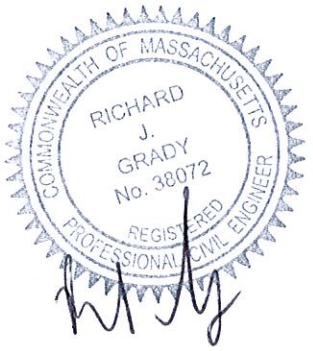
GRADY CONSULTING, L.L.C.
Registered Professional Civil Engineers & Land Surveyors

STORMWATER MANAGEMENT DESIGN CALCULATIONS

345 Oak Street
Assessors Map F15-38
Pembroke, Massachusetts



Prepared for

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May 30, 2019

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SUMMARY

The project is the redevelopment of an existing building at 345 Oak Street, Pembroke. The new development will include the construction of a 2,400 S.F. office building with 33 parking spaces, and a 4 car garage.

Stormwater on site is managed through the use of 7 –225' long x 36" diameter polyethylene pipes that fully store the 2, 10, and 25 year storm flow and slowly release the water into the nearby drop inlet. High groundwater and poor soils restrict the feasibility of onsite infiltration of stormwater. A 1" diameter orifice at the bottom of the weir placed inside of the proposed outlet structure controls the flow, with a 6" diameter orifice acting as the emergency overflow. Calculations show peak flow rates post construction to be lower for the 2, 10, 25, and 100 year storms.

This analysis was prepared to demonstrate Compliance with the Massachusetts Stormwater Management Regulations and the Town of Pembroke Rules and Regulations for Stormwater Management.

This analysis is divided into the following sections:

Section I Overall Site Analysis
Section II Compliance with Massachusetts Storm water Management Regulations
Section III Operation And Maintenance Plan

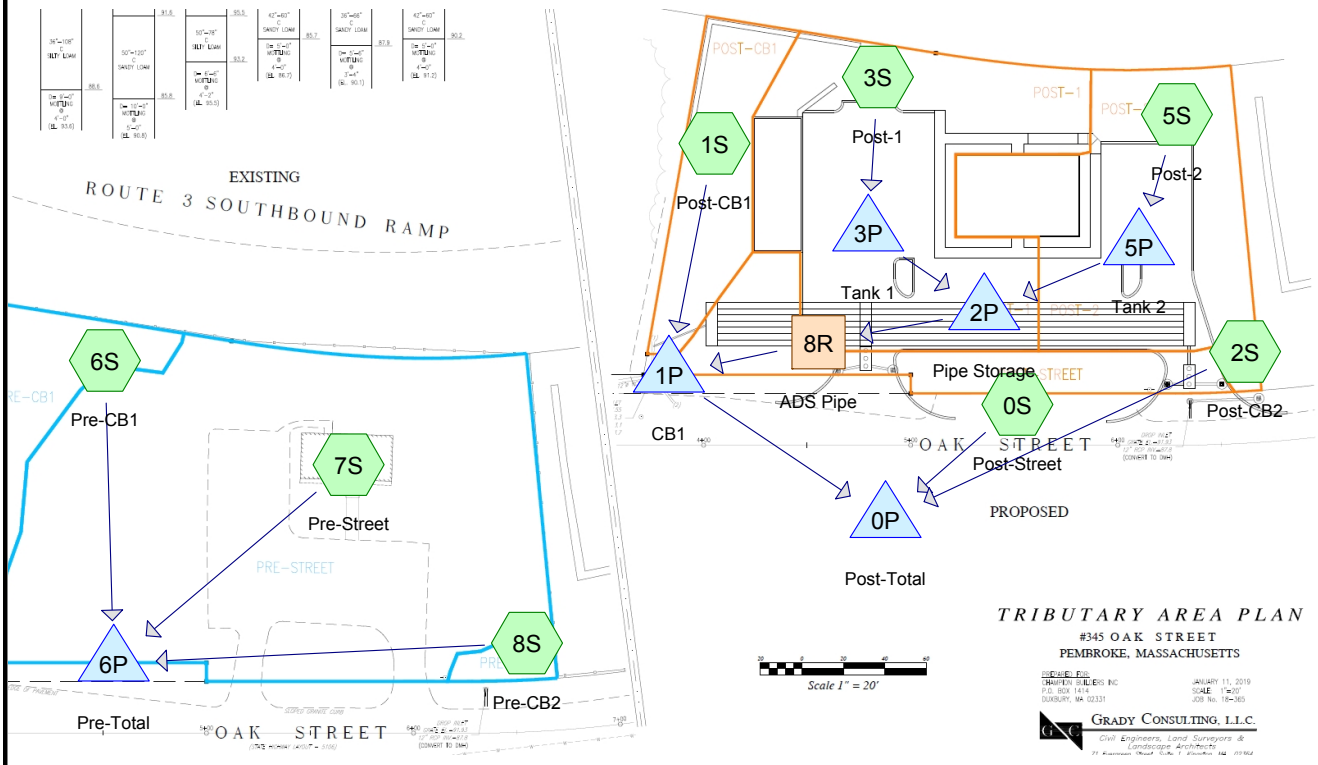
The calculations have been performed for the 2, 10, 25, 100-year 24 hour storm event, using the HydroCAD computer program. This computer program is based upon the Soils Conservation Service (SCS) TR-20 and TR-55 computer models and uses the SCS Curvilinear Unit rainfall distribution.

Peak Rate Summary

The following summary details a reduction in Peak Rate runoff. Values are in cubic feet per second.

	2 YEAR		10 YEAR		25 YEAR		100 YEAR	
	PRE	POST	PRE	POST	PRE	POST	PRE	POST
CB1	0.23	0.22	0.41	0.38	0.53	0.49	0.72	0.66
CB2	0.04	0.02	0.06	0.03	0.08	0.04	0.11	0.05
STREET	1.76	0.29	2.87	0.47	3.65	0.60	4.88	0.81
TOTAL	2.03	0.53	3.33	0.88	4.26	1.13	5.72	1.52

Section I
Overall Site Analysis



Subcat Reach Pond Link

Routing Diagram for 345 Oak Drainage
Prepared by Grady Consulting, LLC, Printed 5/29/2019
HydroCAD® 10.00-21 s/n 09955 © 2018 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
58,152	79	50-75% Grass cover, Fair, HSG C (0S, 1S, 2S, 3S, 5S, 6S, 7S, 8S)
24,001	98	Paved parking, HSG C (0S, 3S, 5S, 7S)
4,946	98	Roofs, HSG C (3S, 5S, 7S)
1,643	98	Unconnected pavement, HSG C (3S, 5S, 7S)
88,742	**86**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
88,742	HSG C	0S, 1S, 2S, 3S, 5S, 6S, 7S, 8S
0	HSG D	
0	Other	
88,742		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sub Num
0	0	58,152	0	0	58,152	50-75% Grass cover, Fair	
0	0	24,001	0	0	24,001	Paved parking	
0	0	4,946	0	0	4,946	Roofs	
0	0	1,643	0	0	1,643	Unconnected pavement	
0	**0**	**88,742**	**0**	**0**	**88,742**	**TOTAL AREA**	

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 0S: Post-Street Runoff Area=6,350 sf 14.90% Impervious Runoff Depth=1.70"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=82 Runoff=0.29 cfs 900 cf

Subcatchment 1S: Post-CB1 Runoff Area=5,213 sf 0.00% Impervious Runoff Depth=1.49"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=79 Runoff=0.20 cfs 647 cf

Subcatchment 2S: Post-CB2 Runoff Area=420 sf 0.00% Impervious Runoff Depth=1.49"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=79 Runoff=0.02 cfs 52 cf

Subcatchment 3S: Post-1 Runoff Area=18,392 sf 67.08% Impervious Runoff Depth=2.54"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=92 Runoff=1.20 cfs 3,895 cf

Subcatchment 5S: Post-2 Runoff Area=13,997 sf 62.64% Impervious Runoff Depth=2.45"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=91 Runoff=0.89 cfs 2,854 cf

Subcatchment 6S: Pre-CB1 Runoff Area=6,022 sf 0.00% Impervious Runoff Depth=1.49"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=79 Runoff=0.23 cfs 747 cf

Subcatchment 7S: Pre-Street Runoff Area=37,415 sf 22.82% Impervious Runoff Depth=1.77"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=83 Runoff=1.76 cfs 5,534 cf

Subcatchment 8S: Pre-CB2 Runoff Area=933 sf 0.00% Impervious Runoff Depth=1.49"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=79 Runoff=0.04 cfs 116 cf

Reach 8R: ADS Pipe Avg. Flow Depth=0.05' Max Vel=2.75 fps Inflow=0.03 cfs 2,556 cf
8.0" Round Pipe n=0.012 L=27.0' S=0.0519 '/' Capacity=2.98 cfs Outflow=0.03 cfs 2,555 cf

Pond 0P: Post-Total Inflow=0.53 cfs 4,154 cf
Primary=0.53 cfs 4,154 cf

Pond 1P: CB1 Inflow=0.22 cfs 3,202 cf
Primary=0.22 cfs 3,202 cf

Pond 2P: Pipe Storage Peak Elev=86.35' Storage=5,060 cf Inflow=2.09 cfs 6,347 cf
Outflow=0.03 cfs 2,556 cf

Pond 3P: Tank 1 Peak Elev=89.28' Storage=235 cf Inflow=1.20 cfs 3,895 cf
12.0" Round Culvert n=0.010 L=15.0' S=0.0100 '/' Outflow=1.20 cfs 3,694 cf

Pond 5P: Tank 2 Peak Elev=89.17' Storage=229 cf Inflow=0.89 cfs 2,854 cf
12.0" Round Culvert n=0.010 L=15.0' S=0.0100 '/' Outflow=0.89 cfs 2,653 cf

Pond 6P: Pre-Total Inflow=2.03 cfs 6,396 cf
Primary=2.03 cfs 6,396 cf

Total Runoff Area = 88,742 sf Runoff Volume = 14,743 cf Average Runoff Depth = 1.99"
65.53% Pervious = 58,152 sf 34.47% Impervious = 30,590 sf

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 0S: Post-Street Runoff Area=6,350 sf 14.90% Impervious Runoff Depth=2.81"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=82 Runoff=0.47 cfs 1,488 cf

Subcatchment 1S: Post-CB1 Runoff Area=5,213 sf 0.00% Impervious Runoff Depth=2.55"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=79 Runoff=0.35 cfs 1,106 cf

Subcatchment 2S: Post-CB2 Runoff Area=420 sf 0.00% Impervious Runoff Depth=2.55"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=79 Runoff=0.03 cfs 89 cf

Subcatchment 3S: Post-1 Runoff Area=18,392 sf 67.08% Impervious Runoff Depth=3.80"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=92 Runoff=1.76 cfs 5,819 cf

Subcatchment 5S: Post-2 Runoff Area=13,997 sf 62.64% Impervious Runoff Depth=3.69"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=91 Runoff=1.31 cfs 4,306 cf

Subcatchment 6S: Pre-CB1 Runoff Area=6,022 sf 0.00% Impervious Runoff Depth=2.55"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=79 Runoff=0.41 cfs 1,277 cf

Subcatchment 7S: Pre-Street Runoff Area=37,415 sf 22.82% Impervious Runoff Depth=2.90"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=83 Runoff=2.87 cfs 9,054 cf

Subcatchment 8S: Pre-CB2 Runoff Area=933 sf 0.00% Impervious Runoff Depth=2.55"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=79 Runoff=0.06 cfs 198 cf

Reach 8R: ADS Pipe Avg. Flow Depth=0.05' Max Vel=2.92 fps Inflow=0.04 cfs 3,176 cf
8.0" Round Pipe n=0.012 L=27.0' S=0.0519 '/' Capacity=2.98 cfs Outflow=0.04 cfs 3,176 cf

Pond 0P: Post-Total Inflow=0.88 cfs 5,859 cf
Primary=0.88 cfs 5,859 cf

Pond 1P: CB1 Inflow=0.38 cfs 4,281 cf
Primary=0.38 cfs 4,281 cf

Pond 2P: Pipe Storage Peak Elev=86.97' Storage=8,062 cf Inflow=3.07 cfs 9,723 cf
Outflow=0.04 cfs 3,176 cf

Pond 3P: Tank 1 Peak Elev=89.45' Storage=245 cf Inflow=1.76 cfs 5,819 cf
12.0" Round Culvert n=0.010 L=15.0' S=0.0100 '/' Outflow=1.76 cfs 5,618 cf

Pond 5P: Tank 2 Peak Elev=89.31' Storage=237 cf Inflow=1.31 cfs 4,306 cf
12.0" Round Culvert n=0.010 L=15.0' S=0.0100 '/' Outflow=1.31 cfs 4,105 cf

Pond 6P: Pre-Total Inflow=3.33 cfs 10,530 cf
Primary=3.33 cfs 10,530 cf

Total Runoff Area = 88,742 sf Runoff Volume = 23,337 cf Average Runoff Depth = 3.16"
65.53% Pervious = 58,152 sf 34.47% Impervious = 30,590 sf

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 0S: Post-Street Runoff Area=6,350 sf 14.90% Impervious Runoff Depth=3.62"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=82 Runoff=0.60 cfs 1,916 cf

Subcatchment 1S: Post-CB1 Runoff Area=5,213 sf 0.00% Impervious Runoff Depth=3.32"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=79 Runoff=0.46 cfs 1,444 cf

Subcatchment 2S: Post-CB2 Runoff Area=420 sf 0.00% Impervious Runoff Depth=3.32"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=79 Runoff=0.04 cfs 116 cf

Subcatchment 3S: Post-1 Runoff Area=18,392 sf 67.08% Impervious Runoff Depth=4.68"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=92 Runoff=2.14 cfs 7,168 cf

Subcatchment 5S: Post-2 Runoff Area=13,997 sf 62.64% Impervious Runoff Depth=4.57"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=91 Runoff=1.61 cfs 5,326 cf

Subcatchment 6S: Pre-CB1 Runoff Area=6,022 sf 0.00% Impervious Runoff Depth=3.32"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=79 Runoff=0.53 cfs 1,668 cf

Subcatchment 7S: Pre-Street Runoff Area=37,415 sf 22.82% Impervious Runoff Depth=3.72"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=83 Runoff=3.65 cfs 11,604 cf

Subcatchment 8S: Pre-CB2 Runoff Area=933 sf 0.00% Impervious Runoff Depth=3.32"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=79 Runoff=0.08 cfs 258 cf

Reach 8R: ADS Pipe Avg. Flow Depth=0.05' Max Vel=3.02 fps Inflow=0.04 cfs 3,585 cf
8.0" Round Pipe n=0.012 L=27.0' S=0.0519 '/' Capacity=2.98 cfs Outflow=0.04 cfs 3,585 cf

Pond 0P: Post-Total Inflow=1.13 cfs 7,061 cf
Primary=1.13 cfs 7,061 cf

Pond 1P: CB1 Inflow=0.49 cfs 5,029 cf
Primary=0.49 cfs 5,029 cf

Pond 2P: Pipe Storage Peak Elev=87.47' Storage=10,191 cf Inflow=3.74 cfs 12,092 cf
Outflow=0.04 cfs 3,585 cf

Pond 3P: Tank 1 Peak Elev=89.56' Storage=251 cf Inflow=2.14 cfs 7,168 cf
12.0" Round Culvert n=0.010 L=15.0' S=0.0100 '/' Outflow=2.14 cfs 6,967 cf

Pond 5P: Tank 2 Peak Elev=89.40' Storage=242 cf Inflow=1.61 cfs 5,326 cf
12.0" Round Culvert n=0.010 L=15.0' S=0.0100 '/' Outflow=1.60 cfs 5,125 cf

Pond 6P: Pre-Total Inflow=4.26 cfs 13,531 cf
Primary=4.26 cfs 13,531 cf

Total Runoff Area = 88,742 sf Runoff Volume = 29,501 cf Average Runoff Depth = 3.99"
65.53% Pervious = 58,152 sf 34.47% Impervious = 30,590 sf

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 0S: Post-Street Runoff Area=6,350 sf 14.90% Impervious Runoff Depth=4.92"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=82 Runoff=0.81 cfs 2,601 cf

Subcatchment 1S: Post-CB1 Runoff Area=5,213 sf 0.00% Impervious Runoff Depth=4.58"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=79 Runoff=0.63 cfs 1,992 cf

Subcatchment 2S: Post-CB2 Runoff Area=420 sf 0.00% Impervious Runoff Depth=4.58"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=79 Runoff=0.05 cfs 160 cf

Subcatchment 3S: Post-1 Runoff Area=18,392 sf 67.08% Impervious Runoff Depth=6.05"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=92 Runoff=2.73 cfs 9,280 cf

Subcatchment 5S: Post-2 Runoff Area=13,997 sf 62.64% Impervious Runoff Depth=5.94"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=91 Runoff=2.06 cfs 6,927 cf

Subcatchment 6S: Pre-CB1 Runoff Area=6,022 sf 0.00% Impervious Runoff Depth=4.58"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=79 Runoff=0.72 cfs 2,301 cf

Subcatchment 7S: Pre-Street Runoff Area=37,415 sf 22.82% Impervious Runoff Depth=5.03"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=83 Runoff=4.88 cfs 15,676 cf

Subcatchment 8S: Pre-CB2 Runoff Area=933 sf 0.00% Impervious Runoff Depth=4.58"
Flow Length=50' Slope=0.0120 '/' Tc=6.5 min CN=79 Runoff=0.11 cfs 356 cf

Reach 8R: ADS Pipe Avg. Flow Depth=0.13' Max Vel=5.16 fps Inflow=0.24 cfs 7,011 cf
8.0" Round Pipe n=0.012 L=27.0' S=0.0519 '/' Capacity=2.98 cfs Outflow=0.24 cfs 7,011 cf

Pond 0P: Post-Total Inflow=1.52 cfs 11,764 cf
Primary=1.52 cfs 11,764 cf

Pond 1P: CB1 Inflow=0.66 cfs 9,002 cf
Primary=0.66 cfs 9,002 cf

Pond 2P: Pipe Storage Peak Elev=87.78' Storage=11,177 cf Inflow=4.78 cfs 15,805 cf
Outflow=0.24 cfs 7,011 cf

Pond 3P: Tank 1 Peak Elev=89.74' Storage=261 cf Inflow=2.73 cfs 9,280 cf
12.0" Round Culvert n=0.010 L=15.0' S=0.0100 '/' Outflow=2.73 cfs 9,079 cf

Pond 5P: Tank 2 Peak Elev=89.53' Storage=249 cf Inflow=2.06 cfs 6,927 cf
12.0" Round Culvert n=0.010 L=15.0' S=0.0100 '/' Outflow=2.06 cfs 6,726 cf

Pond 6P: Pre-Total Inflow=5.72 cfs 18,333 cf
Primary=5.72 cfs 18,333 cf

Total Runoff Area = 88,742 sf Runoff Volume = 39,294 cf Average Runoff Depth = 5.31"
65.53% Pervious = 58,152 sf 34.47% Impervious = 30,590 sf

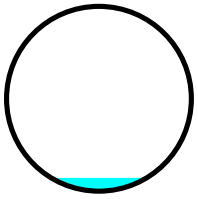
Summary for Reach 8R: ADS Pipe

Inflow Area = 32,389 sf, 65.16% Impervious, Inflow Depth > 0.95" for 2-Year event
Inflow = 0.03 cfs @ 20.63 hrs, Volume= 2,556 cf
Outflow = 0.03 cfs @ 20.64 hrs, Volume= 2,555 cf, Atten= 0%, Lag= 0.3 min

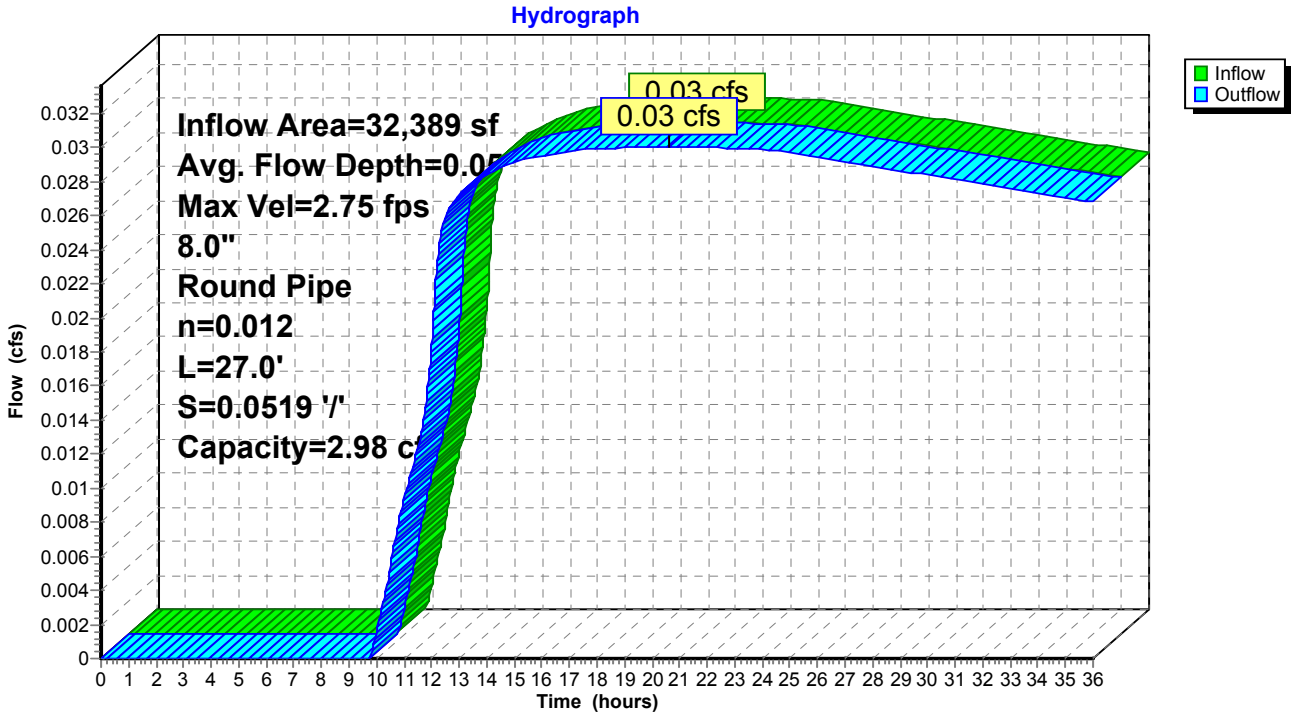
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.75 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.64 fps, Avg. Travel Time= 0.2 min

Peak Storage= 0 cf @ 20.63 hrs
Average Depth at Peak Storage= 0.05'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 2.98 cfs

8.0" Round Pipe
n= 0.012 Corrugated PP, smooth interior
Length= 27.0' Slope= 0.0519 '/'
Inlet Invert= 85.00', Outlet Invert= 83.60'



Reach 8R: ADS Pipe



Summary for Pond 2P: Pipe Storage

Inflow Area = 32,389 sf, 65.16% Impervious, Inflow Depth = 2.35" for 2-Year event
Inflow = 2.09 cfs @ 12.10 hrs, Volume= 6,347 cf
Outflow = 0.03 cfs @ 20.63 hrs, Volume= 2,556 cf, Atten= 99%, Lag= 512.0 min
Primary = 0.03 cfs @ 20.63 hrs, Volume= 2,556 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 86.35' @ 20.63 hrs Surf.Area= 4,851 sf Storage= 5,060 cf

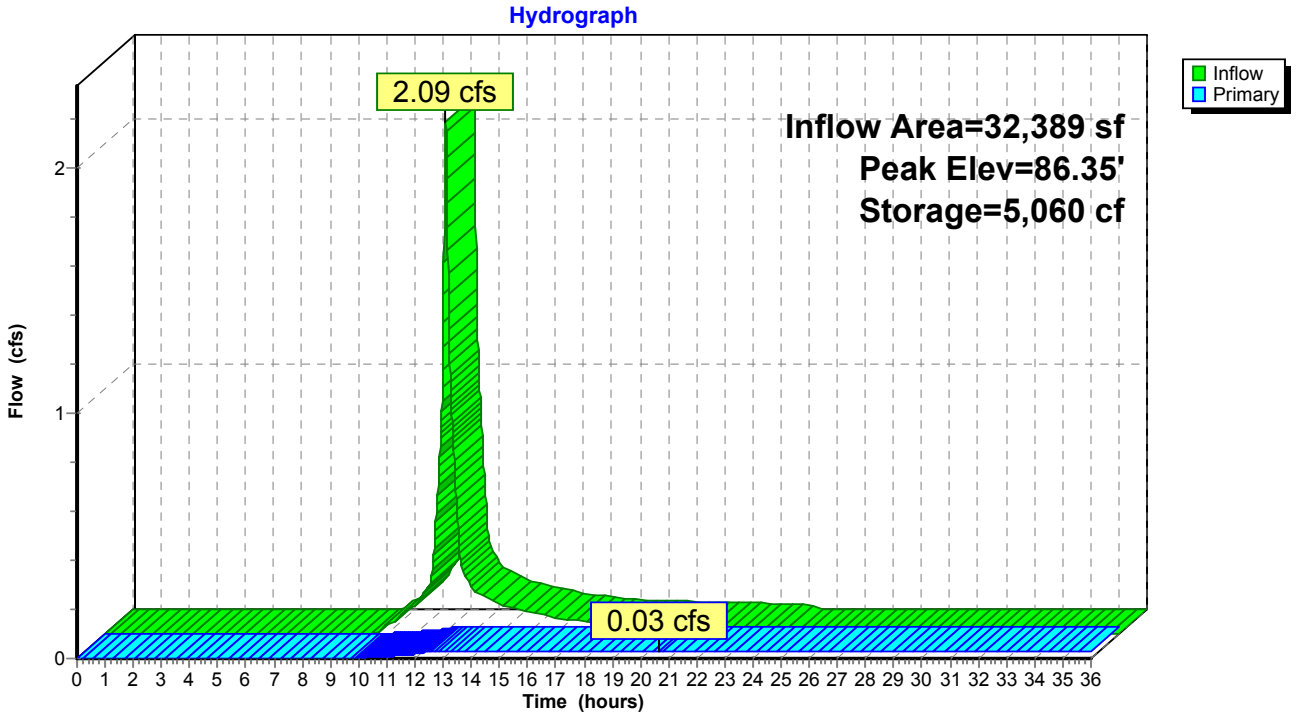
Plug-Flow detention time= 711.9 min calculated for 2,555 cf (40% of inflow)
Center-of-Mass det. time= 598.9 min (1,415.6 - 816.6)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	11,133 cf	**36.0" Round RCP_Round 36"** x 7 L= 225.0'
#2	85.00'	250 cf	**5.00'W x 10.00'L x 5.00'H Tank Housing**
#3	85.00'	250 cf	**5.00'W x 10.00'L x 5.00'H Tank Housing**
#4	85.00'	250 cf	**5.00'W x 10.00'L x 5.00'H Tank Housing**
		11,883 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	85.00'	**1.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	87.50'	**6.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.03 cfs @ 20.63 hrs HW=86.35' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.03 cfs @ 5.51 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 2P: Pipe Storage



Summary for Pond 3P: Tank 1

Inflow Area = 18,392 sf, 67.08% Impervious, Inflow Depth = 2.54" for 2-Year event
Inflow = 1.20 cfs @ 12.09 hrs, Volume= 3,895 cf
Outflow = 1.20 cfs @ 12.10 hrs, Volume= 3,694 cf, Atten= 0%, Lag= 0.3 min
Primary = 1.20 cfs @ 12.10 hrs, Volume= 3,694 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 89.28' @ 12.10 hrs Surf.Area= 55 sf Storage= 235 cf

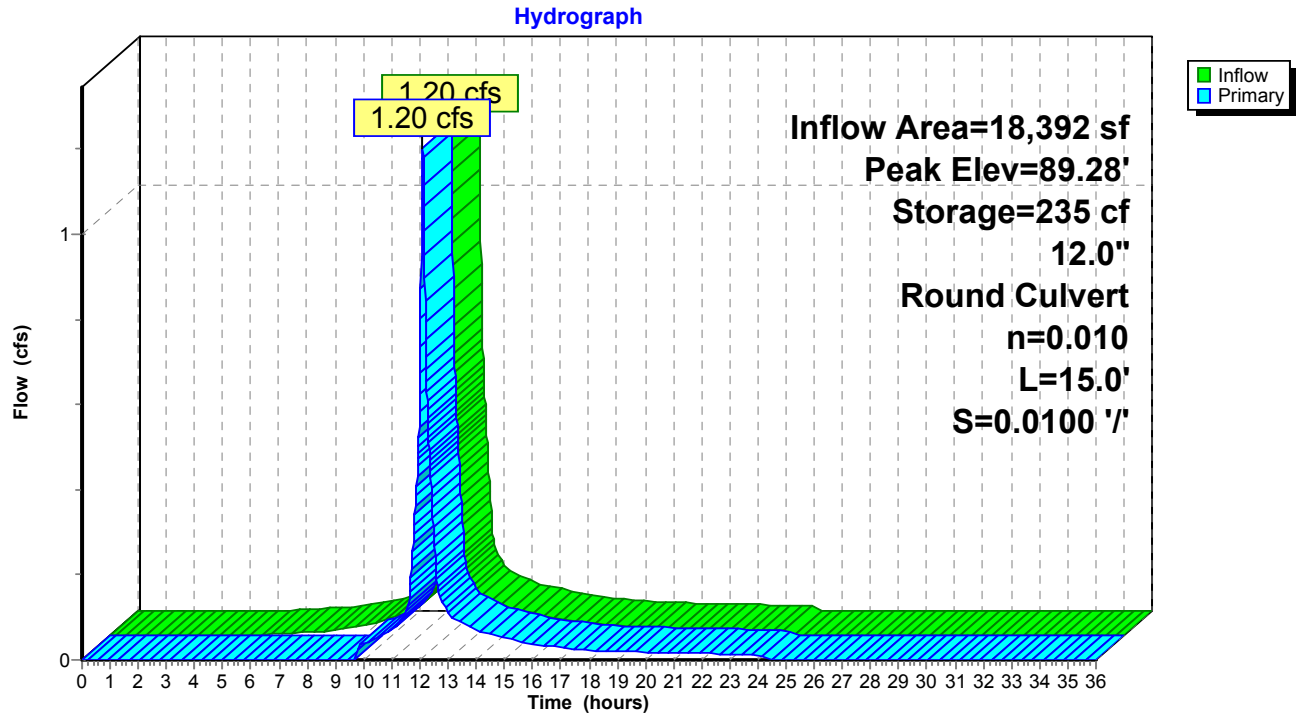
Plug-Flow detention time= 45.8 min calculated for 3,693 cf (95% of inflow)
Center-of-Mass det. time= 17.2 min (813.2 - 796.1)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	293 cf	**5.00'W x 11.00'L x 5.33'H 1500 Gal Tank**

Device	Routing	Invert	Outlet Devices
#1	Primary	88.65'	**12.0" Round RCP_Round 12"** L= 15.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 88.65' / 88.50' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.20 cfs @ 12.10 hrs HW=89.28' (Free Discharge)
1=RCP_Round 12" (Barrel Controls 1.20 cfs @ 3.32 fps)

Pond 3P: Tank 1



Summary for Pond 5P: Tank 2

Inflow Area = 13,997 sf, 62.64% Impervious, Inflow Depth = 2.45" for 2-Year event
Inflow = 0.89 cfs @ 12.09 hrs, Volume= 2,854 cf
Outflow = 0.89 cfs @ 12.10 hrs, Volume= 2,653 cf, Atten= 0%, Lag= 0.3 min
Primary = 0.89 cfs @ 12.10 hrs, Volume= 2,653 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 89.17' @ 12.10 hrs Surf.Area= 55 sf Storage= 229 cf

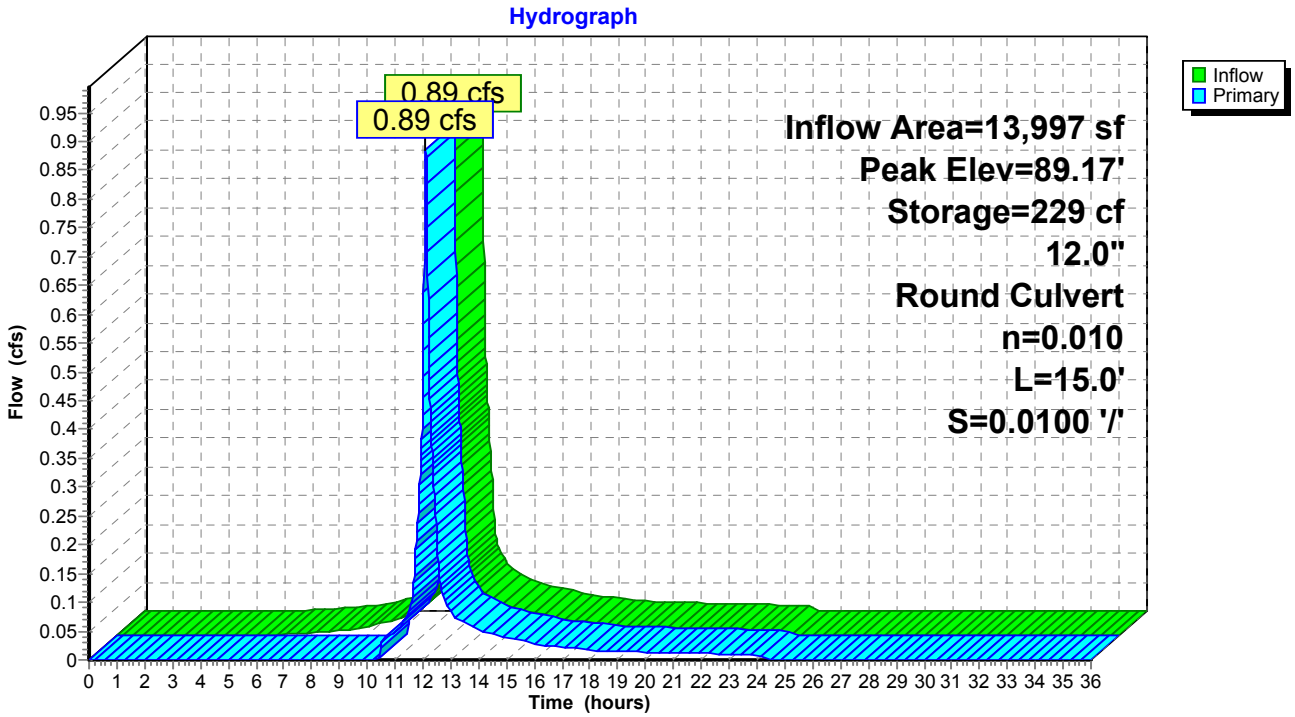
Plug-Flow detention time= 57.6 min calculated for 2,652 cf (93% of inflow)
Center-of-Mass det. time= 20.7 min (821.4 - 800.7)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	293 cf	**5.00'W x 11.00'L x 5.33'H 1500 Gal Tank**

Device	Routing	Invert	Outlet Devices
#1	Primary	88.65'	**12.0" Round RCP_Round 12"** L= 15.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 88.65' / 88.50' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.88 cfs @ 12.10 hrs HW=89.17' (Free Discharge)
↑—**1=RCP_Round 12"** (Barrel Controls 0.88 cfs @ 3.12 fps)

Pond 5P: Tank 2



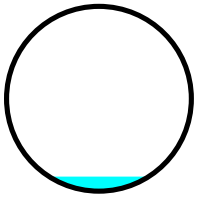
Summary for Reach 8R: ADS Pipe

Inflow Area = 32,389 sf, 65.16% Impervious, Inflow Depth > 1.18" for 10-Year event
Inflow = 0.04 cfs @ 22.20 hrs, Volume= 3,176 cf
Outflow = 0.04 cfs @ 22.20 hrs, Volume= 3,176 cf, Atten= 0%, Lag= 0.3 min

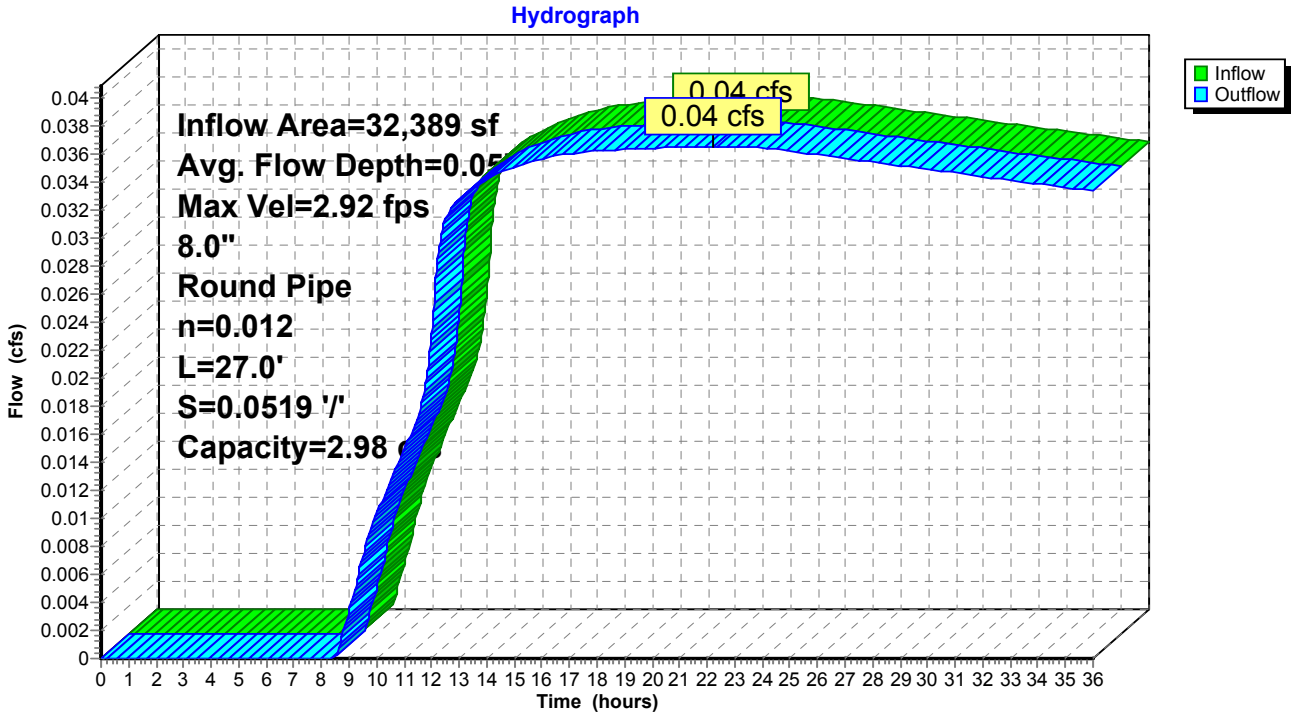
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.92 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.77 fps, Avg. Travel Time= 0.2 min

Peak Storage= 0 cf @ 22.20 hrs
Average Depth at Peak Storage= 0.05'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 2.98 cfs

8.0" Round Pipe
n= 0.012 Corrugated PP, smooth interior
Length= 27.0' Slope= 0.0519 '/'
Inlet Invert= 85.00', Outlet Invert= 83.60'



Reach 8R: ADS Pipe



Summary for Pond 2P: Pipe Storage

Inflow Area = 32,389 sf, 65.16% Impervious, Inflow Depth = 3.60" for 10-Year event
Inflow = 3.07 cfs @ 12.10 hrs, Volume= 9,723 cf
Outflow = 0.04 cfs @ 22.20 hrs, Volume= 3,176 cf, Atten= 99%, Lag= 606.2 min
Primary = 0.04 cfs @ 22.20 hrs, Volume= 3,176 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 86.97' @ 22.20 hrs Surf.Area= 4,633 sf Storage= 8,062 cf

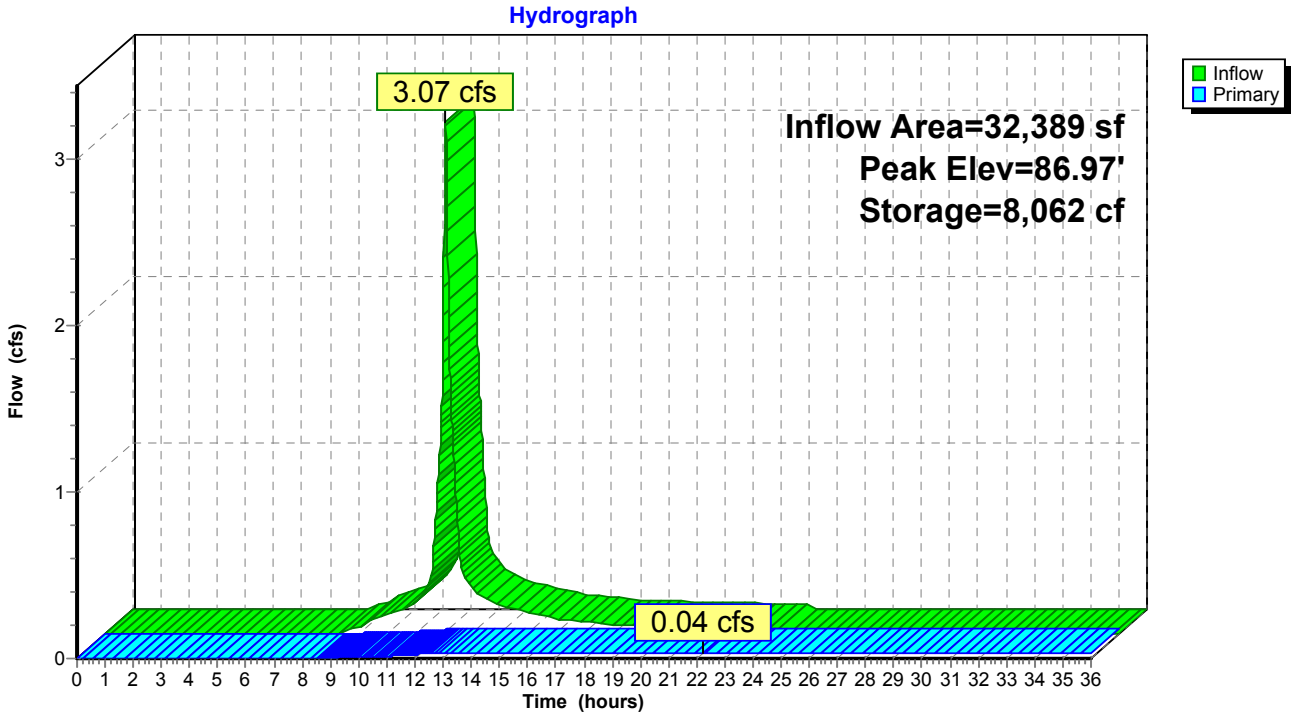
Plug-Flow detention time= 727.5 min calculated for 3,176 cf (33% of inflow)
Center-of-Mass det. time= 602.3 min (1,404.5 - 802.2)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	11,133 cf	**36.0" Round RCP_Round 36"** x 7 L= 225.0'
#2	85.00'	250 cf	**5.00'W x 10.00'L x 5.00'H Tank Housing**
#3	85.00'	250 cf	**5.00'W x 10.00'L x 5.00'H Tank Housing**
#4	85.00'	250 cf	**5.00'W x 10.00'L x 5.00'H Tank Housing**
		11,883 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	85.00'	**1.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	87.50'	**6.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.04 cfs @ 22.20 hrs HW=86.97' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.04 cfs @ 6.69 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 2P: Pipe Storage



Summary for Pond 3P: Tank 1

Inflow Area = 18,392 sf, 67.08% Impervious, Inflow Depth = 3.80" for 10-Year event
Inflow = 1.76 cfs @ 12.09 hrs, Volume= 5,819 cf
Outflow = 1.76 cfs @ 12.10 hrs, Volume= 5,618 cf, Atten= 0%, Lag= 0.3 min
Primary = 1.76 cfs @ 12.10 hrs, Volume= 5,618 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 89.45' @ 12.10 hrs Surf.Area= 55 sf Storage= 245 cf

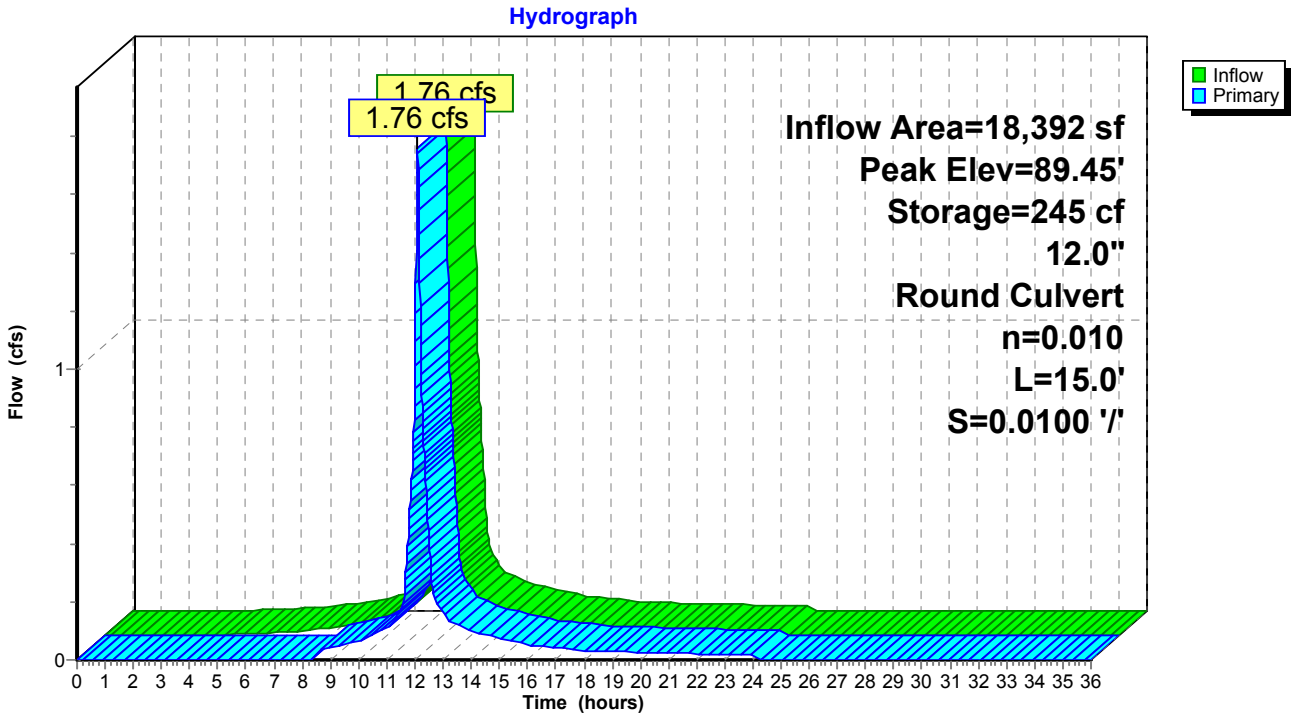
Plug-Flow detention time= 34.5 min calculated for 5,618 cf (97% of inflow)
Center-of-Mass det. time= 14.1 min (799.2 - 785.1)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	293 cf	**5.00'W x 11.00'L x 5.33'H 1500 Gal Tank**

Device	Routing	Invert	Outlet Devices
#1	Primary	88.65'	**12.0" Round RCP_Round 12"** L= 15.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 88.65' / 88.50' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.75 cfs @ 12.10 hrs HW=89.45' (Free Discharge)
1=RCP_Round 12" (Barrel Controls 1.75 cfs @ 3.59 fps)

Pond 3P: Tank 1



Summary for Pond 5P: Tank 2

Inflow Area = 13,997 sf, 62.64% Impervious, Inflow Depth = 3.69" for 10-Year event
Inflow = 1.31 cfs @ 12.09 hrs, Volume= 4,306 cf
Outflow = 1.31 cfs @ 12.10 hrs, Volume= 4,105 cf, Atten= 0%, Lag= 0.3 min
Primary = 1.31 cfs @ 12.10 hrs, Volume= 4,105 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 89.31' @ 12.10 hrs Surf.Area= 55 sf Storage= 237 cf

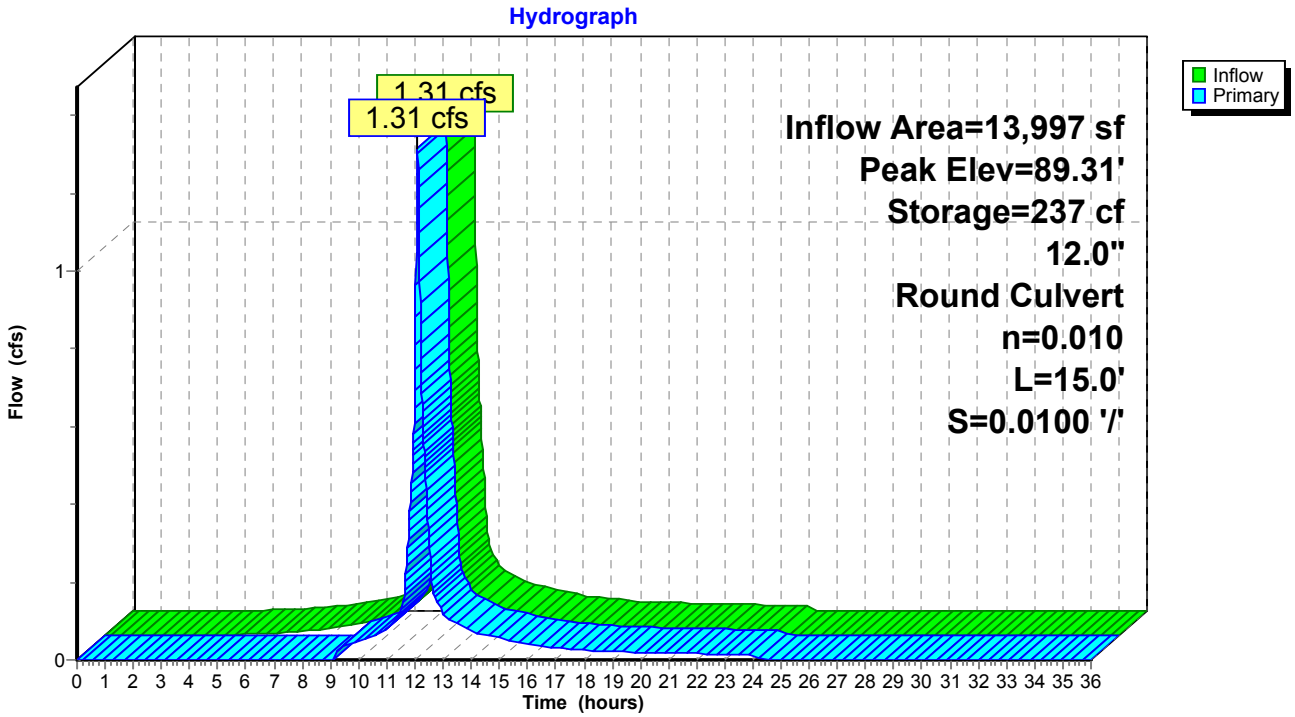
Plug-Flow detention time= 43.5 min calculated for 4,105 cf (95% of inflow)
Center-of-Mass det. time= 17.0 min (806.3 - 789.4)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	293 cf	**5.00'W x 11.00'L x 5.33'H 1500 Gal Tank**

Device	Routing	Invert	Outlet Devices
#1	Primary	88.65'	**12.0" Round RCP_Round 12"** L= 15.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 88.65' / 88.50' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.31 cfs @ 12.10 hrs HW=89.31' (Free Discharge)
↑—**1=RCP_Round 12"** (Barrel Controls 1.31 cfs @ 3.38 fps)

Pond 5P: Tank 2



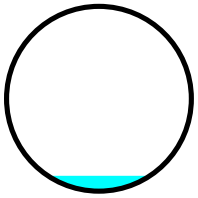
Summary for Reach 8R: ADS Pipe

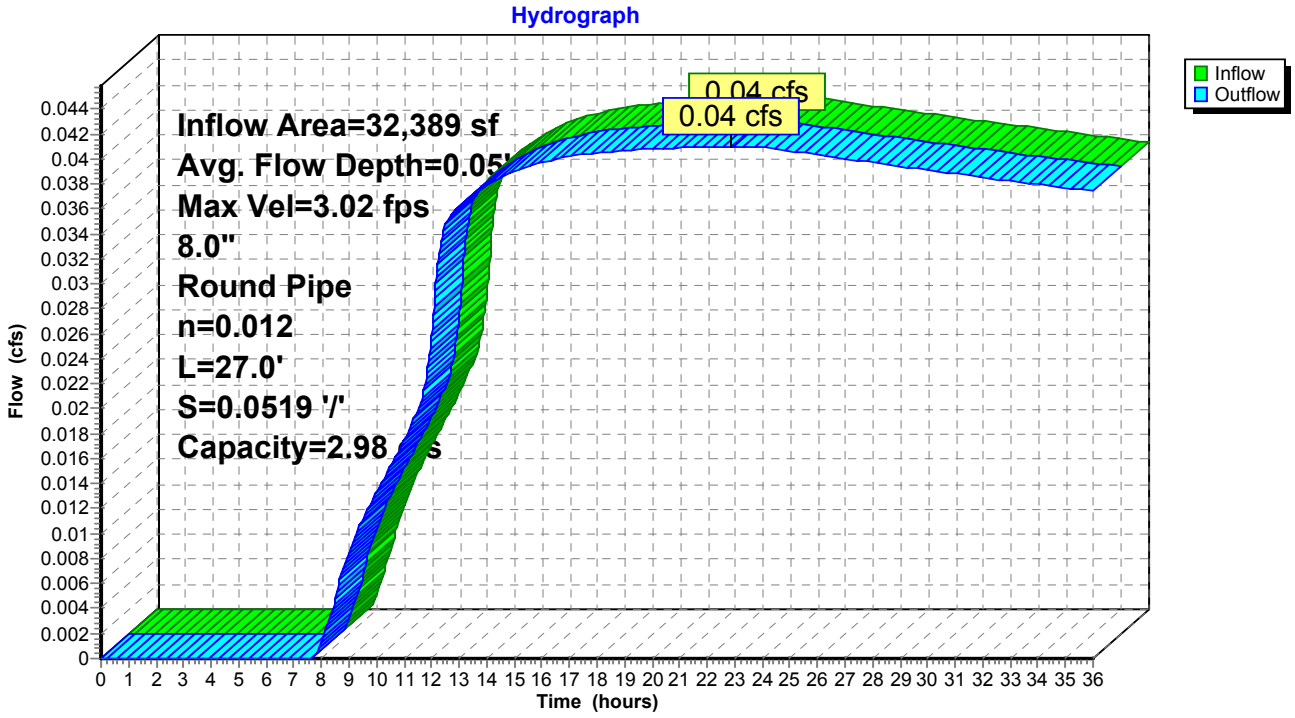
Inflow Area = 32,389 sf, 65.16% Impervious, Inflow Depth > 1.33" for 25-Year event
Inflow = 0.04 cfs @ 22.82 hrs, Volume= 3,585 cf
Outflow = 0.04 cfs @ 22.83 hrs, Volume= 3,585 cf, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.02 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.84 fps, Avg. Travel Time= 0.2 min

Peak Storage= 0 cf @ 22.83 hrs
Average Depth at Peak Storage= 0.05'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 2.98 cfs

8.0" Round Pipe
n= 0.012 Corrugated PP, smooth interior
Length= 27.0' Slope= 0.0519 '/'
Inlet Invert= 85.00', Outlet Invert= 83.60'





Summary for Pond 2P: Pipe Storage

Inflow Area = 32,389 sf, 65.16% Impervious, Inflow Depth = 4.48" for 25-Year event
Inflow = 3.74 cfs @ 12.10 hrs, Volume= 12,092 cf
Outflow = 0.04 cfs @ 22.82 hrs, Volume= 3,585 cf, Atten= 99%, Lag= 643.8 min
Primary = 0.04 cfs @ 22.82 hrs, Volume= 3,585 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 87.47' @ 22.82 hrs Surf.Area= 3,744 sf Storage= 10,191 cf

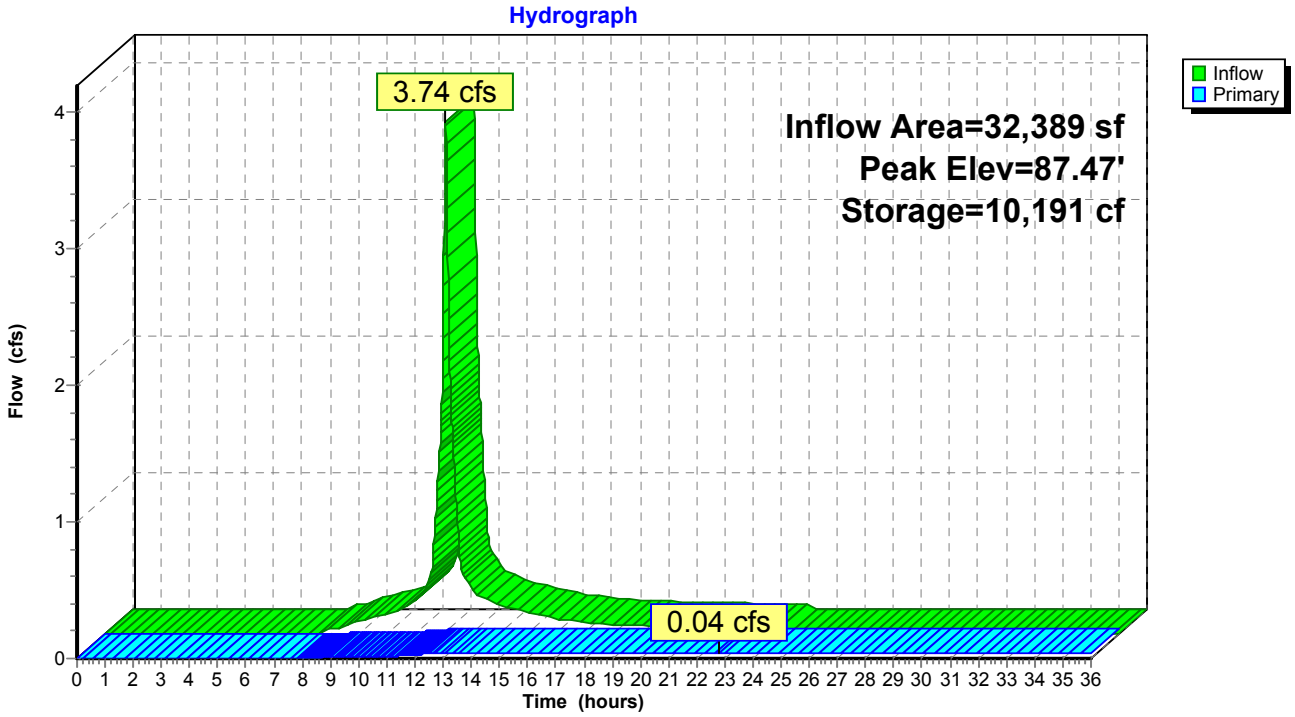
Plug-Flow detention time= 738.5 min calculated for 3,584 cf (30% of inflow)
Center-of-Mass det. time= 602.9 min (1,398.0 - 795.1)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	11,133 cf	**36.0" Round RCP_Round 36"** x 7 L= 225.0'
#2	85.00'	250 cf	**5.00'W x 10.00'L x 5.00'H Tank Housing**
#3	85.00'	250 cf	**5.00'W x 10.00'L x 5.00'H Tank Housing**
#4	85.00'	250 cf	**5.00'W x 10.00'L x 5.00'H Tank Housing**
		11,883 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	85.00'	**1.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	87.50'	**6.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.04 cfs @ 22.82 hrs HW=87.47' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.04 cfs @ 7.51 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 2P: Pipe Storage



Summary for Pond 3P: Tank 1

Inflow Area = 18,392 sf, 67.08% Impervious, Inflow Depth = 4.68" for 25-Year event
Inflow = 2.14 cfs @ 12.09 hrs, Volume= 7,168 cf
Outflow = 2.14 cfs @ 12.10 hrs, Volume= 6,967 cf, Atten= 0%, Lag= 0.3 min
Primary = 2.14 cfs @ 12.10 hrs, Volume= 6,967 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 89.56' @ 12.10 hrs Surf.Area= 55 sf Storage= 251 cf

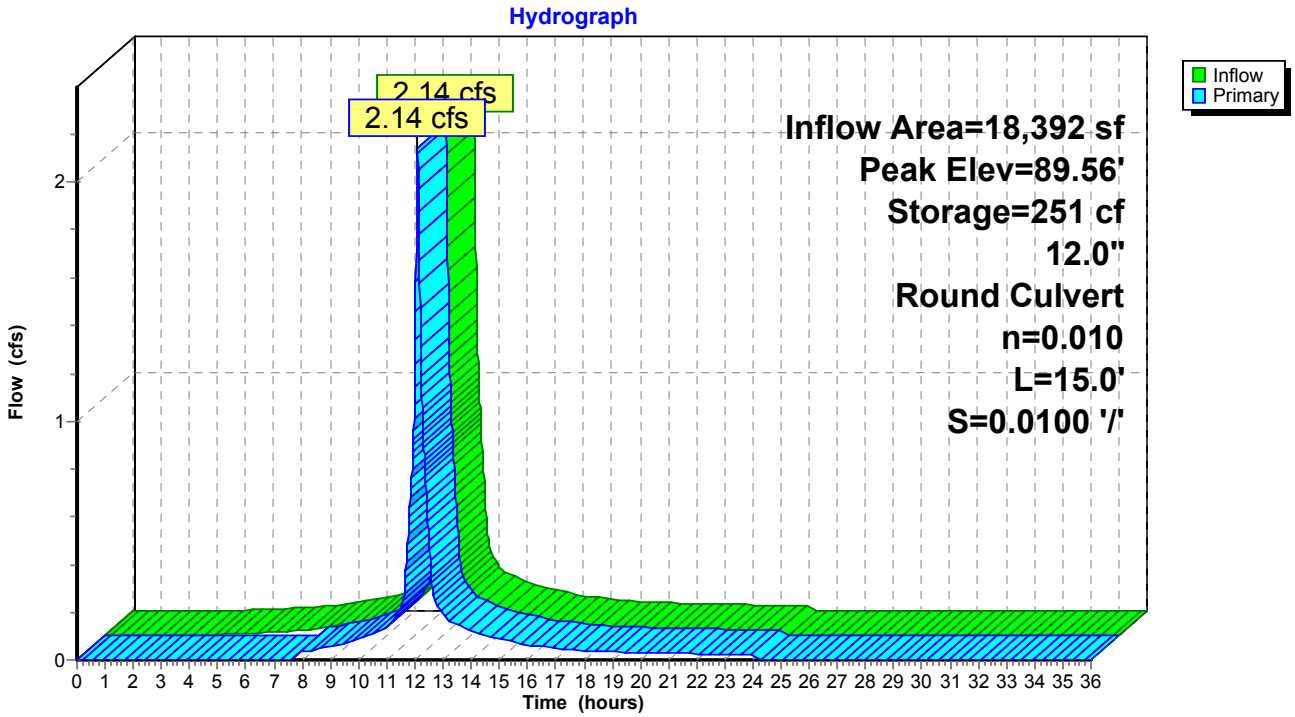
Plug-Flow detention time= 29.6 min calculated for 6,967 cf (97% of inflow)
Center-of-Mass det. time= 12.6 min (792.3 - 779.7)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	293 cf	**5.00'W x 11.00'L x 5.33'H 1500 Gal Tank**

Device	Routing	Invert	Outlet Devices
#1	Primary	88.65'	**12.0" Round RCP_Round 12"** L= 15.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 88.65' / 88.50' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.14 cfs @ 12.10 hrs HW=89.56' (Free Discharge)
1=RCP_Round 12" (Barrel Controls 2.14 cfs @ 3.75 fps)

Pond 3P: Tank 1



Summary for Pond 5P: Tank 2

Inflow Area = 13,997 sf, 62.64% Impervious, Inflow Depth = 4.57" for 25-Year event
Inflow = 1.61 cfs @ 12.09 hrs, Volume= 5,326 cf
Outflow = 1.60 cfs @ 12.10 hrs, Volume= 5,125 cf, Atten= 0%, Lag= 0.3 min
Primary = 1.60 cfs @ 12.10 hrs, Volume= 5,125 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 89.40' @ 12.10 hrs Surf.Area= 55 sf Storage= 242 cf

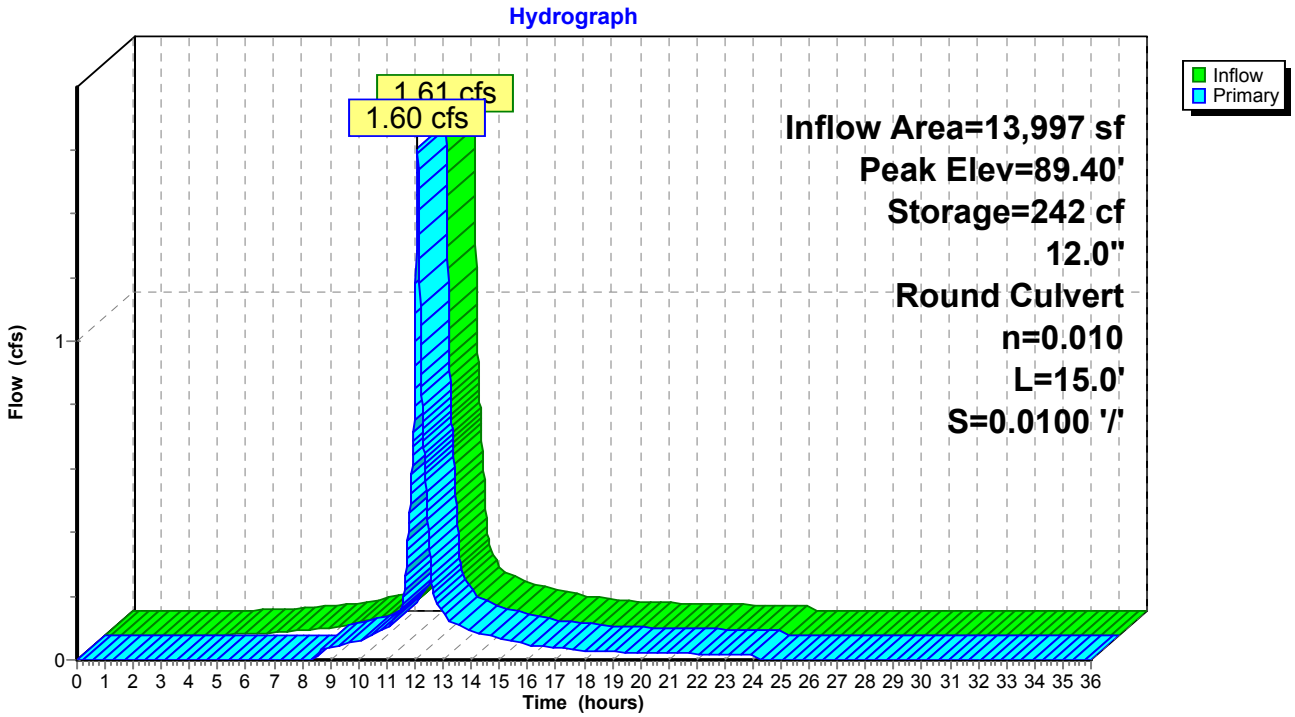
Plug-Flow detention time= 37.4 min calculated for 5,125 cf (96% of inflow)
Center-of-Mass det. time= 15.3 min (799.0 - 783.7)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	293 cf	**5.00'W x 11.00'L x 5.33'H 1500 Gal Tank**

Device	Routing	Invert	Outlet Devices
#1	Primary	88.65'	**12.0" Round RCP_Round 12"** L= 15.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 88.65' / 88.50' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.60 cfs @ 12.10 hrs HW=89.40' (Free Discharge)
↑—**1=RCP_Round 12"** (Barrel Controls 1.60 cfs @ 3.52 fps)

Pond 5P: Tank 2



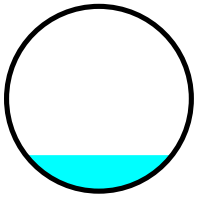
Summary for Reach 8R: ADS Pipe

Inflow Area = 32,389 sf, 65.16% Impervious, Inflow Depth > 2.60" for 100-Year event
Inflow = 0.24 cfs @ 14.23 hrs, Volume= 7,011 cf
Outflow = 0.24 cfs @ 14.24 hrs, Volume= 7,011 cf, Atten= 0%, Lag= 0.2 min

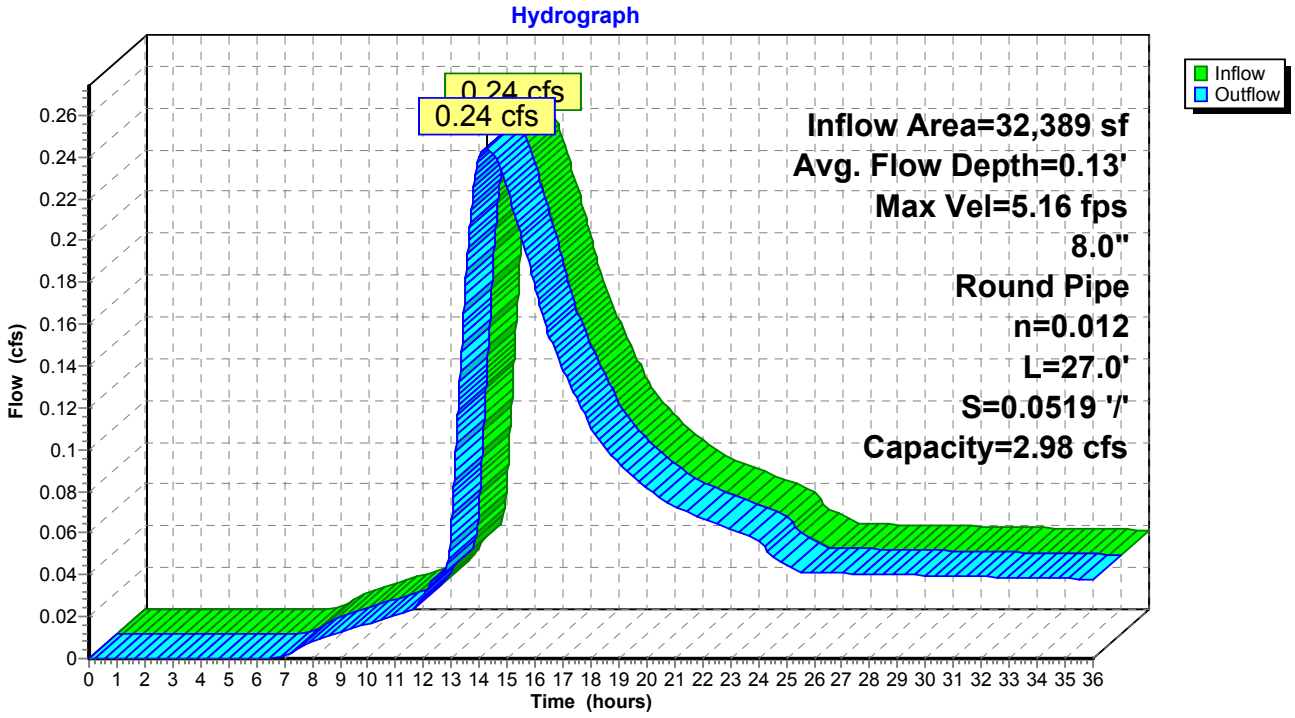
Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.16 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.25 fps, Avg. Travel Time= 0.1 min

Peak Storage= 1 cf @ 14.23 hrs
Average Depth at Peak Storage= 0.13'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 2.98 cfs

8.0" Round Pipe
n= 0.012 Corrugated PP, smooth interior
Length= 27.0' Slope= 0.0519 '/'
Inlet Invert= 85.00', Outlet Invert= 83.60'



Reach 8R: ADS Pipe



Summary for Pond 2P: Pipe Storage

Inflow Area = 32,389 sf, 65.16% Impervious, Inflow Depth = 5.86" for 100-Year event
Inflow = 4.78 cfs @ 12.10 hrs, Volume= 15,805 cf
Outflow = 0.24 cfs @ 14.23 hrs, Volume= 7,011 cf, Atten= 95%, Lag= 128.3 min
Primary = 0.24 cfs @ 14.23 hrs, Volume= 7,011 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 87.78' @ 14.23 hrs Surf.Area= 2,626 sf Storage= 11,177 cf

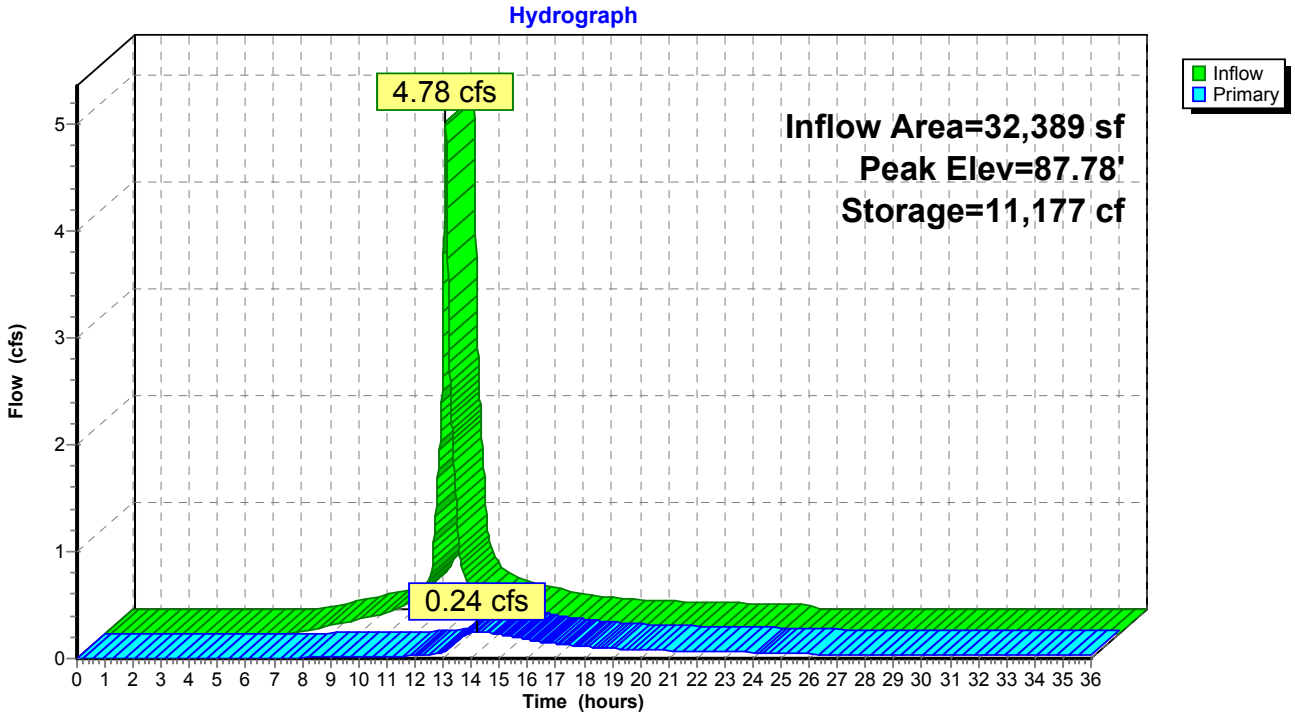
Plug-Flow detention time= 527.4 min calculated for 7,010 cf (44% of inflow)
Center-of-Mass det. time= 410.1 min (1,196.8 - 786.7)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	11,133 cf	**36.0" Round RCP_Round 36"** x 7 L= 225.0'
#2	85.00'	250 cf	**5.00'W x 10.00'L x 5.00'H Tank Housing**
#3	85.00'	250 cf	**5.00'W x 10.00'L x 5.00'H Tank Housing**
#4	85.00'	250 cf	**5.00'W x 10.00'L x 5.00'H Tank Housing**
		11,883 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	85.00'	**1.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	87.50'	**6.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.24 cfs @ 14.23 hrs HW=87.78' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.04 cfs @ 7.96 fps)
└**2=Orifice/Grate** (Orifice Controls 0.20 cfs @ 1.79 fps)

Pond 2P: Pipe Storage



Summary for Pond 3P: Tank 1

Inflow Area = 18,392 sf, 67.08% Impervious, Inflow Depth = 6.05" for 100-Year event
Inflow = 2.73 cfs @ 12.09 hrs, Volume= 9,280 cf
Outflow = 2.73 cfs @ 12.10 hrs, Volume= 9,079 cf, Atten= 0%, Lag= 0.3 min
Primary = 2.73 cfs @ 12.10 hrs, Volume= 9,079 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 89.74' @ 12.10 hrs Surf.Area= 55 sf Storage= 261 cf

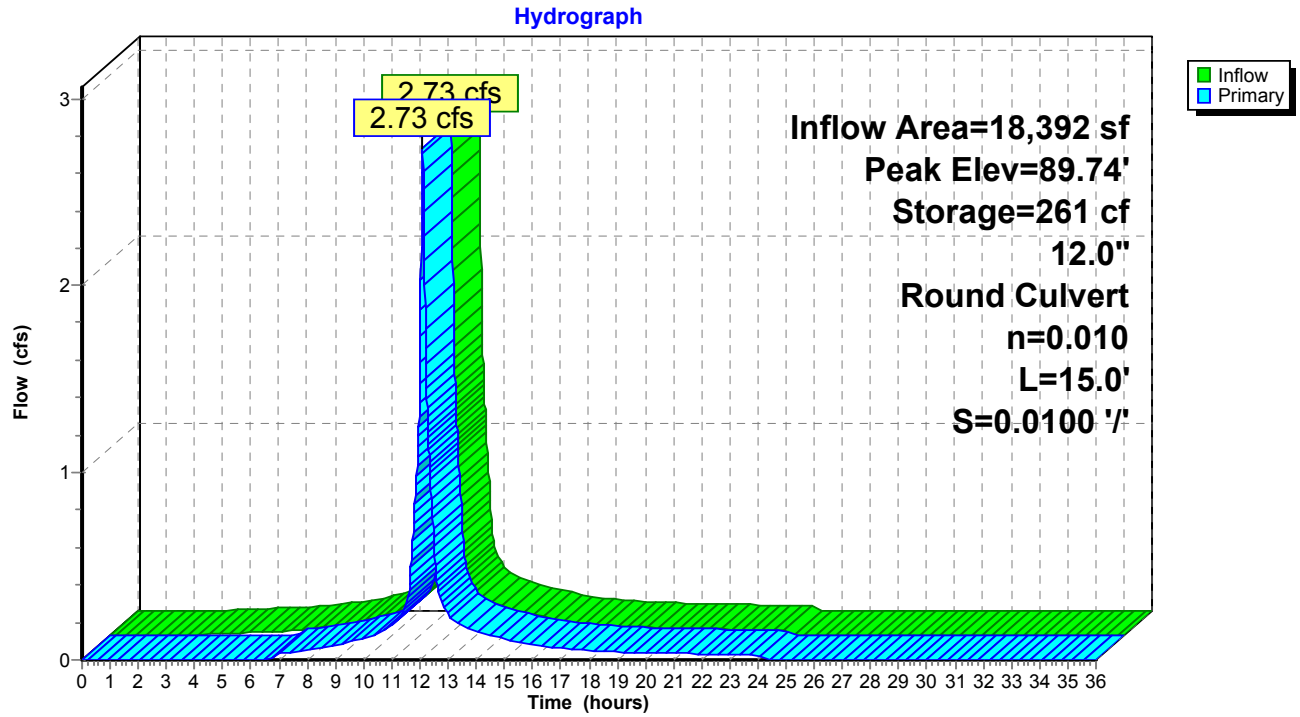
Plug-Flow detention time= 24.4 min calculated for 9,077 cf (98% of inflow)
Center-of-Mass det. time= 10.9 min (784.1 - 773.2)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	293 cf	**5.00'W x 11.00'L x 5.33'H 1500 Gal Tank**

Device	Routing	Invert	Outlet Devices
#1	Primary	88.65'	**12.0" Round RCP_Round 12"** L= 15.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 88.65' / 88.50' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.73 cfs @ 12.10 hrs HW=89.74' (Free Discharge)
↑**1=RCP_Round 12"** (Barrel Controls 2.73 cfs @ 3.98 fps)

Pond 3P: Tank 1



Summary for Pond 5P: Tank 2

Inflow Area = 13,997 sf, 62.64% Impervious, Inflow Depth = 5.94" for 100-Year event
Inflow = 2.06 cfs @ 12.09 hrs, Volume= 6,927 cf
Outflow = 2.06 cfs @ 12.09 hrs, Volume= 6,726 cf, Atten= 0%, Lag= 0.3 min
Primary = 2.06 cfs @ 12.09 hrs, Volume= 6,726 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 89.53' @ 12.09 hrs Surf.Area= 55 sf Storage= 249 cf

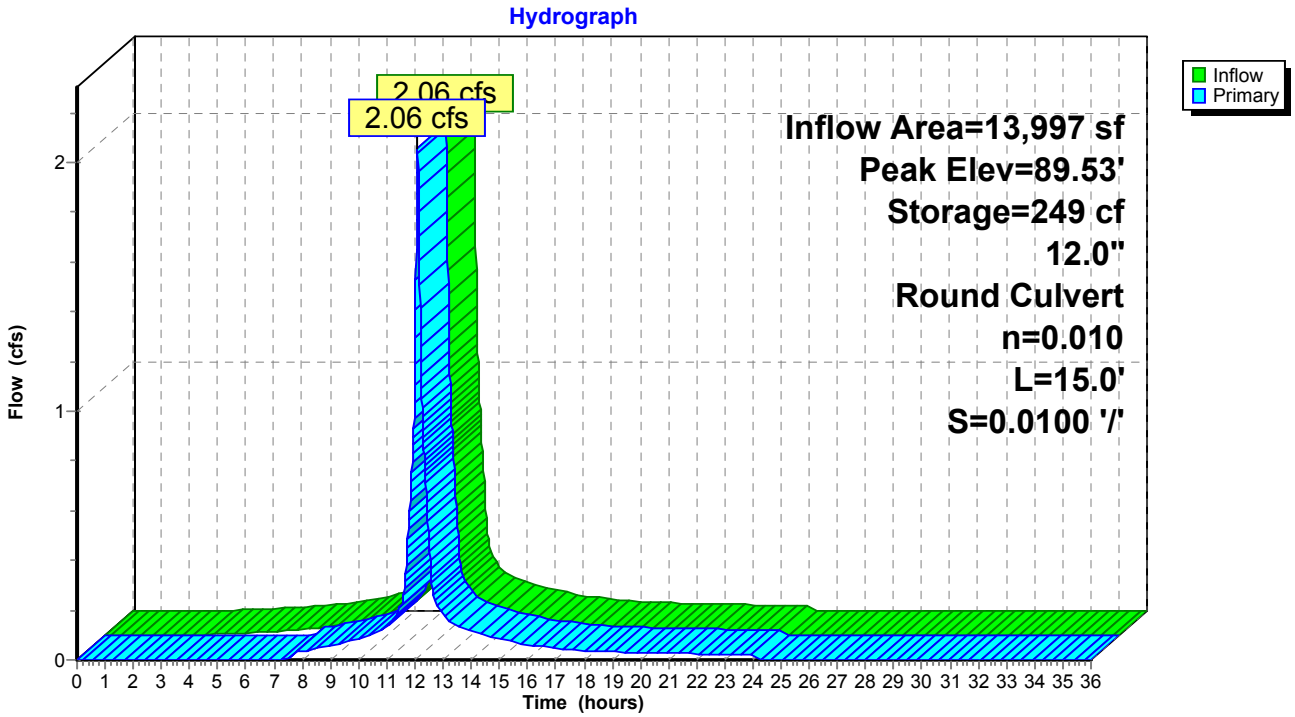
Plug-Flow detention time= 30.9 min calculated for 6,724 cf (97% of inflow)
Center-of-Mass det. time= 13.3 min (790.2 - 776.9)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	293 cf	**5.00'W x 11.00'L x 5.33'H 1500 Gal Tank**

Device	Routing	Invert	Outlet Devices
#1	Primary	88.65'	**12.0" Round RCP_Round 12"** L= 15.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 88.65' / 88.50' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.05 cfs @ 12.09 hrs HW=89.53' (Free Discharge)
1=RCP_Round 12" (Barrel Controls 2.05 cfs @ 3.72 fps)

Pond 5P: Tank 2



Section II
Stormwater Management

- **STANDARD #1 No New Stormwater Conveyances**
  The proposed development proposes no new stormwater conveyances that discharge untreated stormwater off-site or cause down gradient erosion.

- **STANDARD #2 Post Development Peak Discharge**
  The overall site analysis demonstrates that the stormwater management system has been designed so that the post-development peak discharge rates do not exceed the pre-development discharge rate for the 2yr, 10 yr, 25yr & 100 yr 24 hr storm events.

- **STANDARD #3 RECHARGE TO GROUNDWATER**

  High groundwater and poor soils restrict the feasibility of onsite infiltration of stormwater. This project is for the redevelopment of an existing dwelling and proposes to reduce peak flows from the 2, 10, 25, and 100 year storm events.

- **STANDARD #4 WATER QUALITY**

  High groundwater and poor soils restrict the feasibility of onsite infiltration of stormwater. This project is for the redevelopment of an existing dwelling and proposes to reduce peak flows from the 2, 10, 25, and 100 year storm events.

- **TSS REMOVAL** (see TSS Removal Work Sheet)

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: 345 Oak Street, Pembroke

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Oil Grit Separator	0.25	0.75	0.19	0.56
	0.00	0.56	0.00	0.56
	0.00	0.56	0.00	0.56
	0.00	0.56	0.00	0.56

Total TSS Removal = 44%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 18-365
Prepared By: BK
Date: 5/30/2019

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

- **STANDARD #5 Land Uses With Higher Potential Pollutant Loads**
  The site and use is not a LUHPPL

- **STANDARD #6 Critical Areas**
  The site is not located near an Outstanding Resource Water Resource.

- **STANDARD #7 Redevelopment**
  This project is a redevelopment project.

- **STANDARD #8 Erosion & Sediment Control Plan**
  Erosion and sediment controls are detailed within the site plan.

- **STANDARD #9 Operation & Maintenance Plan**
  See O&M plan attached hereto.

- **STANDARD #10 Illicit Discharge Statement**
  "All illicit discharges to the stormwater management system are prohibited."

This statement is intended to meet Standard #10 of the Stormwater Management requirements

Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater.

Except for the potential for deliberate criminal act of discharge by an unauthorized entity for which the property owner has no control, there are to be no illicit discharges into the stormwater system.

AGENT

Applicant\Owner

Section III

Operation & Maintenance

OPERATION AND MAINTENANCE PLAN

PROPOSED SITE WORK – DURING CONSTRUCTION

420 Washington Street, Assessors Map E12-31
Pembroke, Massachusetts

Owner:
Champion Builders Inc.
P.O. Box #1414
Duxbury, MA 02331
Contact: (781) 585-4114 Email: mdacey@championbuilders.com

Party Responsible for Operation and Maintenance:
Champion Builders Inc.
P.O. Box #1414
Duxbury, MA 02331
Contact: (781) 585-4114 Email: mdacey@championbuilders.com

Source of Funding:

Operation and Maintenance of this stormwater management system will be the responsibility of the property owner to include its successor and/or assigns, as the same may appear on record with the appropriate register of deeds.

During Construction:

Construction activities shall follow the Construction Sequence shown on the approved plans. During periods of active construction the stormwater management system shall be inspected on a weekly basis and within 24 hours of a storm event of greater than ½". Maintenance tasks shall be performed monthly or after significant rainfall events of 1" of rain or greater. During construction, silt-laden runoff shall be prevented from entering the drainage system and off-site properties. Temporary swales shall be constructed as needed during construction to direct runoff to sediment traps. Infiltration systems and subsurface storage systems shall not be placed in service until after the installation of base course pavement and vegetative stabilization of the areas contributing to the systems.

During dewatering operations, all water pumped from the dewatering shall be directed to a "dirt bag" pumped sediment removal system (or approved equal) as manufactured by ACF Environmental. Water from construction dewatering activities should not be directed into any of the existing or proposed stormwater management facilities system unless it is fully treated prior to discharge. The unit shall be placed on a crushed stone blanket. Disposal of such "dirt bag" shall occur when the device is full and can no longer effectively filter sediment or allow water to pass at a reasonable flow rate. Disposal of this unit shall be the responsibility of the contractor and shall be as directed by the owner in accordance with applicable local, state, and federal guidelines and regulations.

All erosion and sedimentation control measures shall be in place prior to the commencement of any site work or earthwork operations, and shall be maintained during construction, and shall remain in place until all site work is complete and ground cover is established.

All exposed soils not to be paved shall be stabilized as soon as practical. Seed mixes shall only be applied during appropriate periods as recommended by the seed supplier, typically May 1 to October 15. Any exposed soils that cannot be stabilized by vegetation during these dates shall be stabilized with hay bales, hay mulch, check dams, jute netting or other acceptable means.

Once each structure is in place, it should be maintained in accordance with the procedures described in the post-construction Operations and Maintenance Plan.

During dry periods where dust is created by construction activities the following control measures should be implemented.

- Sprinkling – The contractor may sprinkle the ground along haul roads and traffic areas until moist.
- Vegetative cover – Areas that are not expected to be disturbed regularly may be stabilized with vegetative cover.
- Mulch – Mulching can be used as a quick and effective means of dust control in recently disturbed areas.
- Spray on chemical soil treatments may be utilized. Application rates shall conform to manufacturers recommendations.

Illicit Discharges

Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. Illicit discharges are prohibited from the stormwater management system and the stormwater management system shall be inspected for illicit discharges annually.

STORMWATER MANAGEMENT
BEST MANAGEMENT PRACTICES
INSPECTION SCHEDULE AND EVALUATION CHECKLIST – CONSTRUCTION PHASE

PROJECT LOCATION: 345 Oak Street, Pembroke Latest Revision: May 30, 2019

Stormwater Control Manager: _____ **Stamp**

Best Management Practice	Inspection Frequency (1)	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/ Repair Needed yes/no List items	Date of Cleaning/Repair	Performed By	Water Level in Detention System
Silt socks & swales and silt traps	After every major storm event							
Dewatering Operations	Daily- during actual dewatering							
Temporary Construction Entrance	Daily or as needed.							

(1) Refer to the Massachusetts Stormwater Management, Volume Two: Stormwater Technical Handbook for recommendations regarding frequency for inspection and maintenance of specific BMPs.

Limited or no use of sodium chloride salts, fertilizers or pesticides recommended. Slow release fertilizer recommended.
Other notes:(Include deviations from: Con Com Order of Conditions, PB Approval, Construction Sequence and Approved Plan)

OPERATION AND MAINTENANCE PLAN
PROPOSED DRAINAGE SYSTEM – POST CONSTRUCTION
420 Washington Street, Assessors Map E12-31
Pembroke, Massachusetts

Owner:
Champion Builders Inc.
P.O. Box #1414
Duxbury, MA 02331
Contact: (781) 585-4114 Email: mdacey@championbuilders.com
Party Responsible for Operation and Maintenance:

After construction is complete the owner will be the party responsible for operation and maintenance of the drainage system. When the property is conveyed, the new owner will be the party responsible for operation and maintenance.

Source of Funding:
Operation and Maintenance of this stormwater management system will be the responsibility of the owner.

Schedule for Inspection and Maintenance:
Outlet Structure
After construction, the outlet structure should be inspected at least once per year to ensure that the system is operating as intended. If accumulated sediment is observed within the structure it should be removed as necessary. Any sediment removed should be disposed of in accordance with Town, State and Federal Regulations.

The 1" diameter orifice should be kept clear of debris, and should be inspected quarterly to ensure no blockage exists. Standing water in the storage pipes is an indicator of such a blockage.

Illicit Discharges

> Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. Illicit discharges are prohibited from the stormwater management system and the stormwater management system shall be inspected for illicit discharges annually.

This Standard prohibits illicit discharges to stormwater management systems. The stormwater management system is the system for conveying, treating, and infiltrating stormwater on-site, including stormwater best management practices and any pipes intended to transport stormwater to the groundwater, a surface water, or municipal separate storm sewer system. Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. Notwithstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing and water used to clean residential buildings without detergents.

For additional information, refer to Performance Standards and Guidelines for Stormwater Management in Massachusetts, published by the Department of Environmental Protection.

STORMWATER MANAGEMENT
BEST MANAGEMENT PRACTICES

INSPECTION SCHEDULE AND EVALUATION CHECKLIST – POST CONSTRUCTION PHASE

PROJECT LOCATION: 345 Oak Street, Pembroke Latest Revision January 23, 2019

Best Management Practice	Inspection Frequency (1)	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/ Repair Needed yes/no List items	Date of Cleaning/ Repair	Performed By	Water Level in Drainage System
Outlet Structure	Once per year							

(1) Refer to the Massachusetts Stormwater Management, Volume Two: Stormwater Technical Handbook for recommendations regarding frequency for inspection and maintenance of specific BMPs.
(2) records shall be kept for a minimum of three years.

Limited or no use of sodium chloride salts, fertilizers or pesticides recommended. Slow release fertilizer recommended.

Other notes:(Include deviations from: Con Com Order of Conditions, PB Approval, Construction Sequence and Approved Plan)

Stormwater Control Manager: _____ **Stamp**

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Plymouth County, Massachusetts

January 24, 2019

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:917 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 10 20 40 60

Feet
0 40 80 160 240

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

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: Plymouth County, Massachusetts
Survey Area Data: Version 11, Sep 7, 2018

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

Date(s) aerial images were photographed: Aug 26, 2014—Sep 4, 2014

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
636B	Montauk-Urban land complex, 0 to 8 percent slopes	1.6	100.0%
Totals for Area of Interest		**1.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Plymouth County, Massachusetts

636B—Montauk-Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2w7zx
Elevation: 0 to 230 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Montauk and similar soils: 50 percent
Urban land: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Montauk

Setting

Landform: Hills, ground moraines, recessionial moraines, drumlins
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 4 inches: fine sandy loam
Bw1 - 4 to 26 inches: fine sandy loam
Bw2 - 26 to 34 inches: sandy loam
2Cd - 34 to 72 inches: gravelly loamy sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 5.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: cemented material

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Scituate

Percent of map unit: 5 percent
Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Summit, footslope, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Udorthents, loamy

Percent of map unit: 5 percent
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

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Commonwealth of Massachusetts

_____, Massachusetts

Soil Suitability Assessment for On-site Sewage Disposal

Performed by: Brendan Kling Date: 1/29/19
GRADY CONSULTING, L.L.C.
71 Evergreen Street, Suite 1
Kingston, MA 02364
Phone: (781) 585-2300 Fax: (781) 585-2378

Witnessed by: LISA COLLITY NO CHARGE ; RESCHEDULE

Location Address or Lot # 345 OAK ST PEMBROKE, MA

*Owner's Name STEVE TOMASI
*Address &
*Telephone # 781-354-7002

New Construction ✓ Repair ___

Office Review

Published Soil Survey Available: No X Yes___
Year Published: _____ Publication Scale: _____ Soil Map Unit: _____
Drainage Class: _____ Soil Limitations: _____

Published Soil Survey Available: No X Yes___
Year Published: _____ Publication Scale: _____
Geologic Material (Map Unit): _____
Landform: _____

Flood Insurance Rate Map:
Above 500 year flood boundary: **No** ___ **Yes** X
Within 500 year flood boundary **No** X **Yes** ___
Within 100 year flood boundary **No** X **Yes** ___

Wetland Area:
National Wetland Inventory Map (map unit): _____
Wetlands Conservancy Program Map (map unit): _____

Current Water Resource Conditions (USGS): **Month:** JANUARY
Range: **Above Normal** ✓ **Normal** _____ **Below Normal** _____

Other References Reviewed: _____

Depth of Naturally Occurring Pervious Material

Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

If not, what is the depth of naturally occurring pervious material?

Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise, and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated on the attached soil evaluation form, are accurate and in accordance with CMR 15.100 through 15.107.

Signature: _____ Date: 3/20/19

TITLE 5 ON-SITE REVIEW

Deep Hole # 1 **Date** 1/29 **Time** 9:00 AM **Weather** 30° OVERCAST
Location(identify on Site Plan) _____
Land Use grass **Slope(%)** 1-3 **Surface Stones** N/A
Vegetation grass **Landform** _____

Distances from: Open Water Body - ft. Possible Wet Area - ft. Drinking Water Well _____ ft.

Drainageway _____ ft. Propertyline ~15 ft Other _____

DEEP OBSERVATION HOLE LOG

Depth From Surface (Inches)	Soil Horizon (USDA	Soil Texture (Munsell)	Soil Color	Soil Mottling	Other: Structures, Stones, Boulders, Consistency, %Gravel
0"-18"	FILL	—		—	—
18-36	B	SILTY LOAM	10 YR 5/6	—	— SOME COARSE SAND
36-108	C	SILTY LOAM	10YR 6/2	48"	TIGHT, 10% STONES
					POCKETS of SANDY LOAM

Parent Material (geologic) _____ **Depth to Bedrock** _____
Depth to Groundwater: **Standing Water in Hole:** _____ **Weeping from Pit Face** 74"
Estimated Seasonal High Groundwater 48"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method Used:
___ **Depth observed standing in observation hole:** ____ **inches** ✓ **Depth to soil mottles:** 48 **inches**
___ **Depth to weeping from side of observation hole:** ____ **inches** ____ **Groundwater adjustment** ____ **ft**
Index Well # _____ **Reading Date** _____ **Index well level** _____ **Adj.factor** _____ **Adj.Groundwater level** ____

PERCOLATION TEST **Date** _____ **Time** _____

Observation Hole #			**Time at 9"**		
Depth of Perc			**Time at 6"**		
Start Presoak			**Time (9"-6")**		
End Presoak			**Rate Min/Inch**		

Site Suitability Assessment: **Site Passed** _____ **Site Failed** _____ **Additional Testing Needed:**
Performed By Brendan Kling **Certification #** _____
Witnessed By Lisa Cullity
Comments:

TITLE 5 ON-SITE REVIEW

Deep Hole # 2 **Date** 1/29 **Time** 9 15 **Weather** 30°
Location(identify on Site Plan) 2
Land Use Woods **Slope(%)** 3-8 **Surface Stones** —
Vegetation ↑ deciduous **Landform**

Distances from: Open Water Body ~ ft. Possible Wet Area — ft. Drinking Water Well ____ ft.

Drainageway ____ ft. Propertyline 10-15 ft Other ____

DEEP OBSERVATION HOLE LOG

Depth From Surface (Inches)	Soil Horizon (USDA	Soil Texture (Munsell)	Soil Color	Soil Mottling	Other: Structures, Stones, Boulders, Consistency, %Gravel
0"-18"	FILL	—			
18"-50"	B	LOAM	10YR 5/6	—	
50"-120"	C	SANDY LOAM	10YR 6/2	60"	15% STONES

Parent Material (geologic) ____ **Depth to Bedrock** ____
Depth to Groundwater: **Standing Water in Hole:** 120" **Weeping from Pit Face** ____
Estimated Seasonal High Groundwater 60"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method Used:
___ **Depth observed standing in observation hole:** ____ **inches** ✓ **Depth to soil mottles:** 60 **inches**
___ **Depth to weeping from side of observation hole:** ____ **inches** ____ **Groundwater adjustment** ____ **ft**
Index Well # ____ **Reading Date** ____ **Index well level** ____ **Adj.factor** ____ **Adj.Groundwater level** ____

PERCOLATION TEST **Date** 1/29 **Time** 11:06

Observation Hole #	2		**Time at 9"**			
Depth of Perc	54"		**Time at 6"**			
Start Presoak	11:12		**Time (9"-6")**			
End Presoak	11:27		**Rate Min/Inch**			

Site Suitability Assessment: **Site Passed** ____ **Site Failed** ____ **Additional Testing Needed:**
Performed By Brendan Kling **Certification #** ____
Witnessed By Lisa
Comments: PERC AFTER LISA LEFT

10.75" @ 12:30

TITLE 5 ON-SITE REVIEW

Deep Hole # 3 **Date** 1/29 **Time** 930 **Weather** 30°
Location(identify on Site Plan) #3
Land Use grass **Slope(%)** 1-3 **Surface Stones** —
Vegetation grass **Landform**

Distances from: Open Water Body — ft. Possible Wet Area — ft. Drinking Water Well ft.
Drainageway ft. Propertyline 10-15 ft Other

DEEP OBSERVATION HOLE LOG

Depth From Surface (Inches)	Soil Horizon (USDA	Soil Texture (Munsell)	Soil Color	Soil Mottling	Other: Structures, Stones, Boulders, Consistency, %Gravel
0"-50"	Fill		10YR 5/1		
50"-78"	C	Silty Loam	7.5YR 6/4	50"	

Parent Material (geologic) **Depth to Bedrock** —
Depth to Groundwater: **Standing Water in Hole:** 72" **Weeping from Pit Face** 55"
Estimated Seasonal High Groundwater 50"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method Used:
___ Depth observed standing in observation hole: ____inches ✓ Depth to soil mottles: 50 inches
___ Depth to weeping from side of observation hole: ____inches ____ Groundwater adjustment ____ft
Index Well #_____ Reading Date_____ Index well level_____ Adj.factor_____ Adj.Groundwater level____

PERCOLATION TEST **Date** **Time**

Observation Hole #			Time at 9"			
Depth of Perc			Time at 6"			
Start Presoak			Time (9"-6")			
End Presoak			Rate Min/Inch			

Site Suitability Assessment: **Site Passed**_____ **Site Failed**_____ **Additional Testing Needed:**
Performed By Brendan Kling **Certification #**
Witnessed By Lisa Collity
Comments:

TITLE 5 ON-SITE REVIEW

Deep Hole # 4 **Date** 1/29 **Time** 11:30 **Weather** 30°
Location(identify on Site Plan) _____
Land Use Woods **Slope(%)** 3-8 **Surface Stones** —
Vegetation ↑ **Landform** _____

Distances from: Open Water Body — ft. Possible Wet Area — ft. Drinking Water Well _____ ft.
Drainageway _____ ft. Propertyline 10-15 ft Other _____

DEEP OBSERVATION HOLE LOG

Depth From Surface (Inches)	Soil Horizon (USDA	Soil Texture (Munsell)	Soil Color	Soil Mottling	Other: Structures, Stones, Boulders, Consistency, %Gravel
0-18	FILL			—	
18"-42"	B	SANDY LOAM		—	
42-60	C	SANDY LOAM		48"	15% STONES

Parent Material (geologic) _____ **Depth to Bedrock** _____
Depth to Groundwater: **Standing Water in Hole:** 54" **Weeping from Pit Face** _____
Estimated Seasonal High Groundwater 48"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method Used:
___ **Depth observed standing in observation hole:** ____ **inches** ✓ **Depth to soil mottles:** 48 **inches**
___ **Depth to weeping from side of observation hole:** ____ **inches** ____ **Groundwater adjustment** ____ **ft**
Index Well # _____ **Reading Date** _____ **Index well level** _____ **Adj.factor** _____ **Adj.Groundwater level** ____

PERCOLATION TEST **Date** _____ **Time** _____

Observation Hole #		**Time at 9"**		
Depth of Perc		**Time at 6"**		
Start Presoak		**Time (9"-6")**		
End Presoak		**Rate Min/Inch**		

Site Suitability Assessment: **Site Passed** _____ **Site Failed** _____ **Additional Testing Needed:**
Performed By Brendan Kling **Certification #** _____
Witnessed By —
Comments:

TITLE 5 ON-SITE REVIEW

Deep Hole # 5 **Date** 1/29 **Time** 11:45 **Weather** 30°
Location(identify on Site Plan)
Land Use **Slope(%)** 3-8 **Surface Stones**
Vegetation **Landform**

Distances from: Open Water Body ~ ft. Possible Wet Area — ft. Drinking Water Well ft.
Drainageway ft. Propertyline 20 ft Other

DEEP OBSERVATION HOLE LOG

Depth From Surface (Inches)	Soil Horizon (USDA	Soil Texture (Munsell)	Soil Color	Soil Mottling	Other: Structures, Stones, Boulders, Consistency,%Gravel
0-18	FILL	~			
18"-36"	B				
36"-66"	C	SANDY LOAM		40"	20% STONES

Parent Material (geologic) **Depth to Bedrock**
Depth to Groundwater: **Standing Water in Hole:** **Weeping from Pit Face** 48"
Estimated Seasonal High Groundwater 40"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method Used:
___ **Depth observed standing in observation hole:** ____**inches** ✓ **Depth to soil mottles:** 40 **inches**
___ **Depth to weeping from side of observation hole:** ____**inches** ____ **Groundwater adjustment** ____**ft**
Index Well # _____ **Reading Date** _____ **Index well level** _____ **Adj.factor** _____ **Adj.Groundwater level** ____

PERCOLATION TEST **Date** **Time**

Observation Hole #			**Time at 9"**		
Depth of Perc			**Time at 6"**		
Start Presoak			**Time (9"-6")**		
End Presoak			**Rate Min/Inch**		

Site Suitability Assessment: **Site Passed** _____ **Site Failed** _____ **Additional Testing Needed:**
Performed By Brendan Uling **Certification #**
Witnessed By —
Comments:

TITLE 5 ON-SITE REVIEW

Deep Hole # 6 **Date** 1/29 **Time** 12:00 **Weather** 31°
Location(identify on Site Plan)
Land Use Grass **Slope(%)** 1-3 **Surface Stones** —
Vegetation tall brush / thorns **Landform**

Distances from: Open Water Body — ft. Possible Wet Area — ft. Drinking Water Well ft.

Drainageway ft. Propertyline ≈ 20 ft Other

DEEP OBSERVATION HOLE LOG

Depth From Surface (Inches)	Soil Horizon (USDA	Soil Texture (Munsell)	Soil Color	Soil Mottling	Other: Structures, Stones, Boulders, Consistency, %Gravel
0" - 42"	FILL				
42" - 60"	C	SANDY LOAM		48"	20% Stones Some Boulders

Parent Material (geologic) **Depth to Bedrock**
Depth to Groundwater: **Standing Water in Hole:** **Weeping from Pit Face**
Estimated Seasonal High Groundwater

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method Used:
___ **Depth observed standing in observation hole:** ___ **inches** ✓ **Depth to soil mottles:** 48 **inches**
___ **Depth to weeping from side of observation hole:** ___ **inches** ___ **Groundwater adjustment** ___ **ft**
Index Well # **Reading Date** **Index well level** **Adj.factor** **Adj.Groundwater level**

PERCOLATION TEST **Date** **Time**

Observation Hole #		**Time at 9"**		
Depth of Perc		**Time at 6"**		
Start Presoak		**Time (9"-6")**		
End Presoak		**Rate Min/Inch**		

Site Suitability Assessment: **Site Passed** **Site Failed** **Additional Testing Needed:**
Performed By Brendan Kling **Certification #**
Witnessed By —
Comments:

TITLE 5 ON-SITE REVIEW

Deep Hole # 7 **Date** 3-20-19 **Time** 8:30 AM **Weather** SUNNY - 45°
Location(identify on Site Plan) _____
Land Use Wood **Slope(%)** 1-5% **Surface Stones** —
Vegetation oaks **Landform** _____

Distances from: Open Water Body 100+ ft. Possible Wet Area — ft. Drinking Water Well — ft.
Drainageway 50+ ft. Propertyline 15-20 ft Other _____

DEEP OBSERVATION HOLE LOG

Depth From Surface (Inches)	Soil Horizon (USDA	Soil Texture (Munsell)	Soil Color	Soil Mottling	Other: Structures, Stones, Boulders, Consistency, %Gravel
0-18	A	FILL	7.5YR 3/2		
18-48	B	SILTY LOAM	7.5YR 4/4		
48-84	C1	SILTY LOAM	7.5YR 5/3	60"	
84-150	C2	SANDY LOAM	7.5YR 6/2		

Parent Material (geologic) _____ **Depth to Bedrock** _____
Depth to Groundwater: **Standing Water in Hole:** 144 **Weeping from Pit Face** _____
Estimated Seasonal High Groundwater 60"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method Used:
___ **Depth observed standing in observation hole:** 144 **inches** ✓ **Depth to soil mottles:** 60 **inches**
___ **Depth to weeping from side of observation hole:** ___ **inches** ___ **Groundwater adjustment** ___ **ft**
Index Well # _____ **Reading Date** _____ **Index well level** _____ **Adj.factor** _____ **Adj.Groundwater level** ___

PERCOLATION TEST **Date** _____ **Time** _____

Observation Hole #	7	8	**Time at 9"**	10:41	10:42
Depth of Perc	84"-102"		**Time at 6"**	11:40	11:39
Start Presoak	9:02	9:10	**Time (9"-6")**	59 MIN	57 MIN
End Presoak	9:17	9:25	**Rate Min/Inch**	20	20

Site Suitability Assessment: **Site Passed** ✓ **Site Failed** _____ **Additional Testing Needed:**
Performed By BRENDAN KLING **Certification #** _____
Witnessed By LISA CULLITY
Comments: BACK FILLED W/ PERL SAND