

Drainage Calculations for Surface Water Herbert Street, Cheetham Hill, Manchester

Site split into South side of the Access Road and the North side of the access road.

Flow/Capacity checked for 2year, 30 year & 100 year Events.

Includes manhole schedules and long-sections.

Capacity shows no flooding for the 100 year event.

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	Sheet no. 1			
	Date 20/10/23 10:18			
Project		By	Checked	Reviewed
Title Calculations (2 yrs storm) for HERBERT ST NORTH.SW				

Entry No.	Section No.	Diam mm	Fall mm	Grad 1 in	Length m	Imperm. area	Perm area	Flow l/s	Pipe cap full l/s	Depth of flow %	H.M.D.	Veloc. m/s	Proport. vel. m/s	Time of flow m:s	Time of conc m:s	Rain mm/hr	System vol
1	5.01	150#	100	220	22.0	151	48	1.7	11.9	20.3	0.49	0.67	0.42	0:33	7:33	49.3	
2	6.01	100#	100	115	11.5	80	20	0.9	5.6	21.7	0.52	0.71	0.46	0:16	7:16	50.2	
3	5.02	150#	393	32	12.6	0	0	3.5	31.5	16.9	0.41	1.78	0.99	0:07	7:40	48.9	
4	7.01	150#	200	118	23.7	162	0	1.6	16.3	15.3	0.38	0.92	0.48	0:26	7:26	49.6	
5	8.01	100#	99	132	13.2	86	17	0.9	5.2	23.5	0.56	0.67	0.45	0:20	7:20	50.0	
6	5.03	225#	615	13	8.0	87	0	7.7	145.0	10.3	0.26	3.65	1.49	0:02	7:42	48.8	
7	5.04	225#	50	20	1.0	0	0	7.7	116.8	12.0	0.30	2.94	1.32	0:00	7:42	48.8	

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	Sheet no.			2	
	Date			20/10/23 10:18	
Project		By		Checked	Reviewed
Title		Storage data for HERBERT ST NORTH.SW			

Storage data

Storage= Pipe	Section no. = 5.01	Diam (mm) = 150	Length (m) = 22	Volume = 0.4m ³
Storage= Pipe	Section no. = 6.01	Diam (mm) = 100	Length (m) = 11.5	Volume = 0.1m ³
Storage= Pipe	Section no. = 5.02	Diam (mm) = 150	Length (m) = 12.6	Volume = 0.2m ³
Storage= Pipe	Section no. = 7.01	Diam (mm) = 150	Length (m) = 23.7	Volume = 0.4m ³
Storage= Pipe	Section no. = 8.01	Diam (mm) = 100	Length (m) = 13.2	Volume = 0.1m ³
Storage= Pipe	Section no. = 5.03	Diam (mm) = 225	Length (m) = 8	Volume = 0.3m ³
Storage= Pipe	Section no. = 5.04	Diam (mm) = 225	Length (m) = 1	Volume = 0.0m ³

Storage pipe volume = 1.6m³

Storage volume in manholes = 0.9m³

Total storage = 2.5m³

Total system volume = 2.5m³

Note: Manhole volume is calculated for each manhole from the invert level to a level 300mm below the lowest system manhole ground level times the manhole area. Manhole reference level is 56.4m

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				Sheet no. 3		
				Date 20/10/23 10:18		
Project				By	Checked	Reviewed
Title Data summary for printout						
Location MANCHESTER (CENTRAL)	Nat. Grid ref: SJ8397	M5-60 17.8	r 0.36	wrapx 4	SAAR 900	

Design data

Maximum rainfall rate allowed	= unlimited	Return period	= 2
Urban creep factor (%)	= 0	Growth period (years)	= 0
Minimum velocity (m/s)	= 1.00	Percentage gradient	= 80%
Pipe roughness factor (mm)	= 0.60	Maximum depth of flow	= 100%
Climate change factor	= 0		

System data

Final Rainfall rate (mm/hr)	= 48.78	Total flow rate (l/s)	= 7.66
Total fall of index run (m)	= 0.0	Total length of index run (m)	= 0.0
Total permeable area (Ha)	= 0.0085	Total impermeable area (Ha)	= 0.0565
Time of concentration (mins)	= 7.71	Time of entry (mins)	= 7.0
Outfall diameter (mm)	= 225	Percentage impermeable area	= 86.94

Calculated variables

Routing coefficient (Cr)	= 1.3	Volumetric coefficient (Cv)	= 0.770
UCWI	= 96.15	Areal reduction factor	= 0.999

Notes:-

Default values for runoff used :-

Runoff factor for impervious areas = 70.0
Runoff factor for pervious areas = 40.0

Note 1 = Not applicable

Note 2 - Rainfall calculated using FSR data.

Note 4 - \$ against diameter indicates preferred diameter used.

Note 5 - x against diameter indicates preferred diameter too small and therefore not used.

Note 6 - S against diameter indicates throttle pipe used.

Note 7 - « against diameter indicates carrier pipe used in cellular storage.

Pipe sizes

The pipe definition file used for these calculations allows the following diameters:-

100	allowed	375	allowed	600	allowed	900	allowed	1200	allowed	1800	allowed
150	allowed	400	allowed	700	allowed	1000	allowed	1350	allowed	1950	allowed
225	allowed	450	allowed	750	allowed	1050	allowed	1500	allowed	2100	allowed
300	allowed	500	allowed	800	allowed	1125	allowed	1650	allowed	2400	allowed

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				Sheet no. 1		
				Date 20/10/23 10:22		
Project				By	Checked	Reviewed
Title Calculations (30 yrs storm) for HERBERT ST NORTH.SW						

Entry No.	Section No.	Diam mm	Fall mm	Grad 1 in	Length m	Imperm. area	Perm area	Flow l/s	Pipe cap full l/s	Depth of flow %	H.M.D.	Veloc. m/s	Proport. vel. m/s	Time of flow m:s	Time of conc m:s	Rain mm/hr	System vol
1	5.01	150+	100	220	22.0	151	48	3.4	11.9	32.9	0.74	0.67	0.55	0:33	6:33	96.8	
2	6.01	100+	100	115	11.5	80	20	1.8	5.6	35.4	0.78	0.71	0.61	0:16	6:16	98.6	
3	5.02	150+	393	32	12.6	0	0	6.8	31.5	26.9	0.62	1.78	1.30	0:07	6:40	96.1	
4	7.01	150+	200	118	23.7	162	0	3.1	16.3	24.6	0.58	0.92	0.64	0:26	6:26	97.6	
5	8.01	100+	99	132	13.2	86	17	1.8	5.2	38.3	0.83	0.67	0.59	0:20	6:20	98.2	
6	5.03	225+	615	13	8.0	87	0	15.1	145.0	16.2	0.40	3.65	1.98	0:02	6:42	95.9	
7	5.04	225+	50	20	1.0	0	0	15.1	116.8	18.9	0.46	2.94	1.75	0:00	6:42	95.8	

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	Sheet no.			2	
	Date			20/10/23 10:22	
Project		By		Checked	Reviewed
Title		Storage data for HERBERT ST NORTH.SW			

Storage data

Storage= Pipe	Section no. = 5.01	Diam (mm) = 150	Length (m) = 22	Volume = 0.4m ³
Storage= Pipe	Section no. = 6.01	Diam (mm) = 100	Length (m) = 11.5	Volume = 0.1m ³
Storage= Pipe	Section no. = 5.02	Diam (mm) = 150	Length (m) = 12.6	Volume = 0.2m ³
Storage= Pipe	Section no. = 7.01	Diam (mm) = 150	Length (m) = 23.7	Volume = 0.4m ³
Storage= Pipe	Section no. = 8.01	Diam (mm) = 100	Length (m) = 13.2	Volume = 0.1m ³
Storage= Pipe	Section no. = 5.03	Diam (mm) = 225	Length (m) = 8	Volume = 0.3m ³
Storage= Pipe	Section no. = 5.04	Diam (mm) = 225	Length (m) = 1	Volume = 0.0m ³

Storage pipe volume = 1.6m³

Storage volume in manholes = 0.9m³

Total storage = 2.5m³

Total system volume = 2.5m³

Note: Manhole volume is calculated for each manhole from the invert level to a level 300mm below the lowest system manhole ground level times the manhole area. Manhole reference level is 56.4m

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				Date 20/10/23 10:22		
Project				By	Checked	Reviewed
Title Data summary for printout						
Location	Nat. Grid ref:	M5-60	r	wrapx	SAAR	
MANCHESTER (CENTRAL)	SJ8397	17.8	0.36	4	900	

Design data

Maximum rainfall rate allowed	= unlimited	Return period	= 30
Urban creep factor (%)	= 0	Growth period (years)	= 0
Minimum velocity (m/s)	= 1.00	Percentage gradient	= 80%
Pipe roughness factor (mm)	= 0.60	Maximum depth of flow	= 100%
Climate change factor	= 0		

System data

Final Rainfall rate (mm/hr)	= 95.83	Total flow rate (l/s)	= 15.05
Total fall of index run (m)	= 0.0	Total length of index run (m)	= 0.0
Total permeable area (Ha)	= 0.0085	Total impermeable area (Ha)	= 0.0565
Time of concentration (mins)	= 6.71	Time of entry (mins)	= 6.0
Outfall diameter (mm)	= 225	Percentage impermeable area	= 86.94

Calculated variables

Routing coefficient (Cr)	= 1.3	Volumetric coefficient (Cv)	= 0.770
UCWI	= 96.15	Areal reduction factor	= 0.999

Notes:-

Default values for runoff used :-

Runoff factor for impervious areas = 70.0
Runoff factor for pervious areas = 40.0

Note 1 = Not applicable

Note 2 - Rainfall calculated using FSR data.

Note 4 - # against diameter indicates preferred diameter used.

Note 5 - ✕ against diameter indicates preferred diameter too small and therefore not used.

Note 6 - \$ against diameter indicates throttle pipe used.

Note 7 - « against diameter indicates carrier pipe used in cellular storage.

Pipe sizes

The pipe definition file used for these calculations allows the following diameters:-

100	allowed	375	allowed	600	allowed	900	allowed	1200	allowed	1800	allowed
150	allowed	400	allowed	700	allowed	1000	allowed	1350	allowed	1950	allowed
225	allowed	450	allowed	750	allowed	1050	allowed	1500	allowed	2100	allowed
300	allowed	500	allowed	800	allowed	1125	allowed	1650	allowed	2400	allowed

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				Sheet no. 1		
				Date 20/10/23 10:01		
Project				By	Checked	Reviewed
Title Calculations (100 yrs storm) for HERBERT ST NORTH.SW						

Entry No.	Section No.	Diam mm	Fall mm	Grad 1 in	Length m	Imperm. area	Perm area	Flow l/s	Pipe cap full l/s	Depth of flow %	H.M.D.	Veloc. m/s	Proport. vel. m/s	Time of flow m:s	Time of conc m:s	Rain mm/hr	System vol
1	5.01	150#	100	220	22.0	151	48	4.3	11.9	39.2	0.84	0.67	0.60	0:33	6:33	122.6	
2	6.01	100#	100	115	11.5	80	20	2.2	5.6	42.2	0.89	0.71	0.66	0:16	6:16	124.8	
3	5.02	150#	393	32	12.6	0	0	8.6	31.5	32.1	0.72	1.78	1.44	0:07	6:40	121.8	
4	7.01	150#	200	118	23.7	162	0	3.9	16.3	28.9	0.66	0.92	0.70	0:26	6:26	123.5	
5	8.01	100#	99	132	13.2	86	17	2.3	5.2	45.6	0.94	0.67	0.64	0:20	6:20	124.3	
6	5.03	225#	615	13	8.0	87	0	19.1	145.0	19.2	0.47	3.65	2.19	0:02	6:42	121.5	
7	5.04	225#	50	20	1.0	0	0	19.1	116.8	22.0	0.53	2.94	1.91	0:00	6:42	121.4	

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				Sheet no. 2		
				Date 20/10/23 10:01		
Project				By	Checked	Reviewed
Title Storage data for HERBERT ST NORTH.SW						

Storage data

Storage= Pipe	Section no. = 5.01	Diam (mm) = 150	Length (m) = 22	Volume = 0.4m ³
Storage= Pipe	Section no. = 6.01	Diam (mm) = 100	Length (m) = 11.5	Volume = 0.1m ³
Storage= Pipe	Section no. = 5.02	Diam (mm) = 150	Length (m) = 12.6	Volume = 0.2m ³
Storage= Pipe	Section no. = 7.01	Diam (mm) = 150	Length (m) = 23.7	Volume = 0.4m ³
Storage= Pipe	Section no. = 8.01	Diam (mm) = 100	Length (m) = 13.2	Volume = 0.1m ³
Storage= Pipe	Section no. = 5.03	Diam (mm) = 225	Length (m) = 8	Volume = 0.3m ³
Storage= Pipe	Section no. = 5.04	Diam (mm) = 225	Length (m) = 1	Volume = 0.0m ³

Storage pipe volume = 1.6m³

Storage volume in manholes = 0.7m³

Total storage = 2.3m³

Total system volume = 2.3m³

Note: Manhole volume is calculated for each manhole from the invert level to a level 300mm below the lowest system manhole ground level times the manhole area. Manhole reference level is 56.4m

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				Sheet no. 3		
				Date 20/10/23 10:01		
Project				By	Checked	Reviewed
Title Data summary for printout						
Location	Nat. Grid ref:	M5-60	r	wrapx	SAAR	
MANCHESTER (CENTRAL)	SJ8397	17.8	0.36	4	900	

Design data

Maximum rainfall rate allowed	= unlimited	Return period	= 100
Urban creep factor (%)	= 0	Growth period (years)	= 0
Minimum velocity (m/s)	= 1.00	Percentage gradient	= 80%
Pipe roughness factor (mm)	= 0.60	Maximum depth of flow	= 100%
Climate change factor	= 0		

System data

Final Rainfall rate (mm/hr)	= 121.45	Total flow rate (l/s)	= 19.07
Total fall of index run (m)	= 0.0	Total length of index run (m)	= 0.0
Total permeable area (Ha)	= 0.0085	Total impermeable area (Ha)	= 0.0565
Time of concentration (mins)	= 6.71	Time of entry (mins)	= 6.0
Outfall diameter (mm)	= 225	Percentage impermeable area	= 86.94

Calculated variables

Routing coefficient (Cr)	= 1.3	Volumetric coefficient (Cv)	= 0.770
UCWI	= 96.15	Areal reduction factor	= 0.999

Notes:-

Default values for runoff used :-

Runoff factor for impervious areas = 70.0
 Runoff factor for pervious areas = 40.0

Note 1 = Not applicable

Note 2 - Rainfall calculated using FSR data.

Note 4 - # against diameter indicates preferred diameter used.

Note 5 - ✕ against diameter indicates preferred diameter too small and therefore not used.

Note 6 - \$ against diameter indicates throttle pipe used.

Note 7 - « against diameter indicates carrier pipe used in cellular storage.

Pipe sizes

The pipe definition file used for these calculations allows the following diameters:-

100	allowed	375	allowed	600	allowed	900	allowed	1200	allowed	1800	allowed
150	allowed	400	allowed	700	allowed	1000	allowed	1350	allowed	1950	allowed
225	allowed	450	allowed	750	allowed	1050	allowed	1500	allowed	2100	allowed
300	allowed	500	allowed	800	allowed	1125	allowed	1650	allowed	2400	allowed

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	Sheet no. 1				
	Date 19/10/23 15:28				
Project			By	Checked	Reviewed
Title Calculations (2 yrs storm) for HERBERT ST SOUTH.SW					

Entry No.	Section No.	Diam mm	Fall mm	Grad 1 in	Length m	Imperm. area	Perm area	Flow l/s	Pipe cap full l/s	Depth of flow %	H.M.D.	Veloc. m/s	Proport. vel. m/s	Time of flow m:s	Time of conc m:s	Rain mm/hr	System vol
1	1.01	150#	401	74	29.7	238	48	4.0	20.6	25.4	0.59	1.17	0.83	0:25	7:25	49.7	
2	2.01	100#	199	71	14.2	98	8	1.6	7.2	27.7	0.64	0.91	0.68	0:16	7:16	50.2	
3	1.02	150#	100	116	11.6	0	0	5.5	16.4	37.5	0.82	0.93	0.81	0:12	7:38	49.0	
4	3.01	150#	793	45	35.7	218	0	3.4	26.5	18.9	0.46	1.50	0.89	0:24	7:24	49.7	
5	4.01	100#	198	79	15.7	97	0	1.5	6.8	27.7	0.64	0.86	0.64	0:18	7:18	50.0	
6	1.03	225#	225	59	13.3	100	0	11.9	67.8	23.1	0.55	1.70	1.14	0:08	7:46	48.6	
7	1.04	225#	49	52	2.6	0	0	11.8	72.2	22.4	0.53	1.82	1.19	0:01	7:47	48.5	

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		Sheet no. 2		
		Date 19/10/23 15:28		
Project	Title Storage data for HERBERT ST SOUTH.SW	By	Checked	Reviewed

Storage data

Storage= Pipe	Section no. = 1.01	Diam (mm) = 150	Length (m) = 29.7	Volume = 0.5m ³
Storage= Pipe	Section no. = 2.01	Diam (mm) = 100	Length (m) = 14.2	Volume = 0.1m ³
Storage= Pipe	Section no. = 1.02	Diam (mm) = 150	Length (m) = 11.6	Volume = 0.2m ³
Storage= Pipe	Section no. = 3.01	Diam (mm) = 150	Length (m) = 35.7	Volume = 0.6m ³
Storage= Pipe	Section no. = 4.01	Diam (mm) = 100	Length (m) = 15.7	Volume = 0.1m ³
Storage= Pipe	Section no. = 1.03	Diam (mm) = 225	Length (m) = 13.3	Volume = 0.5m ³
Storage= Pipe	Section no. = 1.04	Diam (mm) = 225	Length (m) = 2.6	Volume = 0.1m ³

Storage pipe volume = 2.2m³

Storage volume in manholes = 0.7m³

Total storage = 3.0m³

Total system volume = 3.0m³

Note: Manhole volume is calculated for each manhole from the invert level to a level 300mm below the lowest system manhole ground level times the manhole area. Manhole reference level is 55.95m

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				Sheet no. 3		
				Date 19/10/23 15:28		
Project				By	Checked	Reviewed
Title Data summary for printout						
Location	Nat. Grid ref:	M5-60	r	wrapx	SAAR	
MANCHESTER (CENTRAL)	SJ8397	17.8	0.36	4	900	

Design data

Maximum rainfall rate allowed	= unlimited	Return period	= 2
Urban creep factor (%)	= 0	Growth period (years)	= 0
Minimum velocity (m/s)	= 0.60	Percentage gradient	= 80%
Pipe roughness factor (mm)	= 0.60	Maximum depth of flow	= 100%
Climate change factor	= 0		

System data

Final Rainfall rate (mm/hr)	= 48.53	Total flow rate (l/s)	= 11.84
Total fall of index run (m)	= 0.78	Total length of index run (m)	= 57.2
Total permeable area (Ha)	= 0.0056	Total impermeable area (Ha)	= 0.0751
Time of concentration (mins)	= 7.79	Time of entry (mins)	= 7.0
Outfall diameter (mm)	= 225	Percentage impermeable area	= 93.06

Calculated variables

Routing coefficient (Cr)	= 1.3	Volumetric coefficient (Cv)	= 0.967
UCWI	= 96.15	Areal reduction factor	= 0.998

Notes:-

Default values for runoff used :-

Runoff factor for impervious areas = 90.0
Runoff factor for pervious areas = 40.0

Note 1 = Not applicable

Note 2 - Rainfall calculated using FSR data.

Note 4 - # against diameter indicates preferred diameter used.

Note 5 - ✕ against diameter indicates preferred diameter too small and therefore not used.

Note 6 - \$ against diameter indicates throttle pipe used.

Note 7 - « against diameter indicates carrier pipe used in cellular storage.

Pipe sizes

The pipe definition file used for these calculations allows the following diameters:-

100	allowed	375	allowed	600	allowed	900	allowed	1200	allowed	1800	allowed
150	allowed	400	-----	700	allowed	1000	allowed	1350	allowed	1950	allowed
225	allowed	450	allowed	750	allowed	1050	allowed	1500	allowed	2100	-----
300	allowed	500	-----	800	allowed	1125	allowed	1650	allowed	2400	allowed

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		Sheet no. 4			
		Date 19/10/23 15:28			
Project			By	Checked	Reviewed
Title Sizing notes and comments					

The following comments were added to the data file:-
1.01 southern network

Additional notes for sizing printout:-
Southern network

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				Sheet no. 1		
				Date 19/10/23 15:31		
Project				By	Checked	Reviewed
Title Calculations (30 yrs storm) for HERBERT ST SOUTH.SW						
Location MANCHESTER (CENTRAL)		Nat. Grid ref: SJ8397	M5-60 17.8	r 0.36	wrapx 4	SAAR 900

Entry No.	SECT. NO.	LENGTH	FALL	GRAD	VEL.	TIME	TIME OF	RATE OF	PIPE	RATE	PIPE	SURCHARGE	REF	COMMENTS
		M	mm	1 in	M/S	secs	min.	mm/Hr	l/s	l/s	mm	fract.	l/s	
1	1.01	29.7	401	74	1.17	0:25	6:25	97.58	20.6	8.78	150	0.43	0.0	I OK
2	2.01	14.2	200	71	0.91	0:33	6:16	98.64	7.2	3.29	100	0.46	0.0	B OK
3	1.02	11.6	100	116	0.93	0:28	6:38	96.28	16.4	11.87	150	0.72	0.0	I OK
4	3.01	35.7	793	45	1.50	0:46	6:24	97.75	26.5	6.70	150	0.25	0.0	B OK
5	4.01	15.7	199	79	0.86	0:09	6:18	98.35	6.8	3.00	100	0.44	0.0	B OK
6	1.03	13.3	225	59	1.70	0:48	6:46	95.48	67.8	24.24	225	0.36	0.0	I OK
7	1.04	2.6	50	52	1.82	0:26	6:47	95.34	72.2	24.20	225	0.34	0.0	I OK

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			Sheet no. 2		
			Date 19/10/23 15:31		
Project	Calculations (30 yrs storm) for HERBERT ST SOUTH.SW		By	Checked	Reviewed
Title					

Data summary for printout

Total flow rate (l/s) = 24.2
 Final rainfall rate (mm/hr) = 95.0
 Time of concentration (mins) = 6.79
 Outfall diameter (mm) = 225
 Percentage runoff factor = 90.0
 Climate change factor = 0%

All sections clear at final time of concentration (6.79 minutes).
 Rainfall intensity used was 95.00 mm/hr.

Note - flow rates marked * are restricted by a flow restrictor if flow rate exceeds restriction rate

Lowest cover level is 56.25 metres at manhole number MH5.

Data for 'critical' manhole (MH5) i.e. the one that will flood first if the system becomes surcharged to the cover level of this manhole.

Data for manhole:-

Manhole shape - circ

Chamber diameter = 600 mm

Cover height above outfall invert =1.200 m

Invert level = 55.6 m

Chamber volume =0.000 m³

Outlet pipe diameter = 100 mm

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				Sheet no. 3		
				Date 19/10/23 15:31		
Project				By	Checked	Reviewed
Title Calculations (30 yrs storm) for HERBERT ST SOUTH.SW						

Surcharge summary for 15, 30, 45 and 60 minute intensities.

**System subjected to a 15 minute intensity (65 mm/hr) with the following results:-
All sections clear.**

**System subjected to a 30 minute intensity (43 mm/hr) with the following results:-
All sections clear.**

**System subjected to a 45 minute intensity (33 mm/hr) with the following results:-
All sections clear.**

**System subjected to a 60 minute intensity (27 mm/hr) with the following results:-
All sections clear.**

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								Sheet no. 1			
								Date 19/10/23 15:38			
Project						By		Checked	Reviewed		
Title Calculations (100 yrs storm) for HERBERT ST SOUTH.SW											
Location MANCHESTER (CENTRAL)		Nat. Grid ref: SJ8397		M5-60 17.8		r 0.36		wrapx 4		SAAR 900	

Entry No.	SECT. NO.	LENGTH	FALL	GRAD	VEL.	TIME	TIME OF	RATE OF	PIPE	RATE	PIPE	SURCHARGE	REF	COMMENTS
		M	mm	1 in	M/S	secs	min.	mm/Hr	l/s	l/s	mm	fract.	l/s	
1	1.01	29.7	401	74	1.17	0:25	6:25	123.55	20.6	11.11	150	0.54	0.0	I OK
2	2.01	14.2	200	71	0.91	0:33	6:16	124.82	7.2	4.16	100	0.58	0.0	B OK
3	1.02	11.6	100	116	0.93	0:28	6:38	121.98	16.4	15.04	150	0.91	0.0	I Marginal
4	3.01	35.7	793	45	1.50	0:46	6:24	123.76	26.5	8.49	150	0.32	0.0	B OK
5	4.01	15.7	199	79	0.86	0:09	6:18	124.48	6.8	3.80	100	0.56	0.0	B OK
6	1.03	13.3	225	59	1.70	0:48	6:46	121.03	67.8	30.72	225	0.45	0.0	I OK
7	1.04	2.6	50	52	1.82	0:26	6:47	120.86	72.2	30.68	225	0.42	0.0	I OK

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	Sheet no. 2			
	Date 19/10/23 15:38			
Project	Calculations (100 yrs storm) for HERBERT ST SOUTH.SW	By	Checked	Reviewed
Title				

Data summary for printout

Total flow rate (l/s) = 30.68
Final rainfall rate (mm/hr) = 121.0
Time of concentration (mins) = 6.79
Outfall diameter (mm) = 225
Percentage runoff factor = 90.0
Climate change factor = 0%

All sections clear at final time of concentration (6.79 minutes).
Rainfall intensity used was 121.00 mm/hr.

Note - flow rates marked * are restricted by a flow restrictor if flow rate exceeds restriction rate

Lowest cover level is 56.25 metres at manhole number MH5.

Data for 'critical' manhole (MH5) i.e. the one that will flood first if the system becomes surcharged to the cover level of this manhole.

Data for manhole:-

Manhole shape - circ

Chamber diameter = 600 mm

Cover height above outfall invert =1.200 m

Invert level = 55.6 m

Chamber volume =0.000 m³

Outlet pipe diameter = 100 mm

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				Sheet no. 3		
				Date 19/10/23 15:38		
Project				By	Checked	Reviewed
Title Calculations (100 yrs storm) for HERBERT ST SOUTH.SW						

Surcharge summary for 15, 30, 45 and 60 minute intensities.

System subjected to a 15 minute intensity (84 mm/hr) with the following results:-
All sections clear.

System subjected to a 30 minute intensity (56 mm/hr) with the following results:-
All sections clear.

System subjected to a 45 minute intensity (43 mm/hr) with the following results:-
All sections clear.

System subjected to a 60 minute intensity (36 mm/hr) with the following results:-
All sections clear.

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				Sheet no. 1		
				Date 20/10/23 10:31		
Project				By	Checked	Reviewed
Title Manhole printout for HERBERT ST NORTH.SW						

Manhole ref.	X ref	Y ref	Form	Cham diam. or length	Rect. width	Chamb. height	Shaft height	MH Volume	Exit Diam	Exit Crown	Exit Invert	Chamb const	Slab level	Cover Level	Dwnstr MH
MH8	N/A	N/A	circ	600	N/A			0.00	150	56.675	56.500	N/A	56.450	57.110	MH10
MH9	N/A	N/A	circ	600	N/A			0.00	100	56.425	56.300	N/A	56.250	56.900	MH10
MH10	N/A	N/A	circ	600	N/A			0.00	150	56.375	56.200	N/A	56.150	57.000	MH12
MH11	N/A	N/A	circ	600	N/A			0.00	150	56.175	56.000	N/A	55.950	56.950	MH12
MH13	N/A	N/A	circ	600	N/A			0.00	100	55.925	55.800	N/A	55.750	56.700	MH12
MH12	N/A	N/A	circ	600	N/A			0.00	225	55.975	55.725	N/A	55.675	56.700	MH14
MH14	N/A	N/A	circ	600	N/A			0.00	225	55.350	55.100	N/A	55.050	56.700	T2

All manholes to be as per 'Sewers for Adoption'

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				Sheet no. 1		
				Date 20/10/23 08:46		
Project				By	Checked	Reviewed
Title Manhole printout for HERBERT ST SOUTH.SW						

Manhole ref.	X ref	Y ref	Form	Cham diam. or length	Rect. width	Chamb. height	Shaft height	MH Volume	Exit Diam	Exit Crown	Exit Invert	Chamb const	Slab level	Cover Level	Dwnstr MH
MH1	N/A	N/A	circ	600	N/A			0.00	150	56.075	55.900	N/A	55.850	56.600	MH2
MH3	N/A	N/A	circ	600	N/A			0.00	100	55.825	55.700	N/A	55.650	56.300	MH2
MH2	N/A	N/A	circ	600	N/A			0.00	150	55.675	55.500	N/A	55.450	56.393	MH6
MH4	N/A	N/A	circ	600	N/A			0.00	150	56.065	55.890	N/A	55.840	56.600	MH6
MH5	N/A	N/A	circ	600	N/A			0.00	100	55.725	55.600	N/A	55.550	56.250	MH6
MH6	N/A	N/A	circ	600	N/A			0.00	225	55.570	55.320	N/A	55.270	56.600	MH7
MH7	N/A	N/A	circ	600	N/A			0.00	225	55.350	55.100	N/A	55.050	56.550	T1

All manholes to be as per 'Sewers for Adoption'



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Job No.

Sheet no. **1**

Date **03/09/20**

Project **Herbert Street**

Title **Peak Flow Storage - 5l/s - 1 in 100 year + 40% Climate Change**

By

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Reviewed

Data:-

FSR Hydrology:-

Location = MANCHESTER (CENTRAL)

M5-60 (mm) = 17.8

Soil index = 0.45

Return period = 100

UCWI = 96.2

Grid reference = SJ8397

r = 0.36

SAAR (mm/yr) = 900

WRAP = 4

Climate change = 40

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Runoff factor (RF) = 55.0, calculated from:-

Runoff factor = $(0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$

where

PIMP = Impervious Area * 100 / (Impervious Area + Pervious Area)

UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area = 1800 m²

Total area (TA) = 2600 m²

Allowed discharge rate = 5.000 l/s

Additional flow = 0.00 l/s

Pervious area = 800 m²

Equiv area = 1430 m² (TA x RF).

Areal reduction factor = 1.000

Climate change factor = 40

Calculated data:-

Time to max = 82.0 mins

Rainfall at max = 40.62 mm/hr

Pipeline storage = 0.0 m³

Offline storage = 0.0 m³

Calculated storage volume = 54.8 m³

Allowed discharge rate = 5.000 l/s

Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours

Rainfall rate = 13.00 mm/hr

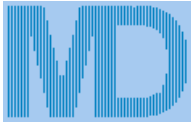
Calculated storage volume = 7.7 m³

Allowed discharge rate = 5.000 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

Diam	Len	Diam	Len	Ovoid	Len	Box culvert	Len
100	6976.6	1125	55.1	400 x 600	304.4	500 x 500	219.1
150	3100.7	1200	48.4	600 x 900	132.5	500 x 750	146.1
225	1378.1	1275	42.9	800 x 1200	74.5	500 x 1000	109.6
300	775.2	1350	38.3			750 x 1000	73.0
375	496.1	1425	34.4			750 x 1200	60.9
450	344.5	1500	31.0			750 x 1500	48.7
525	253.1	1575	28.1			1000 x 1000	54.8
600	193.8	1650	25.6			1000 x 1200	45.7
675	153.1	1725	23.4			1000 x 1500	36.5
750	124.0	1800	21.5			1000 x 1800	30.4
825	102.5	1875	19.8			1000 x 2000	27.4
900	86.1	1950	18.3			1500 x 1500	24.3
975	73.4	2025	17.0			1500 x 1800	20.3
1050	63.3	2100	15.8			1500 x 2000	18.3



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Data:-

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2

Date

03/09/20

Project

Herbert Street

By

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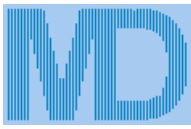
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Title

Peak Flow Storage - 5l/s - 1 in 100 year + 40% Climate Change

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	143.0	34.147	3.000	31.147
20	100.0	47.599	6.000	41.599
30	78.0	56.094	9.000	47.094
40	65.0	62.432	12.000	50.432
50	57.0	67.528	15.000	52.528
60	50.0	71.808	18.000	53.808
70	45.0	75.509	21.000	54.509
80	41.0	78.774	24.000	54.774
90	38.0	81.699	27.000	54.699
100	35.0	84.349	30.000	54.349
110	33.0	86.772	33.000	53.772
120	31.0	89.005	36.000	53.005
130	29.0	91.075	39.000	52.075
140	28.0	93.004	42.000	51.004
150	27.0	94.810	45.000	49.810
160	25.0	96.507	48.000	48.507
170	24.0	98.106	51.000	47.106
180	23.0	99.619	54.000	45.619
190	22.0	101.053	57.000	44.053
200	21.0	102.416	60.000	42.416
210	21.0	103.714	63.000	40.714
220	20.0	104.952	66.000	38.952
230	19.0	106.136	69.000	37.136
240	19.0	107.268	72.000	35.268
250	18.0	108.354	75.000	33.354
260	18.0	109.396	78.000	31.396
270	17.0	110.397	81.000	29.397
280	17.0	111.361	84.000	27.361
290	16.0	112.288	87.000	25.288
300	16.0	113.183	90.000	23.183
310	15.0	114.045	93.000	21.045
320	15.0	114.878	96.000	18.878
330	15.0	115.683	99.000	16.683
340	14.0	116.462	102.000	14.462
350	14.0	117.215	105.000	12.215
360	14.0	117.945	108.000	9.945
370	13.0	118.733	111.000	7.733
380	13.0	119.489	114.000	5.489
390	13.0	120.228	117.000	3.228
400	13.0	120.952	120.000	0.952
410	12.0	121.661	123.000	0.000
420	12.0	122.356	126.000	0.000
430	12.0	123.037	129.000	0.000
440	12.0	123.706	132.000	0.000
450	12.0	124.361	135.000	0.000
460	11.0	125.005	138.000	0.000
470	11.0	125.638	141.000	0.000
480	11.0	126.259	144.000	0.000
490	11.0	126.870	147.000	0.000
500	11.0	127.471	150.000	0.000
510	11.0	128.062	153.000	0.000
520	10.0	128.643	156.000	0.000
530	10.0	129.215	159.000	0.000
540	10.0	129.778	162.000	0.000
550	10.0	130.333	165.000	0.000
560	10.0	130.880	168.000	0.000
570	10.0	131.418	171.000	0.000
580	10.0	131.949	174.000	0.000
590	9.0	132.472	177.000	0.000
600	9.0	132.988	180.000	0.000

Storage volume (m³) = 54.8 m³



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Job No.

Sheet no. **3**

Date **03/09/20**

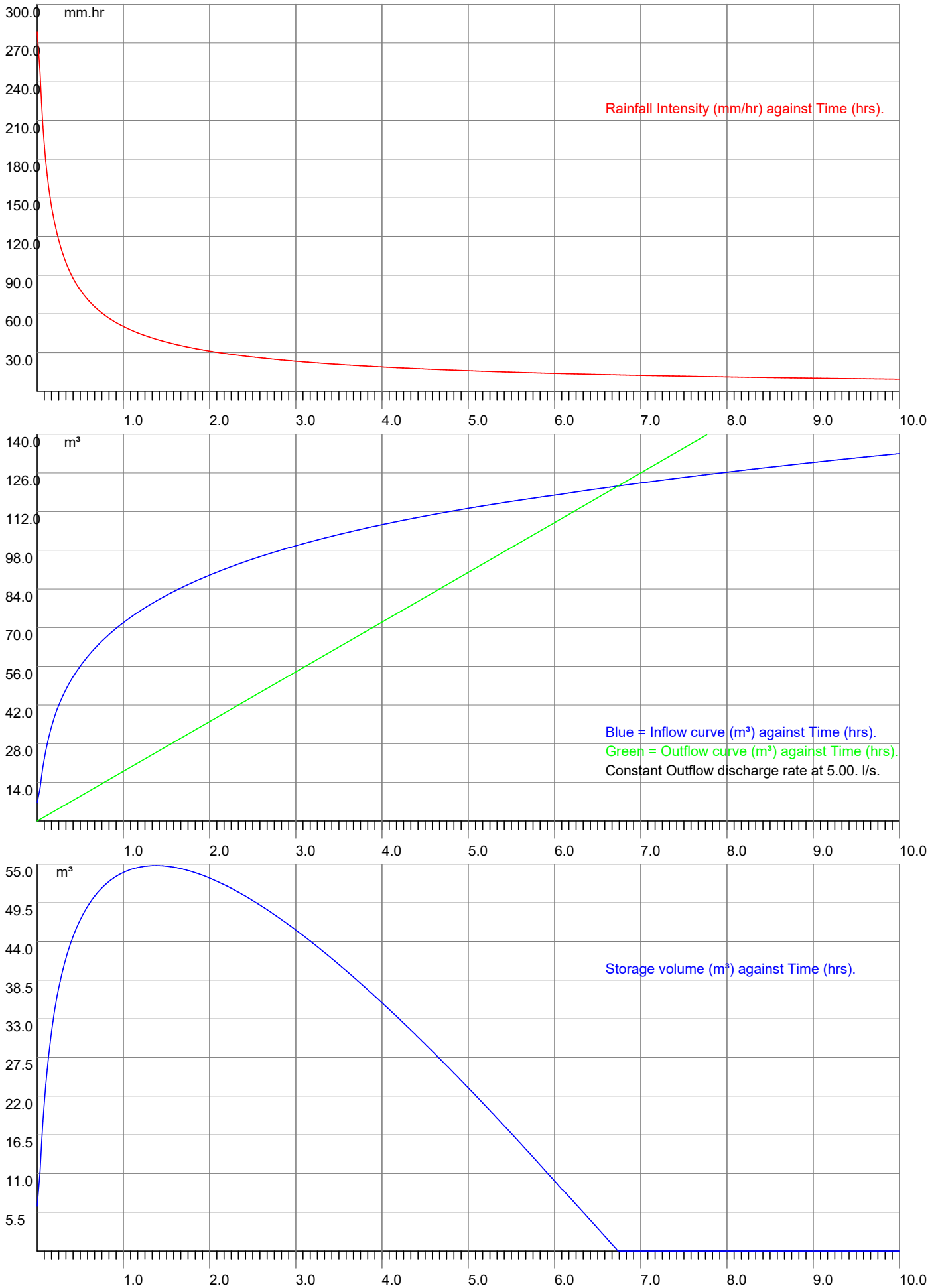
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Checked

Reviewed

Project **Herbert Street**

Title **Peak Flow Storage - 5l/s - 1 in 100 year + 40% Climate Change**





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Job No.		
Sheet no. 4		
Date 03/09/20		
By	Checked	Reviewed

Project **Herbert Street**

Title **Peak Flow Storage - 5l/s - 1 in 100 year + 40% Climate Change**

Explanatory notes for Peak Flow Storage

- 1) This system uses the rainfall intensity/ duration curve calculated using either the Wallingford or FEH method as selected.
- 2) The balance is calculated from the inflow minus the outflow.
- 3) The storage volume is the maximum value of the balance curve.
- 4) This method was described by Davis (1963) - see Butler & Davies, 2nd edition, p294
- 5) References to 'storm duration' relate only to the hydrograph method (qv).
- 6) There are always 600 steps in the calculation process, thus a 'run' time of 10 hours will be sampled every minute,

Explanatory notes for Hydrograph Storage

- 1) The user has the choice of Summer or Winter curves
- 2) The mean intensity varies with the duration of the storm curve
- 3) There are always 120 steps in the calculation process, irrespective of storm duration.
- 4) The balance is calculated from the inflow minus the outflow.
- 5) The storage volume is the sum of the balance values for each step.
- 6) Varying durations should be tried to find the maximum storage value - this can be narrowed down very closely.

*Modelling using the flow characteristics of the restrictor is available using Vortex Control modelling function. Please be aware that this function needs the full design data file to function.

Why do the two methods give different results?

The rainfall characteristics for each method are very different.

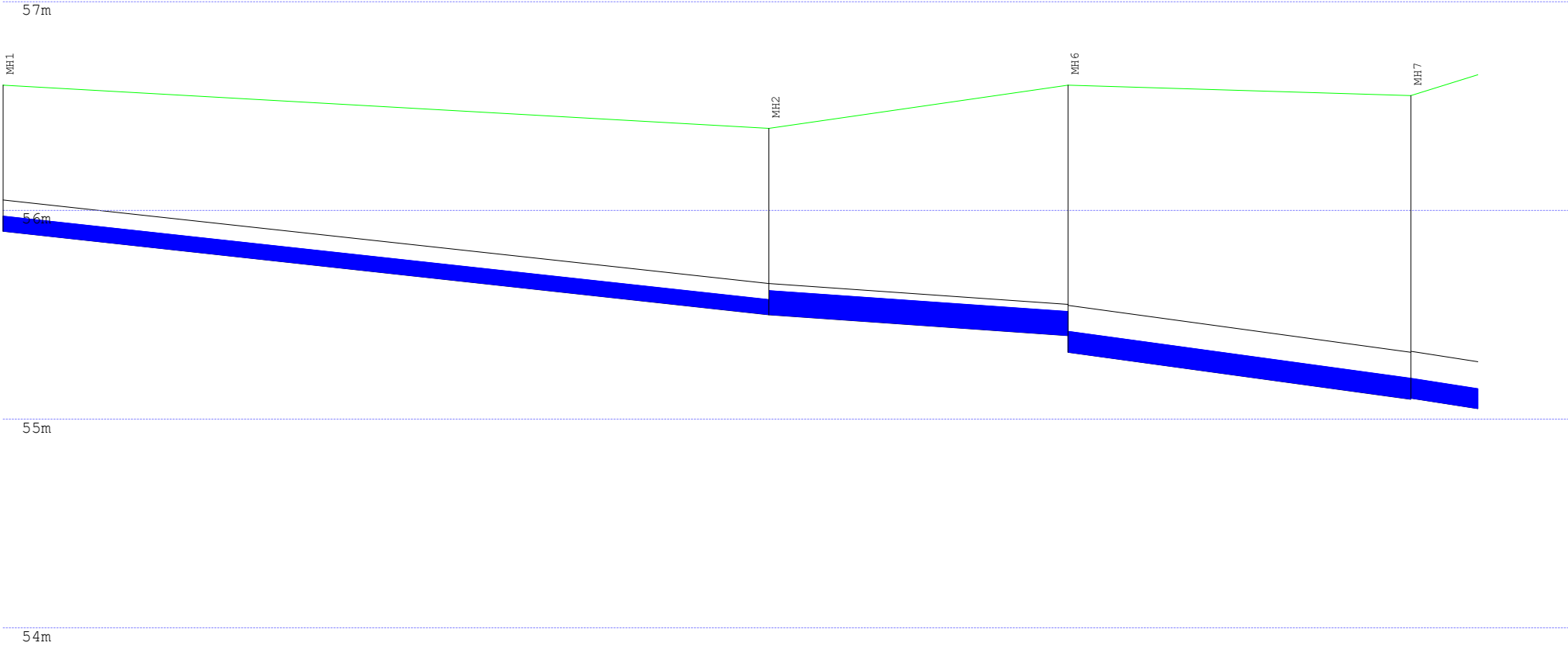
The Peak flow (using the Intensity/Duration/Frequency curve) does not model the actual rainfall. This curve is joined points which represent the mean intensity of a storm at a given duration i.e. a value of 19.5 mm/hr for a 60 minute storm indicates that over the sixty minute period, the mean intensity was 19.5 mm/hr. The calculation method samples the IDF curve for a given location and frequency (Return Period) and calculates the storage for that rate and duration less the outflow volume. The maximum value is displayed as the 'worst case' storage.

The hydrograph method uses a standard curve for either Winter or Summer storms. Traditionally these are symmetrical about the central peak. UK rainfall does not fit into this convenient curve, so the calculations are dealing with a stylised set of data. The mean intensity for the storm is calculated from the IDF curve and applied to the curve data, calculating the storage for that step less the outflow volume. The final storage volume is the sum of the storage for all the steps.

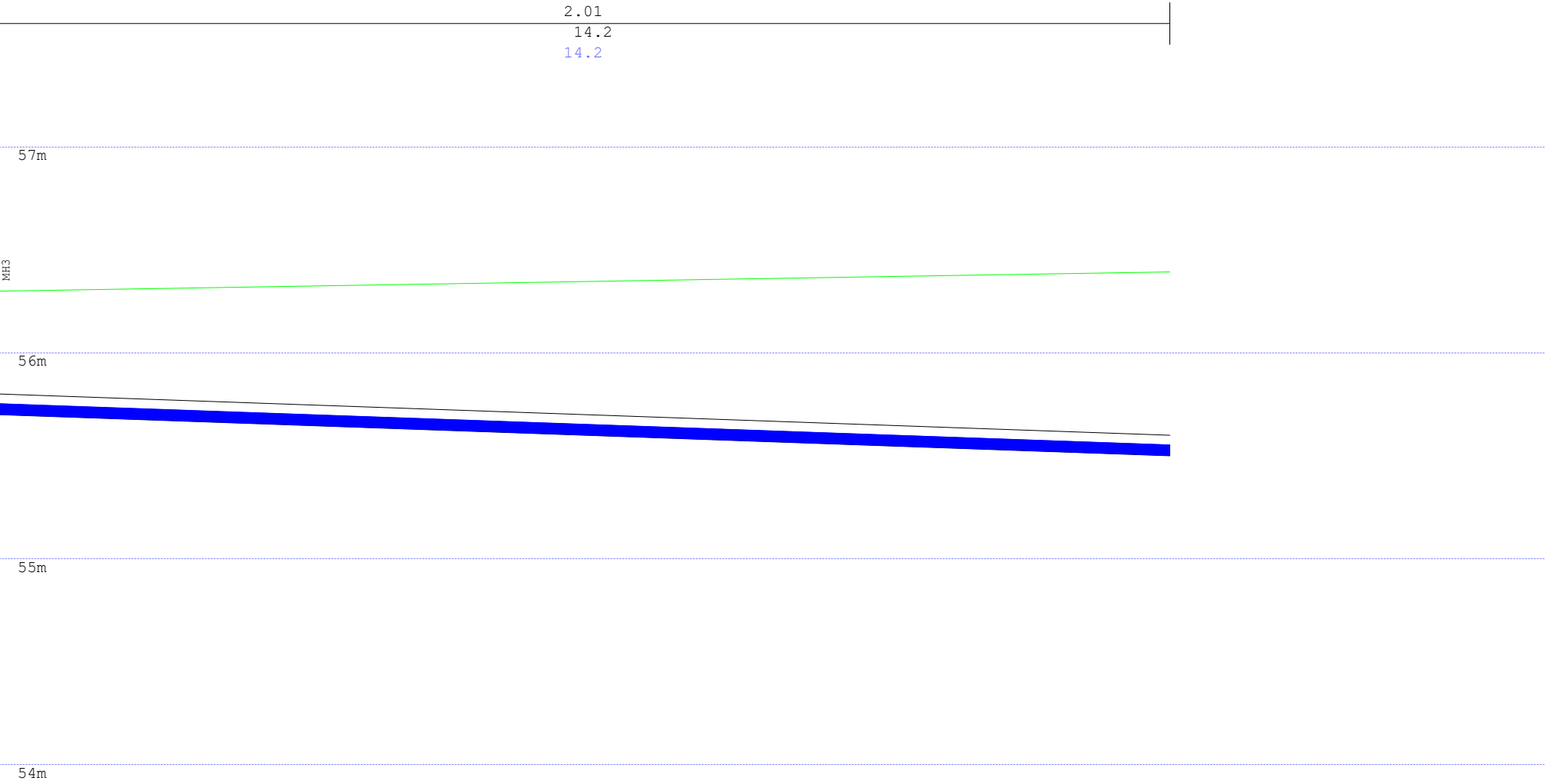
It can be seen that these two methods are very different, and the user may have the choice of which result to use. This is not an exact science, though is often treated as such by those that do not understand the principles of the calculations.

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	Sheet no. 1				
	Date 20/10/23 08:56				
Project			By	Checked	Reviewed
Title Index run for HERBERT ST SOUTH.SW					

1.01	1.02	1.03	1.04
29.7	11.6	13.3	2.6
29.7	41.3	54.6	57.2



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		Sheet no. 1		
		Date 20/10/23 08:58		
Project	By		Checked	Reviewed
Title Branch run number 2 for HERBERT ST SOUTH.SW				

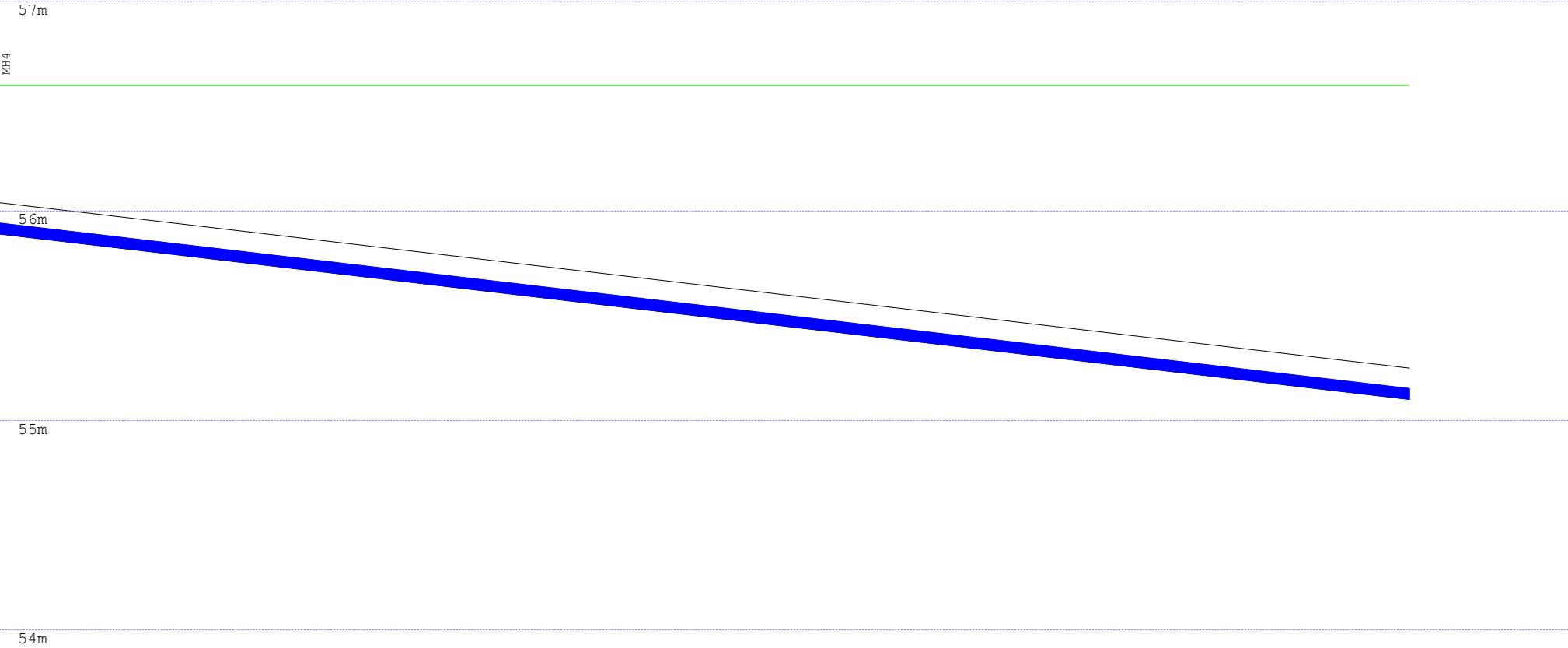


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			Sheet no. 1	
			Date 20/10/23 08:53	
Project		By	Checked	Reviewed
Title Branch run number 3 for HERBERT ST SOUTH.SW				

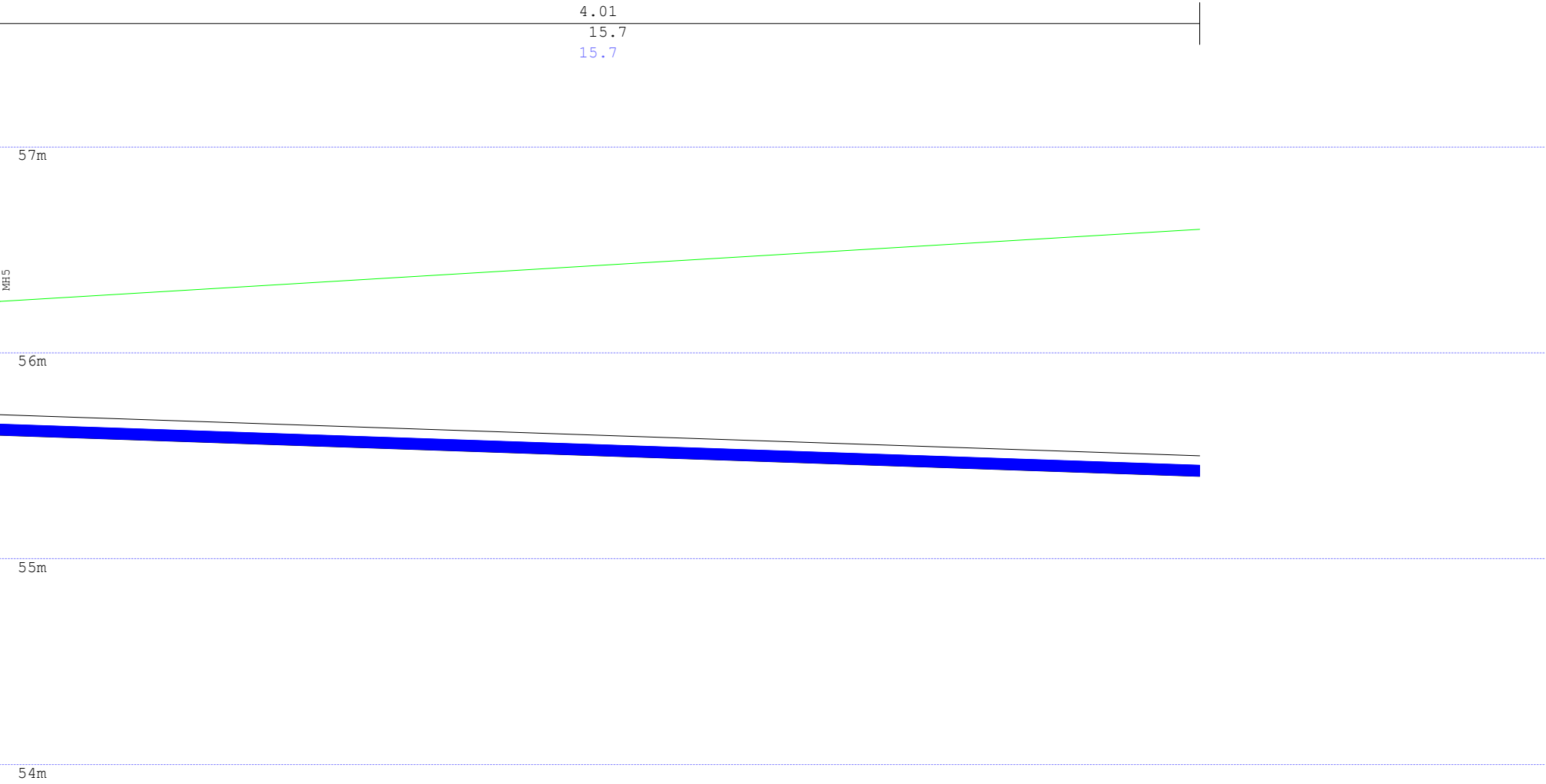
3.01

35.7

35.7

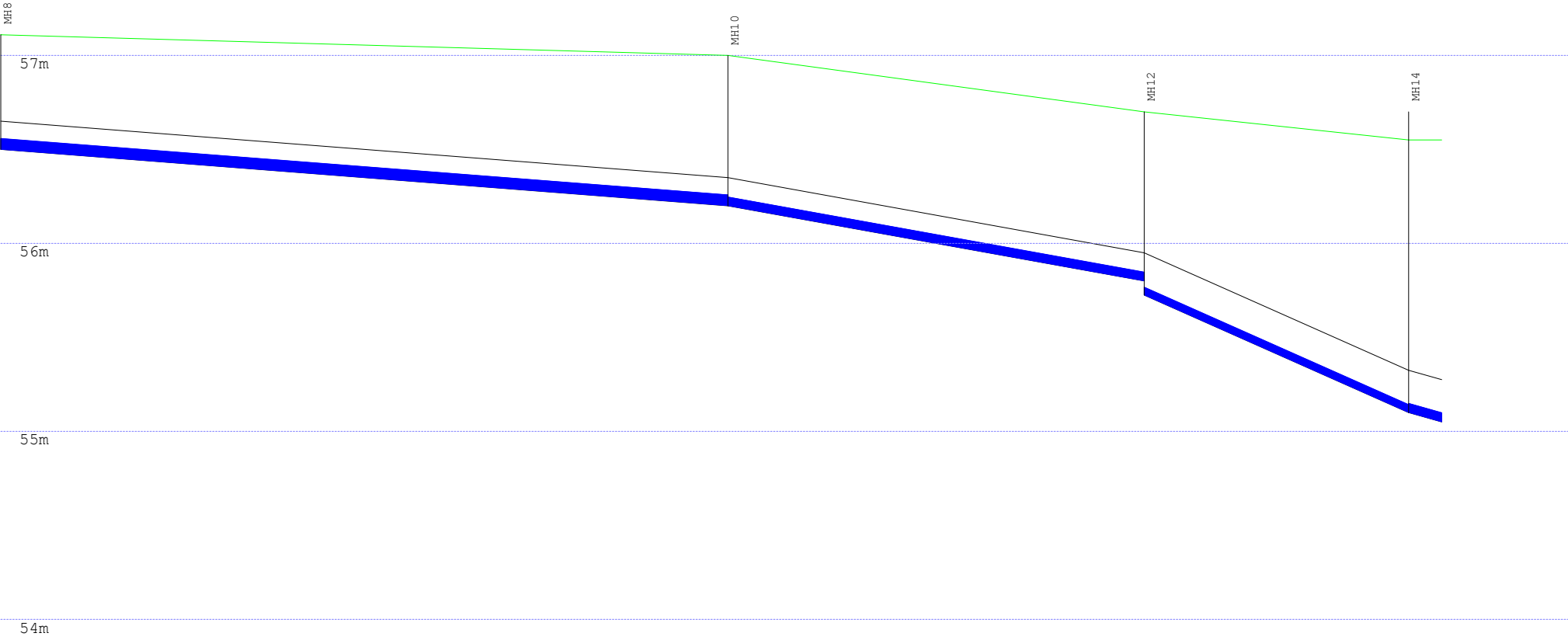


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		Sheet no. 1		
		Date 20/10/23 09:05		
Project	By		Checked	Reviewed
Title Branch run number 4 for HERBERT ST SOUTH.SW				



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				Sheet no. 1		
				Date 20/10/23 10:27		
Project				By	Checked	Reviewed
Title Branch run number 5 for HERBERT ST NORTH.SW						

	5.01	5.02	5.03	5.04
	22	12.6	8	1
58m	22.0	34.6	42.6	43.6



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	Sheet no. 1				
	Date 20/10/23 10:28				
Project		By	Checked	Reviewed	
Title Branch run number 6 for HERBERT ST NORTH.SW					

