

**DRAINAGE STRATEGY
ADDENDUM**

**Vastern Road,
Reading**

**Prepared for
Berkeley Homes
(Oxford and Chiltern)
Ltd**

by

**Stuart Michael
Associates Limited**

November 2025



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1.0 INTRODUCTION

- 1.1 Stuart Michael Associates Limited, consulting engineers, has been commissioned by Berkeley Homes Limited (hereafter referred to as the 'Client') to prepare this Drainage Strategy Addendum for land located at Vastern Road, Reading.
- 1.2 This statement has been prepared in order to provide a revised foul and surface water drainage strategy proposal for a residential development comprising of 209 residential dwellings in building blocks of up to 11 stories in height, on land north of Vastern Road, and to the south of The River Thames in Reading, hereafter referred to as the 'Site'.
- 1.3 Rainfall-runoff management for the Site will follow the procedure laid down by the Non-statutory Technical Standards (NTS) for Sustainable Drainage Systems (SuDS), which were published by the Department for Environment, Food and Rural Affairs (DEFRA) in March 2015.
- 1.4 The purposes of the report are, as follows:
- 1.5 To demonstrate the revised drainage strategy of the proposed Site will not increase risk of flooding elsewhere;
- 1.6 To confirm that satisfactory strategies, incorporating Sustainable Drainage Systems (SuDS), are achievable for disposal of surface water runoff from the proposed development;
- 1.7 To provide details on foul water disposal for the development.



2.0 THE SITE

- 2.1 The site was previously occupied by SSE and consisted of an electricity sub-station, car parking and office buildings. The site is bordered by the River Thames and the Thames footpath to the north, by office buildings on Norman Place to the east, by Vastern Road and a retail estate to the south, and by residential terraced housing on Lynmouth Road to the west. **Appendix 1** shows the location of the Site in relation to its surroundings.
- 2.2 The Site currently comprises an area of circa 0.76ha.
- 2.3 The topographical survey indicates that ground levels range between approximately 38.70m AOD in the centre of the site to 38.0m AOD along the northern and southern boundaries.
- 2.4 The River Thames is a main river located adjacent to the northern boundary of the site.
- 2.5 The River Thames water level has been modelled for various return periods. Flood water levels were summarised in the Approved FRA (Ref: 47500/4001) prepared by Stantec. The key water levels that need to be considered for design proposals are the 1 in 5 year (20% probability) and the 1 in 100 year + 35% climate change return periods.
- 2.6 The 1 in 5 year River Thames water level is 37.09m AOD and is to be incorporated into the surface water drainage proposals to confirm the network will continue to operate affectively if it becomes surcharged to this level.
- 2.7 The 1 in 100 year + 35% climate change return period water level is 38.30m AOD and it has been agreed with the EA that all FFL levels to habitable dwellings will be a minimum level of 38.60m AOD.
- 2.8 There are existing foul and surface water sewers across the site which include outfall connections to both a sewer in Lynmouth Road and headwall into the River Thames. An existing Drainage Survey is provided in **Appendix 2**.



3.0 SURFACE WATER DRAINAGE STRATEGY

Guidance and Standards

- 3.1 The proposed development will incorporate SuDS to dispose surface water runoff for all impermeable areas. The guidance given in the CIRIA report C753 'The SuDS Manual' will be followed during the design of the proposed SuDS solutions.
- 3.2 The NTS for SuDS sets out the recommended procedures for rainfall runoff management for developments in various terms, including peak flow control, volume control and flood risk within the development.
- 3.3 Requirement H3 Part 3 of the Building Regulations Approved Document H (2002 Edition) states that rainwater from a system should discharge to one of the following listed in order of priority:
- an adequate soakaway or some adequate infiltration system; or, where this is not reasonably practicable,
 - a watercourse; or, where that is not reasonably practicable,
 - a sewer
- 3.4 As there is no infiltration into the existing ground, SuDS measures will focus on attenuating and discharging surface water runoff into existing sewers and the River Thames at a restricted flow rate.
- 3.5 NTS states that the proposed drainage system must be designed so that flooding does not occur on any part of the Site for a 1 in 30 rainfall event.
- 3.6 The drainage system must be designed so that flooding does not occur to any building or utility plant susceptible to water during a 1 in 100 year rainfall event.
- 3.7 Calculations for the proposed SuDS system will include a 40% allowance for climate change in accordance with the latest Environment Agency (EA) climate change guidance.
- 3.8 Calculations will mimic the FSR rainfall data applied to the Approved Drainage Strategy prepared by Stantec (Ref: 47500/2001).

Surface Water Drainage Proposals

- 3.9 All surface water runoff from proposed impermeable areas which include roofs, roads and parking areas will drain to a standard sewer network via rainwater pipes, gullies and linear drainage channels.
- 3.10 The Site has a total impermeable area of circa 0.58ha. These areas are provided in an impermeable catchment areas plan in **Appendix 3**.
- 3.11 All new sewer networks have been designed to contain storm events up to and including the 1 in 30 year return period within the network, with no flooding. For the 1 in 100 year with 40% climate change storm event some minor flooding occurs. See overland flood routing section and **Appendix 5** Flow SW calculation reports for further details.
- 3.12 The drainage has been designed to attenuate surface water from the development to provide a discharge rate betterment compared to the existing condition for the 1 in 1 year, 1 in 30 year and 1 in 100 year with an allowance for climate change events, as set out in the original Drainage Strategy Report prepared by Stantec (Ref: 47500/2001).



- 3.13 The original drainage strategy (Ref: 47500/2001) split the site into two catchments (North and South) with associated maximum discharge rates, these are labelled Networks 1 and 2 in this report. Refer to **Appendix 3** impermeable catchment areas plan for further details
- 3.14 The two network catchment areas have since been re-distributed with a much larger network 1 (northern outfall) and smaller network 2 (southern outfall), to confirm the maximum discharge rates for the whole site have not been exceeded, the total discharge rate for both original catchments has been compared to the new network 1 and 2 discharge rates for various return periods in **Table 1**. Refer to **Appendix 5** surface water Flow calculations for further information.

Table 1: Discharge Rates Comparisons

Return Period	Total Proposed Peak Discharge Rate (FRA)	Network 1 Maximum Discharge Rate	Network 2 Maximum Discharge Rate	Networks 1 and 2 Total Maximum Discharge Rate
1:1 Year	36 l/s	20.1 l/s	4.4 l/s	24.5 l/s
1:30 Year	99.1 l/s	56.4 l/s	10.9 l/s	67.3 l/s
1:100 Year	121.6 l/s	65.7 l/s	14.1 l/s	79.8 l/s
1:100 Year + 40% CC	160.8 l/s	72.3 l/s	19.7 l/s	92.0 l/s

Network 1

- 3.15 Network 1 is the main network for the site and drains a majority of the development. It serves an impermeable catchment area of 0.545ha.
- 3.16 The surface water sewers drain to a cellular attenuation tank where it will discharge via a new outfall to the River Thames at a restricted flow rate. Refer to **Appendix 4** for drainage strategy drawing.
- 3.17 The new outfall will be via a DN300 pipe headwall connection in the River Thames embankment.
- 3.18 The discharge rate off site is restricted by the DN300 pipe size. Refer to **Appendix 4** for drainage strategy drawing.
- 3.19 The cellular tank in the Block D parking area has been sized with sufficient capacity to store and restrict the discharge rate off site for up to and including the 1 in 100 year with 40% climate change return period with no flooding. Refer to **Appendix 4** for drainage strategy drawing and **Appendix 5** surface water Flow calculations.

Network 2

- 3.20 Network 2 serves a minor area of the site in the south and serves an impermeable catchment area of 0.034ha.
- 3.21 The proposed surface water sewer drains to an existing surface water connection point adjacent to Vastern Road. This existing connection in turn drains to an existing culvert along the southern boundary of the site.



Overland Flood Routing

- 3.22 For the 1 in 100 year with 40% climate change return period some minor flooding will occur. Any flooding that occurs will re-enter the network at the next available point and not leave the site, this is shown on the flood exceedance route drawing in **Appendix 6**.
- 3.23 For rainfall events above the 1 in 100 year with 40% climate change return period flooding will occur. Any overland flood routing will be directed along roads away from dwellings and ground levels suitably adjusted to allow appropriate flow routes. A drawing illustrating the flood exceedance routes is provided in **Appendix 6**.

Water Quality Management

- 3.24 **Table 2** details the pollution hazard indices for the Site as stated by CIRIA C753. The indices range from 0 (no pollution hazard for this contaminant type) to 1 (high pollution hazard for this contaminant type).

Table 2: Pollution Hazard indices for different land use classifications

Land Use	Pollution Hazard	Total Suspended solids (TSS)	Metals	Hydro-carbons
Residential Roofs	Very low	0.2	0.2	0.05
Individual property driveways, residential car parks, low traffic roads and non-residential car parking with infrequent change	Low	0.5	0.4	0.4
Total	Low	0.7	0.6	0.45

- 3.25 To deliver adequate treatment prior to discharging runoff into the River Thames, selected SuDS components must have a total pollution index (for each contaminant type) that equals or exceeds the pollution hazard index.
- 3.26 All surface water runoff from Network 1 will pass through a SPEL Stormceptor treatment tank located adjacent to the River Thames towpath boundary and upstream of the outfall.
- 3.27 The SPEL Stormceptor provided will have the following pollution mitigation indices; TSS 0.8, metals 0.6 and hydrocarbons 0.9. A technical brochure of this product is provided in **Appendix 7**.
- 3.28 All surface water runoff will therefore have sufficient treatment before discharging off site into the river.

River Water Level

- 3.29 River Thames water level modelling was carried out previously and provided by the EA to Stantec at FRA stage (Ref: 47500/4001). It was agreed the surface water network that discharges to the river would be tested to a river water level of 37.09m AOD, to confirm the surface water network would operate affectively for the 1 in 5 year return period.
- 3.30 The surface water Network 1 model has been analysed with a surcharged outfall of 37.09m. The attenuation tank under block D has a base level of 37.10m, which is above this river water level, so storage is not compromised.



4.0 FOUL WATER DRAINAGE

- 4.1 All foul water will discharge via a network of gravity sewers to an existing public sewer in Lynmouth Road. Refer to **Appendix 4** for drainage strategy drawing.
- 4.2 A foul pump station and rising main is provided to drain the lower level sprinkler room in Block D in the event of water escape from the sprinkler water tanks at this lower level. This discharges to a receiving manhole in the block D car park which in turn connects to an existing Thames Water foul sewer in Lynmouth Road.
- 4.3 The proposal is to keep all on-site foul sewers private.
- 4.4 The foul water drainage will comply with Building Regulations Part H.



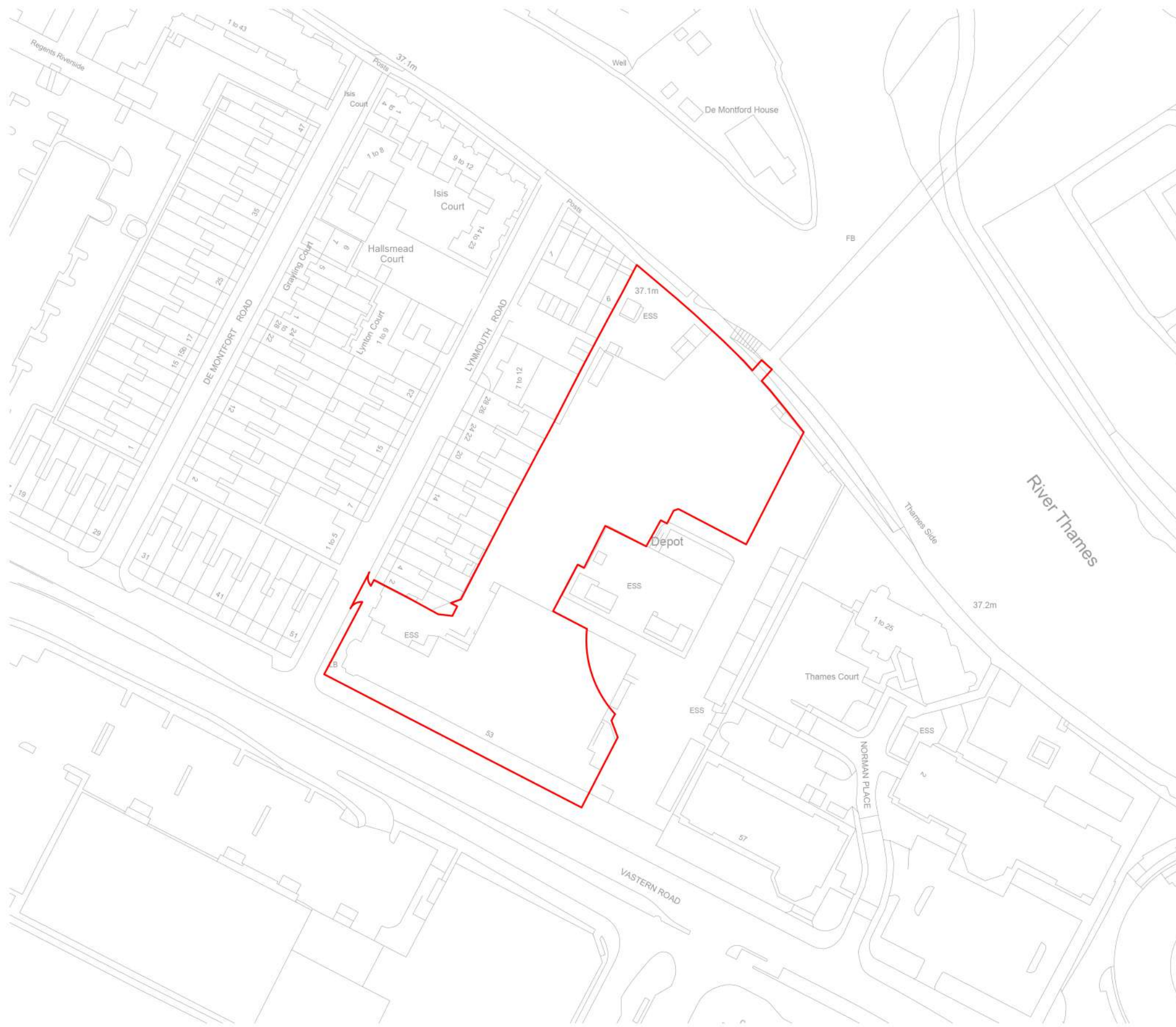
5.0 CONCLUSION

- 5.1 Surface water sewers have been designed to contain storm events up to and including the 1 in 30 year return period within the network with no flooding.
- 5.2 SuDS storage structures have been sized to store storm events up to and including the 1 in 100 year with 40% climate change return period with no flooding whilst restricting the discharge rate off site.
- 5.3 It has been demonstrated that for any storm event above and including the 1 in 100 year with 40% climate change return period flooding will be directed along roads away from dwellings to a point where it can re-enter the sewer network. A drawing illustrating the flood exceedance routes is provided in **Appendix 6**.
- 5.4 It has been demonstrated that for the 1 in 5 year river water level the SW drainage network to the River Thames will continue to operate affectively.
- 5.5 It has been demonstrated the surface water runoff entering the River Thames will have sufficient treatment before discharging into this body of water.
- 5.6 The maintenance schedule for private drainage and SuDS devices is provided in a separate maintenance and management document.
- 5.7 All foul water will discharge via a network of gravity sewers to a proposed public foul sewer in Lynmouth Road.



APPENDIX 1

Location Plan



S106 BOUNDARY

notes

KEY

APPLICATION AREAS

SITE BOUNDARY

S106 REDLINE

revision	date	prepared	description
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Designed for life

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project
Vastern Road

drawing
Plan 1
S106 Boundary

date	scale @ a3	drawn
September 2021	1:1250	-

drawing number	revision
448.S106.001	/



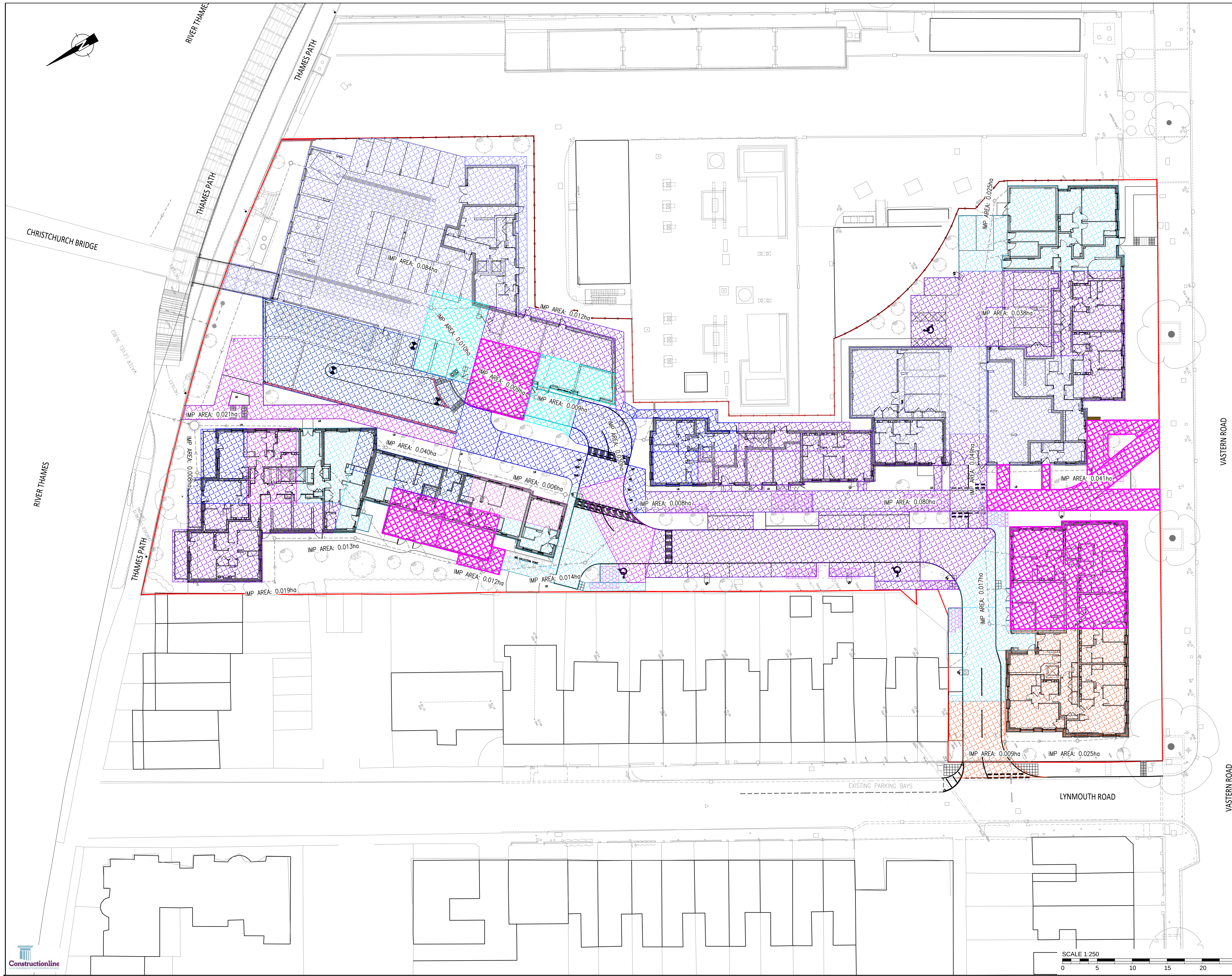
APPENDIX 2

Existing Drainage Survey



APPENDIX 3

Impermeable Catchment Areas Plan



- GENERAL NOTES:**
- G1. DO NOT SCALE FROM THIS DRAWING.
 - G2. ALL DIMENSIONS ARE IN METRES, UNLESS STATED OTHERWISE.
 - G3. LEVELS ARE IN METRES AND ARE RELATED TO GPS DATUM
 - G4. THIS DRAWING IS BASED ON A TOPOGRAPHICAL SURVEY UNDERTAKEN BY:- MALTBY SURVEYS LTD
2 QUEENS ROAD
HAYWARDS HEATH
WEST SUSSEX
RH16 1EB
DATE: OCTOBER 2016
TEL: 01444416246
 - G5. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL RELEVANT SCHEME DRAWINGS AND SPECIFICATIONS.
 - G6. ALL WORKS TO BE CARRIED OUT IN STRICT ACCORDANCE WITH "THE SPECIFICATION FOR HIGHWAY WORKS - MODIFIED AND EXTENDED", INCLUDING READING BOROUGH COUNCIL SUPPLEMENTARY CLAUSES.
 - G7. ALL WORKS WITHIN THE PUBLIC HIGHWAY SHALL BE CARRIED OUT AND COMPLY WITH THE REQUIREMENTS OF THE DTP "TRAFFIC SIGNS MANUAL, CHAPTER 8 - TRAFFIC SAFETY MEASURES AND SIGNS FOR ROAD WORKS AND TEMPORARY SITUATION".
 - G8. ALL EXISTING LEVELS TO BE CONFIRMED ON SITE PRIOR TO COMMENCEMENT OF ANY WORKS.

- KEY:**
- NETWORK 1 IMPERMEABLE CATCHMENT AREA TO RIVER THAMES (TOTAL AREA - 0.545ha)
 - NETWORK 2 IMPERMEABLE CATCHMENT AREA TO EXISTING CULVERT (TOTAL AREA - 0.034ha)

PRELIMINARY ISSUE

P03	PROPOSED TREE LOCATIONS AMENDED	CL	08.12.23		
P02	MINOR AMENDMENTS TO IMPERMEABLE AREAS	CL	07.11.23		
- P01	INITIAL ISSUE	CL	20.09.24		
ST	Rev	Description	Dwn	Chk	Date
REVISIONS					
Preliminary Issue		Submitted for S104			
Planning Issue		Issued for Tender			
Submitted for S38		Issued for Construction		✓	
Submitted for S278		As Built			
DRAWING STATUS					



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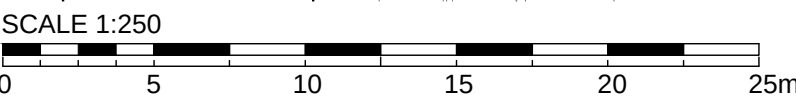


VASTERN ROAD
READING

IMPERMEABLE AREAS
CATCHMENT PLAN

DATE	DRAWN	CHECKED	SCALE	BY
SEPT 2024	CL	MSR	1:250	041
0453-STU05-XX-XX-DR-C-820-012_P03				
SD				

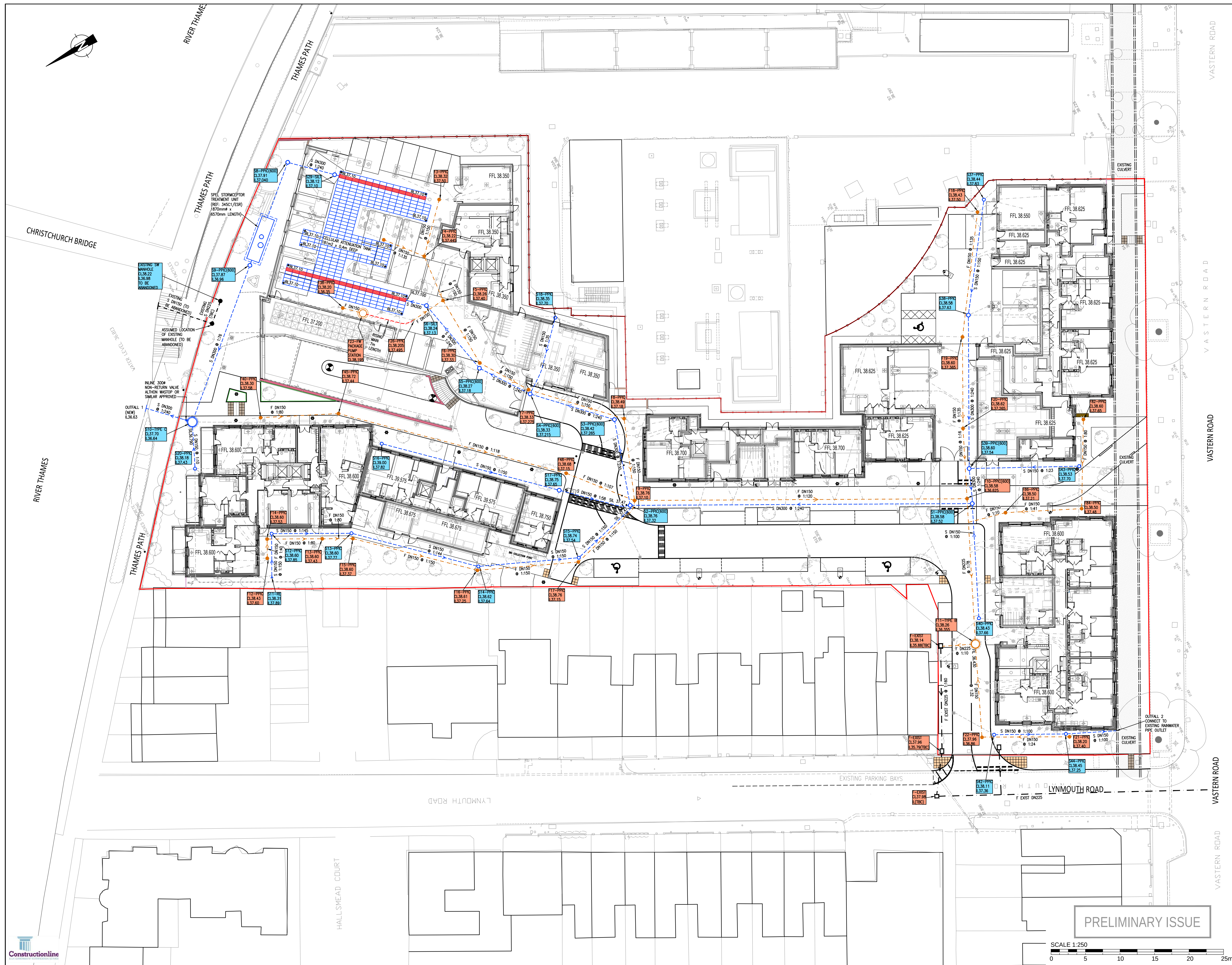
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APPENDIX 4

Drainage Strategy Drawing



- GENERAL NOTES:**
- DO NOT SCALE FROM THIS DRAWING.
 - ALL DIMENSIONS ARE IN METRES, UNLESS STATED OTHERWISE.
 - LEVELS ARE IN METRES AND ARE RELATED TO GPS DATUM.
 - THIS DRAWING IS BASED ON A TOPOGRAPHICAL SURVEY UNDERTAKEN BY:- MALTBY SURVEYS LTD
2 QUEENS ROAD
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 - THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL RELEVANT SCHEME DRAWINGS AND SPECIFICATIONS.
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 - ALL EXISTING LEVELS TO BE CONFIRMED ON SITE PRIOR TO COMMENCEMENT OF ANY WORKS.

- KEY:**
- EXISTING FW MANHOLE AND SEWER
 - EXISTING SW MANHOLE AND SEWER
 - PROPOSED FW RISING MAIN
 - PROPOSED FW PRIVATE SEWER
 - PROPOSED FW PRIVATE MANHOLE
 - PROPOSED SW PRIVATE SEWER
 - PROPOSED SW PRIVATE MANHOLE
 - GEOCELLULAR ATTENUATION TANK

Rev	Description	Drn	Chk	Date
P02	PROPOSED TREE LOCATIONS AMENDED	CL		08.12.25
P01	INITIAL ISSUE	CL	MSR	07.11.25
ST	Rev			
REVISIONS				
Preliminary Issue				
Planning Issue				
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Submitted for S278				
DRAWING STATUS				

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Berkeley
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AW TITLE
VASTERN ROAD
READING
DRAWING TITLE
DRAINAGE STRATEGY

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APPENDIX 5

Surface Water Flow Calculation Reports

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	18.700	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
37	0.025	5.00	38.440	500	471553.822	174082.528	0.610	37.830
38	0.038	5.00	38.580	500	471539.996	174092.368	0.950	37.630
43	0.041	5.00	38.530	500	471513.123	174088.472	0.830	37.700
39	0.049	5.00	38.600	500	471520.298	174102.710	1.060	37.540
40	0.017	5.00	38.430	500	471500.474	174111.652	0.770	37.660
1	0.080	5.00	38.580	500	471515.805	174105.070	1.060	37.520
11	0.019	5.00	38.310	500	471553.485	174199.518	0.420	37.890
12			38.600	500	471559.421	174196.403	0.750	37.850
13	0.013	5.00	38.600	500	471554.041	174186.154	0.830	37.770
14	0.012	5.00	38.620	500	471539.263	174170.136	0.980	37.640
15	0.014	5.00	38.740	500	471535.006	174160.288	1.200	37.540
16	0.040	5.00	39.000	500	471563.885	174176.665	1.180	37.820
17	0.006	5.00	38.750	500	471545.420	174156.648	1.100	37.650
2	0.008	5.00	38.760	500	471538.649	174148.592	1.440	37.320
3	0.030	5.00	38.420	500	471551.930	174145.045	1.155	37.265
18	0.012	5.00	38.350	500	471567.781	174145.403	0.650	37.700
4	0.009	5.00	38.330	500	471560.482	174153.634	1.115	37.215
5	0.009	5.00	38.200	500	471567.107	174158.139	1.020	37.180
6	0.010	5.00	38.280	500	471577.075	174159.683	1.150	37.130
7 (TANK)			38.200	500	471601.095	174163.904	1.100	37.100
8	0.084	5.00	37.730	500	471605.863	174169.069	0.690	37.040

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
9			37.720	500	471595.253	174180.921	0.760	36.960
20	0.008	5.00	38.300	500	471574.249	174201.103	0.990	37.310
10	0.021	5.00	37.700	500	471579.108	174198.955	1.060	36.640
Outfall 1			37.500		471582.713	174205.238	0.870	36.630

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	37	38	16.970	0.600	37.830	37.630	0.200	84.9	150	5.26	50.0
1.001	38	39	22.248	0.600	37.630	37.540	0.090	247.2	300	5.63	50.0
2.000	43	39	15.944	0.600	37.700	37.540	0.160	99.6	150	5.26	50.0
1.002	39	1	5.075	0.600	37.540	37.520	0.020	253.8	300	5.72	50.0
3.000	40	1	16.684	0.600	37.660	37.520	0.140	119.2	150	5.30	50.0
1.003	1	2	49.153	0.600	37.520	37.320	0.200	245.8	300	6.54	50.0
4.000	11	12	6.704	0.600	37.890	37.850	0.040	167.6	150	5.14	50.0
4.001	12	13	11.575	0.600	37.850	37.770	0.080	144.7	150	5.38	50.0
4.002	13	14	21.794	0.600	37.770	37.640	0.130	167.6	150	5.85	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.092	19.3	3.4	0.460	0.800	0.025	0.0	42	0.823
1.001	0.995	70.4	8.5	0.650	0.760	0.063	0.0	70	0.678
2.000	1.006	17.8	5.6	0.680	0.910	0.041	0.0	58	0.892
1.002	0.982	69.4	20.7	0.760	0.760	0.153	0.0	112	0.861
3.000	0.919	16.2	2.3	0.620	0.910	0.017	0.0	38	0.654
1.003	0.998	70.6	33.9	0.760	1.140	0.250	0.0	146	0.988
4.000	0.773	13.7	2.6	0.270	0.600	0.019	0.0	44	0.596
4.001	0.833	14.7	2.6	0.600	0.680	0.019	0.0	42	0.628
4.002	0.773	13.7	4.3	0.680	0.830	0.032	0.0	58	0.688

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)
4.003	14	15	10.729	0.600	37.640	37.540	0.100	107.3	150	6.03	50.0
4.004	15	2	12.250	0.600	37.540	37.470	0.070	175.0	150	6.30	50.0
5.000	16	17	27.233	0.600	37.820	37.650	0.170	160.2	150	5.57	50.0
5.001	17	2	10.524	0.600	37.650	37.470	0.180	58.5	150	5.71	50.0
1.004	2	3	13.746	0.600	37.320	37.265	0.055	249.9	300	6.77	50.0
1.005	3	4	12.121	0.600	37.265	37.215	0.050	242.4	300	6.97	50.0
6.000	18	4	11.001	0.600	37.700	37.215	0.485	22.7	150	5.09	50.0
1.006	4	5	8.012	0.600	37.215	37.180	0.035	228.9	300	7.10	50.0
1.007	5	6	10.087	0.600	37.180	37.130	0.050	201.7	300	7.25	50.0
1.008	6	7 (TANK)	24.388	0.600	37.130	37.100	0.030	812.9	300	8.00	50.0
1.009	7 (TANK)	8	2.400	0.600	37.100	37.040	0.060	40.0	300	8.02	50.0
1.010	8	9	15.907	0.600	37.040	36.960	0.080	198.8	300	8.25	50.0
1.011	9	10	24.205	0.600	36.960	36.640	0.320	75.6	300	8.48	50.0
7.000	20	10	5.313	0.600	37.310	36.745	0.565	9.4	150	5.03	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
4.003	0.969	17.1	6.0	0.830	1.050	0.044	0.0	61	0.885
4.004	0.756	13.4	7.9	1.050	1.140	0.058	0.0	83	0.787
5.000	0.791	14.0	5.4	1.030	0.950	0.040	0.0	65	0.741
5.001	1.318	23.3	6.2	0.950	1.140	0.046	0.0	53	1.120
1.004	0.990	70.0	49.1	1.140	0.855	0.362	0.0	185	1.068
1.005	1.005	71.1	53.1	0.855	0.815	0.392	0.0	194	1.100
6.000	2.123	37.5	1.6	0.500	0.965	0.012	0.0	21	1.066
1.006	1.035	73.1	56.0	0.815	0.720	0.413	0.0	197	1.136
1.007	1.103	78.0	57.2	0.720	0.850	0.422	0.0	191	1.201
1.008	0.544	38.4	58.5	0.850	0.800	0.432	0.0	300	0.551
1.009	2.493	176.2	58.5	0.800	0.390	0.432	0.0	119	2.247
1.010	1.111	78.5	69.9	0.390	0.460	0.516	0.0	222	1.250
1.011	1.809	127.9	69.9	0.460	0.760	0.516	0.0	158	1.849
7.000	3.305	58.4	1.1	0.840	0.805	0.008	0.0	14	1.286

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)
1.012	10	Outfall 1	7.244	0.600	36.640	36.630	0.010	724.4	300	8.69	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.012	0.576	40.7	73.9	0.760	0.570	0.545	0.0	300	0.584

Simulation Settings

Rainfall Methodology	FSR	Summer CV	0.750	Additional Storage (m³/ha)	20.0
Rainfall Events	Singular	Winter CV	0.840	Starting Level (m)	
FSR Region	England and Wales	Analysis Speed	Normal	Check Discharge Rate(s)	x
M5-60 (mm)	18.700	Skip Steady State	x	Check Discharge Volume	x
Ratio-R	0.400	Drain Down Time (mins)	240		

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

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	40	0	0

Node 7 (TANK) Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	37.100
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	19

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	181.0	0.0	0.400	181.0	0.0	0.401	0.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 98.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	37	10	37.872	0.042	3.3	0.0423	0.0000	OK
15 minute winter	38	10	37.698	0.068	8.2	0.0674	0.0000	OK
15 minute winter	43	10	37.756	0.056	5.4	0.0665	0.0000	OK
15 minute winter	39	11	37.676	0.136	19.7	0.1520	0.0000	OK
15 minute winter	40	10	37.697	0.037	2.2	0.0236	0.0000	OK
15 minute winter	1	11	37.659	0.139	31.6	0.2365	0.0000	OK
15 minute winter	11	10	37.935	0.045	2.5	0.0497	0.0000	OK
15 minute winter	12	10	37.891	0.041	2.5	0.0081	0.0000	OK
15 minute winter	13	11	37.827	0.057	4.1	0.0291	0.0000	OK
15 minute winter	14	11	37.701	0.061	5.6	0.0268	0.0000	OK
15 minute winter	15	11	37.626	0.086	7.4	0.0369	0.0000	OK
15 minute winter	16	10	37.886	0.066	5.3	0.0576	0.0000	OK
15 minute summer	17	10	37.702	0.052	5.7	0.0160	0.0000	OK
15 minute winter	2	11	37.593	0.273	45.8	0.0839	0.0000	OK
15 minute winter	3	10	37.558	0.293	53.5	0.2098	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	37	1.000	38	3.2	0.560	0.168	0.0992	
15 minute winter	38	1.001	39	8.0	0.389	0.114	0.4757	
15 minute winter	43	2.000	39	5.3	0.458	0.299	0.1804	
15 minute winter	39	1.002	1	19.4	0.622	0.280	0.1592	
15 minute winter	40	3.000	1	2.2	0.211	0.134	0.1695	
15 minute winter	1	1.003	2	31.5	0.742	0.447	2.4364	
15 minute winter	11	4.000	12	2.5	0.589	0.181	0.0281	
15 minute winter	12	4.001	13	2.4	0.489	0.166	0.0583	
15 minute winter	13	4.002	14	4.1	0.640	0.300	0.1398	
15 minute winter	14	4.003	15	5.7	0.672	0.334	0.0918	
15 minute winter	15	4.004	2	7.4	0.721	0.552	0.1586	
15 minute winter	16	5.000	17	5.2	0.810	0.370	0.1745	
15 minute summer	17	5.001	2	5.8	1.003	0.250	0.1078	
15 minute winter	2	1.004	3	49.8	0.798	0.711	0.9425	
15 minute winter	3	1.005	4	54.7	0.840	0.770	0.8510	

Results for 1 year Critical Storm Duration. Lowest mass balance: 98.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	18	10	37.721	0.021	1.6	0.0119	0.0000	OK
15 minute winter	4	10	37.533	0.318	57.3	0.1137	0.0000	SURCHARGED
15 minute summer	5	10	37.510	0.330	58.0	0.1231	0.0000	SURCHARGED
15 minute summer	6	10	37.493	0.363	60.6	0.1344	0.0000	SURCHARGED
30 minute winter	7 (TANK)	25	37.201	0.101	42.1	17.4581	0.0000	OK
30 minute winter	8	24	37.165	0.125	24.7	0.3301	0.0000	OK
30 minute summer	9	16	37.131	0.171	22.3	0.0336	0.0000	OK
15 minute winter	20	10	37.324	0.014	1.1	0.0051	0.0000	OK
60 minute winter	10	23	37.107	0.467	25.1	0.2769	0.0000	SURCHARGED
15 minute summer	Outfall 1	1	37.100	0.470	20.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	18	6.000	4	1.6	0.294	0.042	0.1051	
15 minute winter	4	1.006	5	58.1	0.899	0.795	0.5642	
15 minute summer	5	1.007	6	59.6	0.929	0.764	0.7103	
15 minute summer	6	1.008	7 (TANK)	64.2	1.738	1.671	0.8981	
30 minute winter	7 (TANK)	1.009	8	21.9	0.945	0.124	0.0583	
30 minute winter	8	1.010	9	24.7	0.771	0.315	0.5110	
30 minute summer	9	1.011	10	22.3	0.369	0.175	1.3550	
15 minute winter	20	7.000	10	1.1	0.914	0.019	0.0490	
60 minute winter	10	1.012	Outfall 1	25.1	0.356	0.615	0.5101	51.0

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.27%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	37	12	38.362	0.531	8.1	0.5400	0.0000	FLOOD RISK
15 minute winter	38	12	38.334	0.704	17.7	0.7014	0.0000	FLOOD RISK
15 minute winter	43	12	38.397	0.697	13.2	0.8252	0.0000	FLOOD RISK
15 minute winter	39	12	38.327	0.787	41.0	0.8825	0.0000	FLOOD RISK
15 minute winter	40	12	38.326	0.666	5.5	0.4251	0.0000	FLOOD RISK
15 minute winter	1	12	38.313	0.793	66.8	1.3524	0.0000	FLOOD RISK
15 minute winter	11	13	38.262	0.372	6.1	0.4092	0.0000	FLOOD RISK
15 minute winter	12	13	38.258	0.408	5.6	0.0799	0.0000	SURCHARGED
15 minute winter	13	13	38.249	0.479	9.2	0.2444	0.0000	SURCHARGED
15 minute winter	14	13	38.212	0.572	12.9	0.2524	0.0000	SURCHARGED
15 minute winter	15	12	38.177	0.637	13.2	0.2740	0.0000	SURCHARGED
15 minute winter	16	12	38.284	0.464	12.9	0.4056	0.0000	SURCHARGED
15 minute winter	17	12	38.182	0.532	12.2	0.1624	0.0000	SURCHARGED
15 minute winter	2	12	38.125	0.805	87.3	0.2470	0.0000	SURCHARGED
15 minute winter	3	12	37.997	0.732	94.7	0.5240	0.0000	SURCHARGED
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	37	1.000	38	6.6	0.657	0.340	0.2988	
15 minute winter	38	1.001	39	16.3	0.418	0.231	1.5667	
15 minute winter	43	2.000	39	10.6	0.620	0.594	0.2807	
15 minute winter	39	1.002	1	39.3	0.656	0.566	0.3574	
15 minute winter	40	3.000	1	5.0	0.285	0.309	0.2937	
15 minute winter	1	1.003	2	64.1	0.910	0.908	3.4613	
15 minute winter	11	4.000	12	5.6	0.733	0.408	0.1180	
15 minute winter	12	4.001	13	6.3	0.568	0.426	0.2038	
15 minute winter	13	4.002	14	9.2	0.653	0.671	0.3837	
15 minute winter	14	4.003	15	12.1	0.686	0.705	0.1889	
15 minute winter	15	4.004	2	15.6	0.885	1.166	0.2157	
15 minute winter	16	5.000	17	10.4	0.843	0.747	0.4794	
15 minute winter	17	5.001	2	11.5	1.092	0.493	0.1853	
15 minute winter	2	1.004	3	87.2	1.238	1.246	0.9680	
15 minute winter	3	1.005	4	94.6	1.343	1.331	0.8536	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.27%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	18	12	37.863	0.163	3.9	0.0924	0.0000	SURCHARGED
15 minute winter	4	12	37.859	0.644	99.7	0.2306	0.0000	SURCHARGED
15 minute winter	5	12	37.741	0.561	101.9	0.2091	0.0000	SURCHARGED
15 minute winter	6	8	37.617	0.487	104.3	0.1801	0.0000	SURCHARGED
30 minute winter	7 (TANK)	26	37.318	0.218	85.8	37.5000	0.0000	OK
30 minute winter	8	26	37.297	0.257	64.2	0.6753	0.0000	OK
30 minute winter	9	26	37.230	0.270	64.2	0.0528	0.0000	OK
15 minute winter	20	10	37.332	0.022	2.6	0.0077	0.0000	OK
30 minute winter	10	24	37.138	0.498	66.2	0.2954	0.0000	SURCHARGED
15 minute summer	Outfall 1	1	37.100	0.470	56.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	18	6.000	4	3.5	0.443	0.094	0.1937	
15 minute winter	4	1.006	5	99.6	1.414	1.361	0.5642	
15 minute winter	5	1.007	6	101.8	1.446	1.306	0.7103	
15 minute winter	6	1.008	7 (TANK)	104.3	1.841	2.714	1.4784	
30 minute winter	7 (TANK)	1.009	8	59.3	1.052	0.337	0.1428	
30 minute winter	8	1.010	9	64.2	1.004	0.817	1.0411	
30 minute winter	9	1.011	10	64.2	0.913	0.502	1.6597	
15 minute winter	20	7.000	10	2.6	0.916	0.044	0.0509	
30 minute winter	10	1.012	Outfall 1	66.2	0.940	1.625	0.5101	102.1

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.31%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	37	10	38.440	0.610	16.8	0.6198	2.6472	FLOOD
15 minute winter	38	10	38.488	0.858	30.9	0.8547	0.0000	FLOOD RISK
15 minute winter	43	10	38.530	0.830	17.1	0.9827	0.9912	FLOOD
15 minute winter	39	10	38.491	0.951	42.3	1.0657	0.0000	FLOOD RISK
15 minute winter	40	10	38.430	0.770	13.6	0.4913	1.8873	FLOOD
15 minute winter	1	10	38.475	0.955	74.6	1.6295	0.0000	FLOOD RISK
15 minute winter	11	11	38.310	0.420	13.3	0.4624	1.7987	FLOOD
15 minute summer	12	11	38.325	0.475	6.1	0.0931	0.0000	FLOOD RISK
15 minute summer	13	11	38.342	0.572	8.8	0.2919	0.0000	FLOOD RISK
15 minute winter	14	11	38.351	0.711	10.1	0.3137	0.0000	FLOOD RISK
15 minute winter	15	11	38.352	0.812	13.5	0.3491	0.0000	SURCHARGED
15 minute winter	16	11	38.621	0.801	16.7	0.7000	0.0000	SURCHARGED
15 minute winter	17	11	38.411	0.761	16.7	0.2321	0.0000	SURCHARGED
15 minute winter	2	11	38.298	0.978	92.2	0.3002	0.0000	SURCHARGED
15 minute winter	3	11	38.163	0.898	101.6	0.6431	0.0000	FLOOD RISK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	37	1.000	38	8.0	0.671	0.413	0.2988	
15 minute winter	38	1.001	39	16.1	0.415	0.229	1.5667	
15 minute winter	43	2.000	39	11.5	0.655	0.648	0.2807	
15 minute winter	39	1.002	1	41.3	0.670	0.594	0.3574	
15 minute winter	40	3.000	1	-6.9	-0.390	-0.423	0.2937	
15 minute winter	1	1.003	2	72.6	1.031	1.029	3.4613	
15 minute winter	11	4.000	12	-5.8	0.745	-0.427	0.1180	
15 minute summer	12	4.001	13	6.3	0.588	0.431	0.2038	
15 minute summer	13	4.002	14	9.6	0.649	0.702	0.3837	
15 minute winter	14	4.003	15	12.5	0.711	0.730	0.1889	
15 minute winter	15	4.004	2	16.2	0.920	1.211	0.2157	
15 minute winter	16	5.000	17	14.5	0.900	1.036	0.4794	
15 minute winter	17	5.001	2	17.4	1.064	0.746	0.1853	
15 minute winter	2	1.004	3	90.1	1.279	1.287	0.9680	
15 minute winter	3	1.005	4	101.3	1.438	1.426	0.8536	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.31%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	18	11	38.014	0.314	5.0	0.1778	0.0000	SURCHARGED
15 minute winter	4	11	38.005	0.790	109.3	0.2828	0.0000	SURCHARGED
15 minute winter	5	11	37.863	0.683	112.6	0.2546	0.0000	SURCHARGED
15 minute winter	6	11	37.689	0.559	116.3	0.2069	0.0000	SURCHARGED
30 minute winter	7 (TANK)	27	37.397	0.296	108.8	51.0406	0.0000	OK
30 minute winter	8	27	37.367	0.327	71.1	0.8591	0.0000	SURCHARGED
30 minute winter	9	26	37.274	0.314	71.2	0.0616	0.0000	SURCHARGED
15 minute winter	20	10	37.334	0.024	3.3	0.0087	0.0000	OK
30 minute winter	10	24	37.147	0.507	73.7	0.3007	0.0000	SURCHARGED
15 minute summer	Outfall 1	1	37.100	0.470	65.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	18	6.000	4	4.7	0.379	0.124	0.1937	
15 minute winter	4	1.006	5	109.1	1.549	1.491	0.5642	
15 minute winter	5	1.007	6	112.4	1.597	1.442	0.7103	
15 minute winter	6	1.008	7 (TANK)	116.3	2.012	3.027	1.6068	
30 minute winter	7 (TANK)	1.009	8	66.4	1.071	0.377	0.1688	
30 minute winter	8	1.010	9	71.2	1.011	0.906	1.1202	
30 minute winter	9	1.011	10	71.2	1.011	0.557	1.7045	
15 minute winter	20	7.000	10	3.3	1.034	0.056	0.0516	
30 minute winter	10	1.012	Outfall 1	73.7	1.046	1.808	0.5101	133.7

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.38%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	37	9	38.440	0.610	29.1	0.6198	7.5432	FLOOD
15 minute winter	38	10	38.580	0.950	27.3	0.9462	0.1423	FLOOD
15 minute winter	43	9	38.530	0.830	32.6	0.9827	6.6716	FLOOD
15 minute winter	39	10	38.585	1.045	50.3	1.1713	0.0000	FLOOD RISK
15 minute winter	40	9	38.430	0.770	24.9	0.4913	6.2050	FLOOD
15 minute winter	1	10	38.580	1.060	81.4	1.8079	0.0479	FLOOD
15 minute winter	11	9	38.310	0.420	23.8	0.4624	6.2253	FLOOD
15 minute winter	12	11	38.366	0.516	13.3	0.1011	0.0000	FLOOD RISK
15 minute winter	13	11	38.450	0.680	13.2	0.3468	0.0000	FLOOD RISK
15 minute winter	14	11	38.479	0.839	9.9	0.3700	0.0000	FLOOD RISK
15 minute winter	15	11	38.478	0.938	13.1	0.4032	0.0000	FLOOD RISK
15 minute winter	16	11	39.000	1.180	23.4	1.0313	0.4710	FLOOD
15 minute winter	17	11	38.653	1.003	22.5	0.3058	0.0000	FLOOD RISK
15 minute winter	2	11	38.439	1.119	91.3	0.3436	0.0000	SURCHARGED
15 minute winter	3	11	38.308	1.043	105.9	0.7466	0.0000	FLOOD RISK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	37	1.000	38	-14.6	-0.827	-0.755	0.2988	
15 minute winter	38	1.001	39	18.4	0.422	0.262	1.5667	
15 minute winter	43	2.000	39	11.8	0.671	0.664	0.2807	
15 minute winter	39	1.002	1	40.3	0.687	0.581	0.3574	
15 minute winter	40	3.000	1	-15.0	-0.851	-0.922	0.2937	
15 minute winter	1	1.003	2	68.4	0.971	0.969	3.4613	
15 minute winter	11	4.000	12	-13.4	-0.762	-0.981	0.1180	
15 minute winter	12	4.001	13	-13.3	-0.758	-0.906	0.2038	
15 minute winter	13	4.002	14	9.2	0.687	0.674	0.3837	
15 minute winter	14	4.003	15	12.2	0.714	0.713	0.1889	
15 minute winter	15	4.004	2	15.6	0.887	1.168	0.2157	
15 minute winter	16	5.000	17	19.2	1.089	1.371	0.4794	
15 minute winter	17	5.001	2	22.8	1.293	0.978	0.1853	
15 minute winter	2	1.004	3	89.5	1.271	1.280	0.9680	
15 minute winter	3	1.005	4	105.3	1.496	1.482	0.8536	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.38%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	18	11	38.159	0.459	7.0	0.2598	0.0000	FLOOD RISK
15 minute winter	4	11	38.137	0.922	117.2	0.3301	0.0000	FLOOD RISK
15 minute winter	5	11	37.973	0.793	122.4	0.2957	0.0000	FLOOD RISK
15 minute winter	6	10	37.771	0.641	128.2	0.2373	0.0000	SURCHARGED
60 minute winter	7 (TANK)	43	37.582	0.482	108.3	68.9605	0.0000	SURCHARGED
60 minute winter	8	43	37.538	0.498	97.1	1.3113	0.0000	FLOOD RISK
60 minute winter	9	43	37.387	0.427	90.4	0.0836	0.0000	SURCHARGED
15 minute winter	20	10	37.339	0.029	4.7	0.0103	0.0000	OK
60 minute winter	10	43	37.177	0.537	94.5	0.3187	0.0000	SURCHARGED
15 minute summer	Outfall 1	1	37.100	0.470	72.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	18	6.000	4	7.0	0.502	0.185	0.1937	
15 minute winter	4	1.006	5	117.5	1.669	1.606	0.5642	
15 minute winter	5	1.007	6	122.7	1.742	1.573	0.7103	
15 minute winter	6	1.008	7 (TANK)	128.6	2.175	3.348	1.7174	
60 minute winter	7 (TANK)	1.009	8	83.8	1.190	0.475	0.1690	
60 minute winter	8	1.010	9	90.4	1.283	1.150	1.1202	
60 minute winter	9	1.011	10	90.5	1.285	0.707	1.7045	
15 minute winter	20	7.000	10	4.7	0.971	0.080	0.0530	
60 minute winter	10	1.012	Outfall 1	94.5	1.343	2.320	0.5101	235.3

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	18.700	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
42	0.009	5.00	38.110	500	471484.531	174117.636	0.750	37.360
44	0.025	5.00	38.450	500	471479.742	174108.390	1.200	37.250
Outfall 2			38.450	500	471476.713	174101.704	1.270	37.180

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	42	44	10.413	0.600	37.360	37.250	0.110	94.7	150	5.17	50.0
1.001	44	Outfall 2	1.000	0.600	37.250	37.180	0.070	14.3	150	5.17	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.033	18.3	1.2	0.600	1.050	0.009	0.0	26	0.584
1.001	2.679	47.3	4.6	1.050	1.120	0.034	0.0	31	1.701

Simulation Settings

Rainfall Methodology	FSR	Summer CV	0.750	Additional Storage (m ³ /ha)	20.0
Rainfall Events	Singular	Winter CV	0.840	Starting Level (m)	
FSR Region	England and Wales	Analysis Speed	Normal	Check Discharge Rate(s)	x
M5-60 (mm)	18.700	Skip Steady State	x	Check Discharge Volume	x
Ratio-R	0.400	Drain Down Time (mins)	240		

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

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	40	0	0

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	42	10	37.386	0.026	1.2	0.0113	0.0000	OK
15 minute winter	44	10	37.289	0.039	4.5	0.0240	0.0000	OK
15 minute winter	Outfall 2	10	37.211	0.031	4.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	42	1.000	44	1.2	0.421	0.065	0.0295	
15 minute winter	44	1.001	Outfall 2	4.4	1.420	0.094	0.0031	2.1

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	42	10	37.400	0.040	2.9	0.0175	0.0000	OK
15 minute winter	44	10	37.318	0.068	11.0	0.0418	0.0000	OK
15 minute winter	Outfall 2	10	37.229	0.049	10.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	42	1.000	44	2.9	0.501	0.157	0.0603	
15 minute winter	44	1.001	Outfall 2	10.9	1.710	0.230	0.0064	5.1

Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	42	10	37.406	0.046	3.8	0.0201	0.0000	OK
15 minute winter	44	10	37.331	0.081	14.2	0.0495	0.0000	OK
15 minute winter	Outfall 2	10	37.236	0.056	14.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	42	1.000	44	3.8	0.531	0.206	0.0742	
15 minute winter	44	1.001	Outfall 2	14.1	1.799	0.297	0.0078	6.5

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

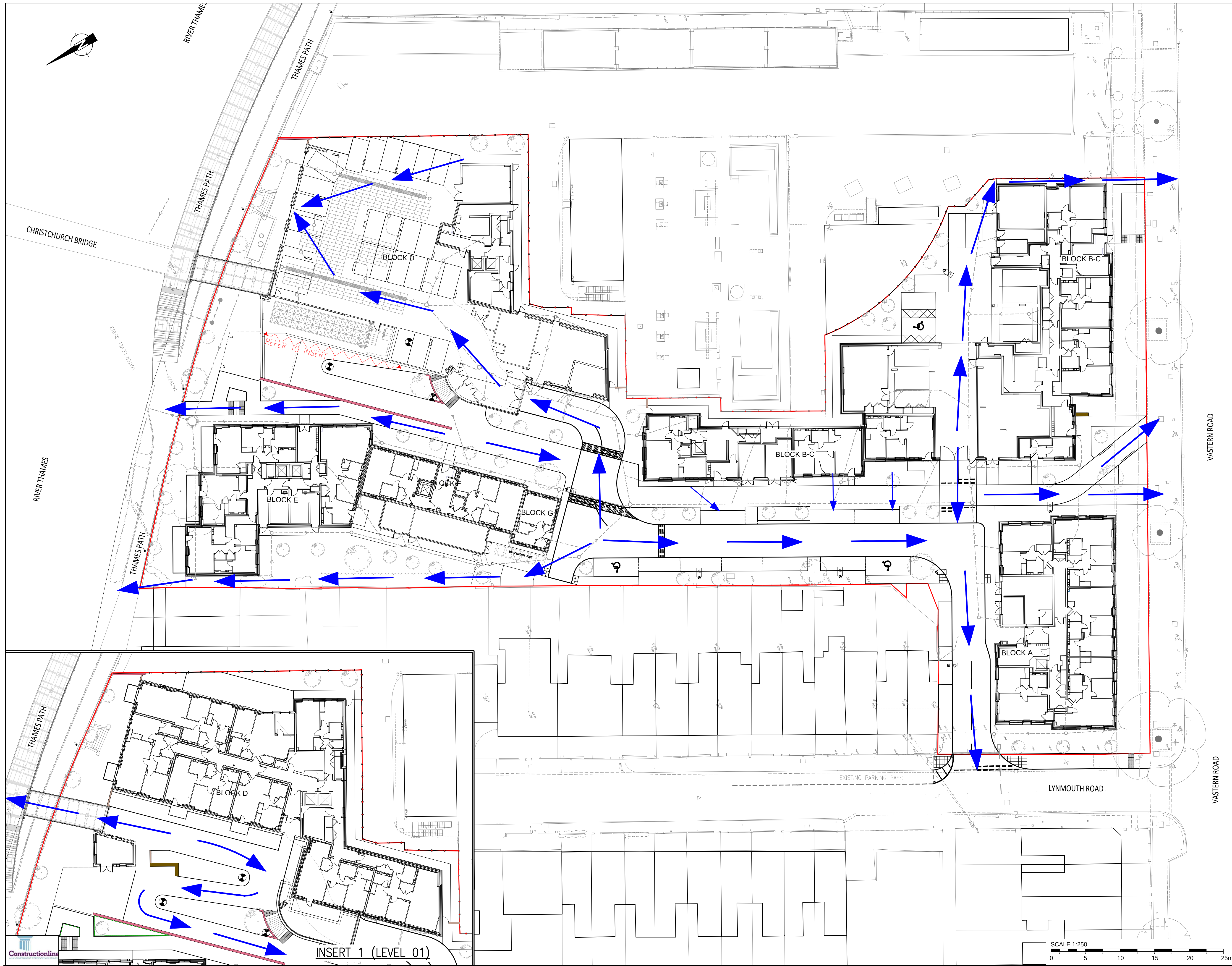
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	42	10	37.415	0.055	5.3	0.0240	0.0000	OK
15 minute winter	44	10	37.352	0.102	19.8	0.0626	0.0000	OK
15 minute winter	Outfall 2	10	37.248	0.068	19.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	42	1.000	44	5.3	0.563	0.288	0.0969	
15 minute winter	44	1.001	Outfall 2	19.7	1.922	0.417	0.0102	9.1



APPENDIX 6

Exceedance Route Drawing



- GENERAL NOTES:
- G1. DO NOT SCALE FROM THIS DRAWING.
 - G2. ALL DIMENSIONS ARE IN METRES, UNLESS STATED OTHERWISE.
 - G3. LEVELS ARE IN METRES AND ARE RELATED TO GPS DATUM
 - G4. THIS DRAWING IS BASED ON A TOPOGRAPHICAL SURVEY UNDERTAKEN BY:- MALTBY SURVEYS LTD
2 QUEENS ROAD
HAYWARDS HEATH
WEST SUSSEX
RH16 1EB
DATE: OCTOBER 2016
TEL: 01444416246
 - G5. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL RELEVANT SCHEME DRAWINGS AND SPECIFICATIONS.
 - G6. ALL WORKS TO BE CARRIED OUT IN STRICT ACCORDANCE WITH "THE SPECIFICATION FOR HIGHWAY WORKS - MODIFIED AND EXTENDED", INCLUDING READING BOROUGH COUNCIL SUPPLEMENTARY CLAUSES.
 - G7. ALL WORKS WITHIN THE PUBLIC HIGHWAY SHALL BE CARRIED OUT AND COMPLY WITH THE REQUIREMENTS OF THE DTP "TRAFFIC SIGNS MANUAL, CHAPTER 8 - TRAFFIC SAFETY MEASURES AND SIGNS FOR ROAD WORKS AND TEMPORARY SITUATION".
 - G8. ALL EXISTING LEVELS TO BE CONFIRMED ON SITE PRIOR TO COMMENCEMENT OF ANY WORKS.

- KEY:
- > FLOW EXCEEDANCE ROUTE
 - PROPOSED SW SEWER

CONSTRUCTION ISSUE

003	PROPOSED TREE LOCATIONS AMENDED	CL	08.12.25		
002	REVISED TO SUIT DRAINAGE CHANGES	CL	07.11.25		
001	REVISED TO SUIT LAYOUT CHANGES	FP	MSR 20.09.24		
—	ISSUED FOR CONSTRUCTION	MSR	JS 20.06.24		
—	INITIAL ISSUE	MSR	JS 20.06.24		
ST	Rev	Description	Dwn	Chk	Date
REVISIONS					
Preliminary Issue		Submitted for S104			
Planning Issue		Issued for Tender			
Submitted for S38		Issued for Construction			
Submitted for S278		As Built			
DRAWING STATUS					

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Berkeley
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JOB TITLE
VASTERN ROAD
READING
DRAWING TITLE
EXCEEDANCE FLOW
ROUTES

DATE
JUNE 2024
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JS
CHECKED
MSR
SCALE
1:250
SHEET
0453-STU05-XX-XX-DR-C-820-010 C03
S0
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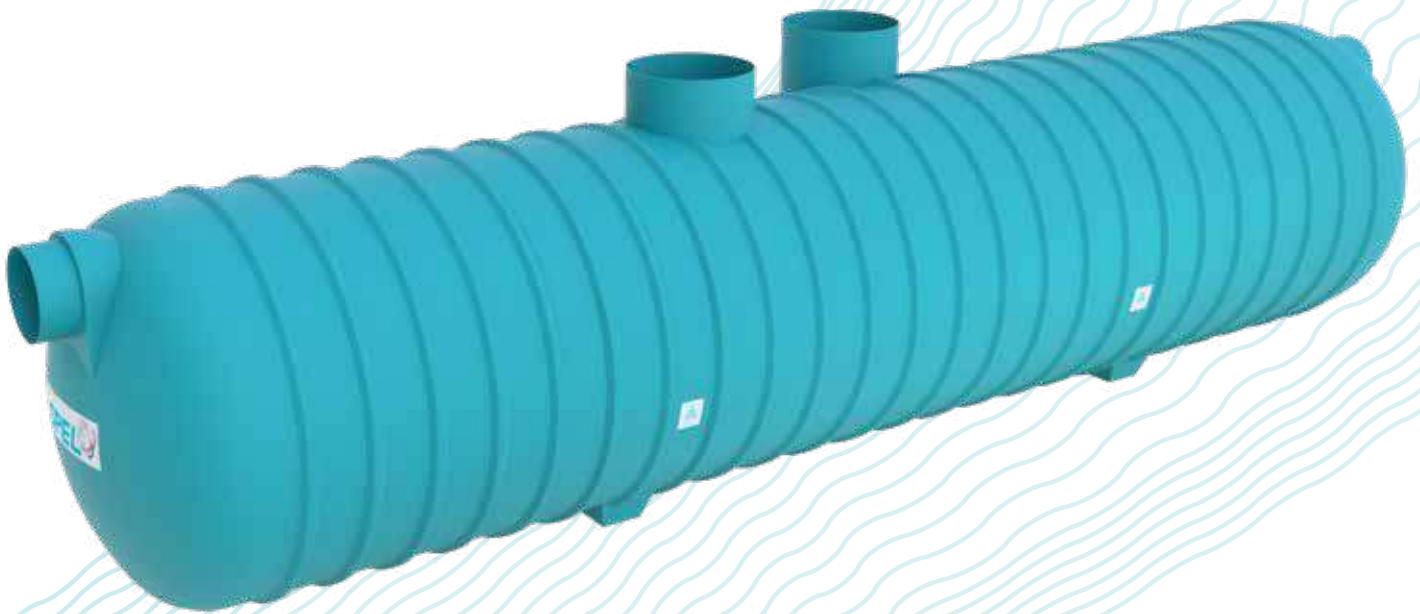
APPENDIX 7

SPEL Stormceptor Product Details



Quality solutions protecting our global environment

The **safest answer** for **pollution control** and our **environment**



SPEL Stormceptor

ESR (Enhanced Silt Retention)

SuDS Compliant ESR Range

spelproducts.co.uk

SPEL Stormceptor ESR Range

By-Pass System

The **total** treatment solution for SuDS

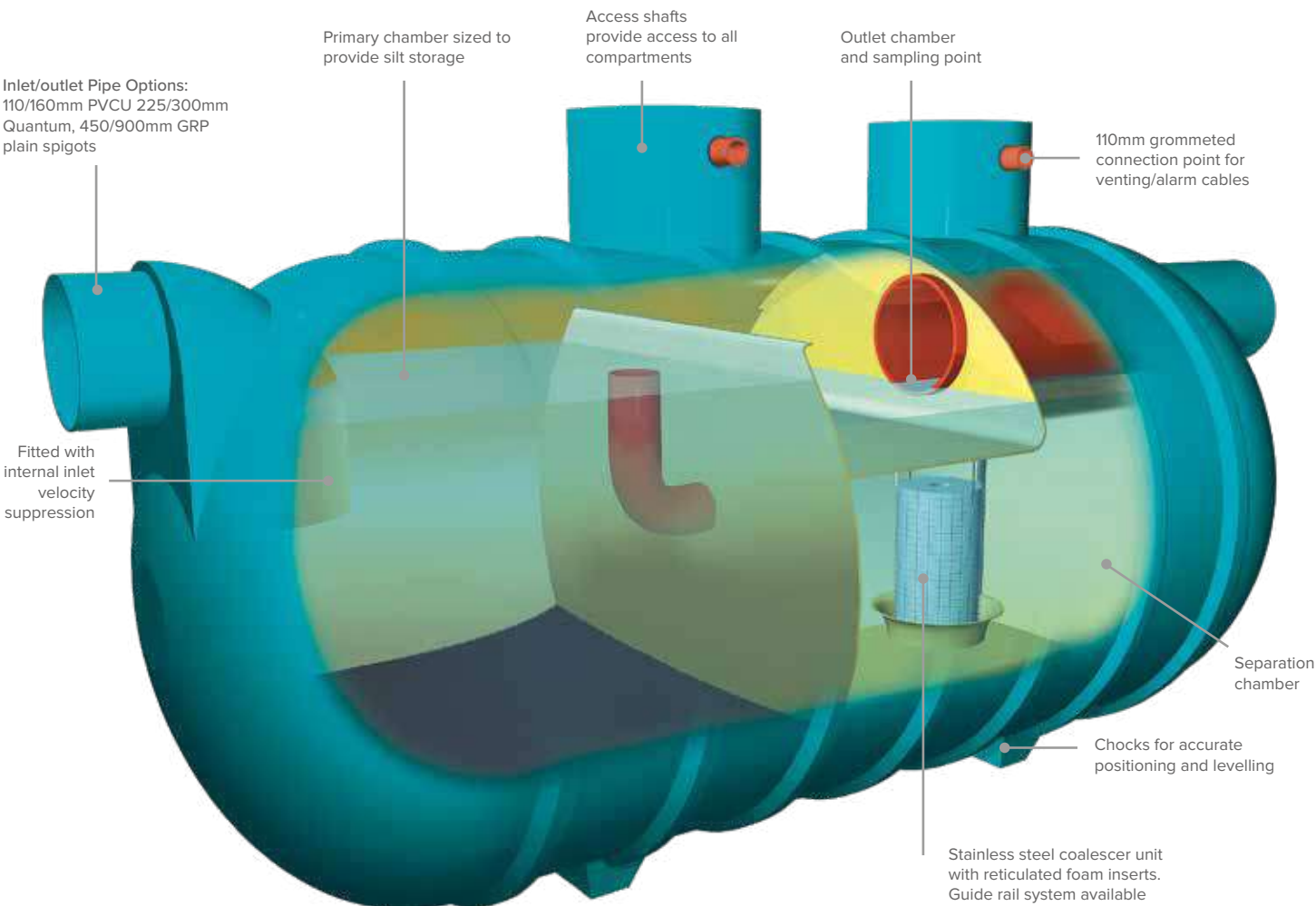
The new SPEL ESR System is fully certified to meet the CIRIA SuDS Mitigation Index. It has been tested by WRc (for TSS and Metals) to the British Water Code of Practice for Manufactured Treatment Devices. This unit is also compliant to the British and European Standard BS EN 858.

SPEL's ESR range is a total treatment system removing Hydrocarbons, Total Suspended Solids (TSS) and Metals (particulate). It's a highly efficient, single unit, water quality SuDS component.

SPEL ESR Stormceptor Certified Mitigation Index

TSS	0.8
Metals	0.6
Hydrocarbons	0.9*

**H R Wallingford test results to BS EN 858*



SPEL Stormceptor ESR Range

By-Pass System



Surface Water Treatment Device Performance Declaration

Testing carried out according to British Water Code of Practice

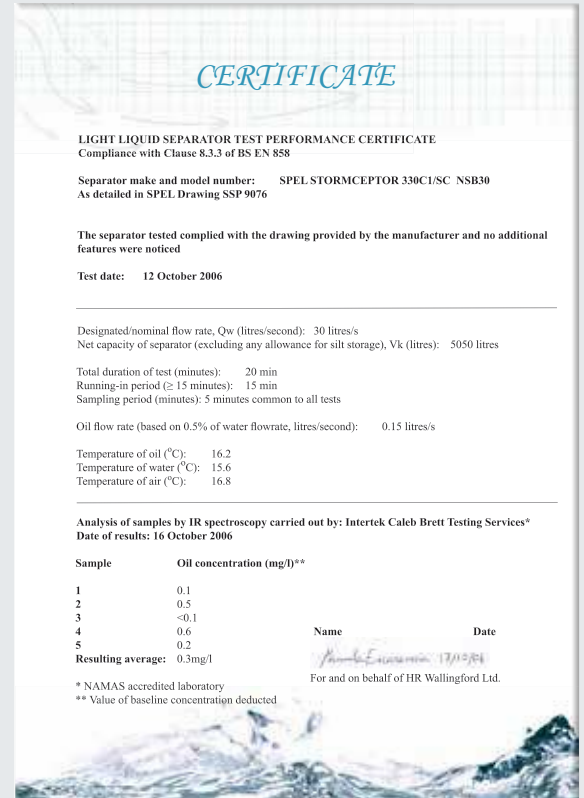
Product Details	Description
Manufacturer	SPEL Products
Treatment Device Name/Model	Stormceptor Type 210 C1/SC
General description	Class 1 By-pass Separator with Silt Capacity
Envisaged application	Treatment of Surface Water Run-off
Pollutant(s) captured	Suspended Solids

Test	Value	Unit
Treatment device capacity	3200	litres
Sediment Storage capacity	1000	litres
Treatment Flow rate	10	l/s
Connected Area	1,333	m²
Pollution retention flow rate	10	l/s

Parameter	Value	Unit
Maximum capacity flow rate	100	l/s
Device head loss (at treatment flowrate)	0.15	m
Device head loss (at maximum capacity treatment flowrate)	-	m
TSS capture and retention efficiency (Milisil W4 test sediment)	82	%
Zinc capture efficiency (if tested)	Not tested for dissolved metals	%
Zinc retention efficiency (if tested)	Not tested for dissolved metals	%
Copper capture efficiency (if tested)	Not tested for dissolved metals	%
Copper retention efficiency (if tested)	Not tested for dissolved metals	%
Dissolved Metals reduction	0.0	%
Particulate metals reduction*	61.5*	%
Total Metals reduction*	61.5*	%
Total Metals Mitigation Index	0.615*	-

* Extrapolated value in accordance with British Water How to Guide: Applying the CIRIA The SuDS Manual (C753) Simple Index Approach to Proprietary / Manufactured Stormwater Treatment Devices. Version 7, Section 4.3, (2021- under pre-publication review).

Certificates of compliance from WRc and HR Wallingford for the SPEL Stormceptor ESR Range



SPEL's Head of Technical Development alongside the WRc testing officer.

Research and Development

Research and development is at the heart of what we do at SPEL, our passion as Zero Pollution Ambassadors is to be at the cutting edge of clean surface water technology.

Months of rigorous testing has resulted in the new SPEL Stormceptor ESR Range.

Protecting our Environment for Over 45 Years

The SuDS Manual is leading good practise in drainage design, SPEL are endorsing this with the release of the new SPEL Stormceptor ESR range.

Total Suspended Solids (TSS)	Metals	Hydrocarbons
0.8	0.6	0.9*

*H R Wallingford test results to BS EN 858

Added to these class-leading Mitigation Indices, the ESR range benefits from:

- British/European Standard BS EN 858-1 2002 certification.
- The SPEL 25 year shell Warranty.
- 50 year+ life expectancy.
- ISO9001 quality assurance.
- ISO14001 committed to environmental improvement

26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ¹	High	0.8 ²	0.8 ²	0.9 ²

26.3 Indicative SuDS mitigation indices for discharges to surface waters

Type of SuDS component	Mitigation Indices		
	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4 ²	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond ⁴	0.7 ³	0.7	0.5
Wetland	0.8 ³	0.8	0.8
Proprietary treatment systems ^{5,6}	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

Tables from The SuDS Manual (C753), p568-569

For reference notes, please see the full manual: https://www.ciria.org/Memberships/The_SuDs_Manual_C753_Chapters.aspx

SPEL Stormceptor ESR Range By-Pass System

ESR Specification Chart

Model	Series	Treated Flow Rate - l/s	Maximum Flow	Catchment area (m ²)*	Oil storage (litres)	Silt capacity (litres)	Overall length* (mm) L	Overall diameter (mm)	Inlet Invert (mm) A	Base to Inlet (mm) B	Base to outlet (mm) C	Max in/out pipe diameter** (mm)	Number of access shafts (dia. mm)			
													600	750	900	1200
210C1/ESR	200	10	100	1,333	150	1,000	2,920	1,225	560	1,350	1,300	300	-	1	-	-
212C1/ESR	200	12	120	1,600	180	1200	3,570	1,225	560	1,350	1,300	300	-	1	-	-
215C1/ESR	200	15	150	2,000	225	1,500	4,237	1,225	560	1,350	1,300	300	-	1	-	-
320C1/ESR	300	20	200	2,665	300	2,000	3,200	1,875	700	1,450	1,350	450	2	-	-	-
325C1/ESR	300	25	250	3,333	375	2,500	3,540	1,875	700	1,450	1,350	450	2	-	-	-
330C1/ESR	300	30	300	4,000	450	3,000	4,420	1,875	700	1,450	1,350	450	-	1	1	-
340C1/ESR	300	40	400	5,333	600	4,000	5,760	1,875	740	1,410	1,310	450	1	1	-	-
345C1/ESR	300	45	450	6,000	675	4,500	6,570	1,875	740	1,410	1,310	450	1	1	-	-
350C1/ESR	300	50	500	6,665	750	5,000	7,060	1,875	740	1,410	1,310	450	1	1	-	-
460C1/ESR	400	60	600	8,000	900	6,000	4,400	2,700	950	2,100	2,000	600	1	-	1	-
470C1/ESR	400	70	700	9,333	1,050	7,000	5,250	2,700	950	2,100	2,000	600	1	-	1	-
480C1/ESR	400	80	800	10,665	1,200	8,000	6,170	2,700	950	2,100	2,000	600	1	-	1	-
4100C1/ESR	400	100	1000	13,333	1,500	10,000	7,400	2,700	1,100	1,950	1,850	750	1	-	1	-
4125C1/ESR	400	125	1250	16,665	1,875	12,500	9,050	2,700	1,100	1,950	1,850	750	1	-	1	-
4150C1/ESR	400	150	1500	20,000	2,250	15,000	9,950	2,700	1,100	1,950	1,850	750	-	-	2	-
4160C1/ESR	400	160	1600	21,333	2,400	16,000	11,830	2,700	1,250	1,800	1,700	750	1	1	1	-
5180C1/ESR	500	180	1800	24,000	2,700	18,000	7,470	3,650	1,185	2,690	2,550	900	Access shafts dependent on orientation of pipework (see page 7 for orientation options).			
5200C1/ESR	500	200	2000	26,665	3,000	20,000	8,530	3,650	1,185	2,690	2,355	1,200				
5250C1/ESR	500	250	2500	33,333	3,750	25,000	10,040	3,650	1,185	2,690	2,355	1,200				
6300C1/ESR	600	300	3000	40,000	4,500	30,000	10,310	4,150	1,325	2,850	2,675	1,200				
6350C1/ESR	600	350	3500	46,665	5,250	35,000	11,470	4,150	1,325	2,850	2,675	1,200				
6400C1/ESR	600	400	4000	53,333	6,000	40,000	12,690	4,150	1,325	2,850	2,675	1,200				
6500C1/ESR	600	500	5000	66,665	7,500	50,000	15,870	4,150	1,325	2,850	2,675	1,200				
6600C1/ESR	600	600	6000	80,000	9,000	60,000	18,260	4,150	1,325	2,850	2,675	1,200				
6700C1/ESR	600	700	7000	93,333	10,500	70,000	22,250	4,150	2,850	2,850	2,675	1,200				

*These catchment areas are based on the SuDS Manual requirement for By-Pass devices to treat the 1 in 1 year storm event (27mm).

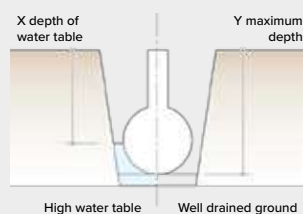
**This dimension is for A-C inlet/outlet options, larger pipe sizes are available for D-I inlet/outlet options.

Tank Shell Specifications

The 'standard' specification is normally adequate for most installations but Heavy, Extra Heavy and Special specifications are available depending upon the burial depth and water table level, in winter. The concern is when the system is emptied completely and remains empty for a period of time.

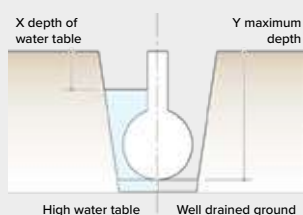
Standard tanks

Series	WT (m)	D (m)
200	1.0	4.0
300	0.9	4.0
400	1.3	5.0
500	1.9	5.7
600	2.4	6.2



Heavy tanks

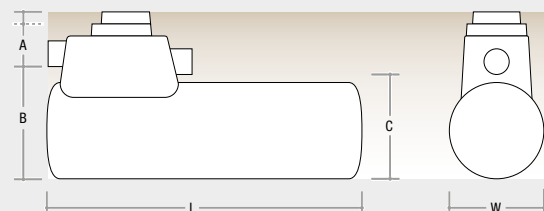
Series	WT (m)	D (m)
200	2.0	6.0
300	2.8	5.6
400	3.5	6.0
500	4.5	7.25
600	4.7	7.3



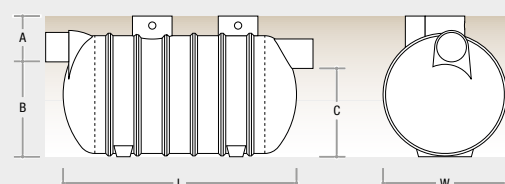
Based on installation in concrete with concrete surround.
For pea gravel surround, see SPEL Data Manual p13.5

- 200 Series ESR** – Inside diameter 1200mm, outside diameter 1225mm.
- 300 series ESR** – Inside diameter 1800mm, outside diameter 1875mm.
- 400 series ESR** – Inside diameter 2600mm, outside diameter 2700mm.
- 500 series ESR** – Inside diameter 3500mm, outside diameter 3650mm.
- 600 series ESR** – Inside diameter 4000mm, outside diameter 4150mm.

200 series



300/400/500 & 600 series



Commissioning, Installation & Maintenance

Installation

SPEL Separators can be installed with a concrete or pea gravel surround, dependent upon ground conditions and water table level. Detailed installation instructions are provided with each unit, see Installation TSII or SPEL Data Manual Section 13.

Site access and conditions

It is the responsibility of the contractor to ensure suitable access to good hard ground that is safe and suitable for off-loading.

Off-loading/handling

The contractor is responsible for off-loading. The tank must be handled with care to prevent accidental damage from impact or contact with sharp objects.

Tanks should be lifted using slings, not chains or wire ropes. Do not drag tanks along the ground for any distance and avoid jarring or bumps. Do not lift with water in the tank.

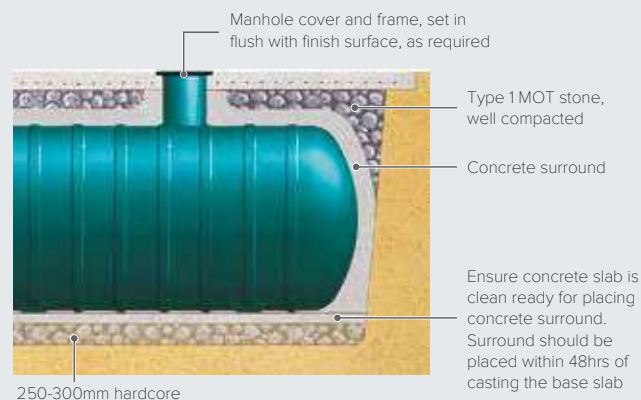
Health and safety

Installation should be carried out by a competent contractor in accordance with Health & Safety at Work legislation and good building practice.

A warning notice should be visible at the top of each access shaft – 'danger, harmful fumes' and 'respirators must be worn in this tank'. Before entering persons must be qualified in accordance with 'confined space' requirements.

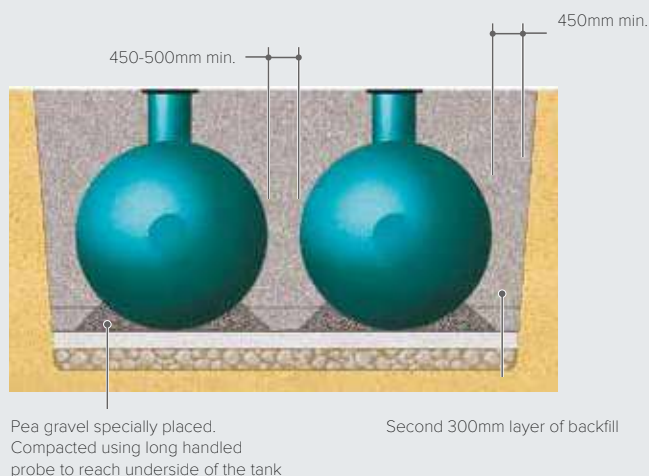
Installation – Concrete

Installation of SPEL Separator tank with chocks and a load bearing cover slab.



Installation – Pea gravel

Installation of SPEL Separator tank where ground over installation is not required to be vehicle load bearing.



Tanks surrounded with pea gravel or similar

Where it is economical to do so, SPEL Separator tanks can be surrounded in pea gravel or with similar free flowing clean rounded aggregate. Details of the installation procedure, approved backfill materials and the need for mechanical anchoring in specific circumstances are contained in the SPEL Data Manual and SPEL Separator Installation Instructions.

Maintenance Requirements

We recommend the SPEL Separator is checked at 3, 6 or 12 monthly intervals to determine the depth of silt in the primary chamber.

The SPEL automatic alarm/monitoring system will automatically warn you when the SPEL Separator requires emptying of light liquids. See ref. 3.10 – 3.19. However, silt will accumulate and require removing at intervals depending on the site conditions.

SPELGuard contracts available.

For more information contact us:

info@spelproducts.co.uk | 01743 445 200



SPELGuard Commissioning & Maintenance

Optional extras

SPEL coalescer unit guide rail systems

To facilitate easy insertion of coalescer units, the SPEL guide rail system manufactured in stainless steel can be incorporated into SPEL Puraceptors and class 1 Stormceptors.

Brackets fixed to the top and bottom of the coalescer unit simply engage the stainless steel guide rail fixed to the top of the stub access shaft. The coalescer unit is then lowered in the normal way, being guided at the correct angle into the conical base.

Lifting chains are available for the larger coalescer units and where extension shafts are fitted.

Extension guide rails can be incorporated into SPEL extension shafts to suit.

SPEL coalescer unit lifting, locating and locking system

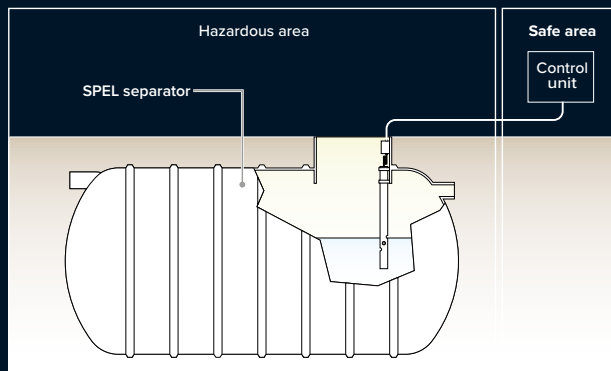
The SPEL lifting, locating and locking system is manufactured in stainless steel and replaces the standard coalescer unit handle.

The locating/locking handle ensures the coalescer unit is seated and locked in its correct position after maintenance.



Above left:
Lifting, locating and locking system with guide rail system.

Above right:
The SPEL coalescer unit with lifting chain.



SPEL offer a range of alarms, for full details refer to the *SPEL Data Manual Section 3*. Kiosks with beacons and provision for BMS and remote information via browser user interface.

SPEL Model Alarm-DY14400

Oil alarm only – not BMS compatible

SPEL Model IdOil-20

Oil, silt and/or high level alarm with volt free terminal for beacon and BMS capability

SPEL Model IdOil-30

For oil, silt and/or high level as required. This alarm provides a range of options for BMS and remote information to on or off-site monitoring facilities.

SPEL Model IdOil Solar Oil Separator Alarm

for remote off-grid areas.

SPEL extension access shafts

Extension access shafts are available for deep invert applications.



Socket joint stub access shaft with extension shaft.

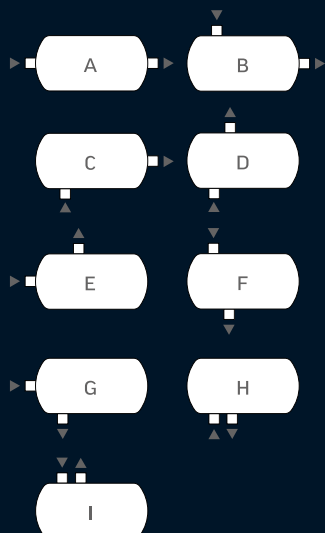
600mm, 750mm, 900mm and 1200mm diameter.

See tripod drawing below for other extension adjustments

Double seal if required

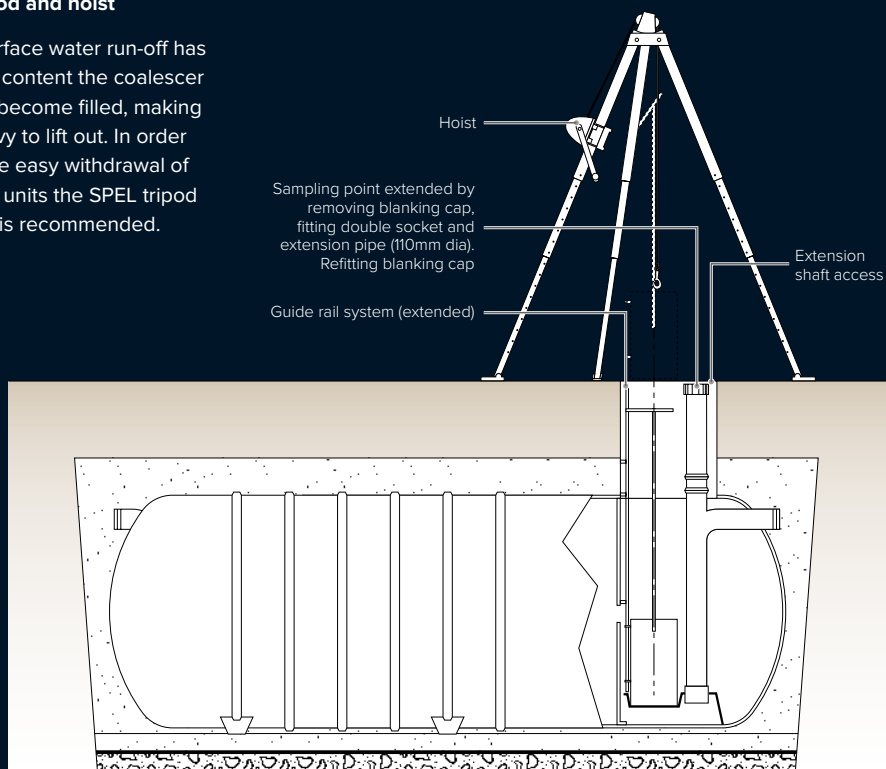
SPEL ESR Range – Inlet/outlet orientation

Dependent upon model and diameter of connections, these nine different orientations are available. However on the larger models it is important to check with our technical department.



SPEL tripod and hoist

Where surface water run-off has a high silt content the coalescer units can become filled, making them heavy to lift out. In order to facilitate easy withdrawal of coalescer units the SPEL tripod and hoist is recommended.



Stormceptor ESR

Enhanced Silt Retention

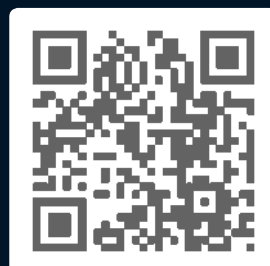
SPEL's ESR range is a total treatment system removing Hydrocarbons, Total Suspended Solids (TSS) and Metals (particulate). It's a highly efficient, single unit, water quality SuDS component.



Lancaster Road, Shrewsbury, Shropshire SY1 3NQ

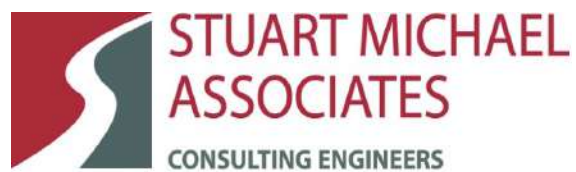
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08/22



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