

**SURFACE WATER DRAINAGE SCHEME**

**for**

**Mr S REDMAN**

**ERECTION OF FOUR RESIDENTIAL DWELLINGS**

**at**

**RAVENSCOURT**

**NEVILLE STREET, LONGRIDGE, PR3 3FD**

**JULY 2024**

**REFORD**

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# 1. INTRODUCTION

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1.1 This surface water drainage scheme has been produced on behalf of Mr S Redman to discharge Condition 18 of the planning approval from Ribble Valley Borough Council (Reference 3/2023/0956) for the erection of four single storey residential dwellings at Ravenscourt, Neville Street, Longridge, PR3 3FD. A location plan is included within Appendix A.

1.2 Condition 18 states the following:

*No development shall commence until a detailed, final surface water sustainable drainage strategy for the site has been submitted to and approved in writing by the Local Planning Authority.*

*The detailed surface water sustainable drainage strategy shall be based upon the sustainable drainage and principles and requirements set out in the National Planning Policy Framework, Planning Practice Guidance and Defra Technical Standards for Sustainable Drainage Systems. No surface water shall be allowed to discharge to the public foul sewer(s), directly or indirectly.*

*The details of the drainage strategy to be submitted for approval should include, as a minimum:*

- *Details of whether the site is greenfield or previously developed in terms of drainage*
- *Assessment of the hierarchy of drainage options*
- *Details of the contributing area*
- *Restricted discharge rate*
- *On-site surface water storage*
- *Allowances for climate change and urban creep*
- *Above ground, multifunctional SuDS components*
- *Arrangements for management and maintenance*

*The sustainable drainage strategy shall be implemented in accordance with the approved details.*

1.3 This surface water drainage scheme is to discharge Condition 18 of the planning approval. It describes the existing site conditions and proposed development. It assesses the potential impact of proposals on existing drainage and includes a proposed scheme for the provision of new drainage to serve the proposed development.

## **2. BASE INFORMATION**

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### **Existing site**

- 2.1 The proposal relates to a roughly 's' shaped brownfield site that lies in Longridge within the residential area between Neville Street that lies along the site's southern boundary, and Fleet Street that lies along the site's northern boundary.
- 2.2 The site is approx. 655m<sup>2</sup> and comprises a dwelling facing Neville Street and a large flat roofed brick outbuilding backing onto Fleet Street to the rear. Between the two buildings the site comprises hardstanding areas that are neglected and heavily overgrown.
- 2.3 The current access to the site is obtainable from both Neville Street and Fleet Street.

### **Site geology**

- 2.4 The online Soilsmap Viewer has identified the site lying in a region characterised by slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils with impeded drainage.

### **Understanding of existing drainage local to the site**

- 2.5 United Utilities sewer records identifies the head of the public sewer system within both Neville Street and Fleet Street immediately outside of the proposed development site. An extract from the sewer records are included within Appendix B.

### **Proposed development**

- 2.6 The development is to comprise four single storey residential dwellings following the demolition of the existing dwelling, outbuildings and detached garage.

### 3. PROPOSED SURFACE WATER DRAINAGE SCHEME

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- 3.1 In accordance with the National Standards for Sustainable Drainage, the surface water drainage scheme should incorporate the use of Sustainable Drainage (SUDS) where possible. The approach promotes the use infiltration features in the first instance. If drainage cannot be achieved solely through infiltration due to site conditions or contamination risks, the preferred options are (in order of preference):
- (i) a controlled discharge to a local waterbody or watercourse, or
  - (ii) a controlled discharge into the public sewer network (depending on availability and capacity).
- 3.2 The rate and volume of discharge should strive to provide betterment and be restricted to the pre-development values as far as practicable.
- 3.3 The online Soilsmap Viewer has identified the site lying in a region characterised by slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils with impeded drainage that is not conducive to infiltration.
- 3.4 In addition, the site lies within a residential area of Longridge and as such it will not be possible for soakaways to be installed and comply with the requirements of Building Regulations.
- 3.5 There are no watercourses local to the site into which a discharge of surface water can be made.
- 3.6 United Utilities sewer records identifies the head of the public sewer system within both Neville Street and Fleet Street immediately outside of the proposed development site. The sewers flow to the west and combine prior to continue to flow to the west along Alexandra Road and then to the south parallel to Windsor Avenue.
- 3.7 Two of the proposed properties will lie fronting Neville Street and the other two proposed properties will lie fronting Fleet Street. It is therefore intended that surface water runoff from each pair of properties will be controlled to the existing pre-development Greenfield runoff rate,  $Q_{bar}$ , or 2.0 l/s whichever is the greater,

allowing surface water runoff generated by all rainfall events up to the 100 year critical rain storm plus 50% on stored volumes to discharge into the public sewer system that lies within both Neville Street and Fleet Street. The additional 50% is to allow for climate change and has been included in the surface water volume.

- 3.8 The proposed surface water drainage for the development will take runoff from the roofs of the properties. As hardstanding areas adjacent each property are to comprise a permeable block paving surface, surface water from these areas will be allowed to soak into the construction matrix and allowed to infiltrate or evaporate, thus dealing with the surface water at source. It has been determined that in order to cater for the 100 year critical rain storm plus 50% added for climate change, the depth of the sub-base comprising open graded crushed rock shall be a minimum thickness of 270mm.
- 3.9 To determine the restricted surface water discharge rate from the developed site, the pre-development Greenfield runoff rates have been calculated using the 'Causeway Flow' programme. The calculations are based upon half the site area of 655m<sup>2</sup>. The existing pre-development Greenfield runoff rates have been calculated as below:

**Pre-development discharge**

Site Makeup	Brownfield
Brownfield Method	Greenfield
Greenfield Method	IH124
Positively Drained Area (ha)	0.033
SAAR (mm)	1172
Soil Index	5
SPR	0.53
Region	10
Betterment (%)	0
	Calc
QBar (l/s)	0.4

Return Period (years)	Growth Factor	Q (l/s)
1	0.87	0.3
30	1.70	0.6
100	2.08	0.8

- 3.10 As the existing pre-development Greenfield runoff rate for each half of the site,  $Q_{bar}$ , has been calculated as 0.4 l/s, new surface water drainage will therefore be constructed, appropriately sized to take all surface water runoff from each pair of properties roofs and be attenuated to 2.0 l/s, as stated above, prior to a controlled discharge being made into the public sewer system that lies within both Neville Street and Fleet Street.
- 3.11 A surface water drainage design has been carried out for the proposed four single storey residential dwellings for all events up to the 100 year critical rain storm plus 50% for climate change on stored volumes. 10% has been added to the roof areas to make allowance for urban creep. Attenuation is provided within the network of pipes and manholes. The surface water drainage design is included within Appendix C.

### **Sustainable Drainage Management and Maintenance Plan**

- 3.12 The drainage within the developed site will remain private, being the responsibility of the owner(s) of each building.
- 3.13 The table below lists the various drainage features, along with the maintenance regime that should be followed.

<b><u>BUILDING DRAINAGE</u></b>	
<b>Regular maintenance</b>	<b>Frequency</b>
Visually inspect gutters to ensure they are kept clear of leaves, debris etc.	Annually.
Lift covers of drainage to inspect chambers for debris and build-up of silts. Manhole covers are securely in place.	No triggers other than maintenance to be taken on regular schedule.
<b>Occasional tasks</b>	<b>Frequency</b>
Remove leaves and debris from gutters. Remove debris from inspection chambers to ensure outlets are kept clear of debris to ensure adequate drainage.	As required. Indicator of problem / trigger for maintenance when surcharging or flooding of drains occurs or gutters and chambers full of debris and leaves etc.

Remedial work	Frequency
Should drains be heavily blocked or damaged contact drainage maintenance company for unblocking / repair works.	As required. Indicator of problem / trigger for maintenance when drainage not functioning and unblocking pipes and chambers etc. not effective.

### **OPERATION AND MAINTENANCE REQUIREMENTS FOR PERMEABLE PAVING**

- 3.14 Maintenance of the permeable paving is carried out to ensure the infiltration into the paving is not compromised.

#### **Regular maintenance**

- 3.15 Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer’s recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment

Brushing and vacuuming of the paving in the Spring and Autumn seasons (standard cosmetic sweep over whole surface)

#### **Occasional maintenance**

- 3.16 As required

Stabilise and mow contributing and adjacent areas

- 3.17 As required – once per year on less frequently used pavements

Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying

#### **Remedial Actions**

- 3.18 As required

Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the pervious area

Remedial work to any depressions and rutting considered detrimental to the structural performance or a hazard to users

- 3.19 Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)

Rehabilitation of surface and upper substructure by remedial sweeping, the uplifting and cleaning of the laying course (or replacing)

**Monitoring**

- 3.20 Monthly for three months after installation

Initial inspection

- 3.21 Three-monthly, 48 hours after large storms in first six months

Inspect for evidence of poor operation and / or weed growth – if required, take remedial action

- 3.22 Annually

Inspect silt accumulation rates and establish appropriate brushing frequencies

Monitor inspection chambers

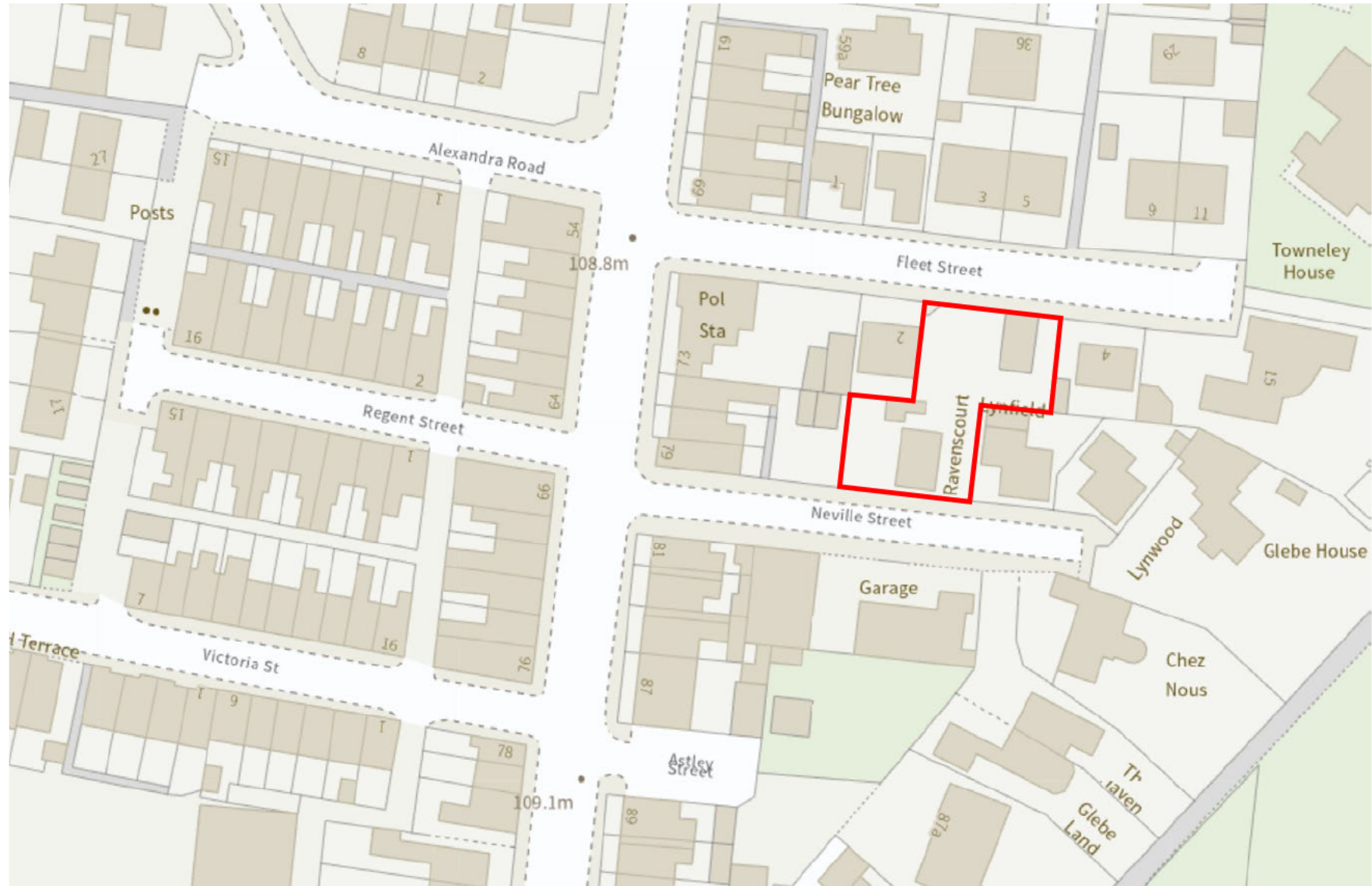
## 4. SUMMARY AND CONCLUSIONS

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- 4.1 This surface water drainage scheme has been produced on behalf of Mr S Redman to discharge Condition 18 of the planning approval from Ribble Valley Borough Council (Reference 3/2023/0956) for the erection of four single storey residential dwellings at Ravenscourt, Neville Street, Longridge, PR3 3FD.
- 4.2 Due to the nature of the ground conditions, soakaways are not a feasible option for the disposal of surface water on this site. In addition, the site lies within a residential area of Longridge and as such it will not be possible for soakaways to be installed and comply with the requirements of Building Regulations.
- 4.3 There are no watercourses local to the site in which a discharge of surface water can be made.
- 4.4 Surface water runoff from each pair of properties will be controlled to 2.0 l/s allowing surface water runoff generated by all rainfall events up to the 100 year critical rain storm plus 50% on stored volumes to discharge into the public sewer system that lies within both Neville Street and Fleet Street.
- 4.5 Surface water from the hardstanding areas adjacent each property will be allowed to soak into the construction matrix of the permeable paving and allowed to infiltrate or evaporate, thus dealing with the surface water at source.

## APPENDIX A

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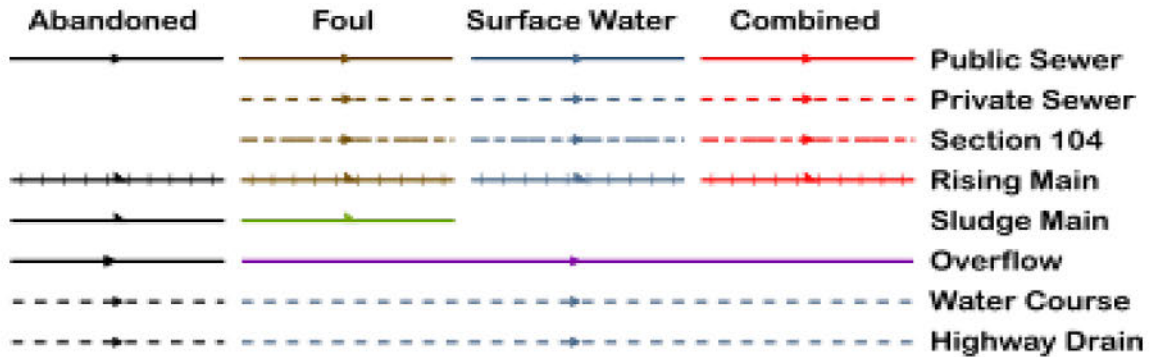


**LOCATION PLAN**

## APPENDIX B

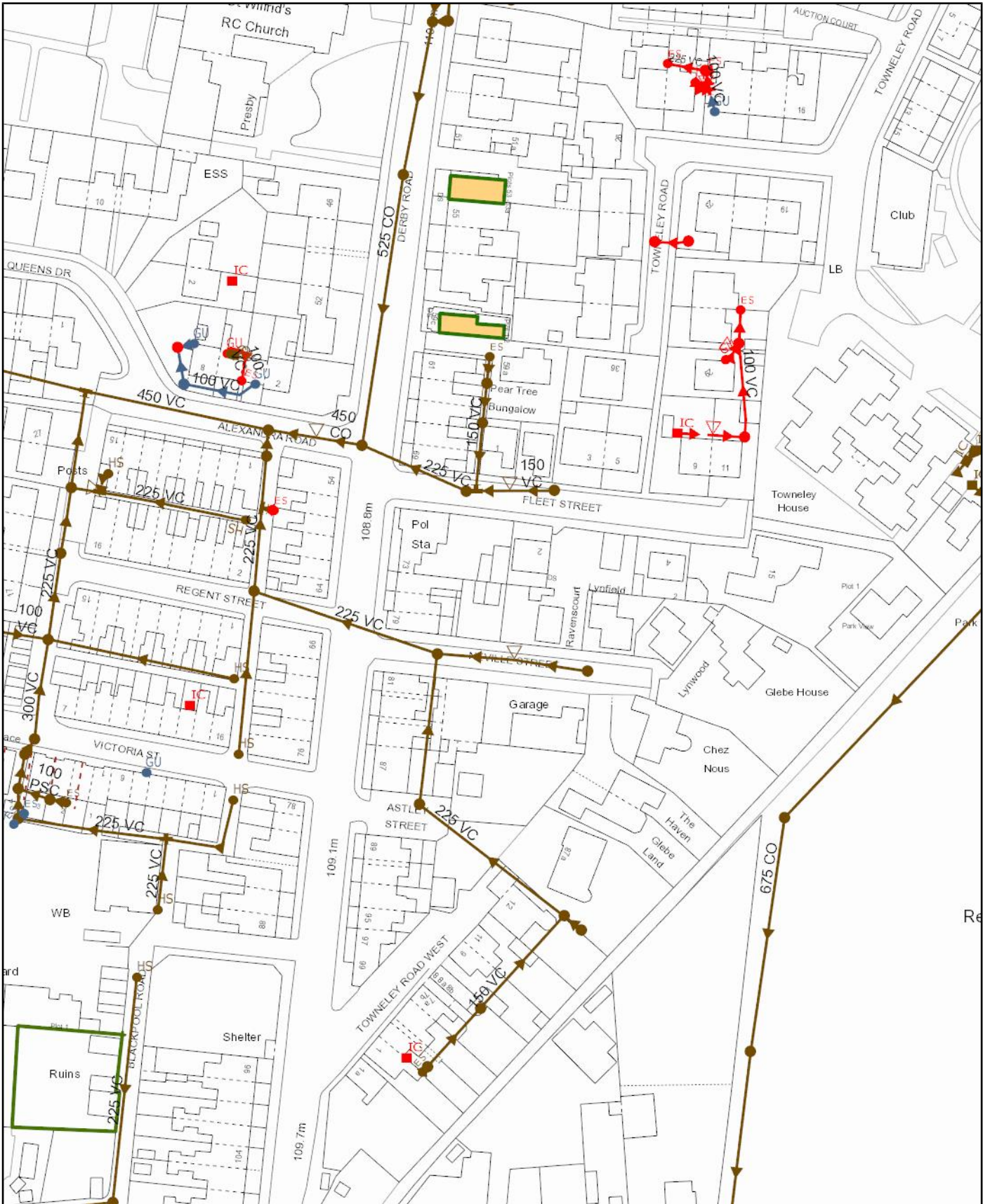
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## Wastewater Symbology



All point assets follow the standard colour convention: **red** – combined      **brown** - foul  
**blue** – surface water      **purple** - overflow

- |                  |                              |
|------------------|------------------------------|
| Manhole          | Side Entry Manhole           |
| Head of System   | Outfall                      |
| Extent of Survey | Screen Chamber               |
| Rodding Eye      | Inspection Chamber           |
| Inlet            | Bifurcation Chamber          |
| Discharge Point  | Lamp Hole                    |
| Vortex           | T Junction / Saddle          |
| Penstock         | Catchpit                     |
| Washout Chamber  | Valve Chamber                |
| Valve            | Vent Column                  |
| Air Valve        | Vortex Chamber               |
| Non Return Valve | Penstock Chamber             |
| Soakaway         | Network Storage Tank         |
| Gully            | Sewer Overflow               |
| Cascade          | Ww Treatment Works           |
| Flow Meter       | Ww Pumping Station           |
| Hatch Box        | Septic Tank                  |
| Oil Interceptor  | Control Kiosk                |
| Summit           | DNM Network Monitoring Point |
| Drop Shaft       | Change of Characteristic     |
| Orifice Plate    |                              |



Scale: 1:1336  
 Date: 22/07/2024

# SEWER RECORDS



Water for the North West

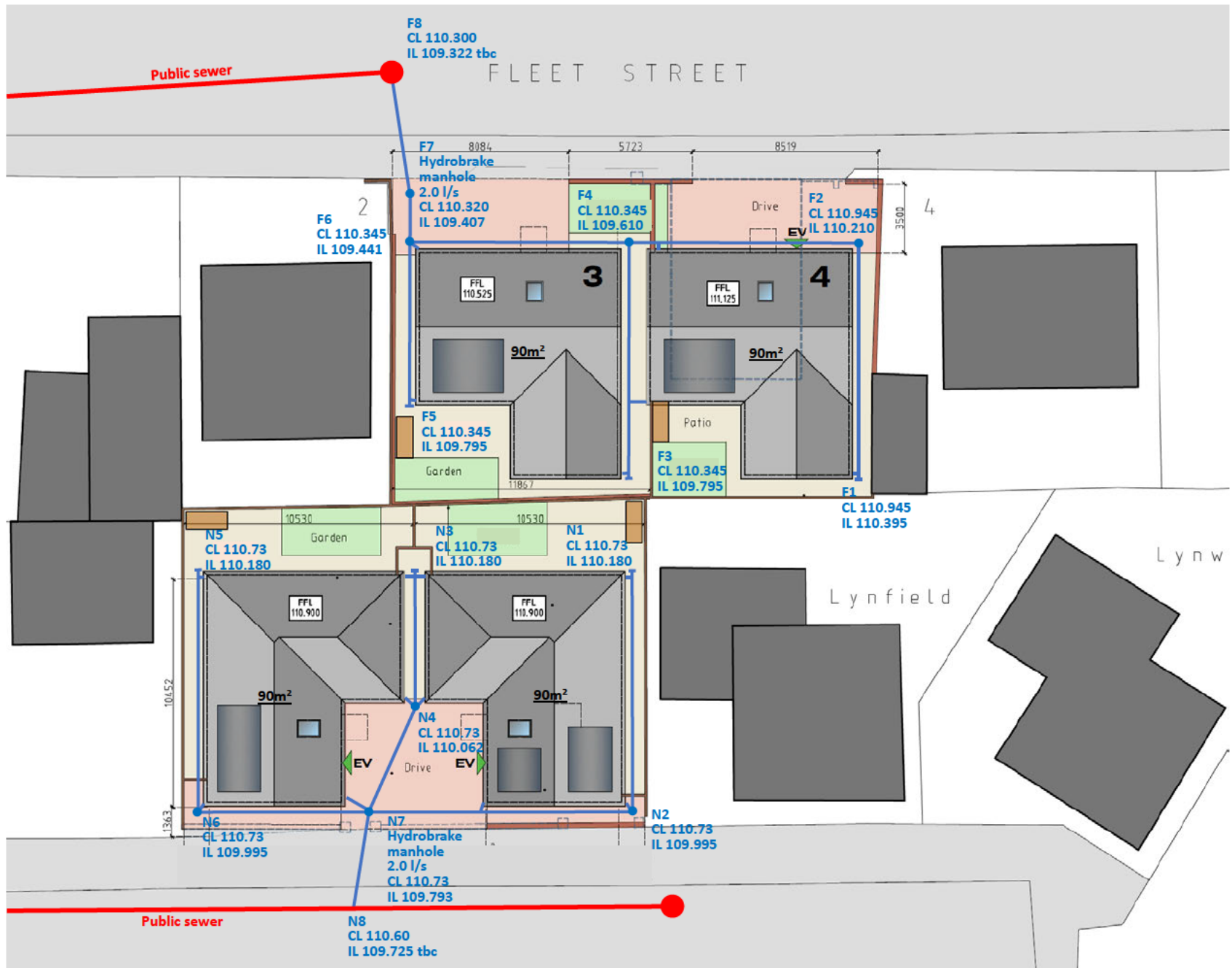
Address or Site Reference: neville street  
 Printed by: Property Searches

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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## APPENDIX C

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**PROPOSED SURFACE WATER DRAINAGE LAYOUT**

**Design Settings**

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	75.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	18.800	Minimum Backdrop Height (m)	2.000
Ratio-R	0.290	Preferred Cover Depth (m)	0.450
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

**Nodes**

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
N1	0.004	5.00	110.730	100	0.550
N2	0.003	5.00	110.730	450	0.735
N3	0.003	5.00	110.730	100	0.550
N4	0.003	5.00	110.730	450	0.668
N5	0.004	5.00	110.730	100	0.550
N6	0.001	5.00	110.730	450	0.735
N7	0.002	5.00	110.730	1500	0.937
N8			110.600	100	0.875
F1	0.002	5.00	110.945	100	0.550
F2	0.004	5.00	110.945	450	0.735
F3	0.006	5.00	110.345	100	0.550
F4			110.345	450	0.735
F5	0.004	5.00	110.345	100	0.550
F6	0.004	5.00	110.345	450	0.904
F7			110.320	1500	0.913
F8			110.300	1200	0.978

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
4.000	N1	N2	11.000	0.600	110.180	109.995	0.185	59.5	100	5.18	55.2
4.001	N2	N7	12.000	0.600	109.995	109.793	0.202	59.4	100	5.38	54.4
6.000	N3	N4	7.000	0.600	110.180	110.062	0.118	59.3	100	5.12	55.5
6.001	N4	N7	5.000	0.600	110.062	109.793	0.269	18.6	100	5.16	55.3
5.000	N5	N6	11.000	0.600	110.180	109.995	0.185	59.5	100	5.18	55.2
5.001	N6	N7	8.000	0.600	109.995	109.793	0.202	39.6	100	5.29	54.8
4.002	N7	N8	4.000	0.600	109.793	109.725	0.068	58.8	100	5.45	54.1
1.000	F1	F2	11.000	0.600	110.395	110.210	0.185	59.5	100	5.18	55.2
1.001	F2	F4	11.000	0.600	110.210	109.610	0.600	18.3	100	5.28	54.8
2.000	F3	F4	11.000	0.600	109.795	109.610	0.185	59.5	100	5.18	55.2
1.002	F4	F6	10.000	0.600	109.610	109.441	0.169	59.2	100	5.45	54.1
3.000	F5	F6	8.000	0.600	109.795	109.441	0.354	22.6	100	5.08	55.6
1.003	F6	F7	2.000	0.600	109.441	109.407	0.034	58.8	100	5.48	54.0






Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
4.000	1.001	7.9	0.6	0.450	0.635	0.004	0.0	18	0.580
4.001	1.001	7.9	1.0	0.635	0.837	0.007	0.0	25	0.693
6.000	1.002	7.9	0.5	0.450	0.568	0.003	0.0	16	0.532
6.001	1.799	14.1	0.9	0.568	0.837	0.006	0.0	17	0.990
5.000	1.001	7.9	0.6	0.450	0.635	0.004	0.0	18	0.580
5.001	1.229	9.7	0.7	0.635	0.837	0.005	0.0	19	0.732
4.002	1.006	7.9	2.9	0.837	0.775	0.020	0.0	43	0.936
1.000	1.001	7.9	0.3	0.450	0.635	0.002	0.0	14	0.480
1.001	1.812	14.2	0.9	0.635	0.635	0.006	0.0	17	0.997
2.000	1.001	7.9	0.9	0.450	0.635	0.006	0.0	23	0.666
1.002	1.003	7.9	1.8	0.635	0.804	0.012	0.0	32	0.811
3.000	1.631	12.8	0.6	0.450	0.804	0.004	0.0	14	0.815
1.003	1.006	7.9	2.9	0.804	0.813	0.020	0.0	42	0.927

Links









Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.004	F7	F8	5.000	0.600	109.407	109.322	0.085	58.8	100	5.57	53.7

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.004	1.006	7.9	2.9	0.813	0.878	0.020	0.0	42	0.927

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
N1	110.730	0.550	100				
				0	4.000	110.180	100
N2	110.730	0.735	450				
				0	4.001	109.995	100
N3	110.730	0.550	100				
				0	6.000	110.180	100
N4	110.730	0.668	450				
				0	6.001	110.062	100
N5	110.730	0.550	100				
				0	5.000	110.180	100

**Manhole Schedule**

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
N6	110.730	0.735	450		1	5.000	109.995	100
					0	5.001	109.995	100
N7	110.730	0.937	1500		1	6.001	109.793	100
					2	5.001	109.793	100
					3	4.001	109.793	100
					0	4.002	109.793	100
N8	110.600	0.875	100		1	4.002	109.725	100
F1	110.945	0.550	100		0	1.000	110.395	100
					1	1.000	110.210	100
F2	110.945	0.735	450		0	1.001	110.210	100
					0	1.001	110.210	100
F3	110.345	0.550	100		0	2.000	109.795	100
					1	2.000	109.610	100
F4	110.345	0.735	450		2	1.001	109.610	100
					0	1.002	109.610	100
					0	1.002	109.610	100
F5	110.345	0.550	100		0	3.000	109.795	100
					0	3.000	109.795	100

### Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
F6	110.345	0.904	450	○	1	3.000	109.441	100
					2	1.002	109.441	100
					0	1.003	109.441	100
F7	110.320	0.913	1500	○	1	1.003	109.407	100
					0	1.004	109.407	100
F8	110.300	0.978	1200	○	1	1.004	109.322	100

### Simulation Settings

Rainfall Methodology	FSR	Summer CV	0.750	Drain Down Time (mins)	240
FSR Region	England and Wales	Winter CV	0.840	Additional Storage (m <sup>3</sup> /ha)	20.0
M5-60 (mm)	18.800	Analysis Speed	Normal	Check Discharge Rate(s)	x
Ratio-R	0.290	Skip Steady State	x	Check Discharge Volume	x

### Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0	100	0	0	0
30	0	0	0	100	50	0	0

**Node N7 Online Hydro-Brake® Control**

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	109.793	Product Number	CTL-SHE-0068-2000-0930-2000
Design Depth (m)	0.930	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

**Node F7 Online Hydro-Brake® Control**

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	109.407	Product Number	CTL-SHE-0069-2000-0900-2000
Design Depth (m)	0.900	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

**Results for 1 year Critical Storm Duration. Lowest mass balance: 99.67%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute winter	N1	10	110.197	0.017	0.5	0.0025	0.0000	OK
15 minute winter	N2	10	110.016	0.021	0.9	0.0052	0.0000	OK
15 minute winter	N3	10	110.195	0.015	0.4	0.0017	0.0000	OK
15 minute winter	N4	10	110.077	0.015	0.8	0.0038	0.0000	OK
15 minute summer	N5	10	110.197	0.017	0.5	0.0026	0.0000	OK
15 minute summer	N6	11	110.011	0.016	0.6	0.0030	0.0000	OK
15 minute winter	N7	13	109.900	0.107	2.2	0.1930	0.0000	SURCHARGED
15 minute summer	N8	1	109.725	0.000	1.7	0.0000	0.0000	OK
30 minute summer	F1	20	110.406	0.011	0.2	0.0009	0.0000	OK
15 minute winter	F2	10	110.225	0.015	0.7	0.0040	0.0000	OK
15 minute winter	F3	11	109.815	0.020	0.7	0.0046	0.0000	OK
15 minute winter	F4	11	109.638	0.028	1.4	0.0045	0.0000	OK
15 minute winter	F5	10	109.808	0.013	0.5	0.0020	0.0000	OK
15 minute winter	F6	13	109.509	0.068	2.3	0.0169	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute winter	N1	4.000	N2	0.5	0.448	0.059	0.0114	
15 minute winter	N2	4.001	N7	0.8	0.452	0.100	0.0538	
15 minute winter	N3	6.000	N4	0.4	0.487	0.046	0.0052	
15 minute winter	N4	6.001	N7	0.7	0.638	0.050	0.0213	
15 minute summer	N5	5.000	N6	0.5	0.552	0.058	0.0092	
15 minute summer	N6	5.001	N7	0.6	0.200	0.058	0.0341	
15 minute winter	N7	Hydro-Brake®	N8	1.7				1.0
30 minute summer	F1	1.000	F2	0.2	0.370	0.025	0.0063	
15 minute winter	F2	1.001	F4	0.7	0.618	0.047	0.0137	
15 minute winter	F3	2.000	F4	0.7	0.498	0.089	0.0161	
15 minute winter	F4	1.002	F6	1.3	0.539	0.171	0.0362	
15 minute winter	F5	3.000	F6	0.5	0.334	0.037	0.0246	
15 minute winter	F6	1.003	F7	1.9	0.592	0.238	0.0135	

**Results for 1 year Critical Storm Duration. Lowest mass balance: 99.67%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute winter	F7	13	109.508	0.101	1.9	0.1783	0.0000	SURCHARGED
15 minute summer	F8	1	109.322	0.000	1.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute winter	F7	Hydro-Brake®	F8		1.7			1.1

**Results for 30 year Critical Storm Duration. Lowest mass balance: 99.67%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute winter	N1	10	110.206	0.026	1.2	0.0040	0.0000	OK
30 minute winter	N2	24	110.148	0.153	1.6	0.0368	0.0000	SURCHARGED
15 minute winter	N3	10	110.203	0.023	0.9	0.0027	0.0000	OK
30 minute winter	N4	24	110.146	0.084	1.4	0.0210	0.0000	OK
15 minute winter	N5	10	110.206	0.026	1.2	0.0040	0.0000	OK
30 minute winter	N6	24	110.147	0.152	1.6	0.0282	0.0000	SURCHARGED
30 minute winter	N7	24	110.146	0.353	4.3	0.6386	0.0000	SURCHARGED
15 minute summer	N8	1	109.725	0.000	2.0	0.0000	0.0000	OK
15 minute winter	F1	10	110.413	0.018	0.6	0.0015	0.0000	OK
15 minute winter	F2	10	110.234	0.024	1.8	0.0063	0.0000	OK
15 minute winter	F3	10	109.826	0.031	1.7	0.0071	0.0000	OK
30 minute winter	F4	24	109.775	0.165	2.8	0.0263	0.0000	SURCHARGED
15 minute winter	F5	10	109.816	0.021	1.2	0.0032	0.0000	OK
30 minute winter	F6	24	109.771	0.330	4.5	0.0817	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute winter	N1	4.000	N2	1.2	0.571	0.149	0.0507	
30 minute winter	N2	4.001	N7	1.5	0.381	0.191	0.0939	
15 minute winter	N3	6.000	N4	0.9	0.627	0.111	0.0248	
30 minute winter	N4	6.001	N7	1.4	0.677	0.099	0.0372	
15 minute winter	N5	5.000	N6	1.2	0.688	0.152	0.0507	
30 minute winter	N6	5.001	N7	1.0	0.188	0.107	0.0626	
30 minute winter	N7	Hydro-Brake®	N8	2.0				3.6
15 minute winter	F1	1.000	F2	0.6	0.476	0.072	0.0131	
15 minute winter	F2	1.001	F4	1.7	0.718	0.121	0.0499	
15 minute winter	F3	2.000	F4	1.7	0.607	0.213	0.0534	
30 minute winter	F4	1.002	F6	2.7	0.523	0.337	0.0782	
15 minute winter	F5	3.000	F6	1.2	0.334	0.092	0.0359	
30 minute winter	F6	1.003	F7	3.3	0.636	0.423	0.0156	

**Results for 30 year Critical Storm Duration. Lowest mass balance: 99.67%**

<b>Node Event</b>	<b>US Node</b>	<b>Peak (mins)</b>	<b>Level (m)</b>	<b>Depth (m)</b>	<b>Inflow (l/s)</b>	<b>Node Vol (m<sup>3</sup>)</b>	<b>Flood (m<sup>3</sup>)</b>	<b>Status</b>
30 minute winter	F7	24	109.767	0.360	3.3	0.6354	0.0000	SURCHARGED
15 minute summer	F8	1	109.322	0.000	2.0	0.0000	0.0000	OK

<b>Link Event (Upstream Depth)</b>	<b>US Node</b>	<b>Link</b>	<b>DS Node</b>	<b>Outflow (l/s)</b>	<b>Velocity (m/s)</b>	<b>Flow/Cap</b>	<b>Link Vol (m<sup>3</sup>)</b>	<b>Discharge Vol (m<sup>3</sup>)</b>
30 minute winter	F7	Hydro-Brake®	F8	2.0				3.7

**Results for 100 year Critical Storm Duration. Lowest mass balance: 99.67%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
30 minute winter	N1	25	110.257	0.077	1.2	0.0118	0.0000	OK
30 minute winter	N2	25	110.256	0.261	2.1	0.0630	0.0000	SURCHARGED
30 minute winter	N3	25	110.256	0.076	0.9	0.0089	0.0000	OK
30 minute winter	N4	25	110.256	0.194	1.8	0.0482	0.0000	SURCHARGED
30 minute winter	N5	25	110.256	0.076	1.2	0.0116	0.0000	OK
30 minute winter	N6	25	110.255	0.260	1.5	0.0484	0.0000	SURCHARGED
30 minute winter	N7	25	110.255	0.462	4.9	0.8354	0.0000	SURCHARGED
15 minute summer	N8	1	109.725	0.000	2.0	0.0000	0.0000	OK
15 minute summer	F1	11	110.415	0.020	0.7	0.0016	0.0000	OK
15 minute winter	F2	10	110.237	0.027	2.2	0.0071	0.0000	OK
30 minute winter	F3	25	109.919	0.124	1.8	0.0281	0.0000	SURCHARGED
30 minute winter	F4	25	109.918	0.308	3.6	0.0490	0.0000	SURCHARGED
30 minute winter	F5	26	109.914	0.119	1.2	0.0183	0.0000	SURCHARGED
30 minute winter	F6	26	109.914	0.473	4.8	0.1173	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
30 minute winter	N1	4.000	N2	1.2	0.549	0.153	0.0786	
30 minute winter	N2	4.001	N7	1.7	0.452	0.213	0.0939	
30 minute winter	N3	6.000	N4	0.9	0.627	0.115	0.0498	
30 minute winter	N4	6.001	N7	1.7	0.638	0.123	0.0391	
30 minute winter	N5	5.000	N6	1.2	0.669	0.153	0.0780	
30 minute winter	N6	5.001	N7	1.2	0.235	0.121	0.0626	
30 minute winter	N7	Hydro-Brake®	N8	2.0				4.8
15 minute summer	F1	1.000	F2	0.7	0.512	0.089	0.0151	
15 minute winter	F2	1.001	F4	2.2	0.738	0.153	0.0520	
30 minute winter	F3	2.000	F4	1.8	0.612	0.229	0.0861	
30 minute winter	F4	1.002	F6	2.8	0.529	0.353	0.0782	
30 minute winter	F5	3.000	F6	1.2	0.334	0.094	0.0626	
30 minute winter	F6	1.003	F7	3.6	0.592	0.455	0.0156	

**Results for 100 year Critical Storm Duration. Lowest mass balance: 99.67%**

<b>Node Event</b>	<b>US Node</b>	<b>Peak (mins)</b>	<b>Level (m)</b>	<b>Depth (m)</b>	<b>Inflow (l/s)</b>	<b>Node Vol (m<sup>3</sup>)</b>	<b>Flood (m<sup>3</sup>)</b>	<b>Status</b>
30 minute winter	F7	26	109.911	0.504	3.6	0.8906	0.0000	SURCHARGED
15 minute summer	F8	1	109.322	0.000	2.0	0.0000	0.0000	OK

<b>Link Event (Upstream Depth)</b>	<b>US Node</b>	<b>Link</b>	<b>DS Node</b>	<b>Outflow (l/s)</b>	<b>Velocity (m/s)</b>	<b>Flow/Cap</b>	<b>Link Vol (m<sup>3</sup>)</b>	<b>Discharge Vol (m<sup>3</sup>)</b>
30 minute winter	F7	Hydro-Brake®	F8	2.0				4.8

**Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 99.67%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
60 minute winter	N1	47	110.546	0.366	1.3	0.0560	0.0000	FLOOD RISK
60 minute winter	N2	47	110.546	0.551	2.1	0.1327	0.0000	FLOOD RISK
60 minute winter	N3	47	110.545	0.365	1.1	0.0426	0.0000	FLOOD RISK
60 minute winter	N4	47	110.544	0.482	1.8	0.1201	0.0000	FLOOD RISK
60 minute winter	N5	47	110.545	0.365	1.3	0.0559	0.0000	FLOOD RISK
60 minute winter	N6	47	110.545	0.550	1.5	0.1022	0.0000	FLOOD RISK
60 minute winter	N7	47	110.544	0.751	3.7	1.3593	0.0000	FLOOD RISK
15 minute summer	N8	1	109.725	0.000	2.0	0.0000	0.0000	OK
15 minute winter	F1	11	110.420	0.025	1.1	0.0021	0.0000	OK
60 minute winter	F2	47	110.267	0.057	2.0	0.0153	0.0000	OK
60 minute winter	F3	46	110.267	0.472	2.0	0.1067	0.0000	FLOOD RISK
60 minute winter	F4	46	110.266	0.656	3.5	0.1043	0.0000	FLOOD RISK
60 minute winter	F5	47	110.262	0.467	1.3	0.0714	0.0000	FLOOD RISK
60 minute winter	F6	47	110.262	0.821	4.6	0.2035	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
60 minute winter	N1	4.000	N2	1.2	0.522	0.153	0.0861	
60 minute winter	N2	4.001	N7	1.3	0.375	0.164	0.0939	
60 minute winter	N3	6.000	N4	0.9	0.605	0.114	0.0548	
60 minute winter	N4	6.001	N7	1.5	0.499	0.108	0.0391	
60 minute winter	N5	5.000	N6	1.2	0.629	0.153	0.0861	
60 minute winter	N6	5.001	N7	1.0	0.207	0.104	0.0626	
60 minute winter	N7	Hydro-Brake®	N8	2.0				9.6
15 minute winter	F1	1.000	F2	1.1	0.589	0.140	0.0208	
60 minute winter	F2	1.001	F4	2.0	0.649	0.140	0.0683	
60 minute winter	F3	2.000	F4	1.8	0.571	0.223	0.0861	
60 minute winter	F4	1.002	F6	2.4	0.525	0.298	0.0782	
60 minute winter	F5	3.000	F6	1.2	0.334	0.093	0.0626	
60 minute winter	F6	1.003	F7	3.6	0.610	0.450	0.0156	

**Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 99.67%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
60 minute winter	F7	47	110.258	0.851	3.6	1.5032	0.0000	FLOOD RISK
15 minute summer	F8	1	109.322	0.000	2.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
60 minute winter	F7	Hydro-Brake®	F8	2.0				9.5