219

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SA1

Section:

Soakaway SA1 - Plot 3

Prepared By:

MFJT

Date:

17/12/2025

ALTERNATIVE SOAKAWAY SIZES

	trench soakaways		
	450	600	900
width of trench [mm]:	4.50	3.73	2.78
required trench length [m]:	4.50	3.73	2.78
	ring soakaways		
	1050	1350	1500
diameter of ring [mm]:	1050	1350	1500
required pit diameter [m]:	1.52	1.52	1.52

* Based on effective depth and number of pits as in Soakaway Data table

SUMMARY OF CALCULATIONS

critical design rainfall duration 't _{crit} ' =	10	min
required storage volume 'V _{req} ' =	1.42	m ³
provided storage volume 'V _{prov} ' =	3.42	m ³
utilisation factor =	0.42	.OK
required time to discharge 50% 't ₅₀ ' =	0.19	hours
utilisation factor =	0.01	.OK

GENERAL DATA

site location:	England and Wales
soakaway type:	geocellular units
impermeable area drained to soakaway 'A' [m ²] =	100
60 min rainfall depth of 5 year return period 'R' [mm] =	20
M5-60 to M5-2d rainfall ratio 'r' =	0.50
allowance for climate change:	40%

SOAKAWAY DATA

soakaway width 'W' [m] =	1.50
soakaway length 'L' [m] =	3.00
total depth from ground level 'D _b ' [m] =	1.40
depth to drain invert level 'D _d ' [m] =	0.60
soakaway effective depth 'D _{eff} ' [m] =	0.80
free volume in infill aggregate [%] =	95

SOIL INFILTRATION DATA

allowance for infiltration through soakaway base:	30%
available on-site infiltration test results:	☐ Yes ☒ No
soil infiltration rate 'f' [m/s] =	5.00E-04

REQUIRED STORAGE CAPACITY PER RAINFALL DURATION

rainfall duration [min]	rainfall factor Z1	M5-D rainfalls [mm]	M10-D			M50-D			M100-D			outflow from soakaway [m ³]	required storage [m ³]
			Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]		
5	0.39	7.80	1.21	13.18	1.32	1.61	17.59	1.76	1.86	20.28	2.03	0.74	1.29
10	0.54	10.80	1.22	18.49	1.85	1.66	25.07	2.51	1.92	29.07	2.91	1.49	1.42
15	0.65	13.00	1.23	22.42	2.24	1.68	30.58	3.06	1.96	35.64	3.56	2.23	1.34
30	0.82	16.40	1.24	28.47	2.85	1.71	39.22	3.92	2.00	45.95	4.59	4.46	0.14
60	1.00	20.00	1.24	34.72	3.47	1.73	48.44	4.84	2.03	56.84	5.68	8.91	0.00
120	1.19	23.80	1.24	41.32	4.13	1.72	57.39	5.74	2.01	67.13	6.71	17.82	0.00
240	1.38	27.60	1.23	47.51	4.75	1.71	66.06	6.61	1.99	76.86	7.69	35.64	0.00
360	1.51	30.20	1.22	51.56	5.16	1.70	71.83	7.18	1.97	83.22	8.32	53.46	0.00
600	1.68	33.60	1.21	56.88	5.69	1.68	78.95	7.90	1.94	91.31	9.13	89.10	0.00
1440	2.03	40.60	1.19	67.57	6.76	1.64	93.01	9.30	1.89	107.15	10.72	213.84	0.00

* Z2 is growth factor from M5 rainfalls



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SA2

Section:

Soakaway SA2 - Plot 4

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MFJT

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ALTERNATIVE SOAKAWAY SIZES

	trench soakaways		
width of trench [mm]:	450	600	900
required trench length [m]:	4.50	3.73	2.78
	ring soakaways		
diameter of ring [mm]:	1050	1350	1500
required pit diameter [m]:	1.52	1.52	1.52

* Based on effective depth and number of pits as in Soakaway Data table

SUMMARY OF CALCULATIONS

critical design rainfall duration 't _{crit} ' =	10	min
required storage volume 'V _{req} ' =	1.42	m ³
provided storage volume 'V _{prov} ' =	3.42	m ³
utilisation factor =	0.42	.OK
required time to discharge 50% 't ₅₀ ' =	0.19	hours
utilisation factor =	0.01	.OK

GENERAL DATA

site location:	England and Wales
soakaway type:	geocellular units
impermeable area drained to soakaway 'A' [m ²] =	100
60 min rainfall depth of 5 year return period 'R' [mm] =	20
M5-60 to M5-2d rainfall ratio 'r' =	0.50
allowance for climate change:	40%

SOAKAWAY DATA

soakaway width 'W' [m] =	1.50
soakaway length 'L' [m] =	3.00
total depth from ground level 'D _b ' [m] =	1.40
depth to drain invert level 'D _d ' [m] =	0.60
soakaway effective depth 'D _{eff} ' [m] =	0.80
free volume in infill aggregate [%] =	95

SOIL INFILTRATION DATA

allowance for infiltration through soakaway base:	30%
available on-site infiltration test results:	☐ Yes ☒ No
soil infiltration rate 'f' [m/s] =	5.00E-04

REQUIRED STORAGE CAPACITY PER RAINFALL DURATION

rainfall duration [min]	rainfall factor Z1	M5-D rainfalls [mm]	M10-D			M50-D			M100-D			outflow from soakaway [m ³]	required storage [m ³]
			Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]		
5	0.39	7.80	1.21	13.18	1.32	1.61	17.59	1.76	1.86	20.28	2.03	0.74	1.29
10	0.54	10.80	1.22	18.49	1.85	1.66	25.07	2.51	1.92	29.07	2.91	1.49	1.42
15	0.65	13.00	1.23	22.42	2.24	1.68	30.58	3.06	1.96	35.64	3.56	2.23	1.34
30	0.82	16.40	1.24	28.47	2.85	1.71	39.22	3.92	2.00	45.95	4.59	4.46	0.14
60	1.00	20.00	1.24	34.72	3.47	1.73	48.44	4.84	2.03	56.84	5.68	8.91	0.00
120	1.19	23.80	1.24	41.32	4.13	1.72	57.39	5.74	2.01	67.13	6.71	17.82	0.00
240	1.38	27.60	1.23	47.51	4.75	1.71	66.06	6.61	1.99	76.86	7.69	35.64	0.00
360	1.51	30.20	1.22	51.56	5.16	1.70	71.83	7.18	1.97	83.22	8.32	53.46	0.00
600	1.68	33.60	1.21	56.88	5.69	1.68	78.95	7.90	1.94	91.31	9.13	89.10	0.00
1440	2.03	40.60	1.19	67.57	6.76	1.64	93.01	9.30	1.89	107.15	10.72	213.84	0.00

* Z2 is growth factor from M5 rainfalls

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Section:

Soakaway SA3 - Plot 9

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MFJT

Date:

17/12/2025**ALTERNATIVE SOAKAWAY SIZES**

	trench soakaways		
	450	600	900
width of trench [mm]:	7.14	5.94	4.46
required trench length [m]:			
	ring soakaways		
	1050	1350	1500
diameter of ring [mm]:	1.65	1.66	1.66
required pit diameter [m]:			

* Based on effective depth and number of pits as in Soakaway Data table

SUMMARY OF CALCULATIONS

critical design rainfall duration 't _{crit} ' =	15	min
required storage volume 'V _{req} ' =	2.12	m ³
provided storage volume 'V _{prov} ' =	3.42	m ³
utilisation factor =	0.62	.OK
required time to discharge 50% 't ₅₀ ' =	0.20	hours
utilisation factor =	0.01	.OK

GENERAL DATA

site location:	England and Wales
soakaway type:	geocellular units
impermeable area drained to soakaway 'A' [m ²] =	120
60 min rainfall depth of 5 year return period 'R' [mm] =	20
M5-60 to M5-2d rainfall ratio 'r' =	0.50
allowance for climate change:	40%

SOAKAWAY DATA

soakaway width 'W' [m] =	2.00
soakaway length 'L' [m] =	3.00
total depth from ground level 'D _b ' [m] =	1.40
depth to drain invert level 'D _d ' [m] =	0.80
soakaway effective depth 'D _{eff} ' [m] =	0.60
free volume in infill aggregate [%] =	95

SOIL INFILTRATION DATA

allowance for infiltration through soakaway base:	30%
available on-site infiltration test results:	☐ Yes ☒ No
soil infiltration rate 'f' [m/s] =	5.00E-04

REQUIRED STORAGE CAPACITY PER RAINFALL DURATION

rainfall duration [min]	rainfall factor Z1	M5-D rainfalls [mm]	M10-D			M50-D			M100-D			outflow from soakaway [m ³]	required storage [m ³]
			Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]		
5	0.39	7.80	1.21	13.18	1.58	1.61	17.59	2.11	1.86	20.28	2.43	0.72	1.71
10	0.54	10.80	1.22	18.49	2.22	1.66	25.07	3.01	1.92	29.07	3.49	1.44	2.05
15	0.65	13.00	1.23	22.42	2.69	1.68	30.58	3.67	1.96	35.64	4.28	2.16	2.12
30	0.82	16.40	1.24	28.47	3.42	1.71	39.22	4.71	2.00	45.95	5.51	4.32	1.19
60	1.00	20.00	1.24	34.72	4.17	1.73	48.44	5.81	2.03	56.84	6.82	8.64	0.00
120	1.19	23.80	1.24	41.32	4.96	1.72	57.39	6.89	2.01	67.13	8.06	17.28	0.00
240	1.38	27.60	1.23	47.51	5.70	1.71	66.06	7.93	1.99	76.86	9.22	34.56	0.00
360	1.51	30.20	1.22	51.56	6.19	1.70	71.83	8.62	1.97	83.22	9.99	51.84	0.00
600	1.68	33.60	1.21	56.88	6.83	1.68	78.95	9.47	1.94	91.31	10.96	86.40	0.00
1440	2.03	40.60	1.19	67.57	8.11	1.64	93.01	11.16	1.89	107.15	12.86	207.36	0.00

* Z2 is growth factor from M5 rainfalls



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Soakaway SA4 - Plot 10

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ALTERNATIVE SOAKAWAY SIZES

	trench soakaways		
	450	600	900
width of trench [mm]:	450	600	900
required trench length [m]:	8.06	6.71	5.05
	ring soakaways		
	1050	1350	1500
diameter of ring [mm]:	1050	1350	1500
required pit diameter [m]:	1.77	1.77	1.77

* Based on effective depth and number of pits as in Soakaway Data table

SUMMARY OF CALCULATIONS

critical design rainfall duration 't _{crit} ' =	10	min
required storage volume 'V _{req} ' =	2.12	m ³
provided storage volume 'V _{prov} ' =	4.56	m ³
utilisation factor =	0.47	.OK
required time to discharge 50% 't ₅₀ ' =	0.21	hours
utilisation factor =	0.01	.OK

GENERAL DATA

site location:	England and Wales
soakaway type:	geocellular units
impermeable area drained to soakaway 'A' [m ²] =	135
60 min rainfall depth of 5 year return period 'R' [mm] =	20
M5-60 to M5-2d rainfall ratio 'r' =	0.50
allowance for climate change:	40%

SOAKAWAY DATA

soakaway width 'W' [m] =	2.00
soakaway length 'L' [m] =	4.00
total depth from ground level 'D _b ' [m] =	1.40
depth to drain invert level 'D _d ' [m] =	0.80
soakaway effective depth 'D _{eff} ' [m] =	0.60
free volume in infill aggregate [%] =	95

SOIL INFILTRATION DATA

allowance for infiltration through soakaway base:	30%
available on-site infiltration test results:	☐ Yes ☒ No
soil infiltration rate 'f' [m/s] =	5.00E-04

REQUIRED STORAGE CAPACITY PER RAINFALL DURATION

rainfall duration [min]	rainfall factor Z1	M5-D rainfalls [mm]	M10-D			M50-D			M100-D			outflow from soakaway [m ³]	required storage [m ³]
			Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]		
5	0.39	7.80	1.21	13.18	1.78	1.61	17.59	2.37	1.86	20.28	2.74	0.90	1.84
10	0.54	10.80	1.22	18.49	2.50	1.66	25.07	3.38	1.92	29.07	3.92	1.80	2.12
15	0.65	13.00	1.23	22.42	3.03	1.68	30.58	4.13	1.96	35.64	4.81	2.70	2.11
30	0.82	16.40	1.24	28.47	3.84	1.71	39.22	5.30	2.00	45.95	6.20	5.40	0.80
60	1.00	20.00	1.24	34.72	4.69	1.73	48.44	6.54	2.03	56.84	7.67	10.80	0.00
120	1.19	23.80	1.24	41.32	5.58	1.72	57.39	7.75	2.01	67.13	9.06	21.60	0.00
240	1.38	27.60	1.23	47.51	6.41	1.71	66.06	8.92	1.99	76.86	10.38	43.20	0.00
360	1.51	30.20	1.22	51.56	6.96	1.70	71.83	9.70	1.97	83.22	11.24	64.80	0.00
600	1.68	33.60	1.21	56.88	7.68	1.68	78.95	10.66	1.94	91.31	12.33	108.00	0.00
1440	2.03	40.60	1.19	67.57	9.12	1.64	93.01	12.56	1.89	107.15	14.47	259.20	0.00

* Z2 is growth factor from M5 rainfalls



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Highover Farm - Hitchin

Revision

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7219

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SA5

Section:

Soakaway SA5 - Plot 11

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MFJT

Date:

17/12/2025

ALTERNATIVE SOAKAWAY SIZES

	trench soakaways		
	450	600	900
width of trench [mm]:	450	600	900
required trench length [m]:	5.32	4.39	3.28
	ring soakaways		
	1050	1350	1500
diameter of ring [mm]:	1050	1350	1500
required pit diameter [m]:	1.65	1.66	1.66

* Based on effective depth and number of pits as in Soakaway Data table

SUMMARY OF CALCULATIONS

critical design rainfall duration 't _{crit} ' =	10	min
required storage volume 'V _{req} ' =	1.40	m ³
provided storage volume 'V _{prov} ' =	2.57	m ³
utilisation factor =	0.55	.OK
required time to discharge 50% 't ₅₀ ' =	0.18	hours
utilisation factor =	0.01	.OK

GENERAL DATA

site location:	England and Wales
soakaway type:	geocellular units
impermeable area drained to soakaway 'A' [m ²] =	90
60 min rainfall depth of 5 year return period 'R' [mm] =	20
M5-60 to M5-2d rainfall ratio 'r' =	0.50
allowance for climate change:	40%

SOAKAWAY DATA

soakaway width 'W' [m] =	1.50
soakaway length 'L' [m] =	3.00
total depth from ground level 'D _b ' [m] =	1.40
depth to drain invert level 'D _d ' [m] =	0.80
soakaway effective depth 'D _{eff} ' [m] =	0.60
free volume in infill aggregate [%] =	95

SOIL INFILTRATION DATA

allowance for infiltration through soakaway base:	30%
available on-site infiltration test results:	☐ Yes ☒ No
soil infiltration rate 'f' [m/s] =	5.00E-04

REQUIRED STORAGE CAPACITY PER RAINFALL DURATION

rainfall duration [min]	rainfall factor Z1	M5-D rainfalls [mm]	M10-D			M50-D			M100-D			outflow from soakaway [m ³]	required storage [m ³]
			Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]		
5	0.39	7.80	1.21	13.18	1.19	1.61	17.59	1.58	1.86	20.28	1.83	0.61	1.22
10	0.54	10.80	1.22	18.49	1.66	1.66	25.07	2.26	1.92	29.07	2.62	1.22	1.40
15	0.65	13.00	1.23	22.42	2.02	1.68	30.58	2.75	1.96	35.64	3.21	1.82	1.38
30	0.82	16.40	1.24	28.47	2.56	1.71	39.22	3.53	2.00	45.95	4.14	3.65	0.49
60	1.00	20.00	1.24	34.72	3.12	1.73	48.44	4.36	2.03	56.84	5.12	7.29	0.00
120	1.19	23.80	1.24	41.32	3.72	1.72	57.39	5.17	2.01	67.13	6.04	14.58	0.00
240	1.38	27.60	1.23	47.51	4.28	1.71	66.06	5.95	1.99	76.86	6.92	29.16	0.00
360	1.51	30.20	1.22	51.56	4.64	1.70	71.83	6.46	1.97	83.22	7.49	43.74	0.00
600	1.68	33.60	1.21	56.88	5.12	1.68	78.95	7.11	1.94	91.31	8.22	72.90	0.00
1440	2.03	40.60	1.19	67.57	6.08	1.64	93.01	8.37	1.89	107.15	9.64	174.96	0.00

* Z2 is growth factor from M5 rainfalls



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SA6

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Soakaway SA6 - Plot 12

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MFJT

Date:

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ALTERNATIVE SOAKAWAY SIZES

	trench soakaways		
	450	600	900
width of trench [mm]:	450	600	900
required trench length [m]:	5.93	4.91	3.67
	ring soakaways		
	1050	1350	1500
diameter of ring [mm]:	1050	1350	1500
required pit diameter [m]:	1.49	1.49	1.49

* Based on effective depth and number of pits as in Soakaway Data table

SUMMARY OF CALCULATIONS

critical design rainfall duration 't _{crit} ' =	10	min
required storage volume 'V _{req} ' =	1.47	m ³
provided storage volume 'V _{prov} ' =	3.42	m ³
utilisation factor =	0.43	.OK
required time to discharge 50% 't ₅₀ ' =	0.20	hours
utilisation factor =	0.01	.OK

GENERAL DATA

site location:	England and Wales
soakaway type:	geocellular units
impermeable area drained to soakaway 'A' [m ²] =	100
60 min rainfall depth of 5 year return period 'R' [mm] =	20
M5-60 to M5-2d rainfall ratio 'r' =	0.50
allowance for climate change:	40%

SOAKAWAY DATA

soakaway width 'W' [m] =	2.00
soakaway length 'L' [m] =	3.00
total depth from ground level 'D _b ' [m] =	1.40
depth to drain invert level 'D _d ' [m] =	0.80
soakaway effective depth 'D _{eff} ' [m] =	0.60
free volume in infill aggregate [%] =	95

SOIL INFILTRATION DATA

allowance for infiltration through soakaway base:	30%
available on-site infiltration test results:	☐ Yes ☒ No
soil infiltration rate 'f' [m/s] =	5.00E-04

REQUIRED STORAGE CAPACITY PER RAINFALL DURATION

rainfall duration [min]	rainfall factor Z1	M5-D rainfalls [mm]	M10-D			M50-D			M100-D			outflow from soakaway [m ³]	required storage [m ³]
			Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]		
5	0.39	7.80	1.21	13.18	1.32	1.61	17.59	1.76	1.86	20.28	2.03	0.72	1.31
10	0.54	10.80	1.22	18.49	1.85	1.66	25.07	2.51	1.92	29.07	2.91	1.44	1.47
15	0.65	13.00	1.23	22.42	2.24	1.68	30.58	3.06	1.96	35.64	3.56	2.16	1.40
30	0.82	16.40	1.24	28.47	2.85	1.71	39.22	3.92	2.00	45.95	4.59	4.32	0.27
60	1.00	20.00	1.24	34.72	3.47	1.73	48.44	4.84	2.03	56.84	5.68	8.64	0.00
120	1.19	23.80	1.24	41.32	4.13	1.72	57.39	5.74	2.01	67.13	6.71	17.28	0.00
240	1.38	27.60	1.23	47.51	4.75	1.71	66.06	6.61	1.99	76.86	7.69	34.56	0.00
360	1.51	30.20	1.22	51.56	5.16	1.70	71.83	7.18	1.97	83.22	8.32	51.84	0.00
600	1.68	33.60	1.21	56.88	5.69	1.68	78.95	7.90	1.94	91.31	9.13	86.40	0.00
1440	2.03	40.60	1.19	67.57	6.76	1.64	93.01	9.30	1.89	107.15	10.72	207.36	0.00

* Z2 is growth factor from M5 rainfalls



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Highover Farm - Hitchin

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SA7

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Soakaway SA7 - Plot 13 & 14

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MFJT

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ALTERNATIVE SOAKAWAY SIZES

	trench soakaways		
width of trench [mm]:	450	600	900
required trench length [m]:	11.41	9.54	7.22
	ring soakaways		
diameter of ring [mm]:	1050	1350	1500
required pit diameter [m]:	2.15	2.15	2.15

* Based on effective depth and number of pits as in Soakaway Data table

SUMMARY OF CALCULATIONS

critical design rainfall duration 't _{crit} ' =	15	min
required storage volume 'V _{req} ' =	3.53	m ³
provided storage volume 'V _{prov} ' =	5.70	m ³
utilisation factor =	0.62	.OK
required time to discharge 50% 't ₅₀ ' =	0.22	hours
utilisation factor =	0.01	.OK

GENERAL DATA

site location:	England and Wales
soakaway type:	geocellular units
impermeable area drained to soakaway 'A' [m ²] =	190
60 min rainfall depth of 5 year return period 'R' [mm] =	20
M5-60 to M5-2d rainfall ratio 'r' =	0.50
allowance for climate change:	40%

SOAKAWAY DATA

soakaway width 'W' [m] =	2.00
soakaway length 'L' [m] =	5.00
total depth from ground level 'D _b ' [m] =	1.40
depth to drain invert level 'D _d ' [m] =	0.80
soakaway effective depth 'D _{eff} ' [m] =	0.60
free volume in infill aggregate [%] =	95

SOIL INFILTRATION DATA

allowance for infiltration through soakaway base:	30%
available on-site infiltration test results:	☐ Yes ☒ No
soil infiltration rate 'f' [m/s] =	5.00E-04

REQUIRED STORAGE CAPACITY PER RAINFALL DURATION

rainfall duration [min]	rainfall factor Z1	M5-D rainfalls [mm]	M10-D			M50-D			M100-D			outflow from soakaway [m ³]	required storage [m ³]
			Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]		
5	0.39	7.80	1.21	13.18	2.50	1.61	17.59	3.34	1.86	20.28	3.85	1.08	2.77
10	0.54	10.80	1.22	18.49	3.51	1.66	25.07	4.76	1.92	29.07	5.52	2.16	3.36
15	0.65	13.00	1.23	22.42	4.26	1.68	30.58	5.81	1.96	35.64	6.77	3.24	3.53
30	0.82	16.40	1.24	28.47	5.41	1.71	39.22	7.45	2.00	45.95	8.73	6.48	2.25
60	1.00	20.00	1.24	34.72	6.60	1.73	48.44	9.20	2.03	56.84	10.80	12.96	0.00
120	1.19	23.80	1.24	41.32	7.85	1.72	57.39	10.90	2.01	67.13	12.76	25.92	0.00
240	1.38	27.60	1.23	47.51	9.03	1.71	66.06	12.55	1.99	76.86	14.60	51.84	0.00
360	1.51	30.20	1.22	51.56	9.80	1.70	71.83	13.65	1.97	83.22	15.81	77.76	0.00
600	1.68	33.60	1.21	56.88	10.81	1.68	78.95	15.00	1.94	91.31	17.35	129.60	0.00
1440	2.03	40.60	1.19	67.57	12.84	1.64	93.01	17.67	1.89	107.15	20.36	311.04	0.00

* Z2 is growth factor from M5 rainfalls

Anglian Water Asset Records

