

**NOTES**

These drawings have been produced with reference to the CDM Regulations 2015. Please note that these are pre-construction phase drawings and should be subject to further design risk management as required in accordance with Regulation 9

**NOTES**

1. Site layout provided by ACME (drawing ref. 239-ACME-PLA-S00-0013 ILLUSTRATIVE MASTERPLAN - GROUND FLOOR) received 23/05/2022.
2. The First Public Drain overflow culvert is under riparian ownership.
3. Ordinary watercourse consent from Cambridgeshire County Council will be required for the First Public Drain overflow culvert diversion.
4. Balancing pond is sized to attenuate runoff from the adjacent temporary logistics area North of Cowley Road in addition to the pumped flow from Catchment Area 1 and 5.
5. Green / brown roofs to be provided on structures S4, S6, S7, S8 and S9/S10.
6. Existing rain gardens for highway drainage adjacent to Cowley Road to be retained.
7. Tree pits to be provided with 'Arborcell' water attenuation within the sub-base.

**KEY**

- Catchment Area 1
- Catchment Area 2
- Catchment Area 3
- Catchment Area 4
- Catchment Area 5
- Catchment Area 6
- Catchment Area 7
- Proposed Surface Water Drainage
- Proposed Attenuation Tank
- Proposed FPD Diversion
- FPD 5m Easement
- Proposed Attenuation Basin
- Proposed Swale
- Existing Surface Water Rising Main to be Abandoned
- Existing Surface Water Rising Main to be Retained
- Proposed Green / Brown Roof Area
- Proposed Rain Gardens
- Red Line Boundary

REV	DATE	REVISION NOTE	BY
P4	27/05/22	Updated to suit revised site layout	JG
P3	30/03/22	Attenuation basin, residential attenuation tanks and rain gardens updated	JG
P2	15/02/22	Updated to suit revised masterplan	DS
P1	28/01/22	Drainage layout amended following masterplan update, attenuation basin revised, FPD easement added, Chesterton Square attenuation tank revised and green / brown roof area added	DS
P0	07/12/21	First Issue	DS

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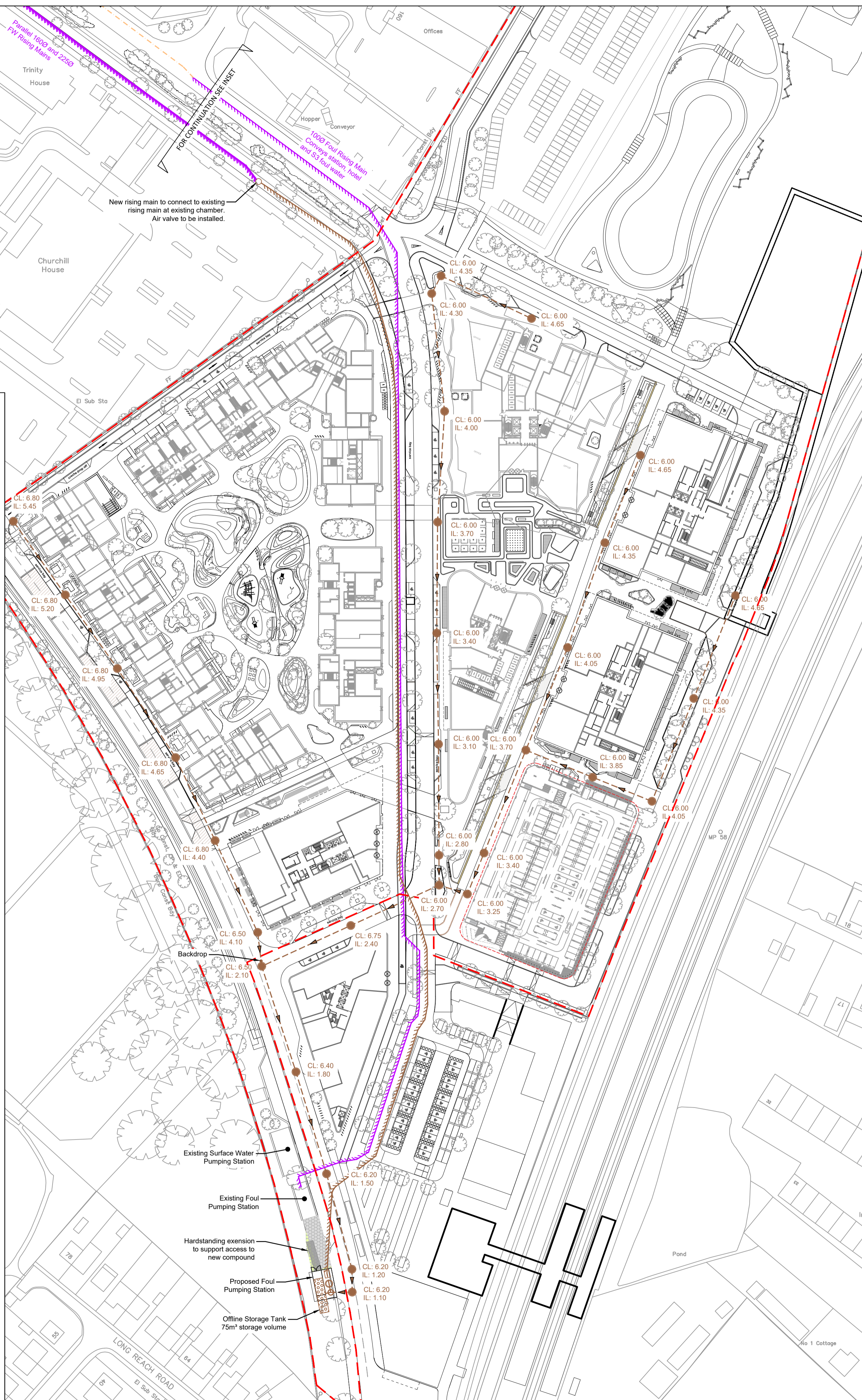
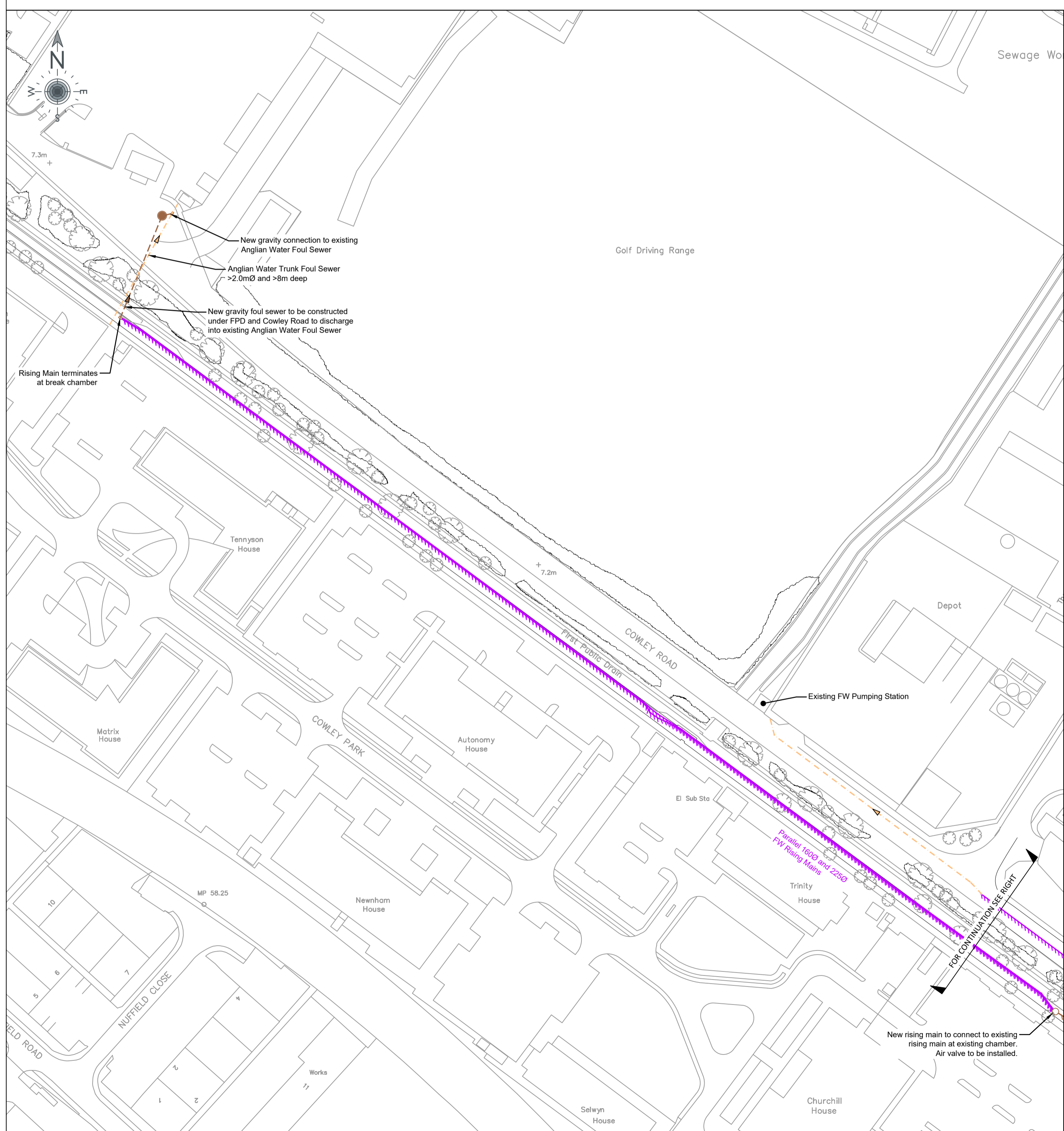
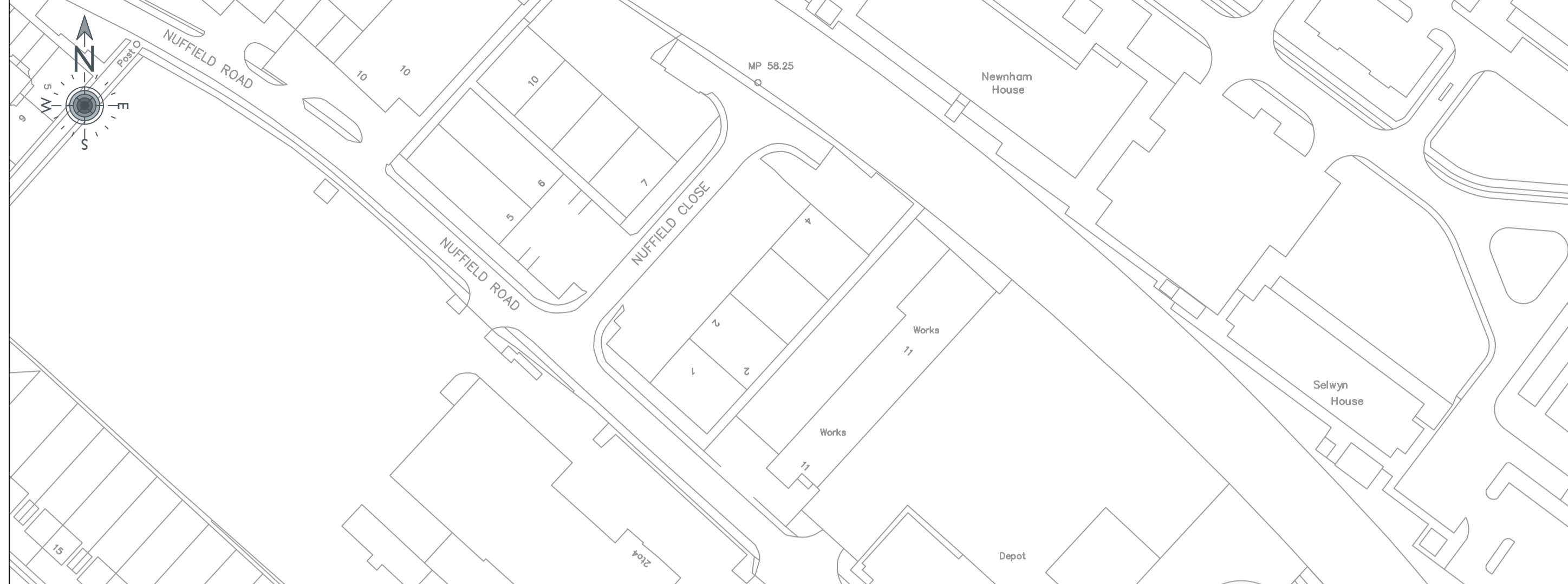
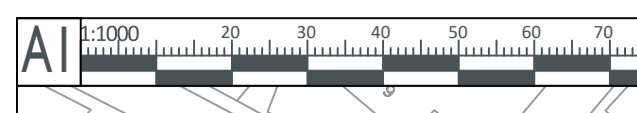
**CLIENT**  
 Brookgate Ltd

**PROJECT**  
 Cambridge North

**DRAWING TITLE**  
 Proposed Drainage Strategy - Basin

**DRAWING ISSUE STATUS**  
**INFORMATION**  
 PJA JOB No. SUB-CODE  
**05425 - C - 1003 - P4**  
 Revision Letter: P - Prelim / A - Approval / T - Tender / C - Construction  
 BIM DRAWING REFERENCE

SCALE	DRAWN	REVIEWED	DATE
AI@1:1000	DS	MC	07/12/2021



**NOTES**

- These drawings have been produced with reference to the CDM Regulations 2015. Please note that these are pre-construction phase drawings and should be subject to further design risk management as required in accordance with Regulation 9.
- All dimensions in metres unless stated otherwise. Cover and Invert levels in metres above ordnance datum (mAOD).
- Site layout provided by ACME (drawing ref. 239-ACME-PLA-500-0013 ILLUSTRATIVE MASTERPLAN - GROUND FLOOR) received 23/05/2022.
- The purpose of this drawing is to show the proposed foul drainage strategy for the Cambridge North development.
- The following utilities information has been considered:
  - Atkins as-built drainage drawings dated April-June 2017
  - Mott MacDonald as-built drainage drawings dated March-April 2021
  - GPR survey data (Survey Solutions ref. 20852UG undertaken 13/02/2018)
  - Multi Utility Trench as-built drawings (prepared by SurvaTec Limited and dated 28/01/2020)
- Proposed foul drainage (gravity and pressurised) to be coordinated with existing and proposed utilities once routes and depths are confirmed.
- Indicative cover and invert levels shown assuming ground levels will be reduced to approx. 6mAOD.

**Key**

- Site Boundary
- Existing Foul Sewer
- Existing Foul Rising Main
- Proposed Foul Chamber
- Proposed Foul Pipe
- Proposed Foul Rising Main

REV	DATE	REVISION NOTE	BY
P3	27/05/22	Updated to suit revised site layout	JG
P2	30/03/22	Foul sewer for residential block added	DS
P1	27/01/22	Updated to suit latest masterplan	JG
P0	14/01/22	First issue	JG

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**Brookgate Ltd**

**Cambridge North**

**Foul Drainage Strategy**

**INFORMATION**

PJA JOB No. SUB-CODE  
**05425 - C - 1011 - P3**

SCALE	DRAWN	REVIEWED	DATE
A1@1:1000	JG	MC	14/01/2022



## Appendix J Microdrainage Surface Water Model Outputs

## Catchment 1

The screenshot shows the 'Quick Storage Estimate' dialog box with the 'Variables' tab selected. The 'Micro Drainage' logo is in the top left. A vertical sidebar on the left contains buttons for 'Variables', 'Results', 'Design', 'Overview 2D', 'Overview 3D', and 'Vt'. The main area is titled 'Variables' and contains the following fields:

FEH Rainfall	Cv (Summer)	0.750
Return Period (years): 100	Cv (Winter)	0.840
Version: 2013	Impemeable Area (ha)	0.713
Catchment: [...]	Maximum Allowable Discharge (l/s)	1.4
Site: GB 547650 260850 TL 47650 60850	Infiltration Coefficient (m/hr)	0.00000
	Safety Factor	2.0
	Climate Change (%)	20

Buttons at the bottom: Analyse, OK, Cancel, Help.

The screenshot shows the 'Quick Storage Estimate' dialog box with the 'Results' tab selected. The 'Micro Drainage' logo is in the top left. A vertical sidebar on the left contains buttons for 'Variables', 'Results', 'Design', 'Overview 2D', 'Overview 3D', and 'Vt'. The main area is titled 'Results' and contains the following text:

**Global Variables require approximate storage of between 568 m<sup>3</sup> and 676 m<sup>3</sup>.**

**These values are estimates only and should not be used for design purposes.**

Buttons at the bottom: Analyse, OK, Cancel, Help.

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Existing Network Details for C3, C4, C7

# - Indicates pipe length does not match coordinates

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
1.000	55.000#	0.225	244.4	0.255	5.00	0.0	0.600	o	375	Pipe/Conduit
1.001	37.026	0.200	185.1	0.900	0.00	0.0	0.600	o	375	Pipe/Conduit
2.000	37.213	0.300	124.0	0.130	5.00	0.0	0.600	o	300	Pipe/Conduit
2.001	45.168	0.325	139.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit
1.002	121.860	0.160	761.6	0.340	0.00	0.0	0.600	o	375	Pipe/Conduit
1.003	22.445	0.220	102.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
1.000	5.725	0.255	0.0	1.15	127.5
1.001	5.500	1.155	0.0	1.33	146.7
2.000	6.000	0.130	0.0	1.41	99.7
2.001	5.700	0.130	0.0	1.33	94.1
1.002	5.300	1.625	0.0	0.65	71.7
1.003	5.140	1.625	0.0	0.99	17.6

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Manhole Schedules for C3, C4, C7

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	Pipe Out		Pipes In			Backdrop (mm)
					PN	Invert Level (m)	Diameter (mm)	PN	Invert Level (m)	
S101	6.500	0.775	Open Manhole	1200	1.000	5.725	375			
S102	6.500	1.000	Open Manhole	1200	1.001	5.500	375	1.000	5.500	375
S103	7.200	1.200	Open Manhole	1200	2.000	6.000	300			
S104	7.200	1.500	Open Manhole	1200	2.001	5.700	300	2.000	5.700	300
S105	6.500	1.200	Open Manhole	1200	1.002	5.300	375	1.001	5.300	375
								2.001	5.375	300
S106	6.500	1.360	Open Manhole	1200	1.003	5.140	150	1.002	5.140	375
FPD	7.000	2.080	Open Manhole	0		OUTFALL		1.003	4.920	150

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S101	547445.102	260890.102	547445.102	260890.102	Required	
S102	547355.822	260888.402	547355.822	260888.402	Required	
S103	547318.715	260861.371	547318.715	260861.371	Required	
S104	547297.728	260892.101	547297.728	260892.101	Required	
S105	547334.337	260918.557	547334.337	260918.557	Required	
S106	547433.423	260989.493	547433.423	260989.493	Required	
FPD	547452.676	261001.029			No Entry	

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PIPELINE SCHEDULES for C3, C4, C7

Upstream Manhole

# - Indicates pipe length does not match coordinates

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	375	S101	6.500	5.725	0.400	Open Manhole	1200
1.001	o	375	S102	6.500	5.500	0.625	Open Manhole	1200
2.000	o	300	S103	7.200	6.000	0.900	Open Manhole	1200
2.001	o	300	S104	7.200	5.700	1.200	Open Manhole	1200
1.002	o	375	S105	6.500	5.300	0.825	Open Manhole	1200
1.003	o	150	S106	6.500	5.140	1.210	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	55.000#	244.4	S102	6.500	5.500	0.625	Open Manhole	1200
1.001	37.026	185.1	S105	6.500	5.300	0.825	Open Manhole	1200
2.000	37.213	124.0	S104	7.200	5.700	1.200	Open Manhole	1200
2.001	45.168	139.0	S105	6.500	5.375	0.825	Open Manhole	1200
1.002	121.860	761.6	S106	6.500	5.140	0.985	Open Manhole	1200
1.003	22.445	102.0	FPD	7.000	4.920	1.930	Open Manhole	0

Free Flowing Outfall Details for C3, C4, C7

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.003	FPD	7.000	4.920	4.500	0	0

Simulation Criteria for C3, C4, C7

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m <sup>3</sup> /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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 2    Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Summer Storms	Yes
Return Period (years)	30	Winter Storms	No
FEH Rainfall Version	2013	Cv (Summer)	0.750
Site Location GB 547650 260850 TL 47650 60850		Cv (Winter)	0.840
Data Type	Catchment	Storm Duration (mins)	30

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Online Controls for C3, C4, C7

Hydro-Brake® Optimum Manhole: S106, DS/PN: 1.003, Volume (m³): 14.9

Unit Reference MD-SHE-0080-3200-1360-3200  
 Design Head (m) 1.360  
 Design Flow (l/s) 3.2  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 80  
 Invert Level (m) 5.140  
 Minimum Outlet Pipe Diameter (mm) 100  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.360	3.2	Kick-Flo®	0.711	2.4
Flush-Flo™	0.350	3.0	Mean Flow over Head Range	-	2.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.3	0.800	2.5	2.000	3.8	4.000	5.3	7.000	6.9
0.200	2.8	1.000	2.8	2.200	4.0	4.500	5.6	7.500	7.1
0.300	2.9	1.200	3.0	2.400	4.2	5.000	5.9	8.000	7.3
0.400	2.9	1.400	3.2	2.600	4.3	5.500	6.1	8.500	7.5
0.500	2.9	1.600	3.4	3.000	4.6	6.000	6.4	9.000	7.7
0.600	2.7	1.800	3.6	3.500	5.0	6.500	6.6	9.500	7.9



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Storage Structures for C3, C4, C7

Cellular Storage Manhole: S102, DS/PN: 1.001

Invert Level (m) 5.500 Safety Factor 2.0  
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	970.0	0.0	0.600	970.0	0.0	0.601	0.0	0.0

Cellular Storage Manhole: S106, DS/PN: 1.003

Invert Level (m) 5.200 Safety Factor 2.0  
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	1140.0	0.0	0.800	1140.0	0.0	0.801	0.0	0.0

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for C3, C4, C7

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000  
 Hot Start (mins) 0 MADD Factor \* 10m³/ha Storage 2.000  
 Hot Start Level (mm) 0 Inlet Coefficient 0.800  
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000  
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0  
 Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Catchment  
 FEH Rainfall Version 2013 Cv (Summer) 0.750  
 Site Location GB 547650 260850 TL 47650 60850 Cv (Winter) 0.840

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

Profile(s) Summer and Winter  
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440, 2880  
 Return Period(s) (years) 2, 30, 100  
 Climate Change (%) 0, 0, 20

PN	US/MH Name	Duration (mins)	US/CL (m)	Water			Surcharged		Flooded		Pipe Flow (l/s)	Status
				Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)				
1.000	S101	15	6.500	5.882	-0.218	0.000	0.36			42.6	OK	
1.001	S102	120	6.500	5.621	-0.254	0.000	0.23			30.4	OK	
2.000	S103	15	7.200	6.099	-0.201	0.000	0.23			21.5	OK	
2.001	S104	15	7.200	5.801	-0.199	0.000	0.24			21.3	OK	
1.002	S105	15	6.500	5.583	-0.092	0.000	0.79			55.0	OK	
1.003	S106	480	6.500	5.461	0.171	0.000	0.18			2.9	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for C3, C4, C7

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000  
 Hot Start (mins) 0 MADD Factor \* 10m³/ha Storage 2.000  
 Hot Start Level (mm) 0 Inlet Coefficient 0.800  
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000  
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0  
 Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Catchment  
 FEH Rainfall Version 2013 Cv (Summer) 0.750  
 Site Location GB 547650 260850 TL 47650 60850 Cv (Winter) 0.840

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

Profile(s) Summer and Winter  
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440, 2880  
 Return Period(s) (years) 2, 30, 100  
 Climate Change (%) 0, 0, 20

PN	US/MH Name	Duration (mins)	US/CL (m)	Water			Surcharged		Flooded		Pipe Flow (l/s)	Status
				Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)				
1.000	S101	15	6.500	5.995	-0.105	0.000	0.83	98.5		OK		
1.001	S102	120	6.500	5.787	-0.088	0.000	0.44	58.6		OK		
2.000	S103	15	7.200	6.162	-0.138	0.000	0.55	50.9		OK		
2.001	S104	15	7.200	6.060	0.060	0.000	0.58	51.4		SURCHARGED		
1.002	S105	15	6.500	5.953	0.278	0.000	1.41	98.0		SURCHARGED		
1.003	S106	960	6.500	5.702	0.412	0.000	0.18	2.9		SURCHARGED		

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for C3, C4, C7

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000  
 Hot Start (mins) 0 MADD Factor \* 10m³/ha Storage 2.000  
 Hot Start Level (mm) 0 Inlet Coefficient 0.800  
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000  
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0  
 Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Catchment  
 FEH Rainfall Version 2013 Cv (Summer) 0.750  
 Site Location GB 547650 260850 TL 47650 60850 Cv (Winter) 0.840

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

Profile(s) Summer and Winter  
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440, 2880  
 Return Period(s) (years) 2, 30, 100  
 Climate Change (%) 0, 0, 20

PN	US/MH Name	Duration (mins)	US/CL (m)	Water			Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
				Level (m)	Depth (m)	Volume (m³)				
1.000	S101	15	6.500	6.261	0.161	0.000	1.28	151.8	FLOOD RISK	
1.001	S102	120	6.500	6.016	0.141	0.000	0.58	77.4	SURCHARGED	
2.000	S103	15	7.200	6.576	0.276	0.000	0.86	79.0	SURCHARGED	
2.001	S104	15	7.200	6.358	0.358	0.000	0.92	81.3	SURCHARGED	
1.002	S105	15	6.500	6.123	0.448	0.000	1.67	115.9	SURCHARGED	
1.003	S106	960	6.500	5.981	0.691	0.000	0.18	2.9	SURCHARGED	

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Date 23/05/2022 10:04

Designed by Joe Garlick

File 05425 - Initial SW Network (S5-...

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Existing Network Details for C3, C4, C7

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type
1.000	11.189	0.050	223.8	0.584	5.00	0.0	0.600		o	375	Pipe/Conduit
1.001	108.847	0.025	4353.9	0.000	0.00	0.0		0.035	\	-1	Pipe/Conduit
1.002	39.925	0.075	532.3	0.000	0.00	0.0		0.035	\	-1	Pipe/Conduit
2.000	36.091	0.150	240.6	1.154	5.00	0.0	0.600		o	375	Pipe/Conduit
1.003	61.223	0.025	2448.9	0.000	0.00	0.0		0.035	\	-1	Pipe/Conduit
1.004	15.766	0.025	630.6	0.000	0.00	0.0	0.600		o	375	Pipe/Conduit
1.005	37.018	0.250	148.1	0.000	0.00	0.0	0.600		o	150	Pipe/Conduit
1.006	3.845	0.025	153.8	0.000	0.00	0.0	0.600		o	150	Pipe/Conduit
1.007	11.921	0.025	476.8	0.000	0.00	0.0	0.600		o	900	Pipe/Conduit
1.008	45.698	0.080	571.2	0.000	0.00	0.0	0.600		o	900	Pipe/Conduit
3.000	45.110	0.150	300.7	0.817	5.00	0.0	0.600		o	450	Pipe/Conduit
3.001	5.364	0.041	130.8	0.000	0.00	0.0	0.600		o	150	Pipe/Conduit
1.009	31.680	0.059	536.9	0.000	0.00	0.0	0.600		[]	-2	Pipe/Conduit

Network Results Table

PN	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Vel (m/s)	Cap (l/s)
1.000	5.100	0.584	0.0	1.21	133.3
1.001	5.050	0.584	0.0	0.34	1470.1
1.002	5.025	0.584	0.0	0.97	4204.3
2.000	5.100	1.154	0.0	1.16	128.5
1.003	4.950	1.738	0.0	0.45	1960.2
1.004	4.925	1.738	0.0	0.71	78.9
1.005	4.900	1.738	0.0	0.82	14.6
1.006	4.650	1.738	0.0	0.81	14.3
1.007	4.425	1.738	0.0	1.43	908.5
1.008	4.400	1.738	0.0	1.30	829.4
3.000	4.500	0.817	0.0	1.17	185.6
3.001	4.350	0.817	0.0	0.88	15.5
1.009	4.309	2.555	0.0	1.63	2516.0

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Manhole Schedules for C3, C4, C7

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S5	6.500	1.400	Open Manhole	1200	1.000	5.100	375				
SwaleA	6.250	1.200	Open Manhole	1	1.001	5.050	-1	1.000	5.050	375	
SwaleB	6.200	1.175	Open Manhole	1	1.002	5.025	-1	1.001	5.025	-1	
S8S9S10	6.500	1.400	Open Manhole	1200	2.000	5.100	375				
SwaleC	6.150	1.200	Open Manhole	1	1.003	4.950	-1	1.002	4.950	-1	
								2.000	4.950	375	
SwaleEnd	6.125	1.200	Open Manhole	1	1.004	4.925	375	1.003	4.925	-1	
FlowControl1	6.500	1.600	Open Manhole	1200	1.005	4.900	150	1.004	4.900	375	
Outfall	6.500	1.850	Open Manhole	1200	1.006	4.650	150	1.005	4.650	150	
FPDDiv1	6.500	2.075	Open Manhole	1800	1.007	4.425	900	1.006	4.625	150	
FPDDiv2	6.500	2.100	Open Manhole	1800	1.008	4.400	900	1.007	4.400	900	
S6S7	6.500	2.000	Open Manhole	1200	3.000	4.500	450				
FlowControl2	6.500	2.150	Open Manhole	1200	3.001	4.350	150	3.000	4.350	450	
FPD	6.500	2.191	Open Manhole	1	1.009	4.309	-2	1.008	4.320	900	
								3.001	4.309	150	
FPD	7.000	2.750	Open Manhole	0		OUTFALL		1.009	4.250	-2	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S5	547488.260	260746.143	547488.260	260746.143	Required	
SwaleA	547478.608	260751.803	547478.608	260751.803	Required	
SwaleB	547519.471	260852.688	547519.471	260852.688	Required	
S8S9S10	547496.771	260894.067	547496.771	260894.067	Required	
SwaleC	547532.672	260890.367	547532.672	260890.367	Required	
SwaleEnd	547555.721	260947.086	547555.721	260947.086	Required	
FlowControl1	547571.045	260950.791	547571.045	260950.791	Required	
Outfall	547605.029	260936.114	547605.029	260936.114	Required	
FPDDiv1	547607.800	260938.779	547607.800	260938.779	Required	
FPDDiv2	547618.466	260933.454	547618.466	260933.454	Required	

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Manhole Schedules for C3, C4, C7

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S6S7	547586.587	260843.244	547586.587	260843.244	Required	
FlowControl12	547603.396	260885.080	547603.396	260885.080	Required	
FPD	547606.718	260889.292	547606.718	260889.292	Required	
FPD	547630.987	260868.930			No Entry	

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PIPELINE SCHEDULES for C3, C4, C7

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	375	S5	6.500	5.100	1.025	Open Manhole	1200
1.001	\	-1	SwaleA	6.250	5.050	0.000	Open Manhole	1
1.002	\	-1	SwaleB	6.200	5.025	-0.025	Open Manhole	1
2.000	o	375	S8S9S10	6.500	5.100	1.025	Open Manhole	1200
1.003	\	-1	SwaleC	6.150	4.950	0.000	Open Manhole	1
1.004	o	375	SwaleEnd	6.125	4.925	0.825	Open Manhole	1
1.005	o	150	FlowControl1	6.500	4.900	1.450	Open Manhole	1200
1.006	o	150	Outfall	6.500	4.650	1.700	Open Manhole	1200
1.007	o	900	FPDDiv1	6.500	4.425	1.175	Open Manhole	1800
1.008	o	900	FPDDiv2	6.500	4.400	1.200	Open Manhole	1800
3.000	o	450	S6S7	6.500	4.500	1.550	Open Manhole	1200
3.001	o	150	FlowControl2	6.500	4.350	2.000	Open Manhole	1200
1.009	[]	-2	FPD	6.500	4.309	1.091	Open Manhole	1

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	11.189	223.8	SwaleA	6.250	5.050	0.825	Open Manhole	1
1.001	108.847	4353.9	SwaleB	6.200	5.025	-0.025	Open Manhole	1
1.002	39.925	532.3	SwaleC	6.150	4.950	0.000	Open Manhole	1
2.000	36.091	240.6	SwaleC	6.150	4.950	0.825	Open Manhole	1
1.003	61.223	2448.9	SwaleEnd	6.125	4.925	0.000	Open Manhole	1
1.004	15.766	630.6	FlowControl1	6.500	4.900	1.225	Open Manhole	1200
1.005	37.018	148.1	Outfall	6.500	4.650	1.700	Open Manhole	1200
1.006	3.845	153.8	FPDDiv1	6.500	4.625	1.725	Open Manhole	1800
1.007	11.921	476.8	FPDDiv2	6.500	4.400	1.200	Open Manhole	1800
1.008	45.698	571.2	FPD	6.500	4.320	1.280	Open Manhole	1
3.000	45.110	300.7	FlowControl2	6.500	4.350	1.700	Open Manhole	1200
3.001	5.364	130.8	FPD	6.500	4.309	2.041	Open Manhole	1
1.009	31.680	536.9	FPD	7.000	4.250	1.650	Open Manhole	0

Free Flowing Outfall Details for C3, C4, C7

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.009	FPD	7.000	4.250	4.500	0	0



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### Simulation Criteria for C3, C4, C7

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m <sup>3</sup> /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Offline Controls	0
Number of Online Controls	2	Number of Storage Structures	3
		Number of Time/Area Diagrams	0
		Number of Real Time Controls	0

### Synthetic Rainfall Details

Rainfall Model	FEH	Summer Storms	Yes
Return Period (years)	30	Winter Storms	No
FEH Rainfall Version	2013	Cv (Summer)	0.750
Site Location	GB 547650 260850 TL 47650 60850	Cv (Winter)	0.840
Data Type		Catchment Storm Duration (mins)	30

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Online Controls for C3, C4, C7

Hydro-Brake® Optimum Manhole: FlowControl1, DS/PN: 1.005, Volume (m³): 3.5

Unit Reference MD-SHE-0084-3400-1225-3400  
Design Head (m) 1.225  
Design Flow (l/s) 3.4  
Flush-Flo™ Calculated  
Objective Minimise upstream storage  
Application Surface  
Sump Available Yes  
Diameter (mm) 84  
Invert Level (m) 4.900  
Minimum Outlet Pipe Diameter (mm) 100  
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.225	3.4	Kick-Flo®	0.753	2.7
Flush-Flo™	0.370	3.4	Mean Flow over Head Range	-	3.0

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)
0.100	2.5	0.800	2.8	2.000	4.3	4.000	5.9	7.000	7.7
0.200	3.2	1.000	3.1	2.200	4.5	4.500	6.2	7.500	7.9
0.300	3.4	1.200	3.4	2.400	4.6	5.000	6.5	8.000	8.2
0.400	3.4	1.400	3.6	2.600	4.8	5.500	6.8	8.500	8.4
0.500	3.3	1.600	3.8	3.000	5.1	6.000	7.1	9.000	8.7
0.600	3.2	1.800	4.1	3.500	5.5	6.500	7.4	9.500	8.9

Hydro-Brake® Optimum Manhole: FlowControl2, DS/PN: 3.001, Volume (m³): 9.4

Unit Reference MD-SHE-0058-2000-1850-2000  
Design Head (m) 1.850  
Design Flow (l/s) 2.0  
Flush-Flo™ Calculated  
Objective Minimise upstream storage  
Application Surface  
Sump Available Yes  
Diameter (mm) 58  
Invert Level (m) 4.350  
Minimum Outlet Pipe Diameter (mm) 75  
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.850	2.0	Kick-Flo®	0.519	1.1
Flush-Flo™	0.255	1.4	Mean Flow over Head Range	-	1.5

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)
0.100	1.2	0.800	1.4	2.000	2.1	4.000	2.8	7.000	3.7
0.200	1.4	1.000	1.5	2.200	2.2	4.500	3.0	7.500	3.8
0.300	1.4	1.200	1.6	2.400	2.3	5.000	3.2	8.000	3.9
0.400	1.3	1.400	1.8	2.600	2.3	5.500	3.3	8.500	4.1
0.500	1.2	1.600	1.9	3.000	2.5	6.000	3.4	9.000	4.2
0.600	1.2	1.800	2.0	3.500	2.7	6.500	3.6	9.500	4.3

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Storage Structures for C3, C4, C7

Cellular Storage Manhole: S8S9S10, DS/PN: 2.000

Invert Level (m) 5.100 Safety Factor 2.0  
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	330.0	0.0	0.800	330.0	0.0	0.801	0.0	0.0

Cellular Storage Manhole: FlowControl1, DS/PN: 1.005

Invert Level (m) 4.900 Safety Factor 2.0  
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	350.0	0.0	1.200	350.0	0.0	1.201	0.0	0.0

Cellular Storage Manhole: FlowControl2, DS/PN: 3.001

Invert Level (m) 4.350 Safety Factor 2.0  
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	567.0	0.0	1.200	567.0	0.0	1.201	0.0	0.0

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for C3, C4, C7

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000  
 Hot Start (mins) 0 MADD Factor \* 10m³/ha Storage 2.000  
 Hot Start Level (mm) 0 Inlet Coefficient 0.800  
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000  
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0  
 Number of Online Controls 2 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Catchment  
 FEH Rainfall Version 2013 Cv (Summer) 0.750  
 Site Location GB 547650 260850 TL 47650 60850 Cv (Winter) 0.840

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

Profile(s) Summer and Winter  
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440, 2880  
 Return Period(s) (years) 2, 30, 100  
 Climate Change (%) 0, 0, 20

PN	US/MH Name	Duration (mins)	US/CL (m)	Water Surcharged Flooded			Pipe		Status
				Level (m)	Depth (m)	Volume (m³)	Flow / Overflow Cap. (l/s)	Flow (l/s)	
1.000	S5	15	6.500	5.398	-0.077	0.000	0.96	97.1	OK
1.001	SwaleA	480	6.250	5.363	-0.887	0.000	0.00	12.2	OK
1.002	SwaleB	480	6.200	5.363	-0.862	0.000	0.00	8.1	OK
2.000	S8S9S10	480	6.500	5.364	-0.111	0.000	0.16	18.4	OK
1.003	SwaleC	480	6.150	5.363	-0.787	0.000	0.01	23.0	OK
1.004	SwaleEnd	480	6.125	5.362	0.062	0.000	0.42	18.7	SURCHARGED
1.005	FlowControl1	480	6.500	5.361	0.311	0.000	0.24	3.4	SURCHARGED
1.006	Outfall	2880	6.500	4.707	-0.093	0.000	0.31	3.4	OK
1.007	FPDDiv1	2880	6.500	4.464	-0.861	0.000	0.01	3.4	OK
1.008	FPDDiv2	2880	6.500	4.432	-0.868	0.000	0.01	3.4	OK
3.000	S6S7	15	6.500	4.815	-0.135	0.000	0.82	136.2	OK
3.001	FlowControl2	960	6.500	4.666	0.166	0.000	0.11	1.4	SURCHARGED
1.009	FPD	2880	6.500	4.361	-1.048	0.000	0.00	4.7	OK

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for C3, C4, C7

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000  
 Hot Start (mins) 0 MADD Factor \* 10m³/ha Storage 2.000  
 Hot Start Level (mm) 0 Inlet Coefficient 0.800  
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000  
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0  
 Number of Online Controls 2 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Catchment  
 FEH Rainfall Version 2013 Cv (Summer) 0.750  
 Site Location GB 547650 260850 TL 47650 60850 Cv (Winter) 0.840

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

Profile(s) Summer and Winter  
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440, 2880  
 Return Period(s) (years) 2, 30, 100  
 Climate Change (%) 0, 0, 20

PN	US/MH Name	Duration (mins)	US/CL (m)	Water Surcharged Flooded			Pipe		Status
				Level (m)	Depth (m)	Volume (m³)	Flow / Overflow Cap. (l/s)	Flow (l/s)	
1.000	S5	15	6.500	5.773	0.298	0.000	2.28	229.8	SURCHARGED
1.001	SwaleA	960	6.250	5.696	-0.554	0.000	0.00	13.6	OK
1.002	SwaleB	960	6.200	5.696	-0.529	0.000	0.00	9.1	OK
2.000	S8S9S10	960	6.500	5.698	0.223	0.000	0.21	23.8	SURCHARGED
1.003	SwaleC	960	6.150	5.696	-0.454	0.000	0.01	21.7	OK
1.004	SwaleEnd	960	6.125	5.696	0.396	0.000	0.42	19.1	SURCHARGED
1.005	FlowControl1	960	6.500	5.694	0.644	0.000	0.24	3.4	SURCHARGED
1.006	Outfall	2880	6.500	4.707	-0.093	0.000	0.31	3.4	OK
1.007	FPDDiv1	2880	6.500	4.464	-0.861	0.000	0.01	3.4	OK
1.008	FPDDiv2	2880	6.500	4.432	-0.868	0.000	0.01	3.4	OK
3.000	S6S7	15	6.500	5.346	0.396	0.000	1.88	314.2	SURCHARGED
3.001	FlowControl2	960	6.500	5.051	0.551	0.000	0.11	1.4	SURCHARGED
1.009	FPD	2880	6.500	4.361	-1.048	0.000	0.00	4.7	OK

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for C3, C4, C7

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000  
 Hot Start (mins) 0 MADD Factor \* 10m³/ha Storage 2.000  
 Hot Start Level (mm) 0 Inlet Coefficient 0.800  
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000  
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0  
 Number of Online Controls 2 Number of Storage Structures 3 Number of Real Time Controls 0


Synthetic Rainfall Details

Rainfall Model FEH Data Type Catchment  
 FEH Rainfall Version 2013 Cv (Summer) 0.750  
 Site Location GB 547650 260850 TL 47650 60850 Cv (Winter) 0.840

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

Profile(s) Summer and Winter  
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440, 2880  
 Return Period(s) (years) 2, 30, 100  
 Climate Change (%) 0, 0, 20


PN	US/MH Name	Duration (mins)	US/CL (m)	Water Surcharged Flooded			Pipe		Status
				Level (m)	Depth (m)	Volume (m³)	Flow / Overflow Cap. (l/s)	Flow (l/s)	
1.000	S5	15	6.500	6.327	0.852	0.000	3.56	358.2	FLOOD RISK
1.001	SwaleA	960	6.250	6.129	-0.121	0.000	0.01	22.8	FLOOD RISK
1.002	SwaleB	960	6.200	6.128	-0.097	0.000	0.00	9.8	FLOOD RISK
2.000	S8S9S10	960	6.500	6.130	0.655	0.000	0.28	32.4	SURCHARGED
1.003	SwaleC	960	6.150	6.128	-0.022	0.000	0.01	29.6	FLOOD RISK
1.004	SwaleEnd	960	6.125	6.121	0.821	0.000	0.44	19.9	FLOOD RISK
1.005	FlowControl1	960	6.500	6.280	1.230	0.000	0.24	3.4	FLOOD RISK
1.006	Outfall	960	6.500	4.708	-0.092	0.000	0.31	3.4	OK
1.007	FPDDiv1	960	6.500	4.464	-0.861	0.000	0.01	3.4	OK
1.008	FPDDiv2	960	6.500	4.432	-0.868	0.000	0.01	3.4	OK
3.000	S6S7	15	6.500	6.131	1.181	0.000	2.91	485.4	SURCHARGED
3.001	FlowControl2	960	6.500	6.087	1.587	0.000	0.15	1.9	SURCHARGED
1.009	FPD	960	6.500	4.361	-1.048	0.000	0.00	5.3	OK

PJA		Page 1
Seven House, High Street Longbridge Birmingham, B31 2UQ	05425 Balancing Pond Catchment 5 + logistics area	
Date 25/03/2022 17:37 File 05425 - Catchment 5 and...	Designed by JG Checked by MC	
Innovyze	Source Control 2019.1	

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	5.323	0.623	11.6	928.2	O K
30 min Summer	5.474	0.774	11.6	1195.5	O K
60 min Summer	5.611	0.911	11.6	1452.4	O K
120 min Summer	5.791	1.091	11.6	1811.2	O K
180 min Summer	5.890	1.190	11.6	2021.0	O K
240 min Summer	5.952	1.252	11.6	2156.0	Flood Risk
360 min Summer	6.019	1.319	11.6	2304.7	Flood Risk
480 min Summer	6.047	1.347	11.6	2370.2	Flood Risk
600 min Summer	6.057	1.357	11.6	2393.4	Flood Risk
720 min Summer	6.057	1.357	11.6	2392.6	Flood Risk
960 min Summer	6.038	1.338	11.6	2350.0	Flood Risk
1440 min Summer	5.974	1.274	11.6	2204.2	Flood Risk
2160 min Summer	5.875	1.175	11.6	1989.7	O K
2880 min Summer	5.799	1.099	11.6	1828.4	O K
4320 min Summer	5.685	0.985	11.6	1597.0	O K
5760 min Summer	5.585	0.885	11.6	1402.5	O K
7200 min Summer	5.508	0.808	11.6	1258.7	O K
8640 min Summer	5.449	0.749	11.6	1150.0	O K
10080 min Summer	5.402	0.702	11.6	1065.8	O K
15 min Winter	5.388	0.688	11.6	1040.7	O K
30 min Winter	5.553	0.853	11.6	1341.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	141.120	0.0	850.0	23
30 min Summer	91.200	0.0	969.5	38
60 min Summer	55.800	0.0	1444.3	68
120 min Summer	35.220	0.0	1766.5	128
180 min Summer	26.524	0.0	1822.3	186
240 min Summer	21.480	0.0	1808.5	246
360 min Summer	15.680	0.0	1783.5	366
480 min Summer	12.388	0.0	1766.0	484
600 min Summer	10.252	0.0	1751.2	604
720 min Summer	8.750	0.0	1737.3	724
960 min Summer	6.771	0.0	1709.6	962
1440 min Summer	4.680	0.0	1651.9	1440
2160 min Summer	3.224	0.0	3045.5	1772
2880 min Summer	2.483	0.0	3106.5	2136
4320 min Summer	1.742	0.0	3050.2	2944
5760 min Summer	1.373	0.0	3498.5	3744
7200 min Summer	1.156	0.0	3683.7	4472
8640 min Summer	1.015	0.0	3879.1	5272
10080 min Summer	0.918	0.0	4081.6	6048
15 min Winter	141.120	0.0	924.8	23
30 min Winter	91.200	0.0	966.3	37


PJA		Page 2
Seven House, High Street Longbridge Birmingham, B31 2UQ	05425 Balancing Pond Catchment 5 + logistics area	
Date 25/03/2022 17:37 File 05425 - Catchment 5 and...	Designed by JG Checked by MC	
Innovyze	Source Control 2019.1	

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m <sup>3</sup> )	Status
60 min Winter	5.702	1.002	11.6	1630.7	O K
120 min Winter	5.896	1.196	11.6	2034.8	O K
180 min Winter	6.005	1.305	11.6	2273.2	Flood Risk
240 min Winter	6.072	1.372	11.6	2427.9	Flood Risk
360 min Winter	6.147	1.447	11.6	2601.8	Flood Risk
480 min Winter	6.181	1.481	11.6	2682.4	Flood Risk
600 min Winter	6.194	1.494	11.7	2715.4	Flood Risk
720 min Winter	6.197	1.497	11.7	2721.4	Flood Risk
960 min Winter	6.183	1.483	11.6	2687.3	Flood Risk
1440 min Winter	6.125	1.425	11.6	2550.3	Flood Risk
2160 min Winter	6.020	1.320	11.6	2307.2	Flood Risk
2880 min Winter	5.930	1.230	11.6	2107.3	Flood Risk
4320 min Winter	5.788	1.088	11.6	1806.7	O K
5760 min Winter	5.661	0.961	11.6	1550.6	O K
7200 min Winter	5.534	0.834	11.6	1306.1	O K
8640 min Winter	5.433	0.733	11.6	1121.2	O K
10080 min Winter	5.351	0.651	11.6	977.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
60 min Winter	55.800	0.0	1605.2	66
120 min Winter	35.220	0.0	1829.1	126
180 min Winter	26.524	0.0	1811.4	184
240 min Winter	21.480	0.0	1797.0	242
360 min Winter	15.680	0.0	1783.9	360
480 min Winter	12.388	0.0	1777.6	478
600 min Winter	10.252	0.0	1772.7	594
720 min Winter	8.750	0.0	1767.8	710
960 min Winter	6.771	0.0	1756.4	940
1440 min Winter	4.680	0.0	1723.0	1386
2160 min Winter	3.224	0.0	3374.5	2008
2880 min Winter	2.482	0.0	3377.4	2252
4320 min Winter	1.742	0.0	3123.6	3196
5760 min Winter	1.372	0.0	3918.2	4096
7200 min Winter	1.156	0.0	4125.9	4896
8640 min Winter	1.015	0.0	4346.0	5624
10080 min Winter	0.918	0.0	4575.2	6360



PJA		Page 3
Seven House, High Street Longbridge Birmingham, B31 2UQ	05425 Balancing Pond Catchment 5 + logistics area	
Date 25/03/2022 17:37 File 05425 - Catchment 5 and...	Designed by JG Checked by MC	
Innovyze	Source Control 2019.1	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 547650 260850 TL 47650 60850
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+20

Time Area Diagram


Total Area (ha) 3.548

Time (mins)		Area	Time (mins)		Area
From:	To:	(ha)	From:	To:	(ha)
0	4	1.774	4	8	1.774

Time Area Diagram

Total Area (ha) 0.000

Time (mins)		Area
From:	To:	(ha)
0	4	0.000

PJA		Page 4
Seven House, High Street Longbridge Birmingham, B31 2UQ	05425 Balancing Pond Catchment 5 + logistics area	
Date 25/03/2022 17:37 File 05425 - Catchment 5 and...	Designed by JG Checked by MC	
Innovyze	Source Control 2019.1	

Model Details

Storage is Online Cover Level (m) 6.200

Tank or Pond Structure

Invert Level (m) 4.700

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	1282.0	1.500	2416.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0149-1170-1500-1170
Design Head (m)	1.500
Design Flow (l/s)	11.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	149
Invert Level (m)	4.700
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

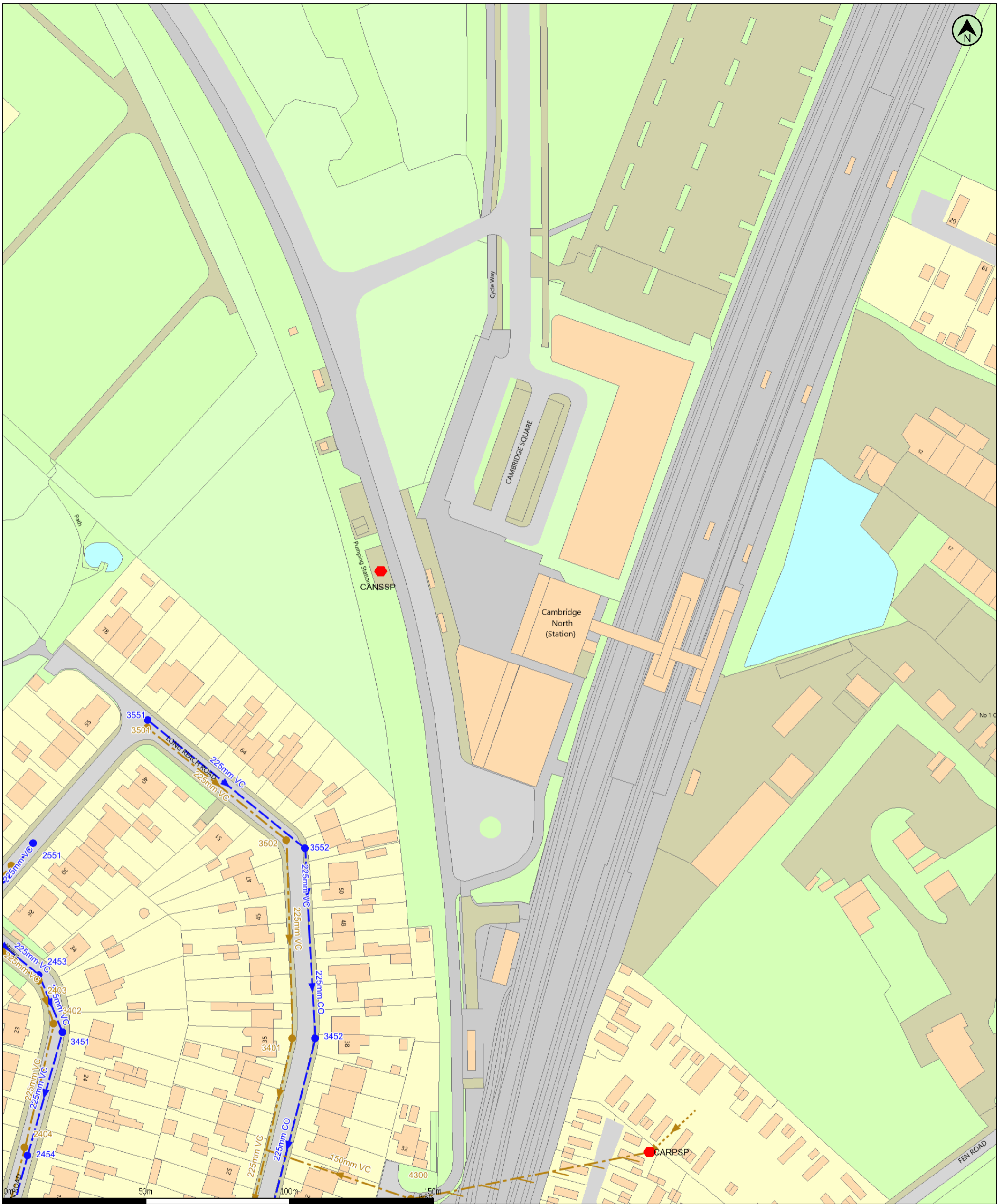
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	11.7
Flush-Flo™	0.440	11.6
Kick-Flo®	0.937	9.4
Mean Flow over Head Range	-	10.1

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	5.4	1.200	10.5	3.000	16.2	7.000	24.3
0.200	10.5	1.400	11.3	3.500	17.5	7.500	25.2
0.300	11.3	1.600	12.0	4.000	18.6	8.000	26.0
0.400	11.6	1.800	12.7	4.500	19.7	8.500	26.7
0.500	11.6	2.000	13.4	5.000	20.7	9.000	27.5
0.600	11.4	2.200	14.0	5.500	21.7	9.500	28.2
0.800	10.7	2.400	14.6	6.000	22.6		
1.000	9.6	2.600	15.2	6.500	23.5		



## Appendix K Anglian Water Asset Mapping



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 Data updated: 30/09/21

Scale: 1:1250  
 Map Centre: 547457,260604

Date: 04/10/21  
 Our Ref: 665732 - 1

Wastewater Plan A3  
 Powered by digdat

Foul Sewer				
Surface Sewer		Outfall*		
Combined Sewer				
Final Effluent		Inlet*		
Rising Main*				
Private Sewer*		Manhole*		
Decommissioned Sewer*				

\*(Colour denotes effluent type)



This plan is provided by Anglian Water pursuant to its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2021 Ordnance Survey 100022432. This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.





(c) Crown copyright and database rights 2021 Ordnance Survey 100022432      Date: 04/10/21      Scale: 1:1250      Map Centre: 547466,260941      Data updated: 30/09/21      Our Ref: 665732 - 2      Wastewater Plan A3

This plan is provided by Anglian Water pursuant its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2021 Ordnance Survey 100022432. This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.

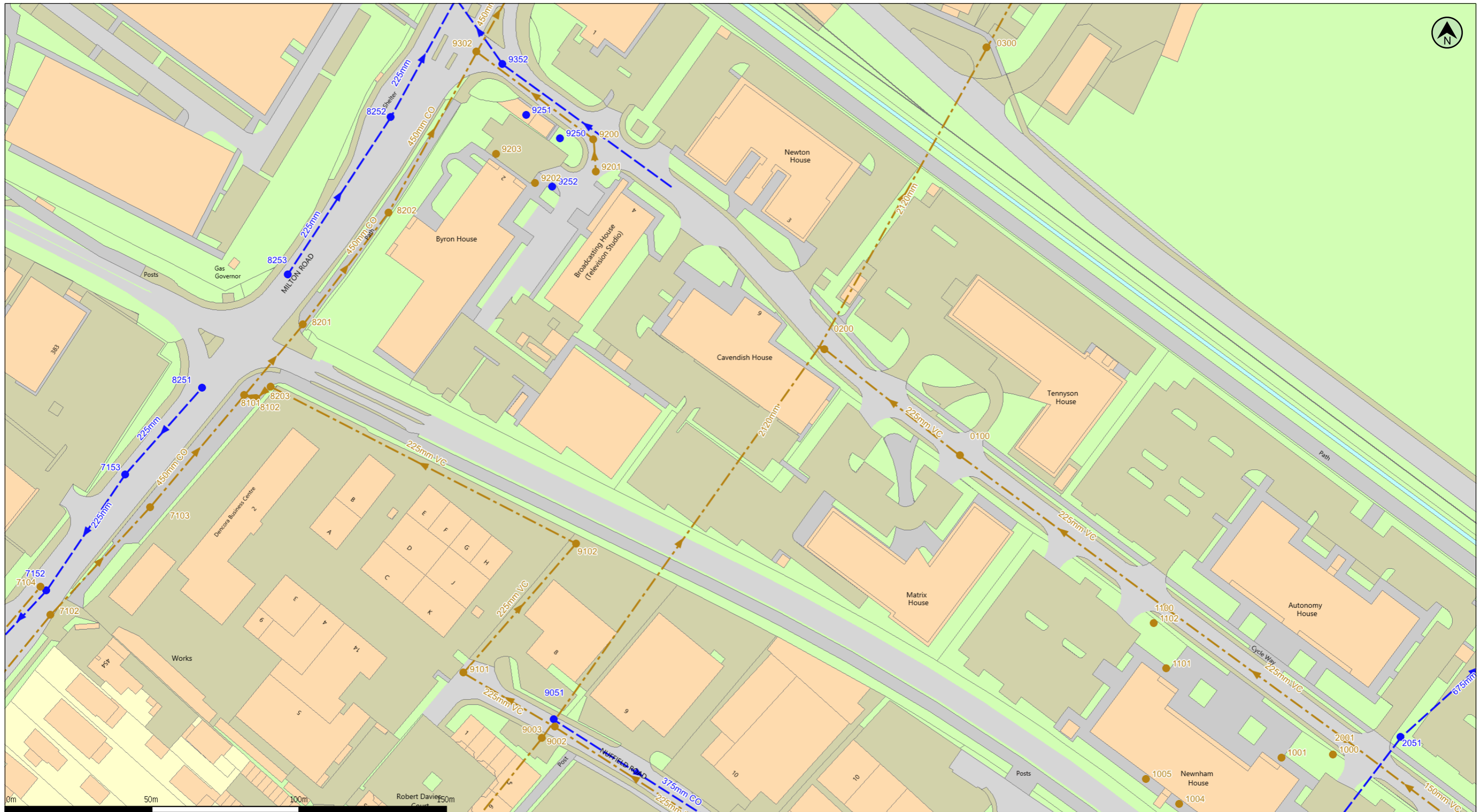
Foul Sewer					
Surface Sewer		Outfall*		Sewage Treatment Works	
Combined Sewer				Public Pumping Station	
Final Effluent		Inlet*		Decommissioned Pumping Station	
Rising Main*					
Private Sewer*		Manhole*			
Decommissioned Sewer*					

\*(Colour denotes effluent type)

paul.bacchus@pja.co.uk
Cambridge North 2







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Date: 04/11/21

Scale: 1:1250

Map Centre: 546996,261195

Data updated: 30/09/21

Our Ref: 693927 - 2

Wastewater Plan A3

This plan is provided by Anglian Water pursuant to its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2021 Ordnance Survey 100022432. This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.

Foul Sewer					
Surface Sewer		Outfall*		Sewage Treatment Works	
Combined Sewer				Public Pumping Station	
Final Effluent		Inlet*		Decommissioned Pumping Station	
Rising Main*					
Private Sewer*		Manhole*			
Decommissioned Sewer*					

\*(Colour denotes effluent type)

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Cambridge North 4







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Date: 04/11/21

Scale: 1:1250

Map Centre: 547478,261178

Data updated: 30/09/21

Our Ref: 693927 - 1

Wastewater Plan A3

This plan is provided by Anglian Water pursuant its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2021 Ordnance Survey 100022432. This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.

Foul Sewer					
Surface Sewer		Outfall*		Sewage Treatment Works	
Combined Sewer				Public Pumping Station	
Final Effluent		Inlet*		Decommissioned Pumping Station	
Rising Main*					
Private Sewer*		Manhole*			
Decommissioned Sewer*					

\*(Colour denotes effluent type)

joe.garlick@pja.co.uk
Cambridge North 3







## **Appendix L      Anglian Water Foul Water Connection Report**



# Pre-Planning Assessment Report

Cambridge North

InFlow Reference: PPE-0135451

Assessment Type: Used Water

Report published: 01/12/2021



Thank you for submitting a pre-planning enquiry.

This has been produced for Phil Jones Associates.

Your reference number is **PPE-0135451**.

This report can be submitted as a drainage strategy for the development should it seek planning permission.

If you have any questions upon receipt of this report, you can submit a further question via InFlow. Alternatively, please contact the Planning & Capacity team on **07929 786 955** or email [planningliaison@anglianwater.co.uk](mailto:planningliaison@anglianwater.co.uk)

---

## Section 1 - Proposed development

The response within this report has been based on the following information which was submitted as part of your application:

List of planned developments	
Type of development	No. Of units
Business	5
Dwellings	450

The anticipated residential build rate is:

Year	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Build rate	50	50	50	50	50	50	50	50	50	5

**Development type:** Brownfield

**Planning application status:** Unknown

**Site grid reference number:** TL4746460873

The comments contained within this report relate to the public water mains and sewers indicated on our records.

Your attention is drawn to the disclaimer in the useful information section of this report.

## Section 2 - Assets affected

Our records indicate that there are no public water mains/public sewers or other assets owned by Anglian Water within the boundary of your development site. However, it is highly recommended that you carry out a thorough investigation of your proposed working area to establish whether any unmapped public or private sewers and lateral drains are in existence.

Due to the private sewer transfer in October 2011 many newly adopted public used water assets and their history are not indicated on our records. You also need to be aware that your development site may contain private water mains, drains or other assets not shown on our records. These are private assets and not the responsibility of Anglian Water but that of the landowner.

## Section 3 - Water recycling services

In examining the used water system we assess the ability for your site to connect to the public sewerage network without causing a detriment to the operation of the system. We also assess the receiving water recycling centre and determine whether the water recycling centre can cope with the increased flow and effluent quality arising from your development.

**Water recycling centre**

The foul drainage from this development is in the catchment of Cambridge Water Recycling Centre, which currently does not have capacity to treat the flows from your development site. Anglian Water are obligated to accept the foul flows from your development with the benefit of planning consent and would therefore take the necessary steps to ensure that there is sufficient treatment capacity should the planning authority grant planning permission.

#### **Used water network**

Our assessment has been based on development flows connecting to the nearest foul water sewer of the same size or greater pipe diameter to that required to drain the site. The infrastructure to convey foul water flows to the receiving sewerage network is assumed to be the responsibility of the developer. Conveyance to the connection point is considered as Onsite Work and includes all work carried out upstream from of the point of connection, including making the connection to our existing network. The preferred connection point of manhole 3006 to the desired pumping station will be unavailable for a development of this size. The recommended connection point has been determined in reference to the calculated discharge flow and on this basis, a 450mm internal diameter pipe is required to drain the development site. The nearest practicable connection is to the 2120mm diameter sewer at manhole 0200 in cowley park at National Grid Reference NGR TL 47023 61215. Anglian Water has assessed the impact of a pumped conveyance from the planned development to the public foul sewerage network and we can confirm that this connection is acceptable as the foul sewerage system, at present, has available capacity for your site. In line with Sewers for Adoption, the pumped discharge will need to connect via an intermediate manhole and at least 5 metres of an appropriately sized gravity sewer. The pump rate and configuration of the connection will be determined with your detailed design. You should submit this detail with your Section 106 new connection application. Please note that Anglian Water will request a suitably worded condition at planning application stage to ensure this strategy is implemented to mitigate the risk of flooding.

It is assumed that the developer will provide the necessary infrastructure to convey flows from the site to the network. Consequently, this report does not include any costs for the conveyance of flows.

#### **Surface water disposal**

You indicated on the Pre-Planning Application form that a connection to the public surface water sewer network is not required. Therefore a capacity assessment has not been made on the public surface water network.

As you may be aware, Anglian Water will consider the adoption of SuDs provided that they meet the criteria outline in our SuDs adoption manual. This can be found on our [website](#). We will adopt features located in public open space that are designed and constructed, in conjunction with the Local Authority and Lead Local Flood Authority (LLFA), to the criteria within our SuDs adoption manual. Specifically, developers must be able to demonstrate:

1. Effective upstream source control,
2. Effective exceedance design, and
3. Effective maintenance schedule demonstrating that the assets can be maintained both now and in the future with adequate access.

If you wish to look at the adoption of any SuDs then an expression of interest form can be found on our [website](#)

As the proposed method of surface water disposal is not relevant to Anglian Water; we suggest that you contact the relevant Local Authority, Lead Local Flood Authority, the Environment Agency or the Internal Drainage Board, as appropriate.

#### **Trade Effluent**

We note that you do not have any trade effluent requirements. Should this be required in the future you will need our written formal consent. This is in accordance with Section 118 of the Water Industry Act (1991).

#### **Used Water Budget Costs**

Your development site will be required to pay an infrastructure charge for each new property connecting to the public sewer that benefits from Full planning permission.

You will be required to pay an infrastructure charge upon connection for each new plot on your development site. The infrastructure charge are types of charges set out in Section 146(2) of the Water Industry Act 1991

The charge should be paid by anyone who wishes to build or develop a property and is payable upon request of connection.

Payment of the infrastructure charge must be made before premises are connected to the public sewer.

Infrastructure charge for water recycling:	<b>£ 573.00</b>
--	-----------------

**The Water Recycling Infrastructure charge for your dwellings is:**

Infrastructure charge	Number of units	Total
£ 573.00	450	£ 257850

Infrastructure charges are raised on a standard basis of one charge per new connection (one for water and one for sewerage). However, if the new connection is to non- household premises, the fixed element is calculated according to the number and type of water fittings in the premises. This is called the "relevant multiplier" method of calculating the charge.

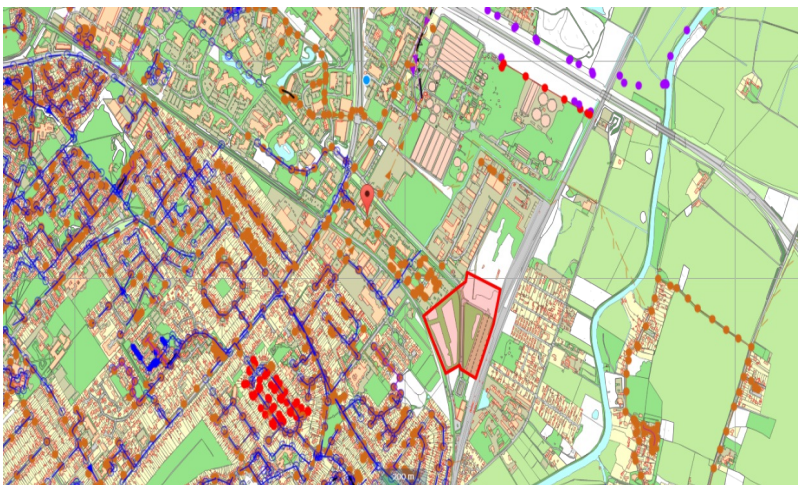
Details of the relevant multiplier for each fitting can be found at our [website](#).

It has been assumed that the onsite used water network will be provided under Section 104 of the Water Industry Act

It is recommended that you also budget for connection costs.

Please note that we offer alternative types of connections depending on your needs and these costs are available at our [website](#).

**Section 4 - Map of Proposed Connection Points**



**Figure 1: Showing your used water point of connection**

**Section 5 - Useful information**

**Water Industry Act – Key used water sections**

**Section 98:**

This provides you with the right to requisition a new public sewer. The new public sewer can be constructed by Anglian Water on your behalf. Alternatively, you can construct the sewer yourself under section 30 of the Anglian Water Authority Act 1977.

**Section 102:**

This provides you with the right to have an existing sewerage asset vested by us. It is your responsibility to bring the infrastructure to an adoptable condition ahead of the asset being vested.

**Section 104:**

This provides you with the right to have a design technically vetted and an agreement reached that will see us adopt your assets following their satisfactory construction and connection to the public sewer.

#### **Section 106:**

This provides you with the right to have your constructed sewer connected to the public sewer.

#### **Section 185**

This provides you with the right to have a public sewerage asset diverted.

Details on how to make a formal application for a new sewer, new connection or diversion are available on our [website](#) or via our Development Services team on **0345 60 66 087**.

#### **Sustainable drainage systems**

Many existing urban drainage systems can cause problems of flooding, pollution or damage to the environment and are not resilient to climate change in the long term. .

Our preferred method of surface water disposal is through the use of Sustainable Drainage Systems or SuDS.

SuDS are a range of techniques that aim to mimic the way surface water drains in natural systems within urban areas. For more information on SuDS, please visit our [website](#)

We recommend that you contact the Local Authority and Lead Local Flood Authority (LLFA) for your site to discuss your application.

#### **Private sewer transfers**

Sewers and lateral drains connected to the public sewer on the 1 July 2011 transferred into Water Company ownership on the 1 October 2011. This follows the implementation of the Floods and Water Management Act (FWMA). This included sewers and lateral drains that were subject to an existing Section 104 Adoption Agreement and those that were not. There were exemptions and the main non-transferable assets were as follows:

Surface water sewers and lateral drains that do not discharge to the public sewer, e.g. those that discharged to a watercourse.

Foul sewers and lateral drains that discharged to a privately owned sewage treatment/collection facility.

Pumping stations and rising mains will transfer between 1 October 2011 and 1 October 2016.

The implementation of Section 42 of the FWMA will ensure that future private sewers will not be created. It is anticipated that all new sewer applications will need to have an approved section 104 application ahead of a section 106 connection.

It is anticipated that all new sewer applications will need to have an approved Section104 application ahead of a Section 106 connection

#### **Encroachment**

Anglian Water operates a risk based approach to development encroaching close to our used water infrastructure. We assess the issue of encroachment if you are planning to build within 400 metres of a water recycling centre or, within 15 metres to 100 metres of a pumping station. We have more information available on our [website](#)

#### **Locating our assets**

Maps detailing the location of our water and used water infrastructure including both underground assets and above ground assets such as pumping stations and recycling centres are available from [digdat](#)

All requests from members of the public or non-statutory bodies for maps showing the location of our assets will be subject to an appropriate administrative charge.

We have more information on our [website](#)

#### **Charging arrangements**

Our charging arrangements and summary for this year's water and used water connection and infrastructure charges can be found on our [website](#)

#### **Section 6 - Disclaimer**



The information provided in this report is based on data currently held by Anglian Water Services Limited ('Anglian Water') or provided by a third party. Accordingly, the information in this report is provided with no guarantee of accuracy, timeliness, completeness and is without indemnity or warranty of any kind (express or implied).

This report should not be considered in isolation and does not nullify the need for the enquirer to make additional appropriate searches, inspections and enquiries. Anglian Water supports the plan led approach to sustainable development that is set out in the National Planning Policy Framework ('NPPF') and any infrastructure needs identified in this report must be considered in the context of current, adopted and/or emerging local plans. Where local plans are absent, silent or have expired these needs should be considered against the definition of sustainability holistically as set out in the NPPF.

Whilst the information in this report is based on the presumption that proposed development obtains planning permission, nothing in this report confirms that planning permission will be granted or that Anglian Water will be bound to carry out the works/proposals contained within this report.

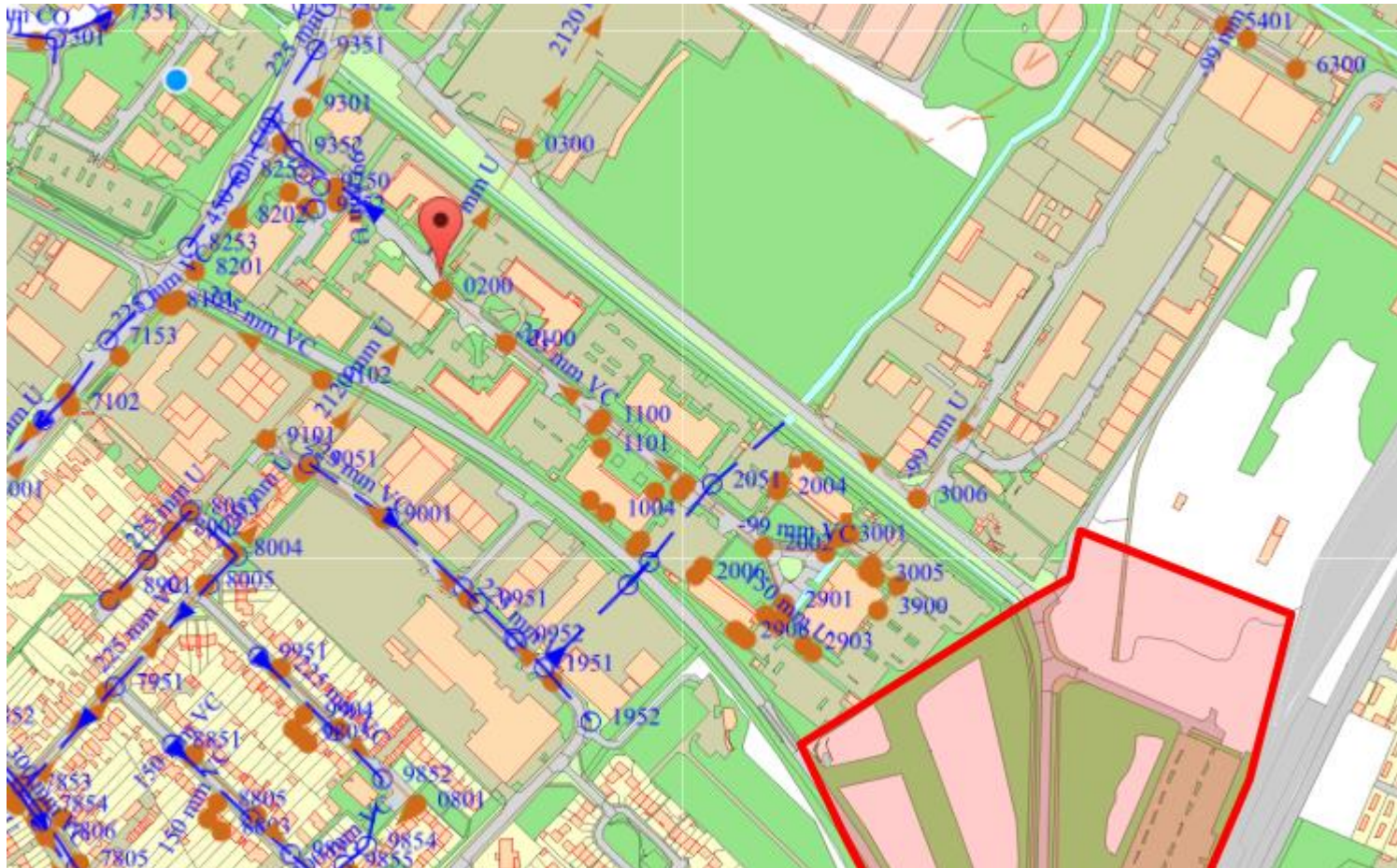
No liability whatsoever, including liability for negligence is accepted by Anglian Water or its partners, employees or agents, for any error or omission, or for the results obtained from the use of this report and/or its content. Furthermore, in no event will any of those parties be liable to the applicant or any third party for any decision made or action taken as a result of reliance on this report.

**This report is valid for the date printed and the enquirer is advised to resubmit their request for an up to date report should there be a delay in submitting any subsequent application for water supply/sewer connection(s).**

Inflow reference: PPE-0135451

Used Water Connection Point: at manhole 0200 in Cowley Park





## Malcolm Crowther

---

**From:** Maks Zdunek <Mzdunek@anglianwater.co.uk>  
**Sent:** 02 December 2021 15:30  
**To:** Malcolm Crowther  
**Subject:** RE: [PJA: 05425-C] RE: Pre-Planning Enquiry for Cambridge North PPE-0135451

**Categories:** Scanned by Gekko

Malcolm,

If that connection were to be preferable then there would be no issues raised with connecting to the manhole downstream of the recommended connection point.

Be advised the infrastructure to convey foul water flows to the receiving sewerage network is assumed to be the responsibility of the developer. Conveyance to the connection point is considered as Onsite Work and includes all work carried out upstream from the point of connection, including making the connection to our existing network.

Regards  
Maks Zdunek

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**From:** Malcolm Crowther <malcolm.crowther@pja.co.uk>  
**Sent:** 02 December 2021 15:22  
**To:** Maks Zdunek <Mzdunek@anglianwater.co.uk>  
**Subject:** [PJA: 05425-C] RE: Pre-Planning Enquiry for Cambridge North PPE-0135451

**\*EXTERNAL MAIL\*** - Please be aware this mail is from an external sender - THINK BEFORE YOU CLICK

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Maks

Thank you for your report yesterday suggesting that manhole 0200 in Cowley Park can accommodate the foul water from our development.

If it was more convenient for the developer could we use the downstream chamber 0300 instead, as shown below.

Thanks  
Malcolm



**Malcolm Crowther**  
Associate  
T. 0118 338 4860  
The Aquarium, King Street, Reading, RG1 2AN  
[www.pja.co.uk](http://www.pja.co.uk)



Our offices will close at 5pm on 24th December and reopen 4th January



Sign up here to receive news from PJA

**From:** Maks Zdunek <[Mzdunek@anglianwater.co.uk](mailto:Mzdunek@anglianwater.co.uk)>  
**Sent:** 24 November 2021 09:35  
**To:** Malcolm Crowther <[malcolm.crowther@pja.co.uk](mailto:malcolm.crowther@pja.co.uk)>  
**Subject:** Pre-Planning Enquiry for Cambridge North PPE-0135451

Good Morning Malcolm,

