PRP environmental

PRP Leicester
Park House 21-22 Warren Park Way
Enderby Leicester LE19 4SA

[redacted]

Foul and Surface Water Drainage Strategy
for
Proposed Residential Development
at
Station Road, Bagworth, Leicestershire LE67 1BA

for:

A R Cartwright Ltd, Vicarage Street, Nuneaton, CV11 4AZ

Date	Issued	Revision
21 August 2025	Issued	A

Reference: 83047-02

Prepared by:

Elliot Cant
MEng
Project Civil Engineer

Approved by:

[redacted]

Jack Norris
BSc. C.Eng. M.I.Struct.E. M.a.p.s
Director
PRP UK Ltd

EXECUTIVE SUMMARY

This drainage strategy has been developed for A R Cartwright Ltd, in support of their planning application for the proposed residential development at Station Road, Bagworth. The planned scheme will involve the construction of 48 residential dwellings and their associated infrastructure. The site is presently occupied by agricultural land.

This report provides a description of the best means of providing foul and surface water drainage to the development along with an assessment of the present and future foul and surface water drainage flows.

The opportunity to integrate SuDS principles has been explored for the surface water drainage system. A soakaway system is not practical due to the likely presence of clays and Edwalton member formation. In view of this, a combination of a permeable paving and an attenuation basin has been specified, thereby reducing the surface water runoff into the culverted watercourse to 2l/s for all storm events up to the 1:100 year event plus 40% for climate change via a flow control chamber with a Hydrobrake. The surface water will drain solely by gravity into the culverted watercourse to the west of the site. Drainage investigations by way of a CCTV survey will be carried out to determine the location, connectivity and condition of the existing culverted watercourse and this report updated accordingly.

The foul drainage will discharge into the Severn Trent Water combined sewer below Station Road to the south of the site via an adoptable pumping station and brake chamber.

In order to ensure that the surface water drainage scheme remains effective, a sustainable drainage operation and maintenance plan specific to the site is included in this report.

CONTENTS

APPENDICES

1. INTRODUCTION

1.1 This drainage strategy report has been prepared on the instruction of A R Cartwright Ltd in support of the planning application for the proposed residential development at Station Road in Bagworth.

1.2 The site is presently a mixture of greenfield and brownfield, with the majority of the site occupied by agricultural land, with three single storey buildings in the south eastern corner of the site. The proposed development is a residential site including 46 dwellings and associated hard paved areas (Roads and driveways). See Appendix I for the Architectural site plans.

1.3 The purpose of the report is to establish the best means of providing surface and foul water drainage for the proposed development while adhering to statutory requirements of Leicestershire County Council.

2. EXISTING CONDITIONS AND THE LOCAL ENVIRONMENT

2.1 The site for the proposed residential development is situated in Bagworth, with the coordinates of the approximate centre of the site being easting 444000 and northing 309375.

2.2 The majority of the site is presently a greenfield site occupied by agricultural land. There is a small area of brownfield in the south eastern corner, where three single storey buildings are located.

2.3 The site has an area of approximately 2.1 hectares.

2.4 The immediate surrounding and proximal land uses are:

Direction	Description
North	Woodland / Residential
South	Woodland / Residential
East	Residential / Highway
West	Woodland / Agricultural Land

3. INVESTIGATIONS INTO THE GEOLOGY AND EXISTING DRAINAGE

3.1 The bedrock described here by the British Geological Survey maps for Britain is the Edwalton Member. This weathers into Mudstone and siltstone.

3.2 No superficial deposits are recorded on the website for this area.

3.3 There are no boreholes recorded in the immediate vicinity of the site location.

3.4 A ground investigation report has yet to be produced.

3.5 The geology beneath the site is likely to have a low to negligible permeability, with the weathered Edwalton Member likely to comprise clay and silt, therefore, soakaways are very unlikely to be feasible.

3.6 Sewer records have been purchased from Severn Trent Water (Appendix V). There are no public surface water sewers within the vicinity of the site. However, there is a combined sewer nearby underneath Station Road.

3.7 A pre-development enquiry was submitted to Severn Trent Water, and their response will be appended to this report upon receipt.

4. ASSESSMENT OF PRESENT AND FUTURE SURFACE WATER FLOWS

4.1 The site area is approximately 2.1ha and is currently occupied by agricultural land.

4.2 The hierarchy of SuDS surface water disposal as outlined within Building Regulations Part H 2015 is as follows:

- A soakaway or infiltration system, or where not reasonably practicable
- A surface water ditch or watercourse, or where not reasonably practicable
- A below ground sewer

4.3 The underlying bedrock is the Edwalton Member, which weathers into Mudstone and siltstone. Given this, the site is likely to have negligible permeability and soakaways are deemed to be impractical.

4.4 There is a culverted watercourse located adjacent to the western site boundary. At the time of writing, this culverted watercourse has yet to be surveyed and validated, however, this is deemed to be the most suitable outfall at this time, subject to LLFA / OWC approval.

4.5 There are no Severn Trent Water surface water sewers within the vicinity of the site, there is a however a combined sewer located within Station Road approximately 150m south of the site entrance. Discharge into the combined sewer could be explored as an alternative, should the culverted watercourse be ruled out, subject to STW and LLFA Approval.

4.6 Private gravity drains are proposed to be constructed locally around the plots, collecting and conveying surface water to adoptable Surface Water Sewers below the proposed highways, subject to a S104 agreement with STW. The surface water will then be attenuated within an attenuation basin where the flow is to be restricted via a flow control chamber prior to discharge into the existing culverted watercourse located to the west of the site, subject to OWC / LLFA approval.

4.7 Type C permeable paving will be provided on the driveways and the shared parking areas to treat and store all surface water runoff before discharging into the proposed public surface water sewers within the site and subsequently into the attenuation basin.

4.8 The Attenuation Basin will not only provide attenuation for the surface water but will provide further treatment to the surface water, as well as promoting amenity and biodiversity.

4.9 Details for the attenuation basin will be developed in conjunction with the landscape architect as part of the detailed design.

4.10 A flow control chamber will be provided downstream of the attenuation basin restricting flows into the culverted watercourse to 2l/s for all storm events, subject to LLFA / OWC approval.

4.11 Discharging at 2l/s will provide a betterment to the existing greenfield runoff rate for all storm events as calculated within Appendix VII.

4.12 300mm sumps will be provided upstream of the attenuation basin to trap detritus, thus extending its lifespan.

4.13 The outline proposed drainage layout is included in Appendix II.

4.14 The first 5mm of rainfall will be retained on-site with the following SuDS features, type C permeable paving, and soft landscaping will be able to retain the hard paving surface water runoff.

4.15 An assessment of the feasibility of different SuDS features has been undertaken for the site and can be found within Appendix VI.

4.16 MicroDrainage Calculations for the site have been carried out, highlighting how the system performs during different storm events. The results for critical storm events are included within Appendix IV.

4.17 Exceedance flows in the event of system failure or an exceptional rainfall event above the 1 in 100 year + 40% for climate change storm event have been considered as follows:

- Channel and threshold drains and gullies will capture any initial overflows
- The road and shared car parking areas are bound by kerb upstands which will be able to provide a significant amount of above ground storage preventing any initial overflows from leaving the site

- Beyond this, any overflow will flow westwards past the properties and into the green areas and attenuation basin west of the site having no adverse effect on neighbouring properties

4.18 Discharging into the culverted watercourse will be subject to LLFA / OWC approval.

5. MAINTENANCE OF THE SURFACE WATER DRAINAGE SYSTEM

5.1 It is recognised that the surface water drainage system has to be designed with its future maintenance being considered. In this context, there will be a management structure in place to cover various aspects of the development which will include the drainage requirements as set out herein.

5.2 In principle, by good design, it is intended to reduce the risk of the existing system becoming broken or otherwise failing to operate properly as the most effective way of reducing the need for active maintenance.

5.3 A SuDS maintenance schedule is included in Appendix III.

5.4 All the above will be developed by PRP and included in the O & M manuals and the health and safety file for the development.

6. FOUL WATER DRAINAGE

6.1 There is a Severn Trent Water combined sewer located within Station Road approximately 150m south of the site entrance, with MH1301 the likely chamber for connection.

6.2 Private gravity drains are proposed to be constructed carrying foul water from properties to the Proposed S104 Foul Sewers, beneath the proposed highway, where the foul water will be conveyed to the proposed Severn Trent Water Pumping Station. The foul water will then be pumped into the combined sewer MH1301 on Station Road via a brake chamber.

6.3 Discharging into the Severn Trent Water combined sewer will be subject to a direct S106 Agreement.

6.4 A predevelopment enquiry has been submitted to Severn Trent Water. Their response will be communicated in due course.

6.5 A Severn Trent Water asset plan is provided in Appendix V which shows the location of the manhole into which the foul water will discharge.

6.6 The outline proposed drainage layout is included in Appendix II.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 It is intended to construct a new residential development consisting of 46 dwellings at Station Road, Bagworth.

7.2 The development should be allowed to proceed because:

- The surface water runoff from the proposed site will discharge into the culverted watercourse to the east of the site, via a hydrobrake at 2l/s providing a betterment to the existing greenfield runoff rates for all storm events.

- The foul water from the proposed site will discharge into the Severn Trent Water combined sewer within Bedford Road via an adoptable pumping station and a new direct connection into STW MH1301 via a brake chamber.

- The first 5mm of rainfall will be retained on-site with the following SuDs features, the type C permeable paving, and soft landscaping will be able to retain the hard paving surface water runoff.

- The initial flood exceedance from exceptional rainfall events above the 1 in 100 year + 40% for climate change storm event will be contained within the kerb bound public highway. Should this be breached further, flood exceedance has been shown to have no adverse effect on neighbouring properties

- A maintenance plan including prevention measures has been outlined for the development and will be finalised as part of the detailed design thus ensuring the longevity of the surface water drainage scheme

7.3 It is recommended that a drainage survey of the existing culverted watercourse is caried out to validate the size, location and invert level to ensure a connection via the site is feasible.

APPENDIX I

ARCHITECTURAL LAYOUT

@ 1:500

SCHEDULE

AFFORDABLE HOUSING @ 40% of 46 = 19

AFFORDABLE RENT @ 75% of 19 = 14

Small dwellings			
1 bed apartments	-	2	
2 bed bungalow	-	2	
2 bed houses	-	4	
TOTAL	**-**	**8**	**= 42.1% of 19**
Medium / large dwellings			
3 bed houses	-	4	
4 bed houses	-	2	
TOTAL	**-**	**6**	**= 31.5% of 19**

FIRST HOMES @ 25% of 19 = 5

Small dwellings			
2 bed houses	-	2	
TOTAL	**-**	**2**	**= 10.6% of 23**
Medium / large dwellings			
3 bed houses	-	3	
TOTAL	**-**	**3**	**= 15.8% of 23**

TOTAL = 19

MARKET HOUSING

2 bed bungalows	-	4	
2 bed houses	-	20	**= 70% of 34**
3 bed houses	-	7	
4 bed houses	-	3	**= 30% of 34**
TOTAL		**= 34**	

TOTAL DWELLINGS = 57

Total housing split

36 x smaller and medium size units = **63%** of which 2 (5%) are flats.

21 x medium and larger family units = **37%**

LANDSCAPING

Proposed new tree planting
- total area = approx. 2187m²
= 10% of total site area

Proposed new BNG planting
- total area = approx. 5050m²

Root protection areas

Attenuation pond

PUMPING STATION

Approx. 0.9m retaining wall

Approx. 1m retaining wall

Approx. 1.7m retaining wall

Approx. 0.6m retaining wall

Approx. 0.7m retaining wall

Approx. 0.6m retaining wall

Cartwright HOMES

Station Road Bagworth

Client	**Cartwright Homes**
Project Title	Proposed development Station Road Bagworth
Drawing Title	**Sketch site layout**
Scale	1:500
Date	Aug 2024
Sheet	A1
Author	ZLM
Checked by	-
Job No.	24/19
Drawing No.	04d
Status	PLANNING

hayward ARCHITECTS LTD
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Hinckley
Leicestershire
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Tel: 01455 635 665
Fax: 01455 618 971
www.hayward-architects.co.uk

Sheet 1

APPENDIX II

PROPOSED DRAINAGE STRATEGY

Drainage Strategy

Surface Water Drainage

- Under part H of the Building Regulations the following discharge heirarchy shall be considered:

1. Soakaways - The British Geological Survey Map of Britain indicates the bedrock here to be Edwalton Member, which weathers into mudstone and siltstone with a negligable permeability. The nearest borehole data indicates a high mudstone and clay content. Due to this information soakaways are deemed unfeasible for this development.
2. Watercourses - There is a culverted watercourse located to the west of the site.
3. Sewers - There are no surface water sewers present in the immediate vicinity of the site.

- A gravity system will be constructed carrying flows to a attenuation basin and a flow control device
- Permeable paving will provide treatment and storage of surface water runoff, as well as retaining the first 5mm of runoff within the site.
- Attenuation basin is proposed to cater for all storms up to and including 100yr + 40% climate change storm.
- A Hydro-brake flow control will be used to restrict flows discharging into the culverted watercourse at 2 l/s.
- Discharging into the culverted watercourse will be subject to LLFA and Ordinary Watercourse agreement.

Foul Water Drainage

- A gravity system will be constructed, connecting flows discharging into a Type 3 pumping station prior to discharging into the XXmm Ø Severn Trent Water foul sewer located along Station Road.
- Discharging in the Severn Trent Water Sewer will be subject to a direct S106 agreement.

Flood Exceedance

- The voids within the subbase of the permeable paving will provide storage for the first 5mm of rainfall.
- In the event of system failure or an excessive rainfall event, some overland flows will travel westwards, towards the attenuation basin, away from any buildings and properties, and some will flow and be retained within the attenuation basin, hence preventing any adverse effects on properties.

Drainage Legend:

- Site Boundary
- MH — Proposed Public Surface Water Sewer
- MH — Proposed Public Foul Water Sewer
- Proposed Public Foul Water Rising Main
- S — Proposed Private Surface Water Drainage
- DC — Surface Water Demarcation Chamber
- Perforated Pipe
- F — Proposed Private Foul Water Drainage
- DC — Foul Water Demarcation Chamber
- HW — Rodding Eye
- G — Gully
- Type C Permeable Paving
- Flood Exceedence Flow Direction

N

Drainage Design subject to confirmation of SVP and RWP locations from Architect

Drainage Design subject to confirmation of SVP and RWP locations from Architect

Attenuation pond

Approx. 0.9m retaining wall

Approx. 1m retaining wall

Approx. 1m retaining wall

Foul Demarcation chamber to discharge into the proposed S104 STW Sewer

Surface Water Demarcation chamber to discharge into the proposed S104 STW Sewer

Locations of all gullies subject to highway design.

Rising main to connect to Brake chamber prior to connection into STW MH 1301. For indicative rising main route refer to Rising main insert on drawing 83047-101-02

Inlet to Attenuation Basin

Hydrobrake Flow control chamber to restrict flows to **2l/s**. Subject to Detailed Design

Grilled outlet from Attenuation Basin

Location and depth of existing surface water manhole and culverted watercourse to be validated prior to construction.

Surface water system to connect to existing MH . Subject to OWC and LLFA Approval.

HW1 HW2 HW3 S8 S14 (FCC) S15 (Ex MH) S1 S2 S3 S4 S6

SAFETY,HEALTH & ENVIRONMENTAL HAZARD INFORMATION BOX.

1

The hazards noted below are in addition to the normal hazards and risks faced by a competent contractor when dealing with the types of works detailed on this drawing.

DEMOLITION RISKS:

CONSTRUCTION RISKS:

MAINTENANCE / CLEANING RISKS:

Notes:

1. DO NOT SCALE FROM THIS DRAWING.
2. PRINT IN COLOUR.
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5. All levels and dimensions are to be checked on site before any work commences.
6. The Health and Safety at Work act is to be complied with at all times. Attention is drawn to the wearing of hard hats, reflectorised clothing, and the use of any other required safety equipment.

Drainage:

1. Invert levels of existing manholes to be checked on site prior to commencing any drainage works.
2. For positions of all rainwater pipes & foul outlets refer to Architect's drawings.
3. All joints between precast manhole components shall have a minimum uncompressed thickness of 10mm of proprietary bitumen or resin mastic sealant.
4. Storm & foul branch connections are to be laid at gradients of between 1:10 & 1:80
5. All in-situ concrete shall be minimum grade GEN3.
6. Precast concrete cover & reducing slabs to be heavy duty reinforced concrete to BS 5911.
7. Rising mains shall be black MDPE SDR11 as WI 4-32-03 & joints & fittings to be in accordance with WI 4-32-04. Other approved pipe materials to be in accordance with their relevant BS.
8. Manhole covers & frames shall be manufactured in cast iron or ductile iron & shall comply with requirements of BS EN 124 & shall be kite marked or equivalent.
9. Where there is no intermediate manhole between the start of a surface water pipe run and the soakaway the gradient of the run shall be not less than 1 : 60.
10. All completed work shall be suitably protected from damage by construction work. Damaged drainage will not be accepted. It is recommended that no heavy loading or underground work is permitted above or near unprotected drainage, and that dumpers, trucks, fork lifts or other heavy vehicles are not driven along or near pipe runs.

Rev	Date	Description	By / Chk
A1	13/08/2025	Issued for comments	EC / JMN

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Northampton
London

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Client: Cartwright Homes

Architect: Hayward Architects Ltd

Project: Station Road, Bagworth

Title: Drainage Strategy Sheet 1 of 2

Status: **PRELIMINARY**

Engineer:	EC	Date:	August 2025
Drawn:	EC	Scales @ A1:	1:250
Checked:	JMN		
Project No:	83047	Drg No: 101-01	Rev: P1

Drainage Legend:

🟥	Site Boundary
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● MH	Proposed Public Foul Water Sewer
	Proposed Public Foul Water Rising Main
○ S	Proposed Private Surface Water Drainage
◉ DC	Surface Water Demarcation Chamber
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G ☒	Gully
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→	Flood Exceedence Flow Direction

Drainage Strategy

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Rising Main Insert

1:500

SAFETY,HEALTH & ENVIRONMENTAL HAZARD INFORMATION BOX.

1

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DEMOLITION RISKS:
- Leptospirosis

CONSTRUCTION RISKS:
- Deep Trenches
- Unforeseen Services

Notes:

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Drainage:

1. Invert levels of existing manholes to be checked on site prior to commencing any drainage works.
2. For positions of all rainwater pipes & foul outlets refer to Architect's drawings.
3. All joints between precast manhole components shall have a minimum uncompressed thickness of 10mm of proprietary bitumen or resin mastic sealant.
4. Storm & foul branch connections are to be laid at gradients of between 1:10 & 1:80
5. All in-situ concrete shall be minimum grade GEN3.
6. Precast concrete cover & reducing slabs to be heavy duty reinforced concrete to BS 5911.
7. Rising mains shall be black MDPE SDR11 as WI 4-32-03 & joints & fittings to be in accordance with WI 4-32-04. Other approved pipe materials to be in accordance with their relevant BS.
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Sheet 2 of 2

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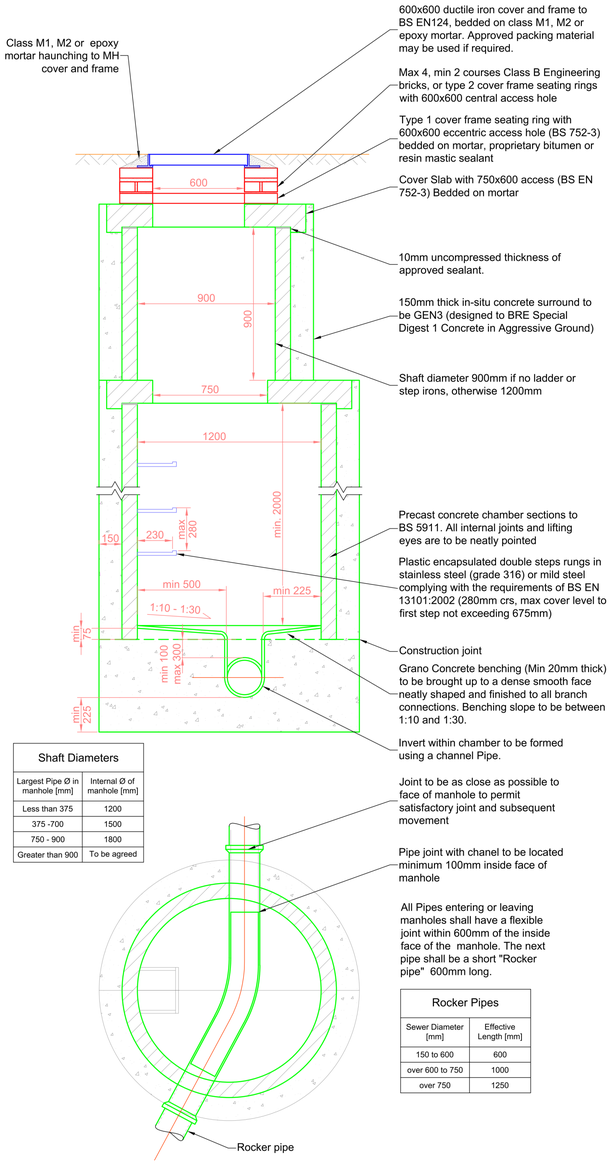
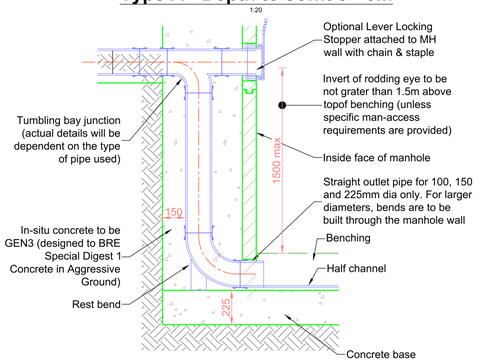


Shaft Diameters	
Largest Pipe Ø in manhole [mm]	Internal Ø of manhole [mm]
Less than 375	1200
375 -700	1500
750 - 900	1800
Greater than 900	To be agreed

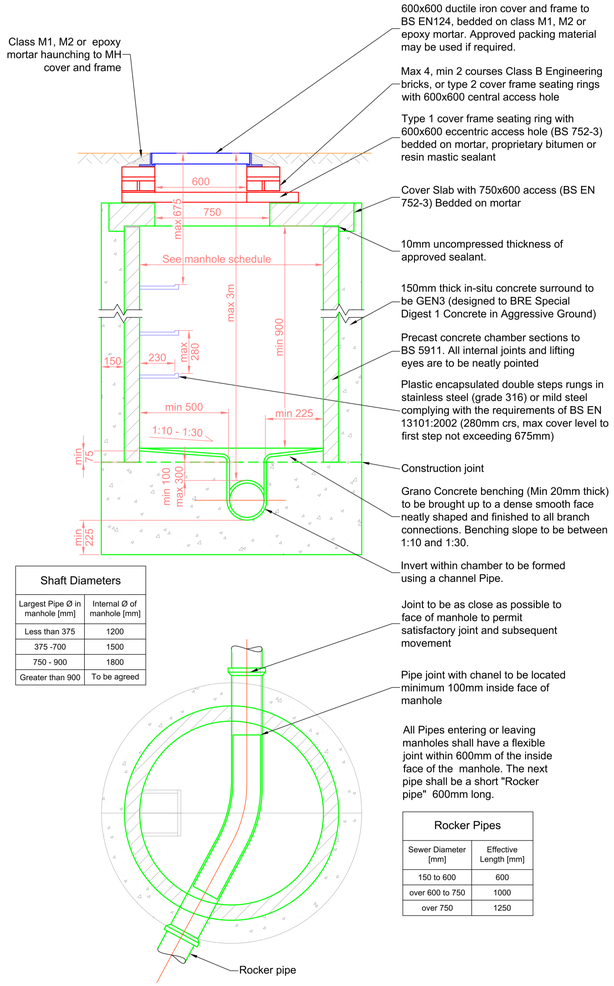
Rocker Pipes	
Sewer Diameter [mm]	Effective Length [mm]
150 to 600	600
over 600 to 750	1000
over 750	1250

Typical Manhole Detail
Type A - Depth to soffit 3 - 6m
1:20



Note: steeper gradients are preferred to the use of backdrops.
Type of backdrop (vertical or 45deg ramped) to be used to be agreed with Undertaker.

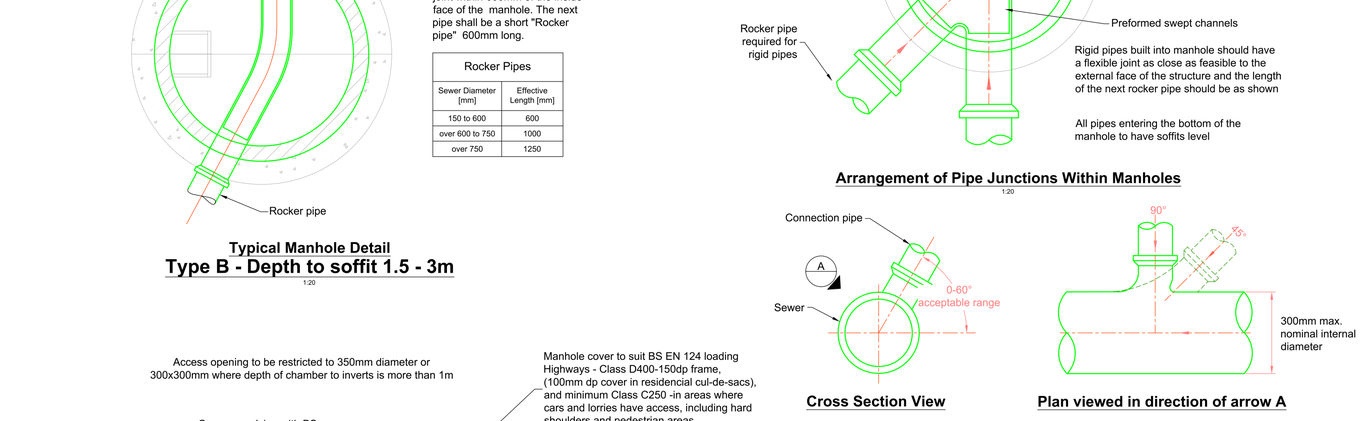
Typical Vertical Backdrop Detail
1:20

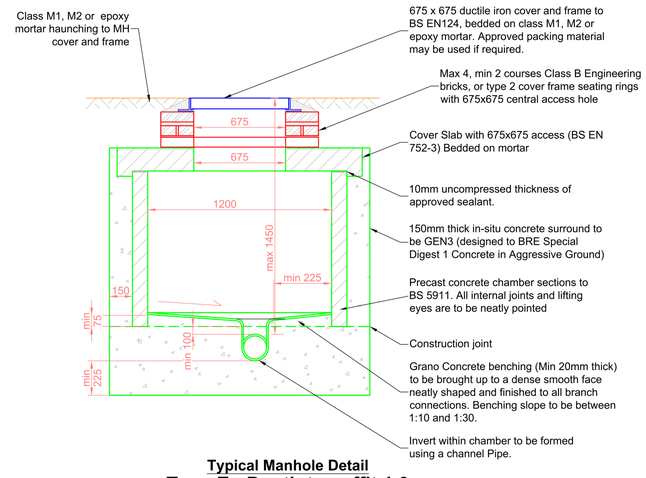


Shaft Diameters	
Largest Pipe Ø in manhole [mm]	Internal Ø of manhole [mm]
Less than 375	1200
375 -700	1500
750 - 900	1800
Greater than 900	To be agreed

Rocker Pipes	
Sewer Diameter [mm]	Effective Length [mm]
150 to 600	600
over 600 to 750	1000
over 750	1250

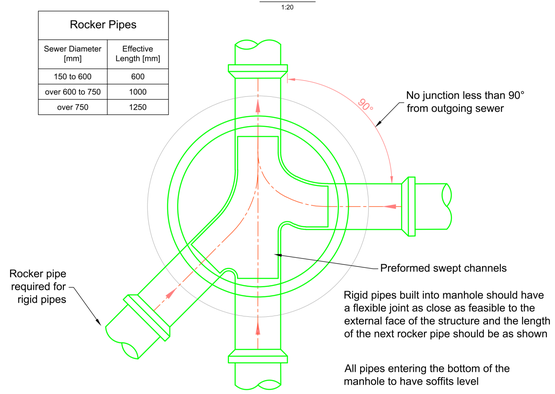
Typical Manhole Detail
Type B - Depth to soffit 1.5 - 3m
1:20





Typical Manhole Detail
Type E - Depth to soffit 1.0 - 1.5m
1:20

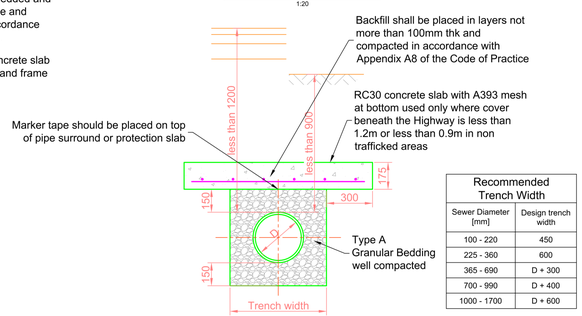
Rocker Pipes	
Sewer Diameter [mm]	Effective Length [mm]
150 to 600	600
over 600 to 750	1000
over 750	1250



Arrangement of Pipe Junctions Within Manholes
1:20

Cross Section View
Plan viewed in direction of arrow A

Connections to Sewer
1:20



Recommended Trench Width	
Sewer Diameter [mm]	Design trench width
100 - 220	450
225 - 360	600
365 - 690	D + 300
700 - 990	D + 400
1000 - 1700	D + 600

Granular bed and surround Class S - bedding factor 2.2

Pipe bed and surround material shall comply with WIS 4-08-02.
See also IGN 4-08-01

Bedding Detail for Concrete and Clayware Pipes
1:20

SAFETY,HEALTH & ENVIRONMENTAL HAZARD INFORMATION BOX. 1

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CONSTRUCTION RISKS:

MAINTENANCE / CLEANING RISKS:

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Drainage:

1. Invert levels of existing manholes to be checked on site prior to commencing any drainage works.
2. For positions of all rainwater pipes & foul outlets refer to Architect's drawings.
3. All joints between precast manhole components shall have a minimum uncompressed thickness of 10mm of proprietary bitumen or resin mastic sealant.
4. Storm & foul branch connections are to be laid at gradients of between 1:10 & 1:80
5. All in-situ concrete shall be minimum grade GEN3.
6. Precast concrete cover & reducing slabs to be heavy duty reinforced concrete to BS 5911.
7. Rising mains shall be black MDPE SDR11 as WI 4-32-03 & joints & fittings to be in accordance with WI 4-32-04. Other approved pipe materials to be in accordance with their relevant BS.
8. Manhole covers & frames shall be manufactured in cast iron or ductile iron & shall comply with requirements of BS EN 124 & shall be kite marked or equivalent.
9. Where there is no intermediate manhole between the start of a surface water pipe run and the soakaway the gradient of the run shall be not less than 1 : 60.
10. All completed work shall be suitably protected from damage by construction work. Damaged drainage will not be accepted. It is recommended that no heavy loading or underground work is permitted above or near unprotected drainage, and that dumpers, trucks, fork lifts or other heavy vehicles are not driven along or near pipe runs.

Rev	Date	Description	By / Chk
A1	13/08/2025	Issued for comments	EC / JMN

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Client: Cartwright Homes

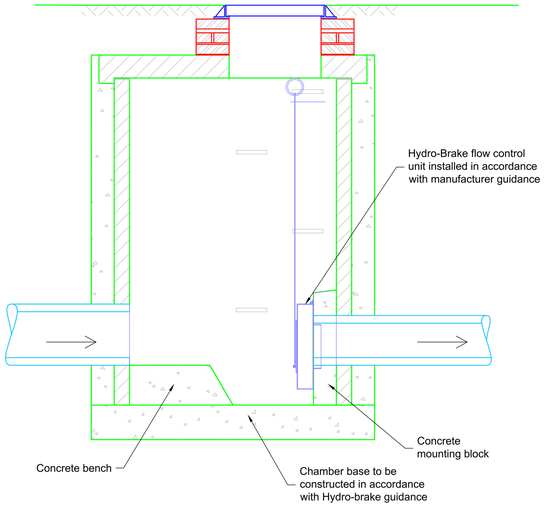
Architect: Hayward Architects Ltd

Project: Station Road, Bagworth

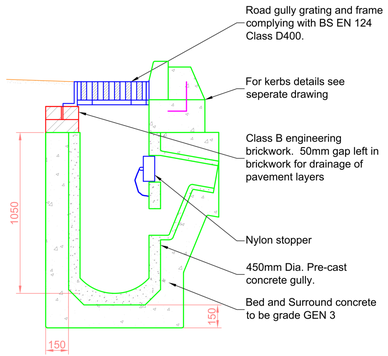
Title: Drainage Details Sheet 1 of 2

Status: **PRELIMINARY**

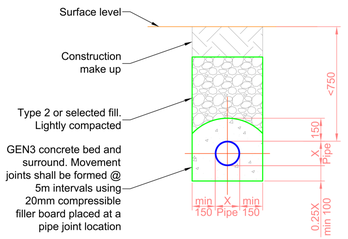
Engineer:	EC	Date:	August 2025
Drawn:	EC	Scales @ A1:	1:250
Checked:	JMN		
Project No:	83047	Drg No: 102-01	Rev: P1



Manhole with Flow Control Unit
1:20

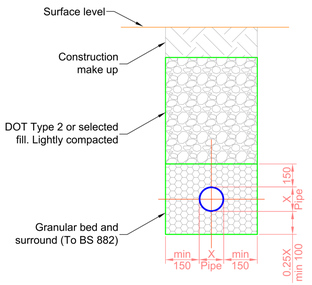


Typical Concrete Gully Detail
1:20



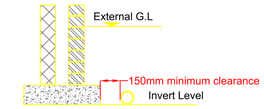
Typical Pipe Bedding With Concrete Bed and Surround
1:20

GEN3 concrete bed and surround to be used under paved areas where the depth between the finished construction level and the Barrel of the drain is less than 750mm.

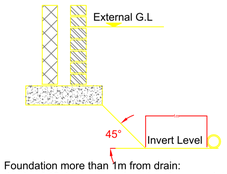


Typical Pipe Bedding With Granular Bed and Surround
1:20

Granular bed and surround to be used where concrete bed and surround are not required.

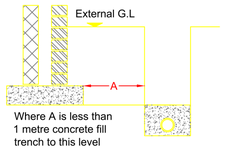


Foundation less than 1m from Public Sewer:
Carry Foundations down below invert level of Sewer

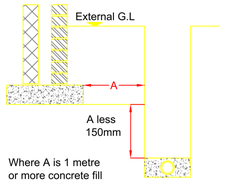


Foundation more than 1m from drain:
Angle of 45 degrees can be taken from a point 1m clear of the Sewer up to the required footing level.

Building Within 3m of a Drain
1:20

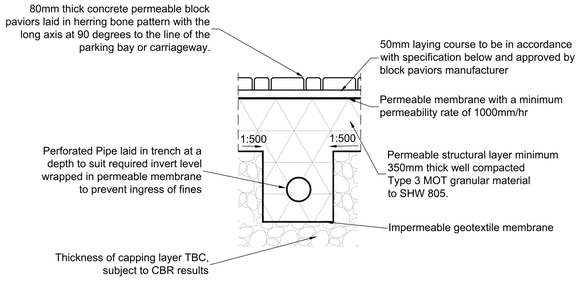


Where A is less than 1 metre concrete fill trench to this level

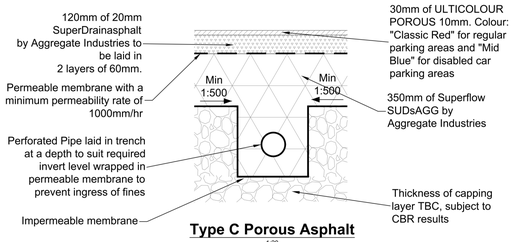


Where A is 1 metre or more concrete fill trench to this level

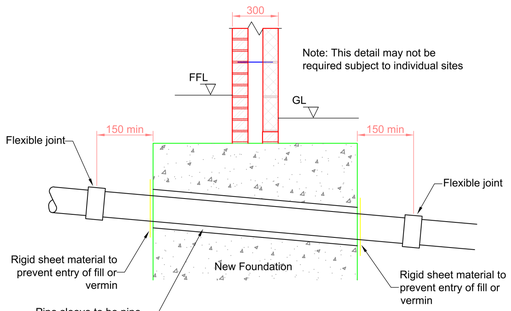
Pipe Runs Near Building
1:20



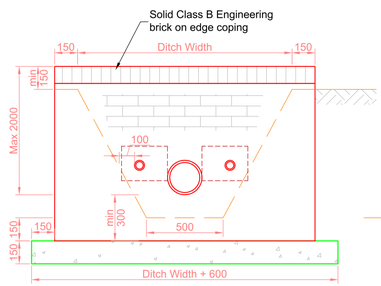
Type C Permeable Paving
1:20

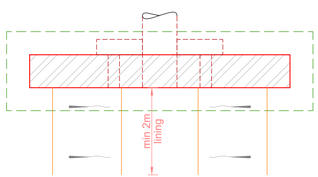


Type C Porous Asphalt
1:20



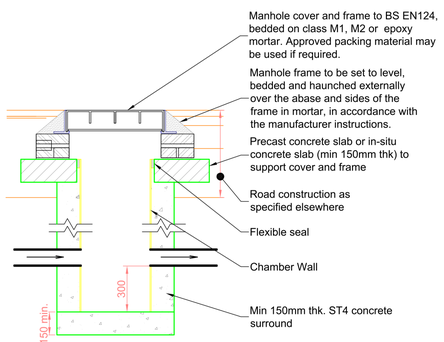
Pipe Through Foundation
1:20





Headwal Details
1:20

1. All dimensions in millimeters
2. Brickwork to be used in England Bond
3. Generally used for maximum depth of up to 2m and a width of 4.5m
4. Ditch lininig to be invert Type 3 with side slopes Type 7 for a minimum distance of 2m unless otherwise described in the Contract
5. this detail is for use with pipe sized up to 450mm diameter



Typical Catchpit Detail
1:20

SAFETY,HEALTH & ENVIRONMENTAL HAZARD INFORMATION BOX. 1

The hazards noted below are in addition to the normal hazards and risks faced by a competent contractor when dealing with the types of works detailed on this drawing.

DEMOLITION RISKS:

CONSTRUCTION RISKS:

MAINTENANCE / CLEANING RISKS:

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Client:
Cartwright Homes

Architect:
Hayward Architects Ltd

Project:
Station Road,
Bagworth

Title:
Drainage Details
Sheet 2 of 2

Status:
PRELIMINARY

Engineer:	EC	Date:	August 2025
Drawn:	EC	Scales @ A1:	1:250
Checked:	JMN		
Project No:	83047	Drg No: 102-02	Rev: P1

APPENDIX III

MAINTENANCE SCHEDULE

Maintenance Schedule – All Maintenance to be Carried Out in Accordance with CIRIA 753

Permeable Paving		
Maintenance Schedule	**Required Action**	**Recommended Frequency**
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface	Once a year, after autumn leaf fall, or reduced frequency as required, based on site specific observation of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this is the most likely to collect the most sediment
	Stabilise and mow contributing and adjacent areas	As required
Occasional maintenance	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
	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 actions	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, are replace lost jointing Material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 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, 48h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually
	Monitor inspection chambers	Annually

Inspection chambers, rodding eyes and catchpits		
Maintenance Schedule	**Required Action**	**Recommended Frequency**
Regular maintenance	Remove cover and inspect, ensuring that water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt. Undertake inspection after leaf fall in autumn	Annually
Remedial actions	Repair physical damage if necessary	As required
Monitoring	Check topsoil levels are 20mm above edges of chambers to avoid mower damage	As required

Flow Control (Hydro-Brake)		
Maintenance Schedule	**Required Action**	**Recommended Frequency**
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action (for 3 months following installation).	Monthly
	Remove sediment from pre-treatment structures.	Monthly
Remedial actions	Repair/ rehabilitation of Hydro-Brake	As required
Monitoring	Inspect and carry out essential recovery works to return the feature to full working order.	Following all significant storm events

Attenuation Basin		
Maintenance Schedule	**Maintenance Schedule**	**Maintenance Schedule**
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action. Monthly for 3 months.	Monthly for 3 months, then six monthly
	Debris removal from catchment surface (where may cause risks to performance).	Monthly
	Mow grass in and around basin as well as access routes.	Monthly (during growing season), or as required
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly for first year, then annually, or as required
	Inspect inlets, outlets and overflows for blockages and clear if required.	Monthly, or as required
Occasional maintenance	Reseed areas of poor vegetation growth.	As required
	Tidy all dead growth before start of growing season.	Annually
	Prune and trim any trees and remove cuttings.	Every 2 years, or as required
	Manage wetland plants.	Annually
	Inspect bankside, structures, pipework etc. for physical damage.	Annually
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required.
Remedial actions	Repair erosion or other damage by reseeding and re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required
Occasional maintenance	Inspect/check all inlets, outlets, and overflows to ensure that they are in good condition and operating as designed.	Annually and after large storms

Filter Drains/Infiltration Trenches		
Maintenance Schedule	**Required Action**	**Recommended Frequency**
Regular maintenance	Grass edges – mow 1m min. wide grass surround to drain at 100mm and 150mm maximum to filter runoff and protect drain from silt	Monthly or as required
Occasional tasks	Weeds – Hand pull or spot treat individual weed growth, only if necessary, ensuring that weed-killer does not enter the filter drain. Weed growth usually dies in dry weather.	As required
Remedial work	Situation at surface – where there is no protective geotextile, remove all stone and perforated pipe replacing as original spec. and include separating geotextile as below. Where there is a separating geotextile, then remove surface stone layer and separating geotextile that protects the stone drain below. Replace geotextile and top stone layer	As required

APPENDIX IV

MICRODRAINAGE CALCULATIONS

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)	20.900	Add Flow / Climate Change (%)	0
Ratio R	0.400	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)	1.200
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

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)
4.000	o	225	S6L	153.400	150.840	2.335	Open Manhole	1200
4.001	o	225	S6	154.000	150.760	3.015	Open Manhole	1200
5.000	o	150	S7L	153.700	151.167	2.383	Open Manhole	1200
4.002	o	225	S7	153.700	150.450	3.025	Open Manhole	1200
6.000	o	150	S8L	153.500	152.000	1.350	Open Manhole	1200
6.001	o	150	S8	153.500	151.967	1.383	Open Manhole	1200
7.000	o	150	S9L	153.500	152.000	1.350	Open Manhole	1200
6.002	o	150	S9	153.400	151.914	1.336	Open Manhole	1200
4.003	o	300	S10	153.200	150.277	2.623	Open Manhole	1200
4.004	o	300	S11	152.500	150.183	2.017	Open Manhole	1200
8.000	o	150	S12L	151.670	149.700	1.820	Open Manhole	1200
4.005	o	300	S12	151.600	149.521	1.779	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)
4.000	12.000	150.0	S6	154.000	150.760	3.015	Open Manhole	1200
4.001	35.238	113.7	S7	153.700	150.450	3.025	Open Manhole	1200
5.000	6.422	10.0	S7	153.700	150.525	3.025	Open Manhole	1200
4.002	14.684	149.8	S10	153.200	150.352	2.623	Open Manhole	1200
6.000	4.934	149.5	S8	153.500	151.967	1.383	Open Manhole	1200
6.001	7.996	150.9	S9	153.400	151.914	1.336	Open Manhole	1200
7.000	5.938	69.0	S9	153.400	151.914	1.336	Open Manhole	1200
6.002	20.055	13.5	S10	153.200	150.427	2.623	Open Manhole	1200
4.003	14.095	149.9	S11	152.500	150.183	2.017	Open Manhole	1200
4.004	18.469	27.9	S12	151.600	149.521	1.779	Open Manhole	1200
8.000	4.411	152.1	S12	151.600	149.671	1.779	Open Manhole	1200
4.005	17.467	20.0	S13	150.700	148.647	1.753	Open Manhole	1200

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)
9.000	o	150	S13L	150.750	149.250	1.350	Open Manhole	1200
4.006	o	300	S13	150.700	148.647	1.753	Open Manhole	1200
10.000	o	225	S1L	156.000	154.180	1.595	Open Manhole	1200
10.001	o	225	S1	156.000	154.100	1.675	Open Manhole	1200
10.002	o	225	S2	155.800	154.000	1.575	Open Manhole	1200
11.000	o	150	S3L	155.800	154.500	1.150	Open Manhole	1200
10.003	o	225	S3	155.650	153.799	1.626	Open Manhole	1200
12.000	o	150	S4L	154.750	153.250	1.350	Open Manhole	1200
10.004	o	225	S4	154.650	153.105	1.320	Open Manhole	1200
13.000	o	150	S5LA	152.500	150.276	2.074	Open Manhole	1200
14.000	o	150	S5LB	152.500	150.643	1.707	Open Manhole	1200
10.005	o	300	S5	152.500	149.828	2.372	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)
9.000	7.128	15.7	S13	150.700	148.797	1.753	Open Manhole	1200
4.006	24.000	20.9	Basin	149.000	147.500	1.200	Open Manhole	1350
10.000	5.473	68.4	S1	156.000	154.100	1.675	Open Manhole	1200
10.001	14.562	145.6	S2	155.800	154.000	1.575	Open Manhole	1200
10.002	18.958	150.5	S3	155.650	153.874	1.551	Open Manhole	1200
11.000	7.171	11.5	S3	155.650	153.874	1.626	Open Manhole	1200
10.003	27.291	39.3	S4	154.650	153.105	1.320	Open Manhole	1200
12.000	7.014	100.2	S4	154.650	153.180	1.320	Open Manhole	1200
10.004	42.371	13.2	S5	152.500	149.903	2.372	Open Manhole	1200
13.000	2.983	10.0	S5	152.500	149.978	2.372	Open Manhole	1200
14.000	6.657	10.0	S5	152.500	149.978	2.372	Open Manhole	1200
10.005	23.275	10.0	Basin	149.000	147.500	1.200	Open Manhole	1350

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)
4.007	o	375	Basin	149.000	147.425	1.200	Open Manhole	1350
4.008	o	375	26	149.250	147.398	1.477	Open Manhole	1350

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)
4.007	4.000	148.1	26	149.250	147.398	1.477	Open Manhole	1350
4.008	10.000	151.5		149.500	147.332	1.793	Open Manhole	0

Online Controls for Storm

Hydro-Brake® Optimum Manhole: Basin, DS/PN: 4.007, Volume (m³): 5.4

Unit Reference	MD-SHE-0070-2000-0800-2000
Design Head (m)	0.800
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	70
Invert Level (m)	147.425
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	2.0
Flush-Flo™	0.240	2.0
Kick-Flo®	0.504	1.6
Mean Flow over Head Range	-	1.7

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	1.8	1.200	2.4	3.000	3.7	7.000	5.5
0.200	2.0	1.400	2.6	3.500	3.9	7.500	5.6
0.300	2.0	1.600	2.7	4.000	4.2	8.000	5.8
0.400	1.9	1.800	2.9	4.500	4.4	8.500	6.0
0.500	1.6	2.000	3.0	5.000	4.7	9.000	6.2
0.600	1.8	2.200	3.2	5.500	4.9	9.500	6.3
0.800	2.0	2.400	3.3	6.000	5.1		
1.000	2.2	2.600	3.4	6.500	5.3		

Storage Structures for Storm

Infiltration Basin Manhole: Basin, DS/PN: 4.007

Invert Level (m) 147.425 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1415.0	1.500	2340.0

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	2.000
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	0.400
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.900	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 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.	Water Level (m)
4.000	S6L	15 Winter	1	+0%	30/15 Summer				150.933
4.001	S6	15 Winter	1	+0%	30/15 Summer				150.863
5.000	S7L	15 Winter	1	+0%	100/15 Summer				151.214
4.002	S7	15 Winter	1	+0%	30/15 Summer				150.610
6.000	S8L	15 Summer	1	+0%	30/15 Summer				152.077
6.001	S8	15 Winter	1	+0%	30/15 Summer				152.052
7.000	S9L	15 Summer	1	+0%	100/15 Summer				152.058
6.002	S9	15 Winter	1	+0%	100/15 Summer				151.973
4.003	S10	15 Winter	1	+0%	30/15 Summer				150.449
4.004	S11	15 Winter	1	+0%	100/15 Winter				150.288
8.000	S12L	15 Summer	1	+0%	100/15 Summer				149.768
4.005	S12	15 Winter	1	+0%	100/15 Summer				149.624
9.000	S13L	15 Winter	1	+0%	100/15 Summer				149.305
4.006	S13	15 Winter	1	+0%	100/15 Summer				148.762
10.000	S1L	15 Summer	1	+0%	100/15 Summer				154.247
10.001	S1	15 Winter	1	+0%	100/15 Summer				154.188
10.002	S2	15 Winter	1	+0%	100/15 Summer				154.095
11.000	S3L	15 Winter	1	+0%					154.541
10.003	S3	15 Winter	1	+0%	100/15 Summer				153.883
12.000	S4L	15 Summer	1	+0%					153.286

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
4.000	S6L	-0.132	0.000	0.36			13.0	OK	
4.001	S6	-0.122	0.000	0.42			19.5	OK	
5.000	S7L	-0.103	0.000	0.21			10.1	OK	
4.002	S7	-0.065	0.000	0.84			31.1	OK	
6.000	S8L	-0.073	0.000	0.52			5.9	OK	
6.001	S8	-0.065	0.000	0.61			7.7	OK	
7.000	S9L	-0.092	0.000	0.32			5.6	OK	
6.002	S9	-0.091	0.000	0.32			14.8	OK	
4.003	S10	-0.128	0.000	0.62			46.5	OK	
4.004	S11	-0.195	0.000	0.27			48.9	OK	
8.000	S12L	-0.082	0.000	0.42			4.5	OK	
4.005	S12	-0.197	0.000	0.26			54.9	OK	
9.000	S13L	-0.095	0.000	0.29			11.1	OK	
4.006	S13	-0.185	0.000	0.31			67.0	OK	
10.000	S1L	-0.158	0.000	0.20			7.8	OK	
10.001	S1	-0.137	0.000	0.32			12.2	OK	
10.002	S2	-0.130	0.000	0.37			14.2	OK	
11.000	S3L	-0.109	0.000	0.17			7.7	OK	
10.003	S3	-0.141	0.000	0.29			22.5	OK	
12.000	S4L	-0.114	0.000	0.13			2.0	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
10.004	S4	15 Winter	1	+0%				
13.000	S5LA	15 Winter	1	+0%				
14.000	S5LB	15 Winter	1	+0%				
10.005	S5	15 Winter	1	+0%				
4.007	Basin	1440 Winter	1	+0%	100/480 Winter			
4.008	26	1440 Winter	1	+0%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
10.004	S4	153.175	-0.155	0.000	0.21			28.1	OK	
13.000	S5LA	150.322	-0.104	0.000	0.21			7.2	OK	
14.000	S5LB	150.664	-0.129	0.000	0.05			2.3	OK	
10.005	S5	149.901	-0.227	0.000	0.13			41.3	OK	
4.007	Basin	147.532	-0.268	0.000	0.02		1344	1.4	OK	
4.008	26	147.422	-0.351	0.000	0.01			1.4	OK	

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 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	0.400
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.900	Cv (Winter)	0.840

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

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

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
4.000	S6L	15 Winter	30	+0%	30/15 Summer				151.403
4.001	S6	15 Winter	30	+0%	30/15 Summer				151.355
5.000	S7L	15 Winter	30	+0%	100/15 Summer				151.244
4.002	S7	15 Winter	30	+0%	30/15 Summer				151.050
6.000	S8L	15 Winter	30	+0%	30/15 Summer				152.239
6.001	S8	15 Winter	30	+0%	30/15 Summer				152.186
7.000	S9L	15 Summer	30	+0%	100/15 Summer				152.100
6.002	S9	15 Winter	30	+0%	100/15 Summer				152.019
4.003	S10	15 Winter	30	+0%	30/15 Summer				150.673
4.004	S11	15 Winter	30	+0%	100/15 Winter				150.358
8.000	S12L	15 Summer	30	+0%	100/15 Summer				149.842
4.005	S12	15 Winter	30	+0%	100/15 Summer				149.692
9.000	S13L	15 Winter	30	+0%	100/15 Summer				149.343
4.006	S13	15 Winter	30	+0%	100/15 Summer				148.842
10.000	S1L	15 Winter	30	+0%	100/15 Summer				154.290
10.001	S1	15 Winter	30	+0%	100/15 Summer				154.267
10.002	S2	15 Winter	30	+0%	100/15 Summer				154.194

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
4.000	S6L	0.338	0.000	0.76			27.5	SURCHARGED	
4.001	S6	0.370	0.000	0.99			45.3	SURCHARGED	
5.000	S7L	-0.073	0.000	0.52			24.9	OK	
4.002	S7	0.375	0.000	1.94			72.2	SURCHARGED	
6.000	S8L	0.089	0.000	1.23			14.0	SURCHARGED	
6.001	S8	0.069	0.000	1.51			19.0	SURCHARGED	
7.000	S9L	-0.050	0.000	0.77			13.8	OK	
6.002	S9	-0.045	0.000	0.82			37.4	OK	
4.003	S10	0.096	0.000	1.47			110.3	SURCHARGED	
4.004	S11	-0.125	0.000	0.64			116.5	OK	
8.000	S12L	-0.008	0.000	1.00			10.8	OK	
4.005	S12	-0.129	0.000	0.62			131.9	OK	
9.000	S13L	-0.057	0.000	0.71			27.2	OK	
4.006	S13	-0.105	0.000	0.74			161.6	OK	
10.000	S1L	-0.115	0.000	0.48			19.2	OK	
10.001	S1	-0.058	0.000	0.86			32.5	OK	
10.002	S2	-0.031	0.000	1.00			38.0	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
11.000	S3L	15 Winter	30	+0%				
10.003	S3	15 Winter	30	+0%	100/15 Summer			
12.000	S4L	15 Summer	30	+0%				
10.004	S4	15 Winter	30	+0%				
13.000	S5LA	15 Winter	30	+0%				
14.000	S5LB	15 Winter	30	+0%				
10.005	S5	15 Winter	30	+0%				
4.007	Basin	1440 Winter	30	+0%	100/480 Winter			
4.008	26	1440 Winter	30	+0%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
11.000	S3L	154.567	-0.083	0.000	0.42			18.8	OK	
10.003	S3	153.949	-0.075	0.000	0.77			59.5	OK	
12.000	S4L	153.309	-0.091	0.000	0.33			5.0	OK	
10.004	S4	153.225	-0.105	0.000	0.55			74.9	OK	
13.000	S5LA	150.352	-0.074	0.000	0.52			17.6	OK	
14.000	S5LB	150.677	-0.116	0.000	0.12			5.8	OK	
10.005	S5	149.952	-0.176	0.000	0.35			110.6	OK	
4.007	Basin	147.653	-0.147	0.000	0.02			2.0	OK	
4.008	26	147.431	-0.342	0.000	0.02			2.0	OK	

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 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	0.400
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.900	Cv (Winter)	0.840

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

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

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
4.000	S6L	15 Winter	100	+40%	30/15 Summer				152.937
4.001	S6	15 Winter	100	+40%	30/15 Summer				152.809
5.000	S7L	15 Winter	100	+40%	100/15 Summer				152.326
4.002	S7	15 Winter	100	+40%	30/15 Summer				151.960
6.000	S8L	15 Winter	100	+40%	30/15 Summer				153.000
6.001	S8	15 Winter	100	+40%	30/15 Summer				152.903
7.000	S9L	15 Winter	100	+40%	100/15 Summer				152.779
6.002	S9	15 Winter	100	+40%	100/15 Summer				152.686
4.003	S10	15 Winter	100	+40%	30/15 Summer				150.989
4.004	S11	15 Winter	100	+40%	100/15 Winter				150.539
8.000	S12L	15 Winter	100	+40%	100/15 Summer				149.990
4.005	S12	15 Winter	100	+40%	100/15 Summer				149.928
9.000	S13L	15 Winter	100	+40%	100/15 Summer				149.768
4.006	S13	15 Winter	100	+40%	100/15 Summer				149.219
10.000	S1L	15 Winter	100	+40%	100/15 Summer				154.870
10.001	S1	15 Winter	100	+40%	100/15 Summer				154.839
10.002	S2	15 Winter	100	+40%	100/15 Summer				154.664

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
4.000	S6L	1.872	0.000	1.26			45.5	SURCHARGED	
4.001	S6	1.824	0.000	1.62			74.3	SURCHARGED	
5.000	S7L	1.009	0.000	0.77			36.6	SURCHARGED	
4.002	S7	1.285	0.000	3.12			116.1	SURCHARGED	
6.000	S8L	0.850	0.000	1.73			19.7	SURCHARGED	
6.001	S8	0.786	0.000	2.01			25.2	SURCHARGED	
7.000	S9L	0.629	0.000	1.05			18.8	SURCHARGED	
6.002	S9	0.622	0.000	1.07			48.8	SURCHARGED	
4.003	S10	0.412	0.000	2.21			166.1	SURCHARGED	
4.004	S11	0.056	0.000	0.96			174.6	SURCHARGED	
8.000	S12L	0.140	0.000	1.85			20.1	SURCHARGED	
4.005	S12	0.107	0.000	0.92			195.8	SURCHARGED	
9.000	S13L	0.368	0.000	1.13			43.5	SURCHARGED	
4.006	S13	0.272	0.000	1.12			241.8	SURCHARGED	
10.000	S1L	0.465	0.000	0.74			29.4	SURCHARGED	
10.001	S1	0.514	0.000	1.32			49.6	SURCHARGED	
10.002	S2	0.439	0.000	1.56			59.4	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
11.000	S3L	15 Winter	100	+40%				
10.003	S3	15 Winter	100	+40%	100/15 Summer			
12.000	S4L	15 Winter	100	+40%				
10.004	S4	15 Winter	100	+40%				
13.000	S5LA	15 Winter	100	+40%				
14.000	S5LB	15 Winter	100	+40%				
10.005	S5	15 Winter	100	+40%				
4.007	Basin 1440	Winter	100	+40%	100/480 Winter			
4.008	26	960 Winter	100	+40%				

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
11.000	S3L	154.646	-0.004	0.000	0.73			33.1	OK
10.003	S3	154.355	0.331	0.000	1.22			93.8	SURCHARGED
12.000	S4L	153.334	-0.066	0.000	0.60			9.1	OK
10.004	S4	153.271	-0.059	0.000	0.88			119.7	OK
13.000	S5LA	150.390	-0.036	0.000	0.94			32.1	OK
14.000	S5LB	150.690	-0.103	0.000	0.22			10.5	OK
10.005	S5	149.996	-0.132	0.000	0.58			180.4	OK
4.007	Basin	147.853	0.053	0.000	0.02			2.0	SURCHARGED
4.008	26	147.431	-0.342	0.000	0.02			2.0	OK

PN	US/MH Name	Level Exceeded
11.000	S3L	
10.003	S3	
12.000	S4L	
10.004	S4	
13.000	S5LA	
14.000	S5LB	
10.005	S5	
4.007	Basin	
4.008	26	

APPENDIX V

SEVERN TRENT WATER ASSET PLAN

Date: 12/08/25

Scale: 1:1250

Map Centre: 443986,309323

Data updated: 14/07/25

Our Ref: 1849592 - 1

Wastewater Plan A1
Powered by digdat

Public Foul Gravity/Lateral Drain	Highway Drain	Manhole Foul
Public Combined Gravity/Lateral Drain	Overflow Pipe	Manhole Surface
Public Surface Water Gravity/Lateral Drain	Disposal Pipe	Abandoned Pipe
Pressure Foul	Culverted Water Course	Chamber
Pressure Combined	Pumping Station	
Pressure Surface Water	Fitting	

Section 104 sewers are shown in green

Private sewers are shown in magenta

elliot.cant@prp.uk.com

83047

SEVERN TRENT

GENERAL CONDITIONS AND PRECAUTIONS TO BE TAKEN WHEN CARRYING OUT WORK ADJACENT TO SEVERN TRENT WATER'S APPARATUS

Please ensure that a copy of these conditions is passed to your representative and/or your contractor on site. If any damage is caused to Severn Trent Water Limited (STW) apparatus (defined below), the person, contractor or subcontractor responsible must inform STW immediately on:
0800 783 4444 (24 hours)

a) These general conditions and precautions apply to the public sewerage, water distribution and cables in ducts including (but not limited to) sewers which are the subject of an Agreement under Section 104 of the Water Industry Act 1991(a legal agreement between a developer and STW, where a developer agrees to build sewers to an agreed standard, which STW will then adopt); mains installed in accordance with an agreement for the self-construction of water mains entered into with STW and the assets described at condition b) of these general conditions and precautions. Such apparatus is referred to as "STW Apparatus" in these general conditions and precautions.

b) Please be aware that due to The Private Sewers Transfer Regulations June 2011, the number of public sewers has increased, but many of these are not shown on the public sewer record. However, some idea of their positions may be obtained from the position of inspection covers and their existence must be anticipated.

c) On request, STW will issue a copy of the plan showing the approximate locations of STW Apparatus although in certain instances a charge will be made. The position of private drains, private sewers and water service pipes to properties are not normally shown but their presence must be anticipated. This plan and the information supplied with it is furnished as a general guide only and STW does not guarantee its accuracy.

d) STW does not update these plans on a regular basis. Therefore the position and depth of STW Apparatus may change and this plan is issued subject to any such change. Before any works are carried out, you should confirm whether any changes to the plan have been made since it was issued.

e) The plan must not be relied upon in the event of excavations or other works in the vicinity of STW Apparatus. It is your responsibility to ascertain the precise location of any STW Apparatus prior to undertaking any development or other works (including but not limited to excavations).

f) No person or company shall be relieved from liability for loss and/or damage caused to STW Apparatus by reason of the actual position and/or depths of STW Apparatus being different from those shown on the plan.

In order to achieve safe working conditions adjacent to any STW Apparatus the following should be observed:

1. All STW Apparatus should be located by hand digging prior to the use of mechanical excavators.

2. All information set out in any plans received from us, or given by our staff at the site of the works, about the position and depth of the mains, is approximate. Every possible precaution should be taken to avoid damage to STW Apparatus. You or your contractor must ensure the safety of STW Apparatus and will be responsible for the cost of repairing any loss and/or damage caused (including without limitation replacement parts).

3. Water mains are normally laid at a depth of 900mm. No records are kept of customer service pipes which are normally laid at a depth of 750mm; but some idea of their positions may be obtained from the position of stop tap covers and their existence must be anticipated.

4. During construction work, where heavy plant will cross the line of STW Apparatus, specific crossing points must be agreed with STW and suitably reinforced where required. These crossing points should be clearly marked and crossing of the line of STW Apparatus at other locations must be prevented.

5. Where it is proposed to carry out piling or boring within 20 metres of any STW Apparatus, STW should be consulted to enable any affected STW Apparatus to be surveyed prior to the works commencing.

6. Where excavation of trenches adjacent to any STW Apparatus affects its support, the STW Apparatus must be supported to the satisfaction of STW. Water mains and some sewers are pressurised and can fail if excavation removes support to thrust blocks to bends and other fittings.

7. Where a trench is excavated crossing or parallel to the line of any STW Apparatus, the backfill should be adequately compacted to prevent any settlement which could subsequently cause damage to the STW Apparatus. In special cases, it may be necessary to provide permanent support to STW Apparatus which has been exposed over a length of the excavation before backfilling and reinstatement is carried out. There should be no concrete backfill in contact with the STW Apparatus.

8. No other apparatus should be laid along the line of STW Apparatus irrespective of clearance. Above ground apparatus must not be located within a minimum of 3 metres either side of the centre line of STW Apparatus for smaller sized pipes and 6 metres either side for larger sized pipes without prior approval. No manhole or chamber shall be built over or around any STW Apparatus.

9. A minimum radial clearance of 300 millimetres should be allowed between any plant or equipment being installed and existing STW Apparatus. We reserve the right to increase this distance where strategic assets are affected.

10. Where any STW Apparatus coated with a special wrapping is damaged, even to a minor extent, STW must be notified and the trench left open until the damage has been inspected and the necessary repairs have been carried out. In the case of any material damage to any STW Apparatus causing leakage, weakening of the mechanical strength of the pipe or corrosion-protection damage, the necessary remedial work will be recharged to you.

11. It may be necessary to adjust the finished level of any surface boxes which may fall within your proposed construction. Please ensure that these are not damaged, buried or otherwise rendered inaccessible as a result of the works and that all stop taps, valves, hydrants, etc. remain accessible and operable. Minor reduction in existing levels may result in conflict with STW Apparatus such as valve spindles or tops of hydrants housed under the surface boxes. Checks should be made during site investigations to ascertain the level of such STW Apparatus in order to determine any necessary alterations in advance of the works.

12. With regard to any proposed resurfacing works, you are required to contact STW on the number given above to arrange a site inspection to establish the condition of any STW Apparatus in the nature of surface boxes or manhole covers and frames affected by the works. STW will then advise on any measures to be taken, in the event of this a proportionate charge will be made.

13. You are advised that STW will not agree to either the erection of posts, directly over or within 1.0 metre of valves and hydrants,

14. No explosives are to be used in the vicinity of any STW Apparatus without prior consultation with STW.

TREE PLANTING RESTRICTIONS

There are many problems with the location of trees adjacent to sewers, water mains and other STW Apparatus and these can lead to the loss of trees and hence amenity to the area which many people may have become used to. It is best if the problem is not created in the first place. Set out below are the recommendations for tree planting in close proximity to public sewers, water mains and other STW Apparatus.

15. Please ensure that, in relation to STW Apparatus, the mature root systems and canopies of any tree planted do not and will not encroach within the recommended distances specified in the notes below.

16. Both Poplar and Willow trees have extensive root systems and should not be planted within 12 metres of a sewer, water main or other STW Apparatus.

17. The following trees and those of similar size, be they deciduous or evergreen, should not be planted within 6 metres of a sewer, water main or other STW Apparatus. E.g. Ash, Beech, Birch, most Conifers, Elm, Horse Chestnut, Lime, Oak, Sycamore, Apple and Pear. Asset Protection Statements Updated May 2014

18. STW personnel require a clear path to conduct surveys etc. No shrubs or bushes should be planted within 2 metre of the centre line of a sewer, water main or other STW Apparatus.

19. In certain circumstances, both STW and landowners may wish to plant shrubs/bushes in close proximity to a sewer, water main of other STW Apparatus for screening purposes. The following are shallow rooting and are suitable for this purpose: Blackthorn, Broom, Cotoneaster, Elder, Hazel, Laurel, Privet, Quickthorn, Snowberry, and most ornamental flowering shrubs.

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
	C		0	0
	C		0	0
	C		0	0
	C		0	0
	C		0	0
	C		0	0
0005	C	0	0	0
0006	C	0	0	0
0007	C	0	0	0
0100	C	0	0	0
0101	C	0	0	0
0102	C	0	0	0
0103	C	0	0	0
0201	C	154.48	153.57	0.91
0202	C	0	0	0
1001	C	148.3	147.38	0.92
1003	C	0	0	0
1004	C	0	0	0
1005	C	0	0	0
1006	C	0	0	0
1007	C	0	0	0
1201	C	153.35	152.43	0.92
1202	C	154.5	153.62	0.88
1203	C	154.61	153	1.61
1204	C	154.89	152.88	2.01
1205	C	0	0	0
1206	C	0	0	0
1301	C	155.29	153.59	1.7
1302	C	155.28	153.41	1.87
1303	C	155.38	153.91	1.47
1304	C	155.37	154.08	1.29
1305	C	155.48	154.47	1.01
1910	C		151.18	0
2000	C		0	0
2001	C	153.1	151.65	1.45
2003	C	153.01	150.55	2.46
2005	C	152.65	151.18	1.47
2006	C	152.66	152.03	0.63
2007	C	0	0	0
2008	C	0	0	0
2101	C	152.72	151.12	1.6
3000	C		0	0
3001	C	153.79	152.57	1.22
3002	C	153.6	152.36	1.24
	F		0	0
	F		0	0
	F		0	0
	F		0	0
	F		0	0
	F		0	0
	F		0	0
	F		0	0
	F		0	0
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	F		0	0
	F		0	0
	F		0	0
	F		0	0
	F		0	0
	F		0	0
	F		0	0
0002	F		0	0
0004	F		0	0
0200	F		0	0
1000	F		0	0
9002	F		0	0
9003	F		0	0
9103	F		0	0
9104	F		0	0
9202	F		0	0
	S		0	0
	S		0	0
	S		0	0
	S		0	0
	S		0	0
	S		0	0
	S		0	0
	S		0	0
	S		0	0
	S		0	0
	S		0	0
	S		0	0
	S		0	0
	S		0	0
	S		0	0
	S		0	0
	S		0	0
	S		0	0
	S		0	0
	S		0	0
	S		0	0
0001	S	0	0	0
8100	S		0	0
8200	S		0	0
9001	S	0	0	0

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
9005	S	0	0	0
9100	S		0	0
9101	S		0	0
9102	S		0	0
9200	S		0	0
9201	S		0	0

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

9004	S	0	0	0

APPENDIX VI

SuDS APPRAISAL

SuDS Appraisal for Station Road, Bagworth – 83047

SuDS Feature	Included	Justification
Soakaway	X	The British Geological Survey map of Britain indicates the bedrock here to be the bedrock described here by the British Geological Survey maps for Britain is the Edwalton Member. This weathers into mudstone and siltstone and is likely to comprise of clay. Following this information, soakaways are deemed not suitable for this development.
Rainwater Harvesting System	X	Not included due to unsuitability for this type of site.
Cellular Attenuation	X	Not included due to the attenuation basin being the preferred option for attenuation.
Attenuation Basin	✓	Attenuation Basin has been included to provide attenuation for the surface water prior to discharging to greenfield runoff rate. The basin will also provide treatment to the surface water.
Infiltration Basin	X	Not included due to the constraints of the site; ground conditions unsuitable for infiltration.
Pond	X	Not included due to the constraints of the site; space required is unfeasible.
Flow Control Chamber	✓	Included to restrict the flow to 2l/s, to ensure no adverse effects on the public sewer system.
Green/Blue Roof	X	Not included due to pitched roof system on dwellings.
Rain Garden	X	Not included due to the constraints of the site; space required is unfeasible.
Filter Trench	X	Not included due to the constraints of the site; space required is unfeasible.
Infiltration Trench	X	Not included due to the constraints of the site; space required is unfeasible and ground conditions unsuitable for infiltration.
Water Butt	X	Has the potential to be utilised, however deemed not necessary due to other methods of treatment.
Permeable Paving	✓	Included to provide treatment to the surface water runoff. Aids in the degradation of contaminants found in runoff
Stormwater Wetland	X	Not included due to the constraints of the site; space required is unfeasible.
Proprietary Device	X	Not included as deemed not necessary due to other methods of treatment.
Tree Pits	X	Has the potential to be utilised as an extra method of treatment, would require coordination with the site landscaping plan.

APPENDIX VII

GREENFIELD RUNOFF RATES

Greenfield runoff rate estimation tool

www.uksuds.com | Greenfield runoff rate estimation tool (https://www.uksuds.com/)

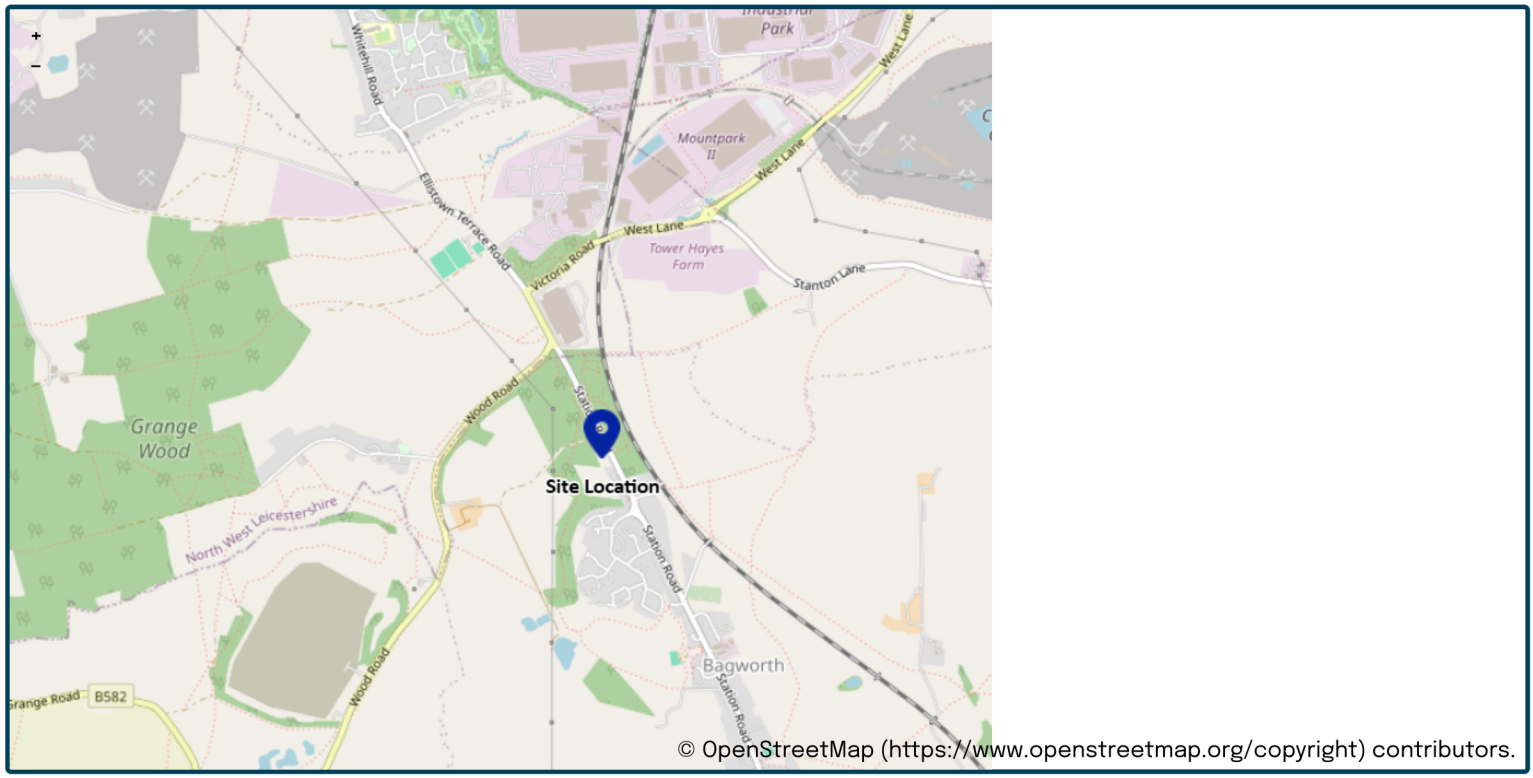
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Project details

Date	19/08/2025
Calculated by	EC
Reference	83047
Model version	2.1.2

Location

Site name	Bagworth
Site location	Bagworth



Site easting (British National Grid)	444015
Site northing (British National Grid)	309369

Site details

Total site area (ha)	2.1 ha

Greenfield runoff

Method

Method	IH124

IH124

	My value		Map value
SAAR (mm)	694 mm		694
How should SPR be derived?	WRAP soil type		
WRAP soil type	4		4
SPR	0.47		
QBar (IH124) (l/s)	10.04 l/s		

Growth curve factors

	My value		Map value
Hydrological region	4		4
1 year growth factor	0.83		
2 year growth factor	0.89		
10 year growth factor	1.49		
30 year growth factor	2		
100 year growth factor	2.57		
200 year growth factor	3.04		

Results

Method	IH124
Flow rate 1 year (l/s)	8.3 l/s
Flow rate 2 year (l/s)	8.9 l/s
Flow rate 10 years (l/s)	15.0 l/s
Flow rate 30 years (l/s)	20.1 l/s
Flow rate 100 years (l/s)	25.8 l/s
Flow rate 200 years (l/s)	30.5 l/s

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent 'zero' figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

APPENDIX VIII

GENERAL CONDITIONS

1. This report has been prepared and written specifically for the Client named in the introduction and is exclusively for his/her/their benefit. No reliance may be placed in the contents of this report by any third party except with the express agreement of the original Client and the written agreement of PRP. Such written agreement may require the payment of an additional fee.
2. This report has been prepared and written in the context of the proposals for the development of the site as stated by the client and will not be valid in a differing context. Furthermore, new information, improved practices, or legislation may necessitate alteration to the report in whole or in part after its submission. Therefore, with any change in circumstances or after the expiry of one year from the date of this report, it should be referred to us for re-assessment.
3. Factual reports received from third parties are included or summarised in this report. They have been used in best faith and in the context of the site and the proposals. We cannot be held responsible for any shortcomings in these third party reports in any way whatsoever.
4. There may also be special conditions appertaining to the site which were not revealed by the investigation and which will not, therefore, have been taken into account in this report. Any assessments may be subject to amendment in the light of additional information becoming available.
5. Whilst an opinion may be expressed or implied in this report on possible configurations or on the possible presence of features based either visual, verbal or published evidence, this is for guidance only and no liability can be accepted for the accuracy of such opinions.
6. Comments on groundwater conditions will have been based on observations made only at the time of any investigation or published data unless otherwise stated. It should be noted, however, that groundwater levels vary due to seasonal and other effects.
7. This report is not a site categorisation, and hazards could occur which have not been detected.
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