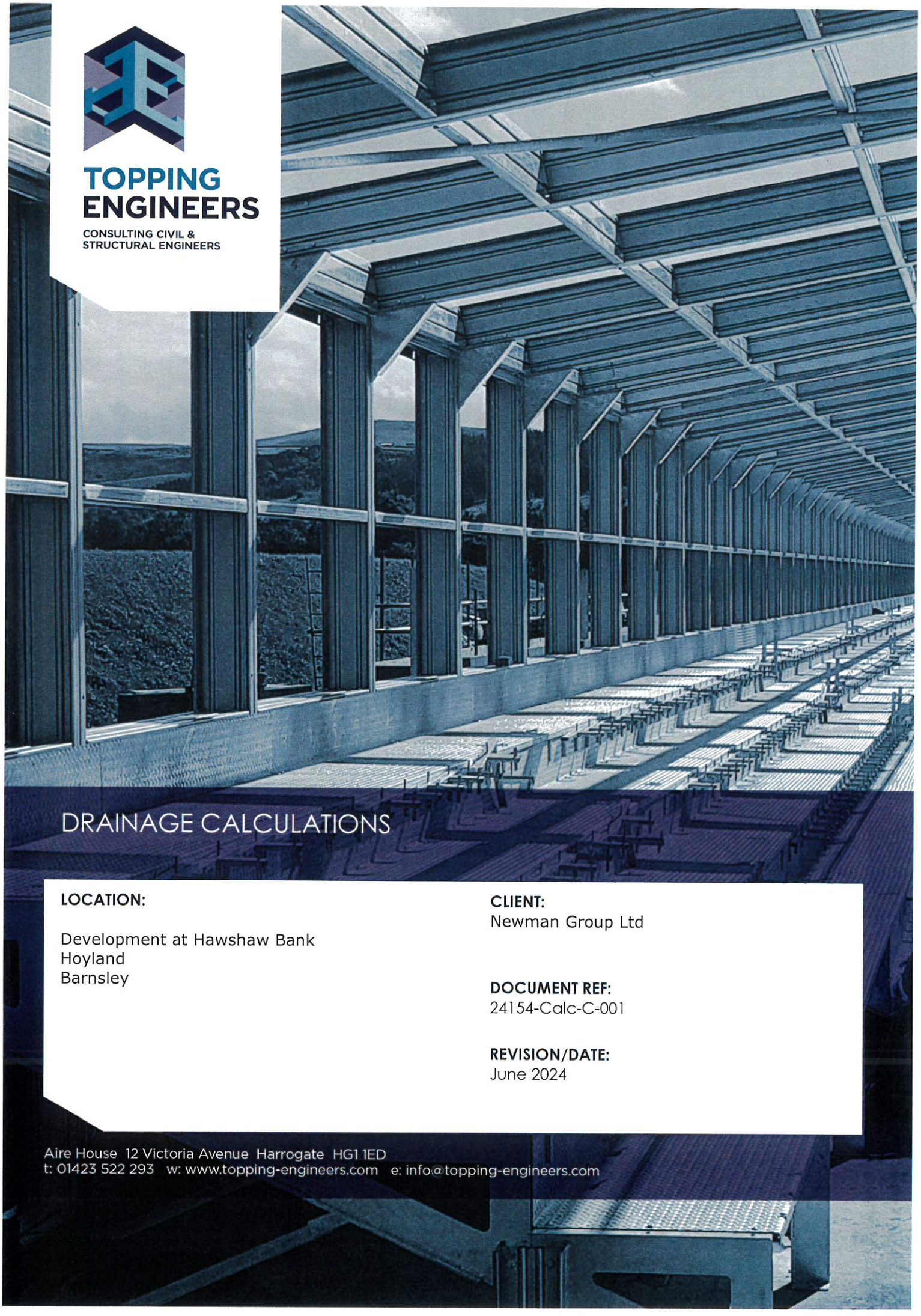

TOPPING ENGINEERS

CONSULTING CIVIL & STRUCTURAL ENGINEERS

DRAINAGE CALCULATIONS

LOCATION:

Development at Hawshaw Bank
Hoyland
Barnsley

CLIENT:
Newman Group Ltd

DOCUMENT REF:
24154-Calc-C-001

REVISION/DATE:
June 2024

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	106.323	0.457	2.8	41.1	O K
30 min Summer	106.465	0.599	2.8	54.4	O K
60 min Summer	106.604	0.738	2.8	67.4	O K
120 min Summer	106.712	0.846	2.8	77.6	O K
180 min Summer	106.745	0.879	2.8	80.7	O K
240 min Summer	106.745	0.879	2.8	80.7	O K
360 min Summer	106.722	0.856	2.8	78.6	O K
480 min Summer	106.697	0.831	2.8	76.2	O K
600 min Summer	106.670	0.804	2.8	73.7	O K
720 min Summer	106.642	0.776	2.8	71.0	O K
960 min Summer	106.584	0.718	2.8	65.5	O K
1440 min Summer	106.452	0.586	2.8	53.2	O K
2160 min Summer	106.295	0.429	2.8	38.4	O K
2880 min Summer	106.179	0.313	2.8	27.5	O K
4320 min Summer	106.046	0.180	2.6	15.0	O K
5760 min Summer	105.985	0.119	2.4	9.2	O K
7200 min Summer	105.960	0.094	2.1	7.0	O K
8640 min Summer	105.947	0.081	1.8	5.7	O K
10080 min Summer	105.939	0.073	1.6	4.9	O K
15 min Winter	106.479	0.613	2.8	55.7	O K
30 min Winter	106.675	0.809	2.8	74.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	125.500	0.0	44.2	25
30 min Summer	84.088	0.0	59.2	39
60 min Summer	53.779	0.0	75.7	68
120 min Summer	33.226	0.0	93.5	126
180 min Summer	24.710	0.0	104.3	182
240 min Summer	19.890	0.0	112.0	240
360 min Summer	14.593	0.0	123.2	302
480 min Summer	11.713	0.0	131.9	366
600 min Summer	9.868	0.0	138.9	432
720 min Summer	8.575	0.0	144.8	502
960 min Summer	6.863	0.0	154.6	644
1440 min Summer	5.006	0.0	169.1	896
2160 min Summer	3.643	0.0	184.6	1260
2880 min Summer	2.904	0.0	196.2	1616
4320 min Summer	2.106	0.0	213.5	2296
5760 min Summer	1.675	0.0	226.3	2952
7200 min Summer	1.401	0.0	236.7	3672
8640 min Summer	1.211	0.0	245.5	4408
10080 min Summer	1.072	0.0	253.4	5136
15 min Winter	125.500	0.0	58.9	25
30 min Winter	84.088	0.0	78.9	40

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	106.867	1.001	2.8	92.2	O K
120 min Winter	107.031	1.165	2.8	107.6	O K
180 min Winter	107.093	1.227	2.9	113.5	O K
240 min Winter	107.112	1.246	2.9	115.2	O K
360 min Winter	107.099	1.233	2.9	113.9	O K
480 min Winter	107.065	1.199	2.9	110.7	O K
600 min Winter	107.031	1.165	2.8	107.6	O K
720 min Winter	106.994	1.128	2.8	104.1	O K
960 min Winter	106.915	1.049	2.8	96.7	O K
1440 min Winter	106.753	0.887	2.8	81.5	O K
2160 min Winter	106.467	0.601	2.8	54.6	O K
2880 min Winter	106.242	0.376	2.8	33.5	O K
4320 min Winter	106.030	0.164	2.6	13.5	O K
5760 min Winter	105.965	0.099	2.2	7.4	O K
7200 min Winter	105.948	0.082	1.8	5.8	O K
8640 min Winter	105.937	0.071	1.6	4.8	O K
10080 min Winter	105.930	0.064	1.4	4.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	53.779	0.0	100.9	68
120 min Winter	33.226	0.0	124.7	124
180 min Winter	24.710	0.0	139.1	180
240 min Winter	19.890	0.0	149.3	236
360 min Winter	14.593	0.0	164.3	344
480 min Winter	11.713	0.0	175.9	392
600 min Winter	9.868	0.0	185.2	468
720 min Winter	8.575	0.0	193.1	546
960 min Winter	6.863	0.0	206.1	702
1440 min Winter	5.006	0.0	225.4	1004
2160 min Winter	3.643	0.0	246.1	1408
2880 min Winter	2.904	0.0	261.6	1732
4320 min Winter	2.106	0.0	284.6	2344
5760 min Winter	1.675	0.0	301.8	2944
7200 min Winter	1.401	0.0	315.6	3672
8640 min Winter	1.211	0.0	327.3	4376
10080 min Winter	1.072	0.0	337.9	5136

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.357	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.188

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.062	4	8	0.062	8	12	0.063

Model Details

Storage is Online Cover Level (m) 107.650

Box Culvert Structure

Height (m) 1.250 Slope (1:X) 750.000 Downstream Invert (m) 105.866
Width (m) 3.000 Length (m) 31.000

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0078-3000-1300-3000
Design Head (m)	1.300
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	78
Invert Level (m)	105.866
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.300	3.0
Flush-Flo™	0.341	2.8
Kick-Flo®	0.695	2.2
Mean Flow over Head Range	-	2.5

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	2.2	1.200	2.9	3.000	4.4	7.000	6.6
0.200	2.7	1.400	3.1	3.500	4.7	7.500	6.8
0.300	2.8	1.600	3.3	4.000	5.0	8.000	7.0
0.400	2.8	1.800	3.5	4.500	5.3	8.500	7.2
0.500	2.7	2.000	3.7	5.000	5.6	9.000	7.4
0.600	2.6	2.200	3.8	5.500	5.9	9.500	7.6
0.800	2.4	2.400	4.0	6.000	6.1		
1.000	2.7	2.600	4.1	6.500	6.3		