

Stormwater Report ***“Westminster Place”***

Holden, MA

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G&H Project G-8928



WESTMINSTER PLACE STORMWATER FACILITY

The proposed drainage calculations for the Westminster Place site in Holden, MA have been upgraded to address the existing building construction and the proposed building and grading modifications of the site, as proposed on October 6, 2022. The major change in the design is that the basins have been redesigned to mitigate the increased runoff calculated using the Atlas 14 Rainfall Map of 8.64 inches in 24 hours compared to the 2002 calculations using TP-40 rainfall map of 6.5 inches in 24 hours.

A Proposed Watershed plan has been provided for review. The stormwater for the site depends 100% on infiltration, and no runoff is conveyed offsite or directed to wetlands. Therefore there is no need to provide a comparison to the preconstruction site because there will be no runoff leaving the site. The 100 year calculations have been provided to demonstrate that the existing and proposed infiltrations basin and drainage conveyance systems are adequate to address the peak flow rate and contain the volume of the entire 100 year storm.

The design of the infiltration system has the upper infiltration systems outlet flow to the next lowest system, with Basin 11B being the final low point and largest infiltration system. With the proposed drainage system modification we will raise the outlets of Basin 14, 15 and 16 to provide a 12" orifice control structure at all at these basins with the orifice invert set at elevation 723.50. These basins will use their storage and infiltration capacity and contain the 100 year storm volume before allowing an overflow from the basins. This will allow for more infiltration capability for larger storm events than the 100 year storm, and provide a larger safety factor for Basin 11B.

The proposed modifications will remove the headwall outlets at Basin 14, 15 and 16 and replace them with a drain manhole with an orifice opening as the new outlet, and the bottom of the drain manhole reconnected to the existing outlet pipe at the lower elevation.

Basin 14 will be regraded to allow for a 10' wide gravel access around the perimeter of the basin. To facilitate the new outlet elevation and the regrading of the basin, a 20' long extension will be made on the existing 18" pipe. A new drain manhole will be installed at the end of this pipe with a new 18" orifice inlet at elevation 723.50 and outlet pipe of 720.47 as the outlet control structure of Basin 14. The calculated volume of storage for the 100 year storm is elevation 722.50, providing one foot of freeboard above the 100 year storm before stormwater will flow out of the basin. A standard 24" frame and grate will be placed on top of the control structure to allow access to the outlet pipe. Two of the 3 other inlet pipes into Basin 14 will be extended matching the existing pipe slopes to meet the grade of the revised basin. The 12" drain pipe from the Tea Party Circle drainage system will be extended 20 feet into the basin. The 18" drain pipe outlet from Basin 15 shall be extended 25 feet into Basin 14. The existing 15" pipe from Watershed 31 on the north side of Tea Party Circle meets the proposed grade and will not need to be adjusted.

The outlet of Basin 15 will be raised to match the outlet of Basin 14, so there is no backflow from Basin 14 prior to an emergency event. The raising of the outlet will be performed by removing the existing headwall and replacing with a standard drain manhole. The drain manhole will have a 12" orifice at elevation 723.50, and the existing 18" pipe outlet at elevation 722.00. The 100 year storm flood elevation within Basin 15 is elevation 719.38, so there will be an approximate 2 foot freeboard in Basin 15.

The outlet of Basin 16 will be raised to elevation 723.5 to contain the 100 year storm event within Basin 16. A Standard drain manhole will be installed to replace the existing headwall. The drain manhole will have a 12" orifice at elevation 723.5, and installed on the existing 18" pipe at elevation 219.74. The 100 year flood elevation in Basin 16 will be approximately 723.50 and therefore there is no freeboard above the 100 year storm event.

Basin 15 overflows to Basin 14. Basin 14 and Basin 16 overflow into Basin 11A.

Basin 11 has been revised to Basin 11A and Basin 11B with a 18" level pipe in between at elevation 716.66.

The existing 24" drain outfall pipe from Tea Party Drive System at Sta 8+25 will be extended 40 feet to outlet to the revised sideslope of Basin 11A.

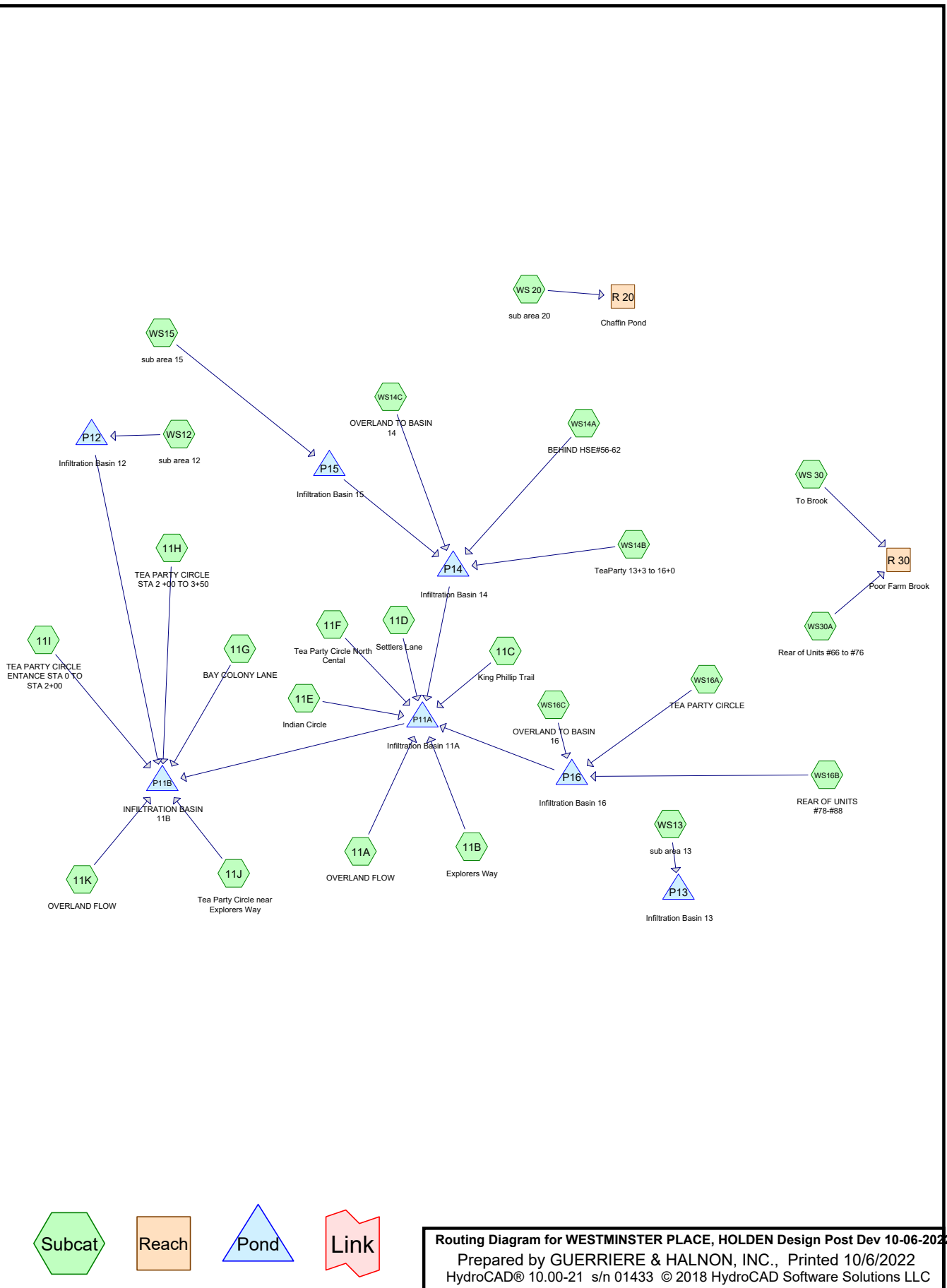
The existing drainage system of Indian Lane will removed and relayed at a lower elevation as shown on the plans.

The existing 15" drain outfall pipe from Tea Party Drive System at Sta 5+40 will be extended 90 feet to meet the revised sideslope of Basin 11B.

The existing drainage system for Bay Colony Lane shall be removed. A new drain system as shown on the plans shall be installed on Bay Colony Lane.

The two existing 12" drain outfall pipe from drain manholes at Sta 2+20 and Sta 3+30 from Tea Party Circle shall be intercepted, combined and rerouted in a 15" drain west of Bay Colony Lane and installed to outlet at Basin 11B.

The attached hydrocad calculations demonstrate that the infiltration system as modified for the Westminster Place site will provide adequate storage to allow the 100 year storm or greater.



WESTMINSTER PLACE, HOLDEN Design Post Dev 10-06-2022

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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
855,031	39	>75% Grass cover, Good, HSG A (11A, 11B, 11C, 11D, 11E, 11F, 11G, 11H, 11I, 11J, 11K, WS12, WS13, WS14A, WS14B, WS14C, WS15, WS16A, WS16B, WS16C, WS30A)
28,350	98	BASIN 11 (11A)
48,749	98	BASINS (11K)
234,188	98	Paved parking, HSG A (11B, 11C, 11D, 11F, 11G, 11H, 11I, 11J, 11K)
38,369	98	Paved roads w/curbs & sewers, HSG A (WS13, WS14B, WS16A)
150,650	98	Roofs, HSG A (11A, 11K, WS12, WS14A, WS14B, WS14C, WS16A, WS16B, WS16C, WS30A)
49,673	98	Unconnected roofs, HSG A (11E, WS15)
2,000	98	Water Surface, 0% imp, HSG A (WS13)
10,800	98	Water Surface, HSG A (WS14C)
187,074	36	Woods, Fair, HSG A (WS 20)
351,804	30	Woods, Good, HSG A (WS 30, WS15)

Summary for Subcatchment 11A: OVERLAND FLOW

Runoff = 15.14 cfs @ 12.09 hrs, Volume= 47,103 cf, Depth= 4.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.64"

Area (sf)	CN	Description
85,908	39	>75% Grass cover, Good, HSG A
25,000	98	Roofs, HSG A
* 28,350	98	BASIN 11
139,258	62	Weighted Average
85,908		61.69% Pervious Area
53,350		38.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Minimum

Summary for Subcatchment 11B: Explorers Way

Runoff = 6.12 cfs @ 12.08 hrs, Volume= 19,840 cf, Depth= 6.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.64"

Area (sf)	CN	Description
7,119	39	>75% Grass cover, Good, HSG A
27,122	98	Paved parking, HSG A
34,241	86	Weighted Average
7,119		20.79% Pervious Area
27,122		79.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Minimum

Summary for Subcatchment 11C: King Phillip Trail

Runoff = 5.40 cfs @ 12.08 hrs, Volume= 17,631 cf, Depth= 7.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.64"

Area (sf)	CN	Description
24,438	98	Paved parking, HSG A
5,470	39	>75% Grass cover, Good, HSG A
29,908	87	Weighted Average
5,470		18.29% Pervious Area
24,438		81.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Minimum

Summary for Subcatchment 11D: Settlers Lane

Runoff = 7.65 cfs @ 12.08 hrs, Volume= 24,245 cf, Depth= 6.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.64"

Area (sf)	CN	Description
32,250	98	Paved parking, HSG A
13,579	39	>75% Grass cover, Good, HSG A
45,829	81	Weighted Average
13,579		29.63% Pervious Area
32,250		70.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Minimum

Summary for Subcatchment 11E: Indian Circle

Runoff = 7.18 cfs @ 12.08 hrs, Volume= 22,756 cf, Depth= 6.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.64"

Area (sf)	CN	Description
30,726	98	Unconnected roofs, HSG A
12,288	39	>75% Grass cover, Good, HSG A
43,014	81	Weighted Average
12,288		28.57% Pervious Area
30,726		71.43% Impervious Area
30,726		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, MINIMUM

Summary for Subcatchment 11F: Tea Party Circle North Cental

Runoff = 16.97 cfs @ 12.08 hrs, Volume= 52,978 cf, Depth= 5.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.64"

WESTMINSTER PLACE, HOLDEN Design Post Dev 1Type III 24-hr 100-Year Rainfall=8.64"

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Area (sf)	CN	Description
70,000	98	Paved parking, HSG A
40,686	39	>75% Grass cover, Good, HSG A
110,686	76	Weighted Average
40,686		36.76% Pervious Area
70,000		63.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Minimum

Summary for Subcatchment 11G: BAY COLONY LANE

Runoff = 8.00 cfs @ 12.08 hrs, Volume= 25,039 cf, Depth= 5.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.64"

Area (sf)	CN	Description
33,275	98	Paved parking, HSG A
17,960	39	>75% Grass cover, Good, HSG A
51,235	77	Weighted Average
17,960		35.05% Pervious Area
33,275		64.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, MINIMUM

Summary for Subcatchment 11H: TEA PARTY CIRCLE STA 2 +00 TO 3+50

Runoff = 1.94 cfs @ 12.08 hrs, Volume= 6,114 cf, Depth= 6.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.64"

Area (sf)	CN	Description
8,184	98	Paved parking, HSG A
3,598	39	>75% Grass cover, Good, HSG A
11,782	80	Weighted Average
3,598		30.54% Pervious Area
8,184		69.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, MINIMUM

Summary for Subcatchment 11I: TEA PARTY CIRCLE ENTANCE STA 0 TO STA 2+00

Runoff = 2.59 cfs @ 12.09 hrs, Volume= 8,086 cf, Depth= 3.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.64"

Area (sf)	CN	Description
9,000	98	Paved parking, HSG A
15,630	39	>75% Grass cover, Good, HSG A
24,630	61	Weighted Average
15,630		63.46% Pervious Area
9,000		36.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, MINIMUM

Summary for Subcatchment 11J: Tea Party Circle near Explorers Way

Runoff = 7.04 cfs @ 12.08 hrs, Volume= 22,084 cf, Depth= 5.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.64"

Area (sf)	CN	Description
29,536	98	Paved parking, HSG A
14,740	39	>75% Grass cover, Good, HSG A
44,276	78	Weighted Average
14,740		33.29% Pervious Area
29,536		66.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Minimum

Summary for Subcatchment 11K: OVERLAND FLOW

Runoff = 26.41 cfs @ 12.09 hrs, Volume= 86,523 cf, Depth= 2.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.64"

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	Area (sf)	CN	Description
*	48,749	98	BASINS
	29,557	98	Roofs, HSG A
	296,858	39	>75% Grass cover, Good, HSG A
	383	98	Paved parking, HSG A
	375,547	51	Weighted Average
	296,858		79.05% Pervious Area
	78,689		20.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry,

Summary for Subcatchment WS 20: sub area 20

Runoff = 2.49 cfs @ 12.37 hrs, Volume= 17,628 cf, Depth= 1.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.64"

	Area (sf)	CN	Description
	187,074	36	Woods, Fair, HSG A
	187,074		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.7	110	0.0400	0.10		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.16"
0.2	90	0.3100	8.96		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
17.9	200	Total			

Summary for Subcatchment WS 30: To Brook

Runoff = 0.87 cfs @ 12.77 hrs, Volume= 12,774 cf, Depth= 0.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.64"

	Area (sf)	CN	Description
	265,129	30	Woods, Good, HSG A
	265,129		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.0	170	0.0200	0.09		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.16"
0.5	70	0.2100	2.29		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
33.5	240	Total			

Summary for Subcatchment WS12: sub area 12

Runoff = 3.71 cfs @ 12.11 hrs, Volume= 12,982 cf, Depth= 2.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.64"

Area (sf)	CN	Description
54,600	39	>75% Grass cover, Good, HSG A
9,740	98	Roofs, HSG A
64,340	48	Weighted Average
54,600		84.86% Pervious Area
9,740		15.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0500	0.15		Sheet Flow, Grass: Dense n= 0.240 P2= 3.16"
1.2	300	0.0700	4.26		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
6.9	350	Total			

Summary for Subcatchment WS13: sub area 13

Runoff = 1.82 cfs @ 12.10 hrs, Volume= 5,921 cf, Depth= 3.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.64"

Area (sf)	CN	Description
4,500	98	Paved roads w/curbs & sewers, HSG A
12,693	39	>75% Grass cover, Good, HSG A
2,000	98	Water Surface, 0% imp, HSG A
19,193	59	Weighted Average
14,693		76.55% Pervious Area
4,500		23.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	50	0.1000	0.13		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.16"
0.5	135	0.0800	4.55		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
7.0	185	Total			

Summary for Subcatchment WS14A: BEHIND HSE#56-62

Runoff = 1.58 cfs @ 12.21 hrs, Volume= 7,486 cf, Depth= 1.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.64"

Area (sf)	CN	Description
45,040	39	>75% Grass cover, Good, HSG A
3,161	98	Roofs, HSG A
48,201	43	Weighted Average
45,040		93.44% Pervious Area
3,161		6.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		Sheet Flow, Grass: Dense n= 0.240 P2= 3.16"
5.0	341	0.0050	1.14		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
13.2	391	Total			

Summary for Subcatchment WS14B: TeaParty 13+3 to 16+0

Runoff = 5.23 cfs @ 12.13 hrs, Volume= 18,777 cf, Depth= 5.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.64"

Area (sf)	CN	Description
7,569	98	Roofs, HSG A
6,603	98	Roofs, HSG A
8,258	98	Paved roads w/curbs & sewers, HSG A
1,276	98	Paved roads w/curbs & sewers, HSG A
1,160	98	Paved roads w/curbs & sewers, HSG A
1,175	39	>75% Grass cover, Good, HSG A
1,490	39	>75% Grass cover, Good, HSG A
4,500	39	>75% Grass cover, Good, HSG A
7,200	39	>75% Grass cover, Good, HSG A
39,231	76	Weighted Average
14,365		36.62% Pervious Area
24,866		63.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		Sheet Flow, AB Grass: Dense n= 0.240 P2= 3.16"
2.0	239	0.0100	2.03		Shallow Concentrated Flow, BC Paved Kv= 20.3 fps
10.2	289	Total			

Summary for Subcatchment WS14C: OVERLAND TO BASIN 14

Runoff = 5.80 cfs @ 12.18 hrs, Volume= 22,830 cf, Depth= 3.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.64"

Area (sf)	CN	Description
14,735	98	Roofs, HSG A
46,170	39	>75% Grass cover, Good, HSG A
10,800	98	Water Surface, HSG A
71,705	60	Weighted Average
46,170		64.39% Pervious Area
25,535		35.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	50	0.0100	0.08		Sheet Flow, Grass: Dense n= 0.240 P2= 3.16"
2.2	209	0.0100	1.61		Shallow Concentrated Flow, BC Unpaved Kv= 16.1 fps
0.0	25	0.3300	9.25		Shallow Concentrated Flow, CD Unpaved Kv= 16.1 fps
13.1	284	Total			

Summary for Subcatchment WS15: sub area 15

Runoff = 2.77 cfs @ 12.24 hrs, Volume= 16,901 cf, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.64"

Area (sf)	CN	Adj	Description
18,947	98		Unconnected roofs, HSG A
59,148	39		>75% Grass cover, Good, HSG A
86,675	30		Woods, Good, HSG A
164,770	41	37	Weighted Average, UI Adjusted
145,823			88.50% Pervious Area
18,947			11.50% Impervious Area
18,947			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	90	0.0400	0.15		Sheet Flow, Grass: Dense n= 0.240 P2= 3.16"
3.1	430	0.0200	2.28		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
13.1	520	Total			

Summary for Subcatchment WS16A: TEA PARTY CIRCLE

Runoff = 13.16 cfs @ 12.08 hrs, Volume= 41,696 cf, Depth= 6.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.64"

Area (sf)	CN	Description
19,790	98	Paved roads w/curbs & sewers, HSG A
3,385	98	Paved roads w/curbs & sewers, HSG A
32,760	98	Roofs, HSG A
22,880	39	>75% Grass cover, Good, HSG A
78,815	81	Weighted Average
22,880		29.03% Pervious Area
55,935		70.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, MINIMUM

Summary for Subcatchment WS16B: REAR OF UNITS #78-#88

Runoff = 1.97 cfs @ 12.09 hrs, Volume= 6,442 cf, Depth= 2.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.64"

Area (sf)	CN	Description
* 5,620	98	Roofs, HSG A
22,340	39	>75% Grass cover, Good, HSG A
27,960	51	Weighted Average
22,340		79.90% Pervious Area
5,620		20.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, MINIMUM

Summary for Subcatchment WS16C: OVERLAND TO BASIN 16

Runoff = 3.42 cfs @ 12.09 hrs, Volume= 11,316 cf, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-Year Rainfall=8.64"

Area (sf)	CN	Description
9,940	98	Roofs, HSG A
41,310	39	>75% Grass cover, Good, HSG A
51,250	50	Weighted Average
41,310		80.60% Pervious Area
9,940		19.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, MINIMUM

Summary for Subcatchment WS30A: Rear of Units #66 to #76

Runoff = 1.75 cfs @ 12.14 hrs, Volume= 6,592 cf, Depth= 2.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.64"

Area (sf)	CN	Description
5,965	98	Roofs, HSG A
22,649	39	>75% Grass cover, Good, HSG A
28,614	51	Weighted Average
22,649		79.15% Pervious Area
5,965		20.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry,

Summary for Reach R 20: Chaffin Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 187,074 sf, 0.00% Impervious, Inflow Depth = 1.13" for 100-Year event
Inflow = 2.49 cfs @ 12.37 hrs, Volume= 17,628 cf
Outflow = 2.49 cfs @ 12.37 hrs, Volume= 17,628 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2

Summary for Reach R 30: Poor Farm Brook

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 293,743 sf, 2.03% Impervious, Inflow Depth = 0.79" for 100-Year event
Inflow = 1.75 cfs @ 12.14 hrs, Volume= 19,366 cf
Outflow = 1.75 cfs @ 12.14 hrs, Volume= 19,366 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2

Summary for Pond P11A: Infiltration Basin 11A

Inflow Area = 884,868 sf, 43.16% Impervious, Inflow Depth = 2.60" for 100-Year event
 Inflow = 58.44 cfs @ 12.08 hrs, Volume= 191,399 cf
 Outflow = 9.33 cfs @ 12.34 hrs, Volume= 191,399 cf, Atten= 84%, Lag= 15.7 min
 Discarded = 1.76 cfs @ 12.58 hrs, Volume= 114,585 cf
 Primary = 7.63 cfs @ 12.31 hrs, Volume= 76,815 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 720.42' @ 12.58 hrs Surf.Area= 31,592 sf Storage= 62,623 cf

Plug-Flow detention time= 207.3 min calculated for 191,380 cf (100% of inflow)
 Center-of-Mass det. time= 207.3 min (1,018.7 - 811.4)

Volume	Invert	Avail.Storage	Storage Description
#1	716.66'	119,341 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
716.66	1	0	0
717.99	20	14	14
718.00	20,385	102	116
720.00	29,220	49,605	49,721
722.00	40,400	69,620	119,341

Device	Routing	Invert	Outlet Devices
#1	Discarded	716.66'	2.400 in/hr Exfiltration over Surface area
#2	Primary	716.66'	18.0" Round Culvert L= 30.0' CMP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 716.66' / 716.66' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf

Discarded OutFlow Max=1.76 cfs @ 12.58 hrs HW=720.42' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 1.76 cfs)

Primary OutFlow Max=7.63 cfs @ 12.31 hrs HW=720.21' TW=719.17' (Dynamic Tailwater)

↑**2=Culvert** (Inlet Controls 7.63 cfs @ 4.32 fps)

Summary for Pond P11B: INFILTRATION BASIN 11B

[80] Warning: Exceeded Pond P11A by 1.34' @ 0.00 hrs (3.99 cfs 1,009,400 cf)

Inflow Area = 1,456,678 sf, 37.78% Impervious, Inflow Depth = 1.93" for 100-Year event
 Inflow = 54.57 cfs @ 12.09 hrs, Volume= 234,636 cf
 Outflow = 3.64 cfs @ 15.52 hrs, Volume= 234,662 cf, Atten= 93%, Lag= 205.8 min
 Discarded = 3.64 cfs @ 15.52 hrs, Volume= 234,662 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2

WESTMINSTER PLACE, HOLDEN Design Post Dev 1Type III 24-hr 100-Year Rainfall=8.64"

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Peak Elev= 720.16' @ 15.52 hrs Surf.Area= 65,450 sf Storage= 123,185 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 360.6 min (1,199.4 - 838.8)

Volume	Invert	Avail.Storage	Storage Description
#1	718.00'	259,280 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
718.00	48,680	0	0
720.00	63,900	112,580	112,580
722.00	82,800	146,700	259,280

Device	Routing	Invert	Outlet Devices
#1	Discarded	718.00'	2.400 in/hr Exfiltration over Surface area

Discarded OutFlow Max=3.64 cfs @ 15.52 hrs HW=720.16' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 3.64 cfs)**Summary for Pond P12: Infiltration Basin 12**

Inflow Area = 64,340 sf, 15.14% Impervious, Inflow Depth = 2.42" for 100-Year event
 Inflow = 3.71 cfs @ 12.11 hrs, Volume= 12,982 cf
 Outflow = 2.99 cfs @ 12.17 hrs, Volume= 12,982 cf, Atten= 20%, Lag= 4.1 min
 Discarded = 0.08 cfs @ 12.17 hrs, Volume= 3,007 cf
 Primary = 2.91 cfs @ 12.17 hrs, Volume= 9,975 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 722.55' @ 12.17 hrs Surf.Area= 1,428 sf Storage= 1,686 cf

Plug-Flow detention time= 63.5 min calculated for 12,981 cf (100% of inflow)

Center-of-Mass det. time= 63.6 min (935.0 - 871.5)

Volume	Invert	Avail.Storage	Storage Description
#1	720.00'	69,945 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
720.00	95	0	0
722.00	938	1,033	1,033
724.00	2,713	3,651	4,684
726.00	62,548	65,261	69,945

Device	Routing	Invert	Outlet Devices
#1	Discarded	720.00'	2.400 in/hr Exfiltration over Surface area Phase-In= 0.10'
#2	Primary	721.68'	15.0" Round Culvert L= 169.6' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 721.68' / 719.75' S= 0.0114 '/' Cc= 0.900 n= 0.013 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf

Discarded OutFlow Max=0.08 cfs @ 12.17 hrs HW=722.55' (Free Discharge)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=2.90 cfs @ 12.17 hrs HW=722.55' TW=718.89' (Dynamic Tailwater)
 ↑ **2=Culvert** (Inlet Controls 2.90 cfs @ 3.18 fps)

Summary for Pond P13: Infiltration Basin 13

Inflow Area = 19,193 sf, 23.45% Impervious, Inflow Depth = 3.70" for 100-Year event
 Inflow = 1.82 cfs @ 12.10 hrs, Volume= 5,921 cf
 Outflow = 0.14 cfs @ 13.91 hrs, Volume= 5,921 cf, Atten= 92%, Lag= 108.3 min
 Discarded = 0.14 cfs @ 13.91 hrs, Volume= 5,921 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 717.11' @ 13.91 hrs Surf.Area= 2,562 sf Storage= 2,650 cf

Plug-Flow detention time= 195.2 min calculated for 5,920 cf (100% of inflow)
 Center-of-Mass det. time= 195.2 min (1,040.1 - 844.9)

Volume	Invert	Avail.Storage	Storage Description
#1	716.00'	46,270 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
716.00	2,200	0	0
718.00	2,850	5,050	5,050
720.00	3,890	6,740	11,790
722.00	9,110	13,000	24,790
724.00	12,370	21,480	46,270

Device	Routing	Invert	Outlet Devices
#1	Discarded	716.00'	2.400 in/hr Exfiltration over Surface area Phase-In= 0.10'
#2	Primary	723.50'	20.0' long (Profile 2) Broad-Crested Rectangular Weir Head (feet) 0.49 0.98 1.48 Coef. (English) 2.90 3.26 3.44

Discarded OutFlow Max=0.14 cfs @ 13.91 hrs HW=717.11' (Free Discharge)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.14 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=716.00' (Free Discharge)
 ↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P14: Infiltration Basin 14

Inflow Area = 323,907 sf, 22.39% Impervious, Inflow Depth = 1.82" for 100-Year event
 Inflow = 12.29 cfs @ 12.16 hrs, Volume= 49,093 cf
 Outflow = 0.53 cfs @ 16.67 hrs, Volume= 49,093 cf, Atten= 96%, Lag= 270.6 min
 Discarded = 0.53 cfs @ 16.67 hrs, Volume= 49,093 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

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Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 722.13' @ 16.67 hrs Surf.Area= 9,474 sf Storage= 29,604 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 637.2 min (1,478.7 - 841.5)

Volume	Invert	Avail.Storage	Storage Description
#1	718.00'	76,140 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
718.00	5,038	0	0
720.00	7,034	12,072	12,072
722.00	9,312	16,346	28,418
724.00	11,872	21,184	49,602
726.00	14,666	26,538	76,140

Device	Routing	Invert	Outlet Devices
#1	Discarded	718.00'	2.400 in/hr Exfiltration over Surface area
#2	Primary	720.65'	18.0" Round Culvert L= 217.0' Ke= 0.900 Inlet / Outlet Invert= 720.65' / 718.63' S= 0.0093 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#3	Device 2	723.50'	18.0" Vert. Orifice/Grate C= 0.600

Discarded OutFlow Max=0.53 cfs @ 16.67 hrs HW=722.13' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.53 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=718.00' TW=716.66' (Dynamic Tailwater)

↑**2=Culvert** (Controls 0.00 cfs)

↑**3=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond P15: Infiltration Basin 15

Inflow Area = 164,770 sf, 11.50% Impervious, Inflow Depth = 1.23" for 100-Year event
 Inflow = 2.77 cfs @ 12.24 hrs, Volume= 16,901 cf
 Outflow = 0.29 cfs @ 16.52 hrs, Volume= 16,902 cf, Atten= 89%, Lag= 256.8 min
 Discarded = 0.29 cfs @ 16.52 hrs, Volume= 16,902 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 720.13' @ 16.52 hrs Surf.Area= 5,260 sf Storage= 7,699 cf

Plug-Flow detention time= 335.5 min calculated for 16,901 cf (100% of inflow)
 Center-of-Mass det. time= 335.6 min (1,254.9 - 919.3)

Volume	Invert	Avail.Storage	Storage Description
#1	718.00'	36,900 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
718.00	1,860	0	0
720.00	5,169	7,029	7,029
722.00	6,580	11,749	18,778
724.00	11,542	18,122	36,900

Device	Routing	Invert	Outlet Devices
#1	Discarded	718.00'	2.400 in/hr Exfiltration over Surface area
#2	Primary	722.88'	18.0" Round Culvert L= 336.0' Ke= 0.700 Inlet / Outlet Invert= 722.88' / 720.35' S= 0.0075 '/' Cc= 0.900 n= 0.013 Concrete sewer w/manholes & inlets, Flow Area= 1.77 sf

Discarded OutFlow Max=0.29 cfs @ 16.52 hrs HW=720.13' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.29 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=718.00' TW=718.00' (Dynamic Tailwater)↑**2=Culvert** (Controls 0.00 cfs)**Summary for Pond P16: Infiltration Basin 16**

Inflow Area =	158,025 sf, 45.24% Impervious, Inflow Depth = 4.51" for 100-Year event
Inflow =	18.51 cfs @ 12.08 hrs, Volume= 59,453 cf
Outflow =	1.16 cfs @ 14.08 hrs, Volume= 59,453 cf, Atten= 94%, Lag= 120.1 min
Discarded =	0.53 cfs @ 14.08 hrs, Volume= 52,606 cf
Primary =	0.63 cfs @ 14.08 hrs, Volume= 6,848 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 722.60' @ 14.08 hrs Surf.Area= 9,609 sf Storage= 33,202 cf

Plug-Flow detention time= 604.8 min calculated for 59,447 cf (100% of inflow)

Center-of-Mass det. time= 604.9 min (1,422.3 - 817.4)

Volume	Invert	Avail.Storage	Storage Description
#1	718.00'	47,792 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
718.00	5,017	0	0
720.00	6,857	11,874	11,874
722.00	8,923	15,780	27,654
724.00	11,215	20,138	47,792

Device	Routing	Invert	Outlet Devices
#1	Discarded	718.00'	2.400 in/hr Exfiltration over Surface area Phase-In= 0.10'
#2	Primary	719.83'	18.0" Round Culvert L= 177.0' Ke= 0.900 Inlet / Outlet Invert= 719.83' / 719.46' S= 0.0021 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#3	Device 2	722.25'	18.0" Vert. Orifice/Grate C= 0.600

Discarded OutFlow Max=0.53 cfs @ 14.08 hrs HW=722.60' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.53 cfs)

Primary OutFlow Max=0.63 cfs @ 14.08 hrs HW=722.60' TW=720.21' (Dynamic Tailwater)

↑ **2=Culvert** (Passes 0.63 cfs of 8.01 cfs potential flow)

↑ **3=Orifice/Grate** (Orifice Controls 0.63 cfs @ 2.01 fps)



DATE: DATE:
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- NOTES
1. PLAN PROPOSES MODIFICATION TO THE BUILDING AND ASSOCIATED ROADWAY/UTILITY CONFIGURATION FOR UNITS 597-610 ONLY.
 2. REFERENCE IS MADE TO PLANNING BOARD NOTICE OF DECISION SPR-0207, SITE PLAN REVIEW SPECIAL PERMIT AND PLAN REFERENCE SITE PLAN LAST REVISED DATE AUGUST 25, 2003, ENTITLED "THE TRULSON PROPERTY OF HOLDEN, MA., 25 SHEETS.
 3. REFERENCE IS MADE TO A PLAN ENTITLED: SEWER EXTENSION PERMIT PLAN FOR "SANCTUARY" AT HOLDEN IN HOLDEN, MASSACHUSETTS OWNER: TRULSON REAL ESTATE CORP. APPLICANT: FAFARD REAL ESTATE AND DEVELOPMENT CORP. PREPARED BY: BENCHMARK ENGINEERING CORP. DATE: 17 SEPTEMBER 2003 REVISED: 20 FEBRUARY 2004
 4. REFERENCE IS MADE TO THE FOLLOWING PLANS RECORDED AT THE WORCESTER DISTRICT REGISTRY OF DEEDS:
PLAN BOOK 904 PLAN 93
PLAN BOOK 885 PLAN 121
PLAN BOOK 884 PLAN 48
PLAN BOOK 878 PLAN 121
PLAN BOOK 847 PLAN 17
PLAN BOOK 829 PLAN 89
PLAN BOOK 808 PLAN 2

LEGEND

EXISTING BUILDING

PROPOSED BUILDING

EXISTING TREES

PROPOSED TREES

OWNER

OWNER
NEWELL ROAD REALTY, LLC
120 QUARRY DRIVE
MILFORD, MA 01757

WATERSHED PLAN
FOR
SITE PLAN SPECIAL PERMIT
AT
WESTMINSTER PLACE
NEWELL ROAD
IN
HOLDEN, MA

DATE MARCH 31, 2020

00	DATE	INITIAL SUBMITTAL	INIT
01	5/6/2020	VISITOR PARKING SPACES	DMK
02	7/14/2020	REVISIONS REQUESTED BY TOWN	DMK
03	2/10/2021	BLDG CHANGES, WATERSHED INFO	DMK
04	8/05/2021	BLDG AND ROAD CHANGES	DMK
05	10/08/2021	REV LOCATION OF WQS #5, 9 AND 10	DMK
06	10/6/2022	REVISED BAY COLONY LANE	DMK

GRAPHIC SCALE: 1"=80'
0 20 40 60 80 100 150 200 FEET
0 10 20 30 40 60 80 METERS

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