Ref: D2068.24

Dear Sir/Madam,

Ref: The Spinney Pulborough, RH20 2AP - DC/24/0068

Drainage Department Recommendations:

1) The applicant has not provided sufficient evidence to confirm or discount the potential for infiltration. The soil and geology identified in the desk study are potentially suitable material for infiltration. The Horsham District Council SFRA-Appendix 1 Figure 4 SuDS Suitability indicates suitability across the district council area for the provision of infiltration SuDS features. This product notes the site to lie in an area of moderate infiltration suitability.

Several constraints have been highlighted by the applicant, including proximity to buildings and the presence of a water supply trunk main. The location of the water supply trunk main has not been identified on a plan.

The applicant must highlight all constraints on a plan to determine available space for infiltration devices.

If spatial constraints allow for the provision of infiltration; the applicant must provide evidence of infiltration testing in accordance with BRE365, at the location and depth of proposed devices.

If evidence is presented to discount infiltration, discharge to sewer would be the next appropriate method of discharge.

2) The applicant has estimated the greenfield runoff rate (Qbar) as 0.3 l/s, this corresponds to 6.08 l/s/ha applied to the existing site impermeable area. The Qbar rate is consistent with the rate calculated using the IH124 methodology.

The applicant has estimated the pre-development brownfield runoff rate using a 50mm rainfall event applied across the existing site impermeable area. The resulting brownfield rate is calculated as 6.6 l/s, which the applicant states is equivalent to a 1 in 2 year return period scenario.

A site specific estimate for existing brownfield runoff rate should be provided: including the 1 in 1, 1 in 30 and 1 in 100 year storm events storm events.

3) The applicant has modelled the proposed Surface Water Drainage network using flow+. It is demonstrated that the proposed geocellular storage tank is adequately sized to manage the critical storm events for all events up to and including the 1 in 100 year event including climate change.

The development will result in a reduction in impermeable area, and storage provided by geocellular storage tanks will reduce runoff from the site. The proposed discharge rate of 2.0 l/s represents a 70% betterment from the existing estimated brownfield runoff rate.

The proposed drainage strategy provides a greater than 50% betterment on existing runoff rate. However, the application has not deemed that the site can discharge at a greenfield 1 in 1 year discharge rate.

4) The applicant has correctly provided an assessment of pollution from the proposed land uses in accordance with the Simple Index Approach. However, the pollutant removal quoted by the applicant for the proposed proprietary device (Permachannel/Permatreat product), is not evidenced. The applicant should obtain evidence from the product supplier that the treatment performance of the proprietary system is adequate to meet the stated requirements.

5) The applicant has incorrectly set urban creep to 0%. An allowance of 10% for urban creep should be used, as per Section 5.6.4 of the West Sussex LLFA Policy for the Management of Surface Water.

6) A Maintenance and Management Plan, including access requirements, maintenance frequency and responsibility, and proprietary device manuals, for all drainage features and SuDS devices should be provided. A section showing the configuration of the proprietary treatment device and geocellular system should be provided.

7) Consideration of how exceedance flows for events greater than the 1 in 100 year plus climate change event will be managed and mitigated on site without significantly increasing flood risks (both on site and outside the development) should be provided. The applicant should confirm whether a 150mm finished floor level freeboard above surrounding ground levels is proposed to mitigate against the residual risk from surface water exceedance events. Proposed site levels and resulting surface water exceedance routes should be provided for the proposal.

8) The detailed foul drainage strategy layout has been designed to account for the proposed peak foul flows generated by two dwellings. The invert levels of the foul water network have not been provided, but the application does not provide clear evidence if foul water pipes are too close to buildings or within the line of influence of the foundations. The applicant must demonstrate that both the surface water and foul water pipes will be set 1.2m clear from the foundation external face, or otherwise not within the line of influence of the building foundations, in accordance with Sewerage Sector Guidance: Design and Construction Guidance.

Written evidence of a Section 106 foul connection agreement with Southern Water should be provided by the applicant, as should a model of the foul strategy with associated drainage design (e.g. gradient, pipe diameter, etc).

Consultant Response:

Following early engagement and consultation with Martin Brightwell of Horsham DC Drainage Team, drainage strategy and design requirements was agreed for a number of WSCC owned former garage sites prior to our design, and this design has followed this remit. Nevertheless, we have addressed the comments as below.

1) Please see attached survey and revised plans which show the Trunk Main. This is in a different position to that previously shown on Southern Water maps, but nevertheless a number of constraints prevent use of soakaways, as agreed previously, due to insufficient space remaining when allowing for a 5.0m buffer from existing and proposed buildings, a 2.5m highway buffer, and root protection zones. Very little room is left following allowance for all these constraints, and this would be insufficient for soakaway storage structures big enough to support drainage of this site.

It is not expected that the site would yield soakage either, with the nearest borehole TQ01NE16 showing existing ground strata of Rock and Clay within the Deposits, and Clay bedrock. The presence of an existing surface water sewer network across the site and surrounding area would also suggest the site did not yield soakage potential.

The discharge to the surface water sewer is therefore the most appropriate connection in absence of sufficient space, and connection has been confirmed from within the site and offsite to the public sewer network.

2) An additional drainage model has been produced of the existing site drainage network. This broadly confirms previous assumptions of existing site runoff. Existing runoff rates are calculated as follows:

- 1 in-1 year storm – 6.8l/s
- 1 in-30 year storm – 23.0l/s
- 1 in-100 year storm – 30.7l/s

This demonstrates even further the benefits of the proposed controlled runoff rate.

3) In accordance with policy, relevant guidance, and best practice, it is generally accepted that 2l/s is the minimum acceptable discharge rate into a surface water body or sewer. This is set out in guidance from DEFRA/EA, DCG, and Horsham's Surface Water drainage policy, which states:

"Hydrobrakes to be used where rates are between 2l/s to 5l/s. Orifices not be used below 5l/s as the pipes may block. Pipes with flows < 2l/s are prone to blockage."

The revised drainage design has therefore been amended to utilise a Hydrobrake at 2.0l/s, subject to further review of appropriate flow control products at detailed design stage.

4) In accordance with CIRIA SuDS Manual Table 26.2, the pollution hazard indices for the site are as follows:

- Property driveways – low/TSS = 0.5/M = 0.4/H = 0.4

Polypipe confirm the SuDS mitigation indices for discharges to surface waters for their products as follows:

SURFACE WATER POLLUTION MITIGATION INDICES Polypipe Treatment Products	*Pollution Mitigation Indices* Total Suspended Solids	Metals	Hydrocarbons	*COMMENT 1*
Permachannel/ Permakerb	0.8	0.4	0.9	SuDS components can only be assumed to deliver these indices if drained area to each 1m channel length <30sq.m and >1:500 longfall.
Permachannel Slotdrain	0.8	0.4	0.9	SuDS components can only be assumed to deliver these indices if drained area to each 1m channel length <50sq.m and >1:500 longfall.

This is also available on their publicly available product design guides.

As the pollution hazard indices do not exceed the SuDS mitigation indices, this is appropriate for use.

5) Urban creep is not typically applied to brownfield regeneration sites where there is already a reduction in catchment area. Nevertheless, the revised modelling results have included an allowance for 10% urban creep in a design storm event to demonstrate that this would not result in exceedance of the system.

6) A detailed maintenance and management plan would typically be provided as part of a detailed drainage and civils design package for discharge of conditions. Construction details would demonstrate device configurations and the maintenance schedule would include any relevant manufacturers requirements.

The maintenance plan will include:

- Confirmation that the proposed drainage system will not be offered for adoption and all maintenance measures will be the responsibility of the Developer (for all shared assets) and the final owner/occupier for any drainage that only serves one plot. It will be the responsibility of the Developer to finance this maintenance, and to agree any financing terms with owners/occupiers for the lifetime of the development.
- Details regarding significant storm events that may cause considerable damage to SuDS and their associated components, and confirmation that it may be necessary to inspect and carry out essential recovery works to return the feature to full working order.
- Detailing required accidental spillages and necessary clean up actions, although it is not envisaged that any materials are to be stored onsite once the development has been completed, which could cause major spills and potential pollution issues within the drainage system.
- Construction phasing
- Future alterations

Maintenance measures included in the final package will include:

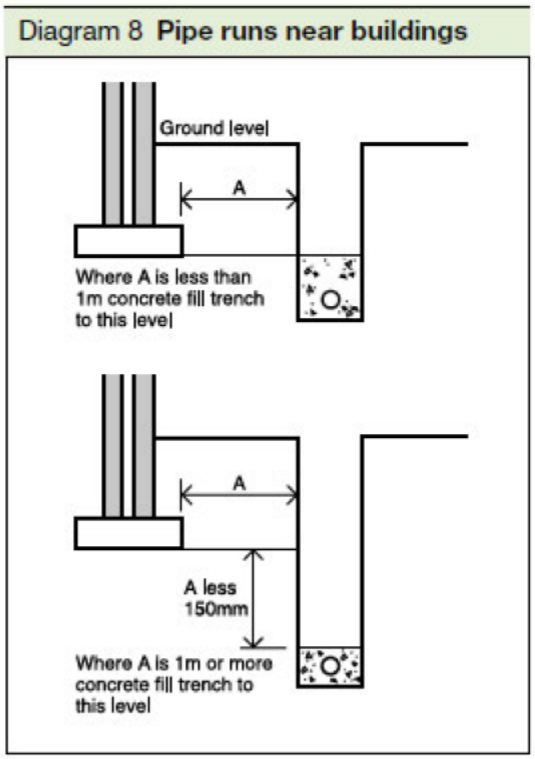
Drainage System feature	Proposed maintenance / remedial works	Required frequency of works
Catch pits, gully sumps and drains, flap valves	Inspection and additional cleansing as required.	Every 6 months
	Desilting	Year 1, Year 3, then every 5 years
Pipework	Jetting to clear blockages	As required
Flow Control Chamber	Clean out chamber/sump	Monthly for first 3 months then twice annually, or as detailed otherwise by manufacturer
	Inspect flow control unit and remove debris, and all other maintenance measures	
Permachannel	All maintenance measures	As detailed by manufacturer
Geocellular Units	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Post-construction, monthly for 3 months, then annually
	Other maintenance measures	As detailed by manufacturer

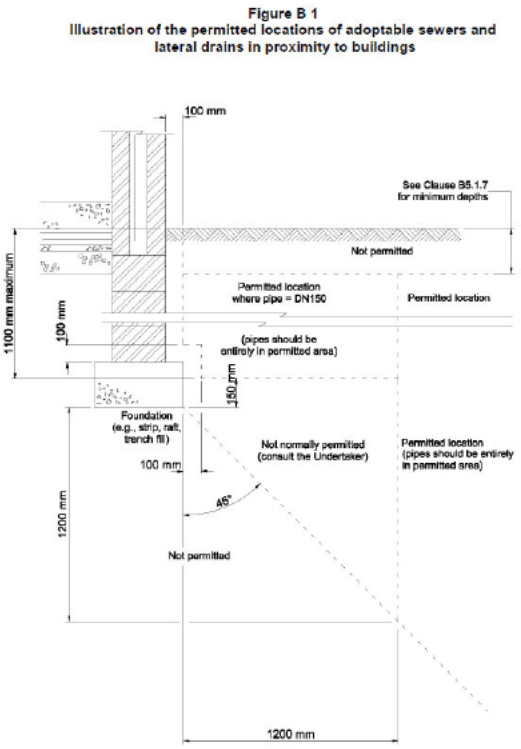
7) Full details of level design will be provided at detailed design for discharge of conditions, however indicative levels have been included on the drainage plan which show levels complying with Building Regulations Part M, with falls away from the building at the front and at the rear, as well as flush front door access and 150mm stepped rear access. Finished floor levels are minimum 300mm above adjacent highway levels, and there is no identified surface water flood risk at or adjacent the site, so it is not expected that surface water flood risk will be an issue to the site.

8) A foul drainage network model has been included in this revised submission. However, it should be clearly noted that the comments requiring building clearance and sewer connection approval are not appropriate at this stage, because:

a) There is no need to demonstrate that pipework will be minimum 1.2m from the buildings, as there is no intention to propose the drainage network for adoption. The drainage system therefore will be designed to suit Building Regulations Part H – diagram 8 on page 15 of this guidance details concrete trench fill requirements for drainage systems adjacent buildings and this will be detailed further in accompanying construction details alongside a drainage and civils design for discharge of conditions.

(The reviewing drainage team should also note that DCG allows for shallow drainage as close as 100mm from a building exterior providing this is above foundations, so that would be something agreed upon at detailed design, alongside a structural engineer, if necessary.)





Building Regulations Extract & DCG Extract, respectively.

b) It is not possible to obtain a S106 Connection Approval from Southern Water prior to planning approval, as evidence of planning approval is required for a S106 Application Submission.

The sewage undertaker is obliged to approve a foul connection application however under the Water Industry Act 1991, and infrastructure and connection charges (OFWAT Charging Rules) place the onus on the sewerage undertaker to reinforce their network should there not be sufficient capacity to serve the new development. Funding for this is provided by revised charging arrangements for infrastructure and connection charges for each dwelling constructed comprising a Network Reinforcement Charge and Site-Specific Charges. The revised charging arrangement (funded by the developer) covers alterations to the Existing Sewer Network and the sewerage undertaker remains responsible for the cost of reinforcing their Strategic Assets. The developer is responsible for connecting the development to the public sewer network.

The S106 connection application will therefore be made as part of the detailed civils and drainage package for discharge of conditions.

Consultant Summary

The above details demonstrate the comments have been addressed where applicable, and how they will be addressed at discharge of conditions where the comments are inapplicable at this time. Please see attached revised drawings and additional documents as required.

Kind Regards,

[redacted]

Dan Lytton
Engineer, BP Civils

-SURFACE WATER DRAINAGE-

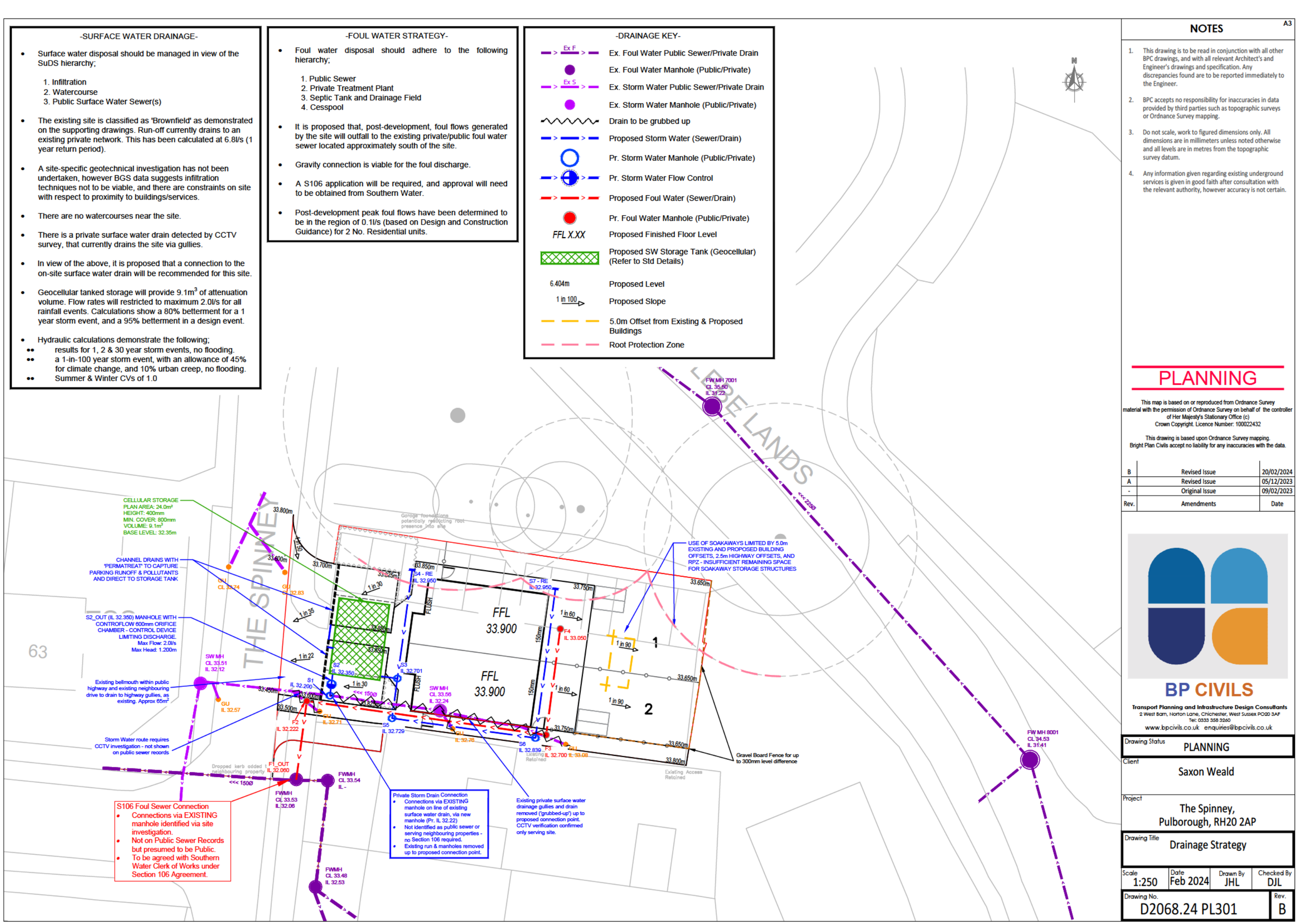
- Surface water disposal should be managed in view of the SuDS hierarchy;
  1. Infiltration
  2. Watercourse
  3. Public Surface Water Sewer(s)
- The existing site is classified as 'Brownfield' as demonstrated on the supporting drawings. Run-off currently drains to an existing private network. This has been calculated at 6.8l/s (1 year return period).
- A site-specific geotechnical investigation has not been undertaken, however BGS data suggests infiltration techniques not to be viable, and there are constraints on site with respect to proximity to buildings/services.
- There are no watercourses near the site.
- There is a private surface water drain detected by CCTV survey, that currently drains the site via gullies.
- In view of the above, it is proposed that a connection to the on-site surface water drain will be recommended for this site.
- Geocellular tanked storage will provide 9.1m^3 of attenuation volume. Flow rates will restricted to maximum 2.0l/s for all rainfall events. Calculations show a 80% betterment for a 1 year storm event, and a 95% betterment in a design event.
- Hydraulic calculations demonstrate the following;
  - results for 1, 2 & 30 year storm events, no flooding.
  - a 1-in-100 year storm event, with an allowance of 45% for climate change, and 10% urban creep, no flooding.
  - Summer & Winter CVs of 1.0

-FOUL WATER STRATEGY-

- Foul water disposal should adhere to the following hierarchy;
  1. Public Sewer
  2. Private Treatment Plant
  3. Septic Tank and Drainage Field
  4. Cesspool
- It is proposed that, post-development, foul flows generated by the site will outfall to the existing private/public foul water sewer located approximately south of the site.
- Gravity connection is viable for the foul discharge.
- A S106 application will be required, and approval will need to be obtained from Southern Water.
- Post-development peak foul flows have been determined to be in the region of 0.1l/s (based on Design and Construction Guidance) for 2 No. Residential units.

-DRAINAGE KEY-

- Ex F — Ex. Foul Water Public Sewer/Private Drain
- Ex. Foul Water Manhole (Public/Private)
- Ex S — Ex. Storm Water Public Sewer/Private Drain
- Ex. Storm Water Manhole (Public/Private)
- Drain to be grubbed up
- Proposed Storm Water (Sewer/Drain)
- Pr. Storm Water Manhole (Public/Private)
- Pr. Storm Water Flow Control
- Proposed Foul Water (Sewer/Drain)
- Pr. Foul Water Manhole (Public/Private)
- FFL X.XX — Proposed Finished Floor Level
- Proposed SW Storage Tank (Geocellular) (Refer to Std Details)
- 6.404m — Proposed Level
- 1 in 100 — Proposed Slope
- 5.0m Offset from Existing & Proposed Buildings
- Root Protection Zone



NOTES

A3

1. This drawing is to be read in conjunction with all other BPC drawings, and with all relevant Architect's and Engineer's drawings and specification. Any discrepancies found are to be reported immediately to the Engineer.
2. BPC accepts no responsibility for inaccuracies in data provided by third parties such as topographic surveys or Ordnance Survey mapping.
3. Do not scale, work to figured dimensions only. All dimensions are in millimeters unless noted otherwise and all levels are in metres from the topographic survey datum.
4. Any information given regarding existing underground services is given in good faith after consultation with the relevant authority, however accuracy is not certain.

PLANNING

This map is based on or reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of the controller of Her Majesty's Stationary Office (c)
Crown Copyright. Licence Number: 100022432

This drawing is based upon Ordnance Survey mapping.
Bright Plan Civils accept no liability for any inaccuracies with the data.

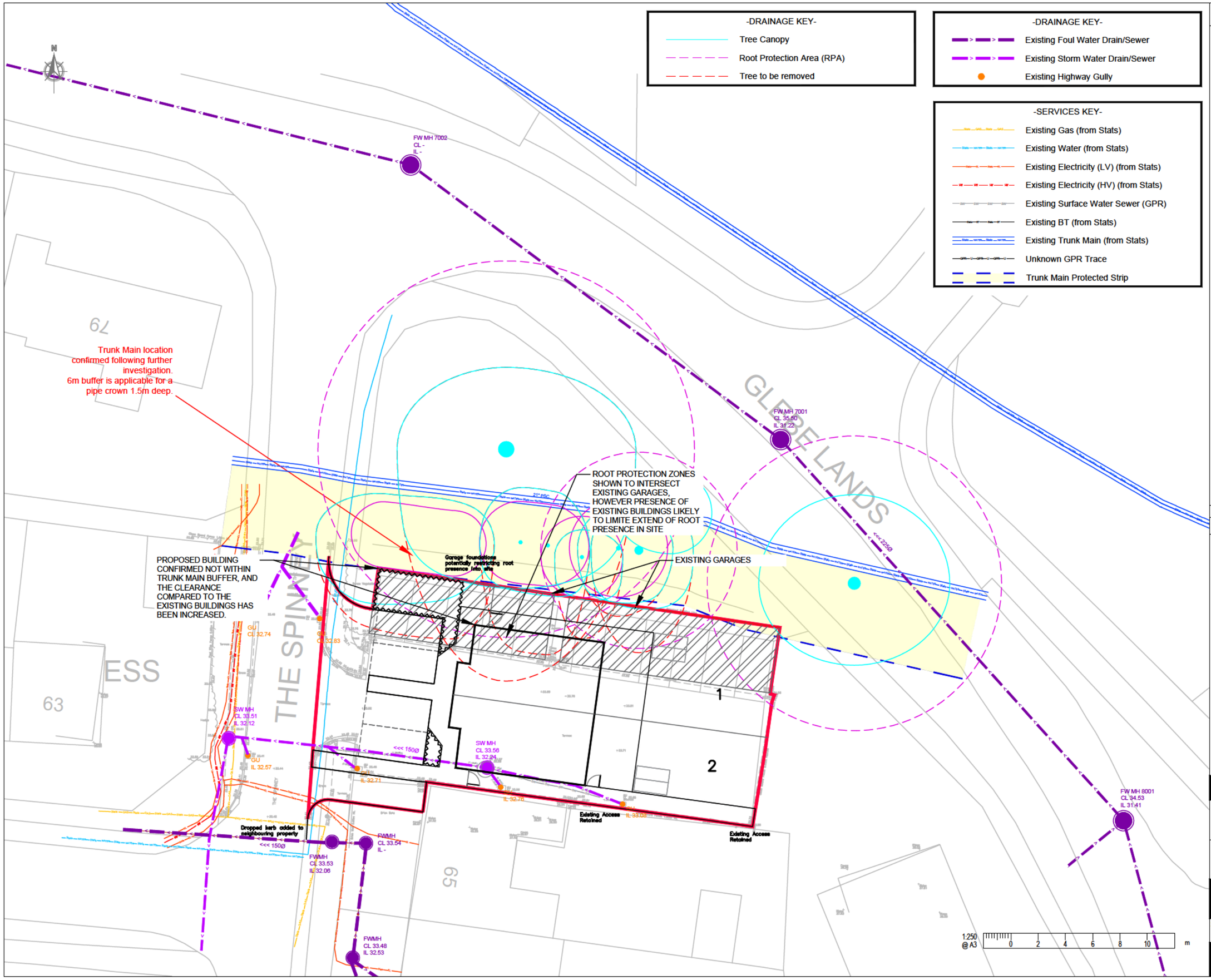
Rev.	Amendments	Date
B	Revised Issue	20/02/2024
A	Revised Issue	05/12/2023
-	Original Issue	09/02/2023

BP CIVILS
Transport Planning and Infrastructure Design Consultants
2 West Barn, Norton Lane, Chichester, West Sussex PO20 3AF
Tel: 0333 358 3260
www.bpcivils.co.uk enquiries@bpcivils.co.uk

Drawing Status	PLANNING
Client	Saxon Weald
Project	The Spinney, Pulborough, RH20 2AP
Drawing Title	Drainage Strategy

Scale	Date	Drawn By	Checked By
1:250	Feb 2024	JHL	DJL

Drawing No.	Rev.
D2068.24 PL301	B



NOTES

A3

1. This drawing is to be read in conjunction with all other BPC drawings, and with all relevant Architect's and Engineer's drawings and specification. Any discrepancies found are to be reported immediately to the Engineer.
2. BPC accepts no responsibility for inaccuracies in data provided by third parties such as topographic surveys or Ordnance Survey mapping.
3. Do not scale, work to figured dimensions only. All dimensions are in millimeters unless noted otherwise and all levels are in metres from the topographic survey datum.
4. Any information given regarding existing underground services is given in good faith after consultation with the relevant authority, however accuracy is not certain.

PLANNING

This map is based on or reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of the controller of Her Majesty's Stationary Office (c) Crown Copyright. Licence Number: 100022432

This drawing is based upon Ordnance Survey mapping. Bright Plan Civils accept no liability for any inaccuracies with the data.

Rev.	Amendments	Date
A	Revised Trunk Main Position	19/12/2023
-	Original Issue	09/02/2023

BP CIVILS
Transport Planning and Infrastructure Design Consultants
2 West Barn, Norton Lane, Chichester, West Sussex PO20 3AF
Tel: 0333 358 3260
www.bpcivils.co.uk enquiries@bpcivils.co.uk

Drawing Status: PLANNING

Client: Saxon Weald

Project: The Spinney, Pulborough, RH20 2AP

Drawing Title: Existing Services, Drainage and Constraints Plan

Scale	Date	Drawn By	Checked By
1:250	Dec 2023	JHL	DJL

Drawing No.: D2068.24 PL300 Rev.: A

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	250.0
Additional Flow (%)	10	Minimum Velocity (m/s)	0.75
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	0.700
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Manhole Type	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
7	0.005	5.00	33.750	Adoptable	450	505767.871	119023.189	0.800
6	0.005	5.00	33.750	Adoptable	450	505766.337	119011.701	0.911
5	0.005	5.00	33.750	Adoptable	450	505754.991	119013.267	1.021
4	0.005	5.00	33.750	Adoptable	450	505756.548	119024.690	0.800
3	0.007	5.00	33.700	Adoptable	450	505755.377	119016.099	0.999
2			33.550	Adoptable	1200	505750.259	119016.479	1.200
1			33.550	Adoptable	450	505750.021	119014.633	1.350

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)
1.004	2	1	1.861	0.600	32.350	32.200	0.150	12.4	150	Circular	5.70	57.6
1.003	3	2	5.132	0.600	32.701	32.652	0.049	104.7	100	Circular	5.69	57.6
1.002	5	3	2.858	0.600	32.729	32.701	0.028	102.1	100	Circular	5.57	58.1
2.000	4	3	8.670	0.600	32.950	32.701	0.249	34.8	100	Circular	5.11	60.1
1.001	6	5	11.454	0.600	32.839	32.729	0.110	104.1	100	Circular	5.51	58.3
1.000	7	6	11.590	0.600	32.950	32.839	0.111	104.4	100	Circular	5.26	59.4

Name	US Node	DS Node	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)
1.004	2	1	2.875	50.8	4.6	1.050	1.200
1.003	3	2	0.751	5.9	4.6	0.899	0.798
1.002	5	3	0.761	6.0	2.6	0.921	0.899
2.000	4	3	1.311	10.3	0.9	0.700	0.899
1.001	6	5	0.753	5.9	1.7	0.811	0.921
1.000	7	6	0.752	5.9	0.9	0.700	0.811

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	1440
Ratio-R	0.300	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Check Discharge Rate(s)	x
Winter CV	1.000	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Flow+ v10.6.232 Copyright © 1988-2024 Causeway Technologies Ltd

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
2	0	0	0
30	40	0	0
100	45	10	0

Node 2 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	32.350	Product Number	CTL-SHE-0064-2000-1200-2000
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	32.350
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	128

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	24.0	0.0	0.400	24.0	0.0	0.401	0.0	0.0

Flow+ v10.6.232 Copyright © 1988-2024 Causeway Technologies Ltd

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.85%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	7	11	32.975	0.025	0.0040	0.0000	OK
15 minute summer	6	11	32.874	0.035	0.0056	0.0000	OK
15 minute summer	5	11	32.781	0.052	0.0083	0.0000	OK
15 minute summer	4	11	32.969	0.019	0.0030	0.0000	OK
15 minute summer	3	11	32.769	0.068	0.0109	0.0000	OK
60 minute summer	2	41	32.427	0.077	1.8454	0.0000	OK
15 minute summer	1	1	32.200	0.000	0.0000	0.0000	OK

US Node	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Discharge Vol (m³)
7	6	0.8	0.405	0.135	
6	5	1.6	0.489	0.270	
5	3	2.4	0.480	0.397	
4	3	0.8	0.277	0.078	
3	2	4.2	0.779	0.718	
2	1	1.3			3.5

Flow+ v10.6.232 Copyright © 1988-2024 Causeway Technologies Ltd

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.85%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	7	10	32.979	0.029	0.0046	0.0000	OK
15 minute summer	6	11	32.880	0.041	0.0065	0.0000	OK
15 minute summer	5	11	32.797	0.068	0.0108	0.0000	OK
15 minute summer	4	10	32.972	0.022	0.0035	0.0000	OK
15 minute summer	3	11	32.788	0.087	0.0138	0.0000	OK
60 minute summer	2	41	32.448	0.098	2.3496	0.0000	OK
15 minute summer	1	1	32.200	0.000	0.0000	0.0000	OK

US Node	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Discharge Vol (m³)
7	6	1.1	0.440	0.180	
6	5	2.1	0.506	0.352	
5	3	3.1	0.481	0.516	
4	3	1.1	0.279	0.104	
3	2	5.5	0.806	0.931	
2	1	1.5			4.3

Flow+ v10.6.232 Copyright © 1988-2024 Causeway Technologies Ltd

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.85%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	7	12	33.134	0.184	0.0292	0.0000	SURCHARGED
15 minute summer	6	12	33.117	0.278	0.0442	0.0000	SURCHARGED
15 minute summer	5	12	33.051	0.322	0.0513	0.0000	SURCHARGED
15 minute summer	4	12	33.011	0.061	0.0097	0.0000	OK
15 minute summer	3	12	33.001	0.300	0.0477	0.0000	SURCHARGED
120 minute summer	2	84	32.679	0.329	7.8683	0.0000	SURCHARGED
15 minute summer	1	1	32.200	0.000	0.0000	0.0000	OK

US Node	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Discharge Vol (m³)
7	6	2.6	0.527	0.432	
6	5	4.2	0.538	0.712	
5	3	6.3	0.806	1.056	
4	3	2.8	0.456	0.270	
3	2	11.6	1.486	1.972	
2	1	1.8			9.0

Flow+ v10.6.232 Copyright © 1988-2024 Causeway Technologies Ltd

Results for 100 year +45% CC +10% A Critical Storm Duration. Lowest mass balance: 99.85%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	7	20	33.411	0.461	0.0733	0.0000	SURCHARGED
120 minute summer	6	90	33.391	0.552	0.0878	0.0000	SURCHARGED
120 minute summer	5	90	33.389	0.660	0.1050	0.0000	SURCHARGED
120 minute summer	4	90	33.388	0.438	0.0697	0.0000	SURCHARGED
120 minute summer	3	90	33.388	0.687	0.1093	0.0000	SURCHARGED
120 minute summer	2	90	33.382	1.032	10.2981	0.0000	FLOOD RISK
15 minute summer	1	1	32.200	0.000	0.0000	0.0000	OK

US Node	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Discharge Vol (m³)
7	6	2.9	0.513	0.485	
6	5	5.5	0.707	0.935	
5	3	8.4	1.069	1.400	
4	3	3.0	0.485	0.294	
3	2	15.4	1.966	2.609	
2	1	1.9			22.1

Flow+ v10.6.232 Copyright © 1988-2024 Causeway Technologies Ltd

Design Settings

Frequency of use (kDU)	0.90	Minimum Velocity (m/s)	0.75
Flow per dwelling per day (l/day)	4000	Connection Type	Level Soffits
Domestic Flow (l/s/ha)	0.6	Minimum Backdrop Height (m)	0.200
Industrial Flow (l/s/ha)	0.8	Preferred Cover Depth (m)	0.600
Additional Flow (%)	0	Include Intermediate Ground	✓

Nodes

Name	Dwellings	Cover Level (m)	Manhole Type	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
4	1	33.750	Adoptable	450	505768.256	119020.025	0.700
3	1	33.750	Adoptable	450	505767.164	119011.849	1.050
2		33.600	Adoptable	450	505748.214	119014.529	1.378
1		33.530	Adoptable	1200	505747.378	119008.128	1.469

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type
1.000	4	3	8.249	1.500	33.050	32.700	0.350	23.6	100	Circular
1.001	3	2	19.139	1.500	32.700	32.222	0.478	40.0	100	Circular
1.002	2	1	6.455	1.500	32.222	32.061	0.161	40.0	100	Circular

Name	US Node	DS Node	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)
1.000	4	3	0.233	1.375	10.8	0.0	0.600	0.950
1.001	3	2	0.238	1.054	8.3	0.1	0.950	1.278
1.002	2	1	0.238	1.054	8.3	0.1	1.278	1.369

Flow+ v10.6.232 Copyright © 1988-2024 Causeway Technologies Ltd

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	250.0
Additional Flow (%)	10	Minimum Velocity (m/s)	0.75
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	0.600
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Manhole Type	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
EX1	0.023	5.00	33.600	Adoptable	225	505768.698	119010.882	0.520
EX2	0.023	5.00	33.560	Adoptable	900	505758.755	119013.573	1.320
EX3			33.510	Adoptable	1200	505739.815	119015.716	1.390

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)
1.000	EX1	EX2	10.301	0.600	33.080	32.240	0.840	12.3	150	Circular	5.06	60.3
1.001	EX2	EX3	19.061	0.600	32.240	32.120	0.120	158.8	150	Circular	5.46	58.6

Name	US Node	DS Node	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)
1.000	EX1	EX2	2.892	51.1	5.5	0.370	1.170
1.001	EX2	EX3	0.795	14.0	10.7	1.170	1.240

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	1440
M5-60 (mm)	20.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.300	Check Discharge Rate(s)	x
Winter CV	1.000	Check Discharge Volume	x
Analysis Speed	Normal		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
2	0	0	0
10	0	0	0
30	40	0	0
100	45	0	0

Flow+ v10.6.232 Copyright © 1988-2024 Causeway Technologies Ltd

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	EX1	10	33.107	0.027	0.0246	0.0000	OK
15 minute winter	EX2	10	32.317	0.077	0.0755	0.0000	OK
15 minute winter	EX3	10	32.193	0.073	0.0000	0.0000	OK

US Node	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Discharge Vol (m³)
EX1	EX2	3.5	0.649	0.068	
EX2	EX3	6.8	0.778	0.487	3.2

Flow+ v10.6.232 Copyright © 1988-2024 Causeway Technologies Ltd

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	EX1	10	33.129	0.049	0.0457	0.0000	OK
15 minute winter	EX2	11	32.615	0.375	0.3690	0.0000	SURCHARGED
15 minute winter	EX3	11	32.256	0.136	0.0000	0.0000	OK

US Node	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Discharge Vol (m³)
EX1	EX2	12.0	0.888	0.234	
EX2	EX3	23.0	1.308	1.638	11.1

Flow+ v10.6.232 Copyright © 1988-2024 Causeway Technologies Ltd

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	EX1	11	33.151	0.071	0.0651	0.0000	OK
15 minute winter	EX2	11	32.920	0.680	0.6701	0.0000	SURCHARGED
15 minute winter	EX3	10	32.262	0.142	0.0000	0.0000	OK

US Node	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Discharge Vol (m³)
EX1	EX2	15.8	1.066	0.309	
EX2	EX3	30.7	1.743	2.185	14.8

Flow+ v10.6.232 Copyright © 1988-2024 Causeway Technologies Ltd