

# **PROPOSED CONDITIONS**

## **100 YEAR STORM**

# Dutchco - Hartwell Ave Post Development

Prepared by Mark Piermarini

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100 Year Storm  
Type III 24-hr Rainfall=6.50"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 10S: Overland runoff to pond** Runoff Area=7.330 ac 18.96% Impervious Runoff Depth>1.25"  
Tc=0.0 min CN=50 Runoff=11.53 cfs 0.766 af

**Subcatchment 20S: Overland runoff to northerly** Runoff Area=2.520 ac 7.54% Impervious Runoff Depth>2.23"  
Flow Length=454' Tc=11.4 min CN=62 Runoff=5.80 cfs 0.469 af

**Subcatchment 30S: Overland runoff to road** Runoff Area=0.160 ac 12.50% Impervious Runoff Depth>2.60"  
Flow Length=60' Slope=0.0170 1' Tc=6.3 min CN=66 Runoff=0.51 cfs 0.035 af

**Subcatchment L5: Lot 5 Roof Runoff** Runoff Area=0.055 ac 100.00% Impervious Runoff Depth>5.78"  
Flow Length=75' Tc=5.0 min CN=98 Runoff=0.35 cfs 0.027 af

**Subcatchment L6: Lot 6 Roof Runoff** Runoff Area=0.055 ac 100.00% Impervious Runoff Depth>5.78"  
Flow Length=80' Tc=5.0 min CN=98 Runoff=0.35 cfs 0.027 af

**Pond 4P: Pond - on site** Peak Elev=251.73' Storage=0.765 af Inflow=11.53 cfs 0.766 af  
Outflow=0.00 cfs 0.000 af

**Pond 5P: Infiltration Chambers** Peak Elev=1.79' Storage=0.013 af Inflow=0.35 cfs 0.027 af  
Outflow=0.02 cfs 0.016 af

**Pond 6P: Infiltration Chambers** Peak Elev=1.79' Storage=0.013 af Inflow=0.35 cfs 0.027 af  
Outflow=0.02 cfs 0.016 af

**Link DP: Northerly Low Area** Inflow=5.80 cfs 0.469 af  
Primary=5.80 cfs 0.469 af

**Total Runoff Area = 10.120 ac Runoff Volume = 1.323 af Average Runoff Depth = 1.57"**  
**83.10% Pervious = 8.410 ac 16.90% Impervious = 1.710 ac**

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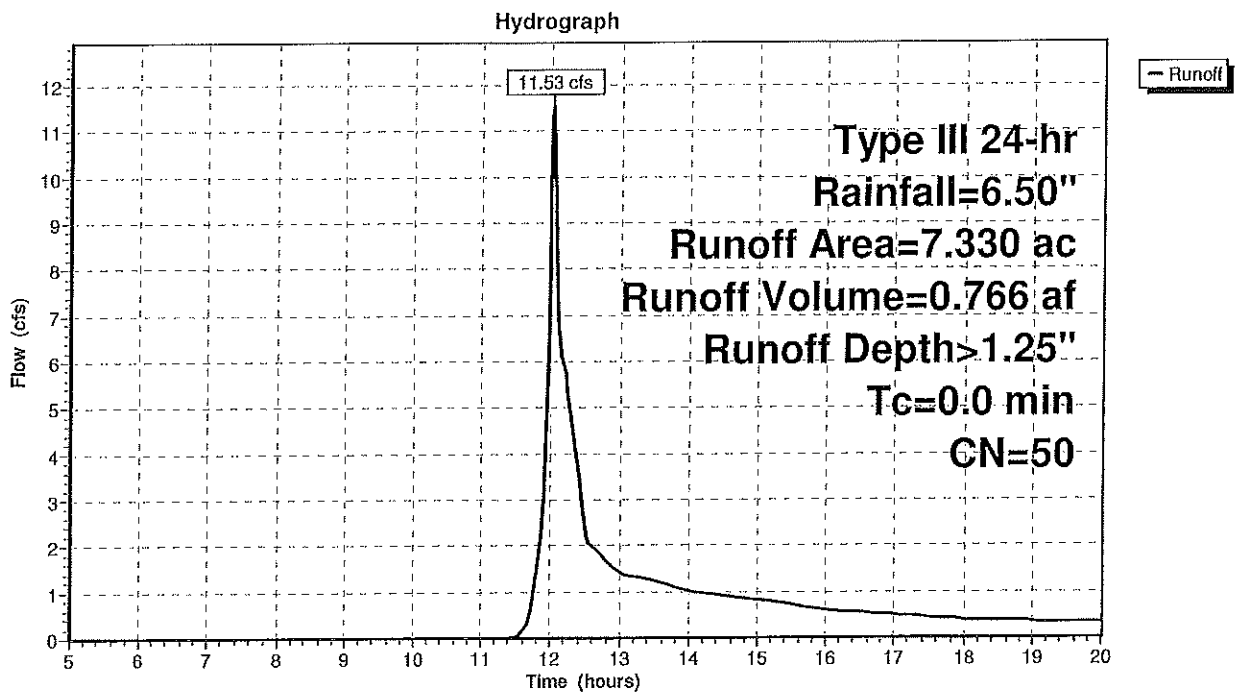
**Summary for Subcatchment 10S: Overland runoff to pond**

Runoff = 11.53 cfs @ 12.02 hrs, Volume= 0.766 af, Depth> 1.25"  
Routed to Pond 4P : Pond - on site

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr Rainfall=6.50"

Area (ac)	CN	Description
* 0.220	98	Roofs
* 0.170	98	Paved Driveways
0.870	39	>75% Grass cover, Good, HSG A
0.440	61	>75% Grass cover, Good, HSG B
0.050	74	>75% Grass cover, Good, HSG C
* 1.000	98	Water Surface
3.730	30	Woods, Good, HSG A
0.150	55	Woods, Good, HSG B
0.700	70	Woods, Good, HSG C
7.330	50	Weighted Average
5.940		81.04% Pervious Area
1.390		18.96% Impervious Area

**Subcatchment 10S: Overland runoff to pond**



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## Hydrograph for Subcatchment 10S: Overland runoff to pond

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.37	0.00	0.00	18.25	6.06	1.17	0.37
5.25	0.39	0.00	0.00	18.50	6.08	1.18	0.36
5.50	0.42	0.00	0.00	18.75	6.11	1.20	0.36
5.75	0.44	0.00	0.00	19.00	6.13	1.21	0.35
6.00	0.47	0.00	0.00	19.25	6.15	1.22	0.34
6.25	0.50	0.00	0.00	19.50	6.18	1.23	0.33
6.50	0.52	0.00	0.00	19.75	6.20	1.24	0.32
6.75	0.56	0.00	0.00	20.00	6.22	1.25	0.32
7.00	0.59	0.00	0.00				
7.25	0.62	0.00	0.00				
7.50	0.66	0.00	0.00				
7.75	0.70	0.00	0.00				
8.00	0.74	0.00	0.00				
8.25	0.79	0.00	0.00				
8.50	0.83	0.00	0.00				
8.75	0.89	0.00	0.00				
9.00	0.95	0.00	0.00				
9.25	1.01	0.00	0.00				
9.50	1.08	0.00	0.00				
9.75	1.15	0.00	0.00				
10.00	1.23	0.00	0.00				
10.25	1.31	0.00	0.00				
10.50	1.41	0.00	0.00				
10.75	1.51	0.00	0.00				
11.00	1.62	0.00	0.00				
11.25	1.76	0.00	0.00				
11.50	1.94	0.00	0.00				
11.75	2.31	0.01	0.97				
12.00	3.25	0.14	11.25				
12.25	4.19	0.39	5.32				
12.50	4.56	0.52	2.18				
12.75	4.74	0.59	1.77				
13.00	4.87	0.64	1.40				
13.25	4.99	0.69	1.31				
13.50	5.09	0.73	1.22				
13.75	5.19	0.77	1.12				
14.00	5.27	0.81	1.02				
14.25	5.35	0.84	0.97				
14.50	5.42	0.87	0.92				
14.75	5.49	0.90	0.87				
15.00	5.55	0.93	0.82				
15.25	5.61	0.96	0.77				
15.50	5.67	0.98	0.71				
15.75	5.71	1.01	0.65				
16.00	5.76	1.03	0.59				
16.25	5.80	1.05	0.56				
16.50	5.84	1.07	0.54				
16.75	5.88	1.08	0.51				
17.00	5.91	1.10	0.49				
17.25	5.94	1.12	0.46				
17.50	5.98	1.13	0.43				
17.75	6.00	1.15	0.41				
18.00	6.03	1.16	0.38				

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**Summary for Subcatchment 20S: Overland runoff to northerly low area**

Runoff = 5.80 cfs @ 12.17 hrs, Volume= 0.469 af, Depth> 2.23"  
Routed to Link DP : Northerly Low Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr Rainfall=6.50"

Area (ac)	CN	Description
* 0.030	98	Roofs
* 0.160	98	Paved Driveways
0.010	74	>75% Grass cover, Good, HSG C
0.900	61	>75% Grass cover, Good, HSG B
0.340	70	Woods, Good, HSG C
1.080	55	Woods, Good, HSG B
2.520	62	Weighted Average
2.330		92.46% Pervious Area
0.190		7.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	50	0.1800	0.16		<b>Sheet Flow, Path 1</b> Woods: Light underbrush n= 0.400 P2= 3.10"
0.4	50	0.0100	2.03		<b>Shallow Concentrated Flow, Path 2</b> Paved Kv= 20.3 fps
3.0	251	0.0400	1.40		<b>Shallow Concentrated Flow, Path 3</b> Short Grass Pasture Kv= 7.0 fps
2.8	103	0.0150	0.61		<b>Shallow Concentrated Flow, Path 4</b> Woodland Kv= 5.0 fps
11.4	454	Total			

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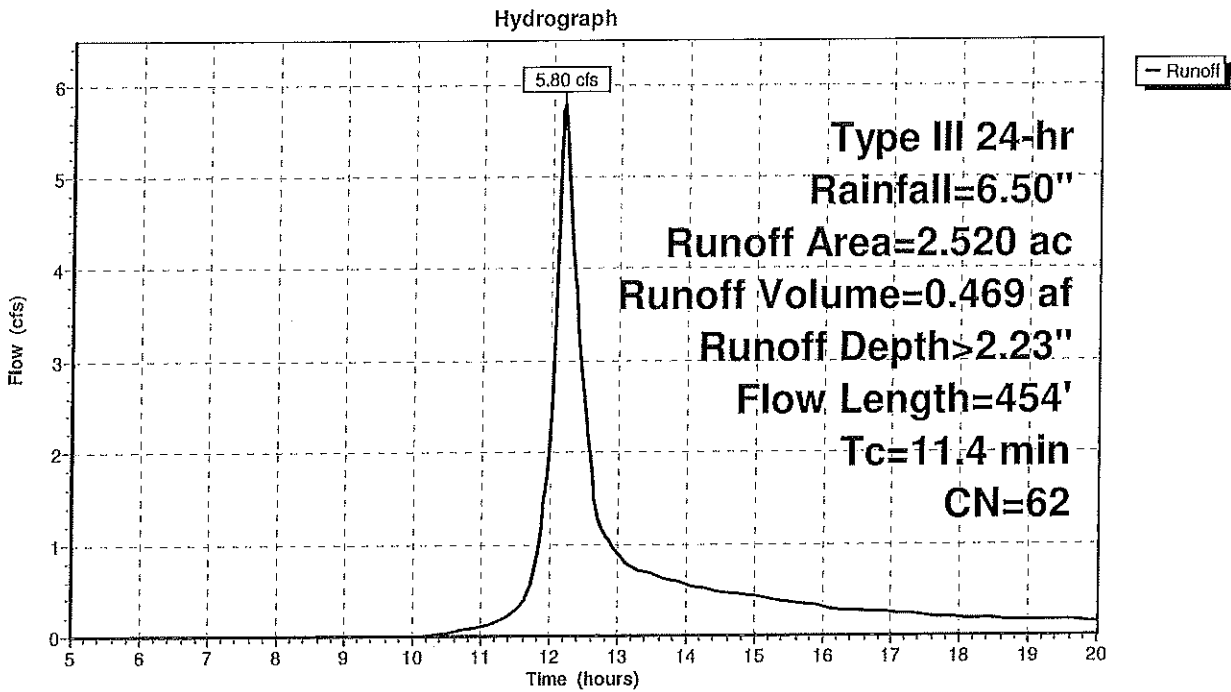
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**Subcatchment 20S: Overland runoff to northerly low area**



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**Hydrograph for Subcatchment 20S: Overland runoff to northerly low area**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.37	0.00	0.00	18.25	6.06	2.13	0.18
5.25	0.39	0.00	0.00	18.50	6.08	2.15	0.18
5.50	0.42	0.00	0.00	18.75	6.11	2.16	0.17
5.75	0.44	0.00	0.00	19.00	6.13	2.18	0.17
6.00	0.47	0.00	0.00	19.25	6.15	2.20	0.16
6.25	0.50	0.00	0.00	19.50	6.18	2.21	0.16
6.50	0.52	0.00	0.00	19.75	6.20	2.23	0.16
6.75	0.56	0.00	0.00	20.00	<b>6.22</b>	<b>2.24</b>	0.15
7.00	0.59	0.00	0.00				
7.25	0.62	0.00	0.00				
7.50	0.66	0.00	0.00				
7.75	0.70	0.00	0.00				
8.00	0.74	0.00	0.00				
8.25	0.79	0.00	0.00				
8.50	0.83	0.00	0.00				
8.75	0.89	0.00	0.00				
9.00	0.95	0.00	0.00				
9.25	1.01	0.00	0.00				
9.50	1.08	0.00	0.00				
9.75	1.15	0.00	0.00				
10.00	1.23	0.00	0.00				
10.25	1.31	0.00	0.01				
10.50	1.41	0.01	0.03				
10.75	1.51	0.01	0.07				
11.00	1.62	0.02	0.11				
11.25	1.76	0.04	0.17				
11.50	1.94	0.07	0.29				
11.75	2.31	0.16	0.71				
12.00	3.25	0.50	<b>2.33</b>				
12.25	4.19	0.97	<b>4.89</b>				
12.50	4.56	1.18	2.54				
12.75	4.74	1.28	1.17				
13.00	4.87	1.36	0.88				
13.25	4.99	1.43	0.73				
13.50	5.09	1.50	0.67				
13.75	5.19	1.56	0.61				
14.00	5.27	1.61	0.56				
14.25	5.35	1.66	0.51				
14.50	5.42	1.70	0.48				
14.75	5.49	1.75	0.45				
15.00	5.55	1.79	0.43				
15.25	5.61	1.83	0.40				
15.50	5.67	1.86	0.37				
15.75	5.71	1.90	0.34				
16.00	5.76	1.93	0.31				
16.25	5.80	1.96	0.28				
16.50	5.84	1.98	0.27				
16.75	5.88	2.01	0.26				
17.00	5.91	2.03	0.24				
17.25	5.94	2.05	0.23				
17.50	5.98	2.07	0.22				
17.75	6.00	2.09	0.20				
18.00	6.03	2.11	0.19				

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**Summary for Subcatchment 30S: Overland runoff to road**

Runoff = 0.51 cfs @ 12.10 hrs, Volume= 0.035 af, Depth> 2.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr Rainfall=6.50"

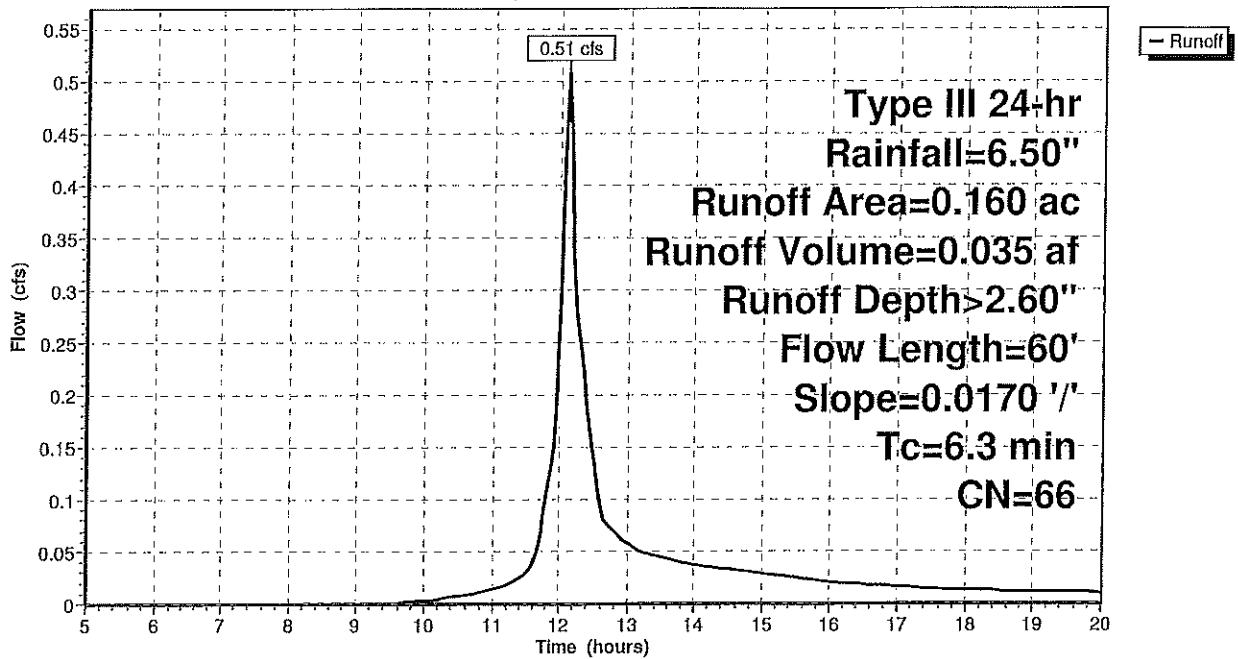
Area (ac)	CN	Description
* 0.020	98	Paved Driveway
0.140	61	>75% Grass cover, Good, HSG B
0.160	66	Weighted Average
0.140		87.50% Pervious Area
0.020		12.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	50	0.0170	0.14		Sheet Flow, Path 1 Grass: Short n= 0.150 P2= 3.10"
0.2	10	0.0170	0.91		Shallow Concentrated Flow, Path 2 Short Grass Pasture Kv= 7.0 fps
6.3	60	Total			

**Subcatchment 30S: Overland runoff to road**

Hydrograph





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Type III 24-hr Rainfall=6.50"

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**Hydrograph for Subcatchment 30S: Overland runoff to road**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.37	0.00	0.00	18.25	6.06	2.48	0.01
5.25	0.39	0.00	0.00	18.50	6.08	2.50	0.01
5.50	0.42	0.00	0.00	18.75	6.11	2.52	0.01
5.75	0.44	0.00	0.00	19.00	6.13	2.54	0.01
6.00	0.47	0.00	0.00	19.25	6.15	2.56	0.01
6.25	0.50	0.00	0.00	19.50	6.18	2.57	0.01
6.50	0.52	0.00	0.00	19.75	6.20	2.59	0.01
6.75	0.56	0.00	0.00	20.00	<b>6.22</b>	<b>2.60</b>	0.01
7.00	0.59	0.00	0.00				
7.25	0.62	0.00	0.00				
7.50	0.66	0.00	0.00				
7.75	0.70	0.00	0.00				
8.00	0.74	0.00	0.00				
8.25	0.79	0.00	0.00				
8.50	0.83	0.00	0.00				
8.75	0.89	0.00	0.00				
9.00	0.95	0.00	0.00				
9.25	1.01	0.00	0.00				
9.50	1.08	0.00	0.00				
9.75	1.15	0.00	0.00				
10.00	1.23	0.01	0.00				
10.25	1.31	0.01	0.00				
10.50	1.41	0.03	0.01				
10.75	1.51	0.04	0.01				
11.00	1.62	0.06	0.01				
11.25	1.76	0.09	0.02				
11.50	1.94	0.14	0.03				
11.75	2.31	0.25	0.09				
12.00	3.25	0.67	<b>0.28</b>				
12.25	4.19	1.20	<b>0.28</b>				
12.50	4.56	1.44	0.14				
12.75	4.74	1.55	0.07				
13.00	4.87	1.64	0.06				
13.25	4.99	1.72	0.05				
13.50	5.09	1.79	0.05				
13.75	5.19	1.86	0.04				
14.00	5.27	1.92	0.04				
14.25	5.35	1.97	0.03				
14.50	5.42	2.02	0.03				
14.75	5.49	2.07	0.03				
15.00	5.55	2.11	0.03				
15.25	5.61	2.16	0.03				
15.50	5.67	2.20	0.02				
15.75	5.71	2.23	0.02				
16.00	5.76	2.26	0.02				
16.25	5.80	2.29	0.02				
16.50	5.84	2.32	0.02				
16.75	5.88	2.35	0.02				
17.00	5.91	2.38	0.02				
17.25	5.94	2.40	0.02				
17.50	5.98	2.42	0.01				
17.75	6.00	2.44	0.01				
18.00	6.03	2.46	0.01				

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**Summary for Subcatchment L5: Lot 5 Roof Runoff**

Runoff = 0.35 cfs @ 12.07 hrs, Volume= 0.027 af, Depth> 5.78"  
Routed to Pond 5P : Infiltration Chambers

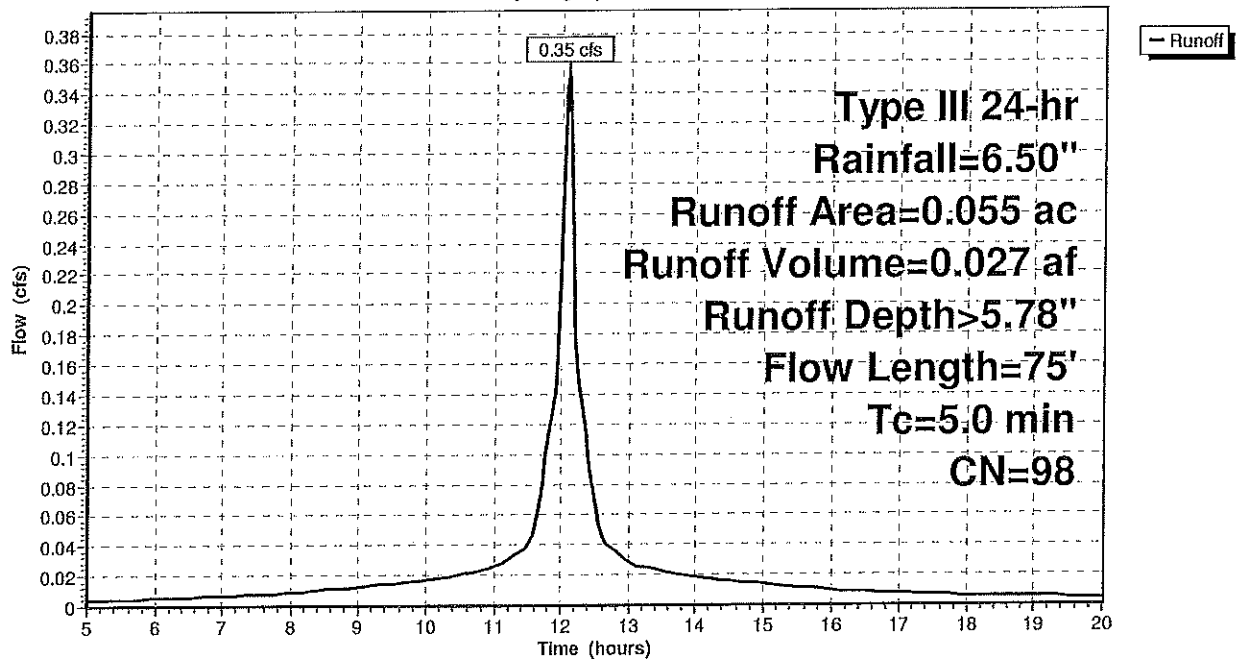
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr Rainfall=6.50"

Area (ac)	CN	Description
0.055	98	Roofs, HSG A
0.055		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	75		0.25		Direct Entry, Path 1

**Subcatchment L5: Lot 5 Roof Runoff**

Hydrograph



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## Hydrograph for Subcatchment L5: Lot 5 Roof Runoff

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.37	0.20	0.00	18.25	6.06	5.82	0.01
5.25	0.39	0.22	0.00	18.50	6.08	5.84	0.01
5.50	0.42	0.24	0.00	18.75	6.11	5.87	0.01
5.75	0.44	0.27	0.00	19.00	6.13	5.89	0.01
6.00	0.47	0.29	0.01	19.25	6.15	5.92	0.01
6.25	0.50	0.31	0.01	19.50	6.18	5.94	0.00
6.50	0.52	0.34	0.01	19.75	6.20	5.96	0.00
6.75	0.56	0.37	0.01	20.00	<b>6.22</b>	<b>5.98</b>	0.00
7.00	0.59	0.40	0.01				
7.25	0.62	0.43	0.01				
7.50	0.66	0.47	0.01				
7.75	0.70	0.50	0.01				
8.00	0.74	0.54	0.01				
8.25	0.79	0.58	0.01				
8.50	0.83	0.63	0.01				
8.75	0.89	0.68	0.01				
9.00	0.95	0.74	0.01				
9.25	1.01	0.80	0.01				
9.50	1.08	0.87	0.01				
9.75	1.15	0.94	0.02				
10.00	1.23	1.01	0.02				
10.25	1.31	1.10	0.02				
10.50	1.41	1.19	0.02				
10.75	1.51	1.29	0.02				
11.00	1.62	1.40	0.03				
11.25	1.76	1.54	0.03				
11.50	1.94	1.71	0.04				
11.75	2.31	2.08	0.10				
12.00	3.25	3.02	<b>0.25</b>				
12.25	4.19	3.96	<b>0.15</b>				
12.50	4.56	4.33	0.07				
12.75	4.74	4.50	0.04				
13.00	4.87	4.64	0.03				
13.25	4.99	4.75	0.02				
13.50	5.09	4.86	0.02				
13.75	5.19	4.95	0.02				
14.00	5.27	5.03	0.02				
14.25	5.35	5.11	0.02				
14.50	5.42	5.18	0.02				
14.75	5.49	5.25	0.01				
15.00	5.55	5.32	0.01				
15.25	5.61	5.37	0.01				
15.50	5.67	5.43	0.01				
15.75	5.71	5.48	0.01				
16.00	5.76	5.52	0.01				
16.25	5.80	5.56	0.01				
16.50	5.84	5.60	0.01				
16.75	5.88	5.64	0.01				
17.00	5.91	5.67	0.01				
17.25	5.94	5.71	0.01				
17.50	5.98	5.74	0.01				
17.75	6.00	5.77	0.01				
18.00	6.03	5.79	0.01				

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**Summary for Subcatchment L6: Lot 6 Roof Runoff**

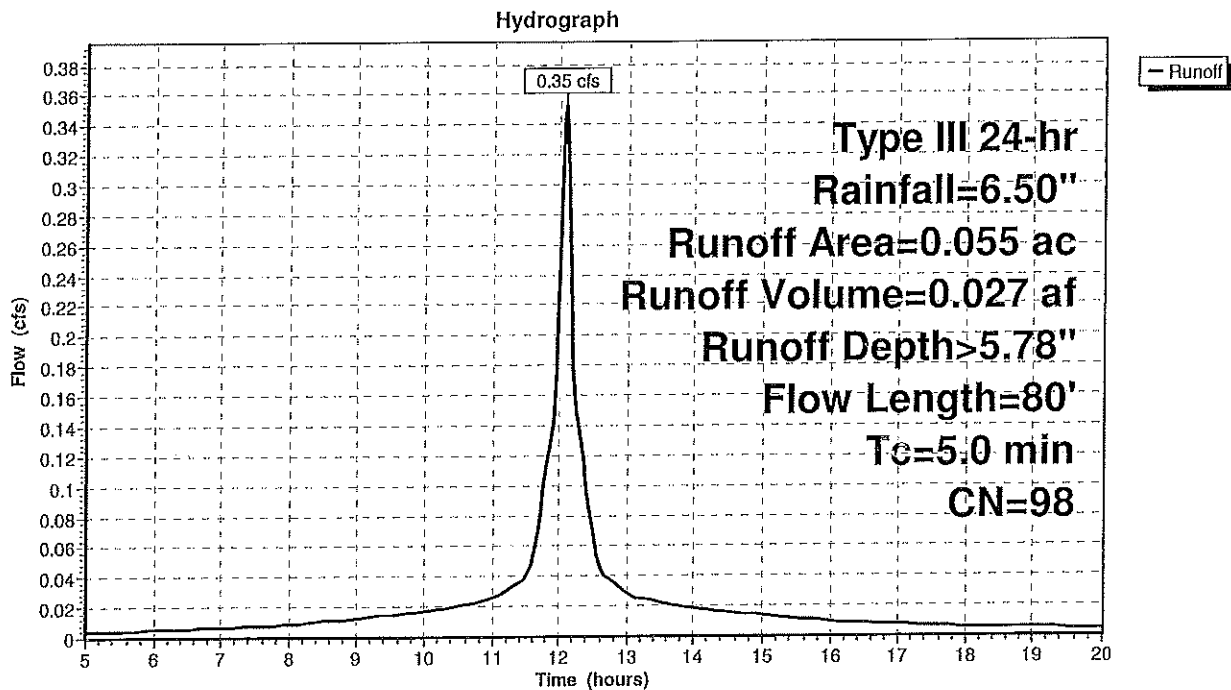
Runoff = 0.35 cfs @ 12.07 hrs, Volume= 0.027 af, Depth> 5.78"  
Routed to Pond 6P : Infiltration Chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr Rainfall=6.50"

Area (ac)	CN	Description
0.055	98	Roofs, HSG A
0.055		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	80		0.27		Direct Entry, Path 1

**Subcatchment L6: Lot 6 Roof Runoff**



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Type III 24-hr Rainfall=6.50"

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## Hydrograph for Subcatchment L6: Lot 6 Roof Runoff

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.37	0.20	0.00	18.25	6.06	5.82	0.01
5.25	0.39	0.22	0.00	18.50	6.08	5.84	0.01
5.50	0.42	0.24	0.00	18.75	6.11	5.87	0.01
5.75	0.44	0.27	0.00	19.00	6.13	5.89	0.01
6.00	0.47	0.29	0.01	19.25	6.15	5.92	0.01
6.25	0.50	0.31	0.01	19.50	6.18	5.94	0.00
6.50	0.52	0.34	0.01	19.75	6.20	5.96	0.00
6.75	0.56	0.37	0.01	20.00	6.22	5.98	0.00
7.00	0.59	0.40	0.01				
7.25	0.62	0.43	0.01				
7.50	0.66	0.47	0.01				
7.75	0.70	0.50	0.01				
8.00	0.74	0.54	0.01				
8.25	0.79	0.58	0.01				
8.50	0.83	0.63	0.01				
8.75	0.89	0.68	0.01				
9.00	0.95	0.74	0.01				
9.25	1.01	0.80	0.01				
9.50	1.08	0.87	0.01				
9.75	1.15	0.94	0.02				
10.00	1.23	1.01	0.02				
10.25	1.31	1.10	0.02				
10.50	1.41	1.19	0.02				
10.75	1.51	1.29	0.02				
11.00	1.62	1.40	0.03				
11.25	1.76	1.54	0.03				
11.50	1.94	1.71	0.04				
11.75	2.31	2.08	0.10				
12.00	3.25	3.02	0.25				
12.25	4.19	3.96	0.15				
12.50	4.56	4.33	0.07				
12.75	4.74	4.50	0.04				
13.00	4.87	4.64	0.03				
13.25	4.99	4.75	0.02				
13.50	5.09	4.86	0.02				
13.75	5.19	4.95	0.02				
14.00	5.27	5.03	0.02				
14.25	5.35	5.11	0.02				
14.50	5.42	5.18	0.02				
14.75	5.49	5.25	0.01				
15.00	5.55	5.32	0.01				
15.25	5.61	5.37	0.01				
15.50	5.67	5.43	0.01				
15.75	5.71	5.48	0.01				
16.00	5.76	5.52	0.01				
16.25	5.80	5.56	0.01				
16.50	5.84	5.60	0.01				
16.75	5.88	5.64	0.01				
17.00	5.91	5.67	0.01				
17.25	5.94	5.71	0.01				
17.50	5.98	5.74	0.01				
17.75	6.00	5.77	0.01				
18.00	6.03	5.79	0.01				

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Type III 24-hr Rainfall=6.50"

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**Summary for Pond 4P: Pond - on site**

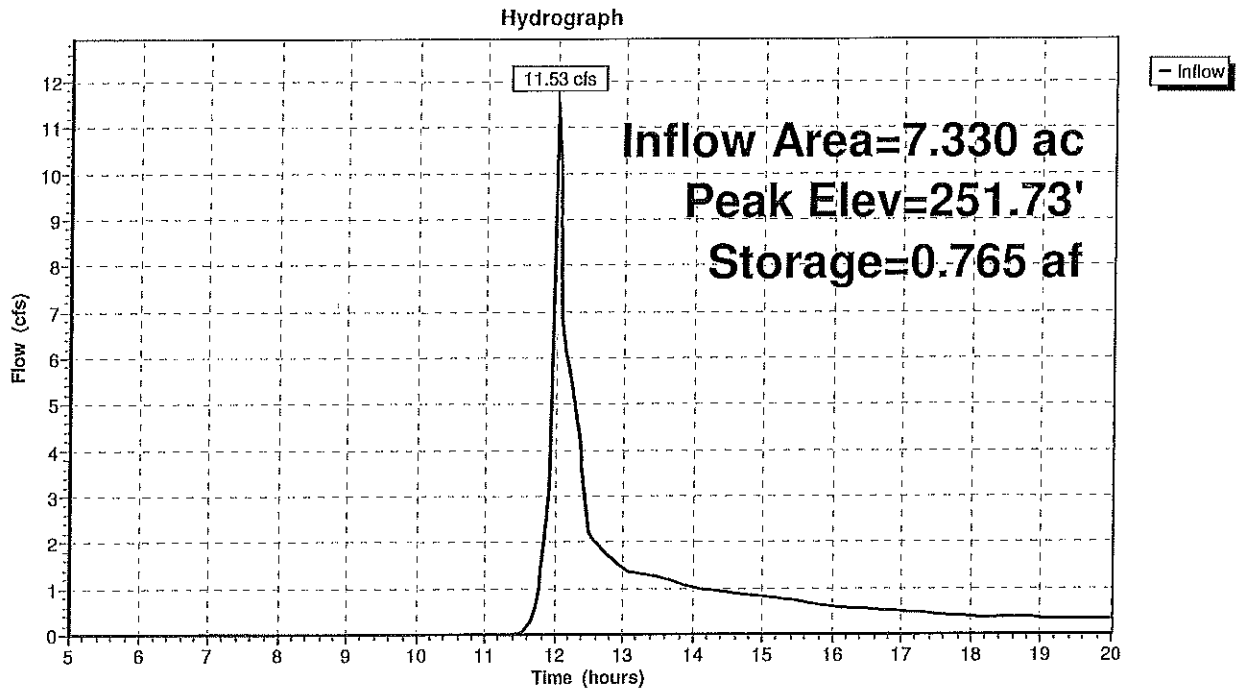
Inflow Area = 7.330 ac, 18.96% Impervious, Inflow Depth > 1.25"  
 Inflow = 11.53 cfs @ 12.02 hrs, Volume= 0.766 af  
 Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 251.73' @ 20.00 hrs Surf.Area= 1.064 ac Storage= 0.765 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)  
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	251.00'	2.160 af	<b>Custom Stage Data (Prismatic) Listed below (Recalc)</b>
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
251.00	1.020	0.000	0.000
252.00	1.080	1.050	1.050
253.00	1.140	1.110	2.160

**Pond 4P: Pond - on site**



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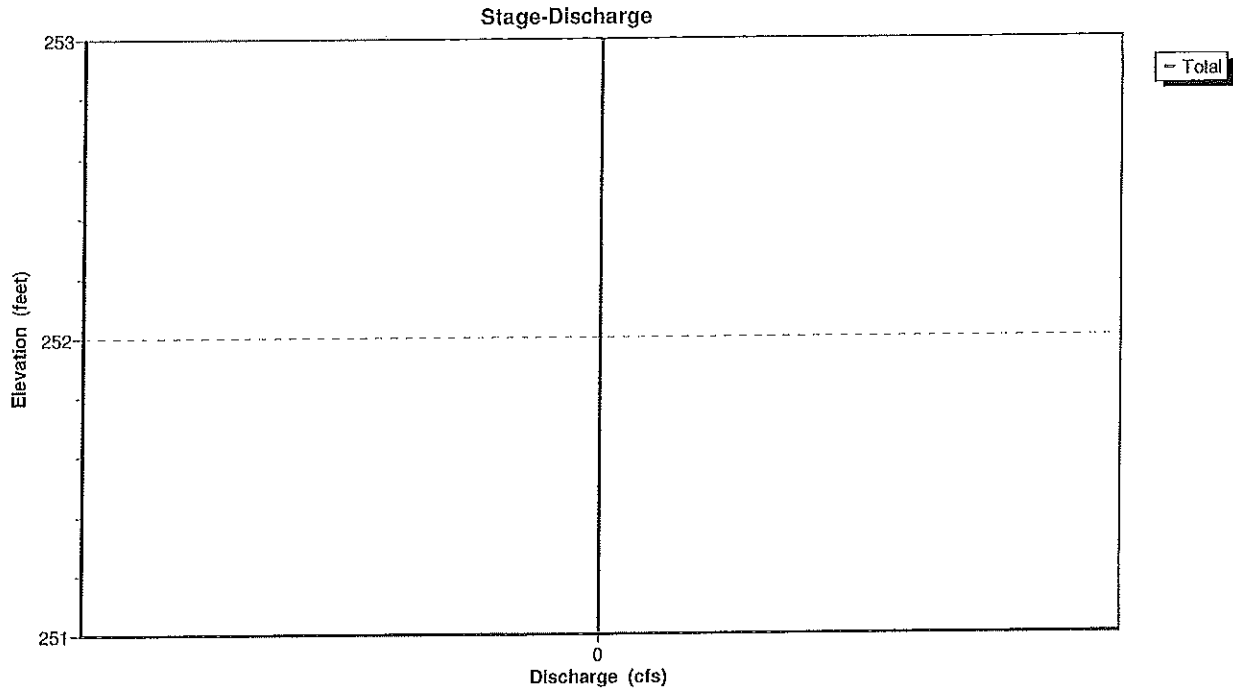
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Type III 24-hr Rainfall=6.50"

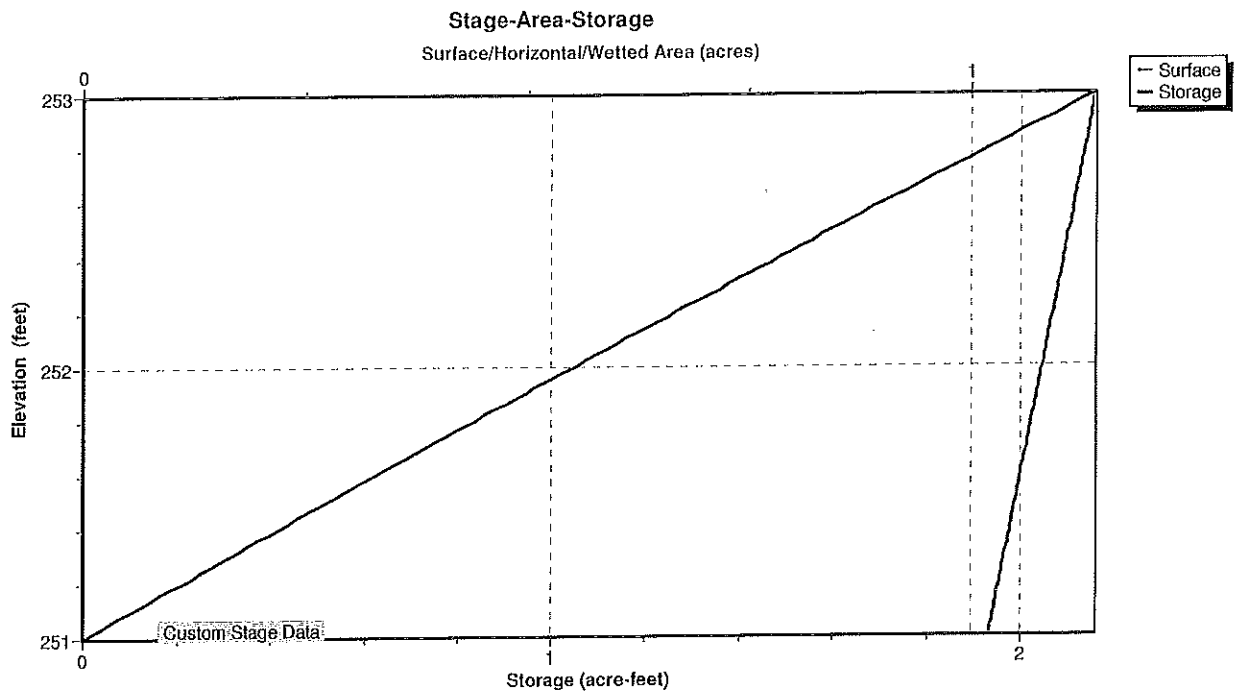
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## Pond 4P: Pond - on site



## Pond 4P: Pond - on site



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100 Year Storm  
Type III 24-hr Rainfall=6.50"

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**Hydrograph for Pond 4P: Pond - on site**

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)
5.00	0.00	0.000	251.00	18.25	0.37	0.715	251.69
5.25	0.00	0.000	251.00	18.50	0.36	0.723	251.69
5.50	0.00	0.000	251.00	18.75	0.36	0.730	251.70
5.75	0.00	0.000	251.00	19.00	0.35	0.738	251.71
6.00	0.00	0.000	251.00	19.25	0.34	0.745	251.72
6.25	0.00	0.000	251.00	19.50	0.33	0.752	251.72
6.50	0.00	0.000	251.00	19.75	0.32	0.759	251.73
6.75	0.00	0.000	251.00	20.00	0.32	<b>0.765</b>	<b>251.73</b>
7.00	0.00	0.000	251.00				
7.25	0.00	0.000	251.00				
7.50	0.00	0.000	251.00				
7.75	0.00	0.000	251.00				
8.00	0.00	0.000	251.00				
8.25	0.00	0.000	251.00				
8.50	0.00	0.000	251.00				
8.75	0.00	0.000	251.00				
9.00	0.00	0.000	251.00				
9.25	0.00	0.000	251.00				
9.50	0.00	0.000	251.00				
9.75	0.00	0.000	251.00				
10.00	0.00	0.000	251.00				
10.25	0.00	0.000	251.00				
10.50	0.00	0.000	251.00				
10.75	0.00	0.000	251.00				
11.00	0.00	0.000	251.00				
11.25	0.00	0.000	251.00				
11.50	0.00	0.000	251.00				
11.75	0.97	0.006	251.01				
12.00	<b>11.25</b>	0.086	251.08				
12.25	5.32	0.240	251.23				
12.50	2.18	0.319	251.31				
12.75	1.77	0.359	251.35				
13.00	1.40	0.392	251.38				
13.25	1.31	0.420	251.41				
13.50	1.22	0.446	251.43				
13.75	1.12	0.470	251.46				
14.00	1.02	0.493	251.48				
14.25	0.97	0.513	251.50				
14.50	0.92	0.533	251.51				
14.75	0.87	0.551	251.53				
15.00	0.82	0.569	251.55				
15.25	0.77	0.585	251.56				
15.50	0.71	0.600	251.58				
15.75	0.65	0.614	251.59				
16.00	0.59	0.627	251.60				
16.25	0.56	0.639	251.62				
16.50	0.54	0.651	251.63				
16.75	0.51	0.662	251.64				
17.00	0.49	0.672	251.65				
17.25	0.46	0.682	251.66				
17.50	0.43	0.691	251.66				
17.75	0.41	0.700	251.67				
18.00	0.38	0.708	251.68				



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## Stage-Discharge for Pond 4P: Pond - on site

Elevation (feet)	Discharge (cfs)	Elevation (feet)	Discharge (cfs)	Elevation (feet)	Discharge (cfs)	Elevation (feet)	Discharge (cfs)
251.00	0.00	251.53	0.00	252.06	0.00	252.59	0.00
251.01	0.00	251.54	0.00	252.07	0.00	252.60	0.00
251.02	0.00	251.55	0.00	252.08	0.00	252.61	0.00
251.03	0.00	251.56	0.00	252.09	0.00	252.62	0.00
251.04	0.00	251.57	0.00	252.10	0.00	252.63	0.00
251.05	0.00	251.58	0.00	252.11	0.00	252.64	0.00
251.06	0.00	251.59	0.00	252.12	0.00	252.65	0.00
251.07	0.00	251.60	0.00	252.13	0.00	252.66	0.00
251.08	0.00	251.61	0.00	252.14	0.00	252.67	0.00
251.09	0.00	251.62	0.00	252.15	0.00	252.68	0.00
251.10	0.00	251.63	0.00	252.16	0.00	252.69	0.00
251.11	0.00	251.64	0.00	252.17	0.00	252.70	0.00
251.12	0.00	251.65	0.00	252.18	0.00	252.71	0.00
251.13	0.00	251.66	0.00	252.19	0.00	252.72	0.00
251.14	0.00	251.67	0.00	252.20	0.00	252.73	0.00
251.15	0.00	251.68	0.00	252.21	0.00	252.74	0.00
251.16	0.00	251.69	0.00	252.22	0.00	252.75	0.00
251.17	0.00	251.70	0.00	252.23	0.00	252.76	0.00
251.18	0.00	251.71	0.00	252.24	0.00	252.77	0.00
251.19	0.00	251.72	0.00	252.25	0.00	252.78	0.00
251.20	0.00	251.73	0.00	252.26	0.00	252.79	0.00
251.21	0.00	251.74	0.00	252.27	0.00	252.80	0.00
251.22	0.00	251.75	0.00	252.28	0.00	252.81	0.00
251.23	0.00	251.76	0.00	252.29	0.00	252.82	0.00
251.24	0.00	251.77	0.00	252.30	0.00	252.83	0.00
251.25	0.00	251.78	0.00	252.31	0.00	252.84	0.00
251.26	0.00	251.79	0.00	252.32	0.00	252.85	0.00
251.27	0.00	251.80	0.00	252.33	0.00	252.86	0.00
251.28	0.00	251.81	0.00	252.34	0.00	252.87	0.00
251.29	0.00	251.82	0.00	252.35	0.00	252.88	0.00
251.30	0.00	251.83	0.00	252.36	0.00	252.89	0.00
251.31	0.00	251.84	0.00	252.37	0.00	252.90	0.00
251.32	0.00	251.85	0.00	252.38	0.00	252.91	0.00
251.33	0.00	251.86	0.00	252.39	0.00	252.92	0.00
251.34	0.00	251.87	0.00	252.40	0.00	252.93	0.00
251.35	0.00	251.88	0.00	252.41	0.00	252.94	0.00
251.36	0.00	251.89	0.00	252.42	0.00	252.95	0.00
251.37	0.00	251.90	0.00	252.43	0.00	252.96	0.00
251.38	0.00	251.91	0.00	252.44	0.00	252.97	0.00
251.39	0.00	251.92	0.00	252.45	0.00	252.98	0.00
251.40	0.00	251.93	0.00	252.46	0.00	252.99	0.00
251.41	0.00	251.94	0.00	252.47	0.00	253.00	0.00
251.42	0.00	251.95	0.00	252.48	0.00		
251.43	0.00	251.96	0.00	252.49	0.00		
251.44	0.00	251.97	0.00	252.50	0.00		
251.45	0.00	251.98	0.00	252.51	0.00		
251.46	0.00	251.99	0.00	252.52	0.00		
251.47	0.00	252.00	0.00	252.53	0.00		
251.48	0.00	252.01	0.00	252.54	0.00		
251.49	0.00	252.02	0.00	252.55	0.00		
251.50	0.00	252.03	0.00	252.56	0.00		
251.51	0.00	252.04	0.00	252.57	0.00		
251.52	0.00	252.05	0.00	252.58	0.00		

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100 Year Storm  
Type III 24-hr Rainfall=6.50"

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**Stage-Area-Storage for Pond 4P: Pond - on site**

Elevation (feet)	Surface (acres)	Storage (acre-feet)	Elevation (feet)	Surface (acres)	Storage (acre-feet)
251.00	1.020	0.000	252.06	1.084	1.115
251.02	1.021	0.020	252.08	1.085	1.137
251.04	1.022	0.041	252.10	1.086	1.158
251.06	1.024	0.061	252.12	1.087	1.180
251.08	1.025	0.082	252.14	1.088	1.202
251.10	1.026	0.102	252.16	1.090	1.224
251.12	1.027	0.123	252.18	1.091	1.245
251.14	1.028	0.143	252.20	1.092	1.267
251.16	1.030	0.164	252.22	1.093	1.289
251.18	1.031	0.185	252.24	1.094	1.311
251.20	1.032	0.205	252.26	1.096	1.333
251.22	1.033	0.226	252.28	1.097	1.355
251.24	1.034	0.247	252.30	1.098	1.377
251.26	1.036	0.267	252.32	1.099	1.399
251.28	1.037	0.288	252.34	1.100	1.421
251.30	1.038	0.309	252.36	1.102	1.443
251.32	1.039	0.329	252.38	1.103	1.465
251.34	1.040	0.350	252.40	1.104	1.487
251.36	1.042	0.371	252.42	1.105	1.509
251.38	1.043	0.392	252.44	1.106	1.531
251.40	1.044	0.413	252.46	1.108	1.553
251.42	1.045	0.434	252.48	1.109	1.575
251.44	1.046	0.455	252.50	1.110	1.598
251.46	1.048	0.476	252.52	1.111	1.620
251.48	1.049	0.497	252.54	1.112	1.642
251.50	1.050	0.517	252.56	1.114	1.664
251.52	1.051	0.539	252.58	1.115	1.686
251.54	1.052	0.560	252.60	1.116	1.709
251.56	1.054	0.581	252.62	1.117	1.731
251.58	1.055	0.602	252.64	1.118	1.753
251.60	1.056	0.623	252.66	1.120	1.776
251.62	1.057	0.644	252.68	1.121	1.798
251.64	1.058	0.665	252.70	1.122	1.821
251.66	1.060	0.686	252.72	1.123	1.843
251.68	1.061	0.707	252.74	1.124	1.866
251.70	1.062	0.729	252.76	1.126	1.888
251.72	1.063	0.750	252.78	1.127	1.911
251.74	1.064	0.771	252.80	1.128	1.933
251.76	1.066	0.793	252.82	1.129	1.956
251.78	1.067	0.814	252.84	1.130	1.978
251.80	1.068	0.835	252.86	1.132	2.001
251.82	1.069	0.857	252.88	1.133	2.024
251.84	1.070	0.878	252.90	1.134	2.046
251.86	1.072	0.899	252.92	1.135	2.069
251.88	1.073	0.921	252.94	1.136	2.092
251.90	1.074	0.942	252.96	1.138	2.114
251.92	1.075	0.964	252.98	1.139	2.137
251.94	1.076	0.985	253.00	1.140	2.160
251.96	1.078	1.007			
251.98	1.079	1.028			
252.00	1.080	1.050			
252.02	1.081	1.072			
252.04	1.082	1.093			

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100 Year Storm  
Type III 24-hr Rainfall=6.50"

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## Summary for Pond 5P: Infiltration Chambers

Inflow Area = 0.055 ac, 100.00% Impervious, Inflow Depth > 5.78"  
 Inflow = 0.35 cfs @ 12.07 hrs, Volume= 0.027 af  
 Outflow = 0.02 cfs @ 10.55 hrs, Volume= 0.016 af, Atten= 94%, Lag= 0.0 min  
 Secondary = 0.02 cfs @ 10.55 hrs, Volume= 0.016 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 1.79' @ 15.12 hrs Surf.Area= 0.005 ac Storage= 0.013 af

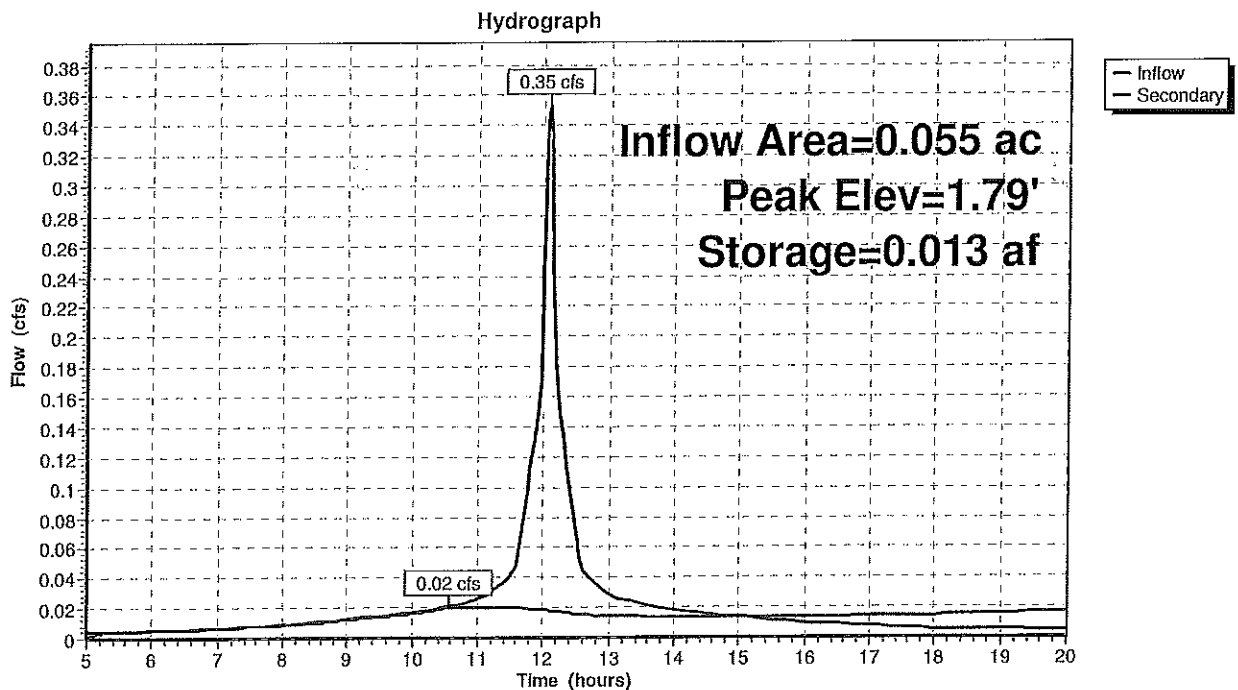
Plug-Flow detention time= 148.6 min calculated for 0.016 af (62% of inflow)  
 Center-of-Mass det. time= 70.8 min ( 803.9 - 733.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	0.015 af	<b>Cultec R-330XLHD x 12</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 4 rows

Device	Routing	Invert	Outlet Devices
#1	Secondary	0.00'	<b>2.410 in/hr Exfiltration over Surface area</b>

**Secondary OutFlow** Max=0.02 cfs @ 10.55 hrs HW=0.03' (Free Discharge)  
 ↑ 1=Exfiltration (Exfiltration Controls 0.02 cfs)

## Pond 5P: Infiltration Chambers



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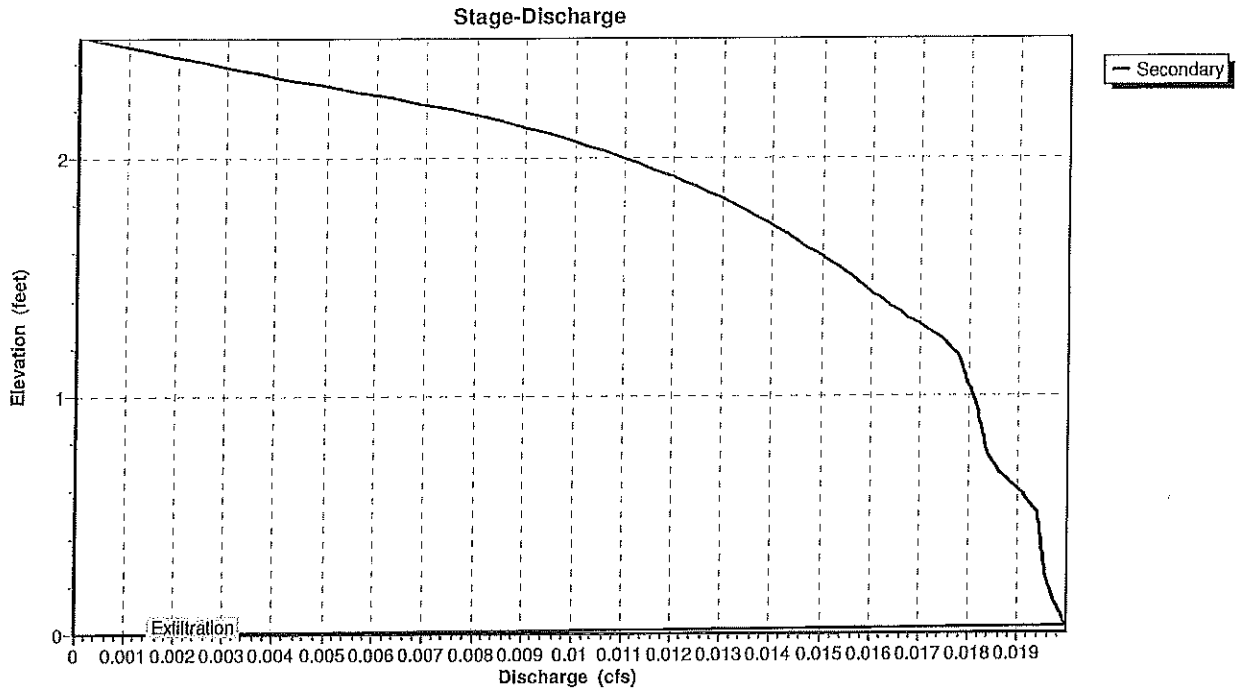
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Type III 24-hr Rainfall=6.50"

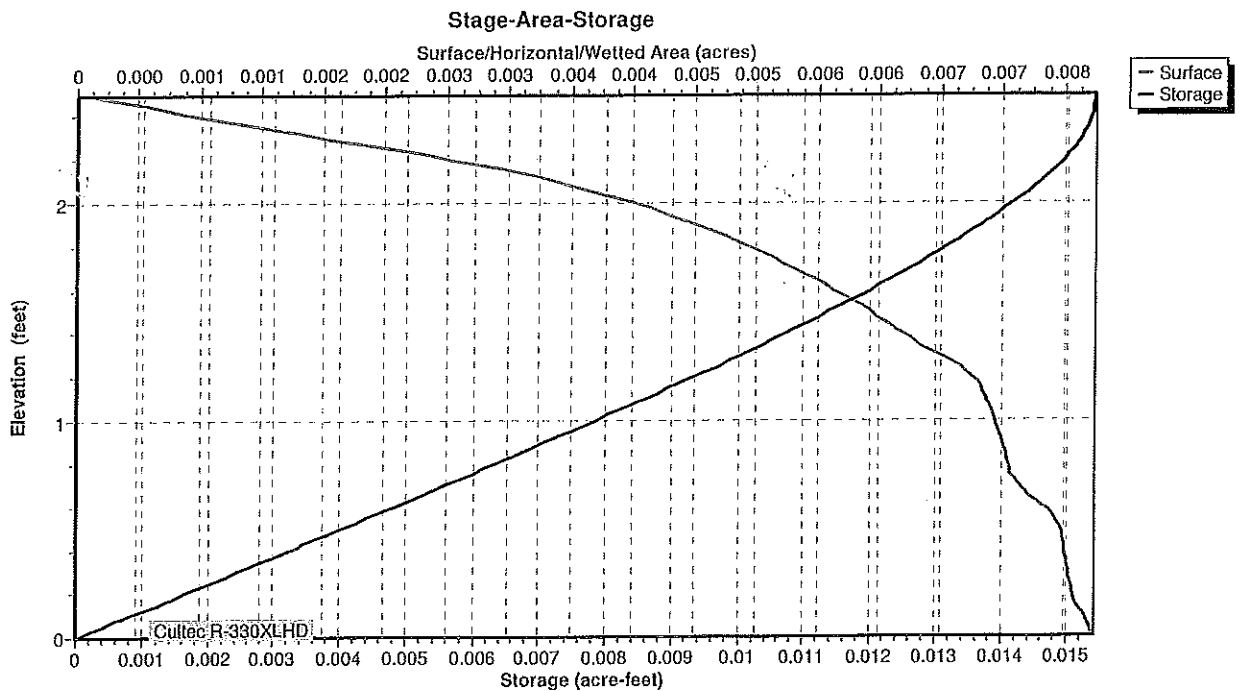
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**Pond 5P: Infiltration Chambers**



**Pond 5P: Infiltration Chambers**



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Type III 24-hr Rainfall=6.50"

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**Hydrograph for Pond 5P: Infiltration Chambers**

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Secondary (cfs)
5.00	0.00	0.000	0.00	0.00
5.50	0.00	0.000	0.01	0.00
6.00	0.01	0.000	0.01	0.01
6.50	0.01	0.000	0.01	0.01
7.00	0.01	0.000	0.01	0.01
7.50	0.01	0.000	0.01	0.01
8.00	0.01	0.000	0.01	0.01
8.50	0.01	0.000	0.01	0.01
9.00	0.01	0.000	0.02	0.01
9.50	0.01	0.000	0.02	0.01
10.00	0.02	0.000	0.02	0.02
10.50	0.02	0.000	0.02	<b>0.02</b>
11.00	0.03	0.000	0.04	<b>0.02</b>
11.50	0.04	0.001	0.10	0.02
12.00	<b>0.25</b>	0.004	0.53	0.02
12.50	<b>0.07</b>	0.011	1.47	0.02
13.00	0.03	0.012	1.63	0.01
13.50	0.02	0.013	1.70	0.01
14.00	0.02	0.013	1.75	0.01
14.50	0.02	0.013	1.77	0.01
15.00	0.01	<b>0.013</b>	<b>1.79</b>	0.01
15.50	0.01	<b>0.013</b>	<b>1.78</b>	0.01
16.00	0.01	0.013	1.76	0.01
16.50	0.01	0.013	1.73	0.01
17.00	0.01	0.013	1.68	0.01
17.50	0.01	0.012	1.64	0.01
18.00	0.01	0.012	1.58	0.02
18.50	0.01	0.011	1.51	0.02
19.00	0.01	0.011	1.45	0.02
19.50	0.00	0.011	1.38	0.02
20.00	0.00	0.010	1.31	0.02

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100 Year Storm  
Type III 24-hr Rainfall=6.50"

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**Stage-Discharge for Pond 5P: Infiltration Chambers**

Elevation (feet)	Secondary (cfs)	Elevation (feet)	Secondary (cfs)	Elevation (feet)	Secondary (cfs)
0.00	0.00	1.06	0.02	2.12	0.01
0.02	0.02	1.08	0.02	2.14	0.01
0.04	0.02	1.10	0.02	2.16	0.01
0.06	0.02	1.12	0.02	2.18	0.01
0.08	0.02	1.14	0.02	2.20	0.01
0.10	0.02	1.16	0.02	2.22	0.01
0.12	0.02	1.18	0.02	2.24	0.01
0.14	0.02	1.20	0.02	2.26	0.01
0.16	0.02	1.22	0.02	2.28	0.01
0.18	0.02	1.24	0.02	2.30	0.00
0.20	0.02	1.26	0.02	2.32	0.00
0.22	0.02	1.28	0.02	2.34	0.00
0.24	0.02	1.30	0.02	2.36	0.00
0.26	0.02	1.32	0.02	2.38	0.00
0.28	0.02	1.34	0.02	2.40	0.00
0.30	0.02	1.36	0.02	2.42	0.00
0.32	0.02	1.38	0.02	2.44	0.00
0.34	0.02	1.40	0.02	2.46	0.00
0.36	0.02	1.42	0.02	2.48	0.00
0.38	0.02	1.44	0.02	2.50	0.00
0.40	0.02	1.46	0.02		
0.42	0.02	1.48	0.02		
0.44	0.02	1.50	0.02		
0.46	0.02	1.52	0.02		
0.48	0.02	1.54	0.02		
0.50	0.02	1.56	0.02		
0.52	0.02	1.58	0.02		
0.54	0.02	1.60	0.01		
0.56	0.02	1.62	0.01		
0.58	0.02	1.64	0.01		
0.60	0.02	1.66	0.01		
0.62	0.02	1.68	0.01		
0.64	0.02	1.70	0.01		
0.66	0.02	1.72	0.01		
0.68	0.02	1.74	0.01		
0.70	0.02	1.76	0.01		
0.72	0.02	1.78	0.01		
0.74	0.02	1.80	0.01		
0.76	0.02	1.82	0.01		
0.78	0.02	1.84	0.01		
0.80	0.02	1.86	0.01		
0.82	0.02	1.88	0.01		
0.84	0.02	1.90	0.01		
0.86	0.02	1.92	0.01		
0.88	0.02	1.94	0.01		
0.90	0.02	1.96	0.01		
0.92	0.02	1.98	0.01		
0.94	0.02	2.00	0.01		
0.96	0.02	2.02	0.01		
0.98	0.02	2.04	0.01		
1.00	0.02	2.06	0.01		
1.02	0.02	2.08	0.01		
1.04	0.02	2.10	0.01		

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**Stage-Area-Storage for Pond 5P: Infiltration Chambers**

Elevation (feet)	Surface (acres)	Storage (acre-feet)
0.00	<b>0.008</b>	0.000
0.05	0.008	0.000
0.10	0.008	0.001
0.15	0.008	0.001
0.20	0.008	0.002
0.25	0.008	0.002
0.30	0.008	0.002
0.35	0.008	0.003
0.40	0.008	0.003
0.45	0.008	0.004
0.50	0.008	0.004
0.55	0.008	0.004
0.60	0.008	0.005
0.65	0.008	0.005
0.70	0.008	0.006
0.75	0.008	0.006
0.80	0.008	0.006
0.85	0.008	0.007
0.90	0.007	0.007
0.95	0.007	0.007
1.00	0.007	0.008
1.05	0.007	0.008
1.10	0.007	0.009
1.15	0.007	0.009
1.20	0.007	0.009
1.25	0.007	0.010
1.30	0.007	0.010
1.35	0.007	0.010
1.40	0.007	0.011
1.45	0.007	0.011
1.50	0.006	0.011
1.55	0.006	0.012
1.60	0.006	0.012
1.65	0.006	0.012
1.70	0.006	0.013
1.75	0.006	0.013
1.80	0.005	0.013
1.85	0.005	0.013
1.90	0.005	0.014
1.95	0.005	0.014
2.00	0.005	0.014
2.05	0.004	0.014
2.10	0.004	0.015
2.15	0.004	0.015
2.20	0.003	0.015
2.25	0.003	0.015
2.30	0.002	0.015
2.35	0.002	0.015
2.40	0.001	0.015
2.45	0.001	0.015
2.50	0.000	<b>0.015</b>

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Type III 24-hr Rainfall=6.50"

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**Summary for Pond 6P: Infiltration Chambers**

Inflow Area = 0.055 ac, 100.00% Impervious, Inflow Depth > 5.78"  
 Inflow = 0.35 cfs @ 12.07 hrs, Volume= 0.027 af  
 Outflow = 0.02 cfs @ 10.55 hrs, Volume= 0.016 af, Atten= 94%, Lag= 0.0 min  
 Secondary = 0.02 cfs @ 10.55 hrs, Volume= 0.016 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 1.79' @ 15.12 hrs Surf.Area= 0.005 ac Storage= 0.013 af

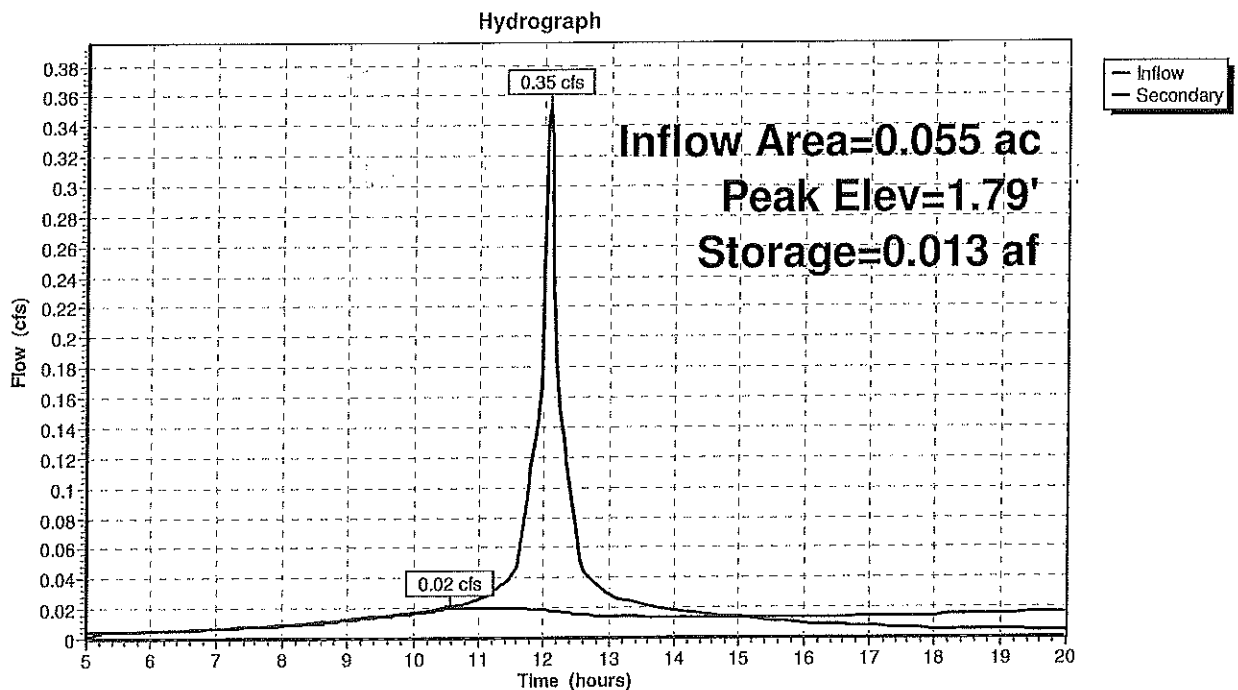
Plug-Flow detention time= 148.6 min calculated for 0.016 af (62% of inflow)  
 Center-of-Mass det. time= 70.8 min ( 803.9 - 733.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	0.015 af	<b>Cultec R-330XLHD x 12</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 4 rows

Device	Routing	Invert	Outlet Devices
#1	Secondary	0.00'	<b>2.410 in/hr Exfiltration over Surface area</b>

**Secondary OutFlow** Max=0.02 cfs @ 10.55 hrs HW=0.03' (Free Discharge)  
 ↑=Exfiltration (Exfiltration Controls 0.02 cfs)

**Pond 6P: Infiltration Chambers**





**Dutchco - Hartwell Ave Post Development**

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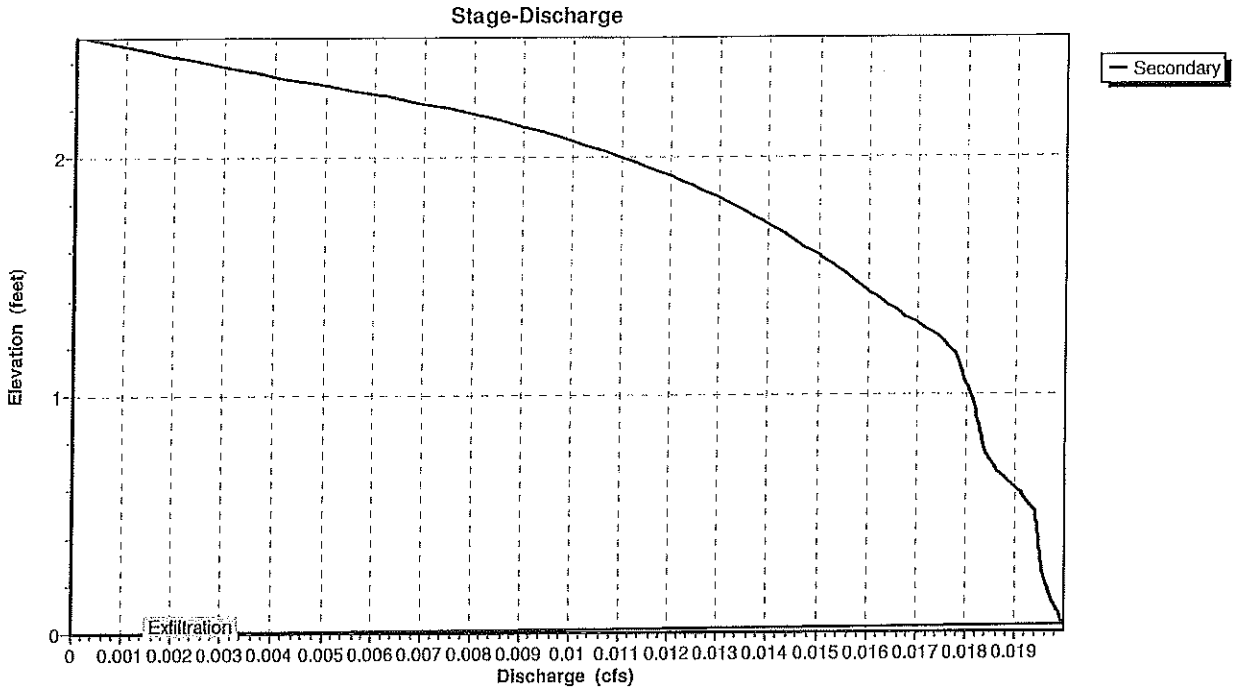
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100 Year Storm  
Type III 24-hr Rainfall=6.50"

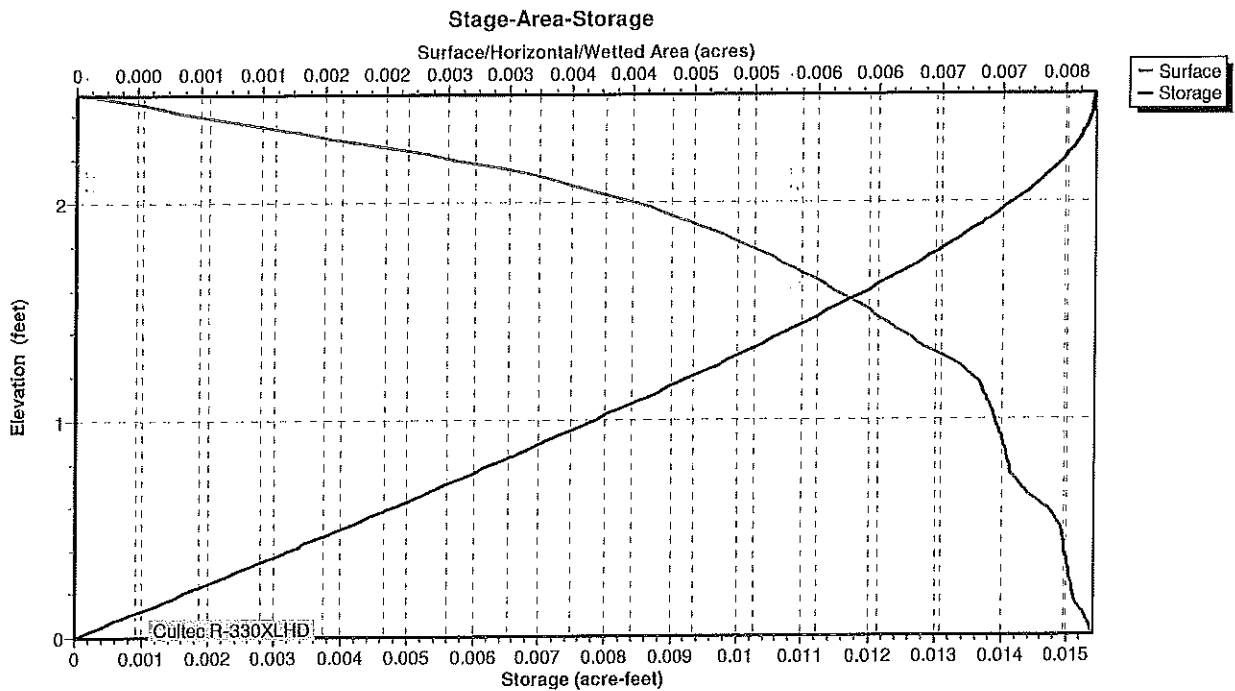
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**Pond 6P: Infiltration Chambers**



**Pond 6P: Infiltration Chambers**



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## Hydrograph for Pond 6P: Infiltration Chambers

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Secondary (cfs)
5.00	0.00	0.000	0.00	0.00
5.50	0.00	0.000	0.01	0.00
6.00	0.01	0.000	0.01	0.01
6.50	0.01	0.000	0.01	0.01
7.00	0.01	0.000	0.01	0.01
7.50	0.01	0.000	0.01	0.01
8.00	0.01	0.000	0.01	0.01
8.50	0.01	0.000	0.01	0.01
9.00	0.01	0.000	0.02	0.01
9.50	0.01	0.000	0.02	0.01
10.00	0.02	0.000	0.02	0.02
10.50	0.02	0.000	0.02	<b>0.02</b>
11.00	0.03	0.000	0.04	<b>0.02</b>
11.50	0.04	0.001	0.10	0.02
12.00	<b>0.25</b>	0.004	0.53	0.02
12.50	<b>0.07</b>	0.011	1.47	0.02
13.00	0.03	0.012	1.63	0.01
13.50	0.02	0.013	1.70	0.01
14.00	0.02	0.013	1.75	0.01
14.50	0.02	0.013	1.77	0.01
15.00	0.01	<b>0.013</b>	<b>1.79</b>	0.01
15.50	0.01	<b>0.013</b>	<b>1.78</b>	0.01
16.00	0.01	0.013	1.76	0.01
16.50	0.01	0.013	1.73	0.01
17.00	0.01	0.013	1.68	0.01
17.50	0.01	0.012	1.64	0.01
18.00	0.01	0.012	1.58	0.02
18.50	0.01	0.011	1.51	0.02
19.00	0.01	0.011	1.45	0.02
19.50	0.00	0.011	1.38	0.02
20.00	0.00	0.010	1.31	0.02

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100 Year Storm  
Type III 24-hr Rainfall=6.50"

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**Stage-Discharge for Pond 6P: Infiltration Chambers**

Elevation (feet)	Secondary (cfs)	Elevation (feet)	Secondary (cfs)	Elevation (feet)	Secondary (cfs)
0.00	0.00	1.06	0.02	2.12	0.01
0.02	0.02	1.08	0.02	2.14	0.01
0.04	0.02	1.10	0.02	2.16	0.01
0.06	0.02	1.12	0.02	2.18	0.01
0.08	0.02	1.14	0.02	2.20	0.01
0.10	0.02	1.16	0.02	2.22	0.01
0.12	0.02	1.18	0.02	2.24	0.01
0.14	0.02	1.20	0.02	2.26	0.01
0.16	0.02	1.22	0.02	2.28	0.01
0.18	0.02	1.24	0.02	2.30	0.00
0.20	0.02	1.26	0.02	2.32	0.00
0.22	0.02	1.28	0.02	2.34	0.00
0.24	0.02	1.30	0.02	2.36	0.00
0.26	0.02	1.32	0.02	2.38	0.00
0.28	0.02	1.34	0.02	2.40	0.00
0.30	0.02	1.36	0.02	2.42	0.00
0.32	0.02	1.38	0.02	2.44	0.00
0.34	0.02	1.40	0.02	2.46	0.00
0.36	0.02	1.42	0.02	2.48	0.00
0.38	0.02	1.44	0.02	2.50	0.00
0.40	0.02	1.46	0.02		
0.42	0.02	1.48	0.02		
0.44	0.02	1.50	0.02		
0.46	0.02	1.52	0.02		
0.48	0.02	1.54	0.02		
0.50	0.02	1.56	0.02		
0.52	0.02	1.58	0.02		
0.54	0.02	1.60	0.01		
0.56	0.02	1.62	0.01		
0.58	0.02	1.64	0.01		
0.60	0.02	1.66	0.01		
0.62	0.02	1.68	0.01		
0.64	0.02	1.70	0.01		
0.66	0.02	1.72	0.01		
0.68	0.02	1.74	0.01		
0.70	0.02	1.76	0.01		
0.72	0.02	1.78	0.01		
0.74	0.02	1.80	0.01		
0.76	0.02	1.82	0.01		
0.78	0.02	1.84	0.01		
0.80	0.02	1.86	0.01		
0.82	0.02	1.88	0.01		
0.84	0.02	1.90	0.01		
0.86	0.02	1.92	0.01		
0.88	0.02	1.94	0.01		
0.90	0.02	1.96	0.01		
0.92	0.02	1.98	0.01		
0.94	0.02	2.00	0.01		
0.96	0.02	2.02	0.01		
0.98	0.02	2.04	0.01		
1.00	0.02	2.06	0.01		
1.02	0.02	2.08	0.01		
1.04	0.02	2.10	0.01		

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**Stage-Area-Storage for Pond 6P: Infiltration Chambers**

Elevation (feet)	Surface (acres)	Storage (acre-feet)
0.00	<b>0.008</b>	0.000
0.05	0.008	0.000
0.10	0.008	0.001
0.15	0.008	0.001
0.20	0.008	0.002
0.25	0.008	0.002
0.30	0.008	0.002
0.35	0.008	0.003
0.40	0.008	0.003
0.45	0.008	0.004
0.50	0.008	0.004
0.55	0.008	0.004
0.60	0.008	0.005
0.65	0.008	0.005
0.70	0.008	0.006
0.75	0.008	0.006
0.80	0.008	0.006
0.85	0.008	0.007
0.90	0.007	0.007
0.95	0.007	0.007
1.00	0.007	0.008
1.05	0.007	0.008
1.10	0.007	0.009
1.15	0.007	0.009
1.20	0.007	0.009
1.25	0.007	0.010
1.30	0.007	0.010
1.35	0.007	0.010
1.40	0.007	0.011
1.45	0.007	0.011
1.50	0.006	0.011
1.55	0.006	0.012
1.60	0.006	0.012
1.65	0.006	0.012
1.70	0.006	0.013
1.75	0.006	0.013
1.80	0.005	0.013
1.85	0.005	0.013
1.90	0.005	0.014
1.95	0.005	0.014
2.00	0.005	0.014
2.05	0.004	0.014
2.10	0.004	0.015
2.15	0.004	0.015
2.20	0.003	0.015
2.25	0.003	0.015
2.30	0.002	0.015
2.35	0.002	0.015
2.40	0.001	0.015
2.45	0.001	0.015
2.50	0.000	<b>0.015</b>

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100 Year Storm  
Type III 24-hr Rainfall=6.50"

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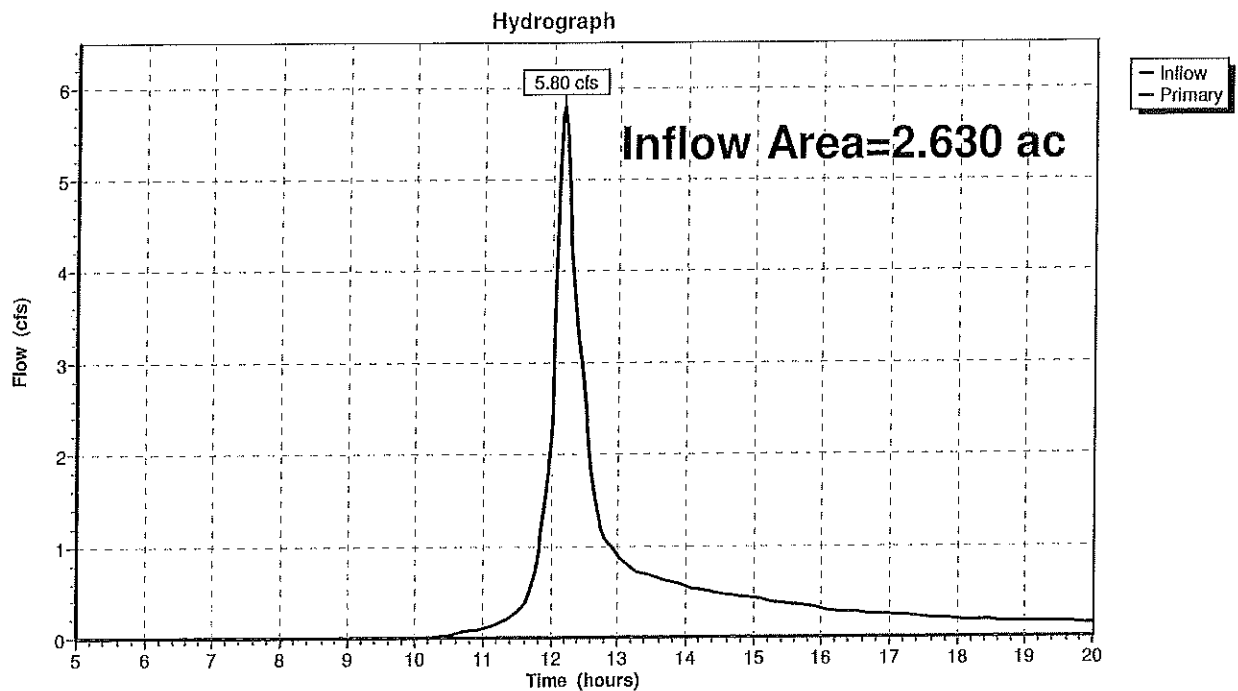
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## Summary for Link DP: Northerly Low Area

Inflow Area = 2.630 ac, 11.41% Impervious, Inflow Depth > 2.14"  
Inflow = 5.80 cfs @ 12.17 hrs, Volume= 0.469 af  
Primary = 5.80 cfs @ 12.17 hrs, Volume= 0.469 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

## Link DP: Northerly Low Area



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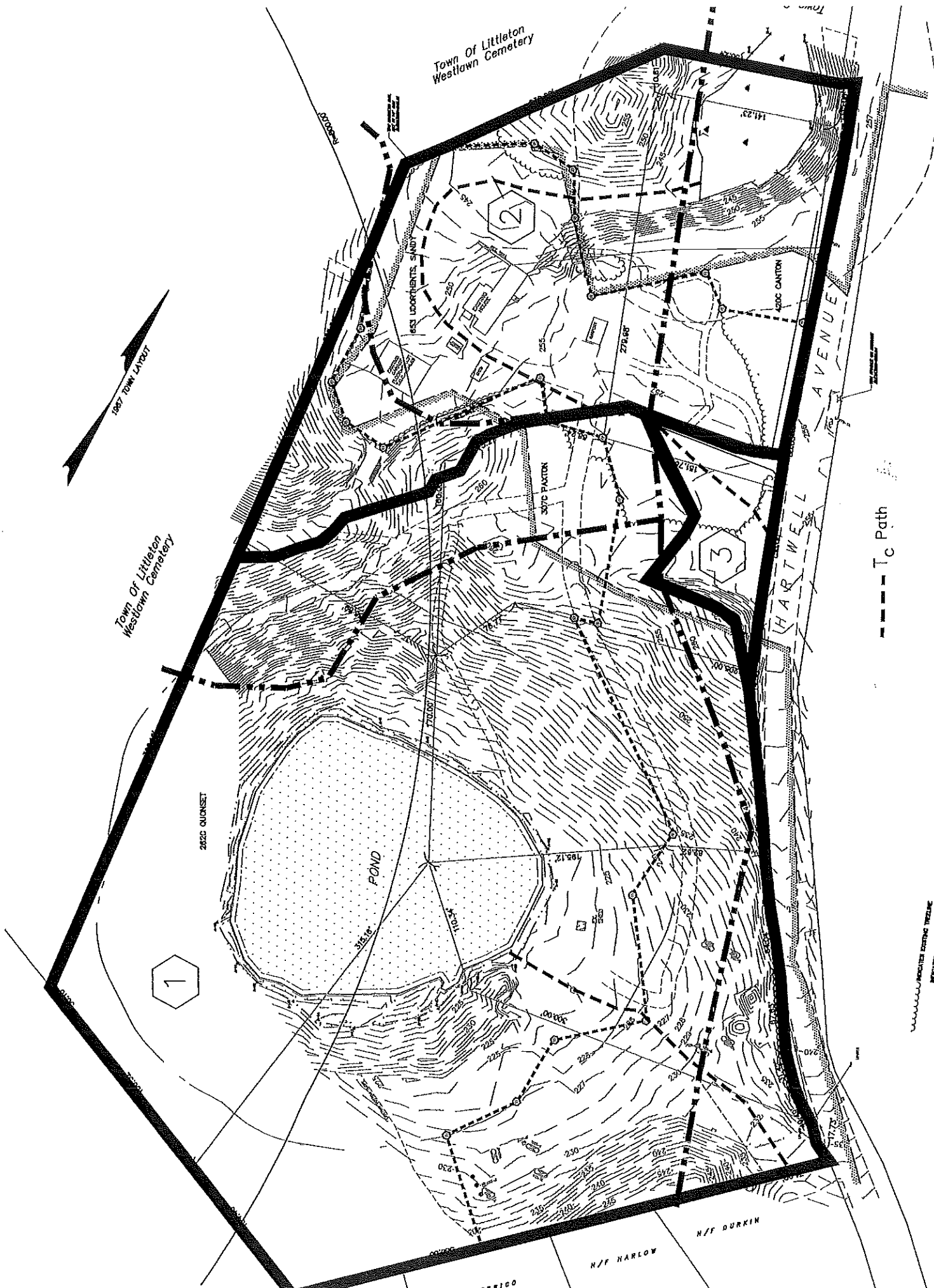
**Hydrograph for Link DP: Northerly Low Area**

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)	Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
5.00	0.00	0.00	0.00	18.25	0.18	0.00	0.18
5.25	0.00	0.00	0.00	18.50	0.18	0.00	0.18
5.50	0.00	0.00	0.00	18.75	0.17	0.00	0.17
5.75	0.00	0.00	0.00	19.00	0.17	0.00	0.17
6.00	0.00	0.00	0.00	19.25	0.16	0.00	0.16
6.25	0.00	0.00	0.00	19.50	0.16	0.00	0.16
6.50	0.00	0.00	0.00	19.75	0.16	0.00	0.16
6.75	0.00	0.00	0.00	20.00	0.15	0.00	0.15
7.00	0.00	0.00	0.00				
7.25	0.00	0.00	0.00				
7.50	0.00	0.00	0.00				
7.75	0.00	0.00	0.00				
8.00	0.00	0.00	0.00				
8.25	0.00	0.00	0.00				
8.50	0.00	0.00	0.00				
8.75	0.00	0.00	0.00				
9.00	0.00	0.00	0.00				
9.25	0.00	0.00	0.00				
9.50	0.00	0.00	0.00				
9.75	0.00	0.00	0.00				
10.00	0.00	0.00	0.00				
10.25	0.01	0.00	0.01				
10.50	0.03	0.00	0.03				
10.75	0.07	0.00	0.07				
11.00	0.11	0.00	0.11				
11.25	0.17	0.00	0.17				
11.50	0.29	0.00	0.29				
11.75	0.71	0.00	0.71				
12.00	2.33	0.00	2.33				
12.25	4.89	0.00	4.89				
12.50	2.54	0.00	2.54				
12.75	1.17	0.00	1.17				
13.00	0.88	0.00	0.88				
13.25	0.73	0.00	0.73				
13.50	0.67	0.00	0.67				
13.75	0.61	0.00	0.61				
14.00	0.56	0.00	0.56				
14.25	0.51	0.00	0.51				
14.50	0.48	0.00	0.48				
14.75	0.45	0.00	0.45				
15.00	0.43	0.00	0.43				
15.25	0.40	0.00	0.40				
15.50	0.37	0.00	0.37				
15.75	0.34	0.00	0.34				
16.00	0.31	0.00	0.31				
16.25	0.28	0.00	0.28				
16.50	0.27	0.00	0.27				
16.75	0.26	0.00	0.26				
17.00	0.24	0.00	0.24				
17.25	0.23	0.00	0.23				
17.50	0.22	0.00	0.22				
17.75	0.20	0.00	0.20				
18.00	0.19	0.00	0.19				

# SUBCATCHMENT MAPS

1

1



Town Of Littleton  
Westlawn Cemetery

Town Of Littleton  
Westlawn Cemetery

1987 TOWN LAYOUT

HARTWELL AVENUE

282C QUINSET

POND

307C PAATON

300C CANTON

Tc Path

PRE-DEVELOPMENT SUBCATCHMENT MAP  
SCALE: 1" = 100'

- ~~~~~ INDICATES EXISTING TIE LINE
- INDICATES PROPOSED TIE LINE
- CENTER CONTROL MARKER
- PROPERTY BOUNDARY
- PROPERTY BOUNDARY
- PROPERTY BOUNDARY

H/F ERRICO

H/F HARLOW

H/F DURKIN





# RECHARGE VOLUME CALCULATIONS

## RECHARGE VOLUME CALCULATION

September 18, 2023

Lot 1 – Hartwell Avenue

Calculate recharge volume lost to newly developed impervious areas.

- Quonset (A Soils) and Canton (B soils) –

Total of 0.14 acres (AC) of impervious area in the A and B soil groups

*Recharge volume =*

$$A \text{ Soil} - (0.10 \text{ AC})(0.60"/12"/\text{ft})(43,560 \text{ SF/AC}) = 218 \text{ Cubic Feet (CF)}$$

$$B \text{ Soil} - (0.04 \text{ AC})(0.35"/12"/\text{ft})(43,560 \text{ SF/AC}) = 51 \text{ CF}$$

TOTAL RECHARGE VOLUME REQUIRED = 269 CF

Calculate the recharge volume provided.

Calculate Subsurface Chamber volume from HydroCAD:

Subsurface Roof System

Storage in Recharge units is 0.006 Acre Feet (AF)

$$\text{Total Storage Volume} = 0.008 \text{ AF} \times 43560 \text{ AC} = 348 \text{ CF}$$

TOTAL RECHARGE VOLUME PROVIDED = 348 CF

Recharge volume provided exceeds the recharge volume required.

## DRAWDOWN CALCULATION

September 18, 2023

Lot 1 – Hartwell Avenue

Time (drawdown) = Rv (storage volume) / [K x(Bottom Area)]

Use 8.27 inches/hour (Quonset is an A soil type)

K - Saturated Hydraulic Conductivity 8.27 Inches / Hour = 0.689 Feet / Hour

Infiltration within the subsurface system

$$\text{Time} = 348 \text{ C.F.} / [(0.689 \text{ Feet / Hour}) \times 176 \text{ S.F.}]$$

$$\text{Time} = 2.87 \text{ Hours}$$

The subsurface system will drawdown in less than 72 hours.

## RECHARGE VOLUME CALCULATION

September 18, 2023

Lot 2 – Hartwell Avenue

Calculate recharge volume lost to newly developed impervious areas.

- Quonset (A Soils) and Canton (B soils) –

Total of 0.09 acres (AC) of impervious area in the A and B soil groups

*Recharge volume =*

$$A \text{ Soil} - (0.07 \text{ AC})(0.60"/12"/ft)(43,560 \text{ SF/AC}) = 153 \text{ CF}$$

$$B \text{ Soil} - (0.02 \text{ AC})(0.35"/12"/ft)(43,560 \text{ SF/AC}) = 26 \text{ CF}$$

TOTAL RECHARGE VOLUME REQUIRED = 179 CF

Calculate the recharge volume provided.

Calculate Subsurface Chamber volume from HydroCAD:

Subsurface Roof System

Storage in Recharge units is 0.006 Acre Feet (AF)

$$\text{Total Storage Volume} = 0.008 \text{ AF} \times 43560 \text{ AC} = 348 \text{ CF}$$

TOTAL RECHARGE VOLUME PROVIDED = 348 CF

Recharge volume provided exceeds the recharge volume required.

## DRAWDOWN CALCULATION

September 18, 2023

Lot 2 – Hartwell Avenue

Time (drawdown) = Rv (storage volume) / [K x(Bottom Area)]

Use 8.27 inches/hour (Quonset is an A soil type)

K - Saturated Hydraulic Conductivity 8.27 Inches / Hour = 0.689 Feet / Hour

Infiltration within the subsurface system

$$\text{Time} = 348 \text{ C.F.} / [(0.689 \text{ Feet / Hour}) \times 176 \text{ S.F.}]$$

$$\text{Time} = 2.87 \text{ Hours}$$

The subsurface system will drawdown in less than 72 hours.

## RECHARGE VOLUME CALCULATION

September 18, 2023

Lot 3 – Hartwell Avenue

Calculate recharge volume lost to newly developed impervious areas.

- Quonset (A Soils) and Canton (B soils) –

Total of 0.08 acres (AC) of impervious area in the A and B soil groups

*Recharge volume =*

$$A \text{ Soil} - (0.06 \text{ AC})(0.60"/12"/ft)(43,560 \text{ SF/AC}) = 131 \text{ CF}$$

$$B \text{ Soil} - (0.02 \text{ AC})(0.35"/12"/ft)(43,560 \text{ SF/AC}) = 26 \text{ CF}$$

TOTAL RECHARGE VOLUME REQUIRED = 157 CF

Calculate the recharge volume provided.

Calculate Subsurface Chamber volume from HydroCAD:

Subsurface Roof System

Storage in Recharge units is 0.006 Acre Feet (AF)

$$\text{Total Storage Volume} = 0.008 \text{ AF} \times 43560 \text{ AC} = 348 \text{ CF}$$

TOTAL RECHARGE VOLUME PROVIDED = 348 CF

Recharge volume provided exceeds the recharge volume required.

## DRAWDOWN CALCULATION

September 18, 2023

Lot 3 – Hartwell Avenue

Time (drawdown) = Rv (storage volume) / [K x(Bottom Area)]

Use 8.27 inches/hour (Quonset is an A soil type)

K - Saturated Hydraulic Conductivity 8.27 Inches / Hour = 0.689 Feet / Hour

Infiltration within the subsurface system

$$\text{Time} = 348 \text{ C.F.} / [(0.689 \text{ Feet / Hour}) \times 176 \text{ S.F.}]$$

$$\text{Time} = 2.87 \text{ Hours}$$

The subsurface system will drawdown in less than 72 hours.



## RECHARGE VOLUME CALCULATION

September 18, 2023

Lot 4 – Hartwell Avenue

Calculate recharge volume lost to newly developed impervious areas.

- Canton (B soils) –

Total of 0.09 acres (AC) of impervious area in the B soil group

*Recharge volume =*

$$B \text{ Soil} - (0.09 \text{ AC})(0.35"/12"/ft)(43,560 \text{ SF/AC}) = 115 \text{ CF}$$

TOTAL RECHARGE VOLUME REQUIRED = 115 CF

Calculate the recharge volume provided.

Calculate Subsurface Chamber volume from HydroCAD:

Subsurface Roof System

Storage in Recharge units is 0.006 Acre Feet (AF)

$$\text{Total Storage Volume} = 0.008 \text{ AF} \times 43560 \text{ AC} = 348 \text{ CF}$$

TOTAL RECHARGE VOLUME PROVIDED = 348 CF

Recharge volume provided exceeds the recharge volume required.

## DRAWDOWN CALCULATION

September 18, 2023

Lot 4 – Hartwell Avenue

Time (drawdown) = Rv (storage volume) / [K x (Bottom Area)]

Use 8.27 inches/hour (Quonset is an A soil type)

K - Saturated Hydraulic Conductivity 8.27 Inches / Hour = 0.689 Feet / Hour

Infiltration within the subsurface system

$$\text{Time} = 348 \text{ C.F.} / [(0.689 \text{ Feet / Hour}) \times 176 \text{ S.F.}]$$

$$\text{Time} = 2.87 \text{ Hours}$$

The subsurface system will drawdown in less than 72 hours.

## RECHARGE VOLUME CALCULATION

September 18, 2023

Lot 5 – Hartwell Avenue

Calculate recharge volume lost to newly developed impervious areas.

- Canton (B soils) & Udorthents, sandy (Using B soil), Paxton (C soils) –

Total of 0.11 acres (AC) of impervious area in the B & C soil groups

*Recharge volume =*

$$B \text{ Soil} - (0.10 \text{ AC})(0.35"/12"/ft)(43,560 \text{ SF/AC}) = 127 \text{ CF}$$

$$C \text{ Soil} - (0.01 \text{ AC})(0.25"/12"/ft)(43,560 \text{ SF/AC}) = 10 \text{ CF}$$

TOTAL RECHARGE VOLUME REQUIRED = 137 CF

Calculate the recharge volume provided.

Calculate Subsurface Chamber volume from HydroCAD:

Subsurface Roof System

Storage in Recharge units is 0.027 Acre Feet (AF)

$$\text{Total Storage Volume} = 0.027 \text{ AF} \times 43560 \text{ AC} = 1,176 \text{ CF}$$

TOTAL RECHARGE VOLUME PROVIDED = 1,176 CF

Recharge volume provided exceeds the recharge volume required.

## DRAWDOWN CALCULATION

September 18, 2023

Lot 5 – Hartwell Avenue

Time (drawdown) = Rv (storage volume) / [K x(Bottom Area)]

Use 1.02 inches/hour (Canton is a B soil type)

K - Saturated Hydraulic Conductivity 1.02 Inches / Hour = 0.085 Feet / Hour

Infiltration within the subsurface system

$$\text{Time} = 1,176 \text{ C.F.} / [(0.085 \text{ Feet / Hour}) \times 478 \text{ S.F.}]$$

$$\text{Time} = 28.95 \text{ Hours}$$

The subsurface system will drawdown in less than 72 hours.

## RECHARGE VOLUME CALCULATION

September 18, 2023

Lot 6 – Hartwell Avenue

Calculate recharge volume lost to newly developed impervious areas.

- Udorthents, sandy (Using B soil) & Paxton (C soils) –

Total of 0.26 acres (AC) of impervious area in the B & C soil groups

*Recharge volume =*

$$B \text{ Soil} - (0.19 \text{ AC})(0.35"/12"/ft)(43,560 \text{ SF/AC}) = 242 \text{ CF}$$

$$C \text{ Soil} - (0.07 \text{ AC})(0.25"/12"/ft)(43,560 \text{ SF/AC}) = 64 \text{ CF}$$

TOTAL RECHARGE VOLUME REQUIRED = 306 CF

Calculate the recharge volume provided.

Calculate Subsurface Chamber volume from HydroCAD:

Subsurface Roof System

Storage in Recharge units is 0.027 Acre Feet (AF)

$$\text{Total Storage Volume} = 0.027 \text{ AF} \times 43560 \text{ AC} = 1,176 \text{ CF}$$

TOTAL RECHARGE VOLUME PROVIDED = 1,176 CF

Recharge volume provided exceeds the recharge volume required.

## DRAWDOWN CALCULATION

September 18, 2023

Lot 6 – Hartwell Avenue

Time (drawdown) = Rv (storage volume) / [K x (Bottom Area)]

Use 1.02 inches/hour (Canton is a B soil type)

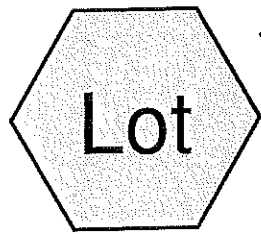
K - Saturated Hydraulic Conductivity 1.02 Inches / Hour = 0.085 Feet / Hour

Infiltration within the subsurface system

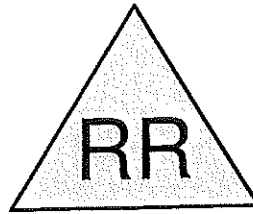
$$\text{Time} = 1,176 \text{ C.F.} / [(0.085 \text{ Feet / Hour}) \times 478 \text{ S.F.}]$$

$$\text{Time} = 28.95 \text{ Hours}$$

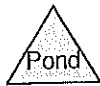
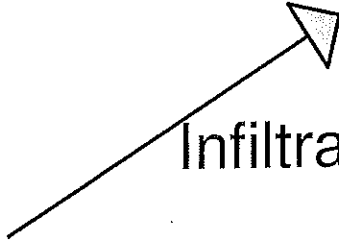
The subsurface system will drawdown in less than 72 hours.



Roof Runoff



Infiltration Chambers



Routing Diagram for Dutchco - Roof Recharge 1.5 inch  
Prepared by Mark Piermarini, Printed 9/23/2023  
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**Dutchco - Roof Recharge 1.5 inch**

Prepared by Mark Piermarini

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1.5" Rainfall - Roof  
Type III 24-hr Rainfall=1.50"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment Lot: Roof Runoff**

Runoff Area=0.055 ac 100.00% Impervious Runoff Depth>1.21"  
Flow Length=76' Tc=5.0 min CN=98 Runoff=0.08 cfs 0.006 af

**Pond RR: Infiltration Chambers**

Peak Elev=0.36' Storage=0.001 af Inflow=0.08 cfs 0.006 af  
Outflow=0.02 cfs 0.006 af

**Total Runoff Area = 0.055 ac Runoff Volume = 0.006 af Average Runoff Depth = 1.21"**  
**0.00% Pervious = 0.000 ac 100.00% Impervious = 0.055 ac**



# Dutchco - Roof Recharge 1.5 inch

Prepared by Mark Piermarini

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1.5" Rainfall - Roof  
Type III 24-hr Rainfall=1.50"

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## Summary for Subcatchment Lot: Roof Runoff

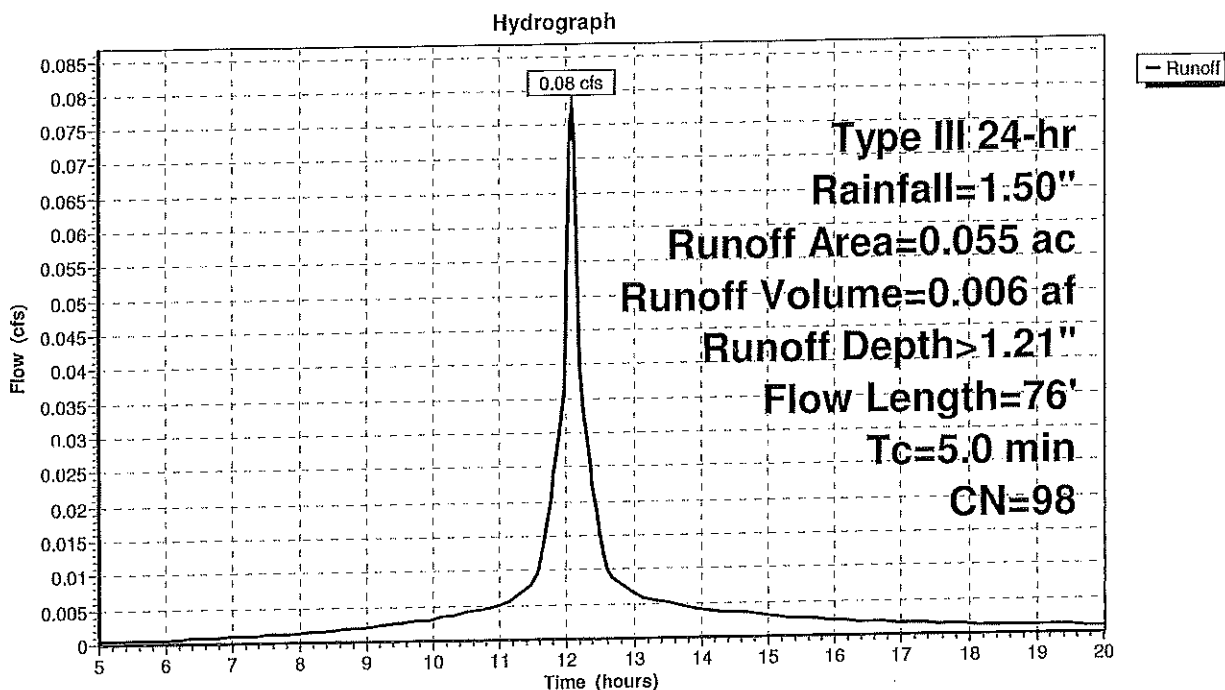
Runoff = 0.08 cfs @ 12.07 hrs, Volume= 0.006 af, Depth> 1.21"  
Routed to Pond RR : Infiltration Chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr Rainfall=1.50"

Area (ac)	CN	Description
0.055	98	Roofs, HSG A
0.055		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	76		0.25		Direct Entry, Path 1

## Subcatchment Lot: Roof Runoff



**Dutchco - Roof Recharge 1.5 inch**

Prepared by Mark Piermarini

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1.5" Rainfall - Roof  
Type III 24-hr Rainfall=1.50"

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**Hydrograph for Subcatchment Lot: Roof Runoff**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.09	0.01	0.00	18.25	1.40	1.18	0.00
5.25	0.09	0.01	0.00	18.50	1.40	1.19	0.00
5.50	0.10	0.01	0.00	18.75	1.41	1.19	0.00
5.75	0.10	0.01	0.00	19.00	1.41	1.20	0.00
6.00	0.11	0.02	0.00	19.25	1.42	1.20	0.00
6.25	0.11	0.02	0.00	19.50	1.43	1.21	0.00
6.50	0.12	0.02	0.00	19.75	1.43	1.21	0.00
6.75	0.13	0.03	0.00	20.00	1.44	1.22	0.00
7.00	0.14	0.03	0.00				
7.25	0.14	0.03	0.00				
7.50	0.15	0.04	0.00				
7.75	0.16	0.04	0.00				
8.00	0.17	0.05	0.00				
8.25	0.18	0.06	0.00				
8.50	0.19	0.06	0.00				
8.75	0.21	0.07	0.00				
9.00	0.22	0.08	0.00				
9.25	0.23	0.09	0.00				
9.50	0.25	0.11	0.00				
9.75	0.27	0.12	0.00				
10.00	0.28	0.13	0.00				
10.25	0.30	0.15	0.00				
10.50	0.32	0.17	0.00				
10.75	0.35	0.19	0.00				
11.00	0.38	0.21	0.01				
11.25	0.41	0.23	0.01				
11.50	0.45	0.27	0.01				
11.75	0.53	0.35	0.02				
12.00	0.75	0.55	<b>0.05</b>				
12.25	0.97	0.76	<b>0.03</b>				
12.50	1.05	0.84	0.02				
12.75	1.09	0.88	0.01				
13.00	1.12	0.91	0.01				
13.25	1.15	0.94	0.01				
13.50	1.18	0.96	0.01				
13.75	1.20	0.98	0.00				
14.00	1.22	1.00	0.00				
14.25	1.23	1.02	0.00				
14.50	1.25	1.04	0.00				
14.75	1.27	1.05	0.00				
15.00	1.28	1.07	0.00				
15.25	1.29	1.08	0.00				
15.50	1.31	1.09	0.00				
15.75	1.32	1.10	0.00				
16.00	1.33	1.11	0.00				
16.25	1.34	1.12	0.00				
16.50	1.35	1.13	0.00				
16.75	1.36	1.14	0.00				
17.00	1.36	1.15	0.00				
17.25	1.37	1.15	0.00				
17.50	1.38	1.16	0.00				
17.75	1.39	1.17	0.00				
18.00	1.39	1.17	0.00				

# Dutchco - Roof Recharge 1.5 inch

Prepared by Mark Piermarini

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1.5" Rainfall - Roof  
Type III 24-hr Rainfall=1.50"

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## Summary for Pond RR: Infiltration Chambers

Inflow Area = 0.055 ac, 100.00% Impervious, Inflow Depth > 1.21"  
 Inflow = 0.08 cfs @ 12.07 hrs, Volume= 0.006 af  
 Outflow = 0.02 cfs @ 11.85 hrs, Volume= 0.006 af, Atten= 70%, Lag= 0.0 min  
 Primary = 0.02 cfs @ 11.85 hrs, Volume= 0.006 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 0.36' @ 12.39 hrs Surf.Area= 0.003 ac Storage= 0.001 af

Plug-Flow detention time= 10.1 min calculated for 0.006 af (100% of inflow)  
 Center-of-Mass det. time= 9.7 min ( 758.4 - 748.6 )

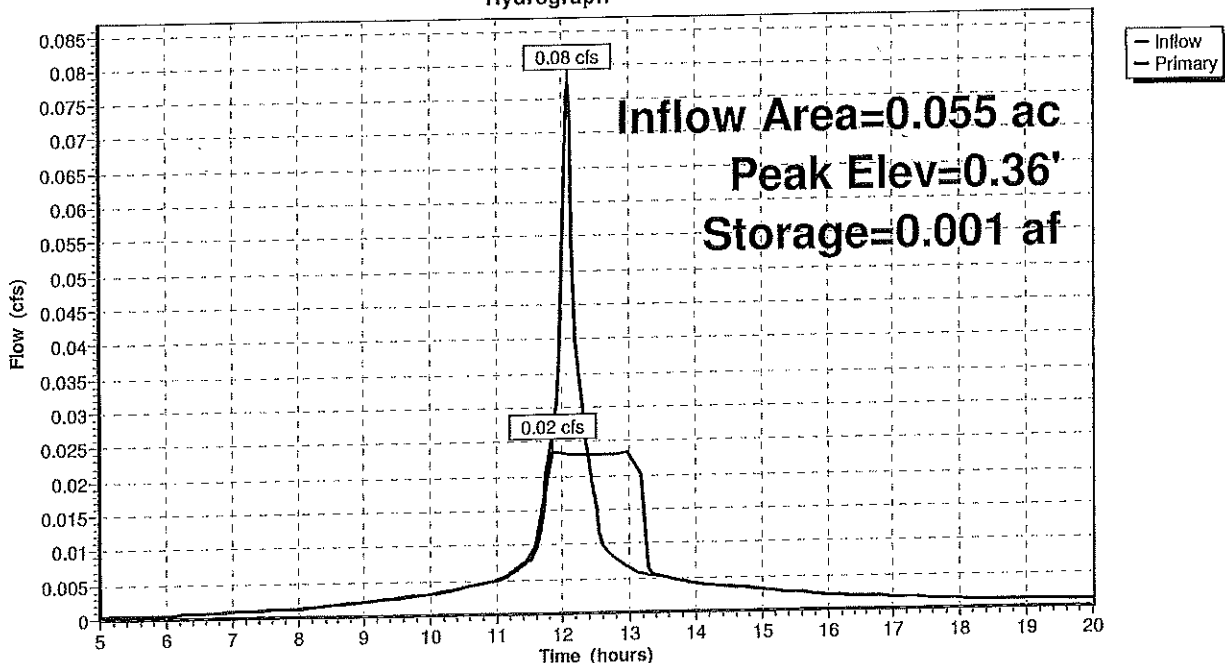
Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	0.005 af	<b>Cultec R-330XLHD x 4</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 2 rows

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	<b>8.270 in/hr Exfiltration over Surface area</b>

**Primary OutFlow** Max=0.02 cfs @ 11.85 hrs HW=0.03' (Free Discharge)  
 ↑=Exfiltration (Exfiltration Controls 0.02 cfs)

## Pond RR: Infiltration Chambers

Hydrograph



# Dutchco - Roof Recharge 1.5 inch

Prepared by Mark Piermarini

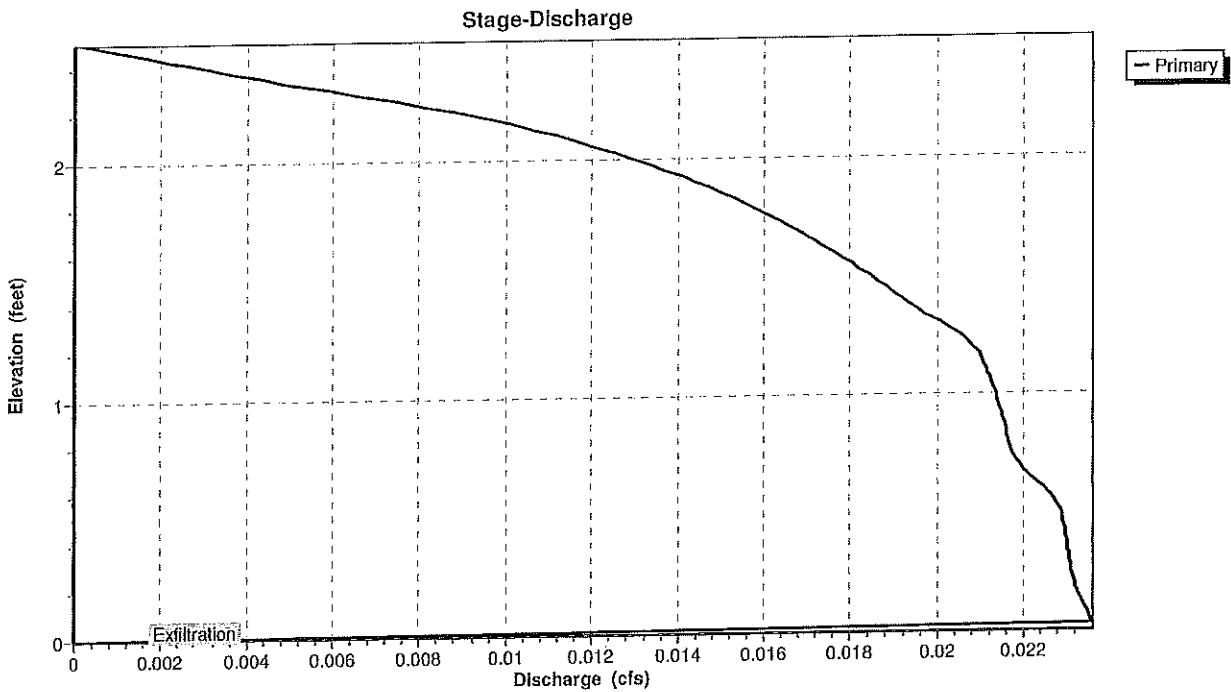
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1.5" Rainfall - Roof  
Type III 24-hr Rainfall=1.50"

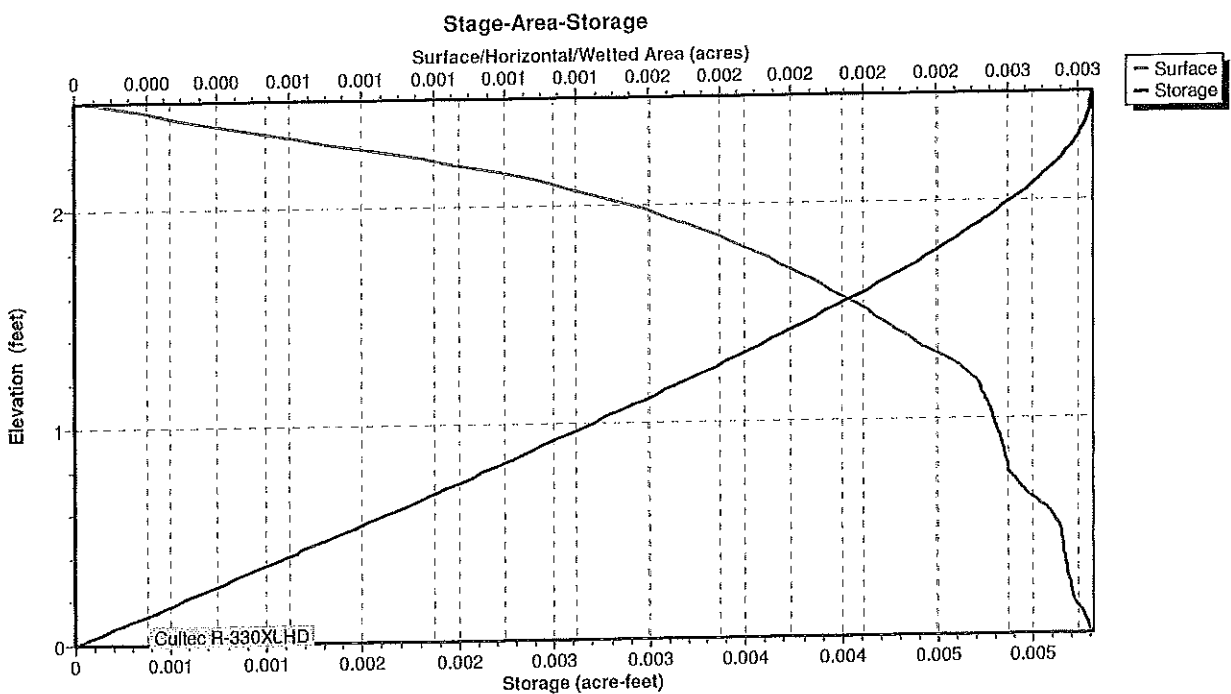
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## Pond RR: Infiltration Chambers



## Pond RR: Infiltration Chambers



**Dutchco - Roof Recharge 1.5 inch**

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1.5" Rainfall - Roof  
Type III 24-hr Rainfall=1.50"

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**Hydrograph for Pond RR: Infiltration Chambers**

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Primary (cfs)
5.00	0.00	0.000	0.00	0.00
5.50	0.00	0.000	0.00	0.00
6.00	0.00	0.000	0.00	0.00
6.50	0.00	0.000	0.00	0.00
7.00	0.00	0.000	0.00	0.00
7.50	0.00	0.000	0.00	0.00
8.00	0.00	0.000	0.00	0.00
8.50	0.00	0.000	0.00	0.00
9.00	0.00	0.000	0.00	0.00
9.50	0.00	0.000	0.00	0.00
10.00	0.00	0.000	0.00	0.00
10.50	0.00	0.000	0.00	0.00
11.00	0.01	0.000	0.01	0.00
11.50	0.01	0.000	0.01	<b>0.01</b>
12.00	<b>0.05</b>	<b>0.000</b>	<b>0.08</b>	<b>0.02</b>
12.50	<b>0.02</b>	<b>0.001</b>	<b>0.34</b>	0.02
13.00	0.01	0.000	0.13	0.02
13.50	0.01	0.000	0.01	0.01
14.00	0.00	0.000	0.00	0.00
14.50	0.00	0.000	0.00	0.00
15.00	0.00	0.000	0.00	0.00
15.50	0.00	0.000	0.00	0.00
16.00	0.00	0.000	0.00	0.00
16.50	0.00	0.000	0.00	0.00
17.00	0.00	0.000	0.00	0.00
17.50	0.00	0.000	0.00	0.00
18.00	0.00	0.000	0.00	0.00
18.50	0.00	0.000	0.00	0.00
19.00	0.00	0.000	0.00	0.00
19.50	0.00	0.000	0.00	0.00
20.00	0.00	0.000	0.00	0.00

# Dutchco - Roof Recharge 1.5 inch

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1.5" Rainfall - Roof  
Type III 24-hr Rainfall=1.50"

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## Stage-Discharge for Pond RR: Infiltration Chambers

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	1.06	0.02	2.12	0.01
0.02	0.02	1.08	0.02	2.14	0.01
0.04	0.02	1.10	0.02	2.16	0.01
0.06	0.02	1.12	0.02	2.18	0.01
0.08	0.02	1.14	0.02	2.20	0.01
0.10	0.02	1.16	0.02	2.22	0.01
0.12	0.02	1.18	0.02	2.24	0.01
0.14	0.02	1.20	0.02	2.26	0.01
0.16	0.02	1.22	0.02	2.28	0.01
0.18	0.02	1.24	0.02	2.30	0.01
0.20	0.02	1.26	0.02	2.32	0.01
0.22	0.02	1.28	0.02	2.34	0.00
0.24	0.02	1.30	0.02	2.36	0.00
0.26	0.02	1.32	0.02	2.38	0.00
0.28	0.02	1.34	0.02	2.40	0.00
0.30	0.02	1.36	0.02	2.42	0.00
0.32	0.02	1.38	0.02	2.44	0.00
0.34	0.02	1.40	0.02	2.46	0.00
0.36	0.02	1.42	0.02	2.48	0.00
0.38	0.02	1.44	0.02	2.50	0.00
0.40	0.02	1.46	0.02		
0.42	0.02	1.48	0.02		
0.44	0.02	1.50	0.02		
0.46	0.02	1.52	0.02		
0.48	0.02	1.54	0.02		
0.50	0.02	1.56	0.02		
0.52	0.02	1.58	0.02		
0.54	0.02	1.60	0.02		
0.56	0.02	1.62	0.02		
0.58	0.02	1.64	0.02		
0.60	0.02	1.66	0.02		
0.62	0.02	1.68	0.02		
0.64	0.02	1.70	0.02		
0.66	0.02	1.72	0.02		
0.68	0.02	1.74	0.02		
0.70	0.02	1.76	0.02		
0.72	0.02	1.78	0.02		
0.74	0.02	1.80	0.02		
0.76	0.02	1.82	0.02		
0.78	0.02	1.84	0.02		
0.80	0.02	1.86	0.01		
0.82	0.02	1.88	0.01		
0.84	0.02	1.90	0.01		
0.86	0.02	1.92	0.01		
0.88	0.02	1.94	0.01		
0.90	0.02	1.96	0.01		
0.92	0.02	1.98	0.01		
0.94	0.02	2.00	0.01		
0.96	0.02	2.02	0.01		
0.98	0.02	2.04	0.01		
1.00	0.02	2.06	0.01		
1.02	0.02	2.08	0.01		
1.04	0.02	2.10	0.01		

**Dutchco - Roof Recharge 1.5 inch**

Prepared by Mark Piermarini

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1.5" Rainfall - Roof  
Type III 24-hr Rainfall=1.50"

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**Stage-Area-Storage for Pond RR: Infiltration Chambers**

Elevation (feet)	Surface (acres)	Storage (acre-feet)
0.00	0.003	0.000
0.05	0.003	0.000
0.10	0.003	0.000
0.15	0.003	0.000
0.20	0.003	0.001
0.25	0.003	0.001
0.30	0.003	0.001
0.35	0.003	0.001
0.40	0.003	0.001
0.45	0.003	0.001
0.50	0.003	0.001
0.55	0.003	0.002
0.60	0.003	0.002
0.65	0.003	0.002
0.70	0.003	0.002
0.75	0.003	0.002
0.80	0.003	0.002
0.85	0.003	0.002
0.90	0.003	0.002
0.95	0.003	0.003
1.00	0.003	0.003
1.05	0.003	0.003
1.10	0.003	0.003
1.15	0.003	0.003
1.20	0.002	0.003
1.25	0.002	0.003
1.30	0.002	0.003
1.35	0.002	0.004
1.40	0.002	0.004
1.45	0.002	0.004
1.50	0.002	0.004
1.55	0.002	0.004
1.60	0.002	0.004
1.65	0.002	0.004
1.70	0.002	0.004
1.75	0.002	0.004
1.80	0.002	0.005
1.85	0.002	0.005
1.90	0.002	0.005
1.95	0.002	0.005
2.00	0.002	0.005
2.05	0.001	0.005
2.10	0.001	0.005
2.15	0.001	0.005
2.20	0.001	0.005
2.25	0.001	0.005
2.30	0.001	0.005
2.35	0.001	0.005
2.40	0.000	0.005
2.45	0.000	0.005
2.50	0.000	0.005

# **OPERATION AND MAINTENANCE PLAN**



**STORMWATER MANAGEMENT SYSTEM  
INSPECTION AND MAINTENANCE PLAN**

Hartwell Avenue  
Littleton, Massachusetts

Prepared for:

Dutchco Builders  
8 Mason Brook Lane  
Littleton, MA 01460

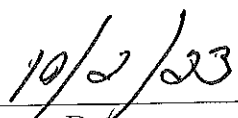
Date: September 25, 2023

The proposed Hartwell Avenue (six lots) roof infiltration systems have been designed to function properly provided that routine maintenance is performed. Maintenance of the subsurface drainage systems and roof stone drip trenches is required to ensure that sedimentation and pollution is controlled and storm water infiltration capacity is sustained. To ensure the proper functioning of these facilities the following maintenance practices will be used:

Owner and Party Responsible for Maintenance (Landowner):

Dutchco Builders  
8 Mason Brook Lane  
Littleton, MA 01460

  
\_\_\_\_\_  
Owner's Signature

  
\_\_\_\_\_  
Date

The owner shall develop a chart with a list of the following Best Management Practices (BMP's) with the chart listing the maintenance requirement, frequency of maintenance and the date the maintenance was performed.

PART 1 - INSPECTION AND MAINTENANCE (DURING CONSTRUCTION)

- A. It shall be the responsibility of the General Contractor to ensure that the inspection, maintenance and protection of the stormwater management system (defined in Section 2a below) is performed during the construction phase of the project and up to final stabilization of the site (refer to attached plan).
- B. The on-site stormwater management system shall be protected from the introduction of sediments and debris both during installation and throughout the duration of site construction in order to provide a fully functioning and long lasting system upon completion of construction.
- C. The following steps shall be implemented, at a minimum, to protect the stormwater management system during construction:
  - 1. During construction of the subsurface drainage systems and the roof stone drip trenches, the open excavation shall be protected from on-site sediments from storm runoff and snow melt by providing a line of erosion controls consisting of haybales or silt fence or a combination of both. In the event that the excavation is compromised by sediment, the sediments shall be removed and the bottom of the excavation restored.

2. An inspection of the stormwater management system shall be conducted by the General Contractor weekly as well as during and after all rainstorms until the completion of construction. In case of any noted introduction of sediments into the system, the General Contractor shall immediately remove said sediments and take any necessary steps to limit further introduction of sediments and notify the engineer of any problems involving storm water management systems.
  - a) The stormwater management system shall be defined as the subsurface drainage systems and roof stone drip trenches.
  - b) A rainstorm shall be defined by all or one of the following thresholds:
    - i. Any storm in which rain is predicted to last for twelve consecutive hours or more.
    - ii. Any storm for which a flash flood watch or warning is issued.
    - iii. Any single storm predicted to have a cumulative rainfall of greater than one-half inch.
    - iv. Any storm not meeting the previous three thresholds but which would mark a third consecutive day of measurable rainfall.
3. The General Contractor shall also inspect the stormwater management systems at times of significant increase in surface water runoff due to rapid thawing when the risk of sediment migration is significant.
4. All collected/removed sediments shall be removed from the site and disposed of in a legal manner.

#### PART 2 - INSPECTION AND MAINTENANCE (POST-CONSTRUCTION)

- A. It shall be the responsibility of the Owner to ensure that the long-term inspection and maintenance of the stormwater management system on-site is performed. The on-site system shall include the following individual components of the stormwater management system: subsurface drainage systems and roof stone drip trenches as shown on the approved plans. The Owner shall obtain the services of a qualified Contractor to perform the required inspections and maintenance of the individual components of the stormwater management system on-site, as listed above. All inspections and maintenance of the components of the stormwater management system.
- B. It shall be the responsibility of the Owner to maintain adequate records to demonstrate conformance with this inspection and maintenance plan.
- C. The inspection and maintenance plan for the on-site stormwater management system (as listed in Section A above) shall be carried out by the current owner (project applicant) and by any and all future owners of the site in perpetuity.
- D. The inspection and maintenance plan shall be carried out as outlined below upon completion and final stabilization of the project site:

- E. During the first six months of operation of the facility the stormwater management system shall be inspected a minimum of once per month and after every rainstorm (defined in Part 1 above). A portion of this time period must be in the growing season. As warranted by these inspections maintenance of the system shall be performed including, but not limited to the following:
1. Visual inspection of the subsurface drainage systems and roof stone drip trenches to ensure that the system is not backed up and is emptying properly.
- F. After the six month time period above has elapsed, thorough investigations shall be conducted four times a year. Maintenance requirements may be adjusted based upon the results obtained from the first year of operation. As warranted by these inspections maintenance of the system shall be performed including, but not limited to the following:
1. The subsurface drainage systems and roof stone drip trenches require a bi-annual inspection for necessary maintenance (refer to attached plan). This consists of visually inspecting for the accumulation of sediment; obstructions within the channels. Remove sediments from the subsurface drainage systems and roof stone drip trenches. Sediment, which is removed, shall be legally disposed of. The subsurface drainage systems and roof stone drip trenches shall be monitored at several intervals during and after a small and large rainfall event to ensure they are functional.

## MAINTENANCE LOGS

Maintain a log of all operation and maintenance activities including without limitation inspections, repairs, replacement and disposal (for disposal, the log shall indicate the type of material and disposal location). A copy of the yearly maintenance logs shall be made accessible to the following agencies:

Conservation Commission  
37 Shattuck Street  
1<sup>st</sup> Floor, B100  
Littleton, MA 01460

Department of Environmental Protection  
Central Regional Office  
627 Main Street  
Worcester, MA 01608

## MAINTENANCE SCHEDULE

Structure Type	Inspection	Maintenance	Task	Cost Estimate (per Year)	Owner
Subsurface Drainage System	Twice per year Spring and Fall	Twice per year, or whenever the depth of the deposits is greater than or equal to half the depth from the bottom of the system to the inlet pipe	Clean/Remove debris and sediment	\$1,000	Land Owner
Stone Drip Trench	Twice per year Spring and Fall	Twice per year, or whenever the trench appears to be clogged with sediment and debris	Remove stone, wash and replace, remove debris and sediment prior to re-installing stone	\$1,000	Land Owner
		Total Annual Estimated Cost =		\$2,000	Land Owner

**SUBSURFACE DRAINAGE SYSTEM INSPECTION FORM**

Dutchco Builders  
8 Mason Brook Lane  
Littleton, MA

Owner: \_\_\_\_\_

Property Manager: \_\_\_\_\_

Inspected By: \_\_\_\_\_

Date of Inspection: \_\_\_\_\_

Subsurface Drainage System inspected (circle): Lot 1 Lot 2 Lot 3 Lot 4 Lot 5 Lot 6

Acceptable  Needs Work

Add notes below if structures need work:

Date of cleaning: \_\_\_\_\_

By Whom: \_\_\_\_\_

Date of repair: \_\_\_\_\_

By Whom: \_\_\_\_\_

Below note any further actions that need to be taken as necessary:

**ROOF STONE DRIP TRENCH INSPECTION FORM**

Dutchco Builders  
8 Mason Brook Lane  
Littleton, MA

Owner: \_\_\_\_\_

Property Manager: \_\_\_\_\_

Inspected By: \_\_\_\_\_

Date of Inspection: \_\_\_\_\_

Roof Stone Drip Trench inspected (circle): Lot 1 Lot 2 Lot 3 Lot 4 Lot 5 Lot 6

Acceptable  Needs Work

Add notes below if structures need work:

Date of cleaning: \_\_\_\_\_

By Whom: \_\_\_\_\_

Date of repair: \_\_\_\_\_

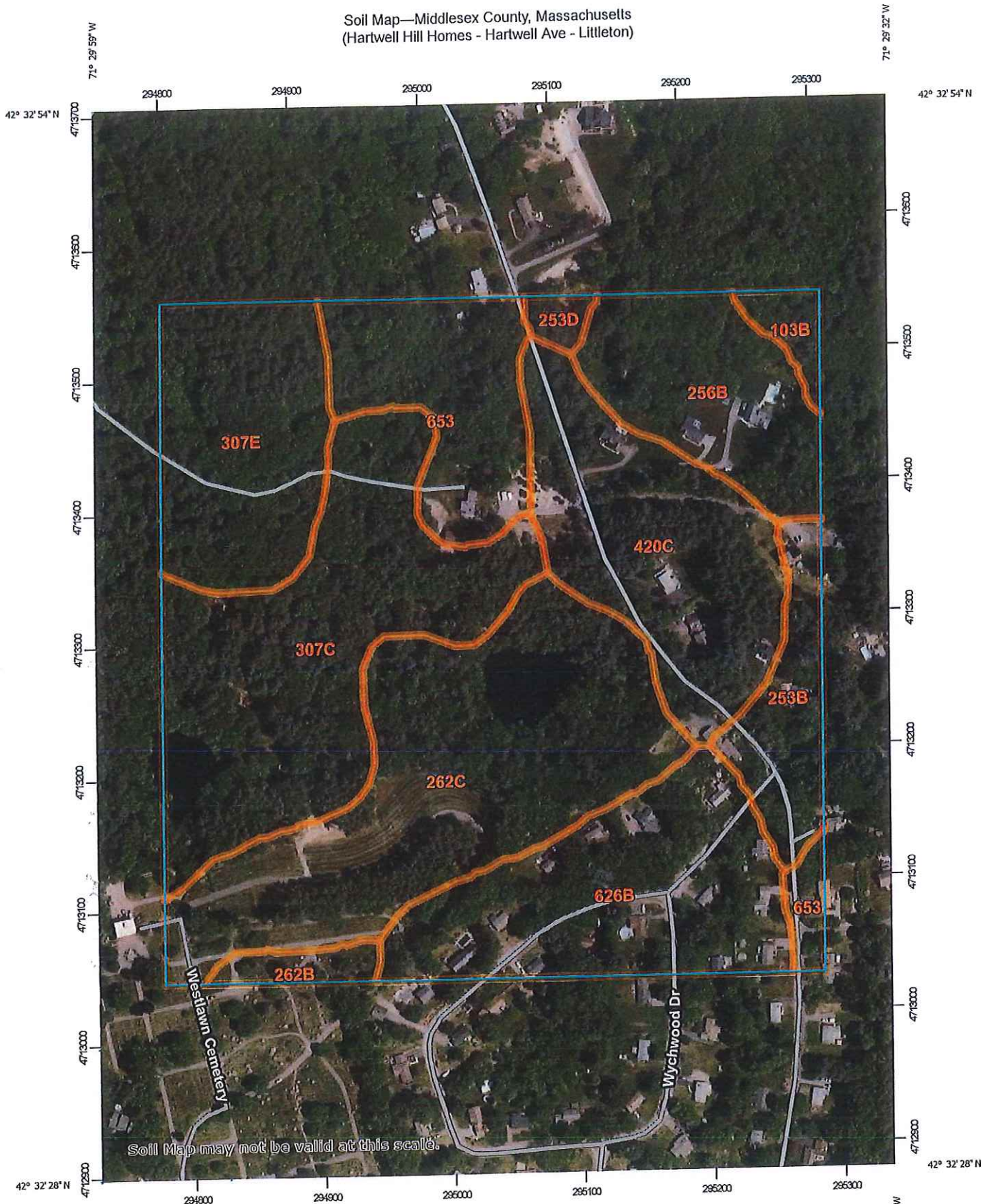
By Whom: \_\_\_\_\_

Below note any further actions that need to be taken as necessary:

# **NRCS SOILS MAP**

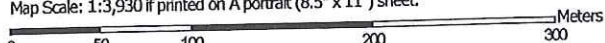


Soil Map—Middlesex County, Massachusetts  
(Hartwell Hill Homes - Hartwell Ave - Littleton)



Soil Map may not be valid at this scale.

Map Scale: 1:3,930 if printed on A portrait (8.5" x 11") sheet.







































Map projection: Web Mercator Corner coordinates: WGS84 Edge ticks: UTM Zone 19N WGS84



Soil Map—Middlesex County, Massachusetts  
(Hartwell Hill Homes - Hartwell Ave - Littleton)

**MAP LEGEND**

- |  |   |
|--|---|
|  Area of Interest (AOI) |  Spoil Area            |
|  Soil Map Unit Polygons |  Stony Spot            |
|  Soil Map Unit Lines    |  Very Stony Spot       |
|  Soil Map Unit Points   |  Wet Spot              |
| <b>Special Point Features</b>  |  Other                 |
|  Blowout                |  Special Line Features |
|  Borrow Pit             | <b>Water Features</b>   |
|  Clay Spot             |  Streams and Canals    |
|  Closed Depression    | <b>Transportation</b>   |
|  Gravel Pit           |  Rails                 |
|  Gravelly Spot        |  Interstate Highways |
|  Landfill             |  US Routes           |
|  Lava Flow            |  Major Roads         |
|  Marsh or swamp       |  Local Roads         |
|  Mine or Quarry       | <b>Background</b>   |
|  Miscellaneous Water  |  Aerial Photography  |
|  Perennial Water      |   |
|  Rock Outcrop         |   |
|  Saline Spot          |   |
|  Sandy Spot           |   |
|  Severely Eroded Spot |   |
|  Sinkhole             |   |
|  Slide or Slip        |   |
|  Sodic Spot           |   |

**MAP INFORMATION**

The soil surveys that comprise your AOI were mapped at 1:25,000.

**Warning: Soil Map may not be valid at this scale.**  
Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service  
Web Soil Survey URL:  
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Middlesex County, Massachusetts  
Survey Area Data: Version 22, Sep 9, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial Images were photographed: May 22, 2022—Jun 5, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
103B	Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes	0.7	1.1%
253B	Hinckley loamy sand, 3 to 8 percent slopes	2.9	4.5%
253D	Hinckley loamy sand, 15 to 25 percent slopes	0.4	0.7%
256B	Deerfield loamy fine sand, 3 to 8 percent slopes	5.2	8.0%
262B	Quonset sandy loam, 3 to 8 percent slopes	0.8	1.2%
262C	Quonset sandy loam, 8 to 15 percent slopes	13.5	20.9%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	12.2	18.8%
307E	Paxton fine sandy loam, 25 to 35 percent slopes, extremely stony	6.6	10.2%
420C	Canton fine sandy loam, 8 to 15 percent slopes	8.2	12.7%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	8.5	13.1%
653	Udorthents, sandy	5.7	8.8%
<b>Totals for Area of Interest</b>		<b>64.7</b>	<b>100.0%</b>

## TABLES AND CHARTS

Table 2-2a.—Runoff curve numbers for urban areas<sup>1</sup>

Cover description	Average percent impervious area <sup>2</sup>	Curve numbers for hydrologic soil group—			
		A	B	C	D
<i>Fully developed urban areas (vegetation established)</i>					
Open space (lawns, parks, golf courses, cemeteries, etc.) <sup>3</sup> :					
Poor condition (grass cover < 50%) .....		68	79	86	89
Fair condition (grass cover 50% to 75%) .....		49	69	79	84
Good condition (grass cover > 75%) .....		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way) .....		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way) .....		98	98	98	98
Paved; open ditches (including right-of-way) .....		83	89	92	93
Gravel (including right-of-way) .....		76	85	89	91
Dirt (including right-of-way) .....		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) <sup>4</sup> ...		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders) .....		96	96	96	96
Urban districts:					
Commercial and business .....	85	89	92	94	95
Industrial .....	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses) .....	65	77	85	90	92
1/4 acre .....	38	61	75	83	87
1/3 acre .....	30	57	72	81	86
1/2 acre .....	25	54	70	80	85
1 acre .....	20	51	68	79	84
2 acres .....	12	46	65	77	82
<i>Developing urban areas</i>					
Newly graded areas (pervious areas only, no vegetation) <sup>5</sup> .....		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

<sup>1</sup>Average runoff condition, and  $I_a = 0.2S$ .

<sup>2</sup>The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

<sup>3</sup>CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

<sup>4</sup>Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

<sup>5</sup>Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4, based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2c.—Runoff curve numbers for other agricultural lands<sup>1</sup>

Cover description		Curve numbers for hydrologic soil group—			
		A	B	C	D
Cover type	Hydrologic condition				
Pasture, grassland, or range—continuous forage for grazing. <sup>2</sup>	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. <sup>3</sup>	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30	48	65	73
Woods—grass combination (orchard or tree farm). <sup>5</sup>	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. <sup>6</sup>	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

<sup>1</sup>Average runoff condition, and  $I_a = 0.2S$ .

<sup>2</sup>*Poor:* <50% ground cover or heavily grazed with no mulch.  
*Fair:* 50 to 75% ground cover and not heavily grazed.  
*Good:* >75% ground cover and lightly or only occasionally grazed.

<sup>3</sup>*Poor:* <50% ground cover.  
*Fair:* 50 to 75% ground cover.  
*Good:* >75% ground cover.

<sup>4</sup>Actual curve number is less than 30; use CN = 30 for runoff computations.

<sup>5</sup>CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

<sup>6</sup>*Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.  
*Fair:* Woods are grazed but not burned, and some forest litter covers the soil.  
*Good:* Woods are protected from grazing, and litter and brush adequately cover the soil.

### Sheet flow

Sheet flow is flow over plane surfaces. It usually occurs in the headwater of streams. With sheet flow, the friction value (Manning's *n*) is an effective roughness coefficient that includes the effect of raindrop impact; drag over the plane surface; obstacles such as litter, crop ridges, and rocks; and erosion and transportation of sediment. These *n* values are for very shallow flow depths of about 0.1 foot or so. Table 3-1 gives Manning's *n* values for sheet flow for various surface conditions.

For sheet flow of less than 300 feet, use Manning's kinematic solution (Overton and Meadows 1976) to compute  $T_t$ :

$$T_t = \frac{0.007 (nL)^{0.8}}{(P_2)^{0.5} s^{0.4}} \quad [\text{Eq. 3-3}]$$

Table 3-1.—Roughness coefficients (Manning's *n*) for sheet flow

Surface description	<i>n</i> <sup>1</sup>
Smooth surfaces (concrete, asphalt, gravel, or bare soil) .....	0.011
Fallow (no residue) .....	0.05
Cultivated soils:	
Residue cover ≤ 20% .....	0.06
Residue cover > 20% .....	0.17
Grass:	
Short grass prairie .....	0.15
Dense grasses <sup>2</sup> .....	0.24
Bermudagrass .....	0.41
Range (natural) .....	0.13
Woods: <sup>3</sup>	
Light underbrush .....	0.40
Dense underbrush .....	0.80

<sup>1</sup>The *n* values are a composite of information compiled by Engman (1986).

<sup>2</sup>Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.

<sup>3</sup>When selecting *n*, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

where

- $T_t$  = travel time (hr),
- n* = Manning's roughness coefficient (table 3-1),
- L* = flow length (ft),
- $P_2$  = 2-year, 24-hour rainfall (in), and
- s* = slope of hydraulic grade line (land slope, ft/ft).

This simplified form of the Manning's kinematic solution is based on the following: (1) shallow steady uniform flow, (2) constant intensity of rainfall excess (that part of a rain available for runoff), (3) rainfall duration of 24 hours, and (4) minor effect of infiltration on travel time. Rainfall depth can be obtained from appendix B.

### Shallow concentrated flow

After a maximum of 300 feet, sheet flow usually becomes shallow concentrated flow. The average velocity for this flow can be determined from figure 3-1, in which average velocity is a function of watercourse slope and type of channel. For slopes less than 0.005 ft/ft, use equations given in appendix F for figure 3-1. Tillage can affect the direction of shallow concentrated flow. Flow may not always be directly down the watershed slope if tillage runs across the slope.

After determining average velocity in figure 3-1, use equation 3-1 to estimate travel time for the shallow concentrated flow segment.

### Open channels

Open channels are assumed to begin where surveyed cross section information has been obtained, where channels are visible on aerial photographs, or where blue lines (indicating streams) appear on United States Geological Survey (USGS) quadrangle sheets. Manning's equation or water surface profile information can be used to estimate average flow velocity. Average flow velocity is usually determined for bank-full elevation.

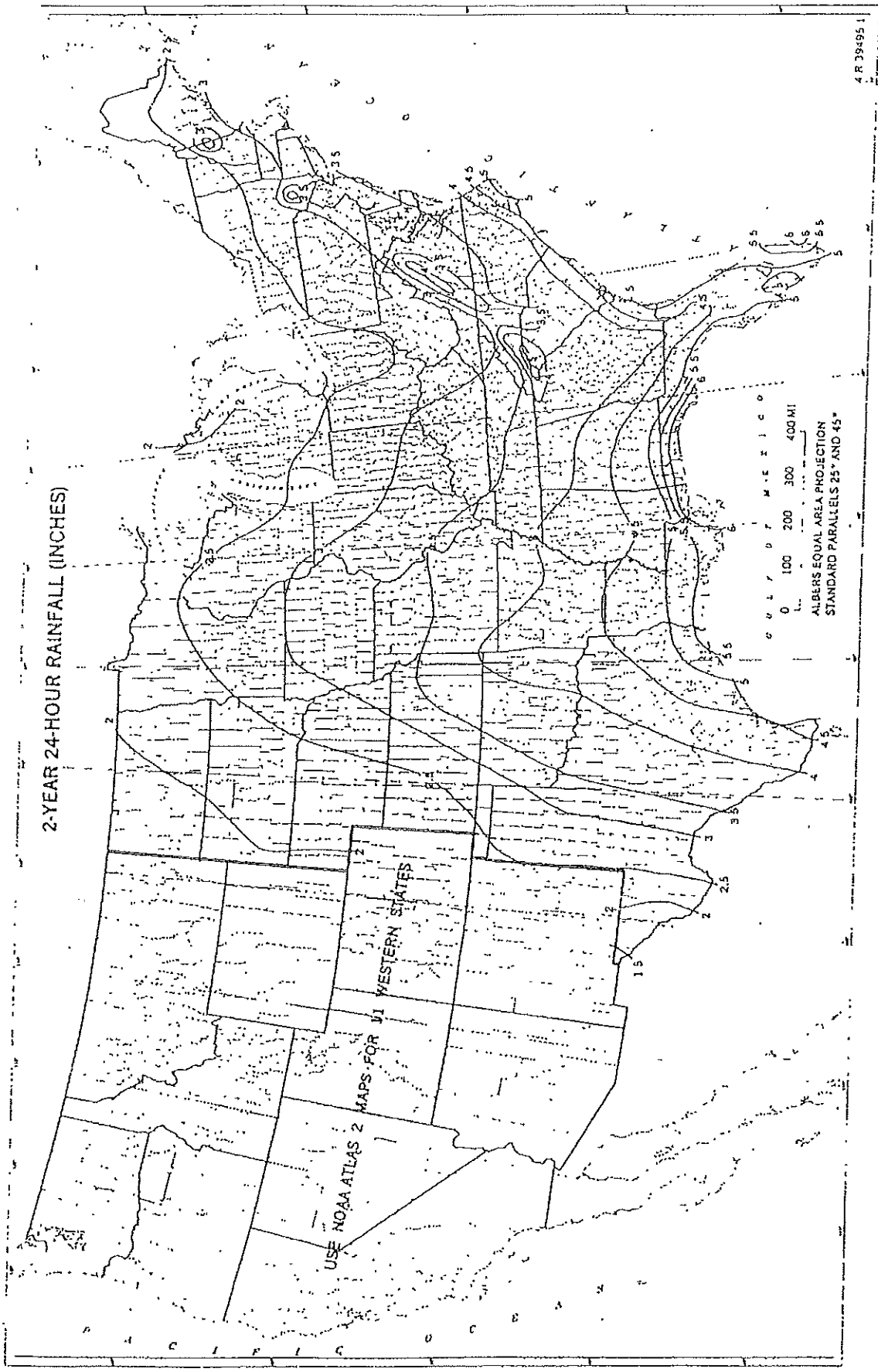


Figure B-3.—Two-year, 24-hour rainfall.



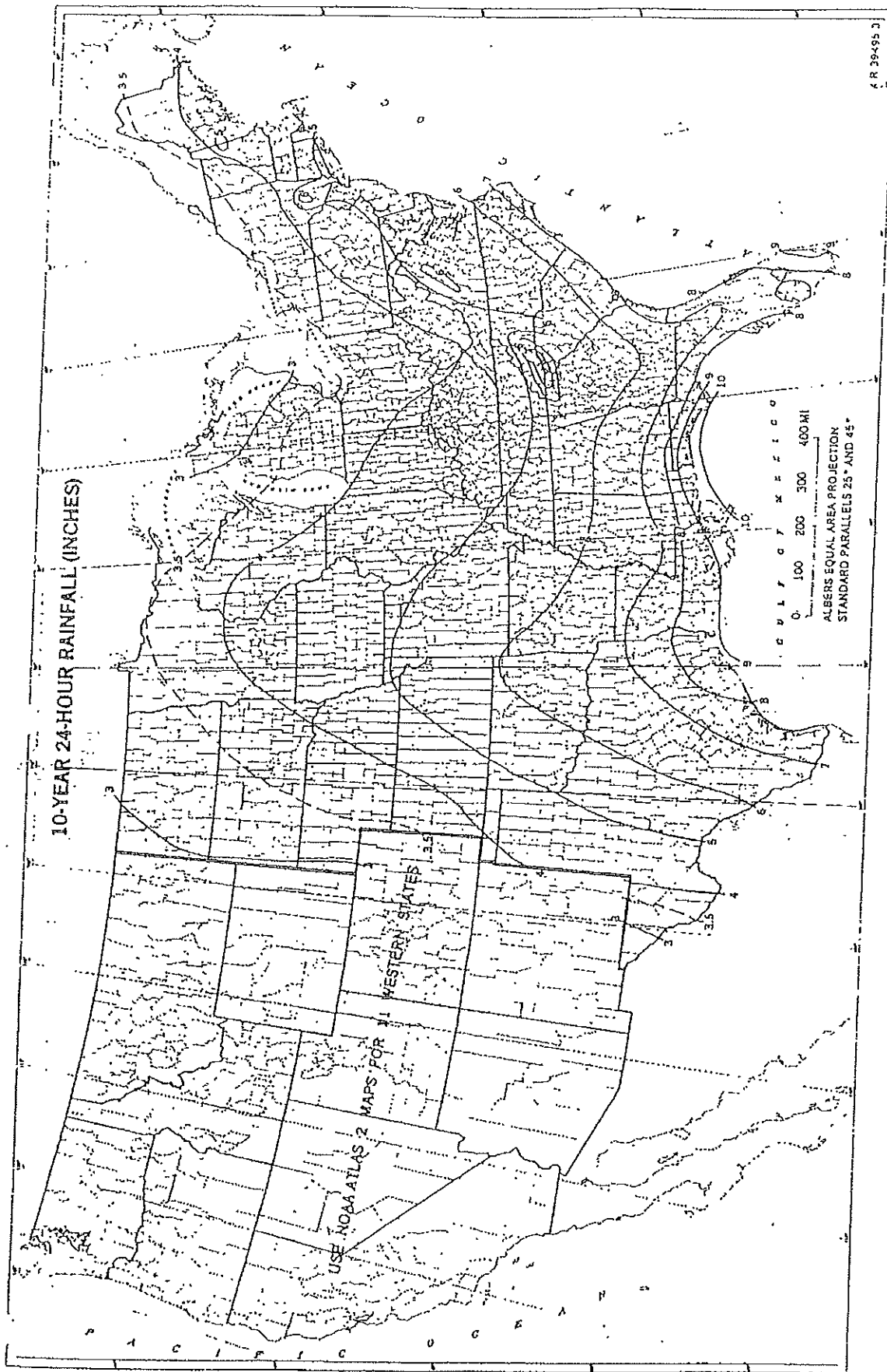
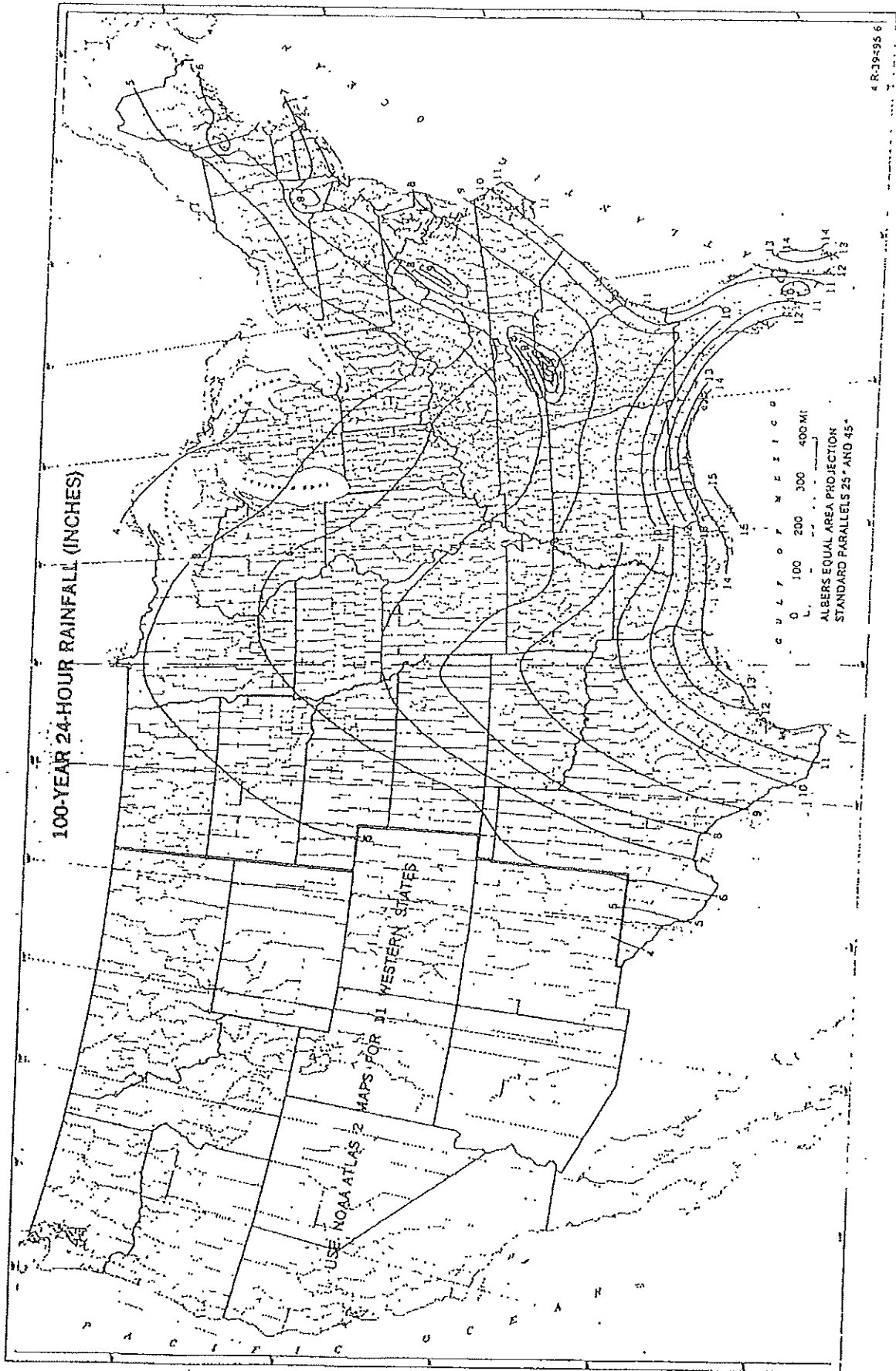


Figure B-5.—Ten-year, 24-hour rainfall.



4 R-39-595 6

Figure B-8.—One-hundred-year, 24-hour rainfall.