Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	59.377	0.377	0.0	53.3	53.3	306.0	O K
60 min Winter	59.421	0.421	0.0	54.0	54.0	345.0	O K
120 min Winter	59.407	0.407	0.0	53.7	53.7	332.0	O K
180 min Winter	59.374	0.374	0.0	53.2	53.2	302.8	O K
240 min Winter	59.333	0.333	0.0	52.5	52.5	267.3	O K
360 min Winter	59.254	0.254	0.0	51.2	51.2	199.8	O K
480 min Winter	59.180	0.180	0.0	49.9	49.9	139.2	O K
600 min Winter	59.115	0.115	0.0	48.8	48.8	87.8	O K
720 min Winter	59.062	0.062	0.0	47.8	47.8	46.5	O K
960 min Winter	59.000	0.000	0.0	46.7	46.7	0.2	O K
1440 min Winter	59.000	0.000	0.0	34.3	34.3	0.0	O K
2160 min Winter	59.000	0.000	0.0	25.0	25.0	0.0	O K
2880 min Winter	59.000	0.000	0.0	19.9	19.9	0.0	O K
4320 min Winter	59.000	0.000	0.0	14.4	14.4	0.0	O K
5760 min Winter	59.000	0.000	0.0	11.5	11.5	0.0	O K
7200 min Winter	59.000	0.000	0.0	9.6	9.6	0.0	O K
8640 min Winter	59.000	0.000	0.0	8.3	8.3	0.0	O K
10080 min Winter	59.000	0.000	0.0	7.4	7.4	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	88.566	0.0	408.0	35
60 min Winter	56.713	0.0	523.1	60
120 min Winter	35.004	0.0	646.8	98
180 min Winter	25.973	0.0	720.2	136
240 min Winter	20.877	0.0	772.2	172
360 min Winter	15.365	0.0	849.7	242
480 min Winter	12.341	0.0	909.1	306
600 min Winter	10.402	0.0	960.2	366
720 min Winter	9.042	0.0	1000.2	420
960 min Winter	7.241	0.0	1069.5	494
1440 min Winter	5.284	0.0	1170.7	0
2160 min Winter	3.848	0.0	1278.7	0
2880 min Winter	3.068	0.0	1359.6	0
4320 min Winter	2.226	0.0	1479.6	0
5760 min Winter	1.771	0.0	1569.1	0
7200 min Winter	1.483	0.0	1643.3	0
8640 min Winter	1.284	0.0	1707.3	0
10080 min Winter	1.137	0.0	1763.4	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.099

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.366	4	8	0.366	8	12	0.366

Model Details

Storage is Online Cover Level (m) 59.500

Complex Structure

Tank or Pond

Invert Level (m) 59.000

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	250.0	0.500	450.0	0.501	0.0

Cellular Storage

Invert Level (m)	59.000	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	**Area (m²)**	**Inf. Area (m²)**	**Depth (m)**	**Area (m²)**	**Inf. Area (m²)**
0.000	1635.0	0.0	0.501	0.0	0.0
0.500	1635.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0293-5200-1500-5200
Design Head (m)	1.500
Design Flow (l/s)	52.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	293
Invert Level (m)	57.800
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	2100

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.500	52.0
Flush-Flo™	0.508	52.0
Kick-Flo®	1.071	44.2
Mean Flow over Head Range	-	43.8

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

Hydro-Brake® Optimum Outflow Control

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	9.0	1.200	46.7	3.000	72.7	7.000	109.8
0.200	30.2	1.400	50.3	3.500	78.3	7.500	113.5
0.300	49.6	1.600	53.6	4.000	83.6	8.000	117.2
0.400	51.5	1.800	56.8	4.500	88.5	8.500	120.7
0.500	52.0	2.000	59.7	5.000	93.2	9.000	124.1
0.600	51.7	2.200	62.5	5.500	97.6	9.500	127.4
0.800	50.3	2.400	65.2	6.000	101.8		
1.000	46.8	2.600	67.8	6.500	105.9		

Appendix G

Overland Flow Routes

KEY PLAN

NOTES

1. All dimensions are to be checked on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figured dimensions only are to be taken from this drawing.
2. The DWG file is issued for the purposes of coordination only and do not represent formal drawing issue and are not to be reprinted in any form. Formal issue of drawings is via DWF, Adobe PDF files and/or hard copies and their associated information issue sheets.
3. Note that all care has been taken with the export of DWG files and their content, but we recommend that you make due dimensional checks before using any DWG file information. Any errors found are to be reported to Hydrock immediately.
4. All levels are shown in metres above Ordnance Datum (m AOD).

REV	REVISION NOTES/COMMENTS					
P01	PRELIMINARY ISSUE					
	A.TODD	03/12/19	J.MAGEE	03/12/19	J.MAGEE	03/12/19
	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE

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PROJECT
EPSOM HOSPITAL
LATER LIVING DEVELOPMENT

TITLE
OVERLAND FLOW ROUTES

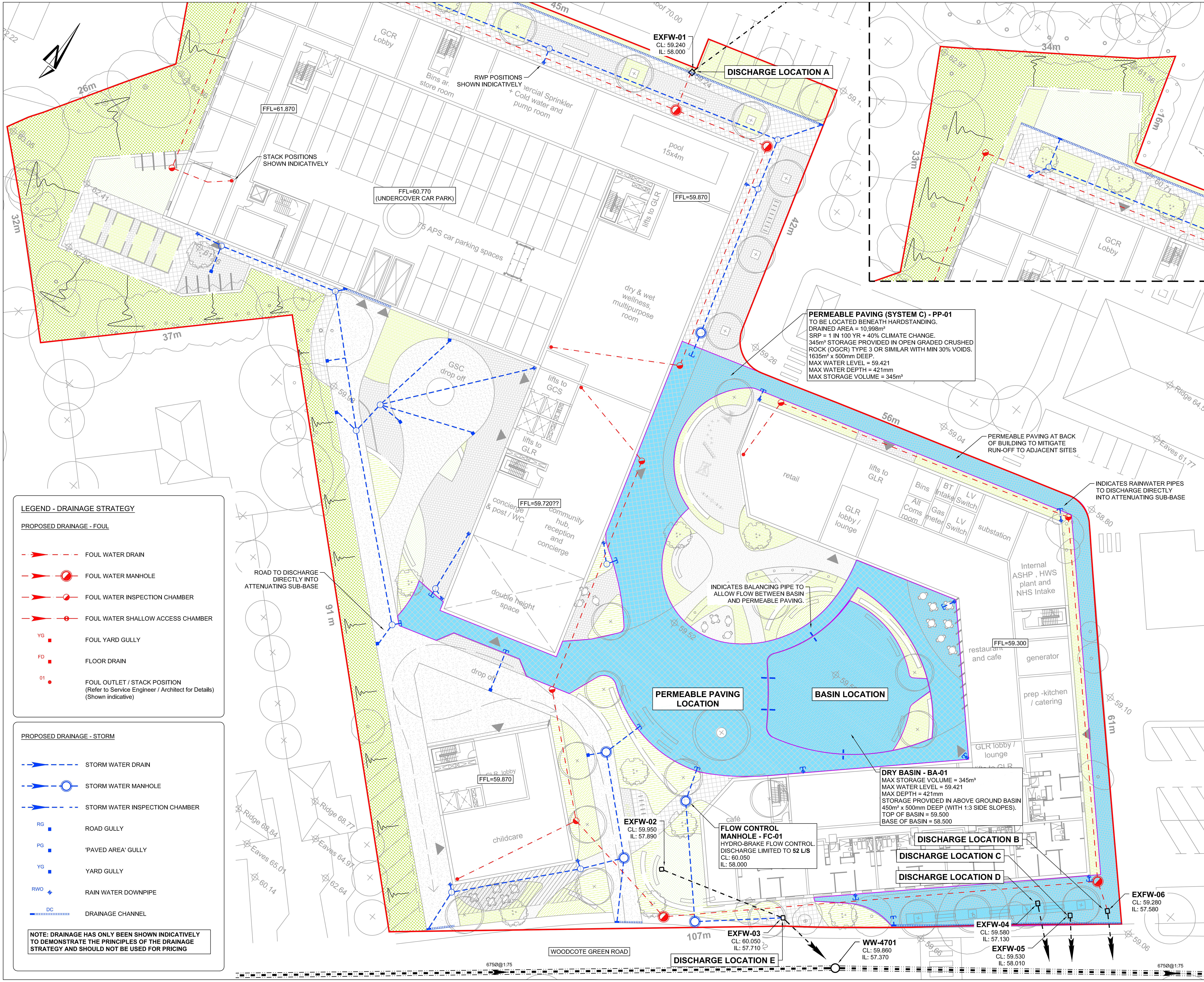
HYDROCK PROJECT NO.	SCALE @ A1
C-11310-C	1:250

STATUS DESCRIPTION	STATUS
PLANNING	S2

DRAWING NO. (PROJECT CODE-ORIGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER)	REVISION
###-HYD-00-ZZ-DR-C-7704	P01

Appendix H

Drainage Strategy Layout



KEY PLAN

NOTES

1. All dimensions are to be checked on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figured dimensions only are to be taken from this drawing.
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3. Note that all care has been taken with the export of DWG files and their content, but we recommend that you make due dimensional checks before using any DWG file information. Any errors found are to be reported to Hydrock immediately.
4. All levels are shown in metres above Ordnance Datum (m AOD).
5. All private drainage to comply with current Building Regulations, BS EN-752 Drain and Sewer systems outside Buildings and other relevant British Standards and Codes of Practices.
6. Drainage pipework routes under building footprint will require Co-ordination with foundations.
7. Final foul pipe connection routes and manholes are subject to confirmation of above ground drainage design discharge points at ground level by others to allow final pipe sizes, configuration and connections.
8. Door threshold drainage channel requirements to be advised by others.
9. Surface water drainage RWP locations to be confirmed by Architect.
10. External levels shown on this drawing relating to the civils, drainage works etc are to be confirmed on receipt of final external levels drawing (by others).
11. Foul drainage shown indicative subject to detailed design.

P01	PRELIMINARY ISSUE						
	X. XXXXX	NYI	X. XXXXX	NYI	X. XXXXX	NYI	
REV	REVISION NOTES/COMMENTS						
	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE	

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PROJECT
EPSOM HOSPITAL
LATER LIVING DEVELOPMENT

TITLE
DRAINAGE STRATEGY

DRAFT

HYDROCK PROJECT NO. C-11…C
SCALE @ A1 1:250

STATUS DESCRIPTION PLANNING
STATUS S2

DRAWING NO. (PROJECT CODE-ORGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER)
###-HYD-00-ZZ-DR-C-7000
REVISION P01

Appendix J

Correspondence

Mr Jason Magee
Hydrock
By email to JasonMagee@hydrock.com

Wastewater pre-planning

Our ref DS6064489–DTS 62970

11 September 2019

Pre-planning enquiry: Epsom Hospital, Dorking Rd, Epsom, Surrey, KT18 7EG

Dear Mr Magee,

Thank you for providing information on your Redevelopment of Hospital into retirement. For Connection 1 to the north into 380mm foul sewer in Dorking Rd; Existing: Surf and foul water sewer connections draining 6400sqm surface and 201 hospital beds by gravity. Proposed: no surface water discharge and 335 beds retirement by gravity. Connection 2 to the South into 675mm foul at Woodcote Green; Existing 5,929sqm surface and 468 hospital beds by gravity. Proposed 334 retirement beds and same surface water drainage regime as before (5,929sqm)

Foul Water

We're pleased to confirm that there will be sufficient foul water capacity in our sewerage network to serve your development, so long as your phasing follows the timescale you've suggested.

This confirmation is valid for 12 months or for the life of any planning approval that this information is used to support, to a maximum of three years.

Surface Water

We confirm that there will be sufficient capacity in our sewerage network to accept the surface water discharge rate provided as part of the enquiry, however this does not preclude the requirement as set out by Policy 5.13 of the London Plan. Management of surface water from the site should follow policy 5.13 of the London Plan, development should 'aim to achieve greenfield run-off rates' utilising Sustainable Drainage and where this is not possible information explaining why it is not possible should be provided to both the LLFA and Thames Water. Typically greenfield run off rates of 5l/s/ha should be aimed for using the drainage hierarchy. The hierarchy lists the preference for surface water disposal as follows; Store Rainwater for later use > Use infiltration techniques, such as porous surfaces in non-clay areas > Attenuate rainwater in ponds or open water features for gradual release > Discharge rainwater direct to a watercourse > Discharge rainwater direct to a surface water sewer/drain > Discharge rainwater to the combined sewer.
To reduce flood risk from the sewers, the developer should aim to achieve greenfield runoff rates and at least 50% reduction for all storm events

What happens next?

You'll need to keep us informed of any changes to your design – for example, an increase in the number or density of homes. Such changes could mean there is no longer sufficient capacity.

Please note that we may contact you if we need to carry out any network modelling associated with this. The modelling would be done at our cost and within your timescales.

Please make sure you submit your connection application, giving us at least 21 days' notice of the date you wish to make your new connection/s.

If you've any further questions, please contact me on the numbers below.

Yours sincerely

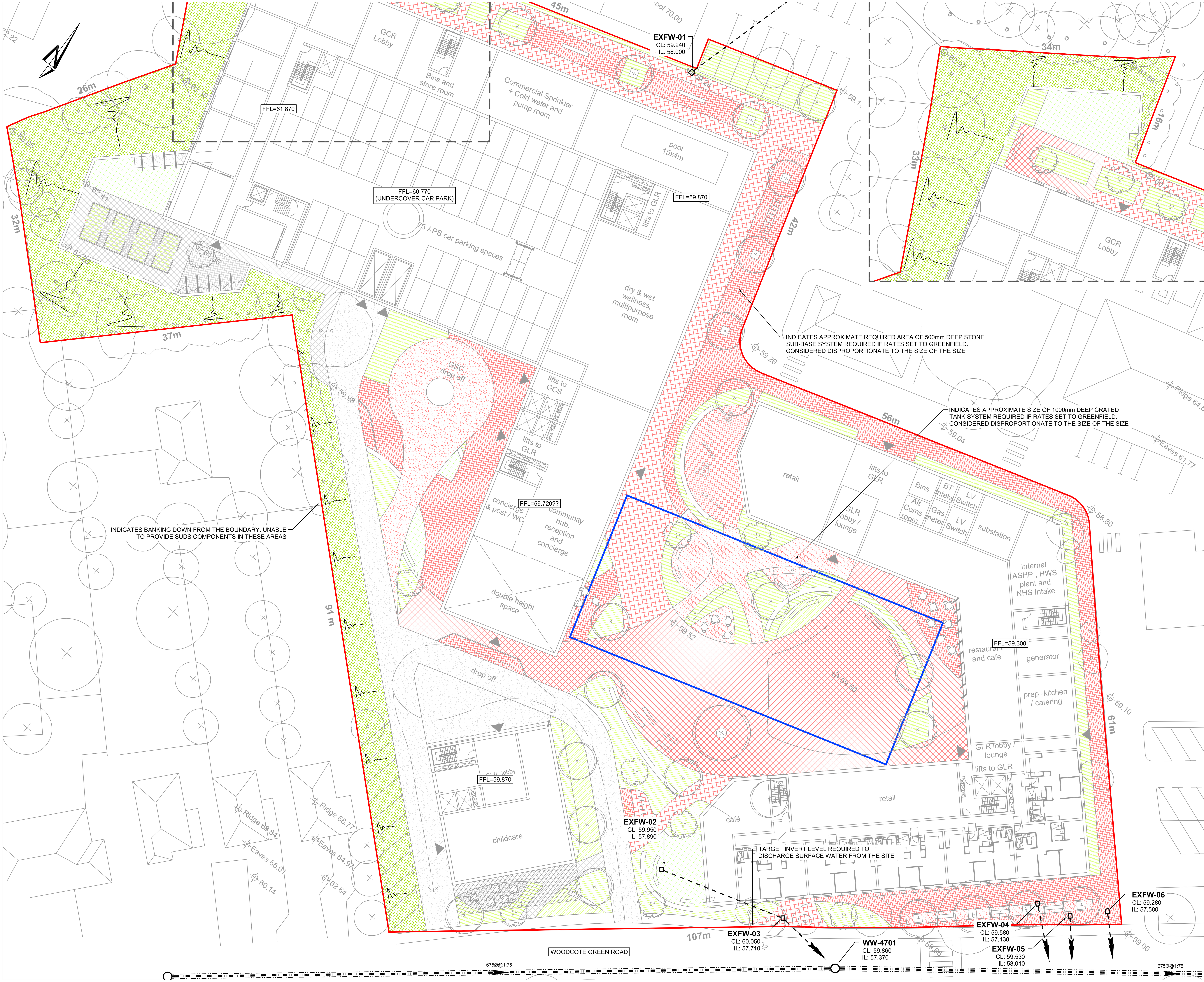
Jose Varela

Developer Services – Adoptions Engineer Mobile 07747 640250 Landline 02035 778753
jose.varela@thameswater.co.uk Clearwater Court, Vastern Road, Reading, RG1 8DB

Find us online at developers.thameswater.co.uk

Appendix K

Constraints Plan / Calculations



KEY PLAN

NOTES

1. All dimensions are to be checked on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figured dimensions only are to be taken from this drawing.
2. The DWG file is issued for the purposes of coordination only and do not represent formal drawing issue and are not to be reprinted in any form. Formal issue of drawings is via DWF, Adobe PDF files and/or hard copies and their associated information issue sheets.
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4. All levels are shown in metres above Ordnance Datum (m AOD).

REV						
P01	PRELIMINARY ISSUE					
	A.TODD	03/12/19	J.MAGEE	03/12/19	J.MAGEE	03/12/19
REV	REVISION NOTES/COMMENTS					
	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE

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PROJECT
EPSOM HOSPITAL
LATER LIVING DEVELOPMENT

TITLE
LEVEL AND SPATIAL CONSTRAINTS PLAN

HYDROCK PROJECT NO. C-11310-C
SCALE @ A1 1:250

STATUS DESCRIPTION INFORMATION
STATUS S2

DRAWING NO. (PROJECT CODE-ORIGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER) ###-HYD-00-ZZ-SK-C-7705
REVISION P01

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 1258 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Σ Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	58.242	0.242	0.0	5.3	5.3	263.5	O K
30 min Summer	58.324	0.324	0.0	5.3	5.3	352.3	O K
60 min Summer	58.409	0.409	0.0	5.3	5.3	445.6	O K
120 min Summer	58.493	0.493	0.0	5.3	5.3	537.2	O K
180 min Summer	58.537	0.537	0.0	5.3	5.3	584.6	O K
240 min Summer	58.563	0.563	0.0	5.3	5.3	612.8	O K
360 min Summer	58.596	0.596	0.0	5.3	5.3	649.1	O K
480 min Summer	58.613	0.613	0.0	5.3	5.3	667.9	O K
600 min Summer	58.621	0.621	0.0	5.3	5.3	676.6	O K
720 min Summer	58.623	0.623	0.0	5.3	5.3	678.5	O K
960 min Summer	58.614	0.614	0.0	5.3	5.3	668.7	O K
1440 min Summer	58.578	0.578	0.0	5.3	5.3	629.7	O K
2160 min Summer	58.538	0.538	0.0	5.3	5.3	585.7	O K
2880 min Summer	58.503	0.503	0.0	5.3	5.3	547.9	O K
4320 min Summer	58.437	0.437	0.0	5.3	5.3	475.5	O K
5760 min Summer	58.374	0.374	0.0	5.3	5.3	406.8	O K
7200 min Summer	58.316	0.316	0.0	5.3	5.3	344.3	O K
8640 min Summer	58.264	0.264	0.0	5.3	5.3	288.0	O K
10080 min Summer	58.218	0.218	0.0	5.3	5.3	237.8	O K
15 min Winter	58.272	0.272	0.0	5.3	5.3	296.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	131.851	0.0	271.0	26
30 min Summer	88.566	0.0	364.3	41
60 min Summer	56.713	0.0	466.5	70
120 min Summer	35.004	0.0	576.2	130
180 min Summer	25.973	0.0	641.6	188
240 min Summer	20.877	0.0	687.6	248
360 min Summer	15.365	0.0	759.5	366
480 min Summer	12.341	0.0	813.2	486
600 min Summer	10.402	0.0	857.0	604
720 min Summer	9.042	0.0	884.0	724
960 min Summer	7.241	0.0	883.2	962
1440 min Summer	5.284	0.0	873.6	1230
2160 min Summer	3.848	0.0	1140.9	1584
2880 min Summer	3.068	0.0	1213.8	1972
4320 min Summer	2.226	0.0	1320.2	2772
5760 min Summer	1.771	0.0	1400.1	3576
7200 min Summer	1.483	0.0	1466.9	4328
8640 min Summer	1.284	0.0	1524.1	5104
10080 min Summer	1.137	0.0	1573.6	5848
15 min Winter	131.851	0.0	303.7	26

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	58.364	0.364	0.0	5.3	5.3	396.3	O K
60 min Winter	58.461	0.461	0.0	5.3	5.3	502.3	O K
120 min Winter	58.558	0.558	0.0	5.3	5.3	607.7	O K
180 min Winter	58.609	0.609	0.0	5.3	5.3	663.7	O K
240 min Winter	58.641	0.641	0.0	5.3	5.3	698.3	O K
360 min Winter	58.684	0.684	0.0	5.3	5.3	745.2	O K
480 min Winter	58.710	0.710	0.0	5.3	5.3	772.7	O K
600 min Winter	58.724	0.724	0.0	5.3	5.3	788.7	O K
720 min Winter	58.732	0.732	0.0	5.3	5.3	797.1	O K
960 min Winter	58.734	0.734	0.0	5.3	5.3	799.6	O K
1440 min Winter	58.708	0.708	0.0	5.3	5.3	771.5	O K
2160 min Winter	58.641	0.641	0.0	5.3	5.3	698.0	O K
2880 min Winter	58.591	0.591	0.0	5.3	5.3	643.2	O K
4320 min Winter	58.487	0.487	0.0	5.3	5.3	530.5	O K
5760 min Winter	58.388	0.388	0.0	5.3	5.3	423.0	O K
7200 min Winter	58.301	0.301	0.0	5.3	5.3	327.4	O K
8640 min Winter	58.225	0.225	0.0	5.3	5.3	245.1	O K
10080 min Winter	58.162	0.162	0.0	5.3	5.3	176.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	88.566	0.0	408.1	41
60 min Winter	56.713	0.0	523.1	70
120 min Winter	35.004	0.0	645.7	128
180 min Winter	25.973	0.0	718.7	186
240 min Winter	20.877	0.0	770.5	244
360 min Winter	15.365	0.0	850.7	362
480 min Winter	12.341	0.0	870.6	478
600 min Winter	10.402	0.0	864.5	594
720 min Winter	9.042	0.0	858.7	710
960 min Winter	7.241	0.0	848.9	938
1440 min Winter	5.284	0.0	836.2	1384
2160 min Winter	3.848	0.0	1278.6	1740
2880 min Winter	3.068	0.0	1359.4	2168
4320 min Winter	2.226	0.0	1478.7	3032
5760 min Winter	1.771	0.0	1567.8	3864
7200 min Winter	1.483	0.0	1643.2	4624
8640 min Winter	1.284	0.0	1707.4	5368
10080 min Winter	1.137	0.0	1763.1	6056

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.099

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.366	4	8	0.366	8	12	0.366

Model Details

Storage is Online Cover Level (m) 59.500

Cellular Storage Structure

Invert Level (m) 58.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	3630.0	0.0	1.001	0.0	0.0
1.000	3630.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0102-5700-1700-5700
Design Head (m)	1.700
Design Flow (l/s)	5.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	102
Invert Level (m)	57.800
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.700	5.7
Flush-Flo™	0.446	5.3
Kick-Flo®	0.909	4.3
Mean Flow over Head Range	-	4.8

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.4	1.200	4.8	3.000	7.4	7.000	11.1
0.200	4.8	1.400	5.2	3.500	8.0	7.500	11.5
0.300	5.2	1.600	5.5	4.000	8.5	8.000	11.8
0.400	5.3	1.800	5.9	4.500	9.0	8.500	12.2
0.500	5.3	2.000	6.1	5.000	9.5	9.000	12.5
0.600	5.3	2.200	6.4	5.500	9.9	9.500	12.9
0.800	4.8	2.400	6.7	6.000	10.3		
1.000	4.5	2.600	7.0	6.500	10.7		

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 1261 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Σ Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	58.247	0.247	0.0	5.3	5.3	263.5	O K
30 min Summer	58.331	0.331	0.0	5.3	5.3	352.3	O K
60 min Summer	58.418	0.418	0.0	5.3	5.3	445.6	O K
120 min Summer	58.505	0.505	0.0	5.3	5.3	537.3	O K
180 min Summer	58.549	0.549	0.0	5.3	5.3	584.7	O K
240 min Summer	58.576	0.576	0.0	5.3	5.3	613.0	O K
360 min Summer	58.610	0.610	0.0	5.3	5.3	649.4	O K
480 min Summer	58.628	0.628	0.0	5.3	5.3	668.5	O K
600 min Summer	58.636	0.636	0.0	5.3	5.3	677.3	O K
720 min Summer	58.638	0.638	0.0	5.3	5.3	679.4	O K
960 min Summer	58.629	0.629	0.0	5.3	5.3	669.9	O K
1440 min Summer	58.592	0.592	0.0	5.3	5.3	630.6	O K
2160 min Summer	58.551	0.551	0.0	5.3	5.3	586.3	O K
2880 min Summer	58.515	0.515	0.0	5.3	5.3	548.3	O K
4320 min Summer	58.447	0.447	0.0	5.3	5.3	475.7	O K
5760 min Summer	58.382	0.382	0.0	5.3	5.3	406.8	O K
7200 min Summer	58.323	0.323	0.0	5.3	5.3	344.2	O K
8640 min Summer	58.270	0.270	0.0	5.3	5.3	287.8	O K
10080 min Summer	58.223	0.223	0.0	5.3	5.3	237.5	O K
15 min Winter	58.278	0.278	0.0	5.3	5.3	296.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	131.851	0.0	271.1	26
30 min Summer	88.566	0.0	364.4	41
60 min Summer	56.713	0.0	467.1	70
120 min Summer	35.004	0.0	576.5	130
180 min Summer	25.973	0.0	641.6	188
240 min Summer	20.877	0.0	687.9	248
360 min Summer	15.365	0.0	759.3	366
480 min Summer	12.341	0.0	813.2	486
600 min Summer	10.402	0.0	856.6	604
720 min Summer	9.042	0.0	881.7	724
960 min Summer	7.241	0.0	880.6	962
1440 min Summer	5.284	0.0	870.9	1234
2160 min Summer	3.848	0.0	1141.4	1584
2880 min Summer	3.068	0.0	1213.7	1972
4320 min Summer	2.226	0.0	1320.8	2772
5760 min Summer	1.771	0.0	1400.0	3576
7200 min Summer	1.483	0.0	1467.1	4328
8640 min Summer	1.284	0.0	1524.5	5104
10080 min Summer	1.137	0.0	1574.1	5848
15 min Winter	131.851	0.0	303.9	26

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Σ Max Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	58.372	0.372	0.0	5.3	5.3	396.3	O K
60 min Winter	58.472	0.472	0.0	5.3	5.3	502.3	O K
120 min Winter	58.571	0.571	0.0	5.3	5.3	607.8	O K
180 min Winter	58.623	0.623	0.0	5.3	5.3	663.8	O K
240 min Winter	58.656	0.656	0.0	5.3	5.3	698.6	O K
360 min Winter	58.700	0.700	0.0	5.3	5.3	745.7	O K
480 min Winter	58.726	0.726	0.0	5.3	5.3	773.3	O K
600 min Winter	58.741	0.741	0.0	5.3	5.3	789.3	O K
720 min Winter	58.749	0.749	0.0	5.3	5.3	797.7	O K
960 min Winter	58.751	0.751	0.0	5.3	5.3	800.2	O K
1440 min Winter	58.726	0.726	0.0	5.3	5.3	773.5	O K
2160 min Winter	58.657	0.657	0.0	5.3	5.3	699.7	O K
2880 min Winter	58.605	0.605	0.0	5.3	5.3	644.3	O K
4320 min Winter	58.499	0.499	0.0	5.3	5.3	531.0	O K
5760 min Winter	58.397	0.397	0.0	5.3	5.3	423.1	O K
7200 min Winter	58.307	0.307	0.0	5.3	5.3	327.3	O K
8640 min Winter	58.230	0.230	0.0	5.3	5.3	244.8	O K
10080 min Winter	58.165	0.165	0.0	5.3	5.3	175.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	88.566	0.0	408.2	41
60 min Winter	56.713	0.0	523.0	70
120 min Winter	35.004	0.0	645.5	128
180 min Winter	25.973	0.0	718.5	186
240 min Winter	20.877	0.0	770.3	244
360 min Winter	15.365	0.0	850.4	362
480 min Winter	12.341	0.0	866.7	478
600 min Winter	10.402	0.0	860.6	594
720 min Winter	9.042	0.0	854.9	710
960 min Winter	7.241	0.0	845.0	938
1440 min Winter	5.284	0.0	830.3	1384
2160 min Winter	3.848	0.0	1278.1	1756
2880 min Winter	3.068	0.0	1359.4	2172
4320 min Winter	2.226	0.0	1478.6	3032
5760 min Winter	1.771	0.0	1567.6	3864
7200 min Winter	1.483	0.0	1643.5	4624
8640 min Winter	1.284	0.0	1706.4	5368
10080 min Winter	1.137	0.0	1762.3	6056

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.099

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.366	4	8	0.366	8	12	0.366

Model Details

Storage is Online Cover Level (m) 59.500

Cellular Storage Structure

Invert Level (m) 58.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	1121.0	0.0	1.001	0.0	0.0
1.000	1121.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0102-5700-1700-5700
Design Head (m)	1.700
Design Flow (l/s)	5.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	102
Invert Level (m)	57.800
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

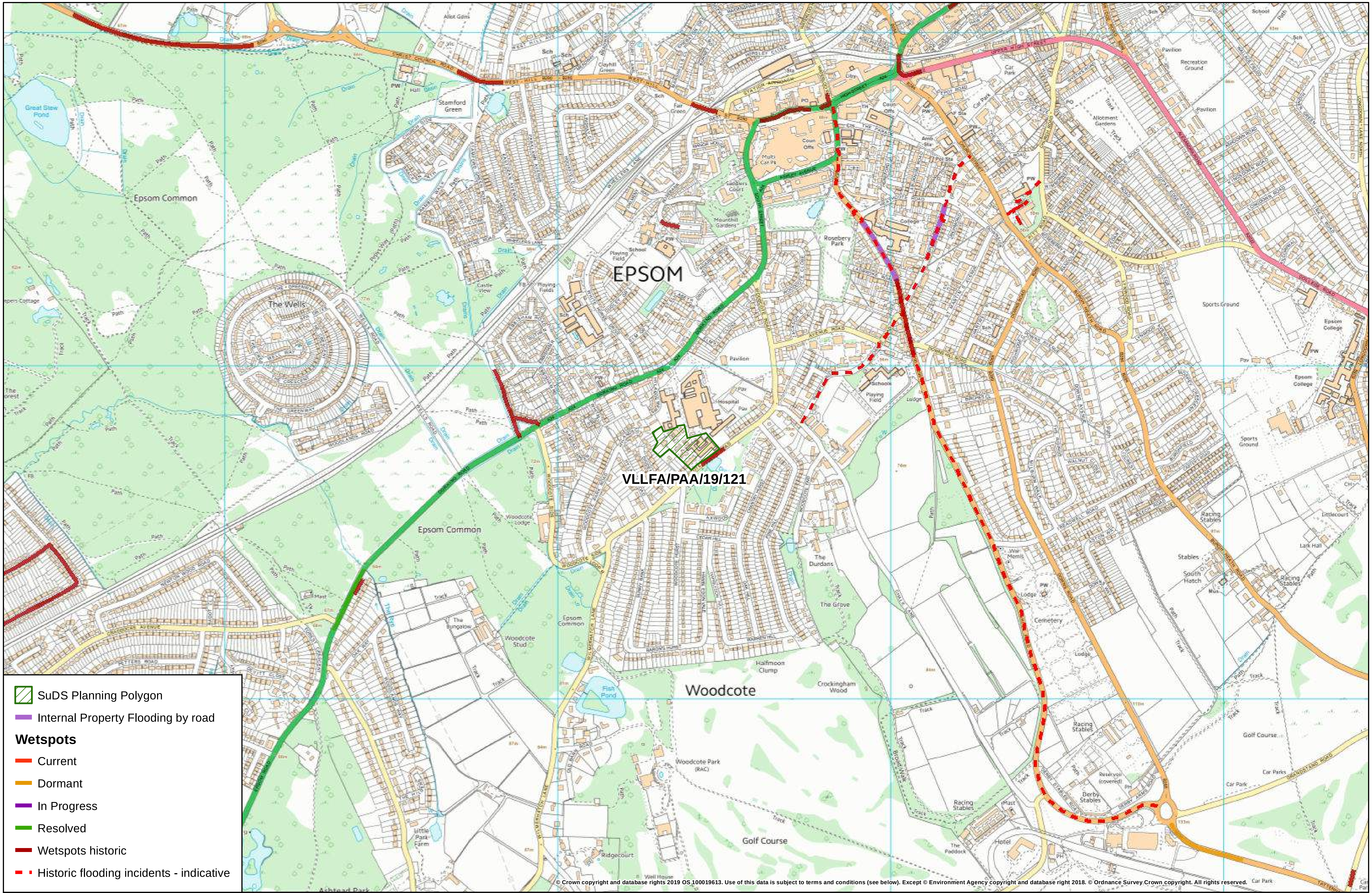
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.700	5.7
Flush-Flo™	0.446	5.3
Kick-Flo®	0.909	4.3
Mean Flow over Head Range	-	4.8

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.4	1.200	4.8	3.000	7.4	7.000	11.1
0.200	4.8	1.400	5.2	3.500	8.0	7.500	11.5
0.300	5.2	1.600	5.5	4.000	8.5	8.000	11.8
0.400	5.3	1.800	5.9	4.500	9.0	8.500	12.2
0.500	5.3	2.000	6.1	5.000	9.5	9.000	12.5
0.600	5.3	2.200	6.4	5.500	9.9	9.500	12.9
0.800	4.8	2.400	6.7	6.000	10.3		
1.000	4.5	2.600	7.0	6.500	10.7		

Appendix K

Supporting Surrey County Council Information



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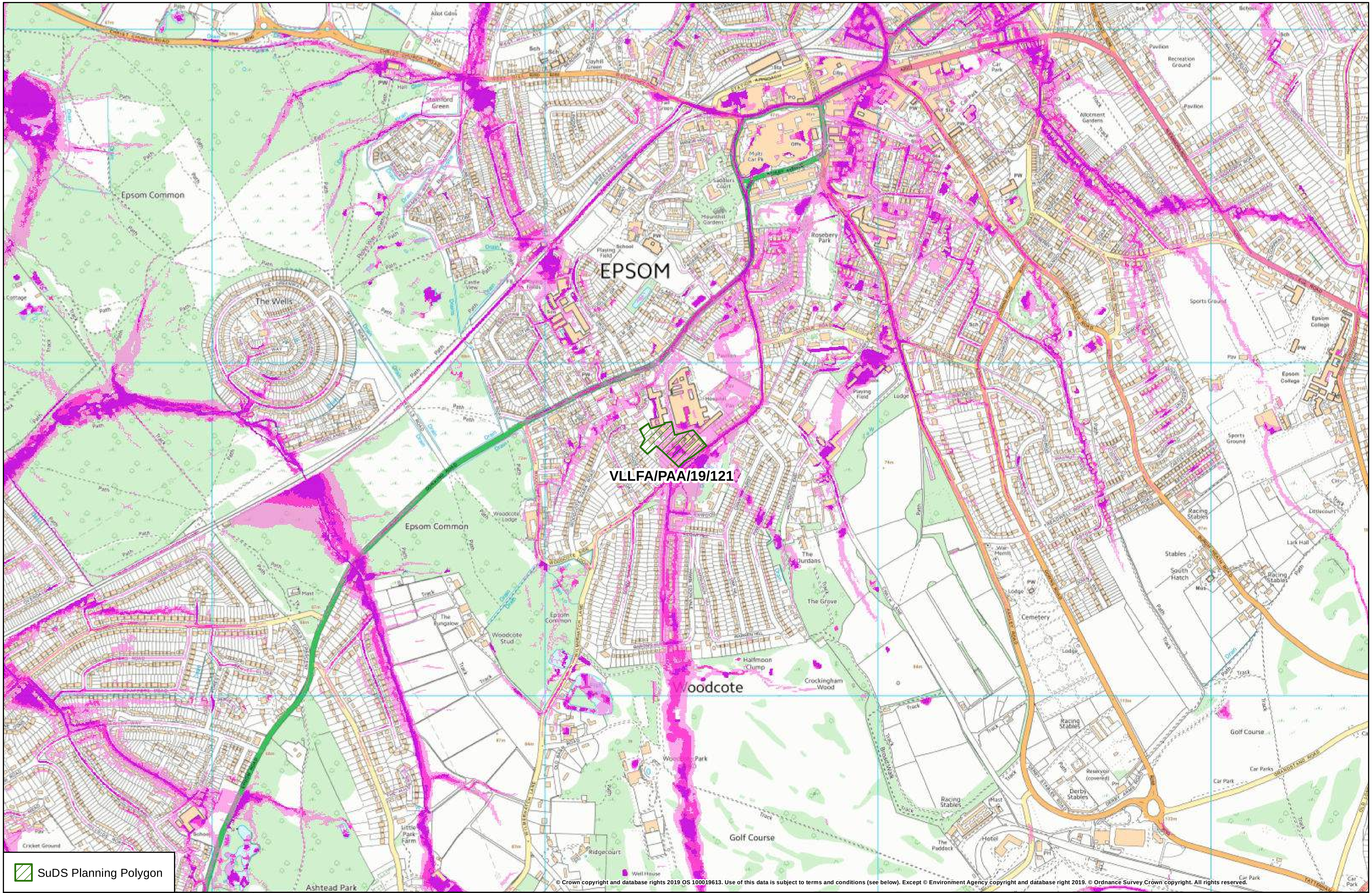
Created by: ADD NAME
Department: Strategic Network Resilience
Printed on: 07/11/2019

Original Size A3
0 150 300 Metres

Pre App for Guild Later Living, Woodcote Green
Historic Flood Evidence
For use in reference to the Flood Risk Report only.

SURREY
COUNTY COUNCIL



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Created by: ADD NAME
Department: Strategic Network Resilience
Printed on: 29/10/2019

Original Size A3

0 150 300 Metres

Pre App for Guild Later Living, Woodcote Green
Surface Water Flood Risk
For use in reference to the Flood Risk Report only.

SURREY
COUNTY COUNCIL

Detailed Flood Risk Report Guild Later Living, Woodcote Green

07 November 2019

SURREY

Detailed Flood Risk Report

Purpose of Report

This document has been prepared for the purpose of providing flood risk information for a specific site; either to aid in the development of a planning application or for flood risk management. The information provided is that which is which is available to Surrey County Council at the time and may include specific guidance e for Planners and Developers about Sustainable Drainage. Surrey County Council gives no guarantee that any flood risk information provided is100% accurate, or exhaustive; it is solely the information we currently hold.

The applicant is advised that there will need to be additional discussions with the County Council as Highway Authority in respect of any drainage proposals for proposed highway works under Section 278 or proposed adoption of new roads under Section 38 of the 1980 Highway Act. Consenting for the discharge of surface water to Ordinary Watercourses should also be directed to the County Council under the Land Drainage Act (1991).

Document History

This report relates to the following enquiry/pre-application request/planning application as:

SCC Application ID	Other ref if applicable	Version	Originator	Date	Reviewer	Date
0	VLLFA/PAA /19/121	0.1	LJ	29/10/2019	AD	29/10/2019

Glossary

The table below defines some of the frequently used terminology for your general information.

Acronym/Term	Definition
Annual Probability	Flood events are defined according to their likelihood of occurrence. The term ‘annual probability of flooding’ is used, meaning the chance of a particular flood occurring in any one year. This can be expressed as a percentage. For example, a flood with an annual probability of 1 in 100 can also be referred to as a flood with a 1% annual probability. This means that every year there is a 1% chance that this magnitude flood could occur.
Flood Zone 1	Area with a low probability of flooding from rivers (< 1 in 1,000 annual chance of flooding).
Flood Zone 2	Area with a medium probability of flooding from rivers (1 in 100 – 1 in 1,000 annual chance of flooding).
Flood Zone 3	Area with a high probability of flooding from rivers (> 1 in 100 annual chance of flooding).
Fluvial flooding	Exceedance of the flow capacity of river channels (whether this is a Main River or an Ordinary Watercourse), leading to overtopping of the river banks and inundation of the surrounding land. Climate change is expected to increase the risk of fluvial flooding in the future.
Infiltration SuDS	These are sustainable drainage systems which facilitate the infiltration of surface water into the ground. Once in the ground, the water percolates through the subsurface to the groundwater.
Groundwater flooding	Emergence of groundwater at the surface (and subsequent overland flows) or into subsurface voids as a result of abnormally high groundwater flows, the introduction of an obstruction to groundwater flow and / or the rebound of previously depressed groundwater levels.
Main River	Main rivers are usually larger streams and rivers, but some of them are smaller watercourses of local significance. Main Rivers indicate those watercourses for which the Environment Agency is the relevant risk management authority.

Ordinary Watercourse	Ordinary Watercourses are displayed in the mapping as the detailed river network. An ordinary watercourse is any watercourse (excluding public sewers) that is not a Main River, and the Lead Local Flood Authority or Internal Drainage Board are the relevant risk management authority.
Other sources of flood risk	Flooding from canals, reservoirs (breach or overtopping) and failure of flood defences.
Sewer flooding	Flooding from sewers is caused by exceedance of sewer capacity and / or a blockage in the sewer network. In areas with a combined sewer network system there is a risk that land and infrastructure could be flooded with contaminated water. In cases where a separate sewer network is in place, sites are not sensitive to flooding from the foul sewer system.
SFRA	Strategic Flood Risk Assessment
SWMP	Surface Water Management Plan
SuDS	Sustainable Drainage Systems
Surface water flooding	Intense rainfall exceeds the available infiltration capacity and / or the drainage capacity leading to overland flows and surface water flooding. Climate change is expected to increase the risk of surface water flooding in the future. This source is also referred to as pluvial flooding.
Tidal flooding	Propagation of high tides and storm surges up tidal river channels, leading to overtopping of the river banks and inundation of the surrounding land.
RoFSW	Risk of Flooding from Surface Water. The data shows areas at risk of flooding from surface water, for three flooding return periods (1 in 30, 1 in 100 and 1 in 1000), and the depth, velocity, hazard and flow direction associated with that flooding. It also includes; data on the models used to develop the maps and information that describes the suitable uses of the data.

Data Sources

The following sources of data have been used in preparing this report and its associated mapping:

- Geology- Bedrock and Superficial Deposits (British Geological Survey- 50,000 scale digital)
- Soilscapes (Cranfield University- http://www.landis.org.uk/soilscapes/)
- SuDS Suitability (British Geological Survey)
- Surface Water Flood Risk
    - Risk of Flooding from Surface Water (RoFSW) (Environment Agency)
- Groundwater
    - Susceptibility to Groundwater Flooding (British Geological Survey)
- Historic Flood Evidence
    - Historic Flood Map (Environment Agency)
    - Wetspots (Surrey County Council)
    - Property Flooding Database (Surrey County Council)
    - Historic Flooding Incidents Database (Surrey County Council)

Site Flood Risk Information

Groundwater

Risk & Evidence

The area of interest is located within an area which is classed as having a potential for groundwater flooding to occur at the surface. This is based on a conceptual understanding of the regional geology and hydrogeology and is therefore only an indication of where geological conditions could enable groundwater flooding to occur. It does not indicate hazard or risk and it does not provide any information on the depth to which groundwater flooding may occur or the likelihood of the occurrence of an event of a particular magnitude. This information should not be used on its own to make planning decisions at any scale, particularly site scale, or to indicate the risk of groundwater flooding.

Implications/Considerations for Planning

The site has a very high susceptibility to groundwater flooding. It is recommended that the following actions are considered as part of the planning application;
• Is there on site monitoring of groundwater levels?
• Is the development planning to discharge to the ground? If so, this may not be appropriate and appropriate site based investigations should be undertaken.

Surface Water

Risk & Evidence

The area of interest is shown to be at risk of surface water flooding in the following return period events; 1 in 30, 1 in 100 and 1 in 1000. The surface water flood extents are not appropriate to be used in assessing flood risk at an individual property level. In addition, the methods used to derive the flood extents are based on modelled design rainfall (i.e. not observed patterns of rainfall) and consequently this information cannot definitively show that an area of land or property is, or is not, at risk of flooding.
The RoFSW have been created from the Environment Agency's nationally produced surface water flood mapping, and appropriate locally produced mapping from Lead Local Flood Authorities such as Surrey County Council. This means that in different areas, the flood extents have varying levels of suitability scales for viewing or assessing. This area's information is only suitable for assessing flood risk at a 'town to street' scale. This scale is suitable for identifying which parts of towns or streets are at risk, or which towns or streets have the most risk. It is likely to be reliable for a local area, but not individual properties.

Implications/Considerations for Planning

In areas at risk of surface water flooding, the following sections outline considerations for the appropriate management of surface water, based on the information provided to Surrey County Council.

Historical Flooding

Risk & Evidence

The Historic Flood Map shows that there is no record of this area being previously flooded by rivers, groundwater or a combination of these sources. However this does not necessarily mean that flooding has not occurred, just that it has not been reported and/or recorded within the Historical Flood Map dataset.

Wetspots indicate the approximate location of known previous flooding on the highway. There is a wetspot near to the area of interest and this highlights that there has been historic flooding in the vicinity. If you would like to find out more about these local wetspots, please visit the Surrey County Council Wetspots Interactive Map: http://new.surreycc.gov.uk/maps/surrey-interactive-map. You can find the wetspots under the 'Roads and Transport' drop down to the right hand side of the map.
According to Surrey County Council's Property Flooding Database, there have been previous instances of property flooding nearby, either internally or externally. The instances of property flooding occurred in Winter 2013/14. Property flooding is sensitive information and this is why more specific details on the location of flooding cannot be provided. Whilst this dataset is the most comprehensive record of property flooding in Surrey, there may be instances of property flooding which were not reported and therefore are not recorded in this dataset.
Surrey County Council's Historic Flooding Incident Database highlights all reported, non point location specific, flooding incidents e.g. example road was flooded. The data indicates that there is a nearby location which has previously reported flooding.

Implications/Considerations for Planning

In areas which have been previously affected by flooding, the following should be considered:
• Is there a safe access/egress route demonstrated?
• Is there an evacuation plan in place?
• Have resilience/resistance measures been considered in the design?

SuDS Suitability

The selection of SuDS should be considered in the early stages of design. The selection criteria, as set out by The SuDS manual (CIRIA C697, 2007), provides a good framework for doing this.

Potential for Infiltration SuDS

Surrey County Council is licensed to use the Infiltration SuDS Data produced by the British Geological Survey. This data was produced after the Pitt Review (2007) and aims to encourage the appropriate use of SuDS. By utilising SuDS, the reliance on traditional piped systems is reduced, and the sustainable management of water is encouraged.
The Infiltration SuDS data is used to make a preliminary assessment of the suitability of the subsurface for infiltration SuDS. This data is not a replacement for a soakaway test or site investigation.

The suitability of utilising infiltration SuDS techniques has been summarised for the application site below.

Constraints to Infiltration

There are very significant constraints indicated at the site for the use of infiltration SuDS and a significant potential for one or more geohazards associated with facilitating infiltration. A full appraisal of ground conditions is necessary and the site investigation should consider whether the potential for or the consequences of infiltration are significant.

Drainage Potential

There is a very significant potential for one or more geohazards associated with infiltration. Only install infiltration SuDS if the potential for or the consequences of infiltration are considered not to be significant.

Stability of Ground

Ground instability problems are probably present. Increased infiltration may result in ground instability. Before installing infiltration SuDS consider the potential for or the consequences of infiltration on ground stability.

Groundwater Vulnerability

The groundwater may be vulnerable to contamination. Where surface water is being infiltrated into the ground, this water should be free of contaminants. Before installing infiltration SuDS, consider the risks associated with the transport of contaminants to the groundwater. Check previous land use and potential for the presence of contaminated ground.

Superficial Deposit Permeability

Superficial deposits are likely to be free-draining. It is recommended that the infiltration rate is quantified via an infiltration/soakaway test.

Bedrock Permeability

The bedrock permeability is spatially variable, but likely to permit moderate infiltration. It is recommended that the infiltration rate is quantified via an infiltration/soakaway test.

Proposed Approach

Drainage and Discharge Methods

Some areas of the site may be suitable for infiltration based SuDS techniques however ground conditions and groundwater levels should be fully investigated through intrusive ground investigations and should be provided to support any Planning Application made in respect of the site.

A hierarchical approach should be taken to the discharge of surface water from the site.

- Option 1 - to ground;
- Option 2 - attenuation and discharge to adjacent watercourse;
- Option 3 - attenuation and discharge to surface water sewer.

Any surface water discharged from the site should be restricted to the existing greenfield run-off rate applied to the impermeable area of the site only. Qbar is considered acceptable (applied to the proposed impermeable area only) or a staged discharge approach with greenfield run-off rates applied to the 1 in 1 year, 1 in 30 year and 1 in 100 year events accordingly.

On site attenuation should be provided for the 1 in 100 year + climate change rainfall event. 40% should be applied for climate change for residential development. A lower % for climate change may be considered acceptable for commercial property dependent upon the life span of the development, however sensitivity testing will be required up to the + 40% event. Where appropriate, a 10% allowance for urban creep should be included in the drainage designs.

If proposed site works affect an Ordinary Watercourse, Surrey County Council as the Lead Local Flood Authority should be contacted to obtain prior written Consent. More details are available on our website.

Areas of the site have been identified as having a risk of surface water flooding and as such this risk should be fully assessed as part of any Planning Application. More vulnerable development should be placed in areas at lower risk and existing surface water flow routes should be maintained to ensure flood risk is not increased.

SuDS Components

Many schemes deliver the management of water quantity but do not fulfil the four pillars of SuDS design as defined by the SuDS Manual. The manual seeks to encourage schemes that manage the quantity and quality of surface water runoff, provide an amenity that integrates surface water as an attractive part of public space and also enhance biodiversity. Schemes based around the management of quantity alone are purely drainage schemes not SuDS.

The following proposals for SuDS have been put forward as part of the drainage design:
Intrusive ground investigations should be completed to determine ground conditions and assess groundwater levels. All SuDS principles could be affected if groundwater levels are high, and therefore this information should be gathered to inform the drainage strategy.

If soakaways are unsuitable, above ground attenuation of surface water should be considered in the first instance before below ground storage is proposed. If above ground attenuation of surface water is not considered feasible full justification should be provided.

The Applicant should consider the management and maintenance of the proposed SuDS elements and this information should be presented as part of any Planning Application.

Site Development Details: Cross-check

The table below cross-checks the information provided with the planning application, with information easily available to Surrey County Council and provides recommendations on the suitability of the proposed drainage.

Site Details	Description
Bedrock	Clay, Silt and Sand on the majority of the site, on the east side of the site the bedrock is Clay and Silt
Superficial Deposits	Sand and Gravel
Soils	"Soilscapes conveys a summary of the broad regional differences in the soil landscapes of England and Wales. Soilscapes is not intended as a means for supporting detailed assessments, such as land planning applications or site investigations; nor should it be used to support commercial activities. For such applications, a parallel service Soils Site Reporter provides comprehensive reporting for specific locations. Ground investigations should also be evidenced when considering infiltration SuDS. " unclassified
Depth to Water Table (m)	Groundwater is likely to be less than 3 m below the ground surface for at least part of the year. It is recommended that the seasonal variation in groundwater levels are determined. The scale of site specific assessments and evidence of groundwater levels should be appropriate to the size and nature of the proposed development site. This site may not be suitable for infiltration SuDS if the groundwater level reaches <1m below the ground surface.
Discharge method- Sewer (if applicable)	The nearest sewer is more than 50m from the proposed development. This indicates that discharging to the sewer may be feasible. Infiltration SuDs are mandatory unless where evidenced that they are not appropriate (e.g. contaminated land, high ground water levels or land subsidence). If SuDS are not appropriate, then evidence that connecting to the sewer network is appropriate and has been permitted by the water utility company should be provided along with any third part land permissions.
Discharge method- Watercourse (if applicable)	The nearest watercourse is less than 50m from the proposed development. This indicates that discharging to the watercourse may be appropriate. Consideration should be given to the downstream flood risk and water quality of the watercourse. When discharging to watercourses, there should be a minimum of an 8m buffer from any building for access and maintenance.

Recommendations and Summary

Any surface water discharged from the site should be limited to the existing greenfield run-off rate applied to the proposed impermeable area of the site only.

Evidence must be provided to establish the greenfield runoff rate for the site. For previously developed sites, evidence must be provided where the greenfield runoff rate cannot be reasonably practicably achieved.

On site attenuation should be provided for the 1 in 100 year + climate change rainfall event, with a sensitivity check up to the 1 in 100 year (+40% climate change) event if not used already.

SCC Surface water drainage pro-forma should be completed to accompany any future Planning Applications with supporting evidence provided.

If proposed site works affect an Ordinary Watercourse, Surrey County Council as the Lead Local Flood Authority should be contacted to obtain prior written Consent. More details are available on our website.

If proposed works result in infiltration of surface water to ground within a Source Protection Zone the Environment Agency will require proof of surface water treatment to achieve water quality standards.

Good Practice Guidance

For all areas within Flood Zone 1 and where the application site is less than 1ha the following guidance should be followed (in addition to that set out above) when considering surface water management and SuDS.

Flood Risk

Please refer to the Environment Agency's Standing Guidance for Flood Risk.

SuDS Suitability and Methods

Please refer to the SuDS advice note and the Evidence Required note on Surrey County Council's website to assist in directing developers and designers to the most appropriate guidance and technical standards.

A non-exhaustive list of references is provided at the end of this document to further assist Planners in informing the planning decision.

References

BRE365. Soakaway Design

Cambridge City Council. 2009. SuDS Design and Adoption Guide. https://www.cambridge.gov.uk/sites/www.cambridge.gov.uk/files/docs/SUDS-Design-and-Adoption-Guide.pdf

CIRIA. 2015. The SuDS Manual (C753).

CIRIA. 2006. Designing for exceedance in urban drainage-good practice (C635).

CIRIA.1996. Infiltration Drainage: Manual of Good Practice (C156)

Defra. 2015. Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf