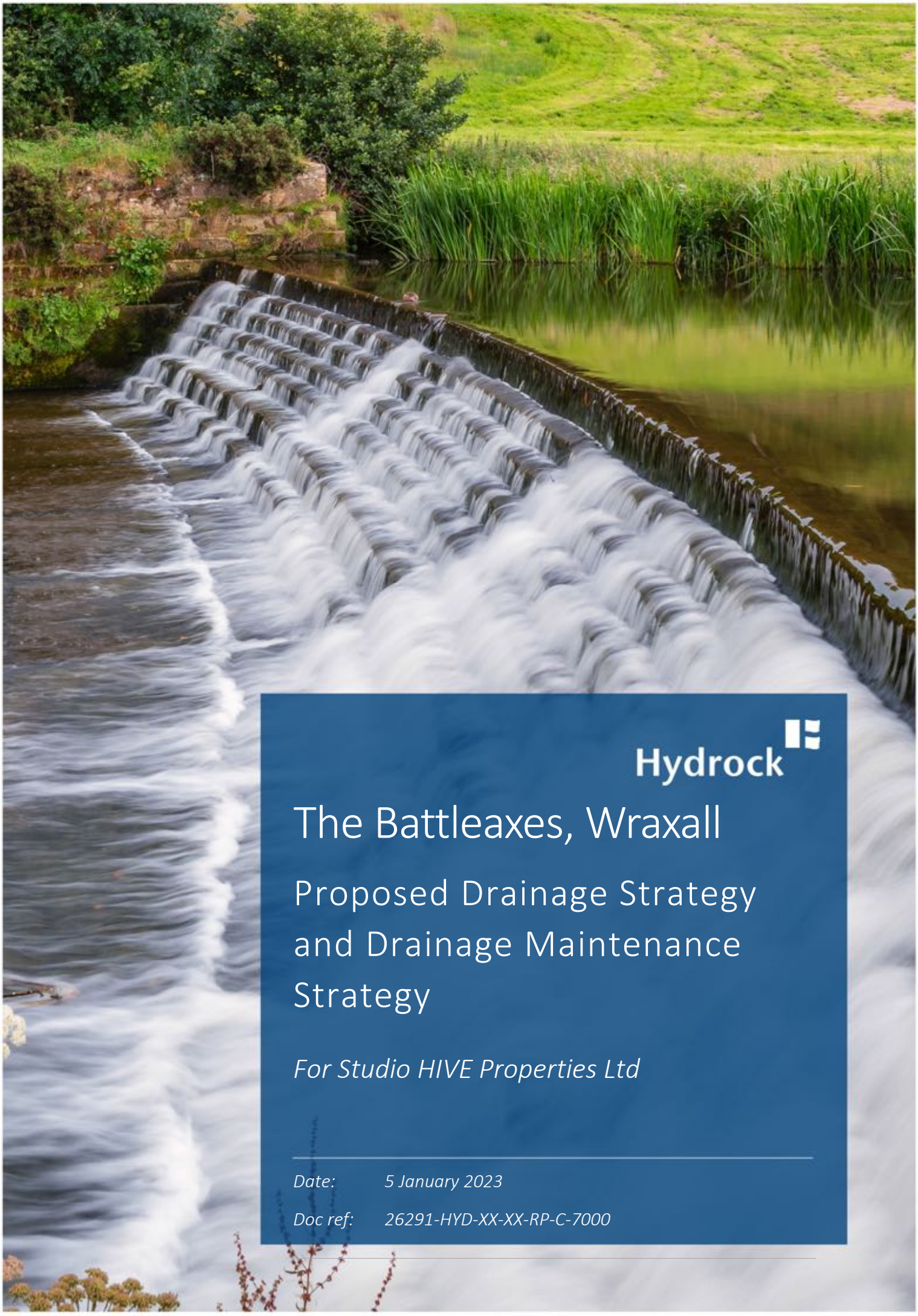

Hydrock

The Battleaxes, Wraxall

Proposed Drainage Strategy and Drainage Maintenance Strategy

For Studio HIVE Properties Ltd

Date: *5 January 2023*

Doc ref: *26291-HYD-XX-XX-RP-C-7000*

DOCUMENT CONTROL SHEET

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CONTENTS

Proposed Drainage Strategy

Hydrock Consultants have been appointed by Studio Hive to complete a drainage strategy and drainage maintenance strategy for the proposed 'The Battleaxes, Wraxall' scheme. The proposed development is. The retention of ancillary bed & breakfast accommodation and part retention of licensed space, change of use of remainder to multi-use business and local community hub, together with rear two-storey extension and 9 new residential dwellings. This report details the proposed storm and foul water strategy for the development and the proposed drainage maintenance strategy. This Report should be read in conjunction with the following Hydrock drawings;

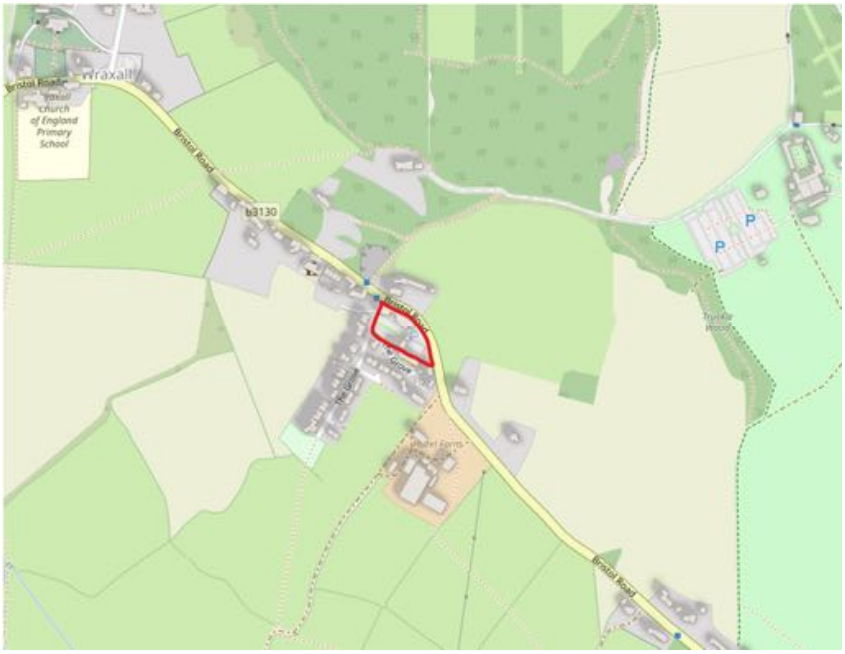
- 26291-HYD-00-ZZ-DR-C-7010 - Proposed Drainage Strategy

A copy of the drawing is shown within Appendix A of this report.

1. EXISTING SITE LOCATION

1.1 Site Location Plan

The site is located within the existing Battleaxes site in the village of Wraxall, about 6 miles west of Bristol, and the B3130 runs next to the site as shown on the extract below. The Grove is a lane that borders the site to the west and the south which provides access to a few residential properties.



The site area is approximately 0.451(ha) and consists of a main building (which used to be the Battleaxes at Wraxall), two existing barns/outbuildings, and a tarmacadam carpark. The site has the postcode BS48 1LQ with grid co-ordinates E=349533, N=171490.

1.2 Existing Topography

The site falls along the B3130 (alongside the northern and eastern boarder of the site) towards the south-west corner of the site, with a level difference of 40.300m to 34.300m. The site consistently falls away from the B3130 at general gradient of 1:9.

There is a series of existing retaining walls on site, the first located to the east of the site with a height of 1.23m to 1.90m. The second is to the northeast boundary of the site with a height of 0.44m to 0.69m. The third retaining wall is in the existing car park with a height of 1.38m to 1.57m. The fourth wall is to the south of the existing Battleaxes building with a height of 0.40m and 0.50m. The final retaining wall runs along the southern boundary with a height 0.59m to 0.80m.

1.3 Existing Drainage

There is an existing Wessex Water foul water sewer that crosses the site with 4 chambers located in the site boundary. The 150mm pipe runs from the east to the west of the site and collects foul water from manhole 5407 from Fryth House.

There is a second Wessex Water sewer that drains across the site from the north west to the south west under the existing Battleaxes building. The sewer records are shown within Appendix B of this report.

There is an existing combined drainage network that currently serves the main Battleaxes building. This appears to drain towards the south of the site to connect into the existing Wessex water sewer. There is also an existing storm drainage network that serves the two outbuildings. It appears that both networks connect into the existing Wessex Water sewer pipe to be a combined system.

1.4 Ground Investigation and Infiltration Testing

An existing borehole record located 360m to the south of the site shows the substrata to be a reddish-brown mudstone. This borehole log is shown in **Appendix C**. The existing site is generally impermeable and consists of carparks and buildings. The combination of steep slopes across the site, existing buildings and retaining walls means the use of soakaways are unfeasible.

1.5 Flood Risk

The Environment Agency flood risk mapping as shown within **Appendix D** of this report shows the site is located within flood risk zone 1 which is a low probability of flooding.

- The site is **not** bigger than 1 hectare (ha)
- The site is **not** in an area with critical drainage problems as notified by the Environment Agency
- The site is **not** identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- The site is **not** at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

The below extract shows there is no surface water risk of flooding on the site.

Based on the above information no further flood risk assessments are required.

2. PROPOSED STORM WATER DRAINAGE

2.1 Sustainable Urban Drainage System (SuDS) Hierarchy

The CIRIA 753 SuDS Manual hierarchy for the discharge of storm water drainage is as follows from Table B4;

1. Infiltration to the maximum extent that is practical - where it is safe to do so.
2. Discharge to surface waters.
3. Discharge to surface water sewer.
4. Discharge to combined sewer (last resort).

Discharge via infiltration is not suitable due to impermeability of the site. There are no watercourses within the immediate vicinity of the development The site is therefore to discharge via the existing Wessex Water sewer network.

2.2 Proposed Discharge Rate and Discharge Location

The site is generally positively drained and is impermeable in nature. The site should therefore be therefore be restricted to a greenfield site with the existing discharge rate modelled using the MicroDrainage ICP SUDS Mean Annual Flood method. With the site generally impermeable in nature the urban factor has been set at 0.75 (this is lower than the actual factor of 0.82 for the existing site).

The calculations do not allow for the area associated with the existing Battleaxes building as this is to remain as existing with limited above ground and internal changes.

The results of the modelling are shown within Appendix E of this report and demonstrate the existing QBAR discharge rate is 6.2(l/s).

2.3 Proposed Storm Water Network

It is proposed to drain the site via gravity and a network of pipes from the southeast to the southwest site access and connect into the combined sewer network to match the existing arrangement. The piped network is oversized to enable the system to be at a flatter gradient and surcharge; this is to enable the attenuation to be located within an area of the site with sufficient available space.

The drainage is to drain via a flow control device restricted to 6.2(l/s) (greenfield runoff rate). The network is to be attenuated within a below ground attenuation crate and discharge to the existing storm water sewer as detailed above.

The network has been modelled using MicroDrainage for all storm events up to and including the 1in100yr+40% climate change storm water event with the results shown within Appendix F of this report. The modelling shows very limited flooding (less than 0.2m3 that can be stored within the unmodelled network) for events up to and including the 1in100yr+40%CC with the discharge rate restricted to 6.2(l/s). The attenuation crate volume is 82.1m^3 and will be located within the existing carpark.

The site offers a reduction in hardstanding overall and therefore a betterment, decreasing the impermeable area by 213m^2. The use of swales, ponds, filter drains etc to attenuate the positively drained system is not practical due to the limited space available on site (note the outbuildings and

retaining walls are existing and a fixed location) and the relatively steep topography local to attenuation areas.

The storm water network is subject to Lead Local Flood Authority and Wessex Water approval.

A S185 (sewer diversion), S106 (right to connect) and build close to agreement will be required from Wessex Water.

2.4 Pollution Control

Based on Table 26.2 of the CIRIA 753 SUDs Manual the pollution hazard level for the residential development of this scale is considered to be low with a total suspended solids value of 0.5, metals value of 0.4 and hydrocarbons value of 0.4.

Unfortunately, due to the topography of the site (1:9 slope) it is not possible to utilise the mitigation SuDS components as highlighted in table 26.3 of the CIRIA 753 document. However; the site has a reduction in impermeable area and a significant reduction in external parking impermeable area resulting in a reduced risk from the pre development pollution hazard levels.

2.5 Flood Exceedance

The flood exceedance routes will follow the proposed topography of the site with the higher areas of the development discharging to the south west to the existing road. There is no change to the overland flow routes and no increase in flood risk as a result of the development. The flow routes are shown on the Hydrock

3. PROPOSED FOUL WATER DRAINAGE

3.1 Foul Water Discharge Location

It is proposed to drain the foul water network to the existing Wessex Water foul manhole 4403 located outside the site boundary in The Grove access road, to the southwest of the site. There are two number foul water sewers that cross the site from the north and east to the south east corner. Both sewers will need to be diverted to avoid clashes with the proposed buildings and retaining features.

3.2 Proposed Foul Water Network

The proposed foul water network is to drain via gravity following the existing topography of the site to the southwest and connect to the existing sewer network.

There is an allowance for an additional 9 dwellings. Based on Table 5 of the Approved Building Regulations Document H the anticipated peak foul flow rate is 4.1(l/s).

It is proposed to connect directly to the diverted Wessex Water sewer. There is a significant reduction in the existing storm water discharge rate connecting to the Wessex Water sewer due to the discharge being restricted to the greenfield run-off rate There is therefore sufficient capacity within the proposed network to accommodate the foul water discharge.

4. DESIGN STANDARDS

British Standards / Eurocodes:

- BS EN 752:2017 Drains and Sewer Systems Outside Buildings

Building Regulations

- Building Regulations 2010 Part H – Drainage and Waste Disposal

Statutory Guidance / Regulations

- Sewers Sector Guidance (where applicable).
- Local Water Authority requirements.
- Local Planning Authority (LPA) and Lead Local Flood Authority (LLFA) requirements.

In addition, where applicable the surface water drainage systems will follow the guidelines as set out in:

- CIRIA C753 - SuDS Manual.
- CIRIA C156 - Infiltration Drainage 'Manual of Good Practice'
- National Planning Policy Framework (NPPF)
- DEFRA Non-Statutory Technical Standards for Sustainable Drainage.
- Environment Agency "Control of Runoff from New Developments Interim Regional Guidance"

Proposed Drainage Operations and Maintenance Manual

Hydrock Consultants Ltd have been appointed by Studio Hive to complete the drainage operations and maintenance manual as below. The intention is for the dwelling occupier/owner to be responsible for the maintenance of the drainage within the dwelling ownership boundary; the wider drainage within shared spaces will be managed by a third-party maintenance team. The contractor will be responsible for the maintenance during the construction phase to ensure the drainage is operational and maintained prior to hand over.

5. OPERATION AND MAINTENANCE REQUIREMENTS

5.1 Drainage General

Manholes are to be inspected for debris and integrity. Any man-entry into manholes should be by trained personnel with adequate personal protective equipment. Approved safety procedures must be followed. To be completed twice a year.

Pipes are to be inspected for integrity and debris by CCTV. To be completed every 10 years.

5.2 Cellular Storage

Inspect and identify any areas that are not operating correctly. To be completed monthly for the first 3 months and then annually. If required remedial action should be taken.

Remove debris from the catchment surface (where it may cause risks to performance). To be completed monthly.

Remove sediment from pre-treatment structures and/or internal forebays. To be completed annually or as required.

Inlets, outlets, overflows and vents are to be repaired and rehabilitated as required.

Inlets, outlets, overflows and vents are to be inspected and checked to ensure that they are in good condition and operating as designed annually.

Inside of tank to be surveyed for sediment build-up and removed if necessary. To be completed every 5 years or as required.

5.3 Gullies & Drainage Channels

Remove litter (including leaf litter) and debris from drain surface devices quarterly or as required.

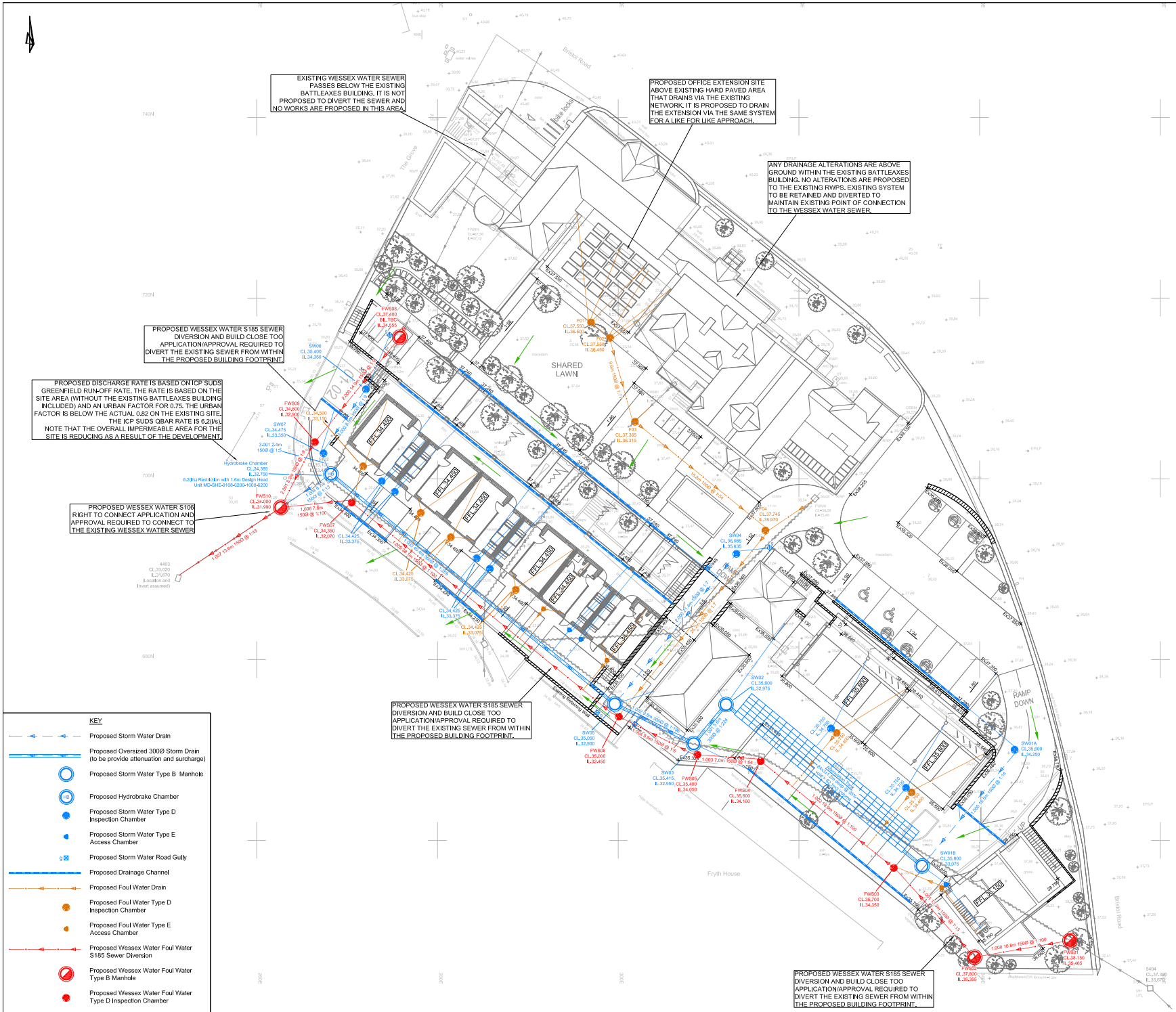
Inspect drain surface and inlets/outlets pipework for blockages, clogging, standing water and structural damage monthly.

Regular maintenance is required to remove silt and debris as necessary to prevent build up

5.4 Third-Party Products

To be maintained as per manufacturer guidelines.

Appendix A - Drainage Strategy



KEY PLAN

NOTES

1. This drawing is to be read in conjunction with relevant Architects, Engineers and specialist manufacturers drawings, reports and specifications.
2. All levels are shown in metres above Ordnance Datum (m AOD) unless otherwise shown.
3. Any ambiguities or discrepancies within this drawing and any other information given elsewhere must be reported to Hydrock for clarification.
4. All dimensions to be checked on site and any discrepancies reported to Hydrock before pricing / works commence.
5. It is recommended that all drains be laid starting from the downstream connection to the outlet and working upstream to the new development.
6. All private drainage to comply with current Building Regulations and relevant British Standards and Codes of Practices.
7. Connections to existing sewers in accordance with the Local Water Authority guidelines & approval.
8. Sewers and drains of different diameters should be laid soffit to soffit unless shown otherwise in the drawing.
9. All access chambers covers and frames to be installed to BS EN 124.
10. Private drainage pipe material and bedding to be agreed with Building control.
11. Foul drainage pipe connection to public sewer to be clay otherwise plastic twin-walled/ribbed pipe constructed to Water Industry Standard (WIS)-4-35-01.
12. Drainage Pipe work routes under building footprint will require installation prior to foundations.
13. The pipe diameters cover and invert levels of any existing manholes are to be verified on site prior to the commencement of the works.
14. All external drainage within trafficked areas with less than 1.2m cover to have type Z concrete bed and surround. All external drainage within landscaped areas with cover less than 0.6m to have type Z concrete bed and surround. All drainage with greater cover than the minimum required to have type S bed and surround.
15. For manufacturer specific items such as petrol interceptors, drainage channels etc please refer to manufacturer specific installation details.
16. For foundation details please refer to structural engineers drawings.

REVISIONS

REV	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE
04	Levels updated and associated drainage					
	RS	22.02.23	JW	22.02.23	JW	22.02.23
03	Levels updated and associated drainage					
	RS	20.02.23	JW	20.02.23	JW	20.02.23
02	Levels updated and associated drainage					
	RS	14.02.23	JW	14.02.23	JW	14.02.23
01	FIRST ISSUE					
	RS	05.01.23	JW	05.01.23	JW	05.01.23

REVISION NOTES/COMMENTS

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CLIENT
STUDIO HIVE

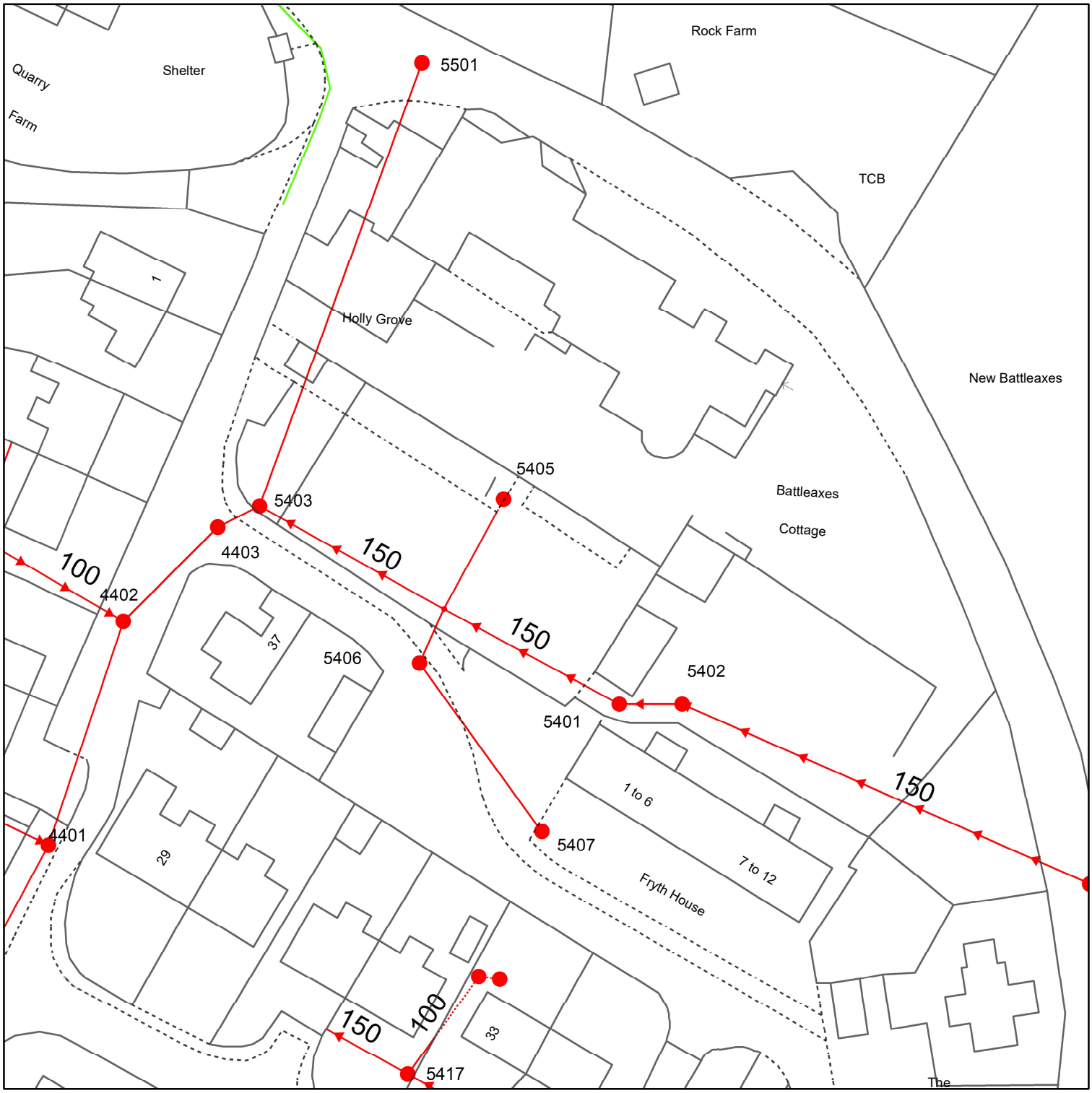
PROJECT
THE BATTLEAXES

TITLE
PROPOSED DRAINAGE STRATEGY

HYDROCK PROJECT NO.	SCALE @ A1
C-26291	1:200
STATUS DESCRIPTION: WORK IN PROGRESS	STATUS: S2
DRAWING NO.: C26291-HYD-XX-XX-DR-C-7010	REVISION: 04

Appendix B - Wessex Water Sewer Map

Wessex Water Network Map



WATER MAINS
- Distribution
- Washout
- Raw Water
- Abandoned
- Private

FITTINGS
- Hydrant
- Other

SEWERS
STRATEGIC PUBLIC PRIVATE SECTION 104
- Foul
- Surface
- Combined
- Abandoned

Colours generally indicate the use of the sewer/drain (i.e Red - Foul, Dark Blue - Surface, Magenta - Combined/Dual Use, Light Green - Highway Drain, Mid Green - Overflow).
Some styles of line and symbol are shown on the key in sample/typical colours.

STRUCTURES
- Manhole - Foul
- Manhole - Surface
- Manhole - Combined
- Inlet
- Outfall
- Lamphole
- Bifurcation - Foul
- Bifurcation - Surface
- Bifurcation - Combined
- Combined Sewage Overflow
- Pumping Station - Surface
- Pumping Stn - Foul/Combined
- Gully
- Vent Column
- Rodding Eye
- Catchpit
- Flushing Chamber
- Soakaway
- Non Return Valve
- Air Valve
- Hatch Box
- Washout

OTHER WESSEX PIPES
- Rising Mains
- Standby Rising Mains
- EDM — Effluent Disposal
- Overflow
- S — Syphon

NON-WESSEX / UNKNOWN
- Private Rising Mains
- CW — Culverted Watercourse
- H — Highway Drain
- ? — Use Unknown
- SU — Status Unknown

OTHER STRUCTURES
- Attenuation Tank
- Storage Tank
- Chamber
- Tunnel
- Interceptor

Wessex Water
YTL GROUP

Date: 20/12/2022
Centre: 349533, 171490
Scale: 1:625
(when printed at A4 size)

N W E S

Appendix C - Historic Borehole Log

BOREHOLE No. 311

297
3606

BOREHOLE LOG

1"NS. 264. NOR. 4940.7114

LOC LOCATION No. 3606 BIRMINGHAM TO EXETER MOTORWAY
Tickenham, Som. ROSS SPUR JUNCTION TO EAST BRENT ST/47SE/9

CARRIED OUT FOR: MINISTRY OF TRANSPORT

CONSULTING ENGINEERS: FREEMAN FOX & PARTNERS & R. F. EARLEY

TYPE OF BORING: H. .UG DIAMETER: 6 INCH DATE: 1[illegible] JUN[illegible] 1961

CHAINAGE: 233+00 GROUND LEVEL 20.9 ft. O.D PAVEMENT LEVEL

Description	Legend	Sample	Depth	m%	Test Results & Notes
					No water encountered
TOPSOIL	Ground Level	1	0ft. 0in. (0'6")		
Reddish [illegible] MUDSTONE (Keuper Marl)		2 (1'0")	(0.15m)	14	C 10,300 pw 137
		3 (1'0")	[illegible] (0.90m)	12	
		[illegible] OF BOREHOLE			

Appendix D - EA Flood Mapping

Flood map for planning

Your reference	Location (easting/northing)	Created
Battleaxes	**349540/171499**	**20 Dec 2022 16:58**

Your selected location is in flood zone 1, an area with a low probability of flooding.

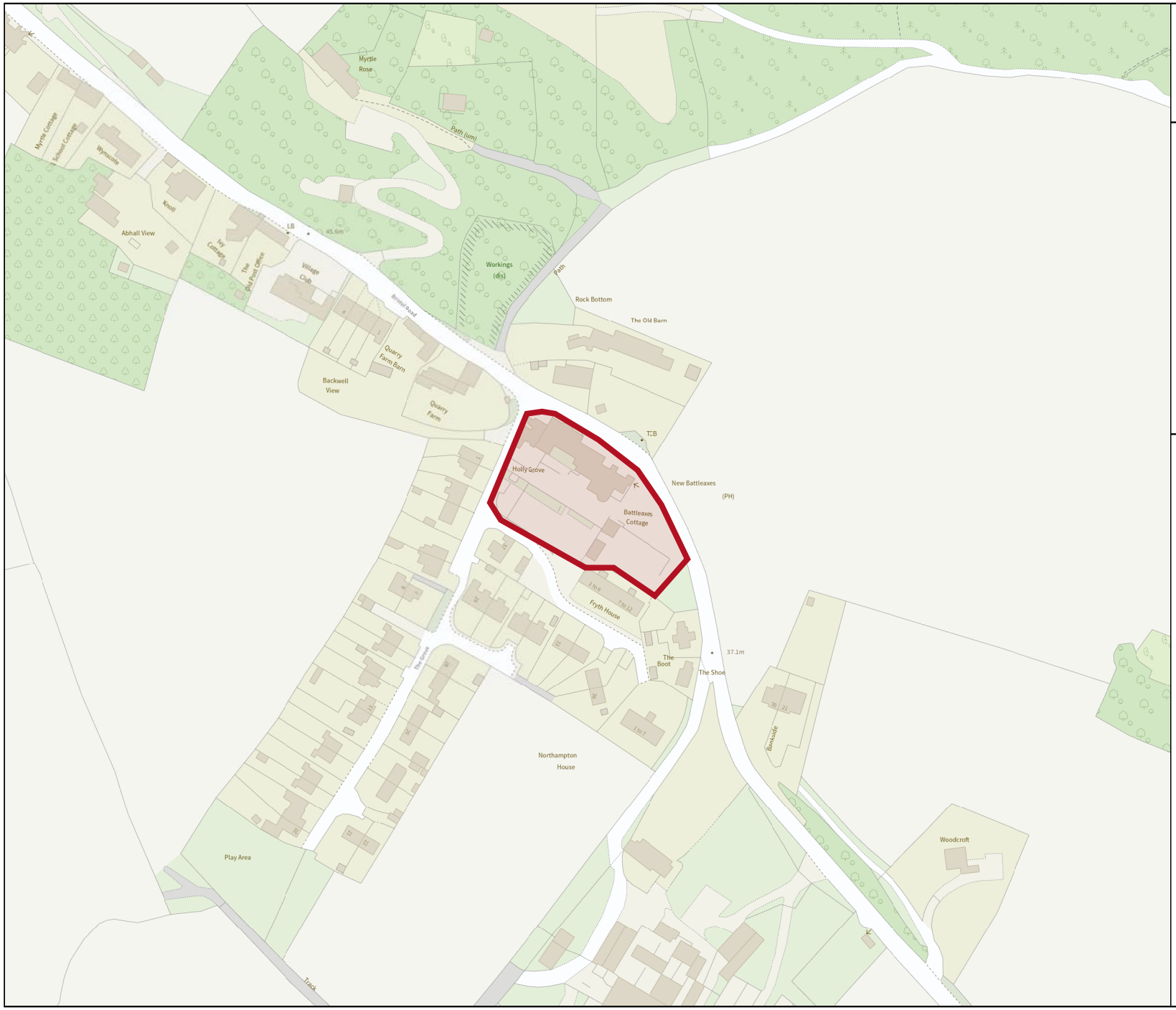
You will need to do a flood risk assessment if your site is **any of the following:**

- bigger that 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.



Environment Agency

Flood map for planning

Your reference
Battleaxes

Location (easting/northing)
349540/171499

Scale
1:2500

Created
20 Dec 2022 16:58

- Selected area
- Flood zone 3
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

0 20 40 60m

Appendix E - Greenfield Run-off Rate

ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	Soil	0.450
Area (ha)	0.390	Urban	0.750
SAAR (mm)	1000	Region Number	Region 8

Results l/s

QBAR Rural	2.6
QBAR Urban	6.2
Q1 year	4.9
Q1 year	4.9
Q30 years	9.8
Q100 years	10.9

Appendix F - Storm Water Calcs

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	16.500	1.025	16.1	0.043	4.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	28.100	0.100	281.0	0.037	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	5.600	0.025	224.0	0.008	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	9.800	0.050	196.0	0.043	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	21.400	2.585	8.3	0.028	4.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	40.400	0.150	269.3	0.062	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.000	9.800	1.050	9.3	0.003	4.00	0.0	0.600	o	150	Pipe/Conduit	
3.001	2.400	0.450	5.3	0.004	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.005	6.700	0.500	13.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	4.11	34.250	0.043	0.0	0.0	0.0	2.52	44.6	5.8
1.001	50.00	4.61	33.075	0.080	0.0	0.0	0.0	0.93	65.9	10.8
1.002	50.00	4.70	32.975	0.088	0.0	0.0	0.0	1.05	74.0	11.9
1.003	50.00	4.85	32.950	0.131	0.0	0.0	0.0	1.12	79.1	17.7
2.000	50.00	4.10	35.635	0.028	0.0	0.0	0.0	3.52	62.3	3.8
1.004	50.00	5.55	32.900	0.221	0.0	0.0	0.0	0.95	67.4	29.9
3.000	50.00	4.05	34.400	0.003	0.0	0.0	0.0	3.32	58.6	0.4
3.001	50.00	4.06	33.350	0.007	0.0	0.0	0.0	4.39	77.6	0.9
1.005	50.00	5.59	32.750	0.228	0.0	0.0	0.0	2.77	48.9	30.9

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.
.

Date 13/02/2023 16:09 | Designed by jameswelch
File STORM WATER CALC.MDX | Checked by
Innovyze | Network 2020.1.3

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
SW01A	35.600	1.350	Open Manhole	1200	1.000	34.250	150				
SW01	35.800	2.725	Open Manhole	1200	1.001	33.075	300	1.000	33.225	150	
SW02	35.600	2.625	Open Manhole	1200	1.002	32.975	300	1.001	32.975	300	
SW03	35.415	2.465	Open Manhole	1200	1.003	32.950	300	1.002	32.950	300	
SW04	36.985	1.350	Open Manhole	1200	2.000	35.635	150				
SW05	35.050	2.150	Open Manhole	1200	1.004	32.900	300	1.003	32.900	300	
								2.000	33.050	150	
SW06	35.450	1.050	Open Manhole	1200	3.000	34.400	150				
SW07	34.400	1.050	Open Manhole	1200	3.001	33.350	150	3.000	33.350	150	
HB	34.350	1.600	Open Manhole	1200	1.005	32.750	150	1.004	32.750	300	
								3.001	32.900	150	150
	34.000	1.750	Open Manhole	0		OUTFALL		1.005	32.250	150	

No coordinates have been specified, layout information cannot be produced.

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	SW01A	35.600	34.250	1.200	Open Manhole	1200
1.001	o	300	SW01	35.800	33.075	2.425	Open Manhole	1200
1.002	o	300	SW02	35.600	32.975	2.325	Open Manhole	1200
1.003	o	300	SW03	35.415	32.950	2.165	Open Manhole	1200
2.000	o	150	SW04	36.985	35.635	1.200	Open Manhole	1200
1.004	o	300	SW05	35.050	32.900	1.850	Open Manhole	1200
3.000	o	150	SW06	35.450	34.400	0.900	Open Manhole	1200
3.001	o	150	SW07	34.400	33.350	0.900	Open Manhole	1200
1.005	o	150	HB	34.350	32.750	1.450	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	16.500	16.1	SW01	35.800	33.225	2.425	Open Manhole	1200
1.001	28.100	281.0	SW02	35.600	32.975	2.325	Open Manhole	1200
1.002	5.600	224.0	SW03	35.415	32.950	2.165	Open Manhole	1200
1.003	9.800	196.0	SW05	35.050	32.900	1.850	Open Manhole	1200
2.000	21.400	8.3	SW05	35.050	33.050	1.850	Open Manhole	1200
1.004	40.400	269.3	HB	34.350	32.750	1.300	Open Manhole	1200
3.000	9.800	9.3	SW07	34.400	33.350	0.900	Open Manhole	1200
3.001	2.400	5.3	HB	34.350	32.900	1.300	Open Manhole	1200
1.005	6.700	13.4		34.000	32.250	1.600	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.005		34.000	32.250	0.000	0	0

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Date 13/02/2023 16:09 | Designed by jameswelch
File STORM WATER CALC.MDX | Checked by
Innovyze | Network 2020.1.3

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	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)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	21.000	Storm Duration (mins)	30
Ratio R	0.345		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: HB, DS/PN: 1.005, Volume (m³): 4.6

Unit Reference	MD-SHE-0108-6200-1600-6200
Design Head (m)	1.600
Design Flow (l/s)	6.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	108
Invert Level (m)	32.750
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.600	6.2
Flush-Flo™	0.472	6.2
Kick-Flo®	0.964	4.9
Mean Flow over Head Range	-	5.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.7	1.200	5.4	3.000	8.3	7.000	12.4
0.200	5.5	1.400	5.8	3.500	9.0	7.500	12.9
0.300	5.9	1.600	6.2	4.000	9.5	8.000	13.3
0.400	6.1	1.800	6.6	4.500	10.1	8.500	13.7
0.500	6.1	2.000	6.9	5.000	10.6	9.000	14.0
0.600	6.1	2.200	7.2	5.500	11.1	9.500	14.4
0.800	5.7	2.400	7.5	6.000	11.6		
1.000	5.0	2.600	7.8	6.500	12.0		

Storage Structures for Storm

Tank or Pond Manhole: SW02, DS/PN: 1.002

Invert Level (m) 32.975

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	72.0	1.200	72.0	1.201	0.0

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	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	0.345
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	21.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
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.
1.000	SW01A	15 Winter	1	+0%				
1.001	SW01	15 Winter	1	+0%	30/30 Winter			
1.002	SW02	60 Winter	1	+0%	30/15 Winter			
1.003	SW03	30 Winter	1	+0%	30/15 Summer			
2.000	SW04	15 Winter	1	+0%				
1.004	SW05	30 Winter	1	+0%	30/15 Summer			
3.000	SW06	15 Summer	1	+0%				
3.001	SW07	15 Winter	1	+0%	30/15 Summer			
1.005	HB	30 Winter	1	+0%	1/15 Summer	100/120 Winter		

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	SW01A	34.289	-0.111	0.000	0.16			6.4	OK
1.001	SW01	33.161	-0.214	0.000	0.18			10.7	OK
1.002	SW02	33.090	-0.185	0.000	0.09			4.4	OK
1.003	SW03	33.123	-0.127	0.000	0.08			5.0	OK

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 / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
2.000	SW04	35.661	-0.124	0.000	0.07			4.2	OK
1.004	SW05	33.129	-0.071	0.000	0.19			11.9	OK
3.000	SW06	34.406	-0.144	0.000	0.01			0.4	OK
3.001	SW07	33.365	-0.135	0.000	0.02			0.9	OK
1.005	HB	33.122	0.222	0.000	0.14			6.0	SURCHARGED

PN	US/MH Name	Level Exceeded
1.000	SW01A	
1.001	SW01	
1.002	SW02	
1.003	SW03	
2.000	SW04	
1.004	SW05	
3.000	SW06	
3.001	SW07	
1.005	HB	1

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	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	0.345
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	21.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
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.
1.000	SW01A	15 Winter	30	+0%				
1.001	SW01	60 Winter	30	+0%	30/30 Winter			
1.002	SW02	60 Winter	30	+0%	30/15 Winter			
1.003	SW03	120 Winter	30	+0%	30/15 Summer			
2.000	SW04	15 Winter	30	+0%				
1.004	SW05	15 Summer	30	+0%	30/15 Summer			
3.000	SW06	15 Summer	30	+0%				
3.001	SW07	15 Summer	30	+0%	30/15 Summer			
1.005	HB	15 Summer	30	+0%	1/15 Summer	100/120 Winter		

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	SW01A	34.314	-0.086	0.000	0.38			15.8	OK
1.001	SW01	33.468	0.093	0.000	0.24			14.5	SURCHARGED
1.002	SW02	33.465	0.190	0.000	0.72			36.6	SURCHARGED
1.003	SW03	33.466	0.216	0.000	0.53			32.2	SURCHARGED

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 / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
2.000	SW04	35.677	-0.108	0.000	0.17			10.3	OK
1.004	SW05	33.495	0.295	0.000	0.37			23.4	SURCHARGED
3.000	SW06	34.415	-0.135	0.000	0.02			1.1	OK
3.001	SW07	33.534	0.034	0.000	0.11			4.8	SURCHARGED
1.005	HB	33.538	0.638	0.000	0.14			5.9	SURCHARGED

PN	US/MH Name	Level Exceeded
1.000	SW01A	
1.001	SW01	
1.002	SW02	
1.003	SW03	
2.000	SW04	
1.004	SW05	
3.000	SW06	
3.001	SW07	
1.005	HB	1

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	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	0.345
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	21.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
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.
1.000	SW01A	120 Winter	100	+40%				
1.001	SW01	120 Winter	100	+40%	30/30 Winter			
1.002	SW02	120 Winter	100	+40%	30/15 Winter			
1.003	SW03	120 Winter	100	+40%	30/15 Summer			
2.000	SW04	15 Winter	100	+40%				
1.004	SW05	120 Winter	100	+40%	30/15 Summer			
3.000	SW06	15 Winter	100	+40%				
3.001	SW07	120 Winter	100	+40%	30/15 Summer			
1.005	HB	120 Winter	100	+40%	1/15 Summer	100/120 Winter		

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	SW01A	34.374	-0.026	0.000	0.22			9.3	OK
1.001	SW01	34.368	0.993	0.000	0.28			16.4	SURCHARGED
1.002	SW02	34.365	1.090	0.000	0.12			6.1	SURCHARGED
1.003	SW03	34.363	1.113	0.000	0.11			6.9	SURCHARGED

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 / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
2.000	SW04	35.693	-0.092	0.000	0.32			18.6	OK
1.004	SW05	34.360	1.160	0.000	0.12			7.5	SURCHARGED
3.000	SW06	34.419	-0.131	0.000	0.04			2.0	OK
3.001	SW07	34.350	0.850	0.000	0.03			1.3	FLOOD RISK
1.005	HB	34.350	1.450	0.264	0.15			6.2	FLOOD

PN	US/MH Name	Level Exceeded
1.000	SW01A	
1.001	SW01	
1.002	SW02	
1.003	SW03	
2.000	SW04	
1.004	SW05	
3.000	SW06	
3.001	SW07	
1.005	HB	1