

Powell Tolner & Associates Ltd

FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY STATEMENT

Project: St Albans Close, Gravesend

PTA Project No: 10164

Document Ref: 10164-PTA-XX-XX-RP-C-9071

Status: For Planning

Revision: P01

Date: April 2025

Client: The Hill Group



Issued by

PTA
29 Red Lion Street
Chesham
Buckinghamshire
United Kingdom
HP5 1EJ
Tel: + 44 1494 772721
central@ptaconsult.co.uk

	Name	Position	Signature	Date
Prepared by:	Dillan Halai	Civil Design Engineer	DH	08.04.2025
Reviewed by:	Alex Herman	Director	AH	08.04.2025
For and on behalf of Powell Tolner & Associates Limited				

Revision	Date	Description	Prepared	Reviewed
P01	08.04.2025	Issued for Planning	DH	AH

This report has been produced by Powell Tolner & Associates Ltd for exclusive use by the client named on the document. This report may not be relied upon by any other party without written consent from Powell Tolner & Associates Ltd. Powell Tolner & Associates Ltd accept no liability for any costs, liabilities or losses arising as a result of the use or reliance upon the contents of this report by any person other than the named client.

All comments and conclusions in this report are based on our reliance on the sourced data and Powell Tolner & Associates Ltd accept no liability for any inaccuracy in that information.

©This report is the copyright of PTA.

Any unauthorised reproduction or usage by any person other than the addressee is strictly prohibited.

TABLE OF CONTENTS

1	INTRODUCTION	1
2	DEVELOPMENT DESCRIPTION.....	2
2.1	Location	2
2.2	Existing Site.....	3
2.3	Development Proposals	3
3	FLOOD RISK.....	4
3.1	Flood Vulnerability Classification	4
3.2	Flood Risk Sources	4
3.2.1	Rivers	4
3.2.2	Tidal	5
3.2.3	Ground Water.....	5
3.2.4	Sewers	5
3.3	Reservoirs	5
3.4	Climate Change.....	5
3.5	Residual Risk	6
4	FLOOD RISK MANAGEMENT	7
4.1	Existing Surface Water Runoff.....	7
4.2	Floor Levels.....	7
4.3	Sustainable Drainage Techniques.....	7
4.3.1	Store Rainwater for Later Use	7
4.3.2	Infiltration Techniques	8
4.3.3	Ponds or Open Water Features	8
4.3.4	Tanks Or Sealed Water Features	8
4.3.5	Discharge Rainwater Direct to A Watercourse.....	8
4.3.6	Discharge to Surface Water Sewers	8
4.3.7	Discharge to Combined Sewer	8
4.4	Proposed Drainage	8
4.4.1	Proposed Surface Water Drainage	8
4.4.2	Exceedance Flow	8
4.4.3	Drainage Model	9
4.4.4	Proposed Foul Water Drainage	9

4.4.5	Drainage Maintenance Strategy.....	9
5	OFFSITE IMPACT	10
6	CONCLUSION	11
	APPENDIX A – Southern Water Asset Plan.....	12
	APPENDIX B – Proposed Drainage Layout.....	13
	APPENDIX C – Post Development Drainage Calcs	14
	APPENDIX D – Below Ground Drainage Maintenance Plan	15

1 INTRODUCTION

Powell Tolner and Associates Limited (PTA) have been appointed by The Hill Group to undertake a Flood Risk Assessment (FRA) and Drainage Strategy (DS) to support the planning application for a small development in Gravesham.

This FRA investigates both the onsite and offsite flood risk from all sources for the development and sets out mitigation measures within the drainage strategy to ensure the sustainability and safety of the proposed development over its lifetime.

This FRA and drainage strategy has been produced in line with the requirements of the National Planning Policy Framework (NPPF 2023) and the Environment Agency's (EA) Standing Advice.

2 DEVELOPMENT DESCRIPTION

2.1 Location

The Site (St Albans Close, Gravesend) is located within Gravesham Borough Council (postcode DA12 5SF),

See Figure 1 and Figure 2 below showing the Site location.

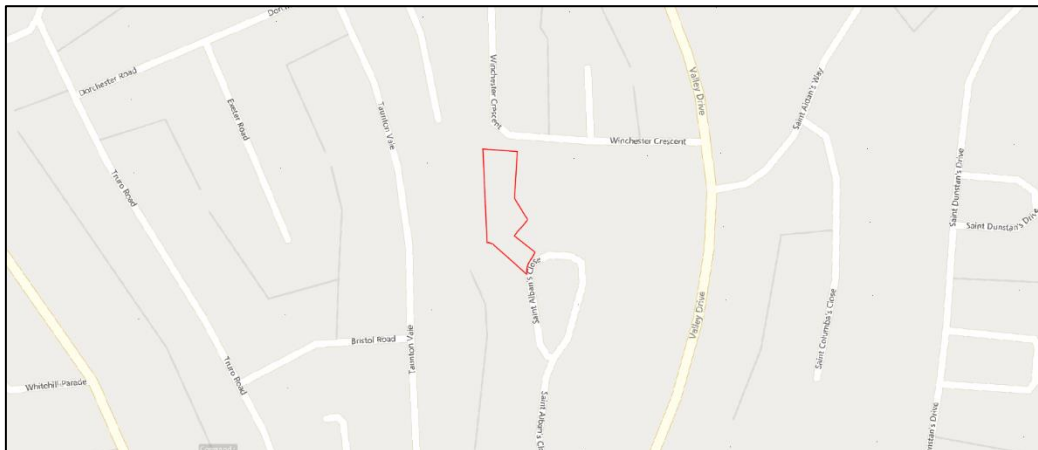


Figure 1: Site Location (Extract from Microsoft Bing Maps)

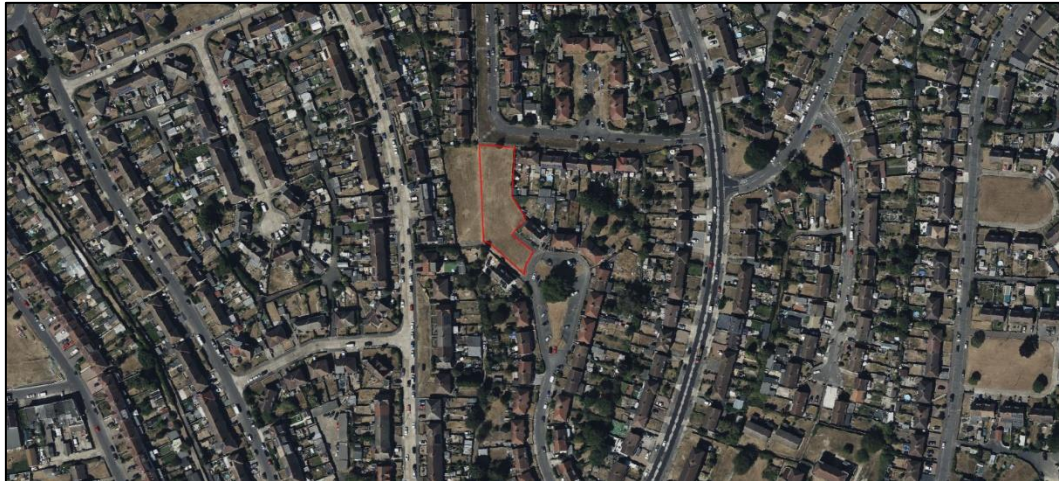


Figure 2: Aerial Photo (Extract from Microsoft Bing Maps)

The Site is bounded by residential houses to the north, east and south, and a strip of grass to the west.

2.2 Existing Site

Currently the Site is comprised of entirely greenfield (soft landscaping), with no hard landscaped areas. The current topography of the site falls gradually from the west towards the east from approximately 32.5m AOD to 29.2m AOD.

2.3 Development Proposals

The proposal includes the construction 8 modular homes, with associated refuse and cycle stores, and a new access footpath.

3 FLOOD RISK

3.1 Flood Vulnerability Classification

The EA's flood risk map below shows the entire site is located within Flood Zone 1, which is defined as having a less than 1:1000 (<0.1%) annual probability of flooding from rivers and seas.

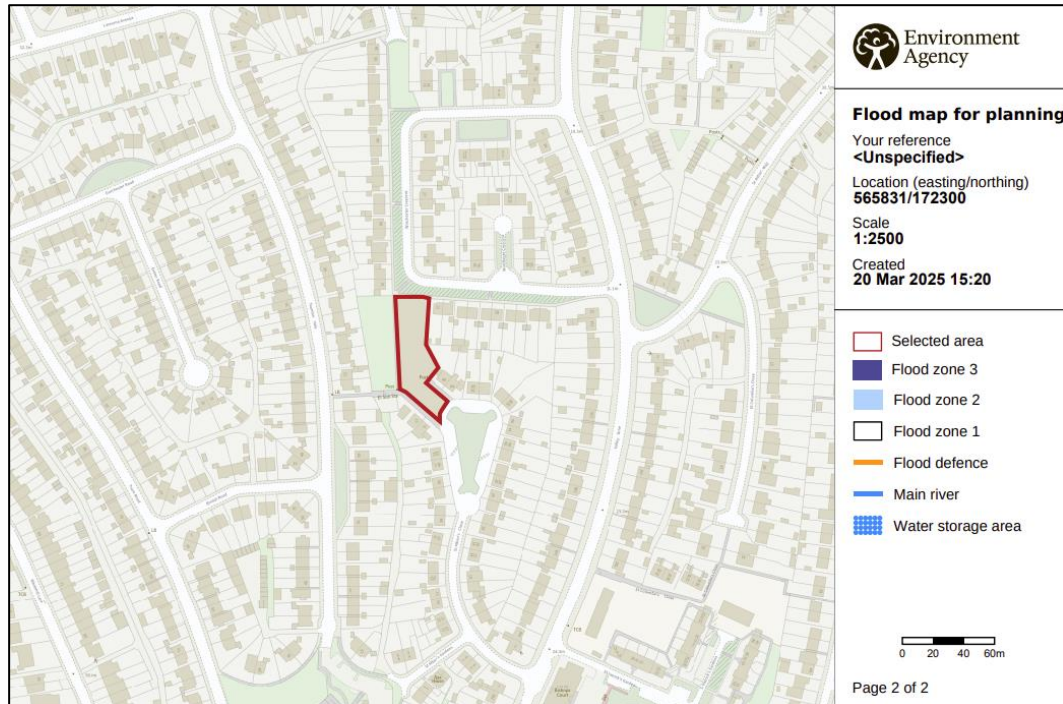


Figure 3: EA's Flood map for planning

3.2 Flood Risk Sources

The following potential sources of flooding have been considered.

3.2.1 Rivers

The River Thames is located approximately 2km north to The Site. The EA's flood map (Figure 4 below) does not show The Site to be at risk of flooding from rivers and the sea.

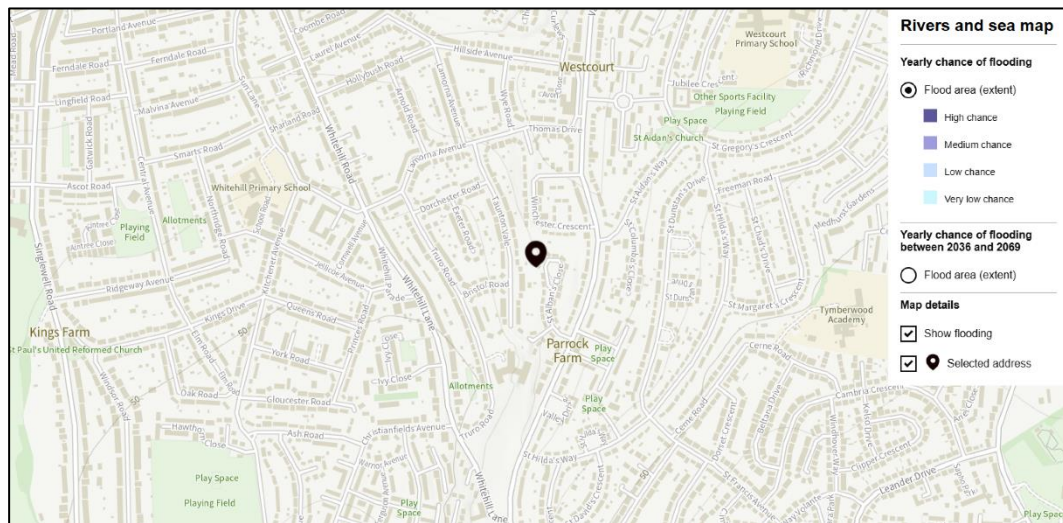


Figure 4: EA Flood Map – Flooding from rivers and the sea

3.2.2 Tidal

The Site is not located within the tidal influence.

3.2.3 Ground Water

Flooding from groundwater is unlikely in this area according to information provided on the British Geological Survey (BGS) website.

3.2.4 Sewers

Southern Water sewers are present within close vicinity of The Site, refer to Appendix A for an asset plan.

The surface water from the Site is proposed to be discharged into the ground via a soakaway. Foul water will be discharged from the site to a separate public foul water sewer at a lower level than the site. Therefore, there should not be an increase in risk of flooding from sewers as a result of this development.

3.3 Reservoirs

There are no reservoirs in the vicinity of the Site. The EA's website states that flooding from reservoirs is unlikely in this area.

3.4 Climate Change

The projected effects of climate change are expected to lead to increased rainfall, river flows, raised sea level and tidal fluctuations. The pertinent effects to this development are the increased rainfall and its effect on drainage systems. See Appendix B for details of the drainage proposals for the site.

As a result of climate change there would be a slight increase in risk of flooding by overland flows and sewers; however, the risk can be mitigated by providing suitable drainage networks for the proposed development and designing levels with exceedance flow routes avoiding the proposed residential units.

3.5 Residual Risk

There are no other known residual flood risks to the development.

4 FLOOD RISK MANAGEMENT

4.1 Existing Surface Water Runoff

As the site is greenfield land, it can be assumed that the existing surface water infiltrates naturally into the ground, and excess runoff is stored within the topsoil.

4.2 Floor Levels

To mitigate the flood risk due to surface water, the proposed development levels should be designed to provide flood flow routes away from the buildings in the event of surface water drainage malfunction, a burst water main or during extreme rainfall events falling outside of the design requirements.

The proposed building FFL's are set to be higher than the external footpath/roads, so that in the event of flooding, water can pond in the low point areas before the drainage system clears. Where this has not been possible, adequate drainage will be installed near building thresholds to avoid floodwater entering the dwellings.

4.3 Sustainable Drainage Techniques

The use of various sustainable drainage techniques has been investigated with respect to their potential to be used within the development to control storm water as close to the source as possible and reduce the potential increased flood risk from the development. They are reviewed in order of most to least sustainable based upon the SuDS Hierarchy, see hierarchy below:

1. store rainwater for later use
2. use infiltration techniques, such as porous surfaces in non-clay areas
3. attenuate rainwater in ponds or open water features for gradual release
4. attenuate rainwater by storing in tanks or sealed water features for gradual release
5. discharge rainwater direct to a watercourse
6. discharge rainwater to a surface water sewer/drain
7. discharge rainwater to the combined sewer.

4.3.1 Store Rainwater for Later Use

The use of rainwater to provide water for re-use within the dwellings has been reviewed and ruled out as being not feasible for the modular units on this development.

4.3.2 Infiltration Techniques

The Site is located over an underlying bedrock geology comprising of chalk. Therefore, it is assumed permeable and suitable for infiltration. A soakaway can allow runoff from hardscaped areas to collate and infiltrate into the ground.

4.3.3 Ponds or Open Water Features

Due to space restrictions, the site will not be able to accommodate basins or ponds.

4.3.4 Tanks Or Sealed Water Features

This is not being considered as another method is currently being pursued which is higher within the surface water discharge hierarchy.

4.3.5 Discharge Rainwater Direct to A Watercourse

The River Thames is located circa 2km north from the site; therefore it would not be feasible to discharge into the river.

4.3.6 Discharge to Surface Water Sewers

This is not being considered as another method is currently being pursued which is higher within the surface water discharge hierarchy.

4.3.7 Discharge to Combined Sewer

This method for discharging surface water runoff is not being considered as another method is currently being pursued which is higher within the surface water discharge hierarchy.

4.4 Proposed Drainage

4.4.1 Proposed Surface Water Drainage

The development's surface water will be collected via rainwater pipes, drainage channels, and gullies before flowing via gravity within underground pipework.

A soakaway located within the Site will attenuate the runoff and allow the water to infiltrate into the ground at the tested infiltration rate. This soakaway will be sized to attenuate runoff from a 1 in 100 year plus 40% storm event. Refer to the Proposed Drainage Layout attached within Appendix B for more information.

4.4.2 Exceedance Flow

The proposed building FFL's are proposed to be higher than the external footpath areas to reduce the risk of internal flooding.

4.4.3 Drainage Model

Causeway Flow software was used to model the proposed drainage system up to the critical 1 in 100+40% CC storm event. The results from the Flow model are included in Appendix C.

The results show that in the more critical storm events some manholes are prone to 'flood risk' however this means that the system is working efficiently by filling up fully.

4.4.4 Proposed Foul Water Drainage

The foul water drainage from the dwellings will be drained and connected into the Southern Water foul water drainage system. A manhole is located within the footpath on Winchester Crescent to the north which may provide a suitable point of connection for the site (refer to Appendix A for the Southern Water asset plan showing public sewers, and Appendix B for the Proposed Drainage Layout).

4.4.5 Drainage Maintenance Strategy

A below ground drainage maintenance plan document has been produced and sets out the required maintenance actions and their frequency for all the drainage components, refer to 10164-PTA-XX-XX-SP-C-9078 Below Ground Drainage Maintenance Plan (see attached in Appendix D).

5 OFFSITE IMPACT

The proposed redevelopment of this site results in a reduction in permeable area and an equivalent increase in surface water runoff volume.

To reduce the offsite impact, the surface water drainage network will be designed to cater for all storm events up to and including the critical 1 in 100 year return period rainfall event with allowances of climate change (40%) without flooding.

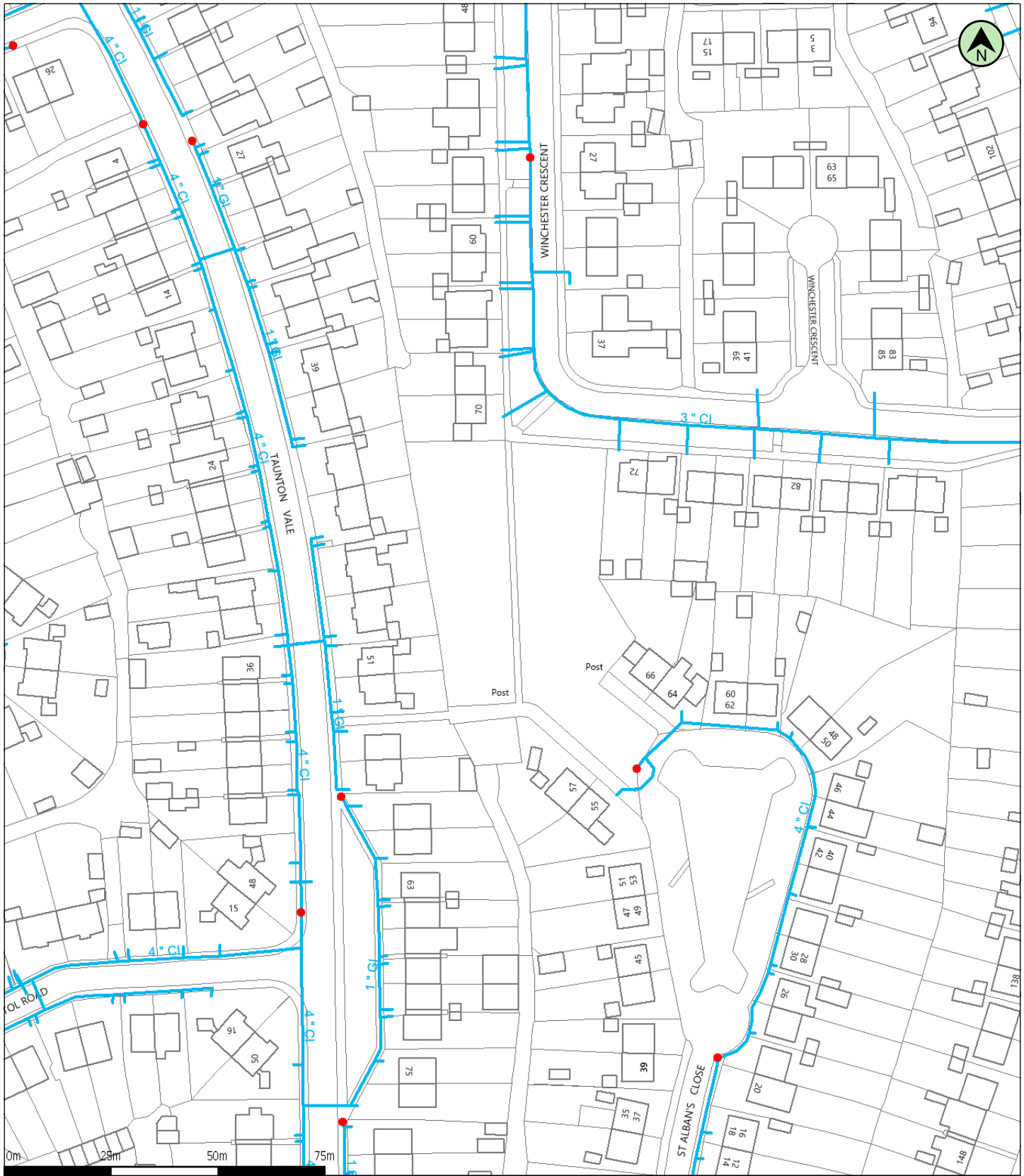
6 CONCLUSION

The FRA has considered the potential flood risk to the proposed development and its potential impact on flood risk:

- The development is located in Flood Zone 1.
- The development has a very low risk of flooding.
- The development drainage system and levels are to be designed to accommodate the 100-year rainfall event with a 40% allowance for climate change.
- The runoff from the proposed development will infiltrate into the ground via a soakaway installed within the site.
- The proposed development's drainage regime aims to reduce the onsite and offsite flood risk.

Therefore, the proposed redevelopment works result in an overall very low flood risk on Site and a low risk of flooding offsite after the mitigation measures are put in place.

APPENDIX A – Southern Water Asset Plan

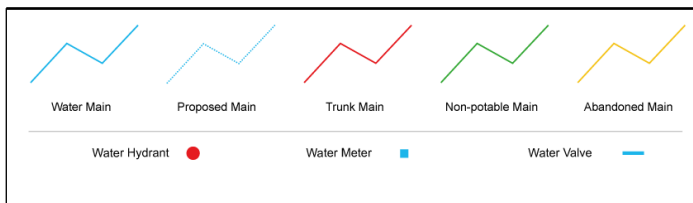


(c) Crown copyright and database rights 2024 Ordnance Survey 100031673
Data updated: 23/05/24

Scale: 1:1250
Map Centre: 565814,172307

Date: 29/05/24
Our Ref: 1481634 - 5

Clean Water Plan A4
Powered by digdat



mail@groundwise.com

00980-1RB-GWS



The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2024 Ordnance Survey 100031673. This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.

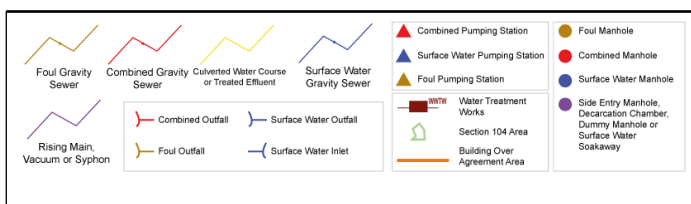


(c) Crown copyright and database rights 2024 Ordnance Survey 100031673
Data updated: 23/05/24

Scale: 1:1250
Map Centre: 565814,172307

Date: 29/05/24
Our Ref: 1481634 - 1

Wastewater Plan A4
Powered by digdat



mail@groundwise.com
00980-1RB-GWS



The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2024 Ordnance Survey 100031673. This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

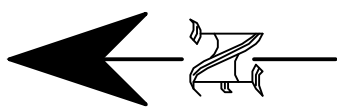
WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
6112	F	43.29	39.78	
6416	F	38.06	0.00	
7105	F	0.00	0.00	
7114	F	0.00	0.00	
7115	F	0.00	0.00	
7119	F	0.00	0.00	
7120	F	40.66	38.18	
7121	F	39.51	37.89	
7122	F	38.90	37.64	
7123	F	0.00	0.00	
7124	F	37.23	0.00	
7201	F	40.69	38.69	
7202	F	39.79	38.49	
7203	F	0.00	0.00	
7204	F	0.00	0.00	
7205	F	0.00	0.00	
7206	F	0.00	0.00	
7207	F	0.00	0.00	
7208	F	37.41	34.84	
7209	F	0.00	0.00	
7210	F	40.03	38.60	
7211	F	36.63	0.00	
7212	F	34.81	33.39	
7213	F	33.47	32.05	
7214	F	0.00	0.00	
7301	F	0.00	0.00	
7302	F	0.00	0.00	
7303	F	0.00	0.00	
7304	F	34.57	32.80	
7305	F	0.00	0.00	
7306	F	0.00	0.00	
7307	F	0.00	0.00	
7308	F	36.91	34.81	
7309	F	0.00	0.00	
7310	F	0.00	0.00	
7311	F	36.55	0.00	
7312	F	0.00	0.00	
7313	F	35.61	34.04	
7314	F	39.07	0.00	
7315	F	39.56	37.91	
7403	F	32.17	29.76	
7404	F	32.68	29.48	
7408	F	37.55	34.30	
7409	F	37.23	0.00	
7410	F	36.67	33.88	
7413	F	0.00	0.00	
8102	F	35.20	33.17	
8106	F	32.22	0.00	

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
8107	F	32.07	0.00	
8108	F	32.05	30.87	
8109	F	32.27	30.94	
8113	F	30.15	0.00	
8114	F	0.00	0.00	
8201	F	0.00	0.00	
8202	F	0.00	0.00	
8203	F	33.85	32.46	
8204	F	33.71	32.31	
8205	F	31.84	30.59	
8206	F	30.84	29.54	
8207	F	0.00	0.00	
8208	F	27.88	25.98	
8209	F	27.40	25.70	
8210	F	26.81	25.36	
8211	F	0.00	0.00	
8212	F	29.19	27.94	
8213	F	0.00	0.00	
8301	F	27.94	26.72	
8302	F	27.92	26.18	
8303	F	25.72	23.94	
8304	F	29.79	27.88	
8305	F	26.19	24.68	
8306	F	25.35	24.03	
8307	F	0.00	0.00	
8308	F	24.26	23.34	
8309	F	24.03	0.00	
8310	F	23.59	22.92	
8311	F	0.00	0.00	
8401	F	24.92	23.41	
8405	F	22.38	21.41	
8406	F	22.73	0.00	
8407	F	22.10	20.86	
8408	F	20.98	0.00	
8410	F	21.97	0.00	
8411	F	21.66	0.00	
9110	F	0.00	0.00	
9111	F	24.15	0.00	
9205	F	24.01	23.22	
9206	F	23.57	0.00	
9207	F	0.00	0.00	
9208	F	0.00	0.00	
9209	F	0.00	0.00	
9211	F	25.90	24.59	
9301	F	0.00	0.00	
9302	F	0.00	0.00	
9305	F	22.01	19.76	
9318	F	21.99	20.83	

[illegible]

APPENDIX B – Proposed Drainage Layout



Soakaway 1
Area - 36.0m²
Depth - 0.8m
Volume - 27.4m³ (assuming 95% porosity)
Crate CL - 28.650 mAOD
Top of Crate - 28.300 mAOD
Crate IL - 27.500 mAOD
Infiltration Rate - 0.13680 m/hr
Soakaway designed for a 1 in 100 year storm event plus 40% climate change allowance.

New connection into existing Southern Water foul water manhole (ref.8304).
Connection subject to approval from Southern Water.

EX.SW F 8304
CL (29.790)
IL (27.680)

S4
CL (28.910)
Outlet IL (27.850)
Sump Depth 0.300

S3
CL (29.177)
IL (28.330)

S1
CL (29.242)
IL (28.600)

F1
CL (29.371)
IL (28.545)

F2
CL (29.295)
IL (28.495)

F3
CL (29.295)
IL (28.445)

F4
CL (29.295)
IL (28.345)

F5
CL (29.062)
IL (28.270)

F6
CL (28.999)
IL (28.240)

F7
CL (28.960)
IL (28.210)

F8
CL (28.960)
IL (28.180)

F9
CL (28.960)
IL (28.150)

FFL 29.350

FFL 29.000

Access to existing substation

Notes:

- Do not scale from this drawing.
- In case of any discrepancies in drawings, details or bills, refer to engineers for clarification: unilateral decisions by the Contractor will not be accepted.
- This drawing is to be read in conjunction with all related Architects, Consultants & Sub-Contractors drawings and specifications.
- The Contractor is advised that all design drawings and information are to be read concurrently and any discrepancies or omissions reported directly to PTA's Civil Engineering Department.

Drainage Key:

Site Boundary

Existing Public Foul Water Drainage

Existing Public Storm Water Drainage

Proposed Private Foul Water Drainage

Proposed Private Surface Water Drainage

Soakaway

RWP FDP Rain Water Pipe & Foul Drain Point

DC Drainage Channel with Sump

SU DC Unit

Drainage Abbreviations:

F = Foul Water
S = Surface Water
EX. = Existing
SW = Southern Water
CL = Cover Level in mAOD
IL = Invert Level in mAOD
USIL = Upstream Invert level for lateral pipe in mAOD

© Powell Tolner & Associates Ltd.
The contents of this drawing may not be reproduced in whole or in part without the prior written permission of Powell Tolner & Associates Ltd.

PRELIMINARY
COMMENT/COSTING/APPROVAL
NOT FOR CONSTRUCTION

S3

Private Drainage Notes:

- All private drainage works to comply with the typical drainage construction details and to be in accordance with Part H of the current Building Regulations & BS EN 752.
- All private drainage pipework to be either:-
uPVC to BS EN 1401,
Vitrified Clayware to BS EN 295,
Concrete to BS 5911 OR,
Twin Walled Plastic to BS EN 13476,
- All new adoptable drainage and laterals to the public sewer are to be constructed in accordance with the DCG 2022 by Water UK.
- All underslab drainage shall be laid at gradients of 1:40 min for foul pipework and 1:80 min for surface water UNO.
- All rest bends at upstream end of underslab drainage to be 450mm below SSL UNO.
- RWP lateral connections are to be sized to suit RWP size as designed by specialist. Gully laterals to be sized to suit gully outlets. All other pipes 100mm diameter UNO.
- All underslab drainage shall be installed in straight runs and be clear of foundations UNO, with long radius bends kept to a minimum and used where unavoidable. Long radius bends along length of runs shall be a maximum of 30 degrees.
- Where sewers cross and there is less than 200mm clearance, both runs are to be encased in concrete for a minimum of 1m in all directions.
- All RWP, SVP, plant gully and all other foul drainage positions are to be set out by the Architect.
- Where RWPs and foul pipes are connected direct to drain, rodding access plates are to be provided above ground (by others).
- At least one soil pipe at the head of each foul run shall be vented to the atmosphere.
- Contractor to ensure that manhole covers are orientated to suit pavement finishes and set flush with surrounding levels.
- Contractor to ensure that any part of the existing drainage system to be retained as part of the new scheme shall be cleaned and inspected by CCTV survey. Any structural defects shall be repaired or replaced as may be required using appropriate and approved methods. Where existing manholes are to be retained the cover and frames shall be checked to ensure they are in suitable condition for re-use and if required cover levels adjusted to suit proposed finished ground levels.
- No allowance has been made for grease traps below ground. Management of grease and fats from kitchens to be provided above ground by others.
- Refer to PTA Drainage Maintenance Schedule for maintenance of the drainage system during and for the end user post construction.

P01	First Issue	DH	08.03.25	AH
-----	-------------	----	----------	----

St Albans Close, Gravesend

Proposed Drainage Layout

DATE	April 2025	This drawing is issued only for the purposes described in the drawing status box.	PTA PROJ No	10164
DRAWN	DH		REVISION	P01
SCALE	1:150			
DRG SIZE	A1			

DRAWING No 10164-PTA-XX-XX-DR-C-9100

Consulting Civil & Structural Engineers

pta

29 Red Lion Street
Chesham
Bucks
HP5 1EJ
Tel. 01494 772721

APPENDIX C – Post Development Drainage Calcs

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	0.500
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)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1		5.00	29.290	350	565840.435	172294.547	0.690
2	0.010	5.00	29.230	350	565823.997	172303.946	0.730
3	0.018	5.00	29.311	350	565830.816	172308.620	0.981
4	0.018	5.00	28.402	450	565832.061	172329.338	0.552
Soakaway			28.756		565829.045	172335.736	1.256

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	3	17.046	0.600	28.600	28.380	0.220	77.5	100	5.32	50.0
2.000	2	3	8.267	0.600	28.500	28.380	0.120	68.9	100	5.15	50.0
1.001	3	4	20.755	0.600	28.330	27.850	0.480	43.2	150	5.55	50.0
1.002	4	Soakaway	7.073	0.600	27.850	27.500	0.350	20.2	150	5.60	50.0

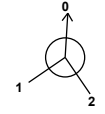
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.875	6.9	0.0	0.590	0.831	0.000	0.0	0	0.000
2.000	0.929	7.3	1.3	0.630	0.831	0.010	0.0	29	0.699
1.001	1.534	27.1	3.8	0.831	0.402	0.028	0.0	38	1.084
1.002	2.250	39.8	6.2	0.402	1.106	0.046	0.0	40	1.647

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	17.046	77.5	100	Circular	29.290	28.600	0.590	29.311	28.380	0.831
2.000	8.267	68.9	100	Circular	29.230	28.500	0.630	29.311	28.380	0.831
1.001	20.755	43.2	150	Circular	29.311	28.330	0.831	28.402	27.850	0.402
1.002	7.073	20.2	150	Circular	28.402	27.850	0.402	28.756	27.500	1.106

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	350	Manhole	Adoptable	3	350	Manhole	Adoptable
2.000	2	350	Manhole	Adoptable	3	350	Manhole	Adoptable
1.001	3	350	Manhole	Adoptable	4	450	Manhole	Adoptable
1.002	4	450	Manhole	Adoptable	Soakaway		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
1	565840.435	172294.547	29.290	0.690	350		0	1.000	28.600	100
2	565823.997	172303.946	29.230	0.730	350		0	2.000	28.500	100
3	565830.816	172308.620	29.311	0.981	350		1	2.000	28.380	100
						2	1.000	28.380	100	
						0	1.001	28.330	150	
4	565832.061	172329.338	28.402	0.552	450		1	1.001	27.850	150
							0	1.002	27.850	150
Soakaway	565829.045	172335.736	28.756	1.256			1	1.002	27.500	150

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
Rainfall Events	Singular	Additional Storage (m³/ha)	20.0
FSR Region	England and Wales	Starting Level (m)	
M5-60 (mm)	26.250	Check Discharge Rate(s)	✓
Ratio-R	0.426	1 year (l/s)	0.4
Summer CV	0.750	30 year (l/s)	0.8
Winter CV	0.840	100 year (l/s)	1.1
Analysis Speed	Normal	Check Discharge Volume	x
Skip Steady State	x		

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
10	0	0	0
30	0	0	0
100	40	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)	0.157	Betterment (%)	0
SAAR (mm)	578	QBar	0.4
Soil Index	3	Q 1 year (l/s)	0.4
SPR	0.40	Q 30 year (l/s)	0.8
Region	7	Q 100 year (l/s)	1.1
Growth Factor 1 year	0.85		

Node Soakaway Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.13680	Invert Level (m)	27.500	Depth (m)	0.800
Side Inf Coefficient (m/hr)	0.13680	Time to half empty (mins)	263	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	6.000	Number Required	1
Porosity	0.95	Pit Length (m)	6.000		

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	1	28.600	0.000	0.0	0.0000	0.0000	OK
15 minute winter	2	10	28.536	0.036	1.9	0.0130	0.0000	OK
15 minute winter	3	10	28.375	0.045	5.4	0.0210	0.0000	OK
15 minute winter	4	10	27.900	0.050	8.8	0.0408	0.0000	OK
60 minute winter	Soakaway	59	27.640	0.140	4.6	4.7994	0.0000	OK

Link Event (Velocity)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	1	1.000	3	0.0	0.000	0.000	0.0000
15 minute winter	2	2.000	3	1.9	0.760	0.256	0.0203
15 minute winter	3	1.001	4	5.3	1.129	0.195	0.0993
15 minute summer	4	1.002	Soakaway	8.4	2.161	0.211	0.0438
60 minute winter	Soakaway	Infiltration		0.7			

Results for 10 year Critical Storm Duration. Lowest mass balance: 99.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	1	28.600	0.000	0.0	0.0000	0.0000	OK
15 minute winter	2	10	28.552	0.052	3.6	0.0189	0.0000	OK
15 minute winter	3	10	28.394	0.064	10.1	0.0299	0.0000	OK
15 minute winter	4	10	27.919	0.069	16.7	0.0564	0.0000	OK
120 minute winter	Soakaway	112	27.794	0.294	5.1	10.0417	0.0000	OK

Link Event (Velocity)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	1	1.000	3	0.0	0.000	0.000	0.0048
15 minute winter	2	2.000	3	3.5	0.892	0.486	0.0328
15 minute winter	3	1.001	4	10.0	1.335	0.369	0.1568
15 minute summer	4	1.002	Soakaway	15.9	2.243	0.401	0.0821
120 minute winter	Soakaway	Infiltration		0.8			

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	1	28.600	0.000	0.0	0.0000	0.0000	OK
15 minute winter	2	10	28.561	0.061	4.6	0.0221	0.0000	OK
15 minute winter	3	10	28.405	0.075	13.0	0.0346	0.0000	OK
15 minute winter	4	10	27.930	0.080	21.5	0.0659	0.0000	OK
120 minute winter	Soakaway	118	27.892	0.392	6.3	13.4049	0.0000	OK

Link Event (Velocity)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	1	1.000	3	0.0	0.000	0.000	0.0113
15 minute winter	2	2.000	3	4.5	0.942	0.619	0.0397
15 minute winter	3	1.001	4	12.9	1.407	0.474	0.1903
15 minute winter	4	1.002	Soakaway	21.3	2.285	0.537	0.0951
120 minute winter	Soakaway	Infiltration		0.9			

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	1	28.600	0.000	0.0	0.0000	0.0000	OK
15 minute winter	2	11	28.641	0.141	8.4	0.0511	0.0000	SURCHARGED
15 minute winter	3	12	28.467	0.137	23.4	0.0634	0.0000	OK
120 minute winter	4	120	28.276	0.426	11.5	0.3496	0.0000	FLOOD RISK
120 minute winter	Soakaway	120	28.276	0.776	11.1	26.5454	0.0000	OK

Link Event (Velocity)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	1	1.000	3	0.0	0.000	0.000	0.0425
15 minute winter	2	2.000	3	8.0	1.028	1.101	0.0628
15 minute summer	3	1.001	4	22.1	1.487	0.817	0.3275
15 minute winter	4	1.002	Soakaway	36.0	2.458	0.905	0.1245
120 minute winter	Soakaway	Infiltration		1.0			

APPENDIX D – Below Ground Drainage Maintenance Plan



Powell Tolner & Associates Ltd

BELOW GROUND DRAINAGE MAINTENANCE PLAN

Project: St Albans Close, Gravesend

PTA Project Ref: 10164

Document Ref: 10164-PTA-XX-XX-SP-C-9078

Status: For Planning

Revision: P01

Date: April 2025

Client: The Hill Group



Issued by

PTA
29 Red Lion Street
Chesham
Buckinghamshire
United Kingdom
HP5 1EJ
Tel: + 44 1494 772721
central@ptaconsult.co.uk

	Name	Position	Signature	Date
Prepared by:	Dillan Halai	Civil Design Engineer	DH	07.04.2025
Reviewed by:	Alex Herman	Director	AH	07.04.2025
For and on behalf of Powell Tolner & Associates Limited				

Revision	Date	Description	Prepared	Reviewed
P01	07.04.2025	Issued for Planning	DH	AH

©This report is the copyright of PTA.

Any unauthorised reproduction or usage by any person other than the addressee is strictly prohibited.

TABLE OF CONTENTS

1	INTRODUCTION	1
2	Manholes, Inspection Chambers, Pipe Work, Drainage Channels & Gullies.....	2
3	Cellular Soakaway Tanks.....	3
4	CONSTRUCTION STAGE	4

1 INTRODUCTION

Project Name: St Albans Close, Gravesend

Project Location: Gravesend, DA12 5SF

PTA Job Number: 10164

This document has been prepared to provide a maintenance methodology to the surface water drainage elements proposed for this development. If any discrepancies from manufactures guidance is encountered, the proprietary system guidance should be adopted.

The drainage networks are comprised of drainage channels, a cellular soakaway attenuation tank together with connecting pipe network, manholes & inspection chambers. Refer to drawing 10164-PTA-ZZ-XX-DR-9100 for the proposed drainage layout.

Any man-entry into the system and silt removal should be by trained personnel with adequate personal protective equipment. Approved safety procedures must be followed in accordance with the Health and Safety Act.

This drainage systems maintenance will be the responsibility of the project developer or by an appointed maintenance company and as such an appropriated maintenance regime should be implemented (as below).

2 Manholes, Inspection Chambers, Pipe Work, Drainage Channels & Gullies

The surface water drainage system should be inspected and maintained periodically, primarily to check for silt sedimentation within the system or ingress of any detritus or debris which would decrease system performance. Table 1 sets out the recommended maintenance actions and frequency.

Maintenance schedule	Required action	Typical frequency
Regular Maintenance	Remove manhole and chamber covers to sewers and flow control on network– inspect to ensure water is flowing freely and that the water flow route is unobstructed. Remove debris and silt as required.	Half Yearly Undertake one of these inspections after leaf fall in autumn
Occasional Maintenance	None required	
Remedial Actions	Re-line or replace pipework if unable to clear blockages by jetting.	As required
Monitoring	Inspect chambers for build-up of silt and debris	Half yearly

Table 1 – Operation & maintenance requirements for pipe network, manholes & inspection chambers, drainage channels & gullies - Based on CIRIA SuDS Manual 2015

3 Cellular Soakaway Tanks

A geocellular soakaway tank has been proposed, this will comprise of modular storage systems made with plastic units. These units can be assembled to achieve the required volume and usually on multiple layers. Generally, the units have 95% voids content and are used to create an efficient below ground structure to temporarily store surface water.

Table 2 sets out the recommended maintenance actions and frequency.

Maintenance schedule	Required action	Typical frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually.
	Remove debris from the catchment surface (where it may cause risks to performance).	Monthly.
	Remove sediments from pre-treatment structures and/or internal forebays.	Annually, or as required.
Remedial Actions	Repair/rehabilitate inlets, outlets, overflows and vents.	As required.
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually
	Survey inside of tank for sediment build-up and remove if necessary.	Every 5 years or as required.

**Table 2 – Operation & maintenance requirements for attenuation storage tanks –
Based on CIRIA SuDS Manual 2015**

4 CONSTRUCTION STAGE

All recently installed drainage is to be checked at least once weekly via walkover survey during the full period of construction. All excess silts and debris to be removed and disposed of appropriately. Temporary covers to be installed in order to avoid any site debris entering the newly installed chambers, linear channel drains & pipework. Excavated materials should be placed in such a manner that any instability will not result in them directly entering the drainage network.

In the temporary condition a minimum cover of 500mm of compacted Type 1 material is required over the cellular soakaway tank, to allow for construction traffic. Construction vehicles must be limited to only tracked excavators with vehicle weight not exceeding 21 tonnes. Vehicles with higher weight loads not permitted. (applicable to Wavin Aquacell Core-R – check requirements with other specified manufacturers)