

Drainage Statement

Phase 6, Green Park Village, Reading

Client

Berekely Homes
200 Longwater Avenue
Green Park
Reading
RG2 6GB
7143/2.3F
First Issue: 26th October 2018

Consulting Engineers

GTA Civils Ltd
66a Church Walk, Burgess Hill
West Sussex RH15 9AS
Tel: 01444 871444
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1.0 INTRODUCTION

This report has been prepared in relation to the proposed drainage scheme submitted for the development of Phase 6 of the development at Green Park Village, Reading.

The aim of this report is to explain the detailed site drainage design, including the SuDS components, that are shown on the proposed site drainage layout drawings submitted with this document.

This report has been specifically designed to provide information to enable discharge of conditions 27, and 28 of the consent:

- (27) *Development shall not commence until a drainage strategy detailing any on and/or off site drainage works, has been submitted to and approved by, the local planning authority in consultation with the sewerage undertaker. No discharge of foul or surface water from the site shall be accepted into the public system until the drainage works referred to in the strategy have been completed.*
- (29) *Prior to commencement of each phase or part of a phase full details of the method of disposal of foul sewage for that phase shall be submitted to and approved in writing by the Local Planning Authority. The development shall be carried out in accordance with the approved details.*

2.0 LIMITATIONS

This report has been prepared for Berkeley Homes (Western) Ltd in relation to the proposed Green Park Village development at Reading. No responsibility is accepted to any third party for all or part of this study in connection with this or any other development.

3.0 EXISTING DRAINAGE

The site is currently unoccupied and comprises of spoil heaps and waste ground.

There are no existing drainage runs on site and all surface water runs overland and into the lake.

4.0 PROPOSED DRAINAGE

Condition 27:

The following drawings contained in Appendix A show the proposed drainage and details:

G259-GTA-SW-00-DR-C-96-1060 and 1061	-	Site Drainage Sheets 1 and 2
G259-GTA-SW-00-DR-C-96-1070, 1071 and 1072-		Drainage details Sheets 1, 2 and 3
G259-GTA-SW-00-DR-C-96-1014	-	Phase 6 Section 104 layout

The total site impermeable area has been calculated as 1.593 Ha.

Greenfield runoff for the 1.593 Ha impermeable area has been calculated as 5.4 l/s. A restriction rate of 4.5l/s has been proposed which is slightly less than the 1 in 1 year greenfield rate of 4.6l/s.

The planning drainage strategy prepared by Glanville consulting engineers split the Phase 6 area into Phase 6a (north section) and Phase 6b (south section). The Phase 6a north section was restricted to 5l/s, whilst the Phase 6b area discharged to soakaways, subject to further investigation. Since then soakaways have been ruled out due to the made ground in the Phase 6b area and high groundwater levels.

Therefore, both Phase 6a and 6b all now discharge to a single outlet to the lake at 4.5l/s.

Microdrainage calculations in Appendix B shows no flooding of the system in a 1 in 100 year + 40% critical storm event.

Peak storage within the tank totals 1026m³, with a tank capacity of 1152m³.

As there it has been demonstrated that the surface water can be disposed of without increased risk of flooding it is proposed that planning condition 27 is deemed to be satisfied.

Peak storage volumes requirements are as follows:

Storm Event	Peak Storage Volume requirement m³
1 in 30 year	542
1 in 100 year + 40%	1026

5.0 PROPOSED FOUL DRAINAGE DESIGN

Condition 29:

Foul water is proposed to drain by gravity to the existing Thames Water sewer laid as part of Phase of the development as per the drainage layout drawings 1060 and 1061. A Section 104 application has been made to Thames Water for the new sewers as shown on drawing 1014.

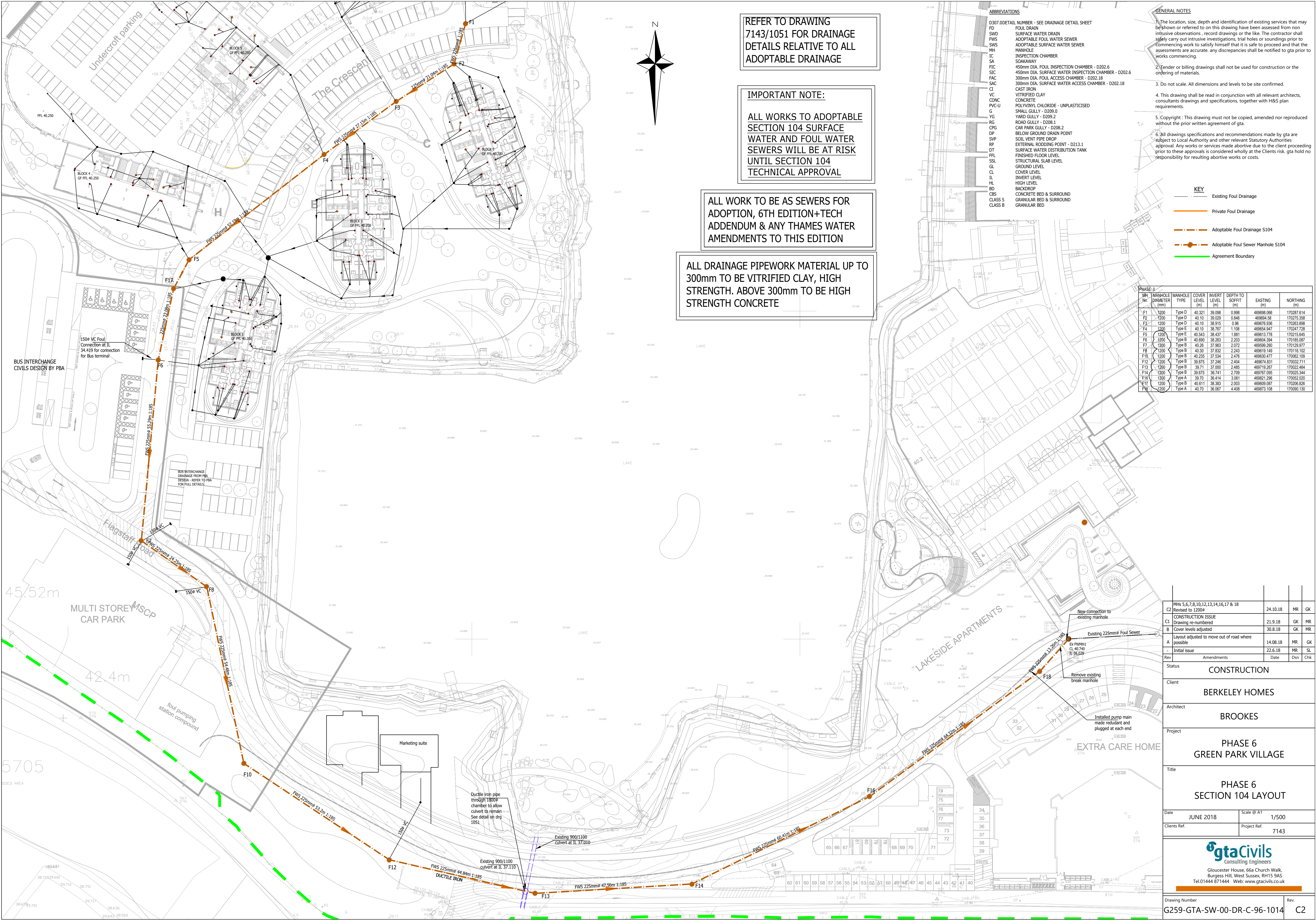
Report by:

Martin Roberts I.Eng ACIWEM MCIHT

GTA Civils Ltd

APPENDIX A – SITE DRAINAGE LAYOUTS

G259-GTA-SW-00-DR-C-96-1060 and 1061	-	Site Drainage Sheets 1 and 2
G259-GTA-SW-00-DR-C-96-1070, 1071 and 1072-		Drainage details Sheets 1, 2 and 3
G259-GTA-SW-00-DR-C-96-1014	-	Phase 6 Section 104 layout



REFER TO DRAWING
7143/1051 FOR DRAINAGE
DETAILS RELATIVE TO ALL
ADOPTABLE DRAINAGE

IMPORTANT NOTE:

ALL WORKS TO ADOPTABLE
SECTION 104 SURFACE
WATER AND FOUL WATER
SEWERS WILL BE AT RISK
UNTIL SECTION 104
TECHNICAL APPROVAL

ALL WORK TO BE AS SEWERS FOR
ADOPTION, 6TH EDITION+TECH
ADDENDUM & ANY THAMES WATER
AMENDMENTS TO THIS EDITION

ALL DRAINAGE PIPEWORK MATERIAL UP TO
300mm TO BE VITRIFIED CLAY, HIGH
STRENGTH. ABOVE 300mm TO BE HIGH
STRENGTH CONCRETE

ABBREVIATIONS

- D307.0 DETAIL NUMBER - SEE DRAINAGE DETAIL SHEET
- FD FOUL DRAIN
- SWD SURFACE WATER DRAIN
- FWS ADOPTABLE FOUL WATER SEWER
- SWS ADOPTABLE SURFACE WATER SEWER
- MH MANHOLE
- IC INSPECTION CHAMBER
- SA SKYWAY
- FIC 450mm DIA. FOUL INSPECTION CHAMBER - D202.6
- SIC 450mm DIA. SURFACE WATER INSPECTION CHAMBER - D202.6
- FAC 300mm DIA. FOUL ACCESS CHAMBER - D202.18
- SAC 300mm DIA. SURFACE WATER ACCESS CHAMBER - D202.18
- CI CAST IRON
- VC VITRIFIED CLAY
- CONC CONCRETE
- PVC-U POLYVINYL CHLORIDE - UNPLASTICISED
- G SMALL GULLY - D209.0
- YG YARD GULLY - D209.2
- RG ROAD GULLY - D208.1
- CPG CAR PARK GULLY - D208.2
- DP BELOW GROUND DRAIN POINT
- SVP SOIL VENT PIPE DROP
- RP EXTERNAL RODDING POINT - D213.1
- DT SURFACE WATER DISTRIBUTION TANK
- FFL FINISHED FLOOR LEVEL
- SSL STRUCTURAL SLAB LEVEL
- GL GROUND LEVEL
- CL COVER LEVEL
- IL INVERT LEVEL
- HL HIGH LEVEL
- BD BACKDROP
- CBS CONCRETE BED & SURROUND
- CLASS B GRANULAR BED & SURROUND
- CLASS S GRANULAR BED

GENERAL NOTES

- The location, size, depth and identification of existing services that may be shown or referred to on this drawing have been assessed from non-intrusive observations, record drawings or the like. The contractor shall safely carry out intrusive investigations, trial holes or soundings prior to commencing work to satisfy himself that it is safe to proceed and that the assessments are accurate. Any discrepancies shall be notified to gta prior to works commencing.
- Tender or billing drawings shall not be used for construction or the ordering of materials.
- Do not scale. All dimensions and levels to be site confirmed.
- This drawing shall be read in conjunction with all relevant architects, consultants drawings and specifications, together with H&S plan requirements.
- Copyright : This drawing must not be copied, amended nor reproduced without the prior written agreement of gta.
- All drawings specifications and recommendations made by gta are subject to Local Authority and other relevant Statutory Authorities approval. Any works or services made abortive due to the client proceeding prior to these approvals is considered wholly at the Clients risk. gta hold no responsibility for resulting abortive works or costs.

KEY

- Existing Foul Drainage
- Private Foul Drainage
- Adoptable Foul Drainage S104
- Adoptable Foul Sewer Manhole S104
- Agreement Boundary

PHASE 6									
MH No.	MANHOLE DIAMETER (mm)	MANHOLE TYPE	COVER LEVEL (m)	INVERT LEVEL (m)	DEPTH TO SOFFIT (m)	EASTING (m)	NORTHING (m)		
F1	1200	Type D	40.321	39.068	0.958	489698.066	170287.614		
F2	1200	Type D	40.10	39.029	0.846	489694.58	170275.358		
F3	1200	Type D	40.10	38.915	0.96	489676.936	170263.898		
F4	1200	Type E	40.10	38.767	1.108	489654.947	170247.728		
F5	1200	Type E	40.543	38.437	1.881	489613.778	170215.645		
F6	1200	Type B	40.690	38.263	2.203	489604.394	170185.087		
F7	1200	Type B	40.26	37.963	2.072	489599.260	170129.977		
F8	1200	Type B	40.30	37.832	2.243	489619.149	170116.102		
F10	1200	Type B	40.235	37.534	2.476	489630.477	170062.109		
F12	1200	Type B	39.875	37.246	2.404	489674.831	170022.711		
F13	1200	Type B	39.71	37.000	2.485	489719.267	170022.464		
F14	1200	Type B	39.675	36.741	2.709	489767.095	170025.344		
F16	1200	Type A	39.70	36.444	3.061	489821.296	170022.020		
F17	1200	Type B	40.611	38.383	2.003	489606.087	170206.826		
F18	1200	Type A	40.70	36.067	4.408	489873.108	170090.130		

Mhs 5,6,7,8,10,12,13,14,16,17 & 18 Revised to 1200e		24.10.18	MR	GK
C1	CONSTRUCTION ISSUE	21.9.18	GK	MR
B	Cover levels adjusted	30.8.18	GK	MR
A	Layout adjusted to move out of road where possible	14.08.18	MR	GK
-	Initial Issue	22.6.18	MR	SL
Rev	Amendments	Date	Dsn	Chk
Status				
CONSTRUCTION				
Client				
BERKELEY HOMES				
Architect				
BROOKES				
Project				
PHASE 6 GREEN PARK VILLAGE				
Title				
PHASE 6 SECTION 104 LAYOUT				
Date		Scale @ A1		
JUNE 2018		1/500		
Clients Ref.		Project Ref.		
		7143		
				
Gloucester House, 66a Church Walk, Burgess Hill, West Sussex, RH15 9AS Tel:01444 871444 Web: www.gtacivils.co.uk				
Drawing Number		Rev.		
G259-GTA-SW-00-DR-C-96-1014		C2		

DESIGN NOTES

1. DISCHARGE RATE OF 4.7L/S ESTABLISHED BY SITES QBAR BASED ON IMPERMEABLE AREA.
2. STORAGE DESIGN BASED ON 1 IN 100 YR STORM + 40% WITH FLOW RESTRICTION OF 4.7L/S TO WATERCOURSE.
3. CONTRACTOR TO ESTABLISH LOCATIONS OF ALL EXISTING SERVICES PRIOR TO COMMENCING.
4. EXISTING TREES TO BE PROTECTED WHERE EXCAVATIONS RUN CLOSE.
5. APPROVAL TO BE GAINED FROM LEAD LOCAL FLOOD AUTHORITY AND THAMES WATER FOR CONNECTIONS TO SEWERS AND DISCHARGE RATES

GENERAL NOTES

1. The location, size, depth and identification of existing services that may be shown or referred to on this drawing have been assessed from non intrusive observations, record drawings or the like. The contractor shall safely carry out intrusive investigations, trial holes or soundings prior to commencing work to satisfy himself that it is safe to proceed and that the assessments are accurate. any discrepancies shall be notified to gta prior to works commencing.
2. Tender or billing drawings shall not be used for construction or the ordering of materials.
3. Do not scale. All dimensions and levels to be site confirmed.
4. This drawing shall be read in conjunction with all relevant architects, consultants drawings and specifications, together with H&S plan requirements.
5. Copyright : This drawing must not be copied, amended nor reproduced without the prior written agreement of gta.
6. All drawings specifications and recommendations made by gta are subject to Local Authority and other relevant Statutory Authorities approval. Any works or services made abortive due to the client proceeding prior to these approvals is considered wholly at the Clients risk. gta hold no responsibility for resulting abortive works or costs.

ABBREVIATIONS

D307.0	DETAIL NUMBER - SEE DRAINAGE DETAIL SHEET
FD	FOUL DRAIN
SWD	SURFACE WATER DRAIN
MH	MANHOLE
IC	INSPECTION CHAMBER
SA	SOAKAWAY
FIC	450mm DIA. FOUL INSPECTION CHAMBER - D202.6
FAC	450mm DIA. SURFACE WATER, INSPECTION CHAMBER - D202.6
SIC	300mm DIA. FOUL ACCESS CHAMBER - D202.18
SAC	300mm DIA. SURFACE WATER ACCESS CHAMBER - D202.18
CI	CAST IRON
VC	VITRIFIED CLAY
CONC	CONCRETE
PVC-U	POLYVINYL CHLORIDE - UNPLASTICISED
G	SMALL GULLY - D209.0
YG	YARD GULLY - D209.2
RG	ROAD GULLY - D208.1
CPG	CAR PARK GULLY - D208.2
DP	BELOW GROUND DRAIN POINT
SVP	SOIL VENT PIPE DROP
RP	EXTERNAL RODDING POINT - D213.1
DT	SURFACE WATER DISTRIBUTION TANK
FFL	FINISHED FLOOR LEVEL
SSL	STRUCTURAL SLAB LEVEL
GL	GROUND LEVEL
CL	COVER LEVEL
IL	INVERT LEVEL
RD	BACKDROP
CBS	CONCRETE BED & SURROUND
CLASS S	GRANULAR BED & SURROUND
CLASS B	GRANULAR BED

REFER TO DRAWING 1070 FOR DRAINAGE DETAILS
RELATIVE TO ALL PRIVATE DRAINAGE

T1	Revised	Issue	Date	By	Check
T1		Drawing re-numbered. Drain connections added, site layout updated. TENDER ISSUE	21.9.18	MR	SL
A		Additional drainage channels	30.8.18	MR	SL
-		Initial issue for comment	17.8.18	MR	SL
Rev		Amendments	Date	By	Check

TENDER

Client

BERKELEY HOMES

Architect

BROOKES

Project

PHASE 6
GREEN PARK VILLAGE

Title

SITE DRAINAGE
SHEET 1 OF 2

Date

JULY 2018

Scale @ A1

1/250

Clients Ref.

Project Ref.

7143

gtaCivils
Consulting Engineers

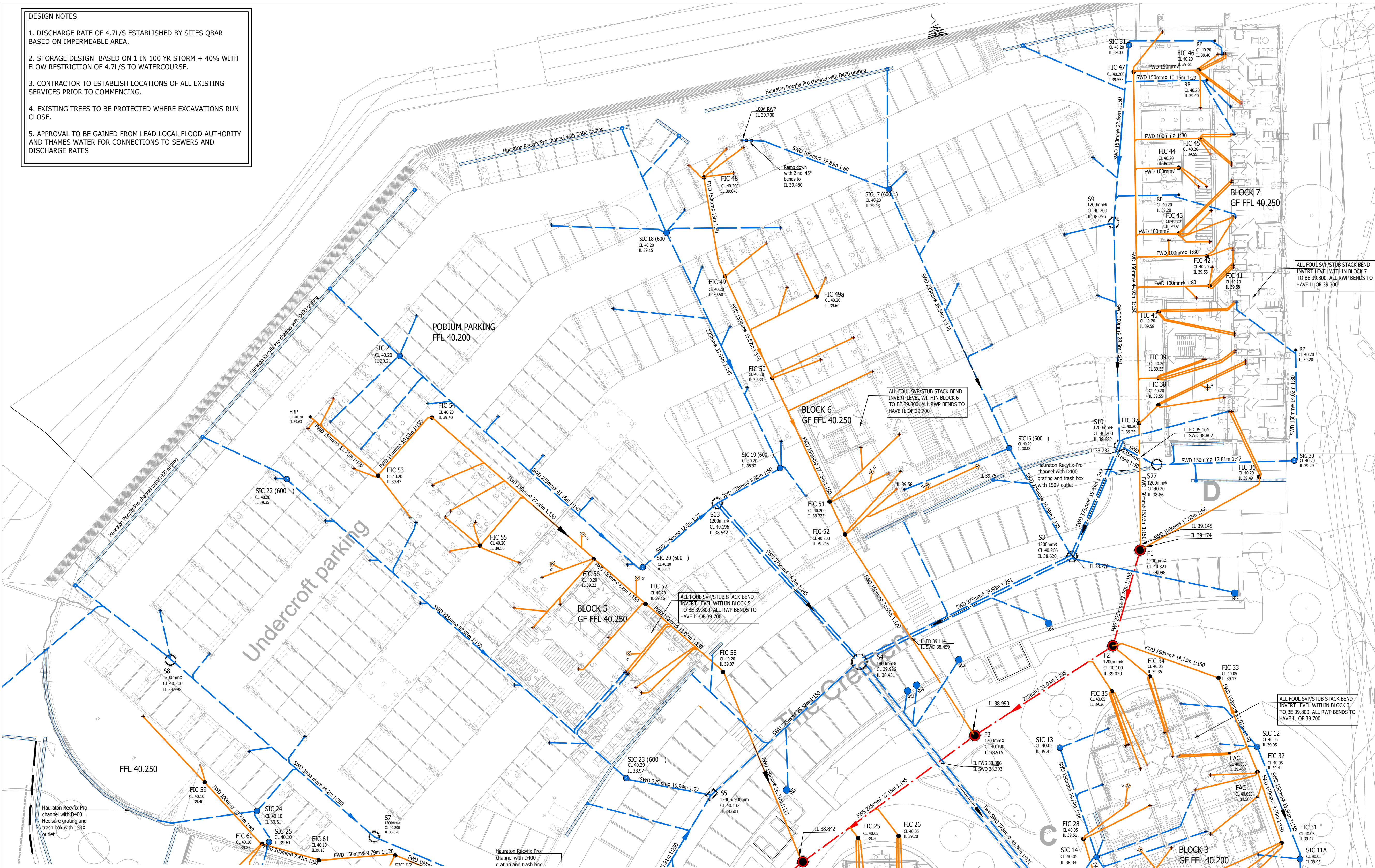
Gloucester House, 66a Church Walk,
Burgess Hill, West Sussex, RH15 9AS
Tel.01444 871444 Web: www.gtacivils.co.uk

Drawing Number

G259-GTA-SW-00-DR-C-96-1060

Rev.

T1



FOR CONTINUATION SEE DRAWING No. 1061

SPECIFICATION NOTES

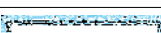
1. ALL ADAPTABLE SEWERS SHALL BE CONSTRUCTED TO THE STANDARDS LAID DOWN IN "SEWERS FOR ADOPTION" 6th EDITION, AND THAMES WATER SPECIFICATIONS, WITH A VIEW TO ADOPTION UPON COMPLETION.
2. BEFORE CONNECTIONS ARE MADE TO EXISTING DRAINAGE, ITS LEVEL IS TO BE CHECKED AND CONFIRMED AGAINST LEVELS SHOWN ON THIS DRAWING AND THIS OFFICE INFORMED OF ANY SIGNIFICANT DIFFERENCE. **NOTE - NO NEW CONNECTIONS ARE TO BE MADE TO THE EXISTING PUBLIC SEWERS UNTIL A SECTION 106 AGREEMENT HAS BEEN APPROVED BY THAMES WATER.**
3. ALL SEWERS WITH LESS THAN 1.2m OF COVER WHEN LAID BENEATH THE ROADS, OR 0.9m OF COVER IN OTHER AREAS, SHALL BE PROTECTED WITH CONCRETE IN ACCORDANCE WITH EITHER OF THE DETAILS SHOWN ON THE STANDARD DRAWING PROVIDED (FOR BEDDING TYPE LOCATIONS, REFER TO SEWER SECTIONS).
4. THE MINIMUM SIZE OF PIPE CONNECTING GULLIES TO THE DRAINAGE SYSTEM SHALL BE 150mm DIA. LAID AT A MINIMUM GRADIENT OF 1 IN 80.
5. IN ORDER TO MAINTAIN THE SATISFACTORY FUNCTIONING OF THE DRAINAGE SYSTEM, ALL ROAD AND YARD GULLIES ARE TO BE "TRAPPED".
6. ALL NON ADAPTABLE LATERALS BENEATH THE HIGHWAY SHALL BE BACKFILLED WITH LEAN MIX CONCRETE UNLESS OTHERWISE AGREED WITH THE HIGHWAYS ENGINEER.
7. THE DESIGN IS SUCH THAT WATER FROM PRIVATE AREAS DOES NOT SHED TO ADAPTABLE AREAS AND VICE VERSA.
8. ALL PRIVATE SEWERS ARE TO BE 100mm DIA. UNLESS OTHERWISE STATED. THE PRIVATE DRAINAGE DESIGN ON THE PLAN HAS BEEN BASED ON THE PRINCIPLES OF A UPVC SYSTEM. IT CAN BE ADAPTED TO SUIT A STONWARE SYSTEM BUT REFERENCE SHOULD BE MADE TO THIS OFFICE BEFORE AMENDMENTS ARE MADE.
9. ALL PRIVATE DRAINAGE TO BE IN ACCORDANCE WITH THE BUILDING REGULATIONS APPROVED DOCUMENT "H" BRITISH STANDARD 8301, AND TO THE SATISFACTION OF THE BUILDING CONTROL SECTION.
10. MANHOLES SITUATED WITHIN AREAS ACCESSIBLE TO MOTOR VEHICLES ARE TO BE FITTED WITH SUITABLE STRENGTH COVERS AND FRAMES.
11. WHERE DRAINS PASS THROUGH FOUNDATIONS, A FLEXIBLE JOINT SHOULD BE PROVIDED WITHIN 150mm OF THE FACE OF THE STRUCTURE. WHERE TYPE 2 MANHOLES ARE EMPLOYED OR CONCRETE SUBROUND IS ADDED TO OTHER MANHOLES, A RODDER PIPE OF MAX 600mm IN LENGTH SHALL BE PROVIDED EITHER SIDE OF THE MANHOLE, LAID AT A SLIGHTLY STEEPER GRADIENT TO ALLOW FOR SETTLEMENT.
12. STUB STACKS FITTED WITH AIR ADMITTANCE VALVES MAY BE USED INSTEAD OF SOIL AND VENT PIPES, SUBJECT TO THE ARCHITECT'S APPROVAL (EXCEPT WHERE THE DRAINAGE CONNECTION EXCEEDS 10m BEFORE CONNECTING WITH ANOTHER VENTILATED DRAIN OR INSPECTION CHAMBER OR MANHOLE). HEAD OF DRAIN VENT PIPES MUST NOT BE FITTED WITH AIR ADMITTANCE VALVES.
13. SHALLOW PRIVATE DRAINS MAY REQUIRE PROTECTION USING CONCRETE SUBROUND OR PAVING SLABS BRIDGING THE TRENCH SUBJECT TO THE BUILDING INSPECTOR'S REQUIREMENTS.
14. APPROPRIATE MEASURES (TO BE AGREED WITH THE BUILDING CONTROL SECTION, ARE TO BE TAKEN TO DISCOURAGE RODENT ENTRY INTO THE PROPERTIES.
15. WHERE DRAIN RUNS PASS CLOSE TO BUILDINGS OR THEIR INVERT LEVELS ARE BELOW FOUNDATION LEVEL, THEN THE TRENCHES ARE TO BE BACKFILLED IN ACCORDANCE WITH THE STANDARD DETAIL PROVIDED.
16. REFERENCE SHOULD BE MADE TO THE STRUCTURAL ENGINEERS DETAILS FOR ALL ASPECTS OF FOUNDATION DESIGN AND CONSTRUCTION.
17. BEFORE DETERMINING THE AMOUNT OF FACE BRICKWORK TO EACH UNIT, CONSIDERATION MUST BE GIVEN TO THE PROPOSED FINISHED GROUND LEVELS IN THE VICINITY OF THE PROPERTY. THE LEVELS SHOWN ON THIS DRAWING HAVE BEEN DESIGNED UPON THE PARAMETERS SET DOWN IN THE APPROVED DOCUMENT "H" OF THE BUILDING REGULATIONS 2000 (2004 EDITION).
18. THE CONTRACTOR IS TO KEEP A RECORD OF ANY VARIATIONS MADE ON SITE, INCLUDING THE RELOCATION OF SEWERS OR DRAINS, SO THAT AN AS CONSTRUCTED DRAWING CAN BE PREPARED UPON COMPLETION OF THE PROJECT.
19. THE CONTRACTOR SHOULD CHECK ALL DIMENSIONS ON SITE.
20. IT IS THE SUBCONTRACTORS RESPONSIBILITY TO ENSURE COMPLIANCE WITH CURRENT BUILDING REGULATIONS AND CODES OF PRACTICE.

KEY

Existing Foul Drainage	Foul Drain connection to SVP/SS
Existing Storm Drainage	Rain Water Pipe 100 unless noted otherwise
Adoptable Storm Drainage S104	Private Road Gully
Adoptable Foul Drainage S104	Private Yard Gully
Private Storm Drainage	Channel Drain
Private Foul Drainage	Direction of Fall
Adoptable Foul Sewer Manhole	
Adoptable Foul Sewer Manhole - Type 3	
Adoptable Storm Sewer Manhole	
Adoptable Storm Sewer Manhole - Type 3	
Manholes fitted with Backdrop Connection	
450mm Foul Plastic Inspection Chamber	
450mm Storm Plastic Inspection Chamber	
300mm Foul Water Access Chamber	
Foul Water Rodding Point	
Storm Water Rodding Point	

APPENDIX B – MICRO DRAINAGE OUTPUTS

GTA Civils Ltd		Page 1																								
Gloucester House 66a Church Walk Burgess Hill, BN43 6LB	Green Park Village Phase 6 7143 - Greenfield runoff																									
Date 25/10/2018	Designed by MCR																									
File	Checked by																									
XP Solutions		Source Control 2018.1																								
<u>ICP SUDS Mean Annual Flood</u> Input <table> <tr> <td>Return Period (years)</td> <td>100</td> <td>Soil</td> <td>0.400</td> </tr> <tr> <td>Area (ha)</td> <td>1.593</td> <td>Urban</td> <td>0.000</td> </tr> <tr> <td>SAAR (mm)</td> <td>700</td> <td>Region Number</td> <td>Region 6</td> </tr> </table> Results 1/s <table> <tr> <td>QBAR Rural</td> <td>5.4</td> </tr> <tr> <td>QBAR Urban</td> <td>5.4</td> </tr> <tr> <td>Q100 years</td> <td>17.3</td> </tr> <tr> <td>Q1 year</td> <td>4.6</td> </tr> <tr> <td>Q30 years</td> <td>12.3</td> </tr> <tr> <td>Q100 years</td> <td>17.3</td> </tr> </table>			Return Period (years)	100	Soil	0.400	Area (ha)	1.593	Urban	0.000	SAAR (mm)	700	Region Number	Region 6	QBAR Rural	5.4	QBAR Urban	5.4	Q100 years	17.3	Q1 year	4.6	Q30 years	12.3	Q100 years	17.3
Return Period (years)	100	Soil	0.400																							
Area (ha)	1.593	Urban	0.000																							
SAAR (mm)	700	Region Number	Region 6																							
QBAR Rural	5.4																									
QBAR Urban	5.4																									
Q100 years	17.3																									
Q1 year	4.6																									
Q30 years	12.3																									
Q100 years	17.3																									
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GTA Civils Ltd		Page 0
Gloucester House 66a Church Walk Burgess Hill, BN43 6LB	Green Park Village Phase 6 SW Calcs	
Date 25/10/2018 File 180814_7143 SW NET.MDX	Designed by MCR Checked by	
XP Solutions	Network 2018.1	

STORM SEWER DESIGN by the Modified Rational Method

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	22.378	0.112	199.8	0.129	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.001	34.362	0.137	250.1	0.129	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	21.912	0.088	250.1	0.030	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	25.517	0.170	150.1	0.046	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.000	28.498	0.114	250.0	0.149	5.00	0.0	0.600	o	300	Pipe/Conduit	
2.001	15.446	0.062	249.1	0.149	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.002	30.340	0.121	250.7	0.116	0.00	0.0	0.600	o	375	Pipe/Conduit	

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.34	38.938	0.129	0.0	0.0	0.0	1.11	78.4	17.5
1.001	50.00	5.92	38.826	0.258	0.0	0.0	0.0	0.99	70.0	34.9
1.002	50.00	6.28	38.689	0.288	0.0	0.0	0.0	0.99	69.9	39.0
1.003	50.00	6.57	38.601	0.334	0.0	0.0	0.0	1.48	163.1	45.2
2.000	50.00	5.48	38.796	0.149	0.0	0.0	0.0	0.99	70.0	20.2
2.001	50.00	5.70	38.682	0.298	0.0	0.0	0.0	1.14	126.3	40.4
2.002	50.00	6.15	38.621	0.414	0.0	0.0	0.0	1.14	125.9	56.1

GTA Civils Ltd		Page 1
Gloucester House 66a Church Walk Burgess Hill, BN43 6LB	Green Park Village Phase 6 SW Calcs	
Date 25/10/2018 File 180814_7143 SW NET.MDX	Designed by MCR Checked by	
XP Solutions	Network 2018.1	

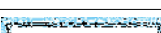
STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Surface Network 1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
3.000	16.815	0.067	251.0	0.135	5.00	0.0	0.600	o	300	Pipe/Conduit	
3.001	14.400	0.059	244.1	0.135	0.00	0.0	0.600	o	375	Pipe/Conduit	
3.002	27.146	0.111	244.6	0.135	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.004	40.541	0.094	431.3	0.000	0.00	0.0	0.600	oo	375	Double Pipe	
1.005	28.953	0.097	298.5	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.006	22.675	0.076	298.4	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.007	16.011	0.053	302.1	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
3.000	50.00	5.28	38.668	0.135	0.0	0.0	0.0	0.99	69.8	18.3
3.001	50.00	5.49	38.601	0.270	0.0	0.0	0.0	1.16	127.6	36.6
3.002	50.00	5.88	38.542	0.405	0.0	0.0	0.0	1.15	127.5	54.8
1.004	50.00	7.35	38.431	1.153	0.0	0.0	0.0	0.87	191.3	156.1
1.005	50.00	7.73	38.337	1.153	0.0	0.0	0.0	1.29	279.5	156.1
1.006	50.00	8.02	38.240	1.153	0.0	0.0	0.0	1.29	279.6	156.1
1.007	50.00	8.23	38.165	1.153	0.0	0.0	0.0	1.28	277.8	156.1

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STORM SEWER DESIGN by the Modified Rational Method

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
4.000	50.966	0.340	149.9	0.124	5.00	0.0	0.600	o	300	Pipe/Conduit	🚧
4.001	14.888	0.300	49.6	0.094	0.00	0.0	0.600	o	300	Pipe/Conduit	🚧
4.002	22.620	0.090	251.3	0.142	0.00	0.0	0.600	o	300	Pipe/Conduit	🚧
4.003	15.682	0.052	301.6	0.080	0.00	0.0	0.600	o	300	Pipe/Conduit	🚧
4.004	27.381	0.091	300.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	🚧
4.005	42.205	0.141	299.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	🚧
1.008	7.793	0.031	251.4	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	🚧

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
4.000	50.00	5.66	39.183	0.124	0.0	0.0	0.0	1.28	90.6	16.8
4.001	50.00	5.77	38.843	0.218	0.0	0.0	0.0	2.24	158.1	29.5
4.002	50.00	6.16	38.543	0.360	0.0	0.0	0.0	0.99	69.8	48.7
4.003	50.00	6.45	38.396	0.440	0.0	0.0	0.0	0.90	63.6	59.6
4.004	50.00	6.95	38.343	0.440	0.0	0.0	0.0	0.90	63.7	59.6
4.005	50.00	7.73	38.252	0.440	0.0	0.0	0.0	0.90	63.9	59.6
1.008	50.00	8.32	38.111	1.593	0.0	0.0	0.0	1.41	304.8	215.7

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Online Controls for Surface Network 1

Hydro-Brake® Optimum Manhole: S18, DS/PN: 1.008, Volume (m³): 9.4

Unit Reference	MD-SHE-0093-4700-1639-4700	Sump Available	Yes
Design Head (m)	1.639	Diameter (mm)	93
Design Flow (l/s)	4.7	Invert Level (m)	38.111
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	150
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points			Control Points		
	Head (m)	Flow (l/s)		Head (m)	Flow (l/s)
Design Point (Calculated)	1.639	4.7	Kick-Flo®	0.830	3.4
Flush-Flo™	0.407	4.3	Mean Flow over Head Range	-	3.9

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.0	0.600	4.2	1.600	4.6	2.600	5.8	5.000	7.9	7.500	9.6
0.200	3.9	0.800	3.6	1.800	4.9	3.000	6.2	5.500	8.3	8.000	9.9
0.300	4.2	1.000	3.7	2.000	5.2	3.500	6.7	6.000	8.6	8.500	10.2
0.400	4.3	1.200	4.1	2.200	5.4	4.000	7.1	6.500	9.0	9.000	10.5
0.500	4.3	1.400	4.4	2.400	5.6	4.500	7.5	7.000	9.3	9.500	10.8

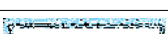
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Storage Structures for Surface Network 1

Cellular Storage Manhole: S18, DS/PN: 1.008

Invert Level (m) 38.150 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	720.0	720.0	1.600	720.0	905.6	1.700	0.0	905.6

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

Simulation Criteria

Areal Reduction Factor	1.000	Manhole Headloss Coeff (Global)	0.500	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Foul Sewage per hectare (l/s)	0.000	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Additional Flow - % of Total Flow	0.000	Flow per Person per Day (l/per/day)	0.000

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	1	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	Site Location	GB 469496	170207	Cv (Summer)	0.740
FEH Rainfall Version	2013	Data Type		Point	Cv (Winter)	0.840

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

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Profile(s)	Summer and Winter
Duration(s) (mins)	120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Infil. Flow (l/s)	Maximum Vol (m³)	Discharge Vol (m³)	Pipe	Status
											Flow (l/s)	
1.000	S8	120 minute 2 year Summer I+0%	40.200	39.010	-0.228	0.000	0.13		0.075	17.569	9.0	OK
1.001	S7	120 minute 2 year Summer I+0%	40.200	38.933	-0.193	0.000	0.27		0.288	35.139	17.6	OK

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

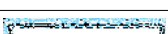
PN	US/MH Name	Event	US/CL (m)	Water Surcharged			Flow / Cap.	Infil. Flow (l/s)	Maximum Vol (m³)	Discharge Vol (m³)	Pipe	
				Level (m)	Depth (m)	Flooded Volume (m³)					Flow (l/s)	Status
1.002	S6	120 minute 2 year Summer I+0%	40.108	38.805	-0.184	0.000	0.32		0.449	39.221	19.6	OK
1.003	S5	120 minute 2 year Summer I+0%	40.323	38.701	-0.275	0.000	0.16		0.400	45.487	22.5	OK
2.000	S9	120 minute 2 year Summer I+0%	40.200	38.877	-0.219	0.000	0.16		0.172	20.292	10.4	OK
2.001	S10	120 minute 2 year Summer I+0%	40.200	38.797	-0.260	0.000	0.20		0.430	40.585	20.4	OK
2.002	S3	120 minute 2 year Summer I+0%	40.293	38.748	-0.248	0.000	0.25		0.463	56.374	28.0	OK
3.000	S11	120 minute 2 year Summer I+0%	40.198	38.755	-0.213	0.000	0.16		0.093	18.386	9.4	OK
3.001	S12	120 minute 2 year Summer I+0%	40.197	38.714	-0.262	0.000	0.18		0.375	36.772	18.4	OK
3.002	S13	120 minute 2 year Summer I+0%	40.195	38.675	-0.242	0.000	0.24		0.466	55.142	27.2	OK
1.004	S4	120 minute 2 year Summer I+0%	40.208	38.613	-0.193	0.000	0.44		2.082	157.034	76.5	OK
1.005	S22	600 minute 2 year Winter I+0%	40.100	38.551	-0.311	0.000	0.09		3.931	288.441	20.0	OK
1.006	S23	600 minute 2 year Winter I+0%	40.100	38.550	-0.215	0.000	0.09		3.360	287.901	19.7	OK
1.007	S24	600 minute 2 year Winter I+0%	40.100	38.549	-0.141	0.000	0.09		3.664	286.685	19.3	OK
4.000	S20	120 minute 2 year Summer I+0%	40.381	39.247	-0.236	0.000	0.10		0.066	16.889	8.6	OK
4.001	S21	120 minute 2 year Summer I+0%	40.462	38.910	-0.233	0.000	0.11		0.148	29.691	15.0	OK
4.002	S14	120 minute 2 year Summer I+0%	40.270	38.674	-0.169	0.000	0.40		0.224	49.020	24.5	OK
4.003	S15	120 minute 2 year Summer I+0%	40.000	38.556	-0.140	0.000	0.55		0.425	59.919	29.7	OK
4.004	S16	600 minute 2 year Winter I+0%	40.000	38.551	-0.092	0.000	0.13		0.834	110.094	7.7	OK
4.005	S17	600 minute 2 year Winter I+0%	40.000	38.550	-0.002	0.000	0.12		1.934	109.768	7.4	OK
1.008	S18	600 minute 2 year Winter I+0%	40.000	38.548	-0.088	0.000	0.02	0.0	278.213	257.907	4.3	OK

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Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coefficient 0.800																																																																		
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Climate Change (%) 0, 0, 40																																																																		
<table><tr><th colspan="4"></th><th colspan="5">Water Surcharged Flooded</th><th colspan="5">Pipe</th></tr><tr><th>PN</th><th>US/MH Name</th><th>Event</th><th>US/CL (m)</th><th>Level (m)</th><th>Depth (m)</th><th>Volume (m³)</th><th>Flow / Cap.</th><th>Infil. Flow (l/s)</th><th>Maximum Vol (m³)</th><th>Discharge Vol (m³)</th><th>Flow (l/s)</th><th>Status</th></tr><tr><td>1.000</td><td>S8</td><td>120 minute 30 year Summer I+0%</td><td>40.200</td><td>39.047</td><td>-0.191</td><td>0.000</td><td>0.27</td><td></td><td>0.118</td><td>36.450</td><td>18.7</td><td>OK</td></tr><tr><td>1.001</td><td>S7</td><td>120 minute 30 year Summer I+0%</td><td>40.200</td><td>38.991</td><td>-0.135</td><td>0.000</td><td>0.58</td><td></td><td>0.674</td><td>72.899</td><td>37.3</td><td>OK</td></tr></table>																		Water Surcharged Flooded					Pipe					PN	US/MH Name	Event	US/CL (m)	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Infil. Flow (l/s)	Maximum Vol (m³)	Discharge Vol (m³)	Flow (l/s)	Status	1.000	S8	120 minute 30 year Summer I+0%	40.200	39.047	-0.191	0.000	0.27		0.118	36.450	18.7	OK	1.001	S7	120 minute 30 year Summer I+0%	40.200	38.991	-0.135	0.000	0.58		0.674	72.899	37.3	OK
				Water Surcharged Flooded					Pipe																																																									
PN	US/MH Name	Event	US/CL (m)	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Infil. Flow (l/s)	Maximum Vol (m³)	Discharge Vol (m³)	Flow (l/s)	Status																																																						
1.000	S8	120 minute 30 year Summer I+0%	40.200	39.047	-0.191	0.000	0.27		0.118	36.450	18.7	OK																																																						
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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

										Water	Surcharged	Flooded					Pipe
PN	US/MH						US/CL	Level	Depth	Volume	Flow /	Infil.	Maximum	Discharge	Flow	Status	
	Name	Event				(m)	(m)	(m)	(m³)	Cap.	Flow (l/s)	Vol (m³)	Vol (m³)	(l/s)			
1.002	S6	600	minute	30	year	Winter	I+0%	40.108	38.937	-0.051	0.000	0.15	1.735	128.861	9.1	OK	
1.003	S5	600	minute	30	year	Winter	I+0%	40.323	38.936	-0.040	0.000	0.07	2.090	148.679	10.5	OK	
2.000	S9	600	minute	30	year	Winter	I+0%	40.200	38.938	-0.158	0.000	0.07	0.308	66.756	4.7	OK	
2.001	S10	600	minute	30	year	Winter	I+0%	40.200	38.937	-0.120	0.000	0.09	1.627	133.234	9.4	OK	
2.002	S3	600	minute	30	year	Winter	I+0%	40.293	38.937	-0.059	0.000	0.12	1.649	184.560	13.0	OK	
3.000	S11	600	minute	30	year	Winter	I+0%	40.198	38.937	-0.031	0.000	0.07	0.299	60.231	4.2	OK	
3.001	S12	600	minute	30	year	Winter	I+0%	40.197	38.937	-0.039	0.000	0.08	1.521	119.933	8.5	OK	
3.002	S13	600	minute	30	year	Winter	I+0%	40.195	38.936	0.019	0.000	0.11	1.933	179.078	12.6	SURCHARGED	
1.004	S4	600	minute	30	year	Winter	I+0%	40.208	38.936	0.130	0.000	0.20	9.465	506.661	35.4	SURCHARGED	
1.005	S22	600	minute	30	year	Winter	I+0%	40.100	38.934	0.072	0.000	0.15	9.670	497.696	33.8	SURCHARGED	
1.006	S23	600	minute	30	year	Winter	I+0%	40.100	38.933	0.168	0.000	0.15	7.157	491.467	32.9	SURCHARGED	
1.007	S24	600	minute	30	year	Winter	I+0%	40.100	38.932	0.242	0.000	0.16	5.933	486.284	32.1	SURCHARGED	
4.000	S20	120	minute	30	year	Summer	I+0%	40.381	39.276	-0.207	0.000	0.21	0.100	35.034	17.9	OK	
4.001	S21	120	minute	30	year	Summer	I+0%	40.462	38.942	-0.201	0.000	0.24	0.224	61.607	31.7	OK	
4.002	S14	600	minute	30	year	Winter	I+0%	40.270	38.937	0.094	0.000	0.18	1.177	160.475	11.2	SURCHARGED	
4.003	S15	600	minute	30	year	Winter	I+0%	40.000	38.936	0.240	0.000	0.25	2.119	194.277	13.4	SURCHARGED	
4.004	S16	600	minute	30	year	Winter	I+0%	40.000	38.935	0.292	0.000	0.23	1.687	192.833	13.1	SURCHARGED	
4.005	S17	600	minute	30	year	Winter	I+0%	40.000	38.933	0.381	0.000	0.22	2.615	190.433	12.9	SURCHARGED	
1.008	S18	600	minute	30	year	Winter	I+0%	40.000	38.932	0.296	0.000	0.02	0.0	542.060	263.594	4.3	SURCHARGED

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

Simulation Criteria

Areal Reduction Factor	1.000	Manhole Headloss Coeff (Global)	0.500	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Foul Sewage per hectare (l/s)	0.000	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Additional Flow - % of Total Flow	0.000	Flow per Person per Day (l/per/day)	0.000

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	1	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	Site Location	GB 469496	170207	Cv (Summer)	0.740
FEH Rainfall Version	2013	Data Type		Point	Cv (Winter)	0.840

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

```

Profile(s)	Summer and Winter
Duration(s) (mins)	120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

						Water		Surcharged		Flooded				Pipe	
	US/MH					US/CL	Level	Depth	Volume	Flow /	Infil.	Maximum	Discharge	Flow	
PN	Name		Event			(m)	(m)	(m)	(m³)	Cap.	Flow (l/s)	Vol (m³)	Vol (m³)	(l/s)	Status
1.000	S8	960 minute	100 year	Winter	I+40%	40.200	39.646	0.408	0.000	0.07		0.795	106.778	4.7	SURCHARGED
1.001	S7	960 minute	100 year	Winter	I+40%	40.200	39.645	0.519	0.000	0.14		2.418	211.728	9.3	SURCHARGED

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

										Water	Surcharged	Flooded					Pipe
US/MH								US/CL	Level	Depth	Volume	Flow /	Infil.	Maximum	Discharge	Flow	
PN	Name	Event						(m)	(m)	(m)	(m³)	Cap.	Flow (l/s)	Vol (m³)	Vol (m³)	(l/s)	Status
1.002	S6	960	minute	100	year	Winter	I+40%	40.108	39.644	0.655	0.000	0.17		3.699	233.315	10.2	SURCHARGED
1.003	S5	960	minute	100	year	Winter	I+40%	40.323	39.643	0.667	0.000	0.08		3.781	268.396	11.6	SURCHARGED
2.000	S9	960	minute	100	year	Winter	I+40%	40.200	39.644	0.548	0.000	0.08		1.897	122.362	5.3	SURCHARGED
2.001	S10	960	minute	100	year	Winter	I+40%	40.200	39.644	0.587	0.000	0.10		3.283	242.941	10.6	SURCHARGED
2.002	S3	960	minute	100	year	Winter	I+40%	40.293	39.643	0.647	0.000	0.13		3.014	336.426	14.5	SURCHARGED
3.000	S11	960	minute	100	year	Winter	I+40%	40.198	39.644	0.676	0.000	0.08		1.098	111.020	4.9	SURCHARGED
3.001	S12	960	minute	100	year	Winter	I+40%	40.197	39.643	0.667	0.000	0.10		2.583	220.609	9.7	SURCHARGED
3.002	S13	960	minute	100	year	Winter	I+40%	40.195	39.643	0.726	0.000	0.13		3.010	329.604	14.4	SURCHARGED
1.004	S4	960	minute	100	year	Winter	I+40%	40.208	39.642	0.836	0.000	0.23		10.818	924.291	39.4	SURCHARGED
1.005	S22	960	minute	100	year	Winter	I+40%	40.100	39.640	0.778	0.000	0.17		10.918	913.990	39.2	SURCHARGED
1.006	S23	960	minute	100	year	Winter	I+40%	40.100	39.639	0.874	0.000	0.17		8.407	906.189	38.8	SURCHARGED
1.007	S24	960	minute	100	year	Winter	I+40%	40.100	39.638	0.948	0.000	0.19		7.180	899.975	38.8	SURCHARGED
4.000	S20	960	minute	100	year	Winter	I+40%	40.381	39.645	0.162	0.000	0.05		0.517	103.479	4.6	SURCHARGED
4.001	S21	960	minute	100	year	Winter	I+40%	40.462	39.645	0.502	0.000	0.06		4.419	178.217	7.8	SURCHARGED
4.002	S14	960	minute	100	year	Winter	I+40%	40.270	39.644	0.801	0.000	0.20		2.207	293.767	12.5	SURCHARGED
4.003	S15	960	minute	100	year	Winter	I+40%	40.000	39.642	0.946	0.000	0.28		2.918	357.149	15.3	SURCHARGED
4.004	S16	960	minute	100	year	Winter	I+40%	40.000	39.641	0.998	0.000	0.26		2.486	355.068	15.2	SURCHARGED
4.005	S17	960	minute	100	year	Winter	I+40%	40.000	39.639	1.087	0.000	0.25		3.414	352.024	15.1	SURCHARGED
1.008	S18	960	minute	100	year	Winter	I+40%	40.000	39.637	1.001	0.000	0.02	0.0	1026.013	458.647	4.5	SURCHARGED