BURO HAPPOLD

Wrexham AFC Kop Stand

Drainage Strategy - Additional Capacity Application

WRX-BHE-KOP-ZZZ-RP-CI-000002

0065004

22 July 2025

Revision P02

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Revision	Description	Issued by	Date	Checked
P01	Draft for team review	AD	18/07/2025	NH/JRP
P02	Planning Issue	AD	22/07/2025	NH/JRP

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date	**22/07/25**

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Glossary

Term	Definition
SuDS	Sustainable Urban Drainage Strategy
SAB	Sustainable Urban Drainage Approving Body
GA	General Arrangement

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1 Introduction

The new Kop Stand at Wrexham Association Football Club (WAFC) was granted planning permission in January 2023 under application P/2022/0725.

A Section 73 application (P/2023/0776) was submitted in November 2023 for the removal of an initial restriction which limited the capacity to 4,900 (condition 3) due to a moratorium on development matters at the time in the County based on phosphates issues. The Section 73 application was approved in January 2024, which allowed the capacity to increase to the submitted 5,500 attendees.

The approved drainage strategy for the Site was undertaken by Ramboll, document reference: WRX-RAM-XX-XX-RP-CD-00001, herewith referred to as The Original Strategy Document.

An additional Section 73 application (P/2025/0090) was submitted January 2025 for the revision to design of the stand and public realm. An updated drainage strategy (WFC-BHE-KOP-ZZ-RP-C-00001) was provided to capture the required changes resulting from amendments to the geometry and footprint of the Kop Stand, alterations to the public realm layout and optimisation of the proposed soakaways. WFC-BHE-KOP-ZZ-RP-C-00001 only presented the required changes and should be read in conjunction with The Original Strategy Document. Information within The Original Strategy Document remains valid if not updated within WFC-BHE-KOP-ZZ-RP-C-00001, for example existing site conditions and flood risk remain unchanged.

This technical note has been produced to support an additional planning application for the Wrexham A.F.C Kop Development. This technical note supports an application for additional measures to increase the capacity of the new Kop Stand capacity for up to 7,750 spectators. This document presents the required changes to the drainage strategy for the application and should be read in conjunction with the Original Strategy Document and WFC-BHE-KOP-ZZ-RP-C-00001. The additional capacity of the Kop Stand can be accommodated within the same building geometry and footprint presented in WFC-BHE-KOP-ZZ-RP-C-00001.

The overall Surface Water Drainage Strategy for the Site retains the principles set in The Original Strategy Document and WFC-BHE-KOP-ZZ-RP-C-00001. The amendments to the surface water drainage strategy are limited to revisions to accommodate rainwater harvesting systems in response to comments received from the LLFA on the previous planning addendum WFC-BHE-KOP-ZZ-RP-C-00001. No alterations to the piped surface water network or the drainage calculations are required. The surface water drainage strategy is discussed further in Section 2 and the results from the hydraulic model can be found in Appendix B.

The overall foul water Drainage Strategy remains unchanged, with flows collected in pipe network below the new stand before being discharged under gravity to a Welsh Water foul sewer at the southern corner of the stand. The design flows from the Site have increased slightly due to the greater number of facilities (toilets, concessions etc) being provided within the stand. The foul water drainage is discussed further in Section 2.

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2 Amendments to Surface Water Drainage Strategy

2.1 Surface Water

The overall proposed Surface Water Drainage Strategy remains consistent with the strategy presented in drawing WRX-BHE-XX-XX-DR-C-3000, whereby there is no change to the general arrangement of the collection features and piped network of the Surface Water Drainage Strategy. This remains in line with the proposed surface water management train and SuDS strategy presented in the original planning application on drawing WRX-RAM-ZZ-ZZ-DR-CD-00102.

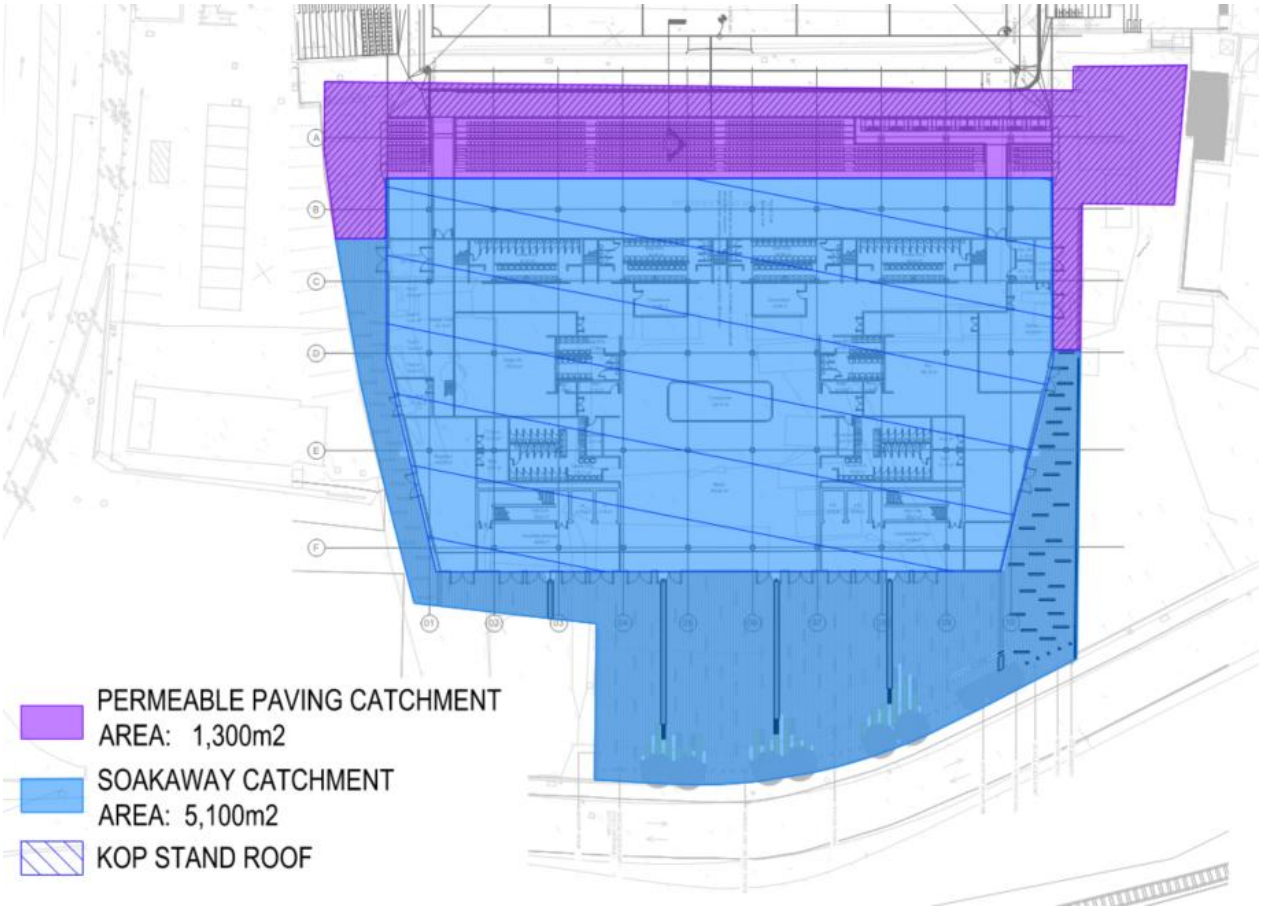
The key changes are presented below:

- Addition of rainwater harvesting system

The revised drainage strategy is presented on drawing WRX-BHE-XX-XX-DR-C-003000 in Appendix A.

2.1.1 Catchment Area

The total catchment area of the Site remains unchanged at 6,400m², the area of the roof remains at 4,100m² and the area of public realm at 2,300m². This can be seen in Figure 2—1.



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Figure 2—1 Catchment Areas Plan

2.1.2 Green Roof

No green roof is proposed. The overall strategy remains unchanged from the previous planning addendum WFC-BHE-KOP-ZZ-RP-C-00001.

A small green roof was previously proposed in the original planning application (P/2022/0725), on a standalone toilet block building that is no longer required. To manage the drainage for the affected area and mitigate the loss of the green roof in drainage terms, the footprint of the removed building is replaced by permeable paving at ground level. This solution will effectively handle surface water runoff at source, allowing infiltration through the paving directly to the ground below.

Additionally, to maintain the commitment to green infrastructure, rain gardens are incorporated into the public plaza area of the Site. These rain gardens will enhance biodiversity, improve water quality and provide aesthetic and ecological benefits.

2.1.3 Permeable Paving

The extent of permeable paving remains unchanged to that proposed in the previous planning addendum WFC-BHE-KOP-ZZ-RP-C-00001.

2.1.4 Rainwater Harvesting

Rainwater harvesting is proposed to supply water for irrigation of the pitch, this is an addition to the scheme since the previous planning addendum drainage strategy WFC-BHE-KOP-ZZ-RP-C-00001. The tank will be located below the public realm to the rear of the stand and will have a capacity of ~100m^3. The tank will collect water from the roof only, to maximise water quality. The tank will contain an integral pump set that will transfer harvested water over to the pitch irrigation storage tank located between the Kop Stand and the Wrexham Lager Stand. The location of the tank is indicated on drawing WRX-BHE-XX-XX-DR-C-3000, the exact details will be developed once a specialist supplier has been chosen.

The RWH tank has not been included in the hydraulic results. It is assumed the tank is already full when the design storms occur, to take a conservative approach to the drainage design.

2.1.5 Infiltration Rate

Soakaway testing was completed at the Site in July 2022 and results provided in Appendix C of the original strategy document.

An infiltration rate of 1.87 m/hr was previously used in calculations within the original strategy document, this was one of the higher results from the soakaway tests and is not a conservative approach to the design of the soakaway in accordance with BRE Digest 365. Using a high infiltration rate will overestimate the rate at which stormwater will discharge into surrounding ground and will not accurately simulate the conditions in a which a flood may occur.

The soak-away designs have been revised using an infiltration rate of 1.44 m/hr, being the lowest value obtained on the 3rd fill during the soak-away test, as required by BRE Digest 365. The lower infiltration rate still indicates the ground is a good infiltration media, according to the CIRIA SuDS Manual.

Additional soakaway testing is currently being completed at the Site. This is being done at the location of the proposed soakaway and is being done to a greater depth to demonstrate the infiltration characteristics of the geology

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further below ground. This is in response to LLFA comments on the previous planning addendum, where concern was raised that the scheme could increase the risk of flooding the nearby railway cutting. This could occur if water from the soakaway encounters an impermeable layer at depth and then flows laterally towards the railway cutting, rather than continuing downwards towards the water table.

2.1.6 Soakaway Sizing

Drainage calculations remain unchanged from the previous planning addendum WFC-BHE-KOP-ZZ-RP-C-00001.

A single soakaway is proposed, located under the public plaza area. The soakaway is proposed to have a plan area of $76m^2$ and a total depth of 4m. The invert level of the inlet pipe to the soakaway is at a depth of 2.1m, giving an effective depth available in the soakaway of 1.9m. This gives an attenuation volume of $137m^3$ available within the soakaway.

These parameters have been modelled using hydraulic modelling software InfoDrainage, modelling results are contained in Appendix B. The soakaway does not result in any flooding for a 1 in 100-year rainfall event +40% climate change. This is compliant with the design criteria specified by Wrexham County Borough Council. The results for this hydraulic modelling can be found in Appendix B.

The previous scheme necessitated a second soakaway to serve the runoff from a green roof. The green roof has been removed from the scheme, and alternative drainage provisions have been proposed. This mitigates the requirement of an additional soakaway.

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3 Amendments to Foul Water Drainage Strategy

The overall Foul Water Drainage Strategy remains unchanged from The Original Strategy Document. Foul water flows are to be collected in a below ground drainage network and discharged to the adjacent Welsh Water sewer network.

A manhole has been constructed specifically for connection of the new Kop Stand development as part of a sewer diversion recently completed through the car park of The Turf public house. The downstream sewer is 225mm in diameter at a gradient of approximately 1 in 150, giving a local capacity of approximately 37 l/sec.

Updated foul water drainage calculations are provided in Appendix C, which estimate the proposed flow peak flow as 21.4 l/sec. This is derived using the discharge unit methodology based on the number of sanitary fixings and fittings proposed in the new Kop Stand for the increased capacity. The discharge unit is considered a conservative approach in deriving the flow from the building.

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Appendix A Surface Water Drainage Drawing

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HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION
COMPLETION OF GPR SURVEY TO IDENTIFY SERVICES. SURVEY IDENTIFIED EXISTING DRAINS, ELECTRIC CABLES, COMMUCBALES AND GAS PIPES. SERVICE NOT IDENTIFIED BY THE SURVEY ARE ANTICIPATED AND REQUIRE CONSIDERATION BY CONTRACTOR DURING CONSTRUCTION.

MAINTENANCE/CLEANING/OPERATION
NO UNUSUAL HAZARDS, TO BE REVIEWED AS DESIGN PROGRESSES.

DECOMMISSIONING/DEMOLITION
NO UNUSUAL HAZARDS, TO BE REVIEWED AS DESIGN PROGRESSES.

KEY
CD - CHANNEL DRAIN
RWP - RAINWATER DOWN PIPE

BLOCK PAVING

PERMEABLE PAVING

SOAKAWAY

1. ALL DIMENSIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. ALL LEVELS ARE TO ORDNANCE SURVEY DATUM UNLESS STATED OTHERWISE.
3. FOR KNOWN EXISTING UTILITIES IDENTIFIED WITH GPR SURVEY REFER TO SUBSITE SURVEY 0223-GAT-001.
6. FOR KNOWN EXISTING TOPOGRAPHIC INFORMATION REFER TO SUBSITE SURVEY 1224-GAT-001.
7. FOR ARCHITECTURAL BACKGROUND REFER TO WRX-POP-KOP-L00-DR-AR-021020.
8. FOR LANDSCAPE ARCHITECTURAL PLAN REFER TO WRX-POP-KOP-L00-DR-LA-701000.
9. ALL RAINWATER DOWNPIPE POSITIONS ARE ASSUMED AND LIKELY TO CHANGE AS DESIGN PROGRESSES.
10. ALL PIPE CONNECTIONS FROM RAIN GARDENS AND CHANNEL DRAINS TO STORM WATER NETWORK ARE ASSUMED TO BE 100mm.

Rev	Description	Date	Iss'd	Rev'd	App'd
01	INFORMATION	18/07/2025	AD	NJH	NJH
00	INFORMATION	29/01/2025	AD	NJH	NJH

PLANNING
Project Stage

INFORMATION
Status of Drawing

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Client WREXHAM AFC
Architect *POPULOUS*
Project WREXHAM AFC KOP STAND
Drg Title SURFACE WATER DRAINAGE STRATEGY GENERAL ARRANGEMENT

Job No. 0065004
Scale@A1 1:200
Drawn/Designed By. AD
Checked By. AD
Approved By. NJH
Drawing No. WRX-BHE-XX-XX-DR-C-3000
Revision 01

Nick Hall C:\Users\nhall\Buro Happold\P65004 Wrexham FC Expansion - Civil Engineering\3_Drawings\3WIP\Sheets\WRX-BHE-XX-XX-DR-C-3000.dwg

Appendix B Surface Water Drainage Calculations

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0065004: Wrexham FC Expansion Surface Water Drainage Strategy Hydraulic Results	Date: 29/01/2025		
	Designed by: AD	Checked by: NJH	Approved By: NJH
Report Details: Type: Junctions Storm Phase: ST_01	Buro Happold: Camdem Mill 230 Lower Bristol Road Bath, BA2 3DQ		

Name	Junction Type	Easting (m)	Northing (m)	Cover Level (m)	Depth (m)	Invert Level (m)	Chamber Shape	Diameter (m)
STMH 1	Manhole	332909.608	350910.285	87.916	1.300	86.616	Circular	1.200
STMH 2	Manhole	332920.649	350909.572	87.513	1.400	86.113	Circular	1.200
STMH 3	Manhole	332924.727	350916.174	87.439	1.528	85.911	Circular	1.200
STMH 4	Manhole	332930.829	350927.023	87.440	1.662	85.778	Circular	1.200
STMH 7	Manhole	332927.080	350929.788	87.673	1.911	85.762	Circular	1.200
STMH 8	Manhole	332929.315	350933.244	87.667	1.919	85.748	Circular	1.200
STMH 5	Manhole	332937.374	350948.147	87.763	1.350	86.413	Circular	1.200
STMH 6	Manhole	332935.644	350937.773	87.542	1.725	85.817	Circular	1.200
STMH 10	Manhole	332891.802	350894.860	88.187	1.702	86.485	Circular	1.350
STMH 11	Manhole	332909.991	350920.199	88.124	1.717	86.407	Circular	1.350
STMH 12	Manhole	332926.370	350945.650	88.118	1.787	86.331	Circular	1.350
STMH 15	Manhole	332928.700	350944.416	87.986	1.661	86.324	Circular	1.350
STMH 13	Manhole	332910.063	350973.181	88.212	1.500	86.712	Circular	1.200
STMH 14	Manhole	332931.432	350952.735	88.067	1.454	86.613	Circular	1.200
STMH 9	Manhole	332865.364	350905.806	88.207	1.650	86.557	Circular	1.350

Name	Lock
STMH 1	None
STMH 2	None
STMH 3	None
STMH 4	None
STMH 7	None
STMH 8	None
STMH 5	None
STMH 6	None
STMH 10	None
STMH 11	None
STMH 12	None
STMH 15	None
STMH 13	None
STMH 14	None
STMH 9	None



Soakaway

Type : Soakaway

Dimensions

Exceedance Level (m)	87.850
Depth (m)	4.000
Base Level (m)	83.850
Freeboard (mm)	0
Soakaway Shape	Rectangular
Diameter / Width (m)	8.000
Length (m)	9.500
Porosity (%)	95
Ineffective Storage Depth (m)	2.102
Number of Soakaways	1
Base Infiltration Rate (m/hr)	1.44
Side Infiltration Rate (m/hr)	1.44
Safety Factor	2.0
Total Volume (m^3)	137.036

Inlets

Inlet (1)

Incoming Item(s)	No Delay
Bypass Destination	(None)
Capacity Type	No Restriction

0065004: Wrexham FC Expansion Surface Water Drainage Strategy Hydraulic Results	Date: 29/01/2025		
	Designed by: AD	Checked by: NJH	Approved By: NJH
Report Details: Type: Connections Storm Phase: ST_01	Buro Happold: Camdem Mill 230 Lower Bristol Road Bath, BA2 3DQ		

Name	Length (m)	Connection Type	Slope (1:X)	Manning's n	Diameter / Base Width (mm)	Upstream Cover Level (m)	Upstream Invert Level (m)	Downstream Cover Level (m)
1.000	11.063	Pipe	24.430	0.013	100	87.916	86.616	87.513
1.001	7.760	Pipe	150.000	0.013	150	87.513	86.113	87.439
1.002	12.447	Pipe	93.587	0.013	300	87.439	85.911	87.440
1.003	4.658	Pipe	300.000	0.013	300	87.440	85.778	87.673
1.004	4.116	Pipe	300.000	0.013	300	87.673	85.762	87.667
2.000	10.517	Pipe	23.605	0.013	150	87.763	86.413	87.542
2.001	11.779	Pipe	300.000	0.013	300	87.542	85.817	87.440
No Delay	15.898	No Delay						
3.001	31.191	Pipe	399.886	0.013	450	88.187	86.485	88.124
3.002	30.266	Pipe	398.237	0.013	450	88.124	86.407	88.118
3.003	2.637	Pipe	400.000	0.013	450	88.118	86.331	87.986
No Delay (1)	11.189	No Delay						
4.000	29.575	Pipe	298.738	0.013	300	88.212	86.712	88.067
4.001	8.708	Pipe	65.972	0.013	300	88.067	86.613	88.118
3.000	28.614	Pipe	400.000	0.013	450	88.207	86.557	88.187

Name	Downstream Invert Level (m)	Lock	Flow Restriction (L/s)
1.000	86.163	All	
1.001	86.061	All	
1.002	85.778	All	
1.003	85.762	All	
1.004	85.748	All	
2.000	85.967	All	
2.001	85.778	All	
No Delay			
3.001	86.407	All	
3.002	86.331	All	
3.003	86.324	All	
No Delay (1)			
4.000	86.613	All	
4.001	86.481	All	
3.000	86.485	All	

0065004: Wrexham FC Expansion Surface Water Drainage Strategy Hydraulic Results	Date: 29/01/2025		
	Designed by: AD	Checked by: NJH	Approved By: NJH
Report Title: Rainfall Analysis Criteria	Buro Happold: Camdem Mill 230 Lower Bristol Road Bath, BA2 3DQ		

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Shortest
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	300
Perform First Flush Analysis	☐

0065004: Wrexham FC Expansion Surface Water Drainage Strategy Hydraulic Results	Date: 29/01/2025		
	Designed by: AD	Checked by: NJH	Approved By: NJH
Report Details: Type: Junctions Summary Storm Phase: ST_01	Buro Happold: Camdem Mill 230 Lower Bristol Road Bath, BA2 3DQ		

Wrexham FC FSR: 100 years: Increase Rainfall (%): +40: Critical Storm Per Item: Rank By: Max. Depth

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
STMH 1	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	87.916	86.616	87.581	0.965	17.2	1.092	0.000	10.7	7.925	Surcharged
STMH 2	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	87.513	86.113	87.348	1.235	18.7	1.397	0.000	14.3	11.604	Flood Risk
STMH 3	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	87.439	85.911	87.298	1.387	29.4	1.569	0.000	25.2	18.627	Flood Risk
STMH 4	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	87.440	85.778	87.292	1.514	58.2	1.713	0.000	53.9	37.705	Flood Risk
STMH 7	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	87.673	85.762	87.280	1.518	53.9	1.716	0.000	49.3	37.600	Surcharged
STMH 8	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	87.667	85.748	87.266	1.518	122.8	1.717	0.000	125.3	117.835	OK
STMH 5	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	87.763	86.413	87.312	0.900	17.6	1.017	0.000	13.2	8.101	Surcharged
STMH 6	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	87.542	85.817	87.295	1.478	22.8	1.671	0.000	18.6	12.536	Flood Risk
STMH 10	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	88.187	86.485	87.984	1.499	62.2	2.145	0.000	46.9	34.537	Flood Risk
STMH 11	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	88.124	86.407	87.964	1.557	86.1	2.228	0.000	61.2	52.486	Flood Risk
STMH 12	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	88.118	86.331	87.924	1.593	93.4	2.280	0.000	79.7	80.506	Flood Risk
STMH 15	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	87.986	86.324	87.910	1.585	79.7	2.268	0.000	84.8	80.340	Flood Risk
STMH 13	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	88.212	86.712	87.985	1.273	28.5	1.440	0.000	10.6	13.252	Flood Risk
STMH 14	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	88.067	86.613	87.944	1.331	14.7	1.505	0.000	24.2	13.293	Flood Risk
STMH 9	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	88.207	86.557	87.985	1.428	52.5	2.043	0.000	40.0	24.345	Flood Risk

0065004: Wrexham FC Expansion Surface Water Drainage Strategy Hydraulic Results	Date: 29/01/2025		
	Designed by: AD	Checked by: NJH	Approved By: NJH
Report Details: Type: Stormwater Controls Summary Storm Phase: ST_01	Buro Happold: Camdem Mill 230 Lower Bristol Road Bath, BA2 3DQ		

Wrexham FC FSR: 100 years: Increase Rainfall (%): +40: Critical Storm Per Item: Rank By: Max. Resident Volume

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Soakaway	Wrexham FC FSR: 100 years: +40 %: 60 mins: Winter	85.724	85.724	1.874	1.874	108.0	135.292	0.000	156.163	0.0	0.000	1.272	OK

0065004: Wrexham FC Expansion Surface Water Drainage Strategy Hydraulic Results	Date: 29/01/2025		
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Report Details: Type: Connections Summary Storm Phase: ST_01	Buro Happold: Camdem Mill 230 Lower Bristol Road Bath, BA2 3DQ		

Wrexham FC FSR: 100 years: Increase Rainfall (%): +40: Critical Storm Per Item: Rank By: Max. Flow

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
1.000	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	Pipe	STMH 1	STMH 2	87.916	87.581	0.100	7.925	1.4	1.02	10.7	Surcharged
1.001	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	Pipe	STMH 2	STMH 3	87.513	87.348	0.150	11.604	0.8	1.15	14.3	Flood Risk
1.002	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	Pipe	STMH 3	STMH 4	87.439	87.298	0.300	18.627	0.4	0.25	25.2	Flood Risk
1.003	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	Pipe	STMH 4	STMH 7	87.440	87.292	0.300	37.705	0.8	0.96	53.9	Flood Risk
1.004	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	Pipe	STMH 7	STMH 8	87.673	87.280	0.300	37.600	0.7	0.88	49.3	Surcharged
2.000	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	Pipe	STMH 5	STMH 6	87.763	87.312	0.150	8.101	1.2	0.42	13.2	Surcharged
2.001	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	Pipe	STMH 6	STMH 4	87.542	87.295	0.300	12.536	0.3	0.33	18.6	Flood Risk
No Delay	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	No Delay	STMH 8	Soakaway		87.266	0.088	117.829	0.0		125.4	
3.001	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	Pipe	STMH 10	STMH 11	88.187	87.984	0.450	34.537	0.5	0.33	46.9	Flood Risk
3.002	Wrexham FC FSR: 100 years: +40 %: 30 mins: Winter	Pipe	STMH 11	STMH 12	88.124	87.858	0.450	71.725	0.4	0.44	63.2	Flood Risk
3.003	Wrexham FC FSR: 100 years: +40 %: 30 mins: Winter	Pipe	STMH 12	STMH 15	88.118	87.840	0.450	109.902	0.6	0.64	90.8	Flood Risk

No Delay (1)	Wrexham FC FSR: 100 years: +40 %: 30 mins: Winter	No Delay	STMH 15	STMH 8		87.830	0.087	109.923	0.0		85.8	
4.000	Wrexham FC FSR: 100 years: +40 %: 30 mins: Winter	Pipe	STMH 13	STMH 14	88.212	87.847	0.300	17.996	0.7	0.33	18.6	Surcharged
4.001	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	Pipe	STMH 14	STMH 12	88.067	87.944	0.300	13.168	0.9	0.2	24.2	Flood Risk
3.000	Wrexham FC FSR: 100 years: +40 %: 15 mins: Winter	Pipe	STMH 9	STMH 10	88.207	87.985	0.450	24.345	0.5	0.28	40.0	Flood Risk

0065004: Wrexham FC Expansion Surface Water Drainage Strategy Hydraulic Results	Date: 29/01/2025		
	Designed by: AD	Checked by: NJH	Approved By: NJH
Report Details: Type: Stormwater Controls Storm Phase: ST_02	Buro Happold: Camdem Mill 230 Lower Bristol Road Bath, BA2 3DQ		



Porous Paving

Type : Porous Paving

Dimensions

Exceedance Level (m)	88.230
Depth (m)	0.500
Base Level (m)	87.730
Paving Layer Depth (mm)	100
Membrane Percolation (m/hr)	0.2
Porosity (%)	30
Length (m)	113.000
Long. Slope (1:X)	10000.00
Width (m)	10.000
Total Volume (m^3)	135.600

Inlets

PP Catchment

Inlet Type	Point Inflow
Incoming Item(s)	Catchment Area
Bypass Destination	(None)
Capacity Type	No Restriction

Advanced

Base Infiltration Rate (m/hr)	1.44
Side Infiltration Rate (m/hr)	1.44
Safety Factor	10.0
Conductivity (m/hr)	36.0

0065004: Wrexham FC Expansion Surface Water Drainage Strategy Hydraulic Results	Date: 29/01/2025		
	Designed by: AD	Checked by: NJH	Approved By: NJH
Report Details: Type: Inflow Summary Storm Phase: ST_02	Buro Happold: Camdem Mill 230 Lower Bristol Road Bath, BA2 3DQ		

Inflow Label	Connected To	Flow (L/s)	Runoff Method	Area (ha)	Percentage Impervious (%)	Urban Creep (%)	Adjusted Percentage Impervious (%)	Area Analysed (ha)
Catchment Area	Porous Paving		Time of Concentration	0.113	95	0	95	0.107
TOTAL		**0.0**		**0.113**				**0.107**

0065004: Wrexham FC Expansion Surface Water Drainage Strategy Hydraulic Results	Date: 29/01/2025		
	Designed by: AD	Checked by: NJH	Approved By: NJH
Report Title: Rainfall Analysis Criteria	Buro Happold: Camdem Mill 230 Lower Bristol Road Bath, BA2 3DQ		

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Shortest
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	300
Perform First Flush Analysis	☐

Rainfall

Wrexham FC FSR

Type: FSR

Region	England And Wales
M5-60 (mm)	18.0
Ratio R	0.327
Summer	☑
Winter	☑

Return Period

Return Period (years)	Increase Rainfall (%)
100.0	40.000

Storm Durations

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
180	360
240	480
360	720
480	960
600	1200
720	1440
960	1920
1440	2880
2160	4320
2880	5760
4320	8640
5760	11520
7200	14400
8640	17280
10080	20160

0065004: Wrexham FC Expansion Surface Water Drainage Strategy Hydraulic Results	Date: 29/01/2025		
	Designed by: AD	Checked by: NJH	Approved By: NJH
Report Details: Type: Stormwater Controls Summary Storm Phase: ST_02	Buro Happold: Camdem Mill 230 Lower Bristol Road Bath, BA2 3DQ		

Wrexham FC FSR: 100 years: Increase Rainfall (%): +40: Critical Storm Per Item: Rank By: Max. Resident Volume

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Porous Paving	Wrexham FC FSR: 100 years: +40 %: 60 mins: Winter	88.025	87.730	0.284	0.000	29.5	19.223	0.000	45.857	0.0	0.000	85.824	OK

Appendix C Foul Water Drainage Calculations

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BURO HAPPOLD								
	Project:	65004	Wrexhan Kop Stand				Author	Abi Donald
	Package:	Foul Water Drainage					Date	16/7/25
	Document:	FW DU calc					Checked	Nick Hall
	Number:	WFC-BHE-KOP-ZZZ-CA-C-00003	**Rev.**	00	16/7/25		Date	16/7/25

Peak foul water flow estimated in accordance with BS EN 12056 - Discharge Unit Methodology

6.3 Calculation of flowrate

6.3.1 Waste water flowrate (Q_{ww})

Q_{ww} is the expected flowrate of waste water in a part or in the whole drainage system where only domestic sanitary appliances (see Table 2) are connected to the system.

$$Q_{ww} = K\sqrt{\sum DU}$$

where:

Q_{ww} = Waste water flowrate (l/s)
K = Frequency factor
ΣDU = Sum of discharge units

6.3.2 Frequency factor (K)

Typical frequency factors associated with different usage of appliances are given in Table 3.

Fixtures and fittings establisehd from the following Populous Drawings and catering equipment schedule.

Drawing Ref	Toilets	Urinals	Showers	Basins	Dishwash	Sink
WRX-POP-KOP-L00-DR-AR-011000	60	68		54		
WRX-POP-KOP-L01-DR-AR-011001	29	8	32	32		
WRX-POP-KOP-L02-DR-AR-011002	22	8		24		
WRX-POP-KOP-L03-DR-AR-011003	22	18		18		
WRX-POP-KOP-L04-DR-AR-011004	24	7		18		
FROM CATERING SCHEDULES				20	1	22
Total	**157**	**109**	**32**	**166**	**1**	**22**

Sanitary Fittings	Quantity	DU	Total DU	
Toilet	157	1.8	282.6	
Urinals	109	0.8	87.2	
Showers	32	0.6	19.2	
Basins	166	0.3	49.8	
Dishwasher	1	1.0	1	
Sink	22	0.8	17.6	
			457.4	Total DUs

Frequency Factor	1	
Peak Flow Rate	**21.4**	L/s

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