

11454 – Wadworth Brewery, Devizes

Technical Note: Drainage Condition 6

15 December 2025

Document Status

Rev	Issue Status	Prepared / Date	Checked / Date	Approved / Date
0	For Submission	RLM / 08.12.2025	PN / 08.12.2025	RLM / 15.12.2025

Introduction

1.1 Background

- 1.1.1 Brookbanks have been appointed by Backhouse Housing Ltd to prepare a Technical Note to discharge Condition 6 of planning consent PL/2023/03573 for the proposed drainage system at Wadworth Brewery, Devizes.

2 Condition Wording

2.1 Condition 6

- 2.1.1 *No development shall commence on site other than archaeological investigations, ground investigations and demolition, until a scheme for the discharge of surface water from the site (including surface water from the access/driveway), incorporating sustainable details, has been submitted to and approved in writing by the Local Planning Authority. The scheme shall take account of the letter dated 10th February 2024 from the Wiltshire Council Drainage Team to the Local Planning Authority. The development shall not be first occupied until surface water drainage has been constructed in accordance with the approved scheme.*

2.2 Proposed Surface Water Drainage System

- 2.2.1 As per the approved Flood Risk Assessment, surface water for the development is to be attenuated on site and discharged at a restricted rate. The network is split into two, with an outfall to the south into the existing sewer within New Park Street and an outfall to the north into the canal. A copy of the Drainage Layout and supporting drawings are provided within **Appendix A**.

- 2.2.2 The southern network is positioned at a lower level, due to the proximity of New Park Street and therefore a gravity connection to the canal is not possible. Attenuation storage is provided within a centrally located Wavin Aquacell Plus R tank system, located beneath the proposed parking court. Treatment of the car park runoff is provided via permeable paving, to avoid typical car park contaminants entering the existing sewer.
- 2.2.3 The outflow from the network is restricted via a Hydrobrake Vortex Flow Control device located within Manhole S15. This will restrict the discharge during the 1 in 100 plus climate change storms to 1.2 l/s. Refer to **Appendix B** for the MicroDrainage calculations for both networks.
- 2.2.4 A Section 106 application for the connection to the existing Wessex Water sewer has been submitted.
- 2.2.5 The northern network includes permeable paving for the parking areas and Wavin Aquacell Plus R attenuation tanks within parking courts to provide the bulk of the attenuation volume. Additional treatment is provided to the runoff in the form of a Downstream Defender located after the proposed Hydrobrake Vortex Flow Control device.
- 2.2.6 The Flow Control restricts discharge to 24.15 l/s, as agreed with the Canal and River Trust (CRT) during the planning process. Refer to **Appendix C** for the CRT correspondence. A detailed permit application has been submitted to the CRT and is currently undergoing review.
- 2.2.7 An additional outfall in the north west corner of the site was proposed on the approved Drainage Strategy. This was to connect to an existing 225mm diameter combined sewer within Lower Wharf. Following planning approval, it was found that Lower Wharf is a privately owned highway and therefore to discharge to this existing sewer a Section 98 application would be required to work within 3rd party land. To simplify the development proposals and avoid discharging additional surface water to a combined sewer, it was agreed to drain this catchment back to the main development network and into the canal, maintaining the previous agreed discharge rate.
- 2.2.8 It is proposed to line the cellular attenuation crates and permeable paving with impermeable membranes. This will prevent the ingress of groundwater into the system and maintain its capacity and functionality. Refer to the Standard Details drawings in **Appendix A**.

2.3 Surface Water Treatment

- 2.3.1 As set out in the approved Drainage Strategy, treatment of runoff is provided across the development by the provision of permeable paving and a Downstream Defender. The treatment of runoff into the canal is important due to its sensitivity to pollution.
- 2.3.2 The canal catchment is made up of residential roofs, driveways and low traffic roads. These have a pollution hazard index of Very Low and Low. As shown in The SuDS Manual Table 26.2, this gives a pollution level of 0.5 for Total suspended solids (TSS), 0.4 for Metals and 0.4 for Hydrocarbons.

TABLE 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

2.3.3 Permeable paving provides mitigation of 0.7 for TSS, 0.6 for Metals and 0.7 for Hydrocarbons, as per The SuDS Manual Table 26.3 shown below. This will provide more than the required treatment for driveways and parking areas.

2.3.4 The Downstream Defender Vortex Plus unit provides treatment of 0.5 for TSS, 0.4 for Metals and 0.5 for Hydrocarbons. This will provide adequate treatment for the remaining catchments for the canal outfall. Refer to **Appendix D** for the product data sheet.

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters

Type of SuDS component	Mitigation indices ¹		
	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.		

2.4 Exceedance

2.4.1 Exceedance routes have been considered in the event of a blockage or storm in excess of the 1 in 100 plus climate change event. These routes are designed to protect dwellings from flooding.

2.4.2 Refer to **Appendix E** for the updated Exceedance Plan.

2.5 Foul Drainage System

- 2.5.1 Foul drainage for the development will be captured in a gravity sewer network and convey flows to outfall into the existing Wessex Water sewer within New Park Street.
- 2.5.2 Refer to **Appendix A** for the Drainage Layout.

2.6 Management and Maintenance

- 2.6.1 It is proposed to offer the on site drainage system to a NAV company for adoption. This company will be responsible for the management and maintenance of the system for the development life span. They will be required to undertake regular inspections and maintenance, in line with guidance from The SuDS Manual.
- 2.6.2 The table below sets out the inspection and maintenance schedule for the proposed drainage infrastructure.

Table 1 – Management and Maintenance Requirements				
Drainage Element	Inspection / Maintenance	Frequency	Remedial Action	Responsible Party
Roof Drainage	Clean gutters and downpipes	Annually	Repair as necessary	Management Company
Below ground gravity drainage runs and chambers	CCTV drain runs and jet wash.	Every 5 years	Repair as necessary	NAV Company
	Inspect chambers for debris	Annually	Remove debris and sediment as required	
Road Gullies	Desilt by vacuum	Twice annually, end of Autumn, end of Spring	Repair as necessary.	NAV Company
Permeable Paving	Inspect for buildup of debris/leaf litter etc	End of Winter, mid Summer and end of Autumn	Permeable paving to be swept twice annually and joints refilled if required, may be necessary to take up and relay bedding layer after 15 years use due to siltation.	Management Company
Cellular Attenuation Crates	CCTV and jet wash internal crate system.	Every 5 years	Repair as necessary	Management Company
	Inspect upstream and downstream chambers for debris	Annually	Remove debris and sediment as required	
Downstream Defender	Regular maintenance required to maintain efficiency.	In line with manufacturer requirements.	Repair as necessary	NAV Company

			Remove debris and sediment as required	
Vortex Flow Control Device	Regular maintenance required to maintain efficiency.	In line with manufacturer requirements.	Repair as necessary Remove debris and sediment as required	NAV Company

- 2.6.3 Where manufacturer requirements exceed the frequency noted above, the more frequent of the two is to be followed by the responsible party.
- 2.6.4 During the first year following installation, more regular inspections are required to ensure the system is functioning as required.

2.7 Construction Management Plan

- 2.7.1 The development will be constructed in a way to mitigate risks associated with surface water flooding during the construction period. Runoff from the development will be attenuated and treated, in line with the approved drainage strategy, before it is discharges to the receiving watercourse or networks.
- 2.7.2 Flow controls and the Downstream Defender are to be installed prior to discharges to the canal being allowed.
- 2.7.3 Temporary headwall filter traps are to be installed on the outfall to the canal, to capture sediment prior to discharge.
- 2.7.4 Permeable paving void material is to be laid on a tanking membrane to seal the system, correctly compacted and then covered with a secondary filtration membrane to prevent the introduction of fine debris. Construction traffic on completed permeable paving block work to be kept to a minimum and block work is to be cleaned in accordance with the approved MMP prior to handover to owners.
- 2.7.5 All installed highway gullies to be fitted with silt protection during construction works. The contractor is to maintain a clean site which minimises construction debris on the highway / impermeable surfaces. The contractor is to minimise the runoff of silt / construction debris into completed drainage networks. Any silt found in gully traps or headwall filters is to be cleared prior to handover of the system.
- 2.7.6 As the development is a brownfield site, there is a possibility of a build-up of runoff prior to the installation of the new drainage system. Where this occurs, the contractor is to capture this runoff, allow settlement and treatment via a silt buster or similar and discharge this into the approved receiving networks at or below the agreed discharge rate. Care is to be taken to avoid sediment or contamination reaching the receiving bodies.

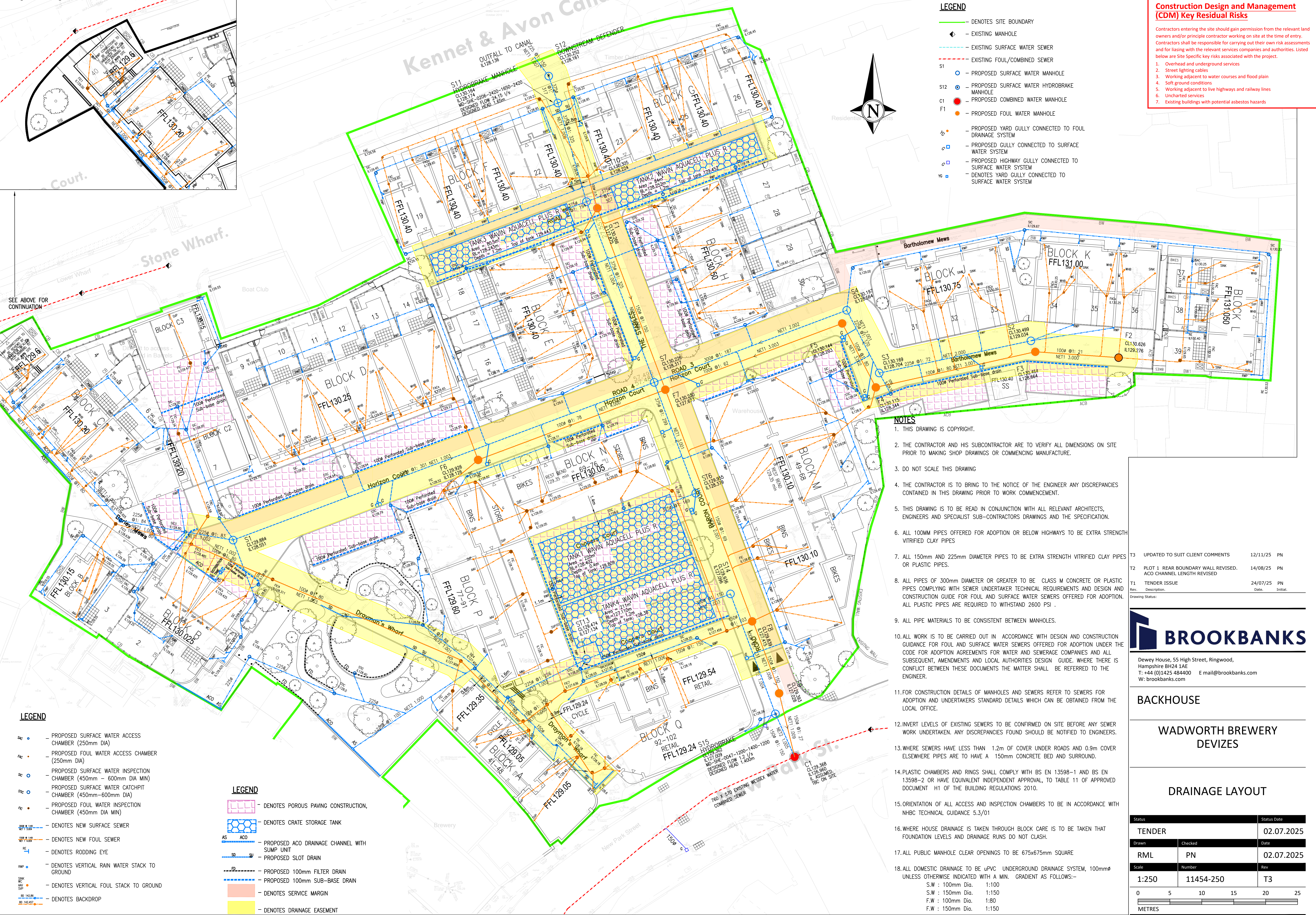
2.8 Conclusion

- 2.8.1 This report has shown that the detailed design of the drainage system is in accordance with the approved Drainage Strategy. The network is split into two, with an outfall into the existing combined Wessex Water sewer within New Park Street and the majority of the development draining to the Canal to the north.
- 2.8.2 Adequate treatment of runoff into sensitive waterbodies has been demonstrated via the introduction of permeable paving and a Downstream Defender.
- 2.8.3 Exceedance Routes for overland flow has been demonstrated, and dwellings are protected from runoff.
- 2.8.4 The foul drainage network will drain via gravity to the existing sewer within New Park Street.
- 2.8.5 The Management and Maintenance responsibilities have been set out for the development drainage system.
- 2.8.6 The Construction Surface Water Management Plan has been set out, demonstrating the developers commitment to maintaining control of runoff during the construction period.

3 Disclaimer

- 3.1.1 The conclusions and recommendations contained herein are limited to those given the general availability of background information and the planned usage of the site.
- 3.1.2 Third party information has been used in the preparation of this report, which Brookbanks, by necessity assumes is correct at the time of writing. While all reasonable checks have been made on data sources and the accuracy of data, Brookbanks accepts no liability for same.
- 3.1.3 The benefits of this report are provided solely to Backhouse Housing Ltd for the proposed development Wadworth Brewery only.
- 3.1.4 Brookbanks excludes third party rights for the information contained in the report.

| Appendix A – Drainage Layout and Supporting Plans



LEGEND

- DENOTES SITE BOUNDARY
- ◊ — EXISTING MANHOLE
- EXISTING SURFACE WATER SEWER
- EXISTING FOUL/COMBINED SEWER
- S1 ○ — PROPOSED SURFACE WATER MANHOLE
- S12 ○ — PROPOSED SURFACE WATER HYDROBRAKE MANHOLE
- C1 ● — PROPOSED COMBINED WATER MANHOLE
- F1 ● — PROPOSED FOUL WATER MANHOLE
- — PROPOSED YARD GULLY CONNECTED TO FOUL DRAINAGE SYSTEM
- — PROPOSED GULLY CONNECTED TO SURFACE WATER SYSTEM
- — PROPOSED HIGHWAY GULLY CONNECTED TO SURFACE WATER SYSTEM
- — DENOTES YARD GULLY CONNECTED TO SURFACE WATER SYSTEM

Construction Design and Management (CDM) Key Residual Risks

- Contractors entering the site should gain permission from the relevant land owners and/or principle contractor working on site at the time of entry. Contractors shall be responsible for carrying out their own risk assessments and for liaising with the relevant services companies and authorities. Listed below are Site Specific key risks associated with the project.
1. Overhead and underground services
 2. Street lighting cables
 3. Working adjacent to water courses and flood plain
 4. Soft ground conditions
 5. Working adjacent to live highways and railway lines
 6. Uncharted services
 7. Existing buildings with potential asbestos hazards

NOTES

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6. ALL 100MM PIPES OFFERED FOR ADOPTION OR BELOW HIGHWAYS TO BE EXTRA STRENGTH VITRIFIED CLAY PIPES
7. ALL 150mm AND 225mm DIAMETER PIPES TO BE EXTRA STRENGTH VITRIFIED CLAY PIPES OR PLASTIC PIPES.
8. ALL PIPES OF 300mm DIAMETER OR GREATER TO BE CLASS M CONCRETE OR PLASTIC PIPES COMPLYING WITH SEWER UNDERTAKER TECHNICAL REQUIREMENTS AND DESIGN AND CONSTRUCTION GUIDE FOR FOUL AND SURFACE WATER SEWERS OFFERED FOR ADOPTION. ALL PLASTIC PIPES ARE REQUIRED TO WITHSTAND 2600 PSI .
9. ALL PIPE MATERIALS TO BE CONSISTENT BETWEEN MANHOLES.
10. ALL WORK IS TO BE CARRIED OUT IN ACCORDANCE WITH DESIGN AND CONSTRUCTION GUIDANCE FOR FOUL AND SURFACE WATER SEWERS OFFERED FOR ADOPTION UNDER THE CODE FOR ADOPTION AGREEMENTS FOR WATER AND SEWERAGE COMPANIES AND ALL SUBSEQUENT, AMENDMENTS AND LOCAL AUTHORITIES DESIGN GUIDE. WHERE THERE IS CONFLICT BETWEEN THESE DOCUMENTS THE MATTER SHALL BE REFERRED TO THE ENGINEER.
11. FOR CONSTRUCTION DETAILS OF MANHOLES AND SEWERS REFER TO SEWERS FOR ADOPTION AND UNDERTAKERS STANDARD DETAILS WHICH CAN BE OBTAINED FROM THE LOCAL OFFICE.
12. INVERT LEVELS OF EXISTING SEWERS TO BE CONFIRMED ON SITE BEFORE ANY SEWER WORK UNDERTAKEN. ANY DISCREPANCIES FOUND SHOULD BE NOTIFIED TO ENGINEERS.
13. WHERE SEWERS HAVE LESS THAN 1.2m OF COVER UNDER ROADS AND 0.9m COVER ELSEWHERE PIPES ARE TO HAVE A 150mm CONCRETE BED AND SURROUND.
14. PLASTIC CHAMBERS AND RINGS SHALL COMPLY WITH BS EN 13598-1 AND BS EN 13598-2 OR HAVE EQUIVALENT INDEPENDENT APPROVAL, TO TABLE 11 OF APPROVED DOCUMENT 'H' OF THE BUILDING REGULATIONS 2010.
15. ORIENTATION OF ALL ACCESS AND INSPECTION CHAMBERS TO BE IN ACCORDANCE WITH NHBC TECHNICAL GUIDANCE 5.3/01
16. WHERE HOUSE DRAINAGE IS TAKEN THROUGH BLOCK CARE IS TO BE TAKEN THAT FOUNDATION LEVELS AND DRAINAGE RUNS DO NOT CLASH.
17. ALL PUBLIC MANHOLE CLEAR OPENINGS TO BE 675x675mm SQUARE
18. ALL DOMESTIC DRAINAGE TO BE uPVC UNDERGROUND DRAINAGE SYSTEM, 100mmØ UNLESS OTHERWISE INDICATED WITH A MIN. GRADIENT AS FOLLOWS:--
 - S.W. : 100mm Dia. : 1:100
 - S.W. : 150mm Dia. : 1:150
 - F.W. : 100mm Dia. : 1:80
 - F.W. : 150mm Dia. : 1:150

LEGEND

- SC ● — PROPOSED SURFACE WATER ACCESS CHAMBER (250mm DIA)
- FC ● — PROPOSED FOUL WATER ACCESS CHAMBER (250mm DIA)
- SC ○ — PROPOSED SURFACE WATER INSPECTION CHAMBER (450mm – 600mm DIA MIN)
- SC ○ — PROPOSED SURFACE WATER CATCHPIT CHAMBER (450mm–600mm DIA)
- FC ○ — PROPOSED FOUL WATER INSPECTION CHAMBER (450mm DIA MIN)
- 225 Ø 1.00 — — DENOTES NEW SURFACE SEWER
- 150 Ø 1.00 — — DENOTES NEW FOUL SEWER
- RE — — DENOTES RODDING EYE
- RWP ● — DENOTES VERTICAL RAIN WATER STACK TO GROUND
- SNK ● — DENOTES VERTICAL FOUL STACK TO GROUND
- BD ● — DENOTES BACKDROP

LEGEND

- DENOTES POROUS PAVING CONSTRUCTION
- DENOTES CRATE STORAGE TANK
- AS — ACO — PROPOSED ACO DRAINAGE CHANNEL WITH SUMP UNIT
- SD — SI — PROPOSED SLOT DRAIN
- — PROPOSED 100mm FILTER DRAIN
- — PROPOSED 100mm SUB-BASE DRAIN
- DENOTES SERVICE MARGIN
- DENOTES DRAINAGE EASEMENT

BROOKBANKS

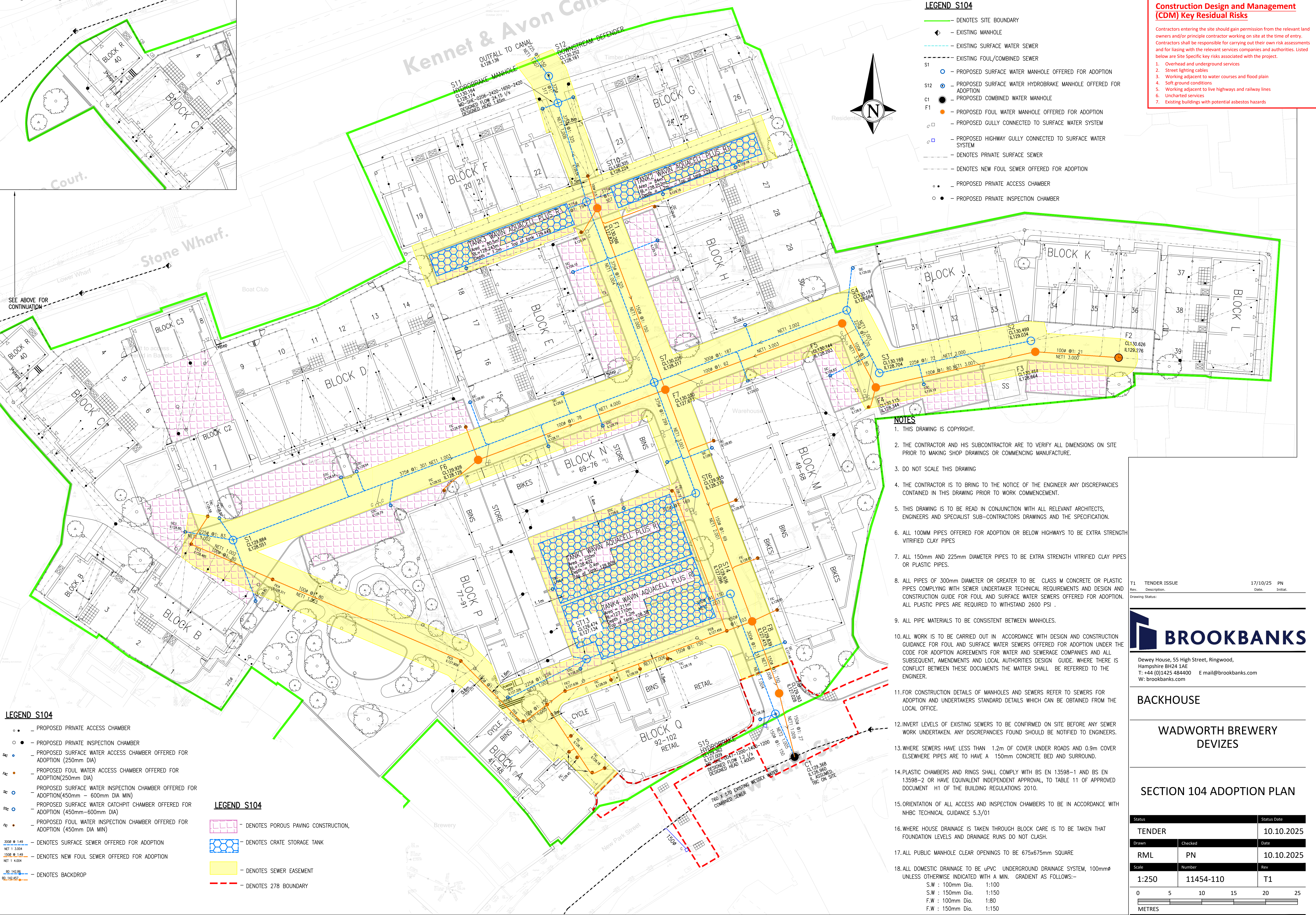
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BACKHOUSE

WADWORTH BREWERY DEVICES

DRAINAGE LAYOUT

Status		Status Date
TENDER		02.07.2025
Drawn	Checked	Date
RML	PN	02.07.2025
Scale	Number	Rev
1:250	11454-250	T3
0 5 10 15 20 25		
METRES		



LEGEND S104

- - PROPOSED PRIVATE ACCESS CHAMBER
- - PROPOSED PRIVATE INSPECTION CHAMBER
- - PROPOSED SURFACE WATER ACCESS CHAMBER OFFERED FOR ADOPTION (250mm DIA)
- - PROPOSED FOUL WATER ACCESS CHAMBER OFFERED FOR ADOPTION (250mm DIA)
- - PROPOSED SURFACE WATER INSPECTION CHAMBER OFFERED FOR ADOPTION (450mm - 600mm DIA MIN)
- - PROPOSED SURFACE WATER CATCHPIT CHAMBER OFFERED FOR ADOPTION (450mm-600mm DIA)
- - PROPOSED FOUL WATER INSPECTION CHAMBER OFFERED FOR ADOPTION (450mm DIA MIN)
- 3000 Ø 1:149 NET 1 3.004 - DENOTES SURFACE SEWER OFFERED FOR ADOPTION
- 1500 Ø 1:149 NET 1 4.004 - DENOTES NEW FOUL SEWER OFFERED FOR ADOPTION
- Ø 142.86 - DENOTES BACKDROP
- Ø 142.457 - DENOTES BACKDROP

LEGEND S104

- - DENOTES POROUS PAVING CONSTRUCTION
- - DENOTES CRATE STORAGE TANK
- - DENOTES SEWER EASEMENT
- - DENOTES 278 BOUNDARY

LEGEND S104

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- - PROPOSED HIGHWAY GULLY CONNECTED TO SURFACE WATER SYSTEM
- - DENOTES PRIVATE SURFACE SEWER
- - DENOTES NEW FOUL SEWER OFFERED FOR ADOPTION
- - PROPOSED PRIVATE ACCESS CHAMBER
- - PROPOSED PRIVATE INSPECTION CHAMBER

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Construction Design and Management (CDM) Key Residual Risks

Contractors entering the site should gain permission from the relevant land owners and/or principle contractor working on site at the time of entry. Contractors shall be responsible for carrying out their own risk assessments and for liaising with the relevant services companies and authorities. Listed below are Site Specific key risks associated with the project.

1. Overhead and underground services
2. Street lighting cables
3. Working adjacent to water courses and flood plain
4. Soft ground conditions
5. Working adjacent to live highways and railway lines
6. Uncharted services
7. Existing buildings with potential asbestos hazards

T1 TENDER ISSUE
Rev. Description. 17/10/25 PN
Date. Initial.
Drawing Status:

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BACKHOUSE

WADSWORTH BREWERY DEVICES

SECTION 104 ADOPTION PLAN

Status	Status Date
TENDER	10.10.2025
Drawn	Checked
RML	PN
Scale	Number
1:250	11454-110
0 5 10 15 20 25	T1

METRES

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2. Street lighting cables

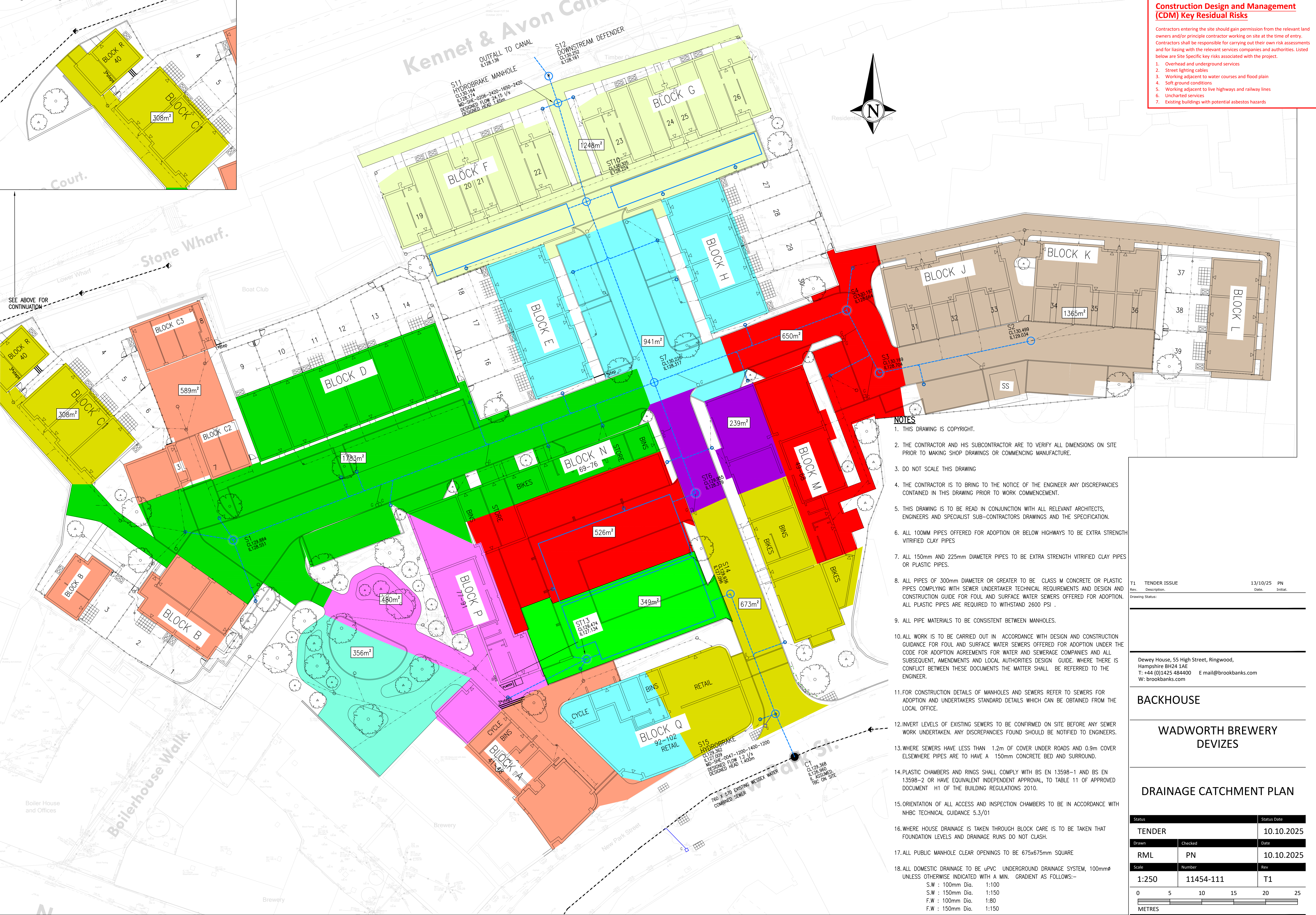
3. Working adjacent to water courses and flood plain

4. Soft ground conditions

5. Working adjacent to live highways and railway lines

6. Uncharted services

7. Existing buildings with potential asbestos hazards



| Appendix B – Drainage Modelling Output

Reuby & Staggs Ltd										Page 1	
Dewey House 55 High Street Ringwood BH24 1AE											
Date 01/01/0001 File 11454 NETWORK 1.MDX						Designed by pnicklen Checked by					
Innovyze						Network 2020.1.3					
Network Design Table for 11454 NET 1.SWS											
PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
3.000	3.887	0.023	169.0	0.026	5.00	0.0	0.600	o	375	Pipe/Conduit	
3.001	18.544	0.062	299.1	0.024	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.004	30.228	0.093	325.0	0.094	0.00	0.0	0.600	o	375	Pipe/Conduit	
4.000	3.038	0.019	159.9	0.000	5.00	0.0	0.600	o	375	Pipe/Conduit	
5.000	4.351	0.028	155.4	0.000	5.00	0.0	0.600	o	375	Pipe/Conduit	
1.005	16.139	0.050	325.0	0.125	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.006	4.445	0.014	325.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.007	3.708	0.025	148.3	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
Network Results Table											
PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	
3.000	58.27	5.05	128.402	0.026	0.0	0.0	0.0	1.39	153.6	4.1	
3.001	56.75	5.34	128.379	0.050	0.0	0.0	0.0	1.04	115.1	7.7	
1.004	49.48	7.13	128.317	0.614	0.0	0.0	0.0	1.00	110.4	82.3	
4.000	58.33	5.04	128.243	0.000	0.0	0.0	0.0	1.43	158.0	0.0	
5.000	58.25	5.05	128.252	0.000	0.0	0.0	0.0	1.45	160.3	0.0	
1.005	48.57	7.40	128.224	0.739	0.0	0.0	0.0	1.00	110.4	97.2	
1.006	48.33	7.47	128.174	0.739	0.0	0.0	0.0	1.00	110.4	97.2	
1.007	48.19	7.51	128.161	0.739	0.0	0.0	0.0	1.49	164.1	97.2	
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Dewey House 55 High Street Ringwood BH24 1AE											
Date 01/01/0001 File 11454 NETWORK 1.MDX					Designed by pnicklen Checked by						
Innovyze					Network 2020.1.3						
Manhole Schedules for 11454 NET 1.SWS											
MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
IC1	130.008	0.783	Open Manhole	600	1.000	129.225	225				
IC2	130.150	1.225	Open Manhole	600	1.001	128.925	225	1.000	128.925	225	
IC3	129.800	0.998	Open Manhole	600	1.002	128.802	225	1.001	128.802	225	
1	129.884	1.333	Open Manhole	1350	1.003	128.551	375	1.002	128.701	225	
2	130.499	1.465	Open Manhole	1200	2.000	129.034	225				
3	130.169	1.465	Open Manhole	1200	2.001	128.704	225	2.000	128.704	225	
4	130.197	1.633	Open Manhole	1200	2.002	128.564	300	2.001	128.639	225	
5	129.934	1.532	Open Manhole	1350	3.000	128.402	375				
6	129.955	1.576	Open Manhole	1350	3.001	128.379	375	3.000	128.379	375	
7	130.226	1.909	Open Manhole	1350	1.004	128.317	375	1.003	128.317	375	
								2.002	128.392	300	
								3.001	128.317	375	
8-Tank	130.305	2.062	Open Manhole	1350	4.000	128.243	375				
9-Tank	130.316	2.064	Open Manhole	1350	5.000	128.252	375				
10	130.305	2.081	Open Manhole	1350	1.005	128.224	375	1.004	128.224	375	
								4.000	128.224	375	
								5.000	128.224	375	
11	130.164	1.990	Open Manhole	1350	1.006	128.174	375	1.005	128.174	375	
12	130.252	2.091	Open Manhole	1350	1.007	128.161	375	1.006	128.161	375	
Canal	129.879	1.743	Open Manhole	0		OUTFALL		1.007	128.136	375	
MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)					
IC1	400148.442	161728.324	400148.442	161728.324	Required						
IC2	400165.194	161709.786	400165.194	161709.786	Required						
IC3	400175.375	161708.027	400175.375	161708.027	Required						
1	400182.847	161706.736	400182.847	161706.736	Required						
2	400307.419	161737.873	400307.419	161737.873	Required						
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Date 01/01/0001 File 11454 NETWORK 1.MDX	Designed by pnicklen Checked by	
Innovyze Network 2020.1.3		

Simulation Criteria for 11454 NET 1.SWS

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

Number of Input Hydrographs	0	Number of Storage Structures	7
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 400202 161694 SU 00202 61694
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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<u>Online Controls for 11454 NET 1.SWS</u> <u>Hydro-Brake® Optimum Manhole: 11, DS/PN: 1.006, Volume (m³): 4.5</u> <table><tr><td>Unit Reference</td><td>MD-SHE-0207-2420-1650-2420</td></tr><tr><td>Design Head (m)</td><td>1.650</td></tr><tr><td>Design Flow (l/s)</td><td>24.2</td></tr><tr><td>Flush-Flo™</td><td>Calculated</td></tr><tr><td>Objective</td><td>Minimise upstream storage</td></tr><tr><td>Application</td><td>Surface</td></tr><tr><td>Sump Available</td><td>Yes</td></tr><tr><td>Diameter (mm)</td><td>207</td></tr><tr><td>Invert Level (m)</td><td>128.174</td></tr><tr><td>Minimum Outlet Pipe Diameter (mm)</td><td>225</td></tr><tr><td>Suggested Manhole Diameter (mm)</td><td>1800</td></tr></table> <table><tr><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td></tr><tr><td>Design Point (Calculated)</td><td>1.650</td><td>24.2</td></tr><tr><td>Flush-Flo™</td><td>0.496</td><td>24.2</td></tr><tr><td>Kick-Flo®</td><td>1.077</td><td>19.7</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>20.9</td></tr></table> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><tr><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td></tr><tr><td>0.100</td><td>7.1</td><td>1.200</td><td>20.8</td><td>3.000</td><td>32.2</td><td>7.000</td><td>48.5</td></tr><tr><td>0.200</td><td>19.8</td><td>1.400</td><td>22.4</td><td>3.500</td><td>34.7</td><td>7.500</td><td>50.2</td></tr><tr><td>0.300</td><td>23.2</td><td>1.600</td><td>23.8</td><td>4.000</td><td>37.0</td><td>8.000</td><td>51.8</td></tr><tr><td>0.400</td><td>24.0</td><td>1.800</td><td>25.2</td><td>4.500</td><td>39.2</td><td>8.500</td><td>53.3</td></tr><tr><td>0.500</td><td>24.2</td><td>2.000</td><td>26.5</td><td>5.000</td><td>41.2</td><td>9.000</td><td>54.8</td></tr><tr><td>0.600</td><td>24.1</td><td>2.200</td><td>27.8</td><td>5.500</td><td>43.2</td><td>9.500</td><td>56.3</td></tr><tr><td>0.800</td><td>23.3</td><td>2.400</td><td>29.0</td><td>6.000</td><td>45.0</td><td></td><td></td></tr><tr><td>1.000</td><td>21.3</td><td>2.600</td><td>30.1</td><td>6.500</td><td>46.8</td><td></td><td></td></tr></table>			Unit Reference	MD-SHE-0207-2420-1650-2420	Design Head (m)	1.650	Design Flow (l/s)	24.2	Flush-Flo™	Calculated	Objective	Minimise upstream storage	Application	Surface	Sump Available	Yes	Diameter (mm)	207	Invert Level (m)	128.174	Minimum Outlet Pipe Diameter (mm)	225	Suggested Manhole Diameter (mm)	1800	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.650	24.2	Flush-Flo™	0.496	24.2	Kick-Flo®	1.077	19.7	Mean Flow over Head Range	-	20.9	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	7.1	1.200	20.8	3.000	32.2	7.000	48.5	0.200	19.8	1.400	22.4	3.500	34.7	7.500	50.2	0.300	23.2	1.600	23.8	4.000	37.0	8.000	51.8	0.400	24.0	1.800	25.2	4.500	39.2	8.500	53.3	0.500	24.2	2.000	26.5	5.000	41.2	9.000	54.8	0.600	24.1	2.200	27.8	5.500	43.2	9.500	56.3	0.800	23.3	2.400	29.0	6.000	45.0			1.000	21.3	2.600	30.1	6.500	46.8		
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<u>Storage Structures for 11454 NET 1.SWS</u> <u>Complex Manhole: 1, DS/PN: 1.003</u> <u>Porous Car Park</u> <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Width (m)</td><td>51.5</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Length (m)</td><td>5.0</td></tr><tr><td>Max Percolation (l/s)</td><td>71.5</td><td>Slope (1:X)</td><td>0.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Porosity</td><td>0.30</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Invert Level (m)</td><td>129.610</td><td>Cap Volume Depth (m)</td><td>0.250</td></tr></table> <u>Porous Car Park</u> <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Width (m)</td><td>40.0</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Length (m)</td><td>7.0</td></tr><tr><td>Max Percolation (l/s)</td><td>77.8</td><td>Slope (1:X)</td><td>60.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Porosity</td><td>0.30</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Invert Level (m)</td><td>129.610</td><td>Cap Volume Depth (m)</td><td>0.250</td></tr></table> <u>Porous Car Park Manhole: 2, DS/PN: 2.000</u> <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Width (m)</td><td>5.0</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Length (m)</td><td>24.0</td></tr><tr><td>Max Percolation (l/s)</td><td>33.3</td><td>Slope (1:X)</td><td>80.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Porosity</td><td>0.30</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Invert Level (m)</td><td>129.930</td><td>Cap Volume Depth (m)</td><td>0.250</td></tr></table> <u>Cellular Storage Manhole: 5, DS/PN: 3.000</u> <table><tr><td>Invert Level (m)</td><td>128.409</td><td>Safety Factor</td><td>2.0</td></tr><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Porosity</td><td>0.95</td></tr><tr><td>Infiltration Coefficient Side (m/hr)</td><td>0.00000</td><td></td><td></td></tr></table> <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>220.0</td><td>0.0</td><td>2.400</td><td>0.0</td><td>0.0</td></tr><tr><td>0.200</td><td>220.0</td><td>0.0</td><td>2.600</td><td>0.0</td><td>0.0</td></tr><tr><td>0.400</td><td>220.0</td><td>0.0</td><td>2.800</td><td>0.0</td><td>0.0</td></tr><tr><td>0.401</td><td>0.0</td><td>0.0</td><td>3.000</td><td>0.0</td><td>0.0</td></tr><tr><td>0.800</td><td>0.0</td><td>0.0</td><td>3.200</td><td>0.0</td><td>0.0</td></tr><tr><td>1.000</td><td>0.0</td><td>0.0</td><td>3.400</td><td>0.0</td><td>0.0</td></tr><tr><td>1.200</td><td>0.0</td><td>0.0</td><td>3.600</td><td>0.0</td><td>0.0</td></tr><tr><td>1.201</td><td>0.0</td><td>0.0</td><td>3.800</td><td>0.0</td><td>0.0</td></tr><tr><td>1.600</td><td>0.0</td><td>0.0</td><td>4.000</td><td>0.0</td><td>0.0</td></tr><tr><td>1.800</td><td>0.0</td><td>0.0</td><td>4.200</td><td>0.0</td><td>0.0</td></tr><tr><td>2.000</td><td>0.0</td><td>0.0</td><td>4.400</td><td>0.0</td><td>0.0</td></tr><tr><td>2.200</td><td>0.0</td><td>0.0</td><td>4.600</td><td>0.0</td><td>0.0</td></tr></table>			Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	51.5	Membrane Percolation (mm/hr)	1000	Length (m)	5.0	Max Percolation (l/s)	71.5	Slope (1:X)	0.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	129.610	Cap Volume Depth (m)	0.250	Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	40.0	Membrane Percolation (mm/hr)	1000	Length (m)	7.0	Max Percolation (l/s)	77.8	Slope (1:X)	60.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	129.610	Cap Volume Depth (m)	0.250	Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.0	Membrane Percolation (mm/hr)	1000	Length (m)	24.0	Max Percolation (l/s)	33.3	Slope (1:X)	80.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	129.930	Cap Volume Depth (m)	0.250	Invert Level (m)	128.409	Safety Factor	2.0	Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95	Infiltration Coefficient Side (m/hr)	0.00000			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	220.0	0.0	2.400	0.0	0.0	0.200	220.0	0.0	2.600	0.0	0.0	0.400	220.0	0.0	2.800	0.0	0.0	0.401	0.0	0.0	3.000	0.0	0.0	0.800	0.0	0.0	3.200	0.0	0.0	1.000	0.0	0.0	3.400	0.0	0.0	1.200	0.0	0.0	3.600	0.0	0.0	1.201	0.0	0.0	3.800	0.0	0.0	1.600	0.0	0.0	4.000	0.0	0.0	1.800	0.0	0.0	4.200	0.0	0.0	2.000	0.0	0.0	4.400	0.0	0.0	2.200	0.0	0.0	4.600	0.0	0.0
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Area (m²)	0.000	80.5	0.0	2.600	0.0	0.0	0.200	80.5	0.0	2.800	0.0	0.0	0.400	80.5	0.0	3.000	0.0	0.0	0.600	80.5	0.0	3.200	0.0	0.0	0.800	80.5	0.0	3.400	0.0	0.0	1.000	80.5	0.0	3.600	0.0	0.0	1.200	80.5	0.0	3.800	0.0	0.0	1.201	0.0	0.0	4.000	0.0	0.0	1.600	0.0	0.0	4.200	0.0	0.0	1.800	0.0	0.0	4.400	0.0	0.0	2.000	0.0	0.0	4.600	0.0	0.0	2.200	0.0	0.0	4.800	0.0	0.0	2.400	0.0	0.0	5.000	0.0	0.0	Invert Level (m)	128.252	Safety Factor	2.0	Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95	Infiltration Coefficient Side (m/hr)	0.00000			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	84.0	0.0	1.800	0.0	0.0	0.200	84.0	0.0	2.000	0.0	0.0	0.400	84.0	0.0	2.200	0.0	0.0	0.600	84.0	0.0	2.400	0.0	0.0	0.800	84.0	0.0	2.600	0.0	0.0	1.000	84.0	0.0	2.800	0.0	0.0	1.200	84.0	0.0	3.000	0.0	0.0	1.201	0.0	0.0	3.200	0.0	0.0	1.600	0.0	0.0	3.400	0.0	0.0
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US/MH		Return Climate		First (X)	First (Y)	First (Z)	Overflow	Water																															
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	Level (m)																														
1.007	12 120 Summer		30	+0%					128.293																														
<table><tr><th colspan="2">US/MH</th><th>Surcharged</th><th>Flooded</th><th colspan="2">Flow / Overflow</th><th>Half Drain</th><th>Pipe</th><th colspan="2">Level</th></tr><tr><th>PN</th><th>Name</th><th>Depth (m)</th><th>Volume (m³)</th><th>Flow / Cap.</th><th>Overflow (l/s)</th><th>Time (mins)</th><th>Flow (l/s)</th><th>Status</th><th>Exceeded</th></tr><tr><td>1.007</td><td>12</td><td>-0.243</td><td>0.000</td><td>0.26</td><td></td><td></td><td>23.1</td><td>OK</td><td></td></tr></table>										US/MH		Surcharged	Flooded	Flow / Overflow		Half Drain	Pipe	Level		PN	Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status	Exceeded	1.007	12	-0.243	0.000	0.26			23.1	OK	
US/MH		Surcharged	Flooded	Flow / Overflow		Half Drain	Pipe	Level																															
PN	Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status	Exceeded																														
1.007	12	-0.243	0.000	0.26			23.1	OK																															

100 year Return Period Summary of Critical Results by Maximum Level (Rank
1) for 11454 NET 1.SWS

PN	US/MH Name	Water	Surcharged	Flooded	Flow / Cap.	Half Drain	Pipe	Status
		Level (m)	Depth (m)	Volume (m³)		Overflow (l/s)	Time (mins)	
1.000	IC1	130.008	0.558	0.000	0.55		29.1	FLOOD RISK
1.001	IC2	130.017	0.867	0.000	1.24		59.0	FLOOD RISK
1.002	IC3	129.805	0.778	4.631	0.57		25.6	FLOOD
1.003	1	129.806	0.880	0.000	0.58	27	63.3	FLOOD RISK
2.000	2	130.267	1.008	0.000	1.30	4	73.0	FLOOD RISK
2.001	3	130.067	1.138	0.000	1.75		58.9	FLOOD RISK
2.002	4	129.926	1.062	0.000	0.95		70.0	FLOOD RISK
3.000	5	129.803	1.026	0.000	0.15	239	12.7	FLOOD RISK
3.001	6	129.802	1.048	0.000	0.22		21.1	FLOOD RISK
1.004	7	129.801	1.109	0.000	1.17	186	114.4	SURCHARGED
4.000	8-Tank	129.787	1.169	0.000	0.25	127	20.9	SURCHARGED
5.000	9-Tank	129.787	1.160	0.000	0.22	125	20.4	SURCHARGED
1.005	10	129.787	1.188	0.000	0.60	31	53.8	SURCHARGED
1.006	11	130.088	1.539	0.000	0.31		24.1	FLOOD RISK

PN	US/MH Name	Level Exceeded
1.000	IC1	
1.001	IC2	
1.002	IC3	5
1.003	1	
2.000	2	
2.001	3	
2.002	4	
3.000	5	
3.001	6	
1.004	7	
4.000	8-Tank	
5.000	9-Tank	
1.005	10	
1.006	11	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for 11454 NET 2.SWS

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 400202 161694 SU 00202 61694
Data Type	Point
Maximum Rainfall (mm/hr)	550
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.600
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.250
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	300

Designed with Level Soffits

Network Design Table for 11454 NET 2.SWS

- Indicates pipe length does not match coordinates

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	22.656	0.226	100.2	0.036	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	6.883	0.078	88.2	0.048	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	13.709	0.117	117.2	0.037	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	5.680#	0.038	149.5	0.083	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	20.064	0.087	230.6	0.067	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	7.396	0.049	150.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	57.01	5.29	127.630	0.036	0.0	0.0	0.0	1.31	51.9	5.6
1.001	56.61	5.37	127.404	0.084	0.0	0.0	0.0	1.39	55.4	12.9
1.002	55.71	5.56	127.326	0.121	0.0	0.0	0.0	1.21	48.0	18.3
1.003	55.38	5.63	127.134	0.204	0.0	0.0	0.0	1.28	90.7	30.6
1.004	53.95	5.96	127.096	0.271	0.0	0.0	0.0	1.03	72.9	39.6
1.005	53.31	6.11	127.009	0.271	0.0	0.0	0.0	0.82	14.4«	39.6

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Free Flowing Outfall Details for 11454 NET 2.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.005	C1	129.368	126.960	126.970	0	0

Simulation Criteria for 11454 NET 2.SWS

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 400202 161694 SU 00202 61694
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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Online Controls for 11454 NET 2.SWS

Non Return Valve Manhole: IC4, DS/PN: 1.001, Volume (m³): 1.5

Hydro-Brake® Optimum Manhole: 15, DS/PN: 1.005, Volume (m³): 3.9

Unit Reference	MD-SHE-0047-1200-1400-1200
Design Head (m)	1.400
Design Flow (l/s)	1.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	127.009
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.400	1.2
Flush-Flo™	0.211	0.9
Kick-Flo®	0.423	0.7
Mean Flow over Head Range	-	0.9

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.8	1.200	1.1	3.000	1.7	7.000	2.5
0.200	0.9	1.400	1.2	3.500	1.8	7.500	2.6
0.300	0.8	1.600	1.3	4.000	1.9	8.000	2.7
0.400	0.7	1.800	1.3	4.500	2.0	8.500	2.7
0.500	0.8	2.000	1.4	5.000	2.1	9.000	2.8
0.600	0.8	2.200	1.5	5.500	2.2	9.500	2.9
0.800	0.9	2.400	1.5	6.000	2.3		
1.000	1.0	2.600	1.6	6.500	2.4		

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Storage Structures for 11454 NET 2.SWS

Porous Car Park Manhole: 13, DS/PN: 1.003

Infiltration Coefficient Base (m/hr) 0.00000	Width (m) 22.5	
Membrane Percolation (mm/hr) 1000	Length (m) 25.0	
Max Percolation (l/s) 156.3	Slope (1:X) 40.0	
Safety Factor 2.0	Depression Storage (mm) 5	
Porosity 0.30	Evaporation (mm/day) 3	
Invert Level (m) 128.890	Cap Volume Depth (m) 0.350	

Cellular Storage Manhole: 14, DS/PN: 1.004

Invert Level (m) 127.096	Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000	Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000	

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	303.0	0.0	2.600	0.0	0.0
0.200	303.0	0.0	2.800	0.0	0.0
0.400	303.0	0.0	3.000	0.0	0.0
0.600	303.0	0.0	3.200	0.0	0.0
0.750	303.0	0.0	3.400	0.0	0.0
0.751	0.0	0.0	3.600	0.0	0.0
0.800	0.0	0.0	3.800	0.0	0.0
1.201	0.0	0.0	4.000	0.0	0.0
1.600	0.0	0.0	4.200	0.0	0.0
1.800	0.0	0.0	4.400	0.0	0.0
2.000	0.0	0.0	4.600	0.0	0.0
2.200	0.0	0.0	4.800	0.0	0.0
2.400	0.0	0.0	5.000	0.0	0.0

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for 11454 NET 2.SWS

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 400202 161694 SU 00202 61694
Data Type	Point
Cv (Summer)	1.000
Cv (Winter)	1.000

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	Aco	15 Summer	2	+0%	100/15 Summer	100/480 Summer		
1.001	IC4	15 Summer	2	+0%	30/15 Summer			
1.002	IC5	15 Summer	2	+0%	30/15 Summer			
1.003	13	15 Summer	2	+0%	30/15 Summer			
1.004	14	600 Winter	2	+0%	30/120 Summer			
1.005	15	600 Winter	2	+0%	2/30 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap. (l/s)	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.001	IC4	127.498	-0.131	0.000	0.36			14.2	OK

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)

for 11454 NET 2.SWS

Simulation Criteria

Areal Reduction Factor 1.000

Additional Flow - % of Total Flow 0.000

Hot Start (mins) 0

MADD Factor * 10m³/ha Storage 2.000

Hot Start Level (mm) 0

Inlet Coefficient 0.800

Manhole Headloss Coeff (Global) 0.500

Flow per Person per Day (l/per/day) 0.000

Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0

Number of Storage Structures 2

Number of Online Controls 2

Number of Time/Area Diagrams 0

Number of Offline Controls 0

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH

FEH Rainfall Version 2013

Site Location GB 400202 161694 SU 00202 61694

Data Type Point

Cv (Summer) 1.000

Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0

Analysis Timestep 2.5 Second Increment (Extended)

DTS Status OFF

DVD Status ON

Inertia Status ON

Profile(s) Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080

Return Period(s) (years) 2, 30, 100

Climate Change (%) 0, 0, 40

US/MH

PN

Name

Storm

Return Period

Climate Change

First (X) Surchage

First (Y) Flood

First (Z) Overflow

Overflow Act.

1.000

Aco

15 Summer

30

+0%

100/15 Summer

100/480 Summer

1.001

IC4

15 Summer

30

+0%

30/15 Summer

1.002

IC5

15 Summer

30

+0%

30/15 Summer

1.003

13

15 Summer

30

+0%

30/15 Summer

1.004

14

720 Winter

30

+0%

30/120 Summer

1.005

15

720 Winter

30

+0%

2/30 Summer

Water

US/MH

Level

Surcharged Depth

Flooded Volume

Flow / Overflow

Half Drain Time

Pipe Flow

Status

PN

Name

(m)

(m)

(m³)

Cap.

(l/s)

(mins)

(l/s)

1.000

Aco

127.852

-0.003

0.000

0.34

16.2

OK

1.001

IC4

127.819

0.190

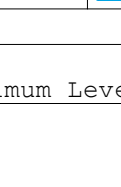
0.000

0.94

37.0

SURCHARGED

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 11454 NET 2.SWS

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 400202 161694 SU 00202 61694
Data Type	Point
Cv (Summer)	1.000
Cv (Winter)	1.000

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	Aco	960 Summer	100	+40%	100/15 Summer	100/480 Summer		
1.001	IC4	960 Summer	100	+40%	30/15 Summer			
1.002	IC5	720 Summer	100	+40%	30/15 Summer			
1.003	13	720 Summer	100	+40%	30/15 Summer			
1.004	14	720 Summer	100	+40%	30/120 Summer			
1.005	15	720 Summer	100	+40%	2/30 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	Aco	128.706	0.851	6.705	0.06		2.7	FLOOD
1.001	IC4	129.005	1.376	0.000	0.16		6.4	SURCHARGED

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| Appendix C – Canal & River Trust Correspondence

21/09/2023

Siphiwe Kazora/Rupert Domoney
RSK Land and Development Engineering Limited
Abbey Park, Humber Road
Coventry

Our Ref KA-087-000-TPW01-
P0000\$

Dear Siphiwe/Rupert,

WADWORTH BREWERY DEVELOPMENT DEVIZES - SURFACE WATER DISCHARGE

Our technical specialists have now undertaken their review of the information provided and can confirm that your proposal is acceptable to the Canal & River Trust to a maximum discharge rate of 24.15 l/s, based on the following conditions listed in the Trust attached review proforma.

Items that will require agreement with the Trust's Infrastructure Services team are:

- Details and design of the proposed outfall, and how it will connect to the Trust' asset. Outfall structures should be designed for the discharge to take place below the normal water surface and not protrude past the surface of the canal wall. A lifetime maintenance plan should be provided including measures to isolate the system from the canal network.
- Risk Assessment, Method Statements and Works Information for the outfall.
- SKY apparatus is in the area and the Trust should be contacted prior to any excavation close to the canal network.
- For us to accept the SWD the following Mitigation requirements are mandatory in line with the review proforma, for us to accept any form of discharge to the canal.

(Mitigation requirements from the review proforma)

- The site is potentially contaminated. Phase 2 Intrusive Investigation Report, Detailed Quantitative Risk Assessment, Remediation Strategy, and Verification Report is required. Please contact the Works Engineer for investigations close to the canal.
- To ensure protection of the canal and its water quality during the construction phase and post-construction phase, it is advised that the development shall not begin until the Local Planning Authority have reviewed and approved: a Flood Risk Assessment, detailed strategy for foul and storm drainage (including design and management details of interceptors and surface finishes), and a Construction Environment Management Plan (CEMP).
- Maintenance schedule and management arrangements/details for drainage system.

- The current proposed maximum discharge velocity of 0.6 m/s is not acceptable and the developer has stated that the outfall will be designed to a maximum of 0.3 m/s. Evidence must be provided prior to proceeding with the works. The development shall not begin until details of a scheme for surface water drainage have been submitted to and approved in writing by the Local Planning Authority so that the Trust can be satisfied that the proposed maximum discharge will not be exceeded.
- It is acknowledged that two historic outfalls are present on site but these are not recorded with the Trust. The surface water discharge should be considered as a new application as this represents a change in land use.

Please note that the SWD assessment review is only acceptable on the basis that the mitigation requirements mentioned are resolved and a solution is put forward for review. This is to be agreed with the Works Engineer (David Wilson).

Please note that any additional input required from the Trust for construction of the outfall or otherwise will be subject to the Code of Practice for Works Affecting the Canal and River Trust. Contact the Works Engineer to review the design and construction before commencement.

Our Utilities Surveyor (Joanna Bryan) will now be in contact to progress the necessary commercial negotiations to allow the proposal to proceed (contact details in the acceptance email). Please note that the legal agreement must be completed prior to any connection to the canal can be made.

D Wilson

David Wilson

Infrastructure Services – Works Engineer

Canal & River Trust

T 0303 040 4040 E canalrivertrust.org.uk/contact-us

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Appendix D – Downstream Defender Data Sheet

Downstream Defender® Select

Design Data

The Downstream Defender® Select is the **new generation of advanced hydrodynamic separator** for treatment of urban surface water runoff. Its customisable performance and extended range of chamber sizes allows engineers to tailor their drainage designs to meet specific pollutant removal standards. The Downstream Defender® Select also offers easier installation with much more flexibility of pipe sizes and connections and can accept up to three inlets.



Key Features

- » Selectable performance levels for pollutant targets and retention.
- » Extended range of chamber sizes.
- » Can accept up to three inlet pipes.
- » Can accept a range of pipe sizes.
- » No moving parts and no power requirement.
- » Available in concrete or plastic chambers.

Fig 1. Downstream Defender® Select. **Advanced Vortex** models in concrete and plastic shown with **Hydro-Logic® Smart Monitoring** and **enhanced hydrocarbon (oil) retention** options.

Targeted Pollutant Removal

The Downstream Defender® Select performance can be tailored to remove some or all of the following pollutants:

Sediment (Total Suspended Solids)



The Downstream Defender® Select is a highly effective sediment/TSS removal device. It can be sized in a number of ways to suit the application and level of protection required (see Table 2).

Liquid Hydrocarbons (oils)



Effective spill containment device at low flow rates. Note these systems are not considered oil separators according to the BS EN 858-1 and must not be used in applications where full certification is required.

Gross Pollutants



100% removal of floatable debris, such as food wrappers, Styrofoam cups and drinks cartons.

Sediment Bound Heavy Metals and Nutrients



As an efficient device for removal of fine sediment, the Downstream Defender® Select is also effective for the removal of sediment bound pollutants.

Sediment Bound Hydrocarbons (including Polycyclic Aromatic Hydrocarbons - PAHs)



PAHs have low solubility in water and are readily adsorbed onto sediment particles. Effective removal of sediment particles will also ensure the removal of many PAHs.

Downstream Defender® Select Model Options

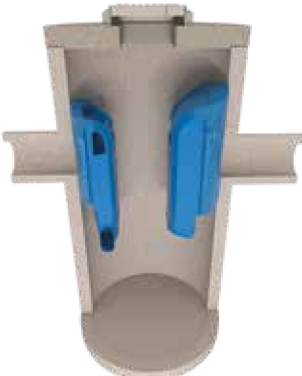
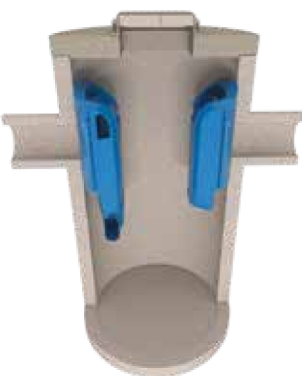
Downstream Defender® Select Model			
	Advanced Vortex Our recommended model which provides sediments, litter and hydrocarbon (oil) removal with enhanced sediment retention up to four times the treatment flow rate. 	Vortex Plus Provides sediments, litter and hydrocarbon (oil) removal, with sediments retained at up to two times the treatment flow rate. 	Vortex A simpler model providing removal of sediments, with retention up to two times the treatment flow rate. 
Key Pollutants			
Sediments	Coarse and fine	Coarse and fine	Coarse and fine
Sediment retention	Retained up to 4 x treatment flow rate	Retained up to 2 x treatment flow rate	Retained up to 2 x treatment flow rate
Litter, debris	✓	✓	✗
Liquid hydrocarbons (oils)	✓	✓	✗
Hydrocarbon (oil) retention	Option for increased retention on request	Option for increased retention on request	✗
Sediment bound metals	✓	✓	✓

Table 1 - Downstream Defender® Select pollutant removal performance

The Downstream Defender® Select may be sized for different target particle sizes and removal efficiencies – contact us for site specific design.

Enhancement Options

Make Maintenance Smart

To help with SuDS maintenance plans and to ensure that maintenance is cost-effective, add Hydro-Logic® Smart Maintenance to any model and get automated maintenance alerts.

The Hydro-Logic® Flexi Logger and ATEX/IECEEx sensors capture real-time data for flow levels and/or sediment build-up. Level monitoring will enable the detection of blockages relating to the unit, and sediment level monitoring can be set to a trigger point and self-report to the client's maintenance team when maintenance is due.

✓ Reduce Risk ✓ Save Costs



Fig 2. Downstream Defender® Select Hydro-Logic® Smart Maintenance. Available for all models.

Enhanced Oil Retention

The option of storing hydrocarbons (oils) as solids can be added, providing increased retention, even at flow rates where the unit is bypassing.

This option is available for the [Advanced Vortex](#) and [Vortex Plus](#) models only.

The Downstream Defender® Select with Enhanced Media has been tested and witnessed to the Deutsches Institut für Bautechnik (DIBt) protocol for liquid hydrocarbons capture and retention, achieving 98%. The WRc Performance Declaration is available on request.

✓ 98% liquid hydrocarbon retention

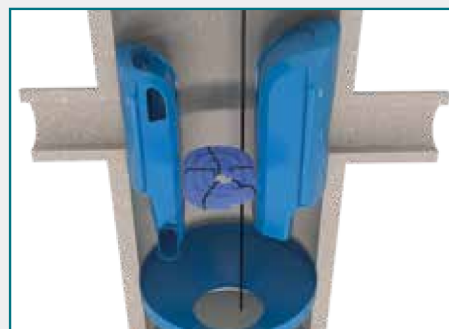


Fig 3. Enhanced hydrocarbon (oil) retention option for the Downstream Defender® Select. Available for the [Advanced Vortex](#) and [Vortex Plus](#) models only.

Pollutant Retention

It is important to ensure that pollutants in a rainfall event are retained throughout subsequent events. The Downstream Defender® Select offers engineers the option of specifying the retention performance of sediments. The [Vortex](#) and [Vortex Plus](#) models provide sediment retention up to twice the treatment flow rate, and the [Advanced Vortex](#), with its benching skirt creating a calm sediment storage zone, provides sediment retention up to four times the treatment flow rate.



Fig 4. Downstream Defender® Select with enhanced sediment retention available for the [Advanced Vortex](#) model only.

The Simple Index Approach (SIA)

The Simple Index Approach (SIA) outlined in CIRIA C753 The SuDS Manual is a water quality design method for sites with a low to medium risk pollution hazard level. Sites with a high risk pollution hazard level should consider a more precautionary approach.

The approach assigns pollution hazard indices to the given land use for three pollutant groups, total suspended solids (TSS), metals and hydrocarbons. SuDS components are then selected until their combined pollution mitigation index score is greater than the pollution hazard index for each pollutant group.

SIA Performance Claims are only applicable when the Downstream Defender® Select is designed using Table 3 for advanced treatment designs.

Downstream Defender® Select Mitigation Indices ^{(a)(b)}			
Model	Total Suspended Solids (TSS)	Metals	Hydrocarbons (Oils)
Vortex	0.3	0.2	0.2
Vortex Plus	0.5	0.4	0.5 / 0.6 *
Advanced Vortex	0.5	0.4	0.5 / 0.6 *
* 0.6 mitigation index requires hydrocarbon retention media supplied by Hydro International Ltd			
Notes: (a) All mitigation indices supplied by Hydro International Ltd are calculated using the methods laid out in the British Water How To Guide: Applying the CIRIA SuDS Manual Simple Index Approach to Proprietary / Manufactured Stormwater Treatment Devices. The Advanced Vortex and Vortex Plus models have also been independently verified by the WRc, with the WRc Performance Declaration available on request. (b) Mitigation Indices quoted for the Downstream Defender® Select are valid when the unit is designed according to the Treatment Flow Rate (see Table 3).			

Table 2 - SuDS Mitigation Indices for Downstream Defender® Select

Sizing for Advanced Treatment

The Downstream Defender® Select, when designed for advanced treatment, offers an annualised removal efficiency of >50% of all particles up to 1000 microns with a mass-median particle size (D50) of 63 microns and a specific gravity of 2.65.

- Tested to the British Water Code of Practice.
- Calculations third party verified by the WRc.
- Treatment Flow Rate should be greater than or equal to the site's Water Quality Flow Rate.
- Catchment Area is calculated using an assumed M1:15 rainfall intensity of 27 mm/hr or 75 l/s/ha.
- Headloss assumes free discharge.
- Hydraulic capacity should be greater than or equal to the site's Peak Discharge Flow Rate.

Model diameter (m)	Treatment flow rate (l/s)	Catchment Area (m²)	Headloss (mm)
1.0	21	2800	160
1.2	30	4000	170
1.5	48	6400	220
1.8	69	9200	230
2.1	94	12500	240
2.4	123	16000	250
3.0	192	25600	260

Table 3 - Downstream Defender® Select design information for advanced treatment (fine particle removal).

Sizing for Basic Treatment

The Downstream Defender® Select, when designed for basic treatment, offers removal efficiencies for > 80% of particles from 150-350 microns with a mass-median particle size (D50) of 230 microns and a specific gravity of 2.65.

The supporting testing was conducted on a full size 1.2 m unit for flow rates from 10 l/s to 50 l/s.

- Treatment Flow Rate should be greater than or equal to the Water Quality Flow Rate.
- Catchment Area is calculated using an assumed rainfall intensity of 15 mm/hr or 42 l/s/ha and requires an external bypass.
- Alternative rainfall intensities can be used to size your Downstream Defender® Select
- Headloss assumes free discharge.
- Using an external bypass will allow for larger hydraulic capacity in order to exceed the site's Peak Discharge Flow Rate.

Model diameter (m)	Treatment flow rate (l/s)	Catchment Area (m²)	Headloss (mm)
1.0	33	7900	270
1.2	47	11300	280
1.5	74	17800	310
1.8	107	25700	320
2.1	145	34800	340
2.4	189	45400	360
3.0	296	71000	370

Table 4 - Downstream Defender® Select design information for basic treatment (coarse particle removal).

Sizing for Betterment

If there is no treatment objective, the Downstream Defender® Select can be designed by ensuring the hydraulic capacity of the device is greater than the site peak discharge flow rate.

More information on hydraulic capacities for Downstream Defender® Select units can be found on Page 7, Table 6.

Important Sizing Information

Free Discharge

All treatment flow rates, and hydraulic capacities given in this document assume a free discharge condition at the outlet of the Downstream Defender® Select. If any surcharge or reverse flow conditions are anticipated, please contact Hydro International.

Treatment Flow Rate

The Treatment Flow Rate for Basic Treatment is higher than that for Advanced Treatment. This is due to the much larger particle size distribution used for the testing. Larger particles settle more readily in the drainage network which means that they are more easily captured inside a hydrodynamic vortex separator than finer material.

Though this data is a valid way to size a Downstream Defender® Select, these larger particles are not representative of typical stormwater runoff in the UK, Europe or the USA. Official testing protocols in these regions require strict particle size distribution control during testing to ensure that performance claims are relevant for the application.

Only Downstream Defender® Select units sized according to advanced treatment methods have official particulate metals and sediment-bound hydrocarbons claims. This is because these claims are generated using the guidance in the British Water How To Guide: Applying the CIRIA SuDS Manual Simple Index Approach to Proprietary / Manufactured Stormwater Treatment Devices, which does not consider testing using larger particle size distributions.

Site Configuration

The Downstream Defender® Select can accommodate a change in pipe direction to suit site specific requirements and accept up to three inlet pipes.

Online configuration

An online Downstream Defender® Select will need to be sized to pass all flows during all storm events through the chamber.

The peak flow through an online Downstream Defender® Select is largely dependant on the diameter of the connected pipework.



Fig 5. Downstream Defender® Select - online configuration

Online with external bypass

An online Downstream Defender® Select with an external bypass is common for regions with high peak flows or extended storms. It will bypass the flow from large storm events around the treatment chamber using offset pipework or a weir wall.

The peak flow through this configuration of Downstream Defender® Select is largely dependant on the surrounding drainage layout.

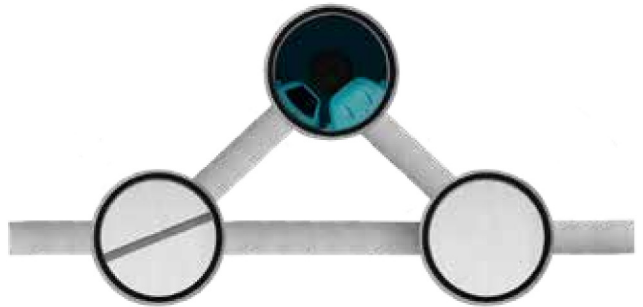


Fig 6. Downstream Defender® Select - external bypass configuration

It is recommended to design an external bypass configuration for catchments where the peak flow rainfall intensity is much larger than the treatment flow rate or average annual rainfall intensity.

Hydraulic Capacity and Peak Flow

The hydraulic capacity or peak flow rate for an online Downstream Defender® Select is the maximum flow rate that can pass through the chamber with a maximum headloss of 500 mm. The peak flow through an online Downstream Defender® Select is largely dependant on the diameter of the connected pipework.

The hydraulic capacity or peak flow rate for an offline Downstream Defender® Select with an external bypass can be directed around the hydrodynamic vortex separator.

If online hydraulic capacity is exceeded, the Downstream Defender® Select or connecting pipework must be upsized accordingly. For 3.0 m units, an external bypass (see Fig. 6) is required to prevent overloading.

Model diameter (m)	Online hydraulic capacity		External bypass level above DDS inlet invert ^(a) (mm)
	with recommended outlet pipe size (l/s)	with maximum outlet pipe size (l/s)	
1.0	46	70	300
1.2	84	107	320
1.5	144	170	370
1.8	217	278	380
2.1	271	355	440
2.4	422	529	460
3.0	652	787	500
Notes:			
a) Upstream weir level shown in Fig 6. Suitable for any pipe sizes specified in Table 6.			

Table 5 - Downstream Defender® Select approximate hydraulic capacity.

Pipe Sizes

The Downstream Defender® Select can accept a range of **inlet / outlet pipe** sizes, removing the need for complicated pipe connections or couplers. The inlet pipe size must always be equal to or smaller than the outlet pipe size.

Additional pipe sizes may be accommodated, please contact Hydro International for assistance.

Chamber size	1.0 m	1.2 m	1.5 m	1.8 m	2.1 m	2.4 m	3.0 m
Pipe sizes	150	150	300	375	375	500	600
	225 ^{a)}	225	375 ^{a)}	400	400	600 ^{a)}	675
	300	300 ^{a)}	400	450 ^{a)}	450	675	750 ^{a)}
		375	450	500	500 ^{a)}	750	900
				600	600		
					675		
Notes: a) The recommended pipe size for optimum performance.							

Table 6 - Downstream Defender® Select pipe sizes.

Pipework

Pipe angles can be adjusted to suit. Minimum angle between inlets and outlet is 90°. All pipe connections are at the same invert level.

Please contact Hydro International with your requirements.

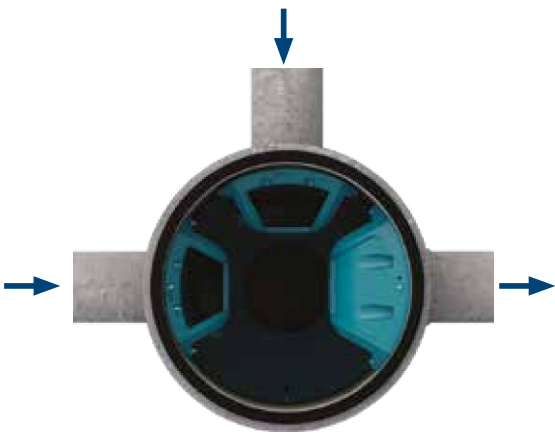


Fig 7. Downstream Defender® Select with two inlets

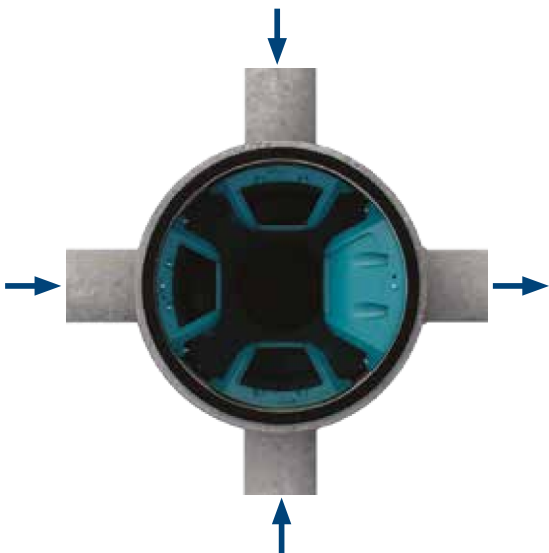


Fig 8. Downstream Defender® Select with three inlets

Model diameter (m)	Oil Storage Capacity (l)		Minimum sediment storage capacity ^(c) (m ³)
	Minimum liquid hydrocarbon (oil) storage capacity up to Treatment Flow Rate ^(a)	Solid state storage capacity with enhanced retention option ^(b)	
1.0	256	43-70	0.31
1.2	442	43-70	0.45
1.5	849	85-140	0.71
1.8	1458	85-140	1.02
2.1	2550	128-210	1.39
2.4	3586	170-280	1.81
3.0	6811	231-350	2.83

Notes:

- (a) Liquid oil storage capacity is valid up to the Treatment Flow Rate. Oil capture and retention is only available for the **Advanced Vortex** and **Vortex Plus** models.
- (b) Permanent oil storage capacity is available when using the enhanced oil retention option (available for the **Advanced Vortex** and **Vortex Plus** models only).
- (c) Additional sediment storage capacity for all Downstream Defender[®] Select models (**Advanced Vortex**, **Vortex Plus** and **Vortex**) can be provided to extend maintenance intervals if required.

Table 7 - Downstream Defender[®] Select storage capacities.

Design your own Downstream Defender[®] Select with our Online Design Tool



Register free and design your own Downstream Defender[®] Select and try out different performance objectives.

Project designs can be saved and submitted for a free review by our expert technical team if required. General arrangement drawings and quotes can also be requested from the tool for any saved design.

Visit: hydro-int.design

Maintenance

Periodic removal of captured pollutants is essential to the continuous, long-term functioning of your Downstream Defender® Select. The device will capture and retain sediment and oil until the sediment and oil storage volumes are full to capacity. When sediment and oil storage capacities are reached, the Downstream Defender® Select will no longer be able to store removed sediment and oil. Pollutant storage capacities are provided in Table 7.

The frequency of clean-out is determined in the field after installation. During the first year of operation, the unit should be inspected every six months or sooner to determine the rate of sediment and floatables accumulation. A simple probe such as a Sludge Judge® can be used to determine the level of accumulated solids stored in the sump.

To enable the provision of maintenance plans for planning applications, a typical maintenance schedule for a Downstream Defender® Select is shown in Table 8.



Activity	Frequency
Inspection	- Regularly during first year of installation. - Every 6 months after the first year of installation
Hydrocarbons (oils) and floatables removal	- Once per year, or as needed with sediment removal. - Following a spill in the drainage area.
Sediment removal	- As and when alerted by the Hydro-Logic® Smart Maintenance system, or - At intervals as determined by the first year's inspections - Following a spill in the drainage area.
Note: For most clean-outs it is not necessary to remove the entire volume of liquid in the vessel. Only removing the first few inches of oils/floatables and the sediment storage volume is required.	

Table 8 - Typical maintenance schedule for a Downstream Defender® Select

We can provide full inspection and maintenance services for the Downstream Defender® Select, as well as for any other Sustainable Drainage Systems (SuDS) on your site - providing peace of mind and saving you time and money.

For more information, please call 01275 878371 or email sudservices@hydro-int.com

Dimensions and Weights for Concrete Chambers

Material	Chamber Diameter Internal - mm (A)	Chamber Diameter External - mm (includes base slab and any extrusions) (B)	Recommended Inlet and Outlet Pipe Internal Diameter- mm ¹ (E)	Minimum Depth to Invert - mm ² (C)	Total Chamber Height Including cover - mm ³ (D)	Maximum Component Lift Weight - kg ⁴
Concrete	1050	1420	225	840	2390	2770
Concrete	1200	1460	300	1074	2831	2320
Concrete	1500	1760	375	1227	3276	3530
Concrete	1800	2160	450	1440	4090	5250
Concrete	2100	2650	500	1500	4364	6670
Concrete	2400	2950	600	2047	5375	8600
Concrete	3000	3480	750	1915	5437	14080

Notes:

- (1) Recommended inlet and outlet pipe internal diameter. For alternative pipe sizes to allow for easier connections, please see Table 5.
- (2) Minimum depth to invert shown. Depth to invert can be increased if required.
- (3) Minimum chamber depth shown. Additional sediment storage capacity or increased depth to invert can be provided if required. Total chamber height for concrete units **includes** the cover slab.
- (4) Maximum component weight is based on a single inlet and includes internal components.

Table 9 - Downstream Defender® Select dimensions and weights for concrete chambers

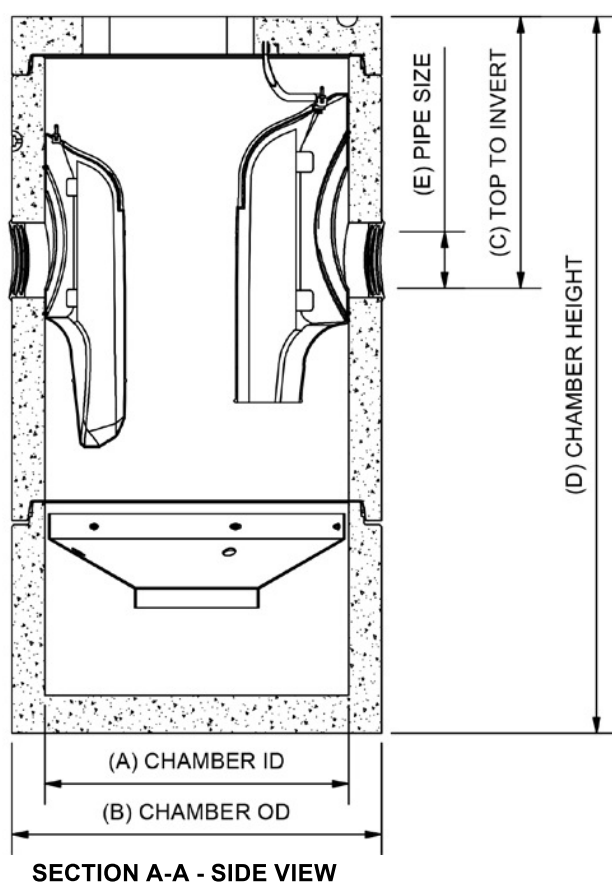


Fig 9. Downstream Defender® Select concrete chamber dimension drawing.

For General Arrangement drawings please email stormwater@hydro-int.com or submit a request at hydro-int.design

Dimensions and Weights for Plastic Chambers

Material	Chamber Diameter Internal - mm (A)	Chamber Diameter External - mm (includes base slab and any extrusions) ⁵ (B)	Recommended Inlet and Outlet Pipe Internal Diameter- mm ¹ (E)	Minimum Depth to Invert - mm ² (C)	Total Chamber Height Including cover - mm ³ (D)	Maximum Component Lift Weight - kg ⁴
HDPE Single Wall	1030	1282	225	662	2012	125
HDPE Single Wall	1200	1435	300	900	2512	170
HDPE Single Wall	1500	1735	375	1036	3012	240
HDPE Single Wall	1800	2317	450	1220	3490	410
HDPE Single Wall	2100	2630	500	1350	3920	750
HDPE Single Wall	2400	2930	600	1620	4440	950
HDPE Single Wall	3000	3530	750	1700	5270	1200

Notes:

- (1) Recommended inlet and outlet pipe internal diameter. For alternative pipe sizes to allow for easier connections, please see Table 5.
- (2) Minimum depth to invert shown. Depth to invert can be increased if required.
- (3) Minimum chamber depth shown. Additional sediment storage capacity or increased depth to invert can be provided if required. Total chamber height for plastic units **excludes** the cover slab.
- (4) Maximum component weight is based on a single inlet and includes internal components.
- (5) Maximum external diameter includes lifting lugs and base slab.

Table 10 - Downstream Defender® Select dimensions and weights for plastic chambers

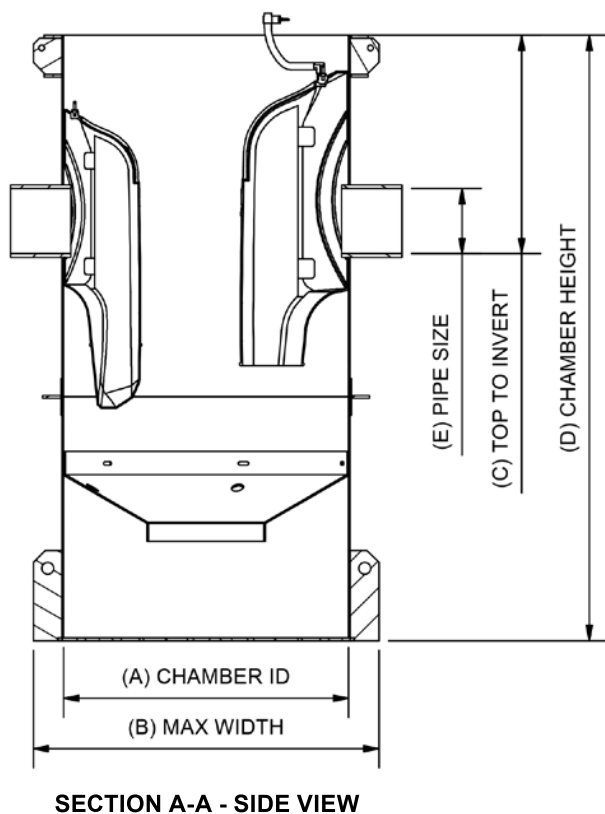


Fig 10. Downstream Defender® Select plastic chamber dimension drawing.

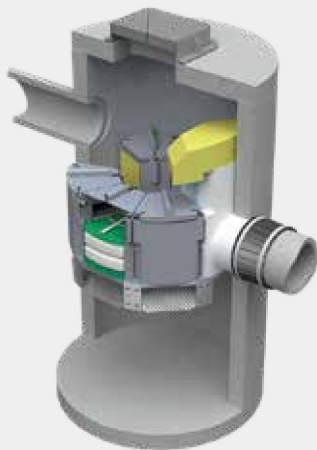
For General Arrangement drawings please email stormwater@hydro-int.com or submit a request at hydro-int.design

Our Full Range of Stormwater Treatment Solutions

We have a range of stormwater treatment devices to treat stormwater flows of varying quality. All our solutions can work alongside, enable or enhance natural SuDS, helping to meet or improve on biodiversity and amenity targets.



[Downstream Defender® Select](#)



[Up-Flo™ Filter](#)



[Hydro Biofilter™](#)

Product		Description	Targeted pollutants						
			Sediments		Litter, debris	Liquid hydrocarbons	Sediment bound hydrocarbons, nutrients and heavy metals	Dissolved metals	Nutrients
Downstream Defender® Select	Vortex	Vortex separator	Coarse & fine	Retained up to 2 x treatment flow rate	✗	✗	✓	✗	✗
	Vortex Plus	Vortex plus separator	Coarse & fine	Retained up to 2 x treatment flow rate	✓	✓ Option for increased retention on request	✓	✗	✗
	Advanced Vortex	Advanced hydrodynamic vortex separator	Coarse & fine	Retained up to 4 x treatment flow rate	✓	✓ Option for increased retention on request	✓	✗	✗
Up-Flo™ Filter	Sand	Fluidised bed up flow filtration system with Sand media	Very fine sediment		✓	✓	✓	✗	✓
	CPZ	Fluidised bed up flow filtration system with CPZ media	Very fine sediment		✓	✓	✓	✓	✓
Hydro Biofilter™		Biofiltration system	Very fine and dissolved sediments		✓	✓	✓	✓	✓

To find out more about our range of stormwater treatment solutions visit [hydro-int.com](https://www.hydro-int.com).

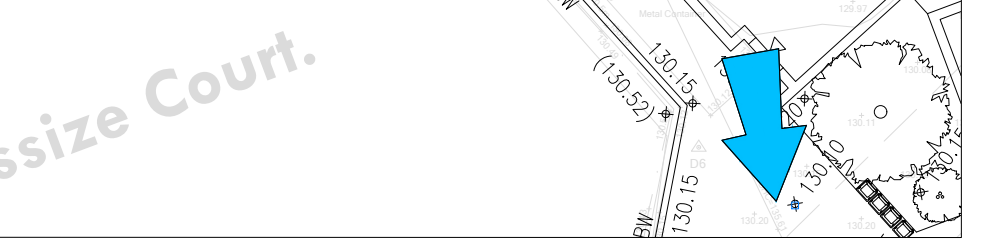
[Downstream Defender® Select](#)

[Up-Flo™ Filter](#)

[Hydro Biofilter™](#)

Patent: www.hydro-int.com/patents

| Appendix E – Exceedance Plan

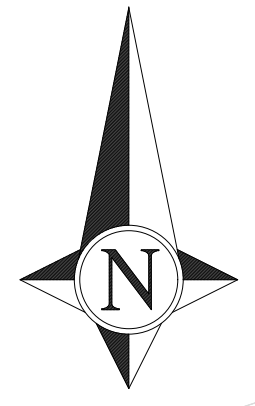


SEE ABOVE FOR CONTINUATION

Note: 4.63m3 of flooding at 1 in 100 year + 40% cc

Note: 12.32m3 of flooding at 1 in 100 year + 40% cc

- LEGEND**
- PROPOSED ACO DRAINAGE CHANNEL
 - PROPOSED SLOT DRAIN
 - G — PROPOSED GULLY
 - ← OVERLAND FLOW ROUTE



- Construction Design and Management (CDM) Key Residual Risks**
- Contractors entering the site should gain permission from the relevant land owners and/or principle contractor working on site at the time of entry. Contractors shall be responsible for carrying out their own risk assessments and for liaising with the relevant services companies and authorities. Listed below are Site Specific key risks associated with the project.
1. Overhead and underground services
 2. Street lighting cables
 3. Working adjacent to water courses and flood plain
 4. Soft ground conditions
 5. Working adjacent to live highways and railway lines
 6. Uncharted services
 7. Existing buildings with potential asbestos hazards

T1	TENDER ISSUE	11/12/25	FH
Rev.	Description	Date	Initial
Drawing Status:			

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BACKHOUSE

WADWORTH BREWERY
DEVIZES

DRAINAGE EXCEEDANCE PLAN

Status		Status Date
FOR INFORMATION		12.11.25
Drawn	Checked	Date
FH	PN	12.11.25
Scale	Number	Rev
1:250	11454-257	T1
0 5 10 15 20 25		
METRES		