Technical Supplement
Drainage Calculations

FOR
The Preserve at Abbyville
And
Abbyville Commons

LOCATED IN
NORFOLK, MASSACHUSETTS

PREPARED FOR
Abbyville Development, LLC
and
Abbyville Residential, LLC
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Wrentham, Massachusetts 02093

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DATE:
October 17, 2017

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Note: Revised Grading and Utility Plans Sheets GU8 thru GU11 are being filed as separate documents. The grading and utility plans reflect the revisions to the three sediment fore-bays and the three infiltration basins. Additionally we added a water main easement at the Daniel Drive Cul-de-sac through the open space to Morse Road.

APPENDIX A

Sediment Fore-bay Sizing Calculations:

IB – 1 modeled as Pond A

Impervious Area = 7.664 acres

7.664 x 1/12 x 0.1 = 0.0639 acre feet required 0.070 acre feet provided

IB – 2 modeled as LS Basin 2

Impervious Area = 3.175 acres

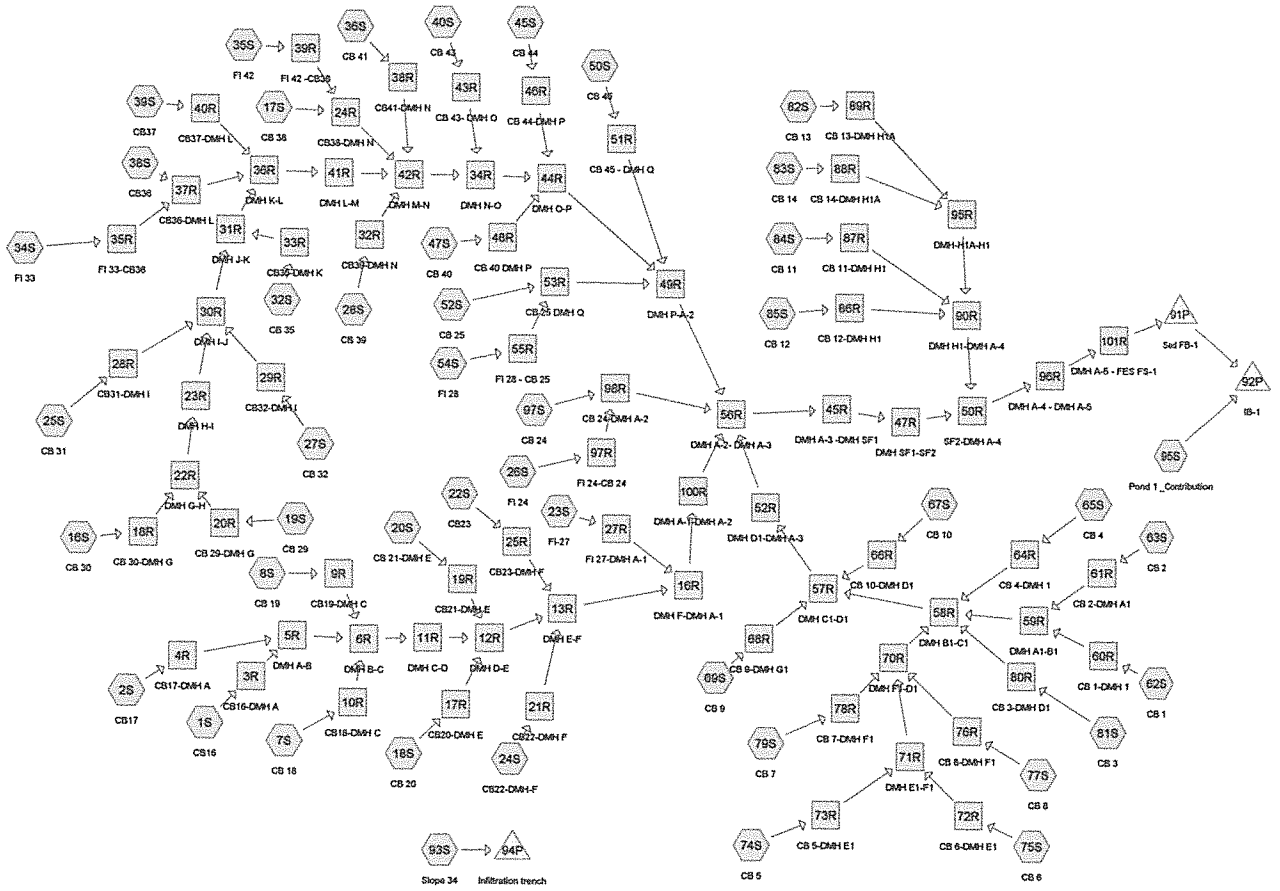
3.175 x 1/12 x 0.1 = 0.0265 acre feet required 0.071 acre feet provided

IB – 3 modeled as Pond A

Impervious Area = 7.664 acres

6.824 x 1/12 x 0.1 = 0.0569 acre feet required 0.295 acre feet provided

APPENDIX B



Subcat Reach Pond Link

Routing Diagram for LS-Apartments (prop Cond)-BasinA -101717
Prepared by Hewlett-Packard Company, Printed 10/17/2017
HydroCAD® 10.00-20 s/n 01535 © 2017 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.550	46	2 acre lots, 12% imp, HSG A (62S)
19.922	39	>75% Grass cover, Good, HSG A (1S, 2S, 7S, 8S, 16S, 17S, 19S, 20S, 23S, 24S, 25S, 26S, 27S, 32S, 34S, 35S, 36S, 38S, 39S, 40S, 45S, 52S, 54S, 62S, 63S, 65S, 67S, 69S, 74S, 75S, 77S, 79S, 81S, 82S, 83S, 84S, 85S, 93S, 95S, 97S)
0.430	98	Paved parking, HSG A (16S, 97S)
5.318	98	Paved roads w/curbs & sewers, HSG A (1S, 2S, 7S, 8S, 17S, 18S, 19S, 20S, 22S, 23S, 24S, 25S, 27S, 28S, 32S, 34S, 35S, 36S, 38S, 39S, 40S, 45S, 47S, 50S, 52S, 62S, 63S, 65S, 67S, 69S, 74S, 75S, 77S, 79S, 81S, 82S, 83S, 84S, 85S)
1.916	98	Roofs, HSG A (26S, 54S, 93S, 95S)
0.386	98	Water Surface, HSG A (95S)

Summary for Pond 91P: Sed FB-1

[93] Warning: Storage range exceeded by 0.32'
[90] Warning: Qout>Qin may require smaller dt or Finer Routing
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=125)

Inflow Area = 24.900 ac, 29.91% Impervious, Inflow Depth = 0.44" for 2 YR event
Inflow = 8.38 cfs @ 12.15 hrs, Volume= 0.911 af
Outflow = 8.75 cfs @ 12.15 hrs, Volume= 0.840 af, Atten= 0%, Lag= 0.1 min
Primary = 8.75 cfs @ 12.15 hrs, Volume= 0.840 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 174.82' @ 12.15 hrs Surf.Area= 0.064 ac Storage= 0.070 af

Plug-Flow detention time= 64.8 min calculated for 0.839 af (92% of inflow)
Center-of-Mass det. time= 24.4 min (897.3 - 872.8)

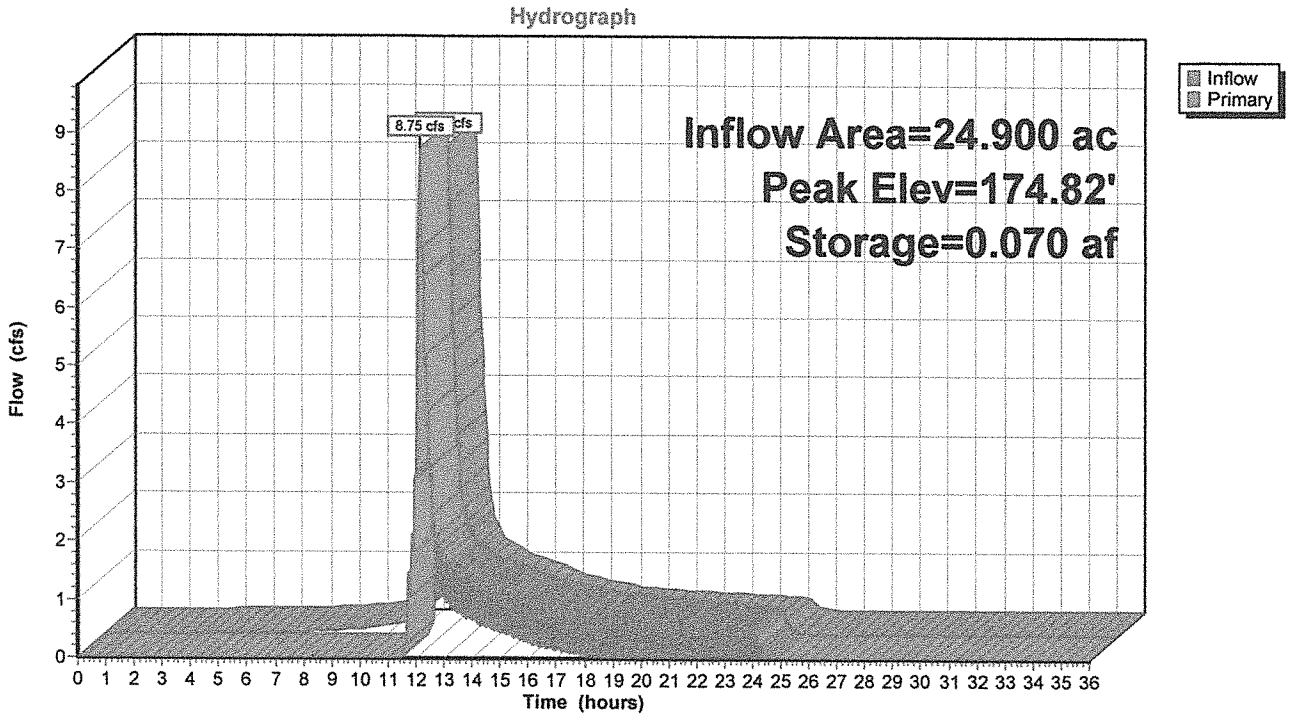
Volume	Invert	Avail.Storage	Storage Description
#1	173.00'	0.070 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
173.00	0.040	0.000	0.000
174.00	0.046	0.043	0.043
174.50	0.064	0.028	0.070

Device	Routing	Invert	Outlet Devices
#1	Primary	174.50'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=8.70 cfs @ 12.15 hrs HW=174.81' TW=172.01' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 8.70 cfs @ 1.39 fps)

Pond 91P: Sed FB-1



Summary for Pond 92P: IB-1

Inflow Area = 27.567 ac, 29.79% Impervious, Inflow Depth = 0.39" for 2 YR event
Inflow = 8.76 cfs @ 12.15 hrs, Volume= 0.902 af
Outflow = 7.53 cfs @ 12.19 hrs, Volume= 0.902 af, Atten= 14%, Lag= 2.2 min
Discarded = 7.53 cfs @ 12.19 hrs, Volume= 0.902 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 172.01' @ 12.19 hrs Surf.Area= 0.374 ac Storage= 0.005 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.1 min (901.9 - 901.8)

Volume	Invert	Avail.Storage	Storage Description
#1	172.00'	1.872 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

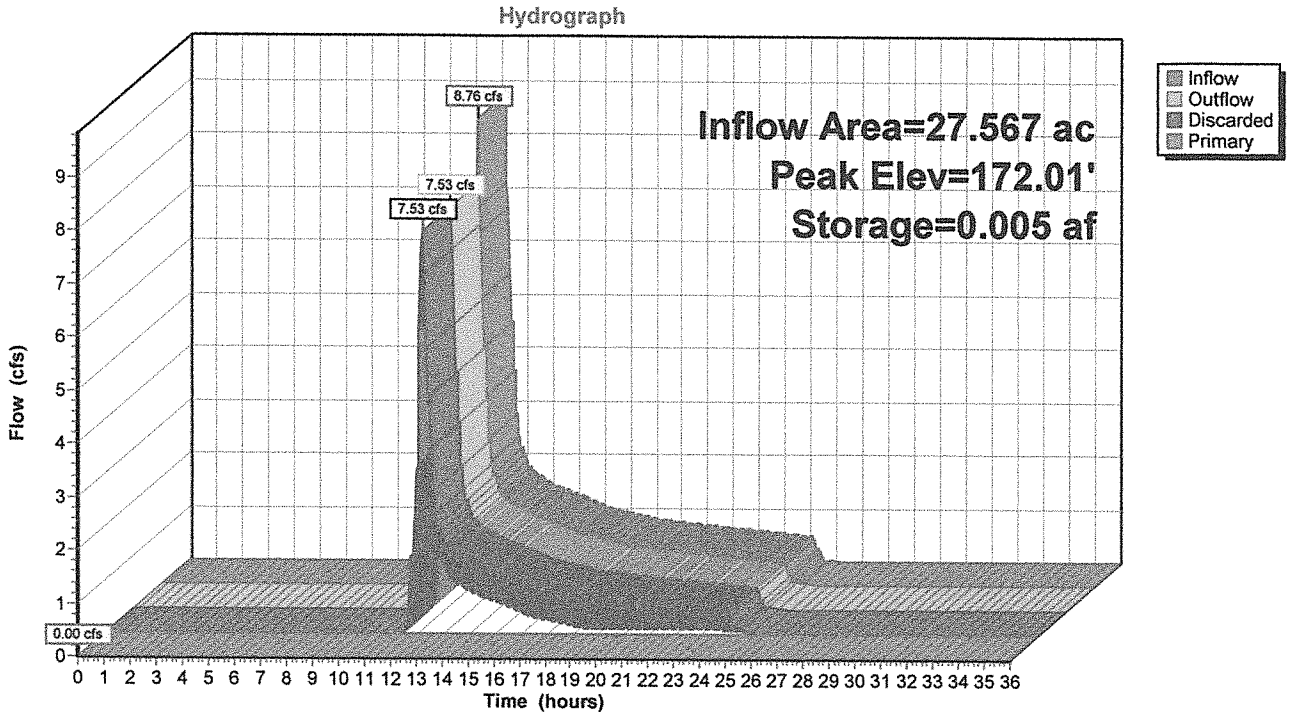
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
172.00	0.373	0.000	0.000
174.00	0.467	0.840	0.840
176.00	0.565	1.032	1.872

Device	Routing	Invert	Outlet Devices
#1	Discarded	172.00'	**20.000 in/hr Exfiltration over Surface area**
#2	Primary	175.00'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=7.53 cfs @ 12.19 hrs HW=172.01' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 7.53 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=172.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 92P: IB-1


Hydrograph
Inflow Area=27.567 ac
Peak Elev=172.01'
Storage=0.005 af
8.76 cfs
7.53 cfs
7.53 cfs
0.00 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36

Summary for Pond 94P: Infiltration trench

Inflow Area = 2.955 ac, 4.91% Impervious, Inflow Depth = 0.01" for 2 YR event
Inflow = 0.01 cfs @ 21.56 hrs, Volume= 0.003 af
Outflow = 0.01 cfs @ 21.56 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.01 cfs @ 21.56 hrs, Volume= 0.003 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 195.00' @ 0.00 hrs Surf.Area= 0.031 ac Storage= 0.000 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (1,213.6 - 1,213.6)

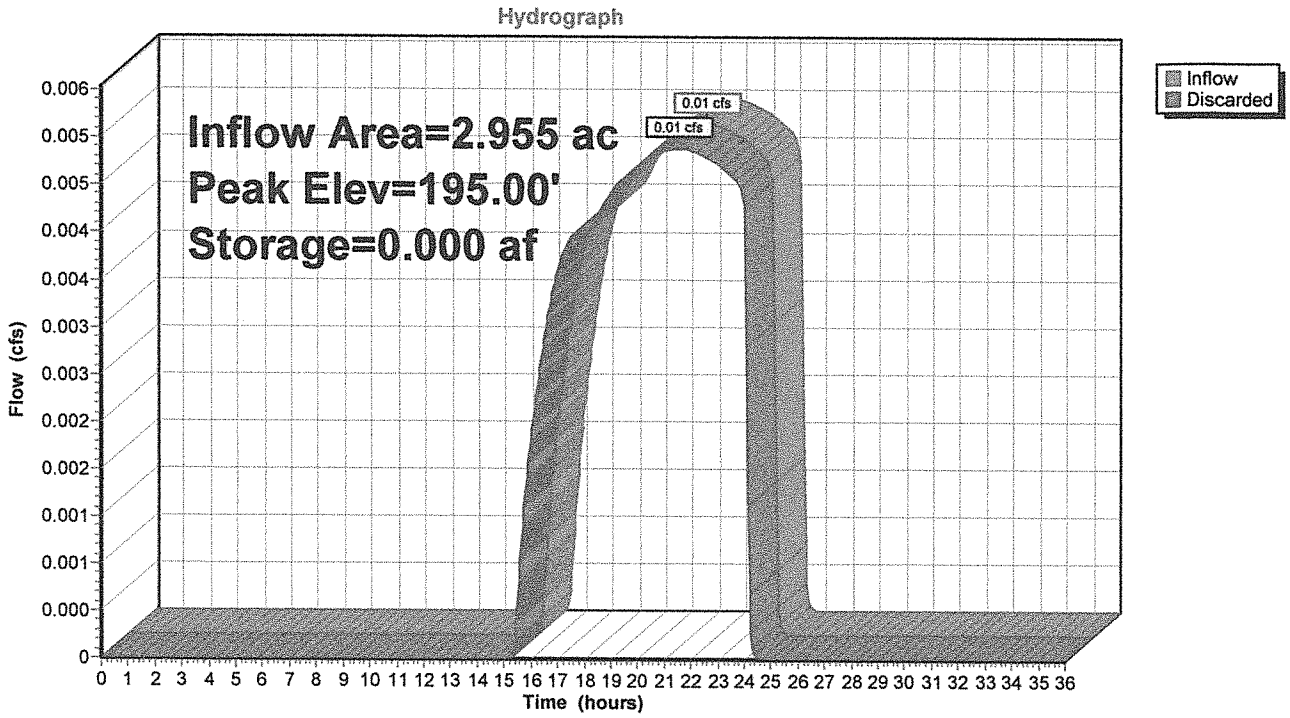
Volume	Invert	Avail.Storage	Storage Description
#1	195.00'	0.031 af	**Custom Stage Data (Prismatic)** Listed below (Recalc) 0.093 af Overall x 33.0% Voids

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
195.00	0.031	0.000	0.000
198.00	0.031	0.093	0.093

Device	Routing	Invert	Outlet Devices
#1	Discarded	195.00'	**20.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 130.00'

Discarded OutFlow Max=0.00 cfs @ 21.56 hrs HW=195.00' (Free Discharge)
↑**1=Exfiltration** (Passes 0.00 cfs of 0.63 cfs potential flow)

Pond 94P: Infiltration trench



Summary for Pond 91P: Sed FB-1

[93] Warning: Storage range exceeded by 0.51'
[90] Warning: Qout>Qin may require smaller dt or Finer Routing
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=132)

Inflow Area = 24.900 ac, 29.91% Impervious, Inflow Depth = 1.10" for 10 YR event
Inflow = 18.64 cfs @ 12.15 hrs, Volume= 2.285 af
Outflow = 18.96 cfs @ 12.15 hrs, Volume= 2.214 af, Atten= 0%, Lag= 0.1 min
Primary = 18.96 cfs @ 12.15 hrs, Volume= 2.214 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 175.01' @ 12.15 hrs Surf.Area= 0.064 ac Storage= 0.070 af

Plug-Flow detention time= 29.0 min calculated for 2.211 af (97% of inflow)
Center-of-Mass det. time= 12.1 min (880.6 - 868.5)

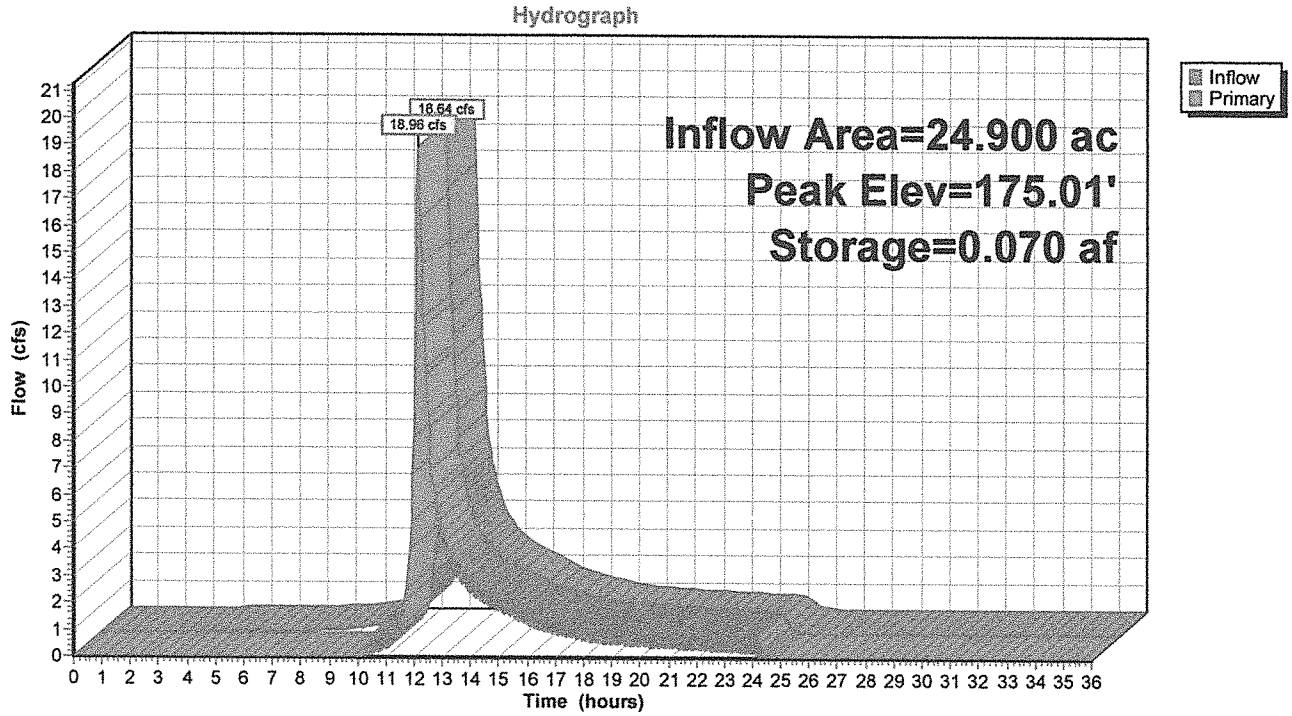
Volume	Invert	Avail.Storage	Storage Description
#1	173.00'	0.070 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
173.00	0.040	0.000	0.000
174.00	0.046	0.043	0.043
174.50	0.064	0.028	0.070

Device	Routing	Invert	Outlet Devices
#1	Primary	174.50'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=18.80 cfs @ 12.15 hrs HW=175.01' TW=172.23' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 18.80 cfs @ 1.86 fps)

Pond 91P: Sed FB-1



Summary for Pond 92P: IB-1

Inflow Area = 27.567 ac, 29.79% Impervious, Inflow Depth = 1.05" for 10 YR event
Inflow = 19.59 cfs @ 12.15 hrs, Volume= 2.423 af
Outflow = 8.21 cfs @ 12.62 hrs, Volume= 2.427 af, Atten= 58%, Lag= 28.0 min
Discarded = 8.21 cfs @ 12.62 hrs, Volume= 2.427 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 172.73' @ 12.62 hrs Surf.Area= 0.407 ac Storage= 0.284 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 7.9 min (890.9 - 883.0)

Volume	Invert	Avail.Storage	Storage Description
#1	172.00'	1.872 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

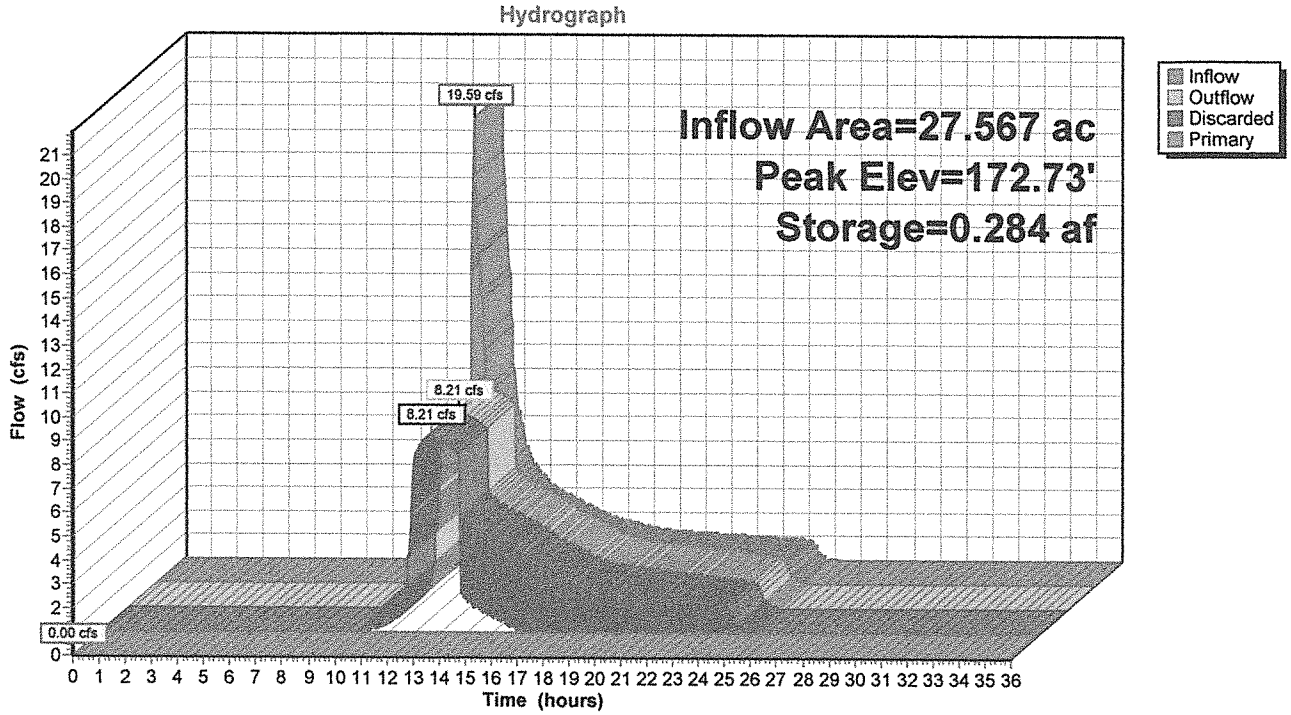
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
172.00	0.373	0.000	0.000
174.00	0.467	0.840	0.840
176.00	0.565	1.032	1.872

Device	Routing	Invert	Outlet Devices
#1	Discarded	172.00'	**20.000 in/hr Exfiltration over Surface area**
#2	Primary	175.00'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=8.21 cfs @ 12.62 hrs HW=172.73' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 8.21 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=172.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 92P: IB-1


Hydrograph
Inflow Area=27.567 ac
Peak Elev=172.73'
Storage=0.284 af
19.59 cfs
8.21 cfs
8.21 cfs
0.00 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
0 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

Summary for Pond 94P: Infiltration trench

Inflow Area = 2.955 ac, 4.91% Impervious, Inflow Depth = 0.26" for 10 YR event
Inflow = 0.22 cfs @ 12.45 hrs, Volume= 0.065 af
Outflow = 0.22 cfs @ 12.45 hrs, Volume= 0.065 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.22 cfs @ 12.45 hrs, Volume= 0.065 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 195.00' @ 0.00 hrs Surf.Area= 0.031 ac Storage= 0.000 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (986.5 - 986.5)

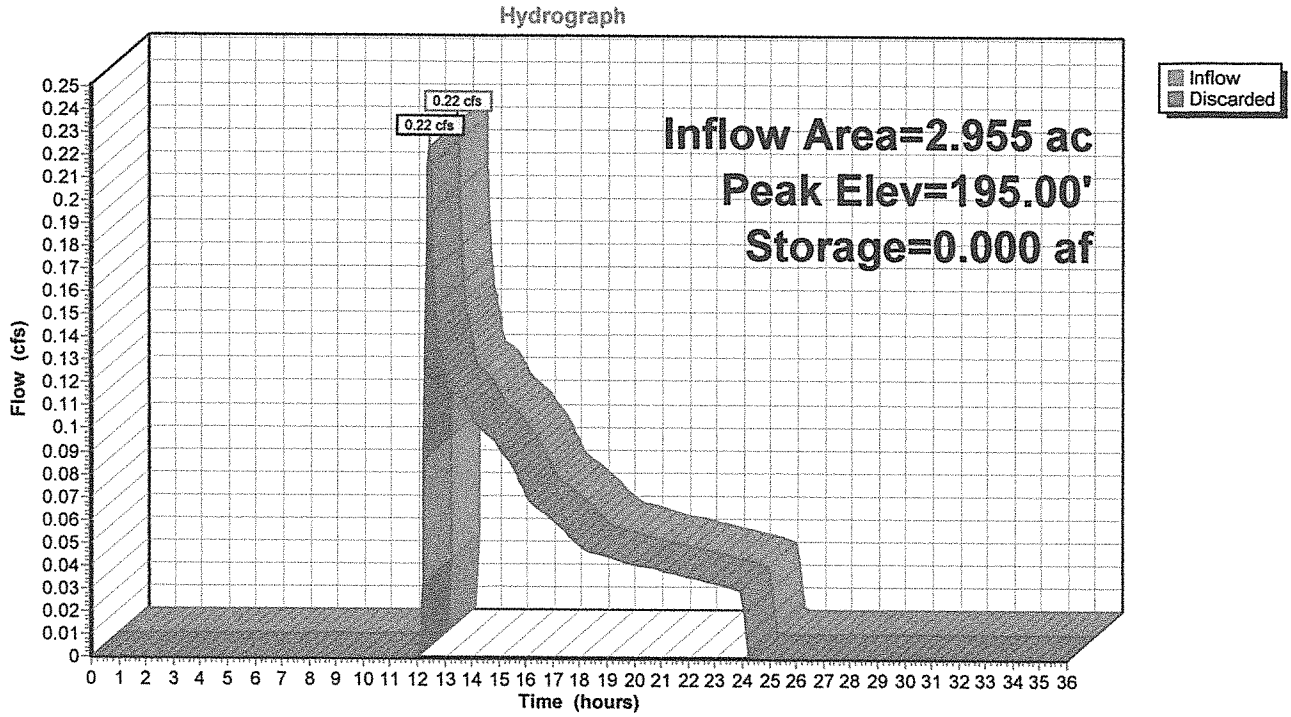
Volume	Invert	Avail.Storage	Storage Description
#1	195.00'	0.031 af	**Custom Stage Data (Prismatic)** Listed below (Recalc) 0.093 af Overall x 33.0% Voids

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
195.00	0.031	0.000	0.000
198.00	0.031	0.093	0.093

Device	Routing	Invert	Outlet Devices
#1	Discarded	195.00'	**20.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 130.00'

Discarded OutFlow Max=0.00 cfs @ 12.45 hrs HW=195.00' (Free Discharge)
↑—**1=Exfiltration** (Passes 0.00 cfs of 0.63 cfs potential flow)

Pond 94P: Infiltration trench



Summary for Pond 91P: Sed FB-1

[93] Warning: Storage range exceeded by 0.60'
[90] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area = 24.900 ac, 29.91% Impervious, Inflow Depth = 1.46" for 25 YR event
Inflow = 24.81 cfs @ 12.15 hrs, Volume= 3.037 af
Outflow = 24.81 cfs @ 12.15 hrs, Volume= 2.966 af, Atten= 0%, Lag= 0.0 min
Primary = 24.81 cfs @ 12.15 hrs, Volume= 2.966 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 175.10' @ 12.15 hrs Surf.Area= 0.064 ac Storage= 0.070 af

Plug-Flow detention time= 22.9 min calculated for 2.966 af (98% of inflow)
Center-of-Mass det. time= 9.7 min (874.0 - 864.3)

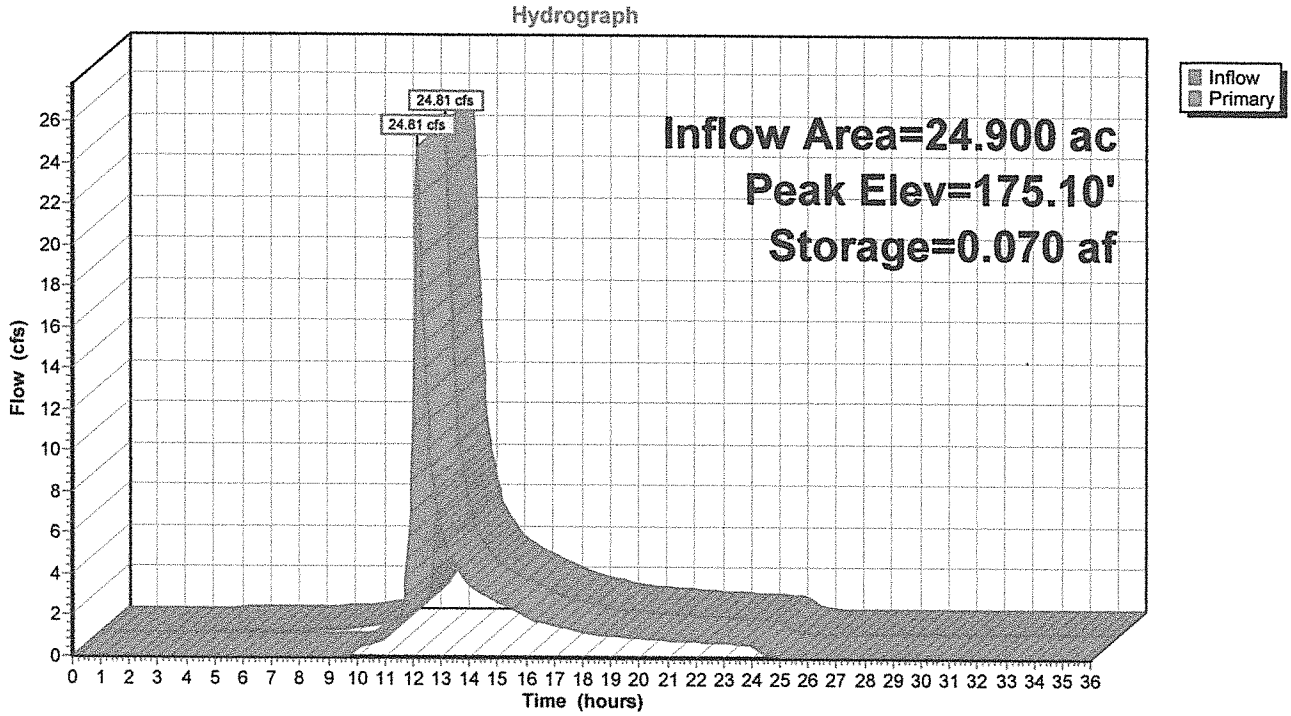
Volume	Invert	Avail.Storage	Storage Description
#1	173.00'	0.070 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
173.00	0.040	0.000	0.000
174.00	0.046	0.043	0.043
174.50	0.064	0.028	0.070

Device	Routing	Invert	Outlet Devices
#1	Primary	174.50'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=24.74 cfs @ 12.15 hrs HW=175.10' TW=172.42' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 24.74 cfs @ 2.07 fps)

Pond 91P: Sed FB-1



Summary for Pond 92P: IB-1

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=102)

Inflow Area = 27.567 ac, 29.79% Impervious, Inflow Depth = 1.42" for 25 YR event
Inflow = 25.97 cfs @ 12.15 hrs, Volume= 3.257 af
Outflow = 8.82 cfs @ 12.80 hrs, Volume= 3.260 af, Atten= 66%, Lag= 38.8 min
Discarded = 8.82 cfs @ 12.80 hrs, Volume= 3.260 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 173.37' @ 12.80 hrs Surf.Area= 0.437 ac Storage= 0.554 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 17.2 min (893.2 - 876.0)

Volume	Invert	Avail.Storage	Storage Description
#1	172.00'	1.872 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

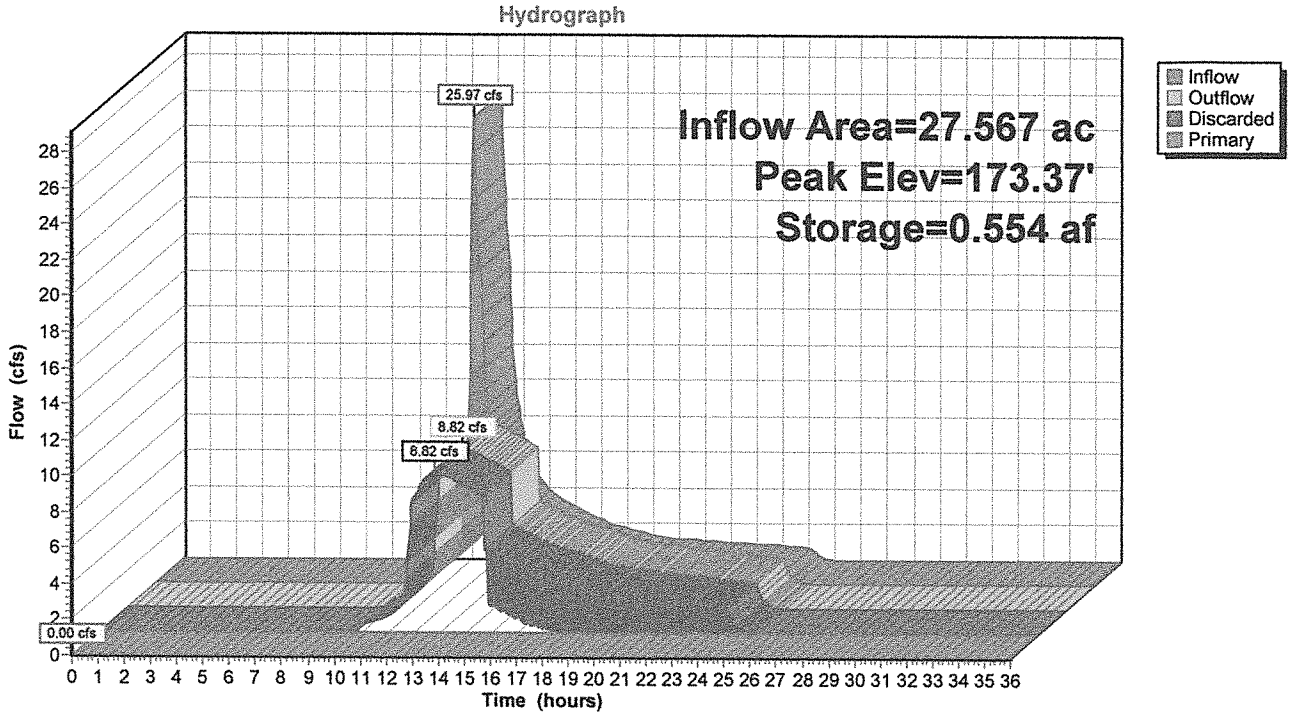
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
172.00	0.373	0.000	0.000
174.00	0.467	0.840	0.840
176.00	0.565	1.032	1.872

Device	Routing	Invert	Outlet Devices
#1	Discarded	172.00'	**20.000 in/hr Exfiltration over Surface area**
#2	Primary	175.00'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=8.82 cfs @ 12.80 hrs HW=173.37' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 8.82 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=172.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 92P: IB-1


Hydrograph
Inflow Area=27.567 ac
Peak Elev=173.37'
Storage=0.554 af
25.97 cfs
8.82 cfs
8.82 cfs
0.00 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28

Summary for Pond 94P: Infiltration trench

Inflow Area = 2.955 ac, 4.91% Impervious, Inflow Depth = 0.45" for 25 YR event
Inflow = 0.56 cfs @ 12.37 hrs, Volume= 0.112 af
Outflow = 0.56 cfs @ 12.37 hrs, Volume= 0.112 af, Atten= 0%, Lag= 0.1 min
Discarded = 0.56 cfs @ 12.37 hrs, Volume= 0.112 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 195.00' @ 12.36 hrs Surf.Area= 0.031 ac Storage= 0.000 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (954.1 - 954.1)

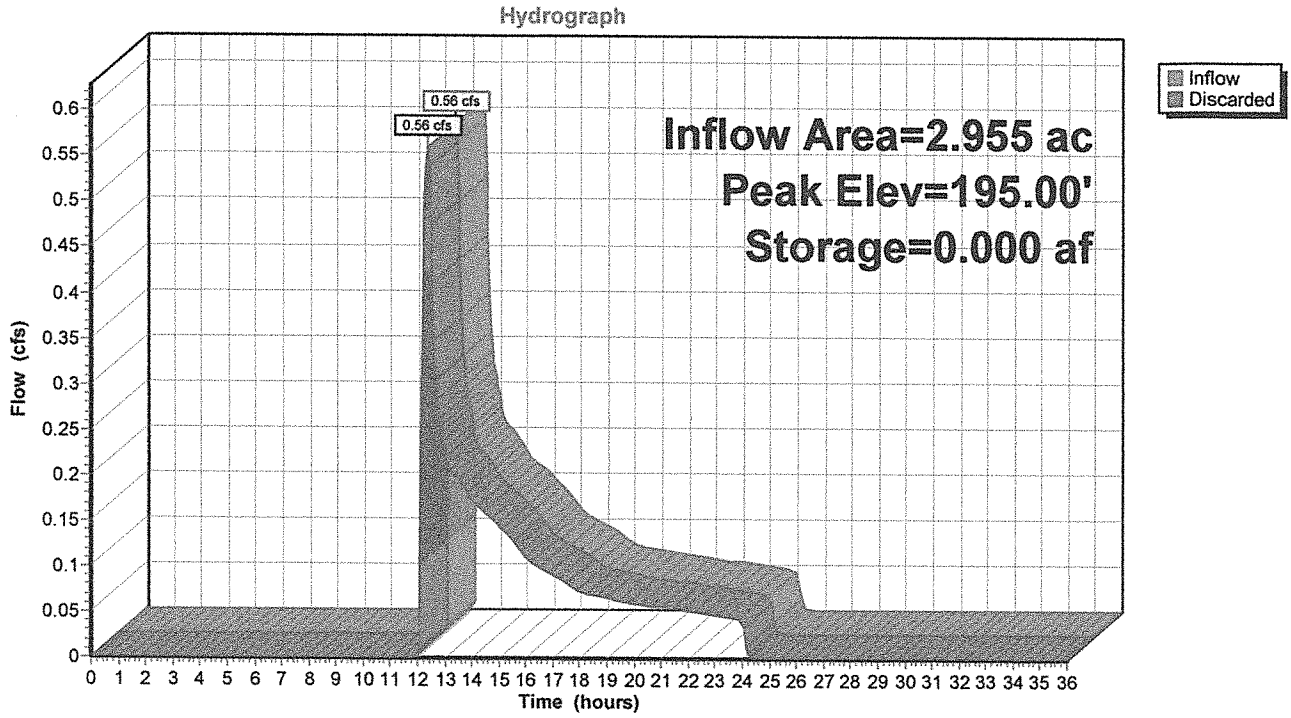
Volume	Invert	Avail.Storage	Storage Description
#1	195.00'	0.031 af	**Custom Stage Data (Prismatic)** Listed below (Recalc) 0.093 af Overall x 33.0% Voids

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
195.00	0.031	0.000	0.000
198.00	0.031	0.093	0.093

Device	Routing	Invert	Outlet Devices
#1	Discarded	195.00'	**20.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 130.00'

Discarded OutFlow Max=0.63 cfs @ 12.37 hrs HW=195.00' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.63 cfs)

Pond 94P: Infiltration trench



Summary for Pond 91P: Sed FB-1

[93] Warning: Storage range exceeded by 0.71'
[90] Warning: Qout>Qin may require smaller dt or Finer Routing
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=132)

Inflow Area = 24.900 ac, 29.91% Impervious, Inflow Depth = 1.86" for 50 YR event
Inflow = 31.94 cfs @ 12.15 hrs, Volume= 3.860 af
Outflow = 32.10 cfs @ 12.15 hrs, Volume= 3.789 af, Atten= 0%, Lag= 0.0 min
Primary = 32.10 cfs @ 12.15 hrs, Volume= 3.789 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 175.21' @ 12.15 hrs Surf.Area= 0.064 ac Storage= 0.070 af

Plug-Flow detention time= 18.5 min calculated for 3.789 af (98% of inflow)
Center-of-Mass det. time= 8.0 min (868.3 - 860.3)

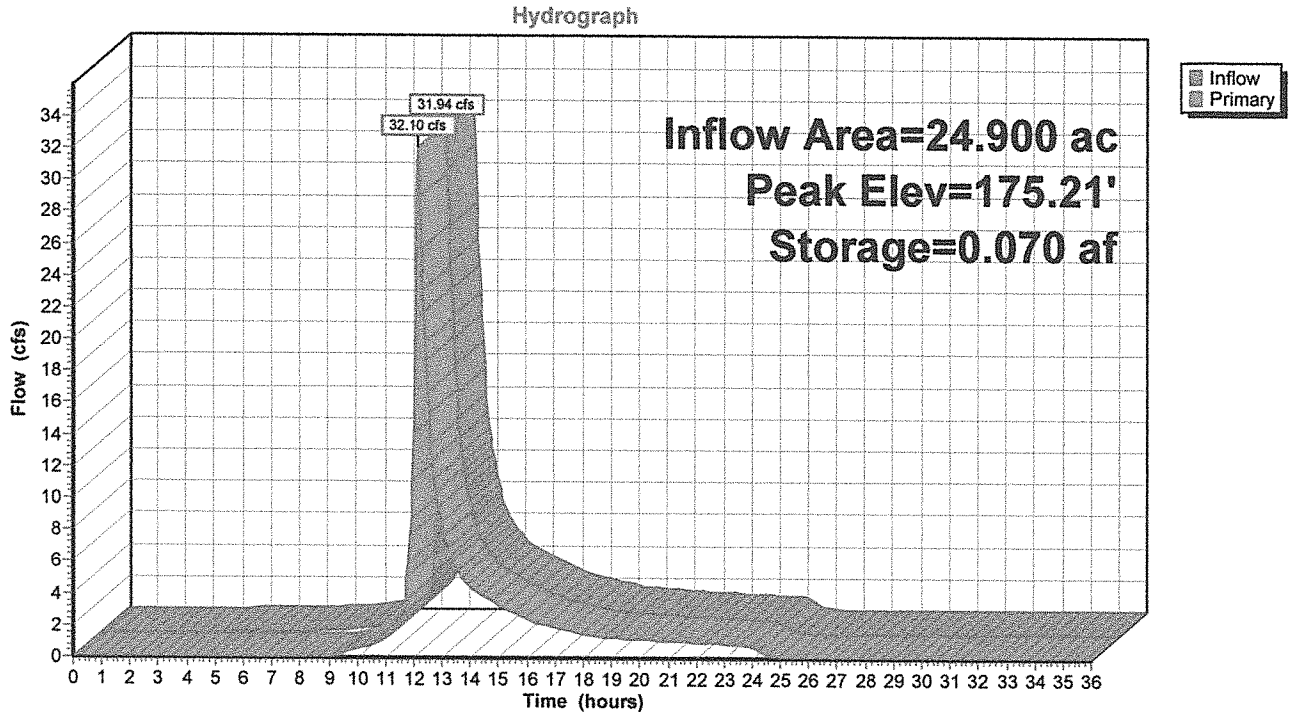
Volume	Invert	Avail.Storage	Storage Description
#1	173.00'	0.070 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
173.00	0.040	0.000	0.000
174.00	0.046	0.043	0.043
174.50	0.064	0.028	0.070

Device	Routing	Invert	Outlet Devices
#1	Primary	174.50'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=32.09 cfs @ 12.15 hrs HW=175.21' TW=172.67' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 32.09 cfs @ 2.26 fps)

Pond 91P: Sed FB-1



Summary for Pond 92P: IB-1

Inflow Area = 27.567 ac, 29.79% Impervious, Inflow Depth = 1.82" for 50 YR event
Inflow = 33.86 cfs @ 12.15 hrs, Volume= 4.170 af
Outflow = 9.56 cfs @ 12.97 hrs, Volume= 4.179 af, Atten= 72%, Lag= 49.1 min
Discarded = 9.56 cfs @ 12.97 hrs, Volume= 4.179 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 174.14' @ 12.97 hrs Surf.Area= 0.474 ac Storage= 0.906 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 30.2 min (900.2 - 870.0)

Volume	Invert	Avail.Storage	Storage Description
#1	172.00'	1.872 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

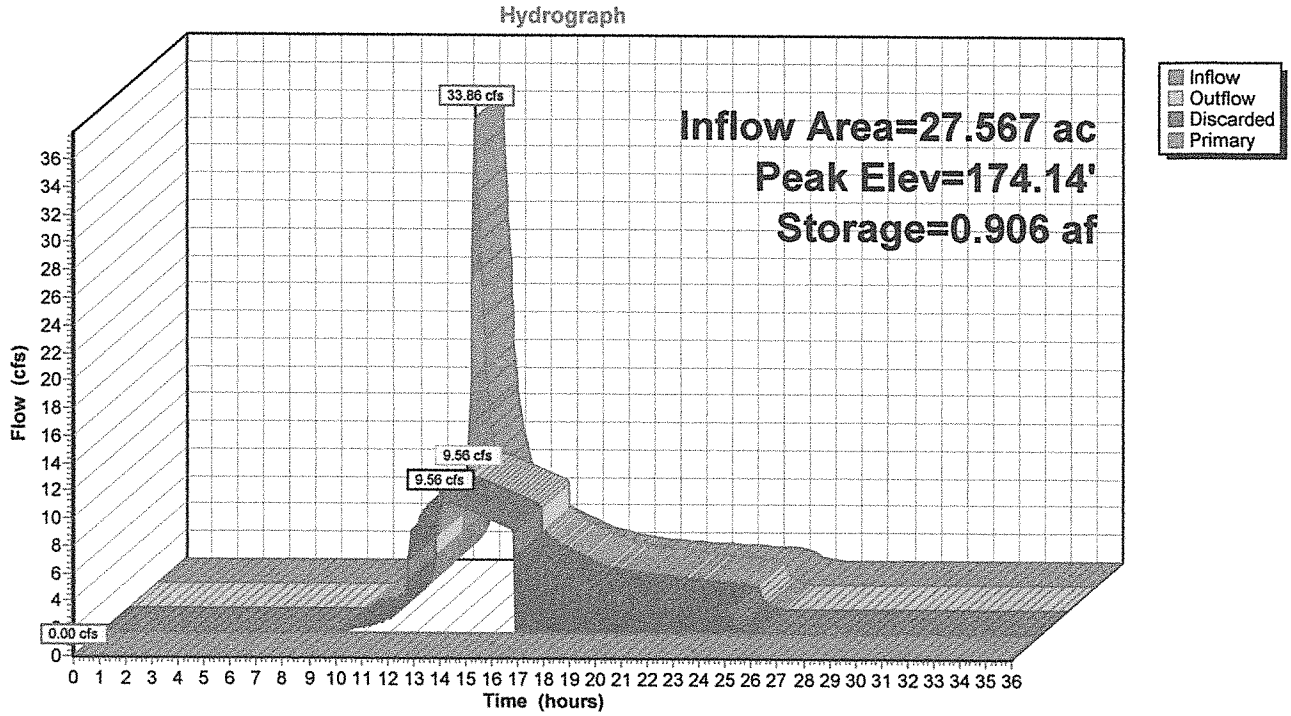
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
172.00	0.373	0.000	0.000
174.00	0.467	0.840	0.840
176.00	0.565	1.032	1.872

Device	Routing	Invert	Outlet Devices
#1	Discarded	172.00'	**20.000 in/hr Exfiltration over Surface area**
#2	Primary	175.00'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=9.56 cfs @ 12.97 hrs HW=174.14' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 9.56 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=172.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 92P: IB-1


Hydrograph
Inflow Area=27.567 ac
Peak Elev=174.14'
Storage=0.906 af
33.86 cfs
9.56 cfs
9.56 cfs
0.00 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)

Summary for Pond 94P: Infiltration trench

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=109)

Inflow Area = 2.955 ac, 4.91% Impervious, Inflow Depth = 0.69" for 50 YR event
Inflow = 1.04 cfs @ 12.20 hrs, Volume= 0.169 af
Outflow = 0.64 cfs @ 12.56 hrs, Volume= 0.169 af, Atten= 39%, Lag= 21.6 min
Discarded = 0.64 cfs @ 12.56 hrs, Volume= 0.169 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 196.05' @ 12.56 hrs Surf.Area= 0.031 ac Storage= 0.011 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 2.8 min (935.6 - 932.8)

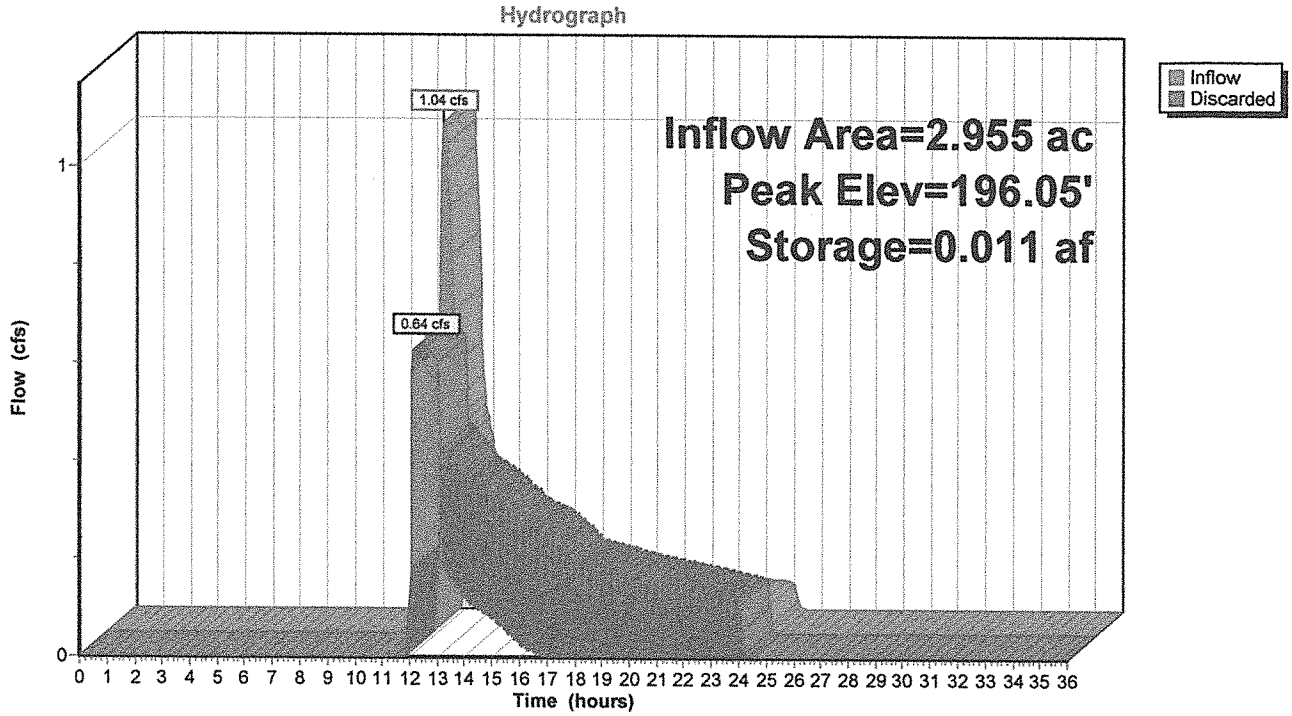
Volume	Invert	Avail.Storage	Storage Description
#1	195.00'	0.031 af	**Custom Stage Data (Prismatic)** Listed below (Recalc) 0.093 af Overall x 33.0% Voids

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
195.00	0.031	0.000	0.000
198.00	0.031	0.093	0.093

Device	Routing	Invert	Outlet Devices
#1	Discarded	195.00'	**20.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 130.00'

Discarded OutFlow Max=0.64 cfs @ 12.56 hrs HW=196.05' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.64 cfs)

Pond 94P: Infiltration trench



Summary for Pond 91P: Sed FB-1

[93] Warning: Storage range exceeded by 0.78'
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=140)

Inflow Area = 24.900 ac, 29.91% Impervious, Inflow Depth = 2.22" for 100 YR event
Inflow = 37.41 cfs @ 12.15 hrs, Volume= 4.613 af
Outflow = 37.11 cfs @ 12.15 hrs, Volume= 4.543 af, Atten= 1%, Lag= 0.0 min
Primary = 37.11 cfs @ 12.15 hrs, Volume= 4.543 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 175.28' @ 12.15 hrs Surf.Area= 0.064 ac Storage= 0.070 af

Plug-Flow detention time= 15.6 min calculated for 4.537 af (98% of inflow)
Center-of-Mass det. time= 7.0 min (864.0 - 857.1)

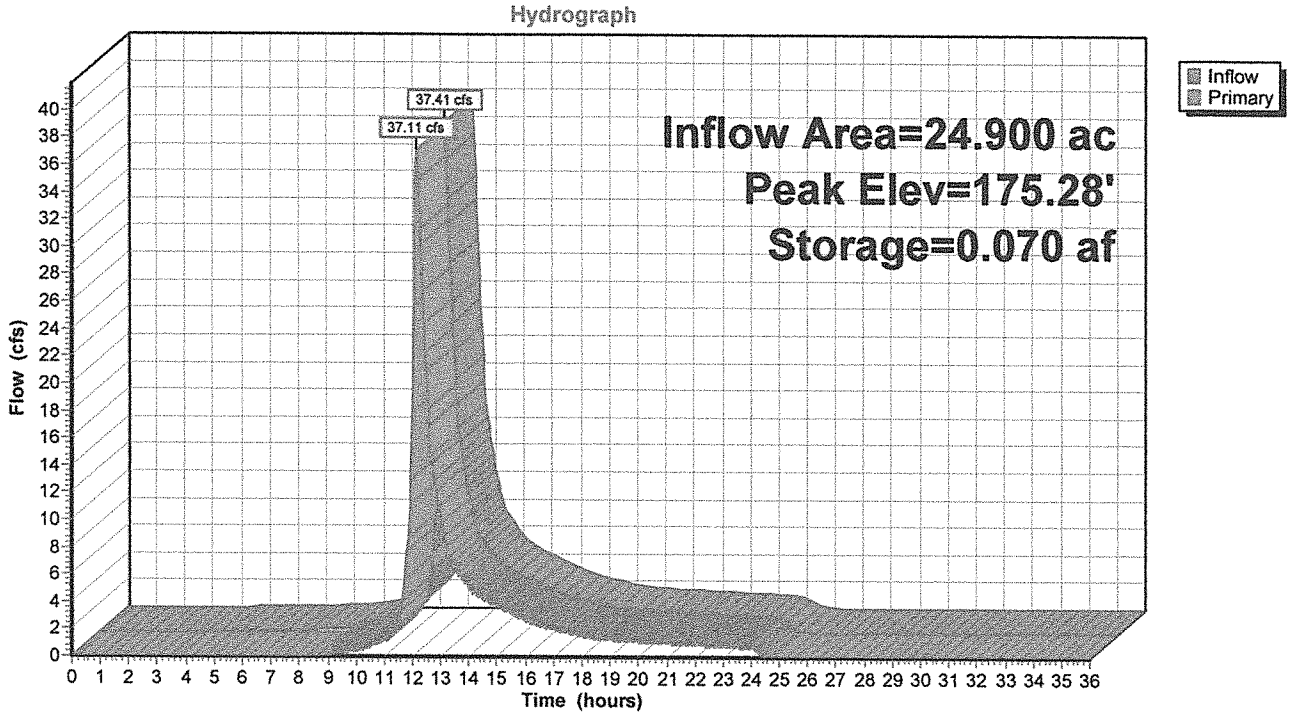
Volume	Invert	Avail.Storage	Storage Description
#1	173.00'	0.070 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
173.00	0.040	0.000	0.000
174.00	0.046	0.043	0.043
174.50	0.064	0.028	0.070

Device	Routing	Invert	Outlet Devices
#1	Primary	174.50'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=37.07 cfs @ 12.15 hrs HW=175.28' TW=172.90' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 37.07 cfs @ 2.37 fps)

Pond 91P: Sed FB-1



Summary for Pond 92P: IB-1

Inflow Area = 27.567 ac, 29.79% Impervious, Inflow Depth = 2.18" for 100 YR event
Inflow = 39.42 cfs @ 12.16 hrs, Volume= 5.007 af
Outflow = 10.27 cfs @ 13.08 hrs, Volume= 5.013 af, Atten= 74%, Lag= 55.2 min
Discarded = 10.27 cfs @ 13.08 hrs, Volume= 5.013 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 174.86' @ 13.08 hrs Surf.Area= 0.509 ac Storage= 1.259 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 42.6 min (908.2 - 865.6)

Volume	Invert	Avail.Storage	Storage Description
#1	172.00'	1.872 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

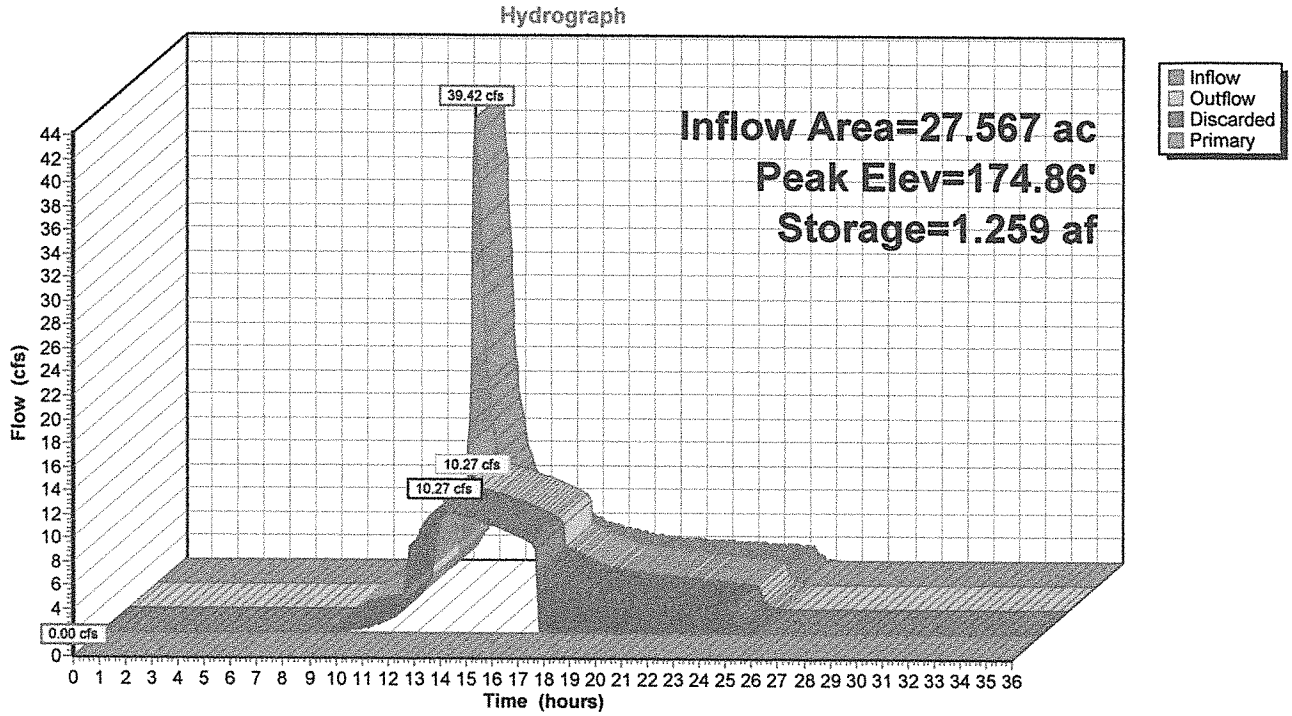
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
172.00	0.373	0.000	0.000
174.00	0.467	0.840	0.840
176.00	0.565	1.032	1.872

Device	Routing	Invert	Outlet Devices
#1	Discarded	172.00'	**20.000 in/hr Exfiltration over Surface area**
#2	Primary	175.00'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=10.27 cfs @ 13.08 hrs HW=174.86' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 10.27 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=172.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 92P: IB-1


Hydrograph
Inflow Area=27.567 ac
Peak Elev=174.86'
Storage=1.259 af
39.42 cfs
10.27 cfs
10.27 cfs
0.00 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)

Summary for Pond 94P: Infiltration trench

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=99)

Inflow Area = 2.955 ac, 4.91% Impervious, Inflow Depth = 0.91" for 100 YR event
Inflow = 1.69 cfs @ 12.18 hrs, Volume= 0.225 af
Outflow = 0.65 cfs @ 12.65 hrs, Volume= 0.226 af, Atten= 61%, Lag= 28.3 min
Discarded = 0.65 cfs @ 12.65 hrs, Volume= 0.226 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 197.91' @ 12.65 hrs Surf.Area= 0.031 ac Storage= 0.030 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 10.3 min (929.7 - 919.4)

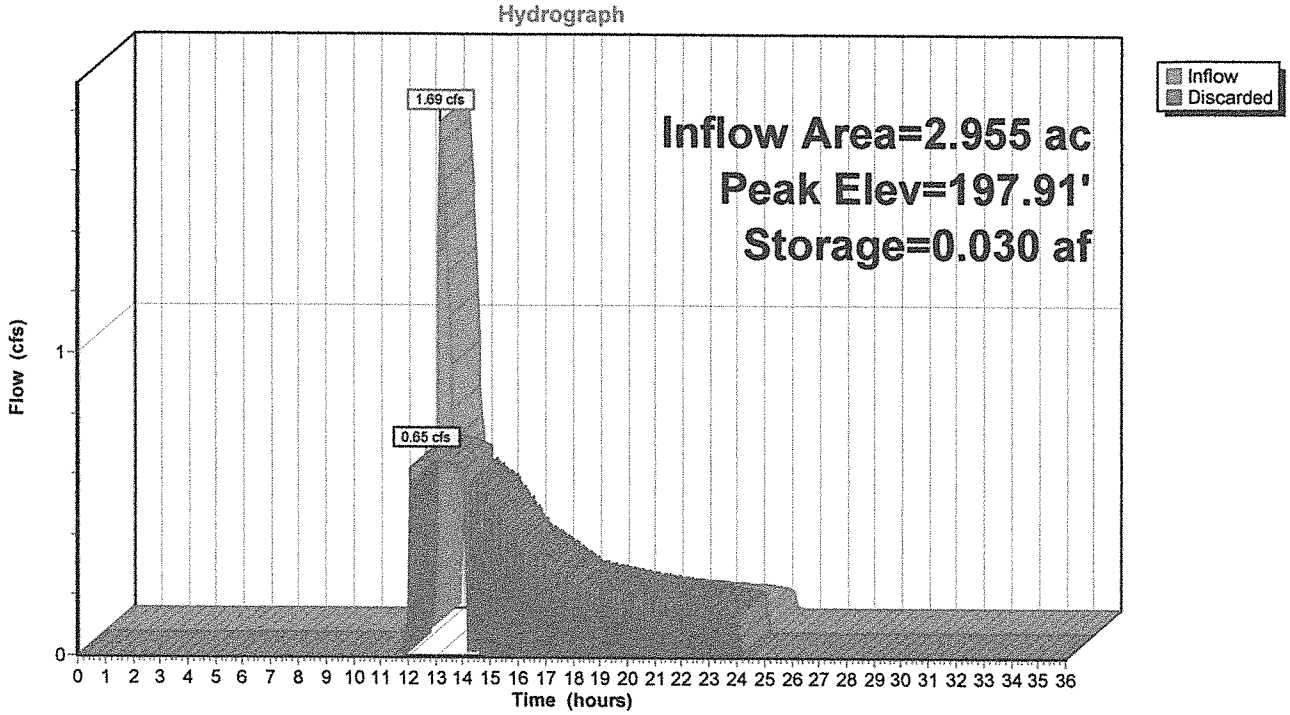
Volume	Invert	Avail.Storage	Storage Description
#1	195.00'	0.031 af	**Custom Stage Data (Prismatic)** Listed below (Recalc) 0.093 af Overall x 33.0% Voids

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
195.00	0.031	0.000	0.000
198.00	0.031	0.093	0.093

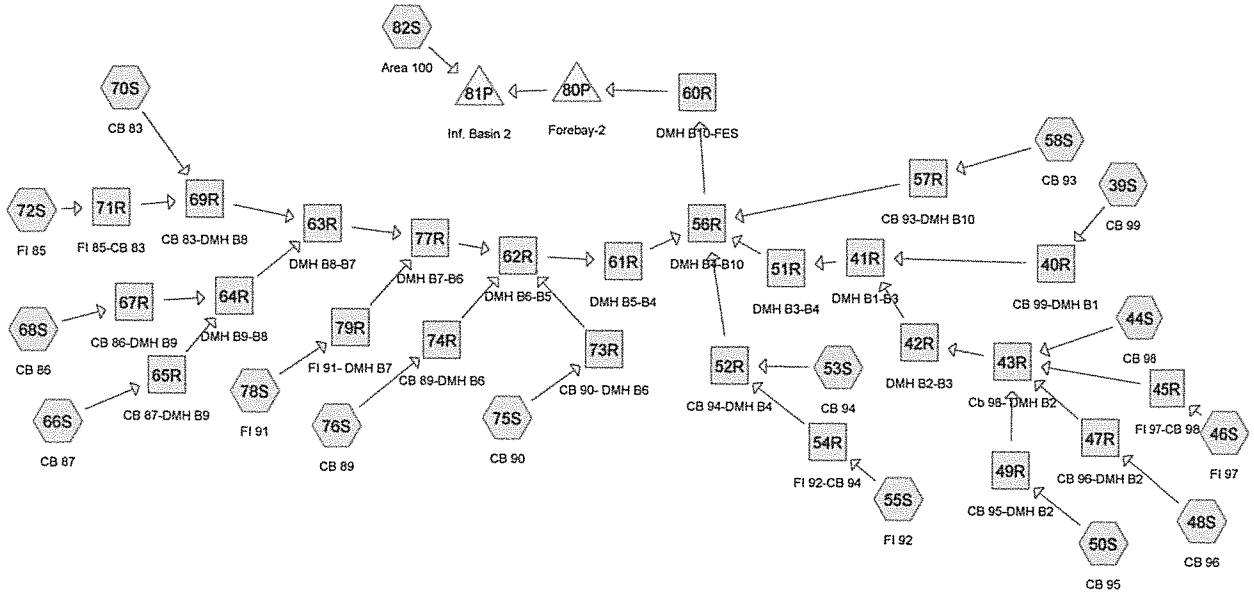
Device	Routing	Invert	Outlet Devices
#1	Discarded	195.00'	**20.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 130.00'

Discarded OutFlow Max=0.65 cfs @ 12.65 hrs HW=197.91' (Free Discharge)
↳**1=Exfiltration** (Controls 0.65 cfs)

Pond 94P: Infiltration trench



APPENDIX C



Subcat Reach Pond Link

Routing Diagram for LS-Basin 2 - Copy
Prepared by Hewlett-Packard Company, Printed 10/17/2017
HydroCAD® 10.00-20 s/n 01535 © 2017 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
7.748	39	>75% Grass cover, Good, HSG A (39S, 44S, 46S, 48S, 50S, 53S, 55S, 58S, 66S, 68S, 70S, 72S, 75S, 76S, 78S, 82S)
1.201	98	Paved roads w/curbs & sewers, HSG A (39S, 44S, 48S, 50S, 53S, 58S, 66S, 68S, 70S, 75S, 76S)
1.974	98	Roofs, HSG A (46S, 48S, 50S, 55S, 66S, 72S, 75S, 76S, 78S, 82S)
0.129	98	Water Surface, HSG A (82S)

Summary for Pond 80P: Forebay-2

Inflow Area = 8.994 ac, 32.10% Impervious, Inflow Depth = 0.44" for 2 YR event
Inflow = 2.76 cfs @ 12.12 hrs, Volume= 0.333 af
Outflow = 1.99 cfs @ 12.30 hrs, Volume= 0.262 af, Atten= 28%, Lag= 10.8 min
Primary = 1.99 cfs @ 12.30 hrs, Volume= 0.262 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 170.12' @ 12.30 hrs Surf.Area= 0.047 ac Storage= 0.077 af

Plug-Flow detention time= 143.2 min calculated for 0.262 af (79% of inflow)
Center-of-Mass det. time= 52.6 min (941.4 - 888.8)

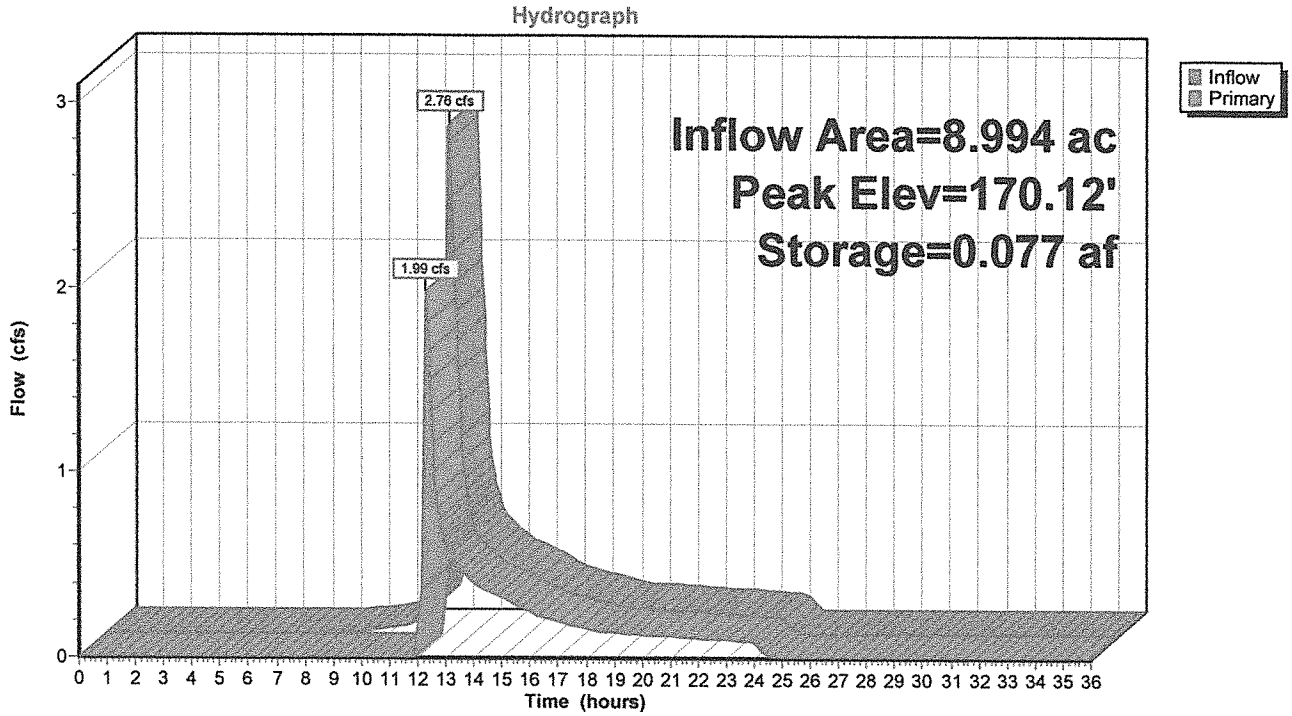
Volume	Invert	Avail.Storage	Storage Description
#1	168.00'	0.187 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
168.00	0.025	0.000	0.000
170.00	0.046	0.071	0.071
172.00	0.070	0.116	0.187

Device	Routing	Invert	Outlet Devices
#1	Primary	170.00'	**20.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=1.98 cfs @ 12.30 hrs HW=170.12' TW=170.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 1.98 cfs @ 0.82 fps)

Pond 80P: Forebay-2



Summary for Pond 81P: Inf. Basin 2

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=114)

Inflow Area = 11.052 ac, 29.90% Impervious, Inflow Depth = 0.31" for 2 YR event
Inflow = 2.07 cfs @ 12.30 hrs, Volume= 0.287 af
Outflow = 2.06 cfs @ 12.30 hrs, Volume= 0.287 af, Atten= 0%, Lag= 0.1 min
Discarded = 2.06 cfs @ 12.30 hrs, Volume= 0.287 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 170.00' @ 12.30 hrs Surf.Area= 0.112 ac Storage= 0.000 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.1 min (945.9 - 945.8)

Volume	Invert	Avail.Storage	Storage Description
#1	170.00'	0.726 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

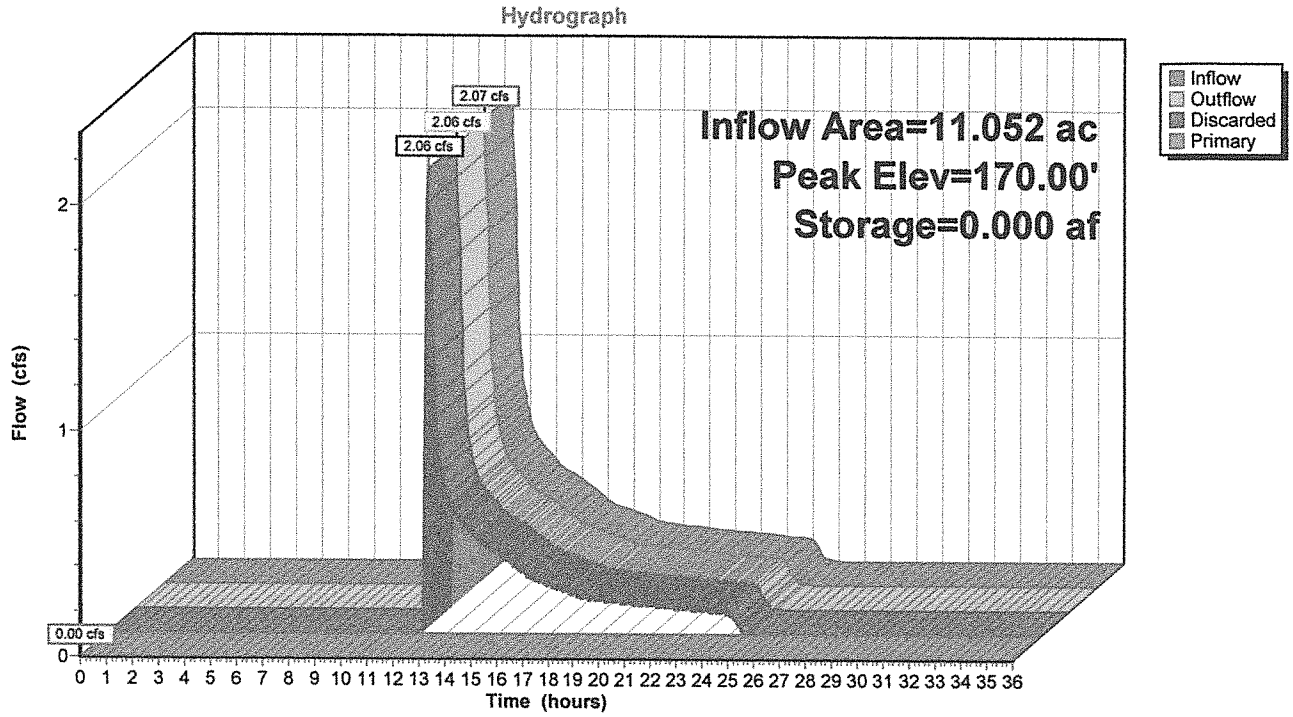
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
170.00	0.112	0.000	0.000
172.00	0.172	0.284	0.284
174.00	0.270	0.442	0.726

Device	Routing	Invert	Outlet Devices
#1	Primary	173.50'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Discarded	170.00'	**20.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=2.26 cfs @ 12.30 hrs HW=170.00' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 2.26 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=170.00' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 81P: Inf. Basin 2



Summary for Pond 80P: Forebay-2

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=11)

Inflow Area = 8.994 ac, 32.10% Impervious, Inflow Depth = 1.15" for 10 YR event
Inflow = 7.35 cfs @ 12.12 hrs, Volume= 0.866 af
Outflow = 6.55 cfs @ 12.10 hrs, Volume= 0.795 af, Atten= 11%, Lag= 0.0 min
Primary = 6.55 cfs @ 12.10 hrs, Volume= 0.795 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 170.99' @ 12.67 hrs Surf.Area= 0.058 ac Storage= 0.122 af

Plug-Flow detention time= 66.9 min calculated for 0.795 af (92% of inflow)
Center-of-Mass det. time= 25.1 min (895.0 - 869.9)

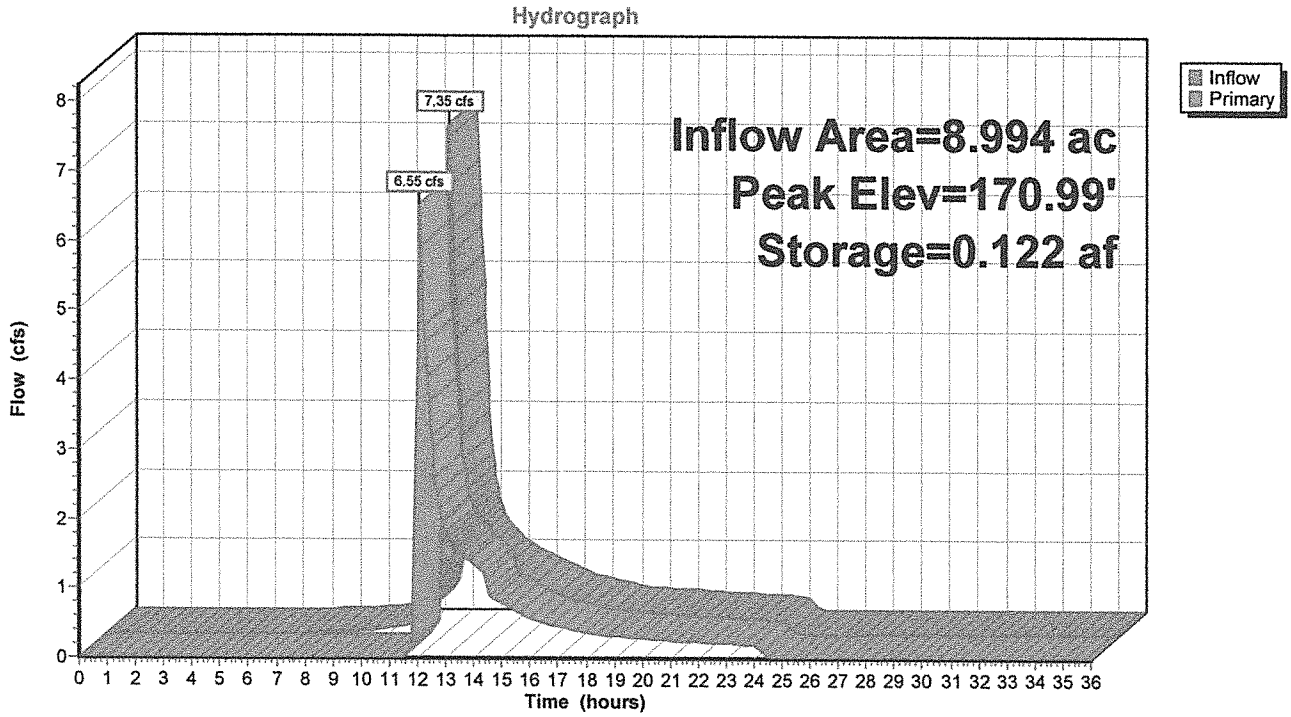
Volume	Invert	Avail.Storage	Storage Description
#1	168.00'	0.187 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
168.00	0.025	0.000	0.000
170.00	0.046	0.071	0.071
172.00	0.070	0.116	0.187

Device	Routing	Invert	Outlet Devices
#1	Primary	170.00'	**20.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=0.00 cfs @ 12.10 hrs HW=170.31' TW=170.36' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 80P: Forebay-2



Summary for Pond 81P: Inf. Basin 2

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=89)
[80] Warning: Exceeded Pond 80P by 0.11' @ 12.15 hrs (11.49 cfs 0.634 af)

Inflow Area =	11.052 ac,	29.90% Impervious,	Inflow Depth =	0.99"	for 10 YR event
Inflow =	7.37 cfs @	12.10 hrs,	Volume=	0.908 af	
Outflow =	2.86 cfs @	12.62 hrs,	Volume=	0.909 af,	Atten= 61%, Lag= 31.6 min
Discarded =	2.86 cfs @	12.62 hrs,	Volume=	0.909 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 170.99' @ 12.62 hrs Surf.Area= 0.142 ac Storage= 0.125 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 12.2 min (909.0 - 896.8)

Volume	Invert	Avail.Storage	Storage Description
#1	170.00'	0.726 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

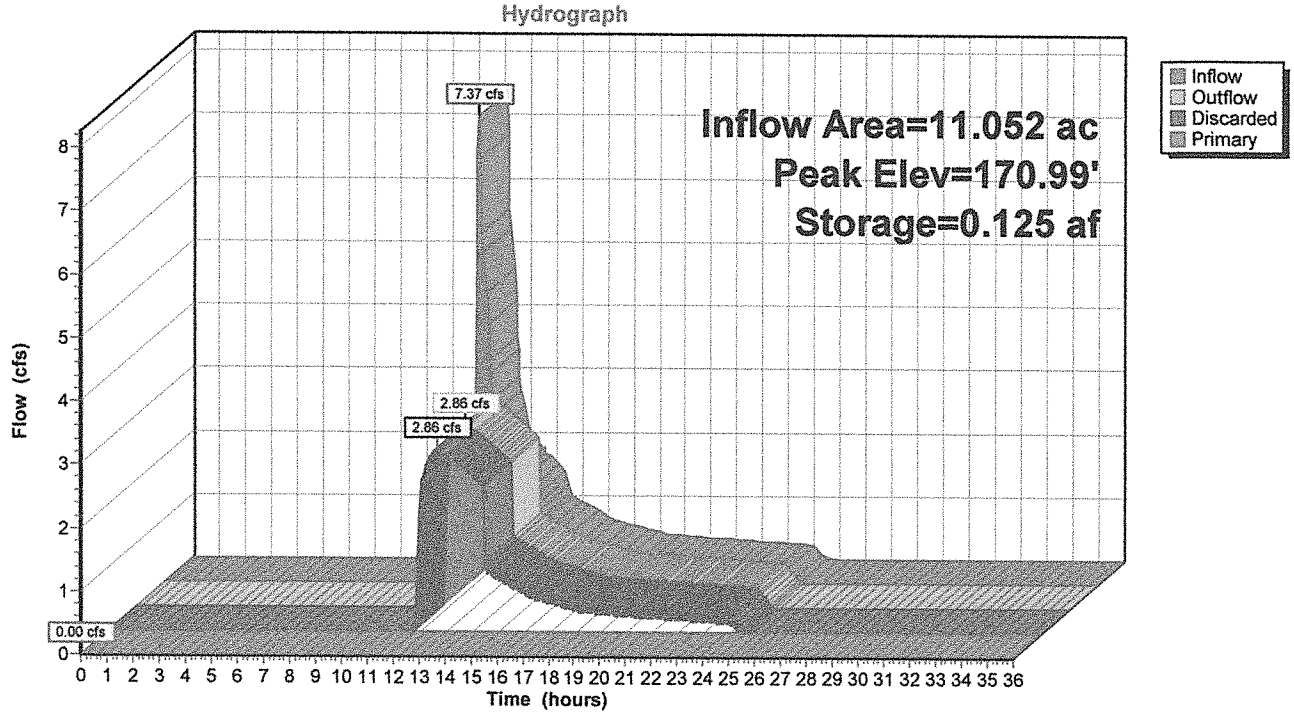
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
170.00	0.112	0.000	0.000
172.00	0.172	0.284	0.284
174.00	0.270	0.442	0.726

Device	Routing	Invert	Outlet Devices
#1	Primary	173.50'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Discarded	170.00'	**20.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=2.86 cfs @ 12.62 hrs HW=170.99' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 2.86 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=170.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 81P: Inf. Basin 2



Summary for Pond 80P: Forebay-2

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=24)

Inflow Area = 8.994 ac, 32.10% Impervious, Inflow Depth = 1.54" for 25 YR event
Inflow = 9.95 cfs @ 12.12 hrs, Volume= 1.153 af
Outflow = 7.89 cfs @ 12.10 hrs, Volume= 1.082 af, Atten= 21%, Lag= 0.0 min
Primary = 7.89 cfs @ 12.10 hrs, Volume= 1.082 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 171.61' @ 12.77 hrs Surf.Area= 0.065 ac Storage= 0.160 af

Plug-Flow detention time= 58.3 min calculated for 1.082 af (94% of inflow)
Center-of-Mass det. time= 25.8 min (889.0 - 863.3)

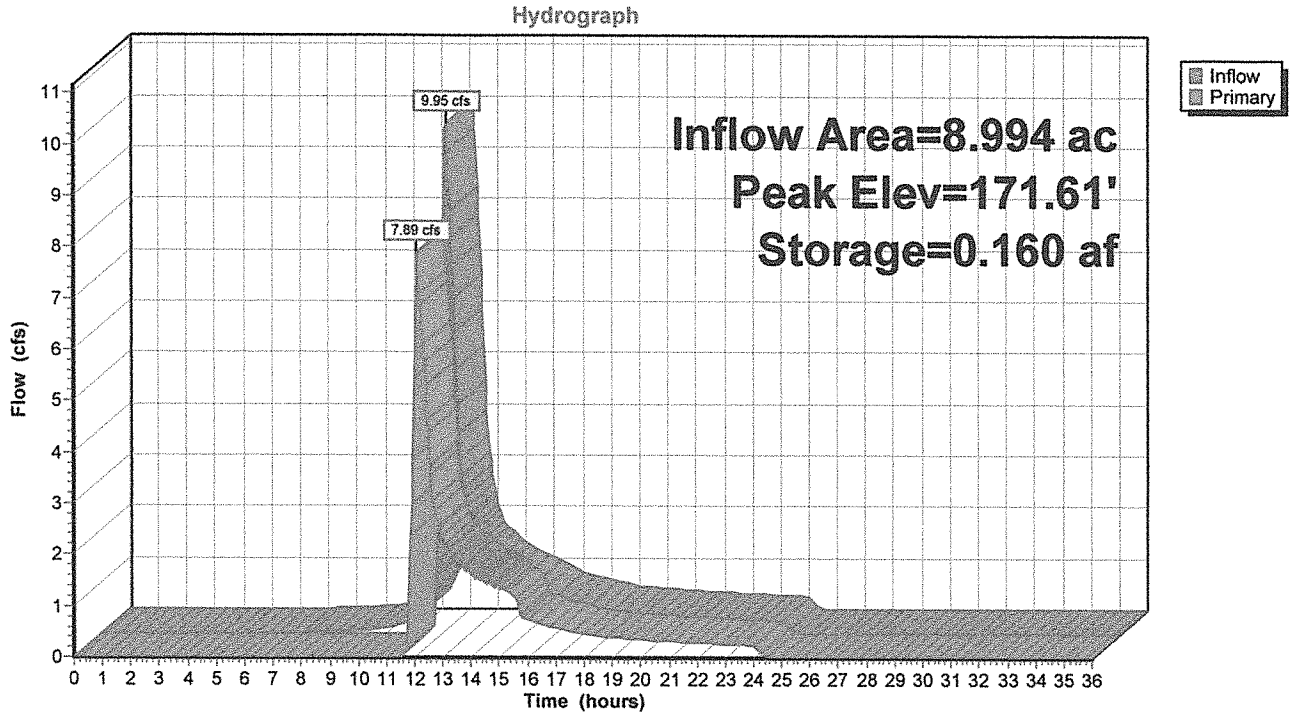
Volume	Invert	Avail.Storage	Storage Description
#1	168.00'	0.187 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
168.00	0.025	0.000	0.000
170.00	0.046	0.071	0.071
172.00	0.070	0.116	0.187

Device	Routing	Invert	Outlet Devices
#1	Primary	170.00'	**20.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=0.00 cfs @ 12.10 hrs HW=170.47' TW=170.63' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 80P: Forebay-2



Summary for Pond 81P: Inf. Basin 2

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=63)
[80] Warning: Exceeded Pond 80P by 0.17' @ 12.15 hrs (25.42 cfs 1.518 af)

Inflow Area =	11.052 ac,	29.90% Impervious,	Inflow Depth =	1.36"	for 25 YR event
Inflow =	9.29 cfs @	12.08 hrs,	Volume=	1.249 af	
Outflow =	3.23 cfs @	12.72 hrs,	Volume=	1.249 af,	Atten= 65%, Lag= 38.9 min
Discarded =	3.23 cfs @	12.72 hrs,	Volume=	1.249 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 171.61' @ 12.72 hrs Surf.Area= 0.160 ac Storage= 0.219 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 22.7 min (912.3 - 889.6)

Volume	Invert	Avail.Storage	Storage Description
#1	170.00'	0.726 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

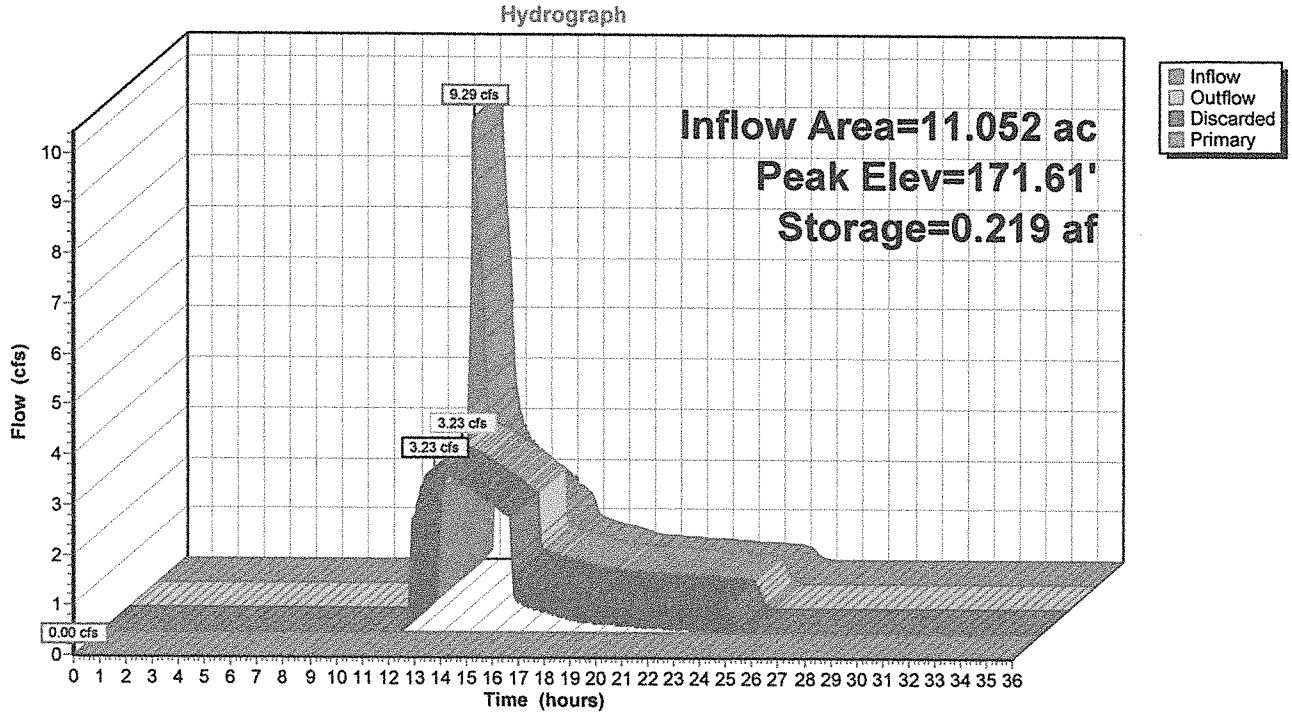
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
170.00	0.112	0.000	0.000
172.00	0.172	0.284	0.284
174.00	0.270	0.442	0.726

Device	Routing	Invert	Outlet Devices
#1	Primary	173.50'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Discarded	170.00'	**20.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=3.23 cfs @ 12.72 hrs HW=171.61' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 3.23 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=170.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 81P: Inf. Basin 2



Summary for Pond 80P: Forebay-2

[93] Warning: Storage range exceeded by 0.32'
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=38)

Inflow Area = 8.994 ac, 32.10% Impervious, Inflow Depth = 1.96" for 50 YR event
Inflow = 12.84 cfs @ 12.13 hrs, Volume= 1.466 af
Outflow = 9.53 cfs @ 12.13 hrs, Volume= 1.395 af, Atten= 26%, Lag= 0.4 min
Primary = 9.53 cfs @ 12.13 hrs, Volume= 1.395 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 172.32' @ 12.85 hrs Surf.Area= 0.070 ac Storage= 0.187 af

Plug-Flow detention time= 54.1 min calculated for 1.395 af (95% of inflow)
Center-of-Mass det. time= 27.7 min (885.3 - 857.6)

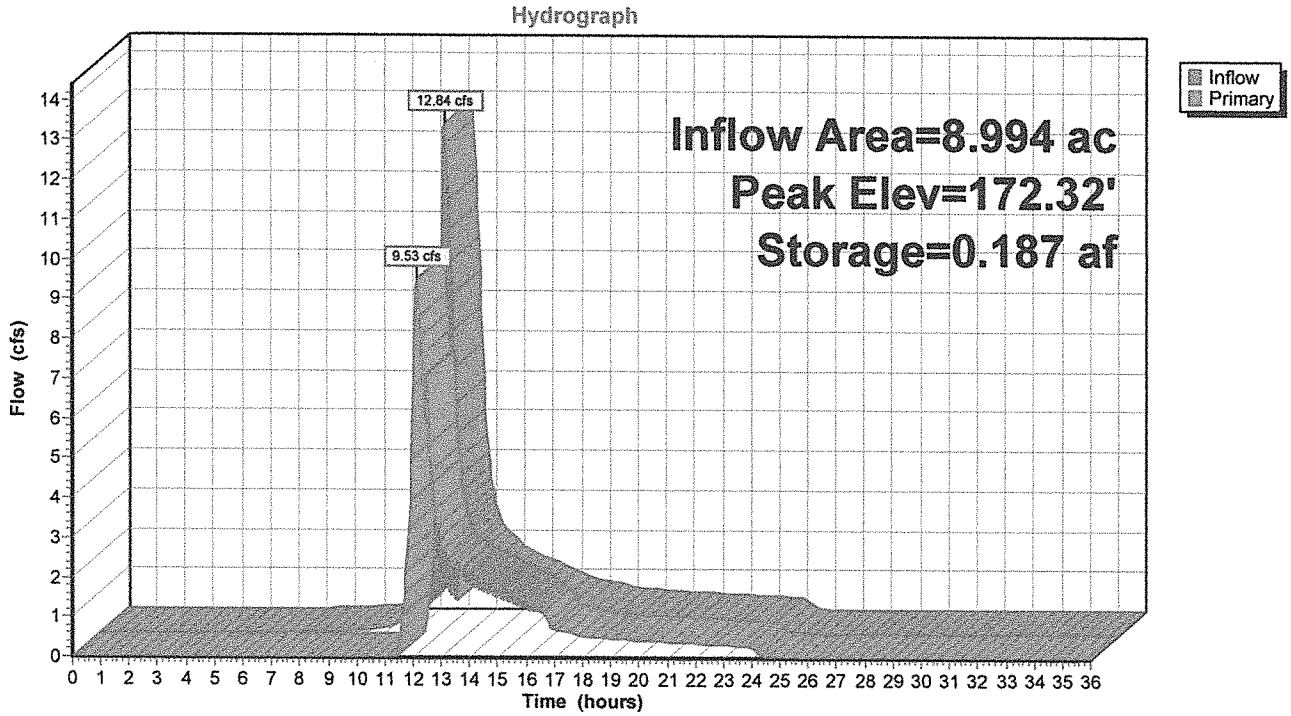
Volume	Invert	Avail.Storage	Storage Description
#1	168.00'	0.187 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
168.00	0.025	0.000	0.000
170.00	0.046	0.071	0.071
172.00	0.070	0.116	0.187

Device	Routing	Invert	Outlet Devices
#1	Primary	170.00'	**20.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=0.00 cfs @ 12.13 hrs HW=170.89' TW=171.12' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 80P: Forebay-2



Summary for Pond 81P: Inf. Basin 2

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=37)
[80] Warning: Exceeded Pond 80P by 0.24' @ 12.10 hrs (33.52 cfs 2.917 af)

Inflow Area = 11.052 ac, 29.90% Impervious, Inflow Depth = 1.76" for 50 YR event
Inflow = 11.56 cfs @ 12.07 hrs, Volume= 1.621 af
Outflow = 3.79 cfs @ 12.80 hrs, Volume= 1.623 af, Atten= 67%, Lag= 43.9 min
Discarded = 3.79 cfs @ 12.80 hrs, Volume= 1.623 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 172.32' @ 12.80 hrs Surf.Area= 0.188 ac Storage= 0.342 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 33.7 min (918.6 - 884.9)

Volume	Invert	Avail.Storage	Storage Description
#1	170.00'	0.726 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

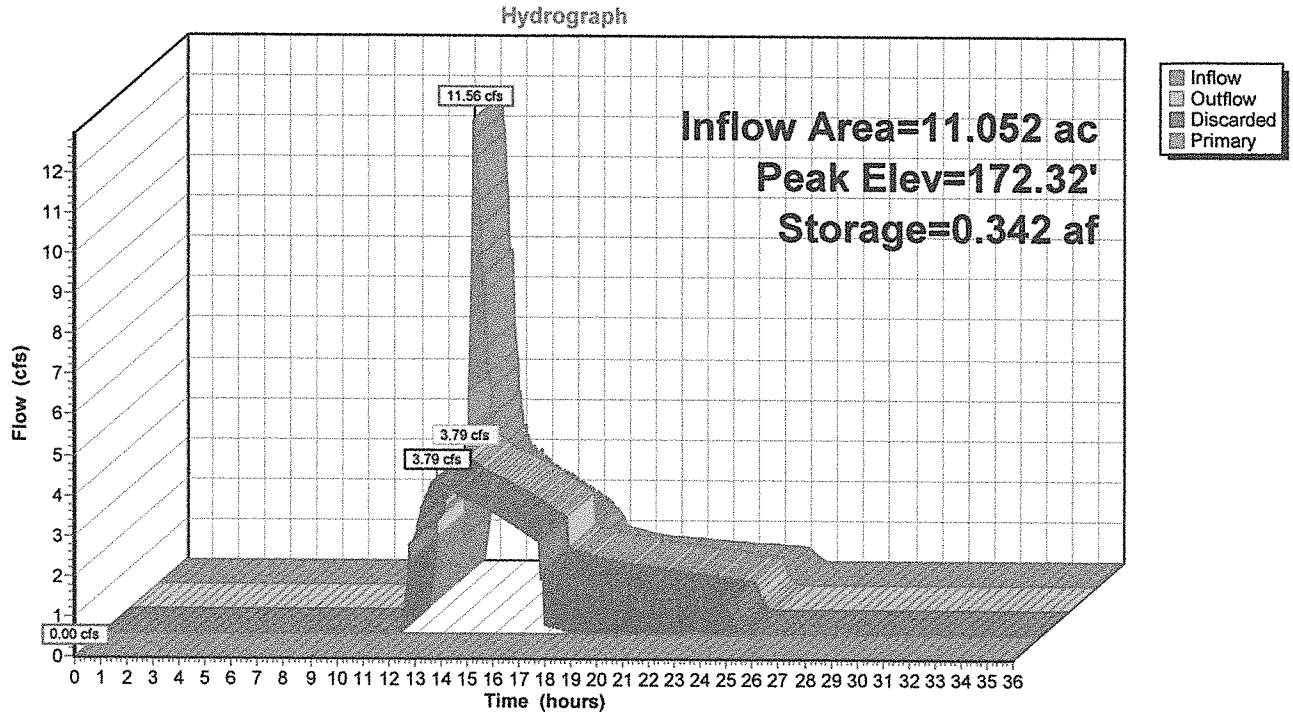
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
170.00	0.112	0.000	0.000
172.00	0.172	0.284	0.284
174.00	0.270	0.442	0.726

Device	Routing	Invert	Outlet Devices
#1	Primary	173.50'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Discarded	170.00'	**20.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=3.79 cfs @ 12.80 hrs HW=172.32' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 3.79 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=170.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 81P: Inf. Basin 2



Summary for Pond 80P: Forebay-2

[93] Warning: Storage range exceeded by 0.99'
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=49)

Inflow Area = 8.994 ac, 32.10% Impervious, Inflow Depth = 2.34" for 100 YR event
Inflow = 15.60 cfs @ 12.13 hrs, Volume= 1.751 af
Outflow = 14.08 cfs @ 12.35 hrs, Volume= 1.680 af, Atten= 10%, Lag= 12.9 min
Primary = 14.08 cfs @ 12.35 hrs, Volume= 1.680 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 172.99' @ 12.84 hrs Surf.Area= 0.070 ac Storage= 0.187 af

Plug-Flow detention time= 49.8 min calculated for 1.680 af (96% of inflow)
Center-of-Mass det. time= 27.4 min (880.7 - 853.4)

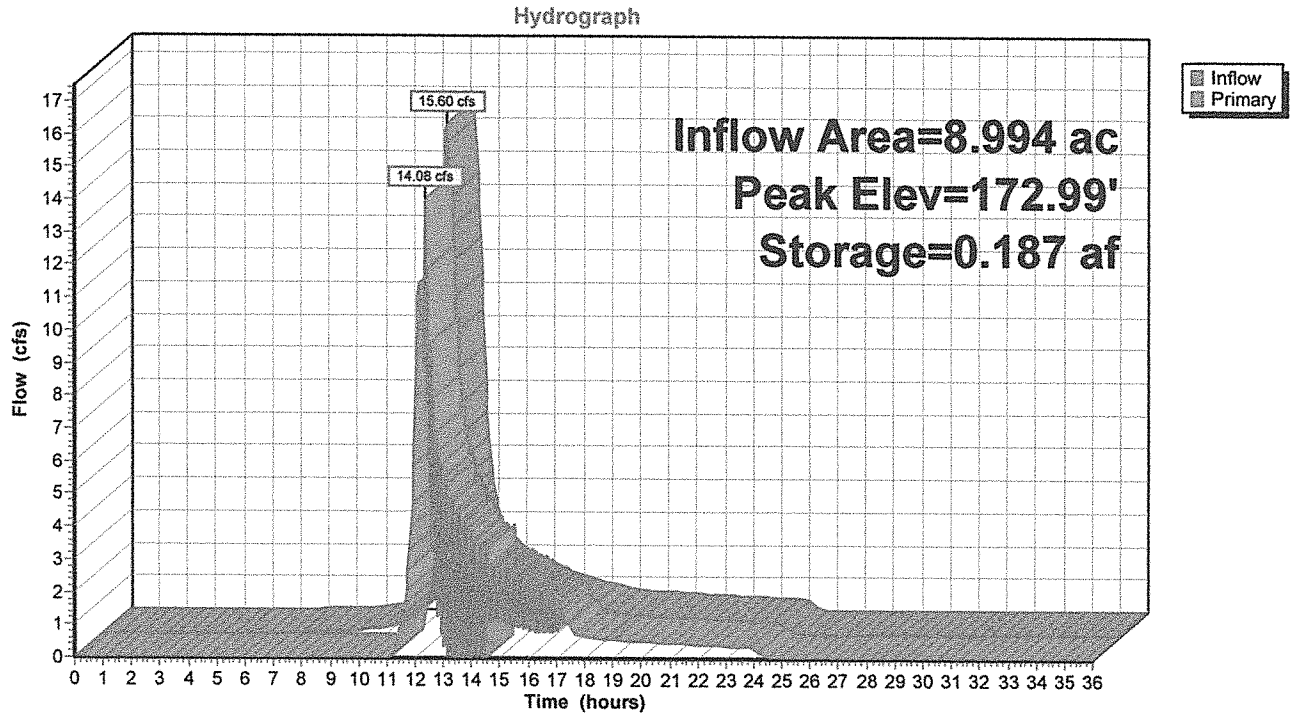
Volume	Invert	Avail.Storage	Storage Description
#1	168.00'	0.187 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
168.00	0.025	0.000	0.000
170.00	0.046	0.071	0.071
172.00	0.070	0.116	0.187

Device	Routing	Invert	Outlet Devices
#1	Primary	170.00'	**20.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=0.00 cfs @ 12.35 hrs HW=172.15' TW=172.35' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 80P: Forebay-2



Summary for Pond 81P: Inf. Basin 2

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=19)
[80] Warning: Exceeded Pond 80P by 0.87' @ 13.20 hrs (184.11 cfs 9.689 af)

Inflow Area = 11.052 ac, 29.90% Impervious, Inflow Depth = 2.13" for 100 YR event
Inflow = 15.46 cfs @ 12.35 hrs, Volume= 1.962 af
Outflow = 4.44 cfs @ 12.81 hrs, Volume= 1.963 af, Atten= 71%, Lag= 27.8 min
Discarded = 4.44 cfs @ 12.81 hrs, Volume= 1.963 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 172.99' @ 12.81 hrs Surf.Area= 0.220 ac Storage= 0.477 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 42.0 min (921.8 - 879.8)

Volume	Invert	Avail.Storage	Storage Description
#1	170.00'	0.726 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

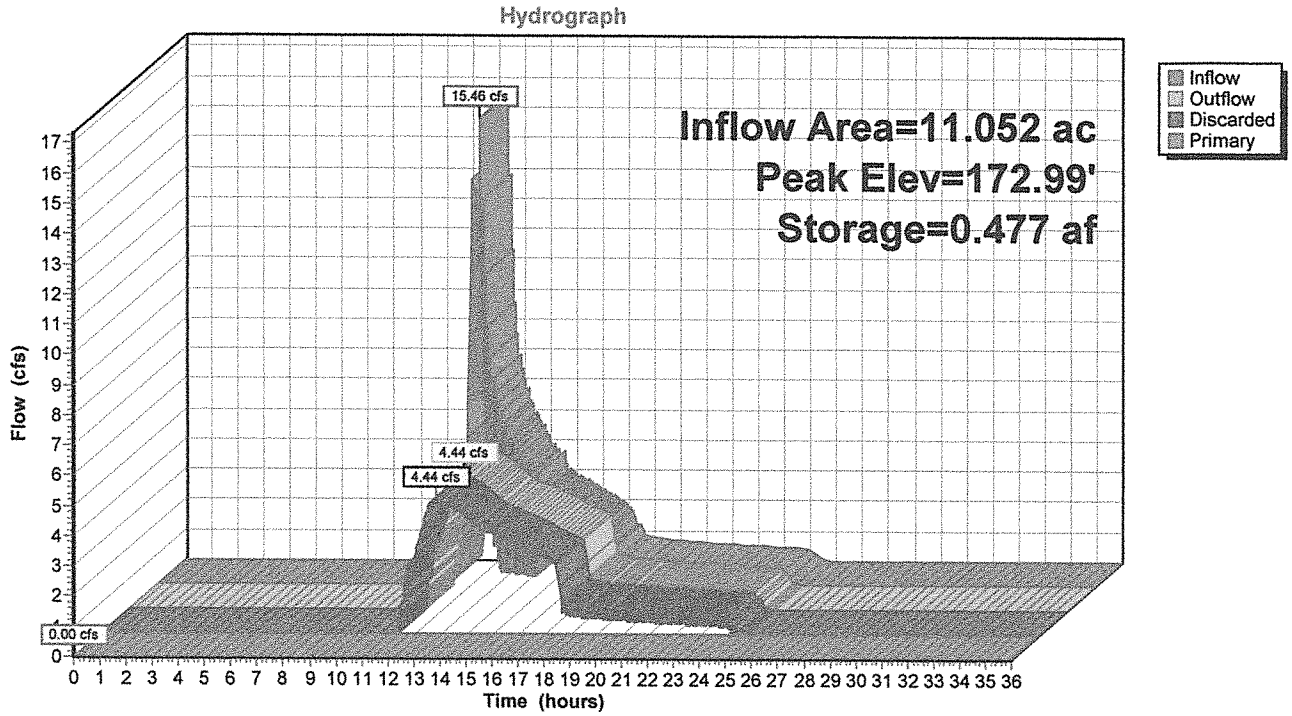
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
170.00	0.112	0.000	0.000
172.00	0.172	0.284	0.284
174.00	0.270	0.442	0.726

Device	Routing	Invert	Outlet Devices
#1	Primary	173.50'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Discarded	170.00'	**20.000 in/hr Exfiltration over Surface area**

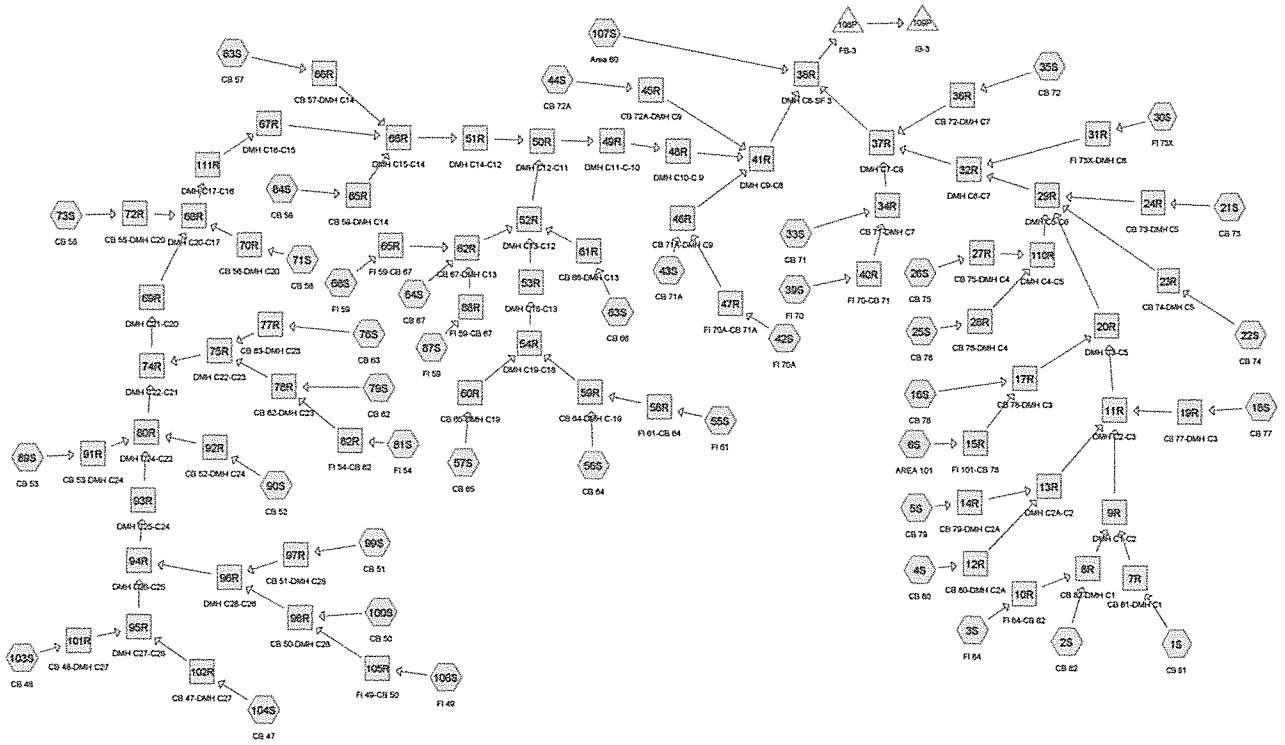
Discarded OutFlow Max=4.44 cfs @ 12.81 hrs HW=172.99' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 4.44 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=170.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 81P: Inf. Basin 2



APPENDIX D



Subcat Reach Pond Link

Routing Diagram for LS-Basin 3 - Copy
Prepared by Hewlett-Packard Company, Printed 10/17/2017
HydroCAD® 10.00-20 s/n 01535 © 2017 HydroCAD Software Solutions LLC

Summary for Pond 108P: FB-3

[93] Warning: Storage range exceeded by 0.12'
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=113)

Inflow Area = 26.892 ac, 27.26% Impervious, Inflow Depth = 0.32" for 2 YR event
Inflow = 5.16 cfs @ 12.14 hrs, Volume= 0.717 af
Outflow = 2.03 cfs @ 13.40 hrs, Volume= 0.422 af, Atten= 61%, Lag= 75.4 min
Primary = 2.03 cfs @ 13.40 hrs, Volume= 0.422 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 169.12' @ 13.40 hrs Surf.Area= 0.130 ac Storage= 0.295 af

Plug-Flow detention time= 269.0 min calculated for 0.422 af (59% of inflow)
Center-of-Mass det. time= 124.1 min (1,042.1 - 918.0)

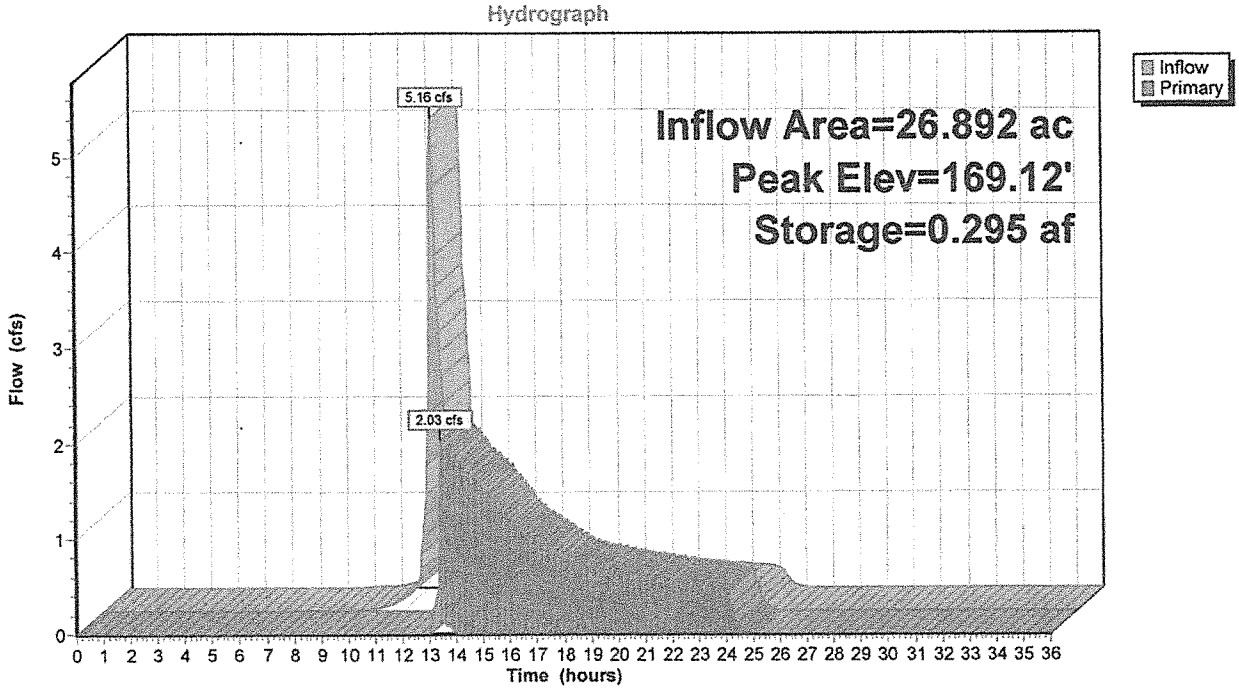
Volume	Invert	Avail.Storage	Storage Description
#1	166.00'	0.295 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
166.00	0.069	0.000	0.000
168.00	0.107	0.176	0.176
169.00	0.130	0.119	0.295

Device	Routing	Invert	Outlet Devices
#1	Primary	169.00'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=2.03 cfs @ 13.40 hrs HW=169.12' TW=166.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 2.03 cfs @ 0.83 fps)

Pond 108P: FB-3



Summary for Pond 108P: FB-3

[93] Warning: Storage range exceeded by 0.49'
[90] Warning: Qout>Qin may require smaller dt or Finer Routing
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=122)

Inflow Area = 26.892 ac, 27.26% Impervious, Inflow Depth = 0.95" for 10 YR event
Inflow = 14.28 cfs @ 12.16 hrs, Volume= 2.127 af
Outflow = 18.07 cfs @ 12.21 hrs, Volume= 1.832 af, Atten= 0%, Lag= 3.1 min
Primary = 18.07 cfs @ 12.21 hrs, Volume= 1.832 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 169.49' @ 12.20 hrs Surf.Area= 0.130 ac Storage= 0.295 af

Plug-Flow detention time= 94.2 min calculated for 1.830 af (86% of inflow)
Center-of-Mass det. time= 30.2 min (921.9 - 891.7)

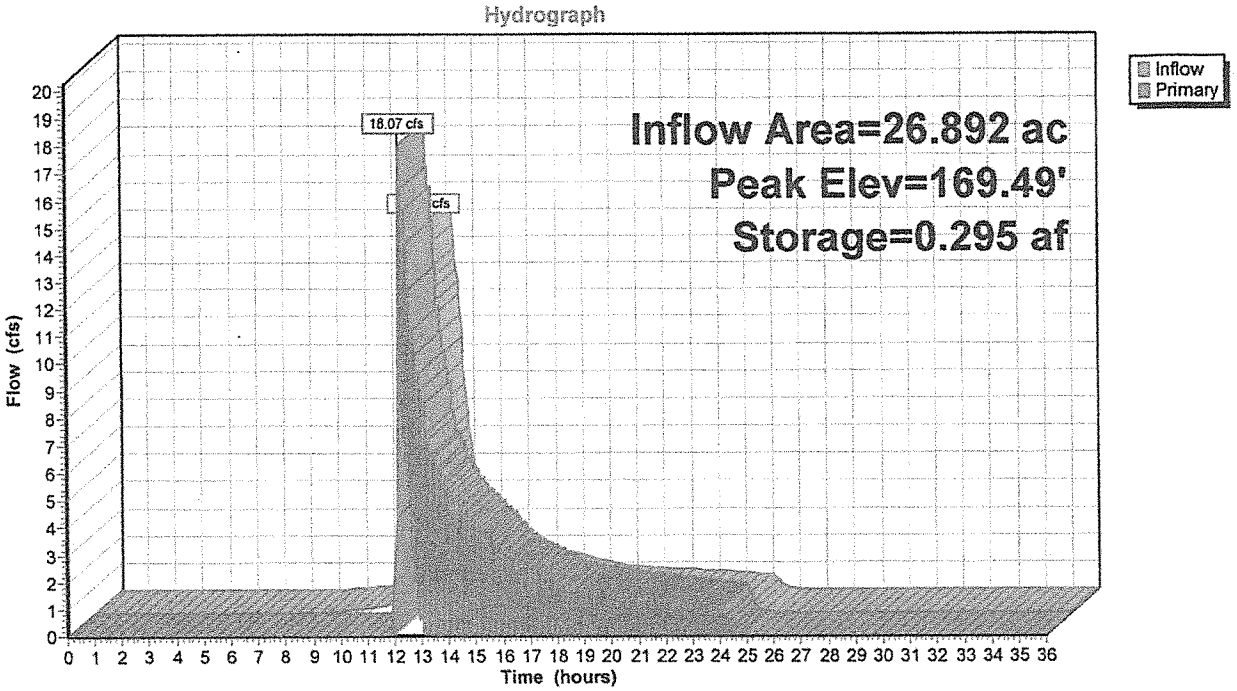
Volume	Invert	Avail.Storage	Storage Description
#1	166.00'	0.295 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
166.00	0.069	0.000	0.000
168.00	0.107	0.176	0.176
169.00	0.130	0.119	0.295

Device	Routing	Invert	Outlet Devices
#1	Primary	169.00'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=16.14 cfs @ 12.21 hrs HW=169.46' TW=166.24' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 16.14 cfs @ 1.75 fps)

Pond 108P: FB-3



Summary for Pond 108P: FB-3

[93] Warning: Storage range exceeded by 0.68'
[90] Warning: Qout>Qin may require smaller dt or Finer Routing
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=122)

Inflow Area = 26.892 ac, 27.26% Impervious, Inflow Depth = 1.30" for 25 YR event
Inflow = 20.53 cfs @ 12.16 hrs, Volume= 2.916 af
Outflow = 30.02 cfs @ 12.15 hrs, Volume= 2.622 af, Atten= 0%, Lag= 0.0 min
Primary = 30.02 cfs @ 12.15 hrs, Volume= 2.622 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 169.68' @ 12.15 hrs Surf.Area= 0.130 ac Storage= 0.295 af

Plug-Flow detention time= 70.7 min calculated for 2.618 af (90% of inflow)
Center-of-Mass det. time= 21.5 min (904.7 - 883.2)

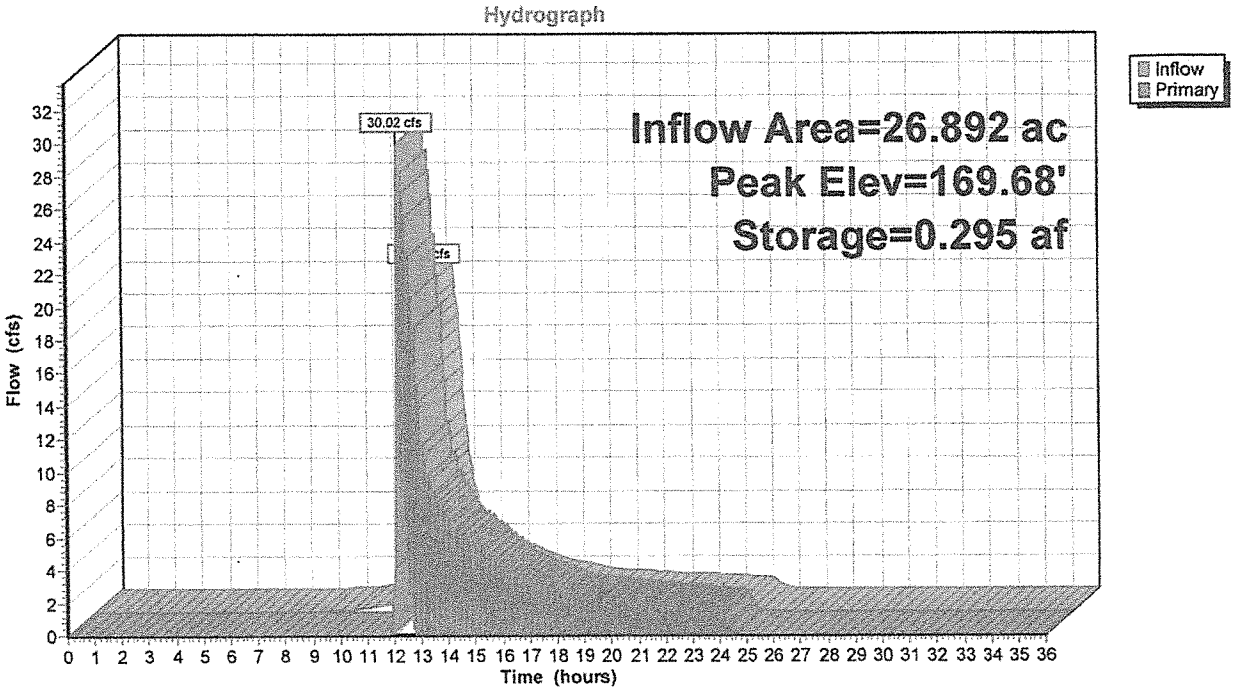
Volume	Invert	Avail.Storage	Storage Description
#1	166.00'	0.295 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
166.00	0.069	0.000	0.000
168.00	0.107	0.176	0.176
169.00	0.130	0.119	0.295

Device	Routing	Invert	Outlet Devices
#1	Primary	169.00'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=29.59 cfs @ 12.15 hrs HW=169.67' TW=166.51' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 29.59 cfs @ 2.20 fps)

Pond 108P: FB-3



Summary for Pond 108P: FB-3

[93] Warning: Storage range exceeded by 0.98'
[90] Warning: Qout>Qin may require smaller dt or Finer Routing
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=123)

Inflow Area = 26.892 ac, 27.26% Impervious, Inflow Depth = 1.69" for 50 YR event
Inflow = 27.86 cfs @ 12.17 hrs, Volume= 3.787 af
Outflow = 33.87 cfs @ 12.15 hrs, Volume= 3.493 af, Atten= 0%, Lag= 0.0 min
Primary = 33.87 cfs @ 12.15 hrs, Volume= 3.493 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 169.98' @ 13.05 hrs Surf.Area= 0.130 ac Storage= 0.295 af

Plug-Flow detention time= 56.0 min calculated for 3.488 af (92% of inflow)
Center-of-Mass det. time= 16.7 min (892.9 - 876.2)

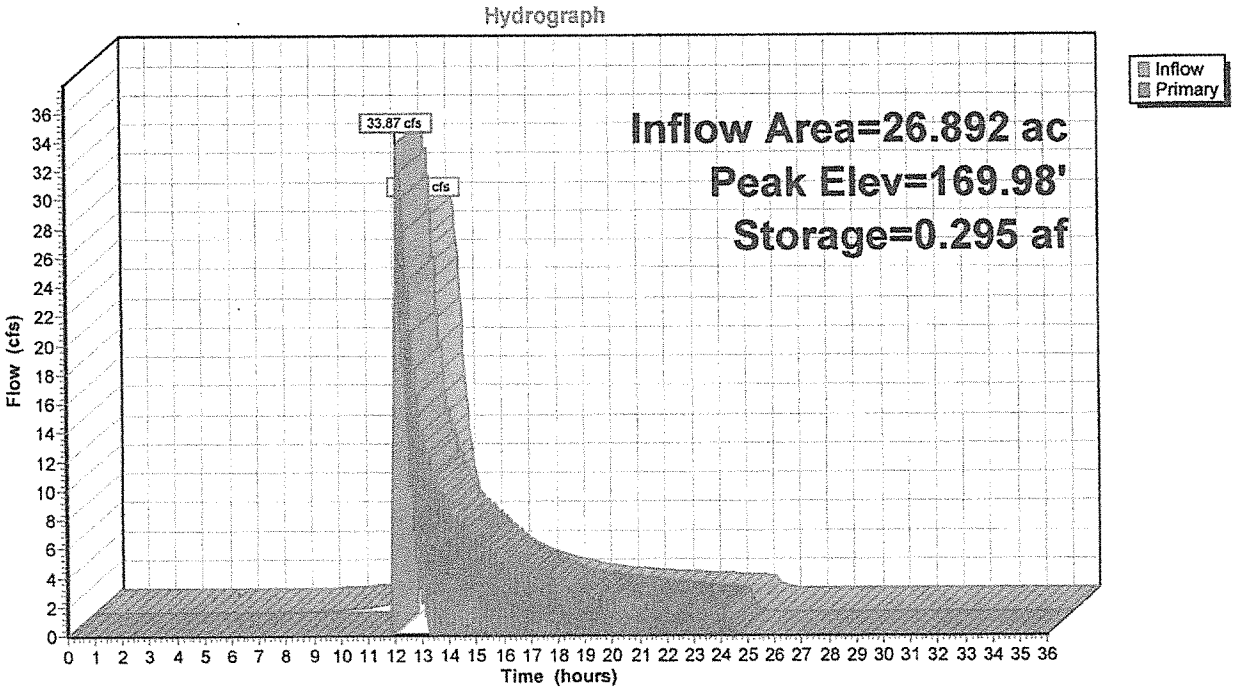
Volume	Invert	Avail.Storage	Storage Description
#1	166.00'	0.295 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
166.00	0.069	0.000	0.000
168.00	0.107	0.176	0.176
169.00	0.130	0.119	0.295

Device	Routing	Invert	Outlet Devices
#1	Primary	169.00'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=33.22 cfs @ 12.15 hrs HW=169.73' TW=167.28' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 33.22 cfs @ 2.29 fps)

Pond 108P: FB-3



Summary for Pond 108P: FB-3

[93] Warning: Storage range exceeded by 1.75'
[90] Warning: Qout>Qin may require smaller dt or Finer Routing
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=122)
[61] Hint: Exceeded Reach 38R outlet invert by 0.35' @ 13.10 hrs

Inflow Area = 26.892 ac, 27.26% Impervious, Inflow Depth = 2.05" for 100 YR event
Inflow = 33.73 cfs @ 12.17 hrs, Volume= 4.589 af
Outflow = 34.36 cfs @ 12.20 hrs, Volume= 4.294 af, Atten= 0%, Lag= 1.8 min
Primary = 34.36 cfs @ 12.20 hrs, Volume= 4.294 af

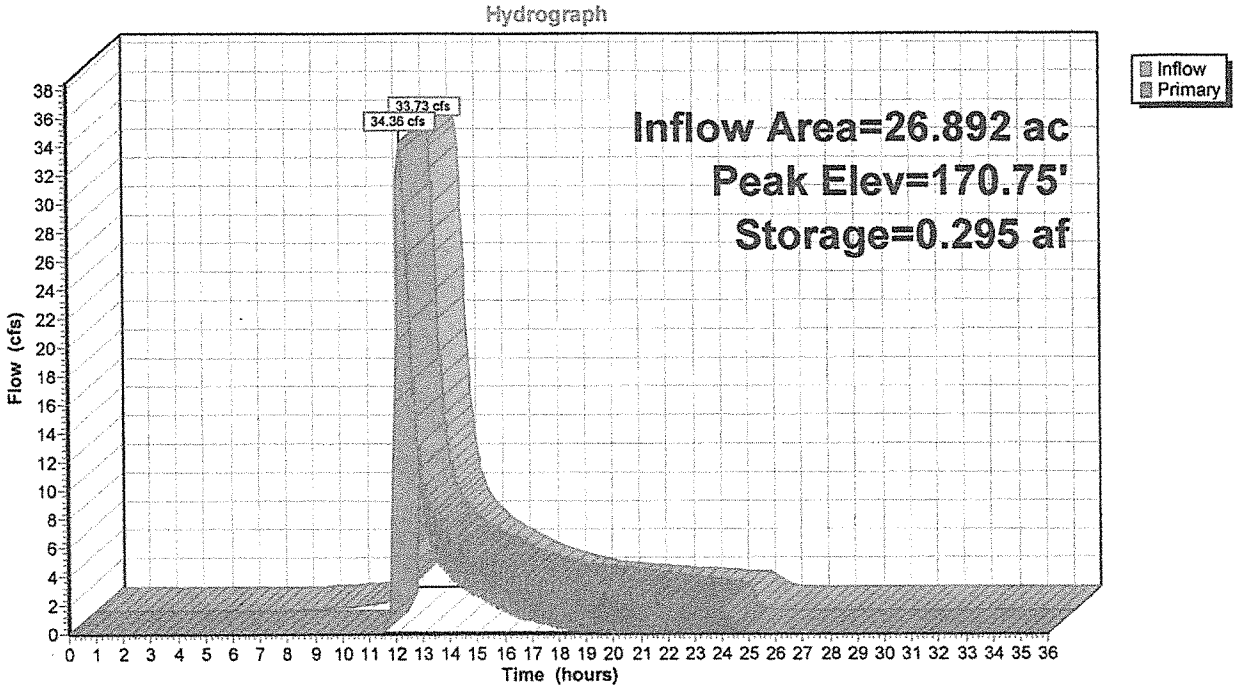
Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 170.75' @ 13.12 hrs Surf.Area= 0.130 ac Storage= 0.295 af

Plug-Flow detention time= 47.7 min calculated for 4.294 af (94% of inflow)
Center-of-Mass det. time= 14.1 min (885.3 - 871.2)

Volume	Invert	Avail.Storage	Storage Description
#1	166.00'	0.295 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
166.00	0.069	0.000	0.000
168.00	0.107	0.176	0.176
169.00	0.130	0.119	0.295

Device	Routing	Invert	Outlet Devices
#1	Primary	169.00'	**20.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=34.13 cfs @ 12.20 hrs HW=169.74' TW=168.37' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 34.13 cfs @ 2.31 fps)

Pond 108P: FB-3