

Received by Ashfield District Council

12/02/2025

# Paul Waite Associates

Consulting Civil, Structural & Geo-Environmental Engineers

Surface Water Calculations  
1 in 100 Year  
40% Climate Change.

Project:  
Store First Observatory Way.

Report Ref:  
23158-PWA-00-XX-CA-C-3000-P01

Prepared For:

**campbelldriverpartnership**  
architects

Date:  
August 2023

Summit House  
Riparian Way  
The Crossing  
Cross Hills  
BD20 7BW

Tel: 01535 633350  
E-mail: [info@pwaite.co.uk](mailto:info@pwaite.co.uk)

[www.pwaite.co.uk](http://www.pwaite.co.uk)



FS 50004

Report Ref: 23158-PWA-00-XX-CA-C-3000-P01  
Project: Store First Observatory Way  
Date: August 2023



## DOCUMENT CONTROL SHEET

**Issued by:** Paul Waite Associates Ltd  
Summit House  
Riparian Way  
The Crossings  
Cross Hills  
Keighley  
West Yorkshire  
BD20 7BW

Tel: 01535 633350  
E-mail: info@pwaite.co.uk

**Client:** Campbell Driver Partnership

**Report Ref:** 23158-PWA-00-XX-CA-C-3000 P01

**Project:** Store First Observatory Way

**Report:** Surface Water Calculations, 1 in 100 year + 40% Climate change.

**Status:** Preliminary

**Date:** August 2023

### Document Production Record

Issue Details	Name	Signature
Prepared by:	Isaac Borchers	
Check By:	Alex Collier	

### Document Revision Record

Issue No	Date	Revision Details
P01	15.08.23	First Issue

Report Ref: 23158-PWA-00-XX-CA-C-3000-P01  
Project: Store First Observatory Way  
Date: August 2023



---

## Contents

---

Summary of Results for 100-year Return Period (40%)	1
Rainfall Details	3
Time Area Diagram	3
Model Details	4
Cellular Storage Structure	4
Crown Vortex Valve Outflow Control	4

Summit House  
Riparian Way  
Keighley BD20 7BW

23159-PWA-00-CA-C-3000 P01  
SURFACE WATER CALCULATIONS  
STORE FIRST, OBSERVATORY WAY



Date 15/08/2023  
File 23158-PWA-00-XX-CA-C-30...

Designed by IB  
Checked by AC

Innovyze

Source Control 2020.1.3

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 15 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (1/s)	Max Control (1/s)	Max Σ Outflow (1/s)	Max Volume (m³)	Status
15 min Summer	153.609	0.609	0.0	4.8	4.8	5.8	O K
30 min Summer	153.649	0.649	0.0	4.9	4.9	6.2	O K
60 min Summer	153.602	0.602	0.0	4.8	4.8	5.7	O K
120 min Summer	153.441	0.441	0.0	4.5	4.5	4.2	O K
180 min Summer	153.291	0.291	0.0	4.3	4.3	2.8	O K
240 min Summer	153.175	0.175	0.0	4.1	4.1	1.7	O K
360 min Summer	153.034	0.034	0.0	3.8	3.8	0.3	O K
480 min Summer	153.000	0.000	0.0	3.5	3.5	0.0	O K
600 min Summer	153.000	0.000	0.0	2.9	2.9	0.0	O K
720 min Summer	153.000	0.000	0.0	2.5	2.5	0.0	O K
960 min Summer	153.000	0.000	0.0	2.0	2.0	0.0	O K
1440 min Summer	153.000	0.000	0.0	1.5	1.5	0.0	O K
2160 min Summer	153.000	0.000	0.0	1.1	1.1	0.0	O K
2880 min Summer	153.000	0.000	0.0	0.8	0.8	0.0	O K
4320 min Summer	153.000	0.000	0.0	0.6	0.6	0.0	O K
5760 min Summer	153.000	0.000	0.0	0.5	0.5	0.0	O K
7200 min Summer	153.000	0.000	0.0	0.4	0.4	0.0	O K
8640 min Summer	153.000	0.000	0.0	0.3	0.3	0.0	O K
10080 min Summer	153.000	0.000	0.0	0.3	0.3	0.0	O K
15 min Winter	153.719	0.719	0.0	5.0	5.0	6.8	O K
30 min Winter	153.757	0.757	0.0	5.0	5.0	7.2	O K
60 min Winter	153.668	0.668	0.0	4.9	4.9	6.3	O K
120 min Winter	153.414	0.414	0.0	4.5	4.5	3.9	O K
180 min Winter	153.204	0.204	0.0	4.2	4.2	1.9	O K
240 min Winter	153.058	0.058	0.0	3.9	3.9	0.5	O K
360 min Winter	153.000	0.000	0.0	3.2	3.2	0.0	O K
480 min Winter	153.000	0.000	0.0	2.5	2.5	0.0	O K
600 min Winter	153.000	0.000	0.0	2.1	2.1	0.0	O K
720 min Winter	153.000	0.000	0.0	1.8	1.8	0.0	O K
960 min Winter	153.000	0.000	0.0	1.5	1.5	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.153	0.0	9.7	14
30 min Summer	90.705	0.0	12.6	23
60 min Summer	56.713	0.0	15.8	40
120 min Summer	34.246	0.0	18.9	74
180 min Summer	25.149	0.0	20.8	104
240 min Summer	20.078	0.0	22.2	134
360 min Summer	14.585	0.0	24.3	190
480 min Summer	11.622	0.0	25.8	0
600 min Summer	9.738	0.0	27.0	0
720 min Summer	8.424	0.0	28.1	0
960 min Summer	6.697	0.0	29.7	0
1440 min Summer	4.839	0.0	32.2	0
2160 min Summer	3.490	0.0	34.9	0
2880 min Summer	2.766	0.0	36.8	0
4320 min Summer	1.989	0.0	39.7	0
5760 min Summer	1.573	0.0	41.9	0
7200 min Summer	1.311	0.0	43.6	0
8640 min Summer	1.129	0.0	45.1	0
10080 min Summer	0.994	0.0	46.4	0
15 min Winter	138.153	0.0	10.7	15
30 min Winter	90.705	0.0	14.0	25
60 min Winter	56.713	0.0	17.6	44
120 min Winter	34.246	0.0	21.2	78
180 min Winter	25.149	0.0	23.4	108
240 min Winter	20.078	0.0	25.0	134
360 min Winter	14.585	0.0	27.2	0
480 min Winter	11.622	0.0	28.9	0
600 min Winter	9.738	0.0	30.3	0
720 min Winter	8.424	0.0	31.4	0
960 min Winter	6.697	0.0	33.3	0

Paul Waite Associates		Page 2
Summit House Riparian Way Keighley BD20 7BW	23159-PWA-00-CA-C-3000 P01 SURFACE WATER CALCULATIONS STORE FIRST, OBSERVATORY WAY	
Date 15/08/2023 File 23158-PWA-00-XX-CA-C-30...	Designed by IB Checked by AC	
Innovyze	Source Control 2020.1.3	

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
1440 min Winter	153.000	0.000	0.0	1.1	1.1	0.0	0.0	O K
2160 min Winter	153.000	0.000	0.0	0.8	0.8	0.0	0.0	O K
2880 min Winter	153.000	0.000	0.0	0.6	0.6	0.0	0.0	O K
4320 min Winter	153.000	0.000	0.0	0.4	0.4	0.0	0.0	O K
5760 min Winter	153.000	0.000	0.0	0.3	0.3	0.0	0.0	O K
7200 min Winter	153.000	0.000	0.0	0.3	0.3	0.0	0.0	O K
8640 min Winter	153.000	0.000	0.0	0.2	0.2	0.0	0.0	O K
10080 min Winter	153.000	0.000	0.0	0.2	0.2	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
1440 min Winter	4.839	0.0	36.1	0
2160 min Winter	3.490	0.0	39.1	0
2880 min Winter	2.766	0.0	41.3	0
4320 min Winter	1.989	0.0	44.5	0
5760 min Winter	1.573	0.0	46.9	0
7200 min Winter	1.311	0.0	48.9	0
8640 min Winter	1.129	0.0	50.5	0
10080 min Winter	0.994	0.0	51.9	0

Summit House  
 Riparian Way  
 Keighley BD20 7BW

23159-PWA-00-CA-C-3000 P01  
 SURFACE WATER CALCULATIONS  
 STORE FIRST, OBSERVATORY WAY



Date 15/08/2023  
 File 23158-PWA-00-XX-CA-C-30...

Designed by IB  
 Checked by AC

Innovyze

Source Control 2020.1.3

Rainfall Details

Rainfall Model	FSR	Ratio R	0.400	Cv (Winter)	0.840
Return Period (years)	100	Summer Storms	Yes	Shortest Storm (mins)	15
Region	England and Wales	Winter Storms	Yes	Longest Storm (mins)	10080
M5-60 (mm)	20.000	Cv (Summer)	0.750	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.037

**Time (mins) Area**  
**From: To: (ha)**

0 4 0.037

Paul Waite Associates		Page 4
Summit House Riparian Way Keighley BD20 7BW	23159-PWA-00-CA-C-3000 P01 SURFACE WATER CALCULATIONS STORE FIRST, OBSERVATORY WAY	
Date 15/08/2023 File 23158-PWA-00-XX-CA-C-30...	Designed by IB Checked by AC	
Innovyze	Source Control 2020.1.3	

Model Details

Storage is Online Cover Level (m) 155.000

Cellular Storage Structure

Invert Level (m) 153.000 Safety Factor 2.0  
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	10.0	0.0	0.799	10.0	0.0	0.800	0.0	0.0

Crown Vortex Valve® Outflow Control

Design Head (m) 1.750 Vortex Valve® Type R1 SW Only Invert Level (m) 152.000  
 Design Flow (l/s) 5.0 Diameter (mm) 80

Depth (m)	Flow (l/s)								
0.100	1.2	0.800	3.4	2.000	5.4	4.000	7.6	7.000	10.0
0.200	1.7	1.000	3.8	2.200	5.6	4.500	8.0	7.500	10.4
0.300	2.1	1.200	4.1	2.400	5.9	5.000	8.5	8.000	10.7
0.400	2.4	1.400	4.5	2.600	6.1	5.500	8.9	8.500	11.0
0.500	2.7	1.600	4.8	3.000	6.6	6.000	9.3	9.000	11.4
0.600	2.9	1.800	5.1	3.500	7.1	6.500	9.6	9.500	11.7



## End of Calculations

---

**Paul Waite Associates Ltd**  
Summit House, Riparian Way,  
Cross Hills, Keighley,  
West Yorkshire, BD20 7BW

t: 01535 633350  
e: [info@pwaite.co.uk](mailto:info@pwaite.co.uk)  
w: [www.pwaite.co.uk](http://www.pwaite.co.uk)

Registered in England 4217530



FS 880804