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Via E-mail

March 28, 2025

Planning & Zoning Commission
Montville Town Hall
310 Norwich-New London Turnpike
Uncasville, CT 06382

RE: Stormwater Narrative
Subdivision Modification application
East Lake Road 8-Lot Subdivision

Previously Approved Drainage Improvements

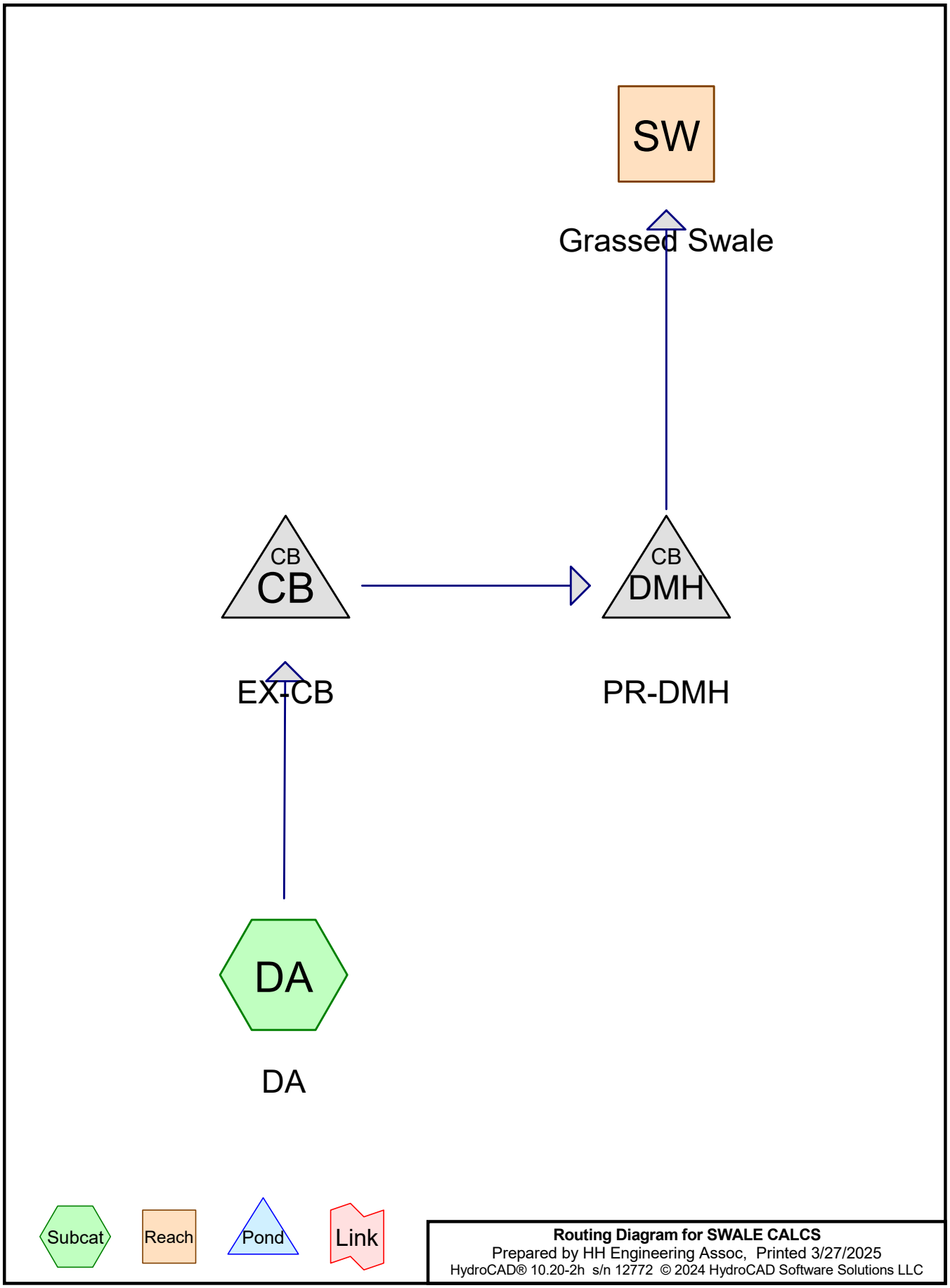
On July 26, 2022, the Town of Montville Planning & Zoning Commission approved subdivision application #22sub3 for a new 8-lot subdivision. The approved plans and stormwater management report were previously prepared by Boundaries, LLC.

The approved subdivision included 8 new lots, each with frontage on East Lake Road and did not include any public improvements. Existing runoff generated along East Lake Road is collected in a series of catch basins which discharges onto approved Lot 7 (1121 East Lake Road). Previously, a 24" culvert was proposed divert the roadway runoff around the proposed improvements for Lot 7. The culvert was sized to pass flows through the 100-year storm event from the contributing 1.8-acre East Lake Road Drainage Watershed. To be conservative, the East Lake Road Drainage Watershed was evaluated as entirely impervious.

Proposed Drainage Modifications

Due to site constraints, the applicant is proposing to modify the previously approved drainage system by removing the 24" culvert, installing a new 24" HDPE pipe from the existing catch basin in East Lake Road to a new drainage manhole, which will direct runoff to the west via a 24" HDPE pipe under the proposed driveway to a flared end section and riprap apron. Runoff is then conveyed around the proposed Lot 7improvements via a new 6'(W) vegetated swale. The proposed improvements have been designed to convey flows through the 100-year storm event. Please refer to Attachment A – Proposed HydroCAD Report, Attachment B – Pipe Flow Velocity Calculations, and Attachment C – Riprap Sizing Calculations for modeling results. The proposed drainage modifications are shown on the plan entitled, "Lot 7 Drainage Modifications, Subdivision Modification, East Lake Road & Fire Street, Montville, CT 06370, Prepared for: Sunmar/RAF Builders, LLC, 285 Old Colchester Road, Uncasville, CT 06382," scale: 1"=20', dated 3/28/2025, prepared by H+H Engineering Associates, LLC.

Attachment A –
Proposed HydroCAD Report



Routing Diagram for SWALE CALCS
Prepared by HH Engineering Assoc, Printed 3/27/2025

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
78,408	98	Paved parking, HSG B (DA)
78,408	**98**	**TOTAL AREA**

Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment DA: DA Runoff Area=1.800 ac 100.00% Impervious Runoff Depth=1.08"
Tc=5.0 min CN=98 Runoff=2.23 cfs 7,080 cf

Reach SW: Grassed Swale Avg. Flow Depth=0.15' Max Vel=2.24 fps Inflow=2.23 cfs 7,080 cf
n=0.030 L=205.0' S=0.0283 '/' Capacity=60.81 cfs Outflow=2.18 cfs 7,080 cf

Pond CB: EX-CB Peak Elev=262.27' Inflow=2.23 cfs 7,080 cf
Primary=2.23 cfs 7,080 cf Secondary=0.00 cfs 0 cf Outflow=2.23 cfs 7,080 cf

Pond DMH: PR-DMH Peak Elev=258.12' Inflow=2.23 cfs 7,080 cf
Primary=2.23 cfs 7,080 cf Secondary=0.00 cfs 0 cf Outflow=2.23 cfs 7,080 cf

Total Runoff Area = 78,408 sf Runoff Volume = 7,080 cf Average Runoff Depth = 1.08"
0.00% Pervious = 0 sf 100.00% Impervious = 78,408 sf

Summary for Subcatchment DA: DA

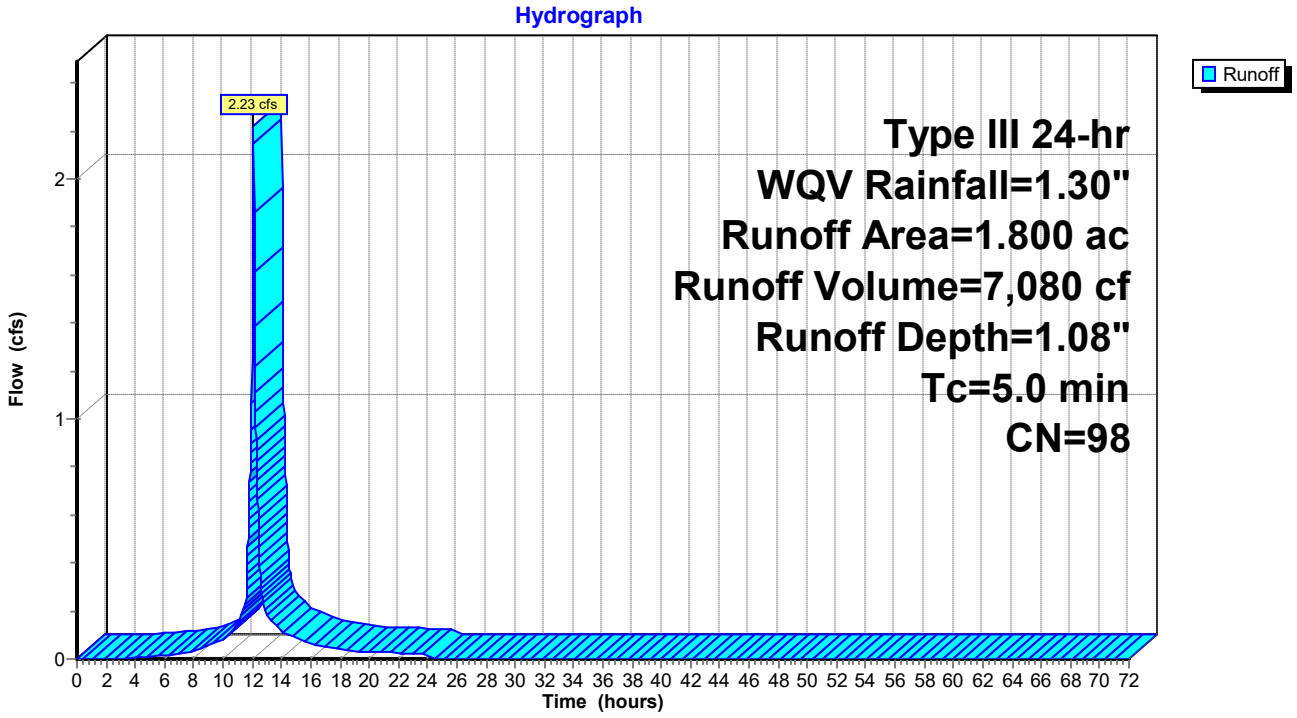
Runoff = 2.23 cfs @ 12.07 hrs, Volume= 7,080 cf, Depth= 1.08"
Routed to Pond CB : EX-CB

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr WQV Rainfall=1.30"

Area (ac)	CN	Description
1.800	98	Paved parking, HSG B
1.800		100.00% Impervious Area

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

Subcatchment DA: DA



Summary for Reach SW: Grassed Swale

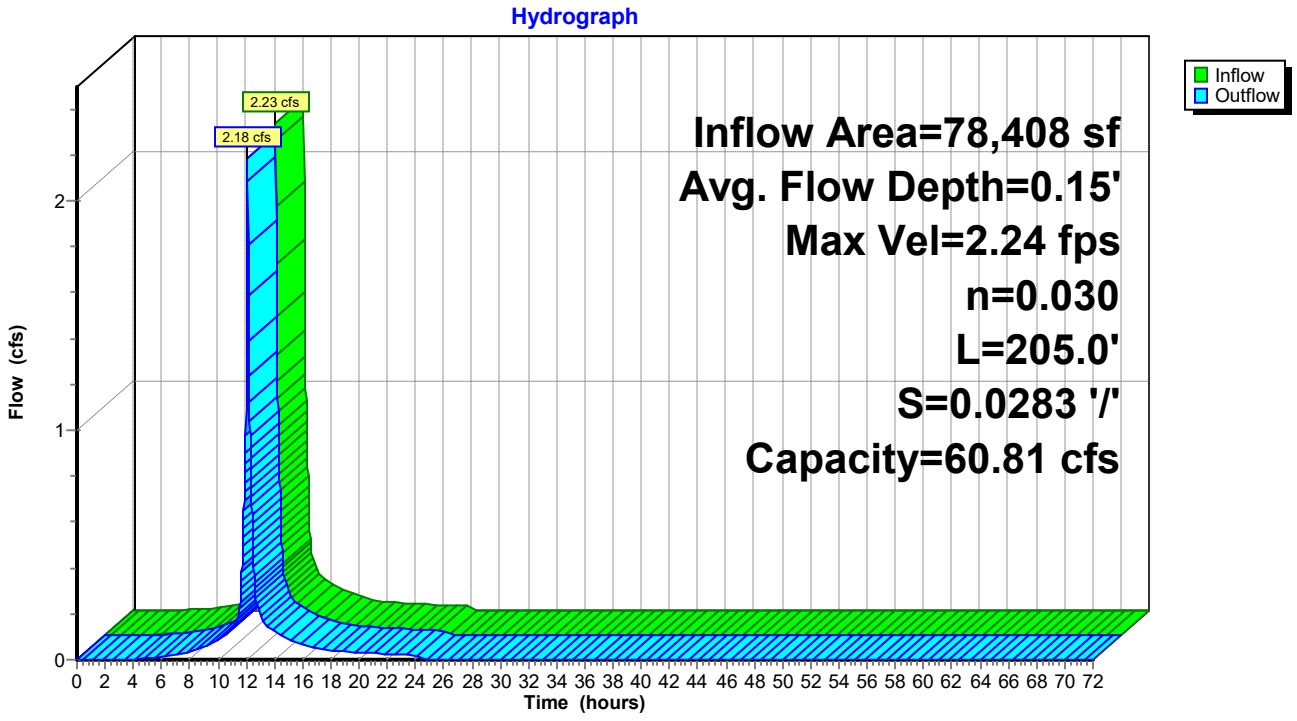
Inflow Area = 78,408 sf,100.00% Impervious, Inflow Depth = 1.08" for WQV event
Inflow = 2.23 cfs @ 12.07 hrs, Volume= 7,080 cf
Outflow = 2.18 cfs @ 12.09 hrs, Volume= 7,080 cf, Atten= 2%, Lag= 1.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 2.24 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 0.56 fps, Avg. Travel Time= 6.1 min

Peak Storage= 199 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.15' , Surface Width= 6.90'
Bank-Full Depth= 1.00' Flow Area= 9.0 sf, Capacity= 60.81 cfs

6.00' x 1.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 12.00'
Length= 205.0' Slope= 0.0283 '/'
Inlet Invert= 255.80', Outlet Invert= 250.00'

‡



Summary for Pond CB: EX-CB

[57] Hint: Peaked at 262.27' (Flood elevation advised)

Inflow Area = 78,408 sf,100.00% Impervious, Inflow Depth = 1.08" for WQV event
Inflow = 2.23 cfs @ 12.07 hrs, Volume= 7,080 cf
Outflow = 2.23 cfs @ 12.07 hrs, Volume= 7,080 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.23 cfs @ 12.07 hrs, Volume= 7,080 cf
Routed to Pond DMH : PR-DMH
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

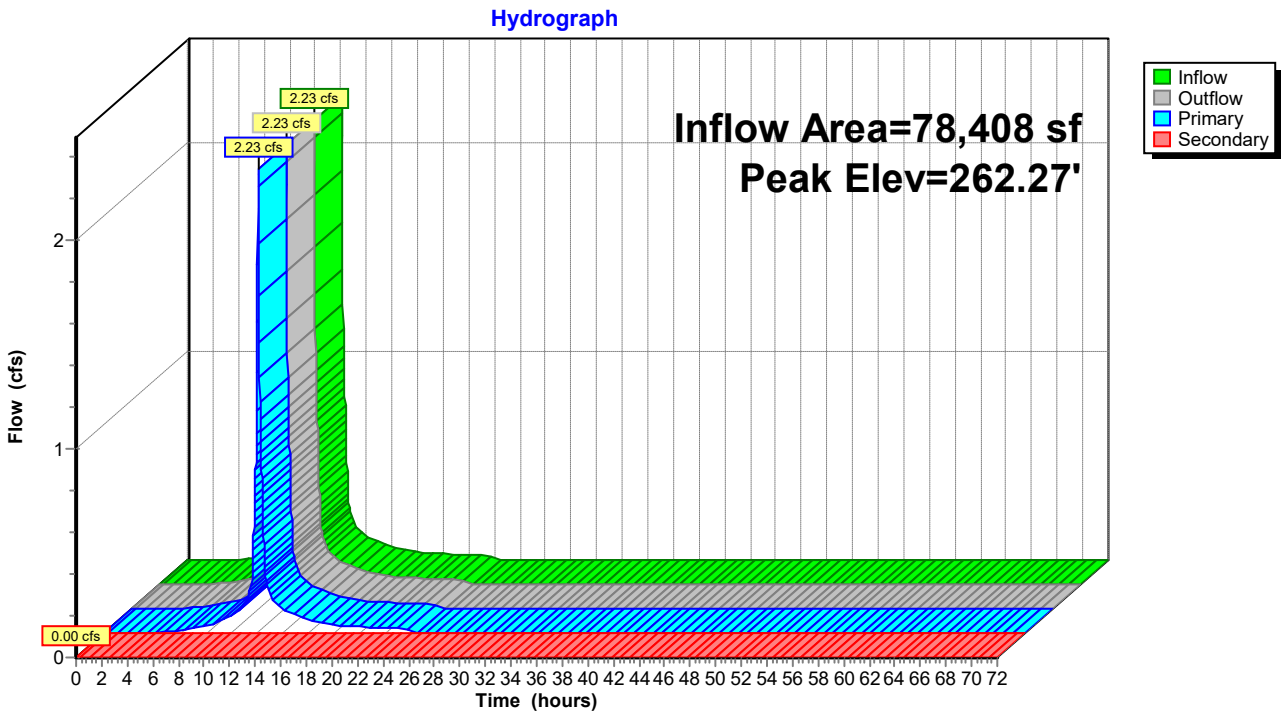
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 262.27' @ 12.07 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	261.65'	**24.0" Round 24" Outlet Pipe** L= 9.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 261.65' / 261.00' S= 0.0722 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Secondary	264.96'	**20.4" x 38.0" Horiz. Top of Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.21 cfs @ 12.07 hrs HW=262.27' TW=258.12' (Dynamic Tailwater)
└**1=24" Outlet Pipe** (Inlet Controls 2.21 cfs @ 2.68 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=261.65' (Free Discharge)
└**2=Top of Grate** (Controls 0.00 cfs)

Pond CB: EX-CB



Summary for Pond DMH: PR-DMH

[57] Hint: Peaked at 258.12' (Flood elevation advised)

Inflow Area = 78,408 sf,100.00% Impervious, Inflow Depth = 1.08" for WQV event
Inflow = 2.23 cfs @ 12.07 hrs, Volume= 7,080 cf
Outflow = 2.23 cfs @ 12.07 hrs, Volume= 7,080 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.23 cfs @ 12.07 hrs, Volume= 7,080 cf
Routed to Reach SW : Grassed Swale
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

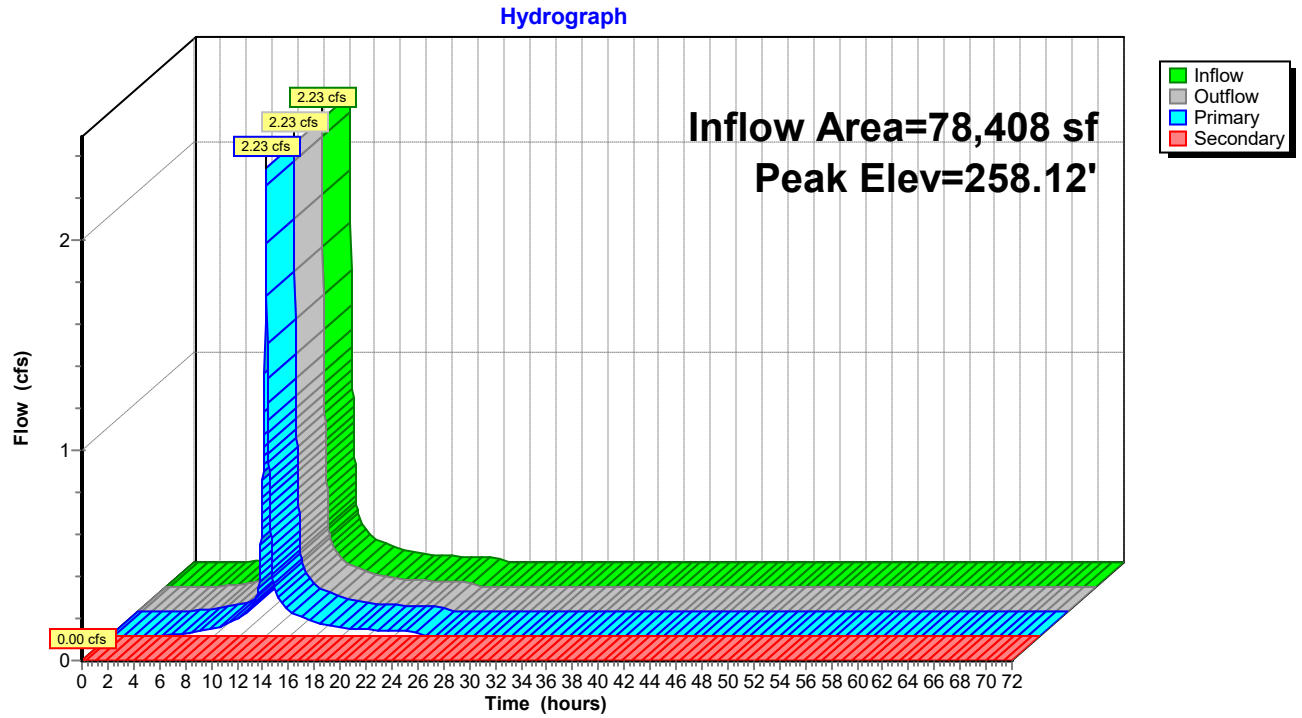
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 258.12' @ 12.07 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	257.50'	**24.0" Round 24" Outlet Pipe** L= 118.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 257.50' / 255.80' S= 0.0144 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Secondary	265.50'	**3.0" Horiz. Top of Frame** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.21 cfs @ 12.07 hrs HW=258.12' TW=255.95' (Dynamic Tailwater)
└**1=24" Outlet Pipe** (Inlet Controls 2.21 cfs @ 2.68 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=257.50' (Free Discharge)
└**2=Top of Frame** (Controls 0.00 cfs)

Pond DMH: PR-DMH



Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment DA: DA Runoff Area=1.800 ac 100.00% Impervious Runoff Depth=3.23"
Tc=5.0 min CN=98 Runoff=6.25 cfs 21,083 cf

Reach SW: Grassed Swale Avg. Flow Depth=0.28' Max Vel=3.26 fps Inflow=6.25 cfs 21,083 cf
n=0.030 L=205.0' S=0.0283 '/' Capacity=60.81 cfs Outflow=6.19 cfs 21,083 cf

Pond CB: EX-CB Peak Elev=262.74' Inflow=6.25 cfs 21,083 cf
Primary=6.25 cfs 21,083 cf Secondary=0.00 cfs 0 cf Outflow=6.25 cfs 21,083 cf

Pond DMH: PR-DMH Peak Elev=258.59' Inflow=6.25 cfs 21,083 cf
Primary=6.25 cfs 21,083 cf Secondary=0.00 cfs 0 cf Outflow=6.25 cfs 21,083 cf

Total Runoff Area = 78,408 sf Runoff Volume = 21,083 cf Average Runoff Depth = 3.23"
0.00% Pervious = 0 sf 100.00% Impervious = 78,408 sf

Summary for Subcatchment DA: DA

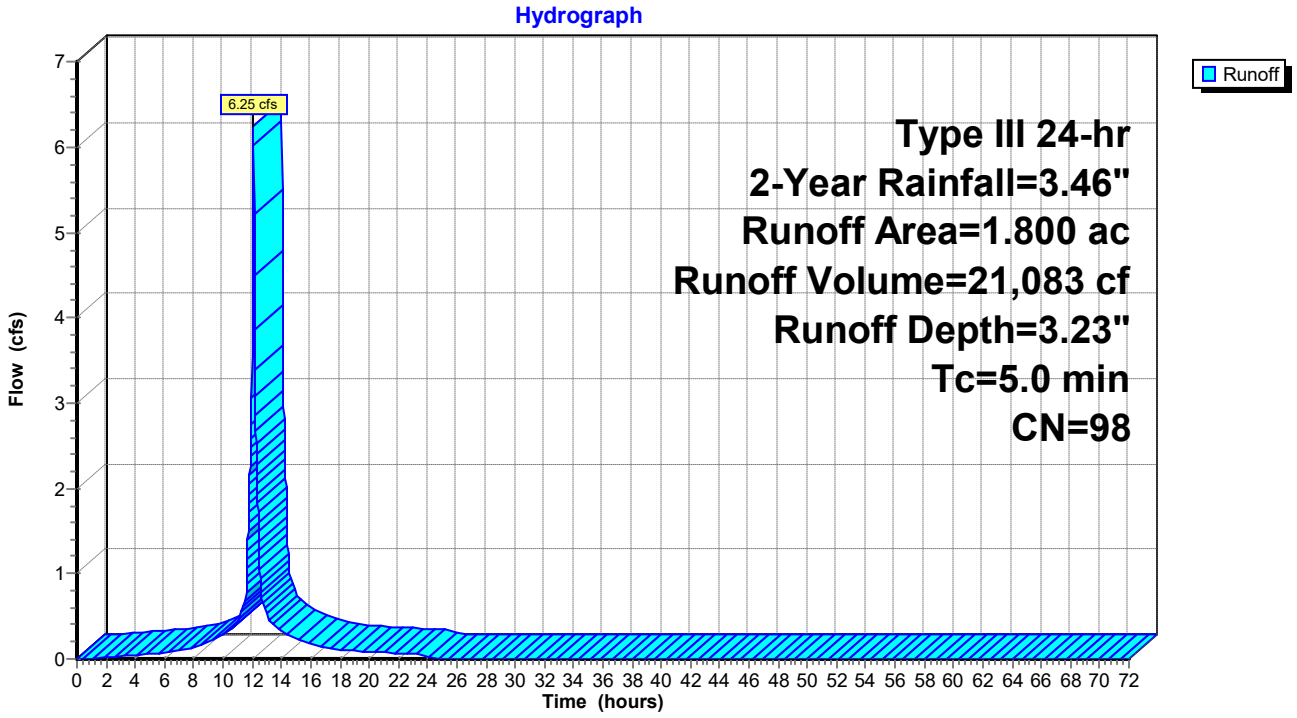
Runoff = 6.25 cfs @ 12.07 hrs, Volume= 21,083 cf, Depth= 3.23"
Routed to Pond CB : EX-CB

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-Year Rainfall=3.46"

Area (ac)	CN	Description
1.800	98	Paved parking, HSG B
1.800		100.00% Impervious Area

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

Subcatchment DA: DA



Summary for Reach SW: Grassed Swale

Inflow Area = 78,408 sf,100.00% Impervious, Inflow Depth = 3.23" for 2-Year event
Inflow = 6.25 cfs @ 12.07 hrs, Volume= 21,083 cf
Outflow = 6.19 cfs @ 12.08 hrs, Volume= 21,083 cf, Atten= 1%, Lag= 0.7 min

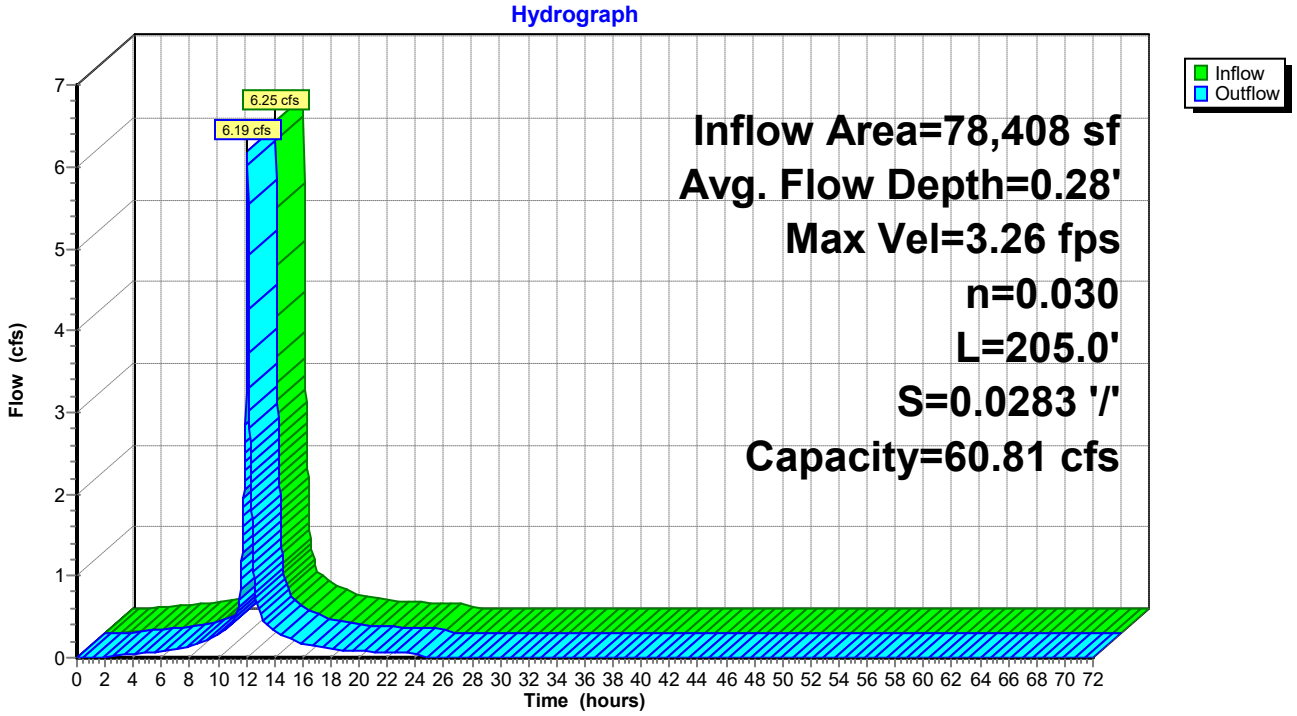
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 3.26 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 0.80 fps, Avg. Travel Time= 4.3 min

Peak Storage= 389 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.28' , Surface Width= 7.67'
Bank-Full Depth= 1.00' Flow Area= 9.0 sf, Capacity= 60.81 cfs

6.00' x 1.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 12.00'
Length= 205.0' Slope= 0.0283 '/'
Inlet Invert= 255.80', Outlet Invert= 250.00'

‡

Reach SW: Grassed Swale



Summary for Pond CB: EX-CB

[57] Hint: Peaked at 262.74' (Flood elevation advised)

Inflow Area = 78,408 sf,100.00% Impervious, Inflow Depth = 3.23" for 2-Year event
Inflow = 6.25 cfs @ 12.07 hrs, Volume= 21,083 cf
Outflow = 6.25 cfs @ 12.07 hrs, Volume= 21,083 cf, Atten= 0%, Lag= 0.0 min
Primary = 6.25 cfs @ 12.07 hrs, Volume= 21,083 cf
Routed to Pond DMH : PR-DMH
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

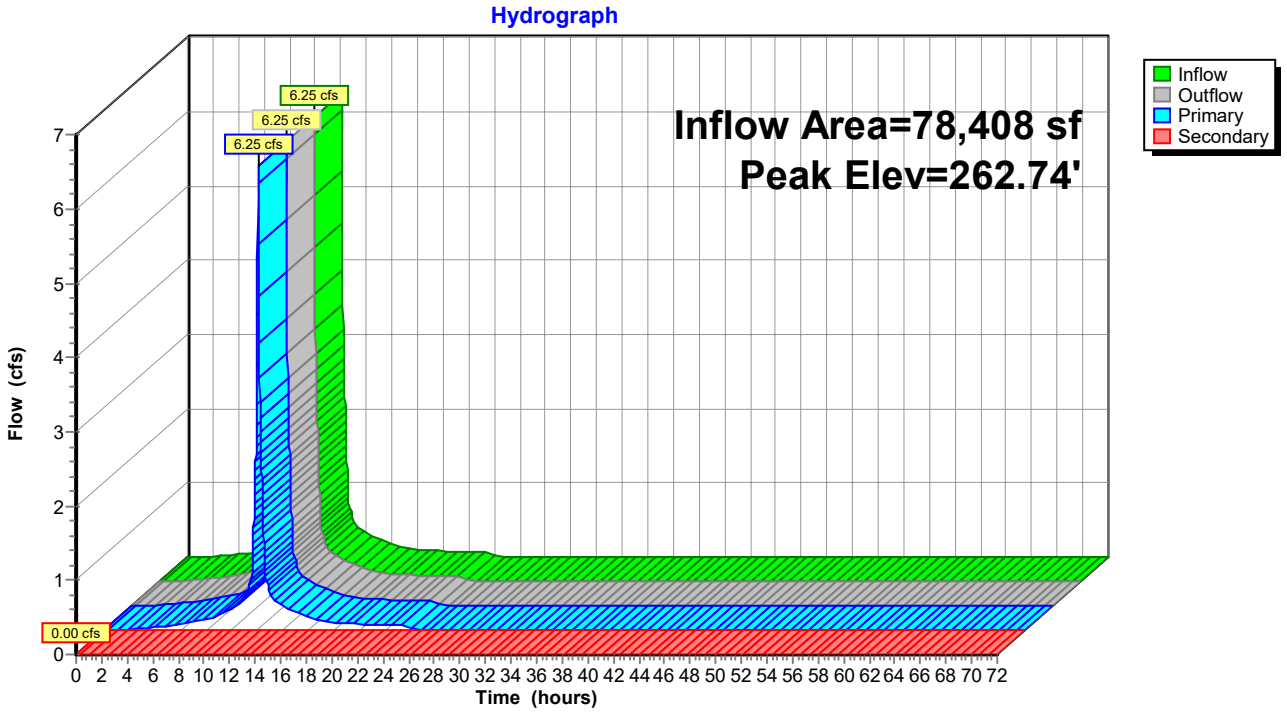
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 262.74' @ 12.07 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	261.65'	**24.0" Round 24" Outlet Pipe** L= 9.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 261.65' / 261.00' S= 0.0722 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Secondary	264.96'	**20.4" x 38.0" Horiz. Top of Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=6.20 cfs @ 12.07 hrs HW=262.74' TW=258.59' (Dynamic Tailwater)
└**1=24" Outlet Pipe** (Inlet Controls 6.20 cfs @ 3.55 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=261.65' (Free Discharge)
└**2=Top of Grate** (Controls 0.00 cfs)

Pond CB: EX-CB



Summary for Pond DMH: PR-DMH

[57] Hint: Peaked at 258.59' (Flood elevation advised)

Inflow Area = 78,408 sf,100.00% Impervious, Inflow Depth = 3.23" for 2-Year event
Inflow = 6.25 cfs @ 12.07 hrs, Volume= 21,083 cf
Outflow = 6.25 cfs @ 12.07 hrs, Volume= 21,083 cf, Atten= 0%, Lag= 0.0 min
Primary = 6.25 cfs @ 12.07 hrs, Volume= 21,083 cf
Routed to Reach SW : Grassed Swale
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

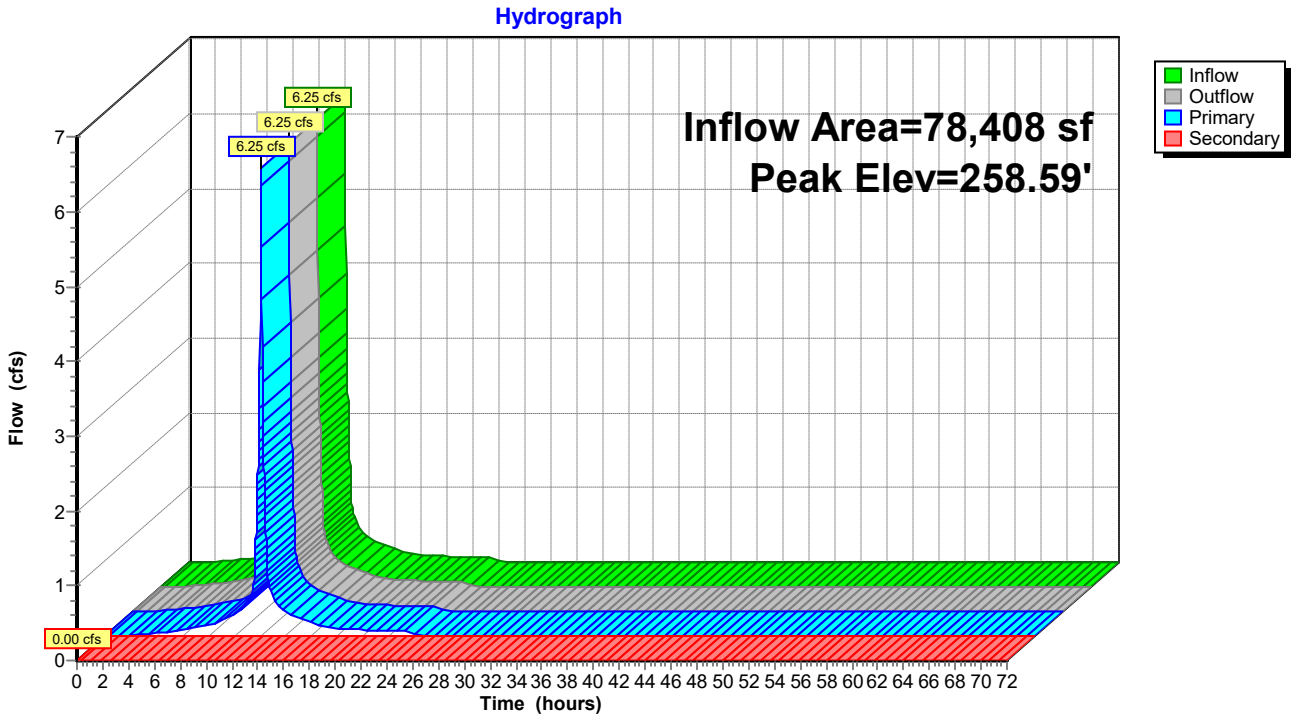
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 258.59' @ 12.07 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	257.50'	**24.0" Round 24" Outlet Pipe** L= 118.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 257.50' / 255.80' S= 0.0144 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Secondary	265.50'	**3.0" Horiz. Top of Frame** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=6.20 cfs @ 12.07 hrs HW=258.59' TW=256.07' (Dynamic Tailwater)
└**1=24" Outlet Pipe** (Inlet Controls 6.20 cfs @ 3.55 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=257.50' (Free Discharge)
└**2=Top of Frame** (Controls 0.00 cfs)

Pond DMH: PR-DMH



Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment DA: DA Runoff Area=1.800 ac 100.00% Impervious Runoff Depth=4.89"
Tc=5.0 min CN=98 Runoff=9.33 cfs 31,971 cf

Reach SW: Grassed Swale Avg. Flow Depth=0.35' Max Vel=3.74 fps Inflow=9.33 cfs 31,971 cf
n=0.030 L=205.0' S=0.0283 '/' Capacity=60.81 cfs Outflow=9.25 cfs 31,971 cf

Pond CB: EX-CB Peak Elev=263.04' Inflow=9.33 cfs 31,971 cf
Primary=9.33 cfs 31,971 cf Secondary=0.00 cfs 0 cf Outflow=9.33 cfs 31,971 cf

Pond DMH: PR-DMH Peak Elev=258.89' Inflow=9.33 cfs 31,971 cf
Primary=9.33 cfs 31,971 cf Secondary=0.00 cfs 0 cf Outflow=9.33 cfs 31,971 cf

Total Runoff Area = 78,408 sf Runoff Volume = 31,971 cf Average Runoff Depth = 4.89"
0.00% Pervious = 0 sf 100.00% Impervious = 78,408 sf

Summary for Subcatchment DA: DA

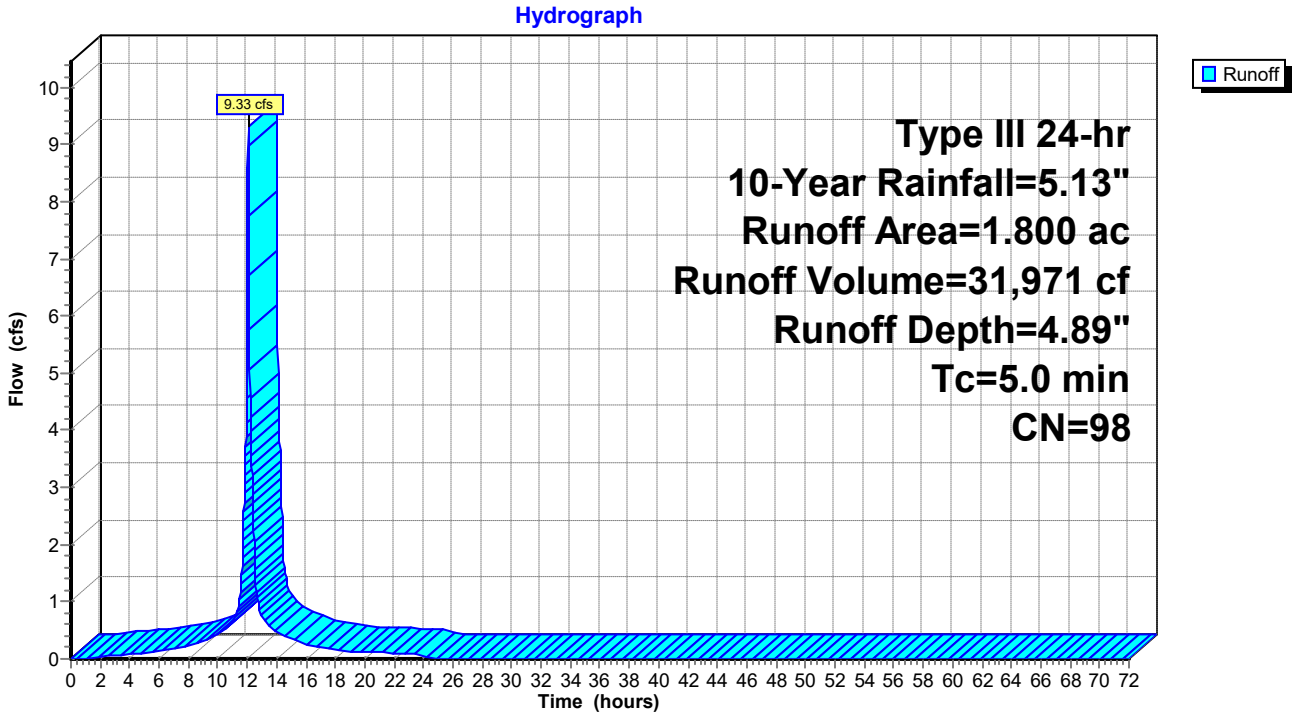
Runoff = 9.33 cfs @ 12.07 hrs, Volume= 31,971 cf, Depth= 4.89"
Routed to Pond CB : EX-CB

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-Year Rainfall=5.13"

Area (ac)	CN	Description
1.800	98	Paved parking, HSG B
1.800		100.00% Impervious Area

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

Subcatchment DA: DA



Summary for Reach SW: Grassed Swale

Inflow Area = 78,408 sf,100.00% Impervious, Inflow Depth = 4.89" for 10-Year event
Inflow = 9.33 cfs @ 12.07 hrs, Volume= 31,971 cf
Outflow = 9.25 cfs @ 12.08 hrs, Volume= 31,971 cf, Atten= 1%, Lag= 0.7 min

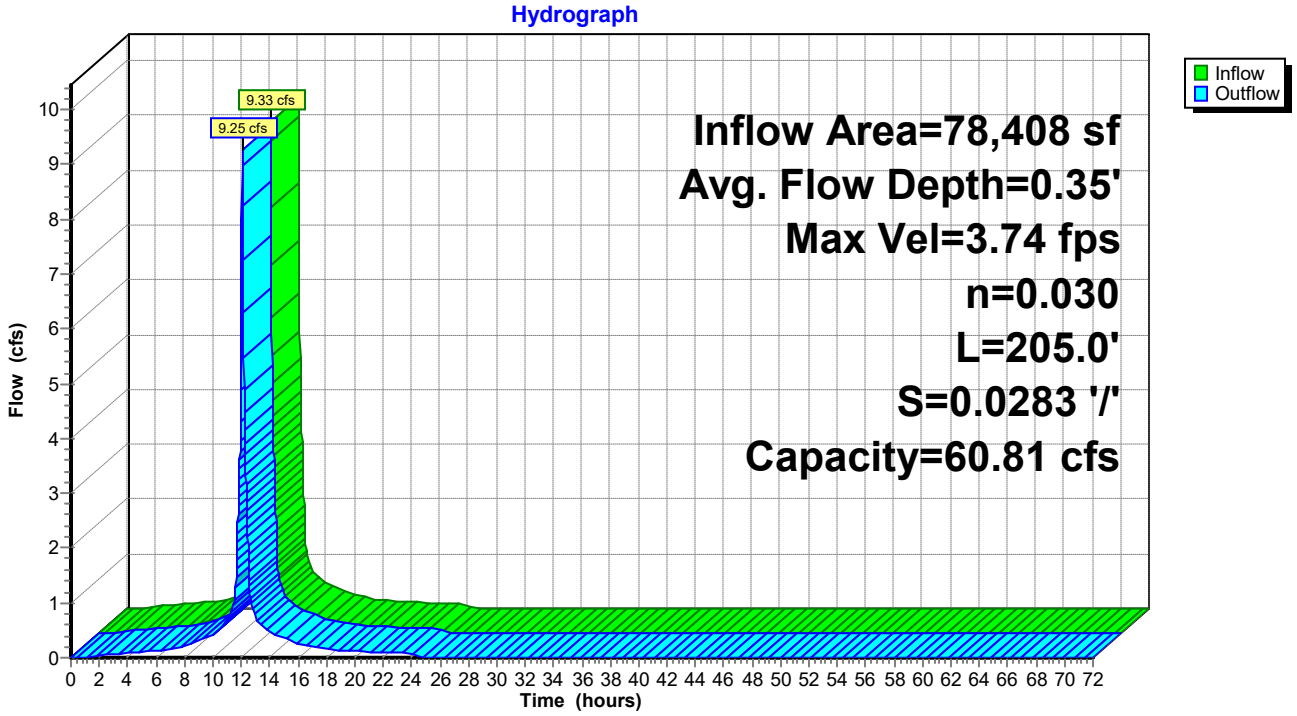
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 3.74 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 0.93 fps, Avg. Travel Time= 3.7 min

Peak Storage= 507 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.35' , Surface Width= 8.10'
Bank-Full Depth= 1.00' Flow Area= 9.0 sf, Capacity= 60.81 cfs

6.00' x 1.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 12.00'
Length= 205.0' Slope= 0.0283 '/'
Inlet Invert= 255.80', Outlet Invert= 250.00'

‡

Reach SW: Grassed Swale



Summary for Pond CB: EX-CB

[57] Hint: Peaked at 263.04' (Flood elevation advised)

Inflow Area = 78,408 sf,100.00% Impervious, Inflow Depth = 4.89" for 10-Year event
Inflow = 9.33 cfs @ 12.07 hrs, Volume= 31,971 cf
Outflow = 9.33 cfs @ 12.07 hrs, Volume= 31,971 cf, Atten= 0%, Lag= 0.0 min
Primary = 9.33 cfs @ 12.07 hrs, Volume= 31,971 cf
Routed to Pond DMH : PR-DMH
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

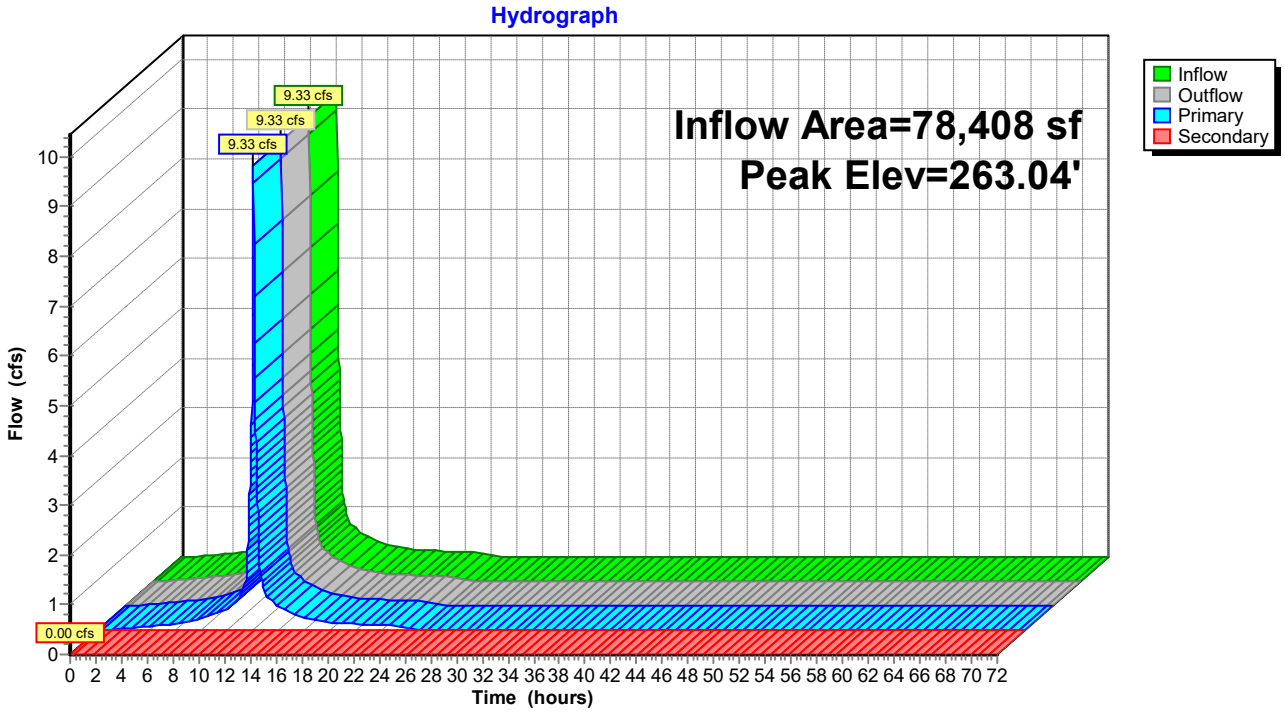
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 263.04' @ 12.07 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	261.65'	**24.0" Round 24" Outlet Pipe** L= 9.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 261.65' / 261.00' S= 0.0722 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Secondary	264.96'	**20.4" x 38.0" Horiz. Top of Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=9.26 cfs @ 12.07 hrs HW=263.03' TW=258.88' (Dynamic Tailwater)
└**1=24" Outlet Pipe** (Inlet Controls 9.26 cfs @ 4.00 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=261.65' (Free Discharge)
└**2=Top of Grate** (Controls 0.00 cfs)

Pond CB: EX-CB



Summary for Pond DMH: PR-DMH

[57] Hint: Peaked at 258.89' (Flood elevation advised)

Inflow Area = 78,408 sf,100.00% Impervious, Inflow Depth = 4.89" for 10-Year event
Inflow = 9.33 cfs @ 12.07 hrs, Volume= 31,971 cf
Outflow = 9.33 cfs @ 12.07 hrs, Volume= 31,971 cf, Atten= 0%, Lag= 0.0 min
Primary = 9.33 cfs @ 12.07 hrs, Volume= 31,971 cf
Routed to Reach SW : Grassed Swale
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

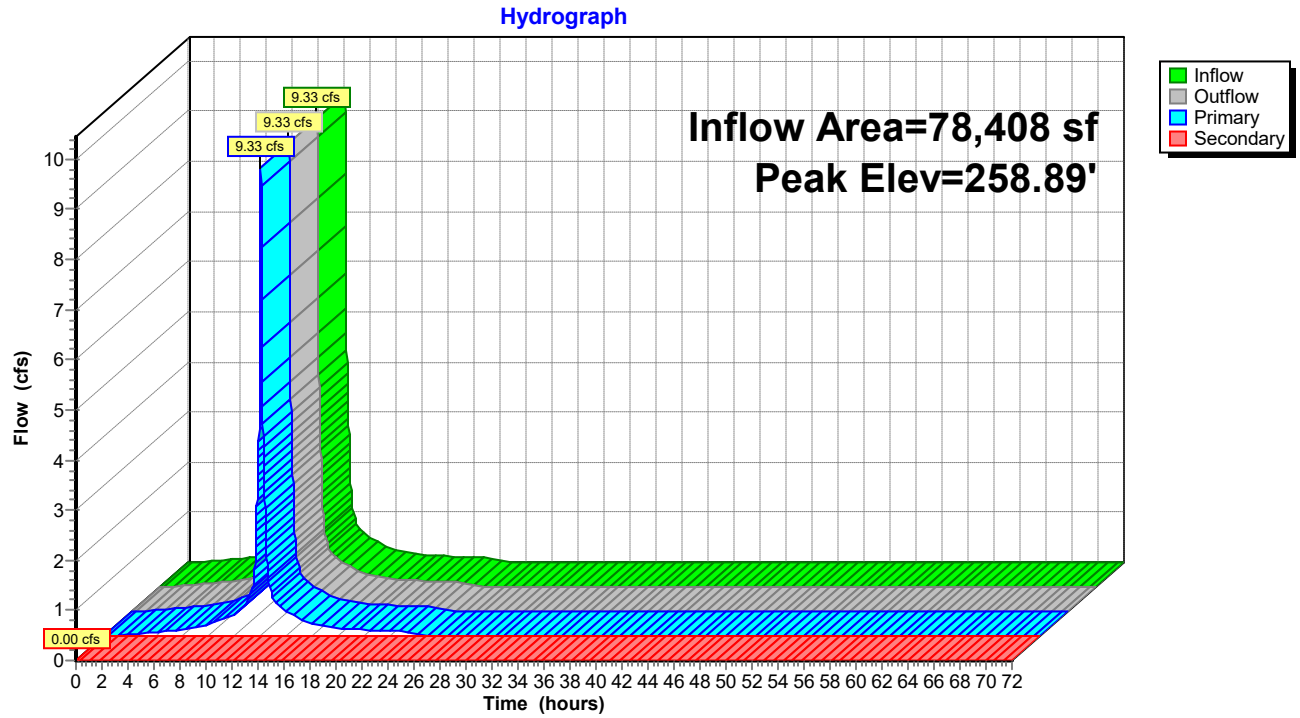
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 258.89' @ 12.07 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	257.50'	**24.0" Round 24" Outlet Pipe** L= 118.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 257.50' / 255.80' S= 0.0144 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Secondary	265.50'	**3.0" Horiz. Top of Frame** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=9.26 cfs @ 12.07 hrs HW=258.88' TW=256.15' (Dynamic Tailwater)
└**1=24" Outlet Pipe** (Inlet Controls 9.26 cfs @ 4.00 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=257.50' (Free Discharge)
└**2=Top of Frame** (Controls 0.00 cfs)

Pond DMH: PR-DMH



Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment DA: DA Runoff Area=1.800 ac 100.00% Impervious Runoff Depth=5.93"
Tc=5.0 min CN=98 Runoff=11.24 cfs 38,758 cf

Reach SW: Grassed Swale Avg. Flow Depth=0.39' Max Vel=3.98 fps Inflow=11.24 cfs 38,758 cf
n=0.030 L=205.0' S=0.0283 '/' Capacity=60.81 cfs Outflow=11.16 cfs 38,758 cf

Pond CB: EX-CB Peak Elev=263.22' Inflow=11.24 cfs 38,758 cf
Primary=11.24 cfs 38,758 cf Secondary=0.00 cfs 0 cf Outflow=11.24 cfs 38,758 cf

Pond DMH: PR-DMH Peak Elev=259.07' Inflow=11.24 cfs 38,758 cf
Primary=11.24 cfs 38,758 cf Secondary=0.00 cfs 0 cf Outflow=11.24 cfs 38,758 cf

Total Runoff Area = 78,408 sf Runoff Volume = 38,758 cf Average Runoff Depth = 5.93"
0.00% Pervious = 0 sf 100.00% Impervious = 78,408 sf

Summary for Subcatchment DA: DA

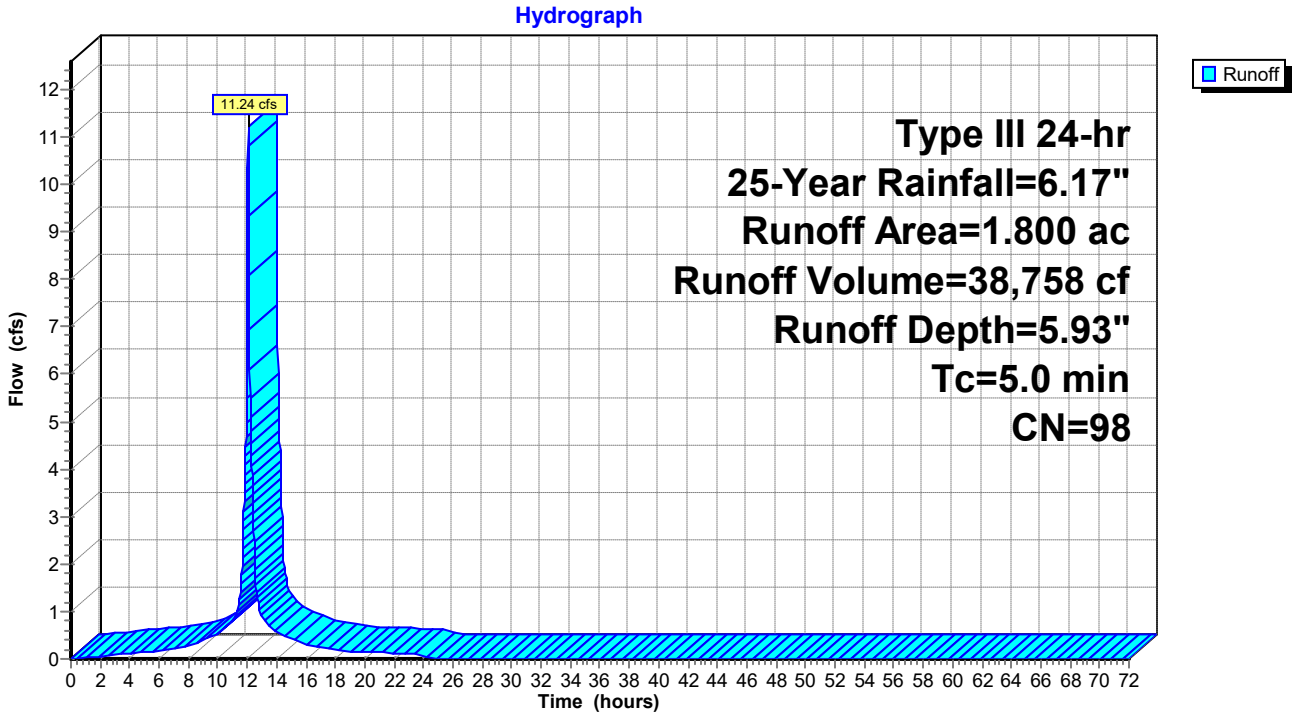
Runoff = 11.24 cfs @ 12.07 hrs, Volume= 38,758 cf, Depth= 5.93"
Routed to Pond CB : EX-CB

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-Year Rainfall=6.17"

Area (ac)	CN	Description
1.800	98	Paved parking, HSG B
1.800		100.00% Impervious Area

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

Subcatchment DA: DA



Summary for Reach SW: Grassed Swale

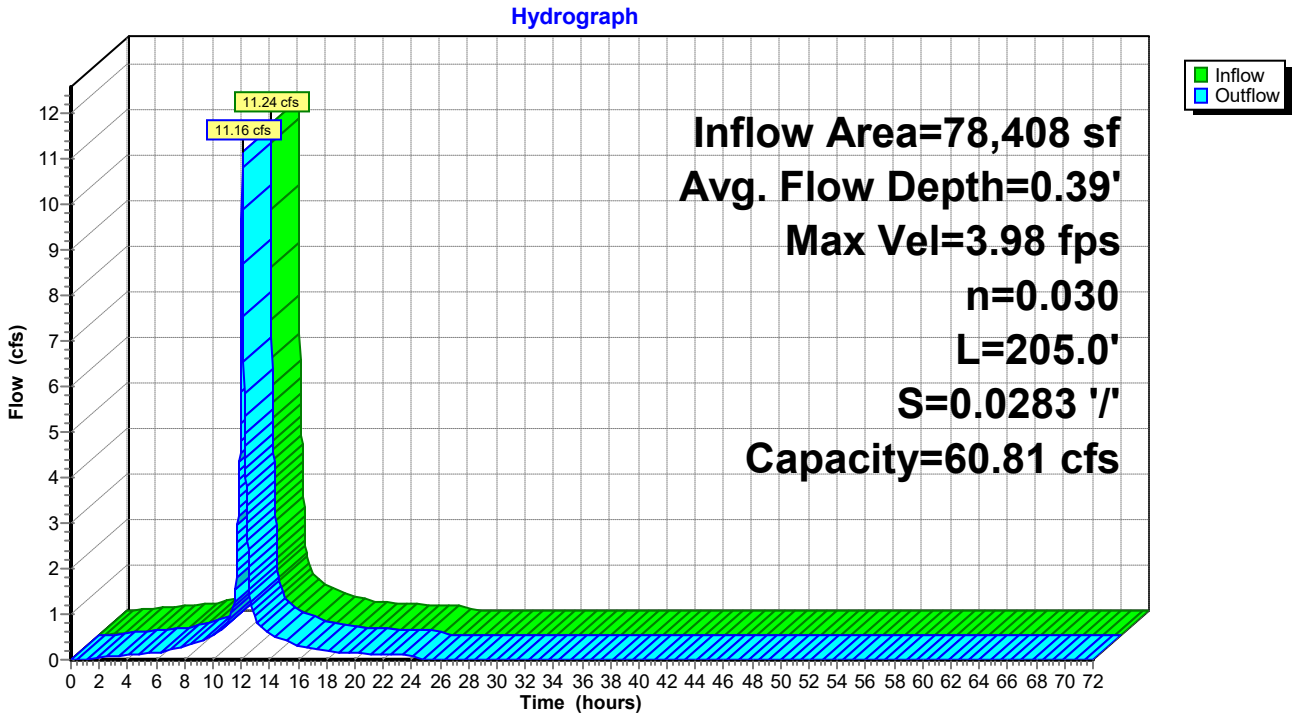
Inflow Area = 78,408 sf,100.00% Impervious, Inflow Depth = 5.93" for 25-Year event
Inflow = 11.24 cfs @ 12.07 hrs, Volume= 38,758 cf
Outflow = 11.16 cfs @ 12.08 hrs, Volume= 38,758 cf, Atten= 1%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 3.98 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.00 fps, Avg. Travel Time= 3.4 min

Peak Storage= 574 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.39' , Surface Width= 8.34'
Bank-Full Depth= 1.00' Flow Area= 9.0 sf, Capacity= 60.81 cfs

6.00' x 1.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 12.00'
Length= 205.0' Slope= 0.0283 '/'
Inlet Invert= 255.80', Outlet Invert= 250.00'

‡



Summary for Pond CB: EX-CB

[57] Hint: Peaked at 263.22' (Flood elevation advised)

Inflow Area = 78,408 sf,100.00% Impervious, Inflow Depth = 5.93" for 25-Year event
Inflow = 11.24 cfs @ 12.07 hrs, Volume= 38,758 cf
Outflow = 11.24 cfs @ 12.07 hrs, Volume= 38,758 cf, Atten= 0%, Lag= 0.0 min
Primary = 11.24 cfs @ 12.07 hrs, Volume= 38,758 cf
Routed to Pond DMH : PR-DMH
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

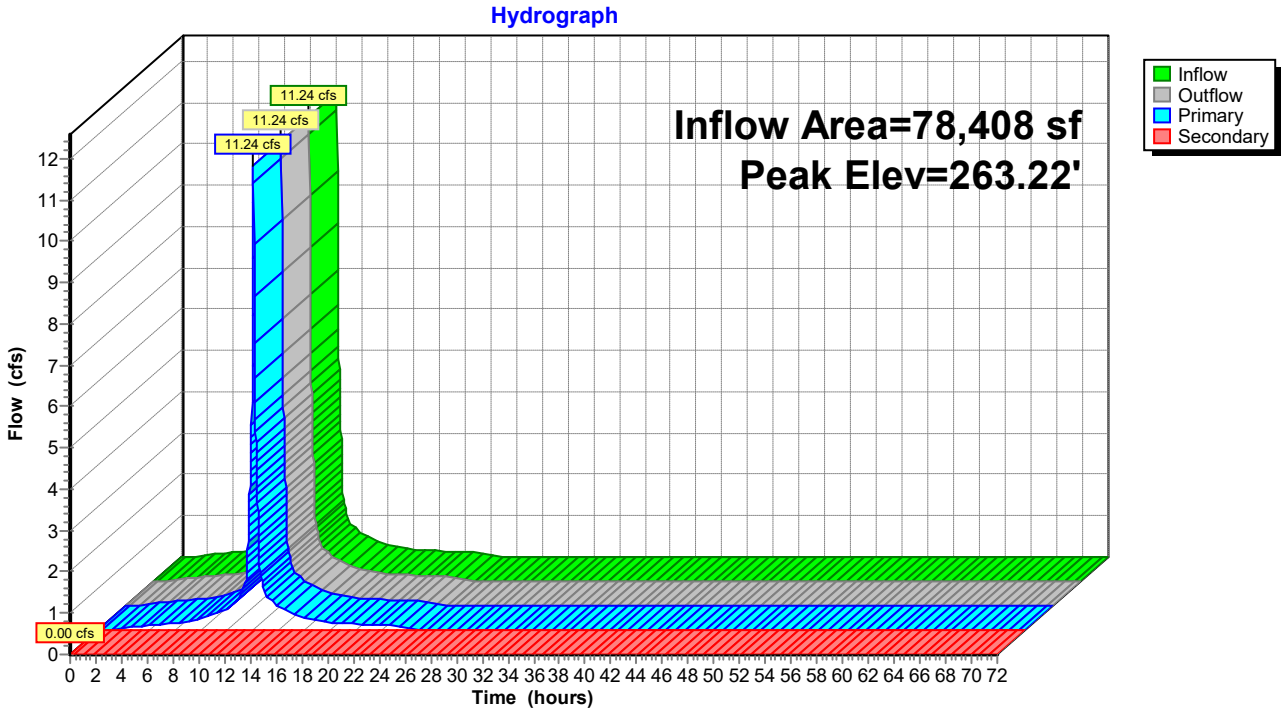
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 263.22' @ 12.07 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	261.65'	**24.0" Round 24" Outlet Pipe** L= 9.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 261.65' / 261.00' S= 0.0722 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Secondary	264.96'	**20.4" x 38.0" Horiz. Top of Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=11.15 cfs @ 12.07 hrs HW=263.21' TW=259.06' (Dynamic Tailwater)
└**1=24" Outlet Pipe** (Inlet Controls 11.15 cfs @ 4.25 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=261.65' (Free Discharge)
└**2=Top of Grate** (Controls 0.00 cfs)

Pond CB: EX-CB



Summary for Pond DMH: PR-DMH

[57] Hint: Peaked at 259.07' (Flood elevation advised)

Inflow Area = 78,408 sf,100.00% Impervious, Inflow Depth = 5.93" for 25-Year event
Inflow = 11.24 cfs @ 12.07 hrs, Volume= 38,758 cf
Outflow = 11.24 cfs @ 12.07 hrs, Volume= 38,758 cf, Atten= 0%, Lag= 0.0 min
Primary = 11.24 cfs @ 12.07 hrs, Volume= 38,758 cf
Routed to Reach SW : Grassed Swale
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

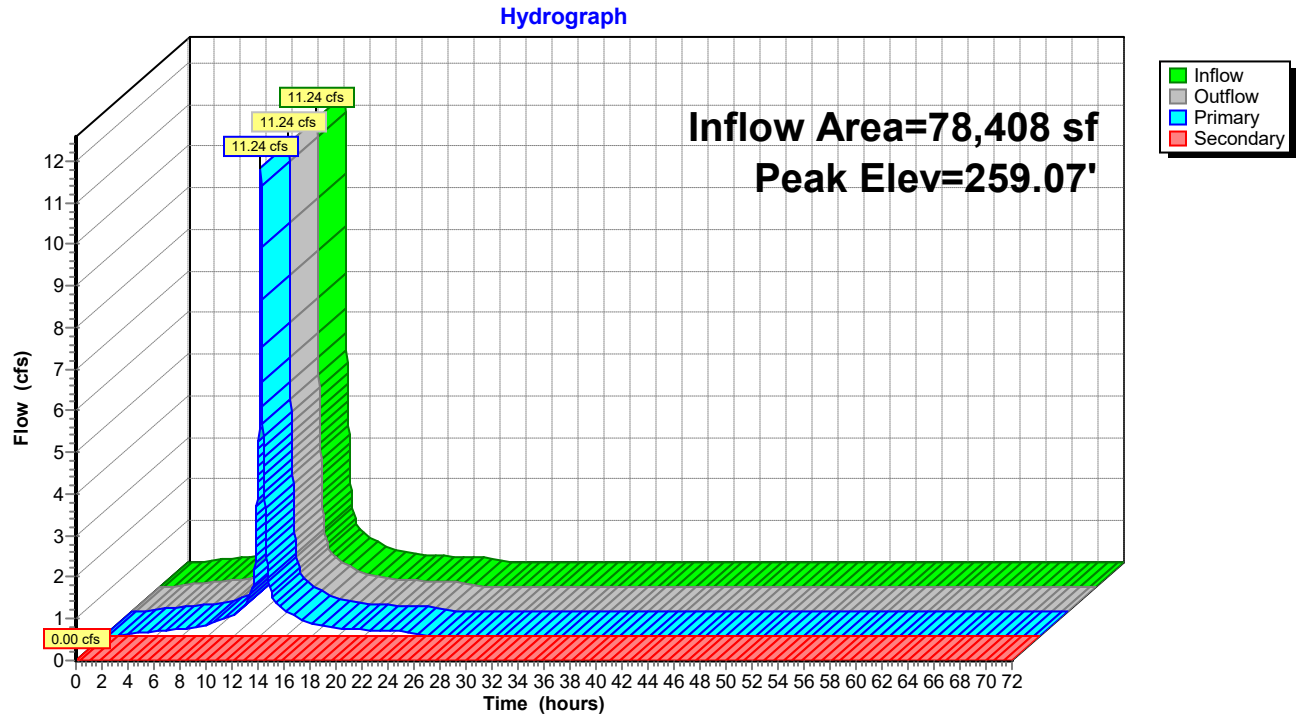
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 259.07' @ 12.07 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	257.50'	**24.0" Round 24" Outlet Pipe** L= 118.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 257.50' / 255.80' S= 0.0144 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Secondary	265.50'	**3.0" Horiz. Top of Frame** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=11.15 cfs @ 12.07 hrs HW=259.06' TW=256.19' (Dynamic Tailwater)
└**1=24" Outlet Pipe** (Inlet Controls 11.15 cfs @ 4.25 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=257.50' (Free Discharge)
└**2=Top of Frame** (Controls 0.00 cfs)

Pond DMH: PR-DMH



Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment DA: DA Runoff Area=1.800 ac 100.00% Impervious Runoff Depth=7.54"
Tc=5.0 min CN=98 Runoff=14.19 cfs 49,269 cf

Reach SW: Grassed Swale Avg. Flow Depth=0.45' Max Vel=4.30 fps Inflow=14.19 cfs 49,269 cf
n=0.030 L=205.0' S=0.0283 '/' Capacity=60.81 cfs Outflow=14.11 cfs 49,269 cf

Pond CB: EX-CB Peak Elev=263.52' Inflow=14.19 cfs 49,269 cf
Primary=14.19 cfs 49,269 cf Secondary=0.00 cfs 0 cf Outflow=14.19 cfs 49,269 cf

Pond DMH: PR-DMH Peak Elev=259.37' Inflow=14.19 cfs 49,269 cf
Primary=14.19 cfs 49,269 cf Secondary=0.00 cfs 0 cf Outflow=14.19 cfs 49,269 cf

Total Runoff Area = 78,408 sf Runoff Volume = 49,269 cf Average Runoff Depth = 7.54"
0.00% Pervious = 0 sf 100.00% Impervious = 78,408 sf

Summary for Subcatchment DA: DA

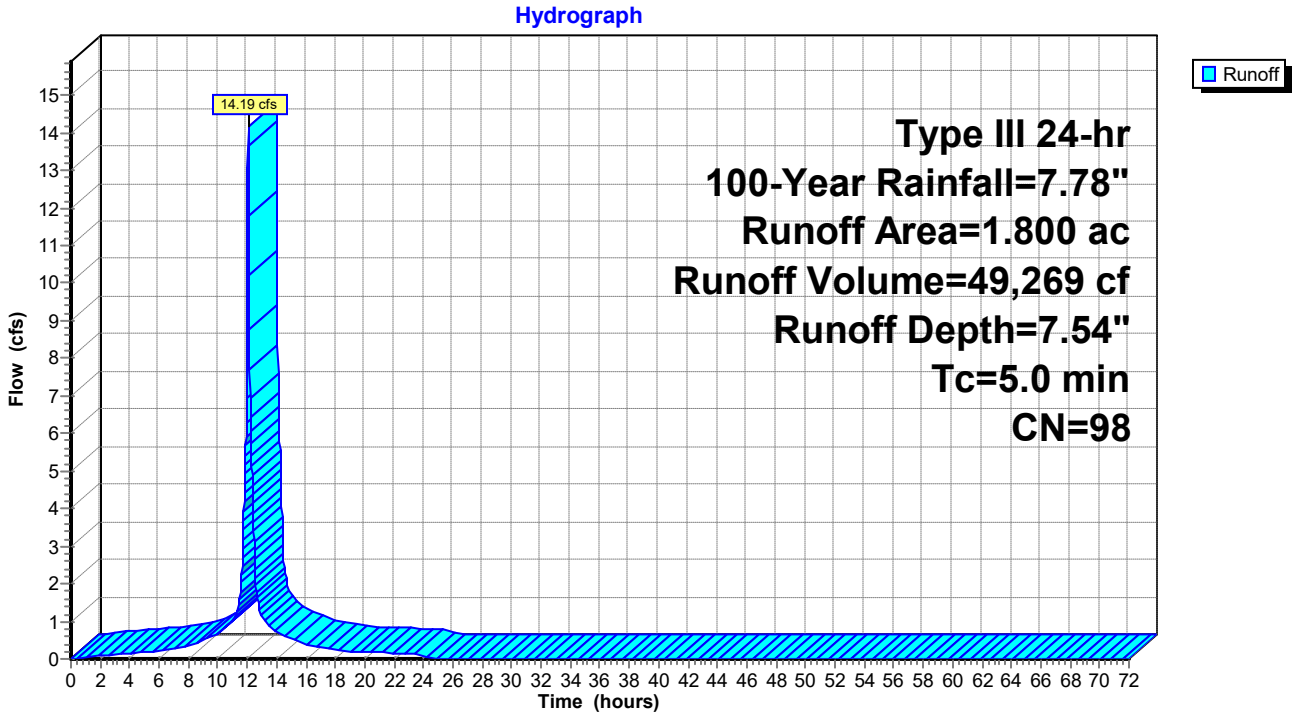
Runoff = 14.19 cfs @ 12.07 hrs, Volume= 49,269 cf, Depth= 7.54"
Routed to Pond CB : EX-CB

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Year Rainfall=7.78"

Area (ac)	CN	Description
1.800	98	Paved parking, HSG B
1.800		100.00% Impervious Area

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

Subcatchment DA: DA



Summary for Reach SW: Grassed Swale

Inflow Area = 78,408 sf,100.00% Impervious, Inflow Depth = 7.54" for 100-Year event
Inflow = 14.19 cfs @ 12.07 hrs, Volume= 49,269 cf
Outflow = 14.11 cfs @ 12.08 hrs, Volume= 49,269 cf, Atten= 1%, Lag= 0.6 min

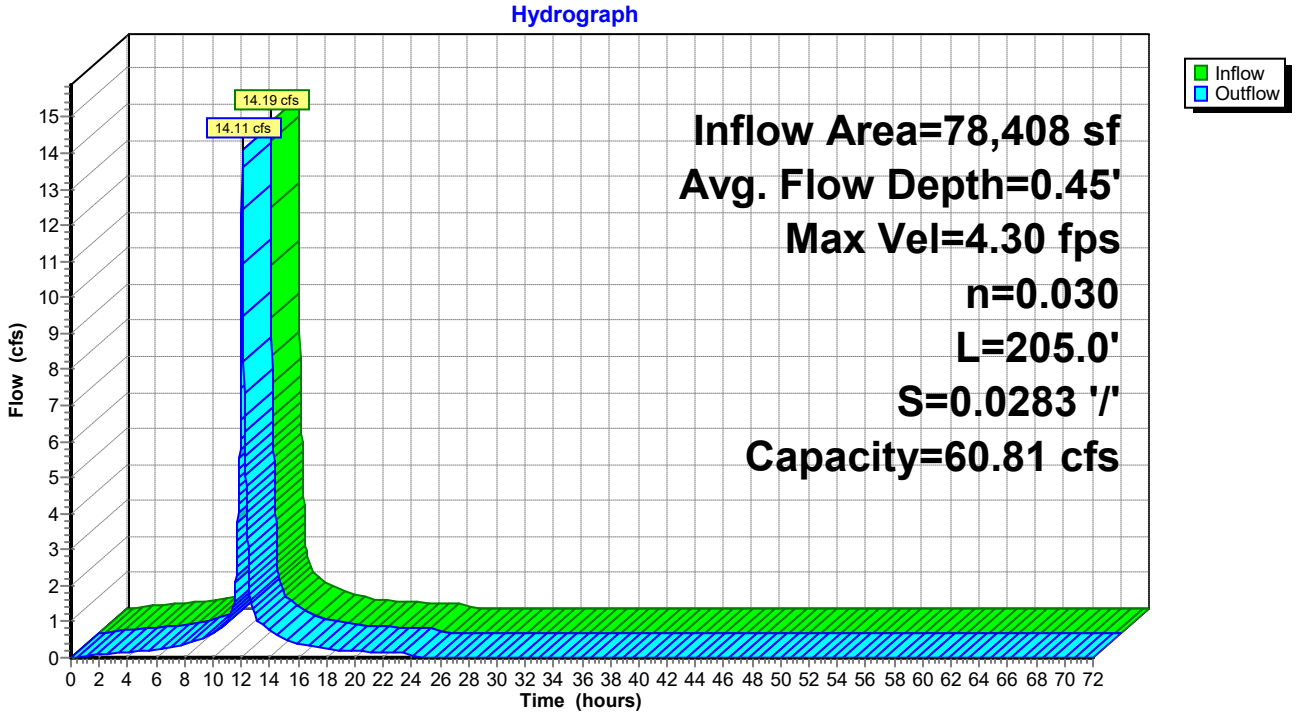
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 4.30 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.10 fps, Avg. Travel Time= 3.1 min

Peak Storage= 672 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.45' , Surface Width= 8.68'
Bank-Full Depth= 1.00' Flow Area= 9.0 sf, Capacity= 60.81 cfs

6.00' x 1.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 12.00'
Length= 205.0' Slope= 0.0283 '/'
Inlet Invert= 255.80', Outlet Invert= 250.00'

‡

Reach SW: Grassed Swale



Summary for Pond CB: EX-CB

[57] Hint: Peaked at 263.52' (Flood elevation advised)

Inflow Area = 78,408 sf,100.00% Impervious, Inflow Depth = 7.54" for 100-Year event
Inflow = 14.19 cfs @ 12.07 hrs, Volume= 49,269 cf
Outflow = 14.19 cfs @ 12.07 hrs, Volume= 49,269 cf, Atten= 0%, Lag= 0.0 min
Primary = 14.19 cfs @ 12.07 hrs, Volume= 49,269 cf
Routed to Pond DMH : PR-DMH
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

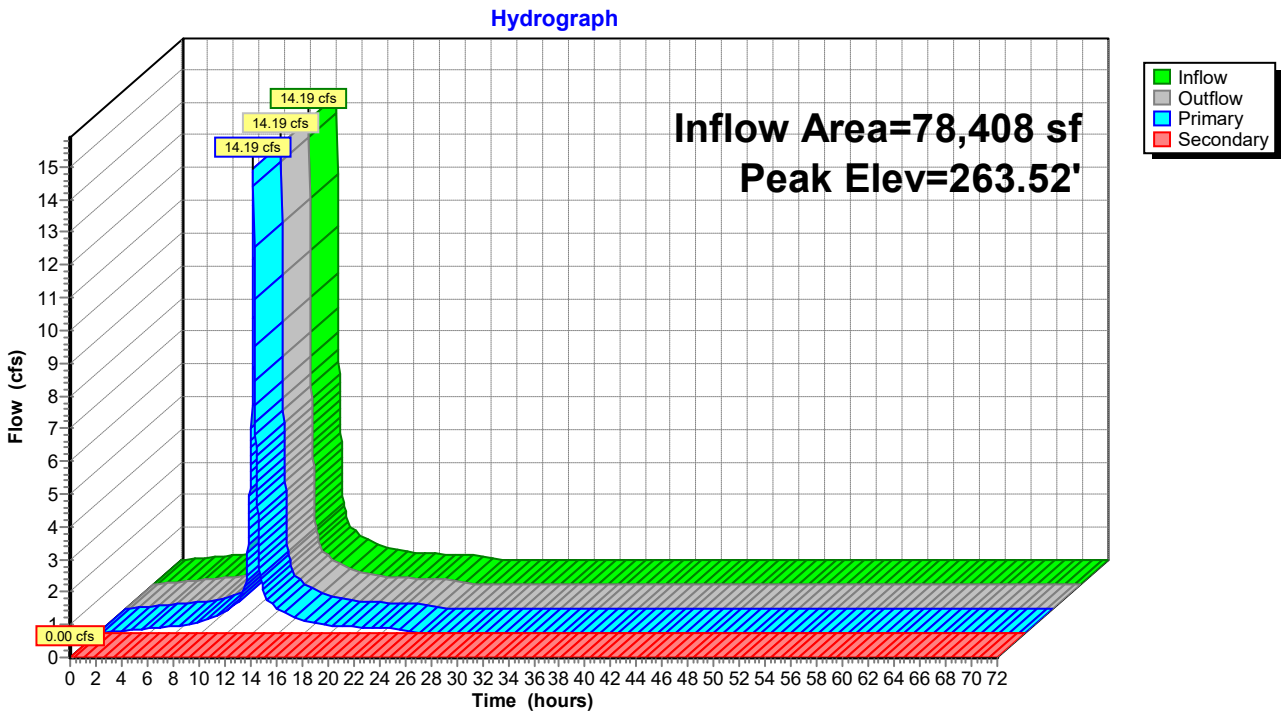
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 263.52' @ 12.07 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	261.65'	**24.0" Round 24" Outlet Pipe** L= 9.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 261.65' / 261.00' S= 0.0722 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Secondary	264.96'	**20.4" x 38.0" Horiz. Top of Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=14.08 cfs @ 12.07 hrs HW=263.50' TW=259.35' (Dynamic Tailwater)
└**1=24" Outlet Pipe** (Inlet Controls 14.08 cfs @ 4.64 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=261.65' (Free Discharge)
└**2=Top of Grate** (Controls 0.00 cfs)

Pond CB: EX-CB



Summary for Pond DMH: PR-DMH

[57] Hint: Peaked at 259.37' (Flood elevation advised)

Inflow Area = 78,408 sf,100.00% Impervious, Inflow Depth = 7.54" for 100-Year event
Inflow = 14.19 cfs @ 12.07 hrs, Volume= 49,269 cf
Outflow = 14.19 cfs @ 12.07 hrs, Volume= 49,269 cf, Atten= 0%, Lag= 0.0 min
Primary = 14.19 cfs @ 12.07 hrs, Volume= 49,269 cf
Routed to Reach SW : Grassed Swale
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

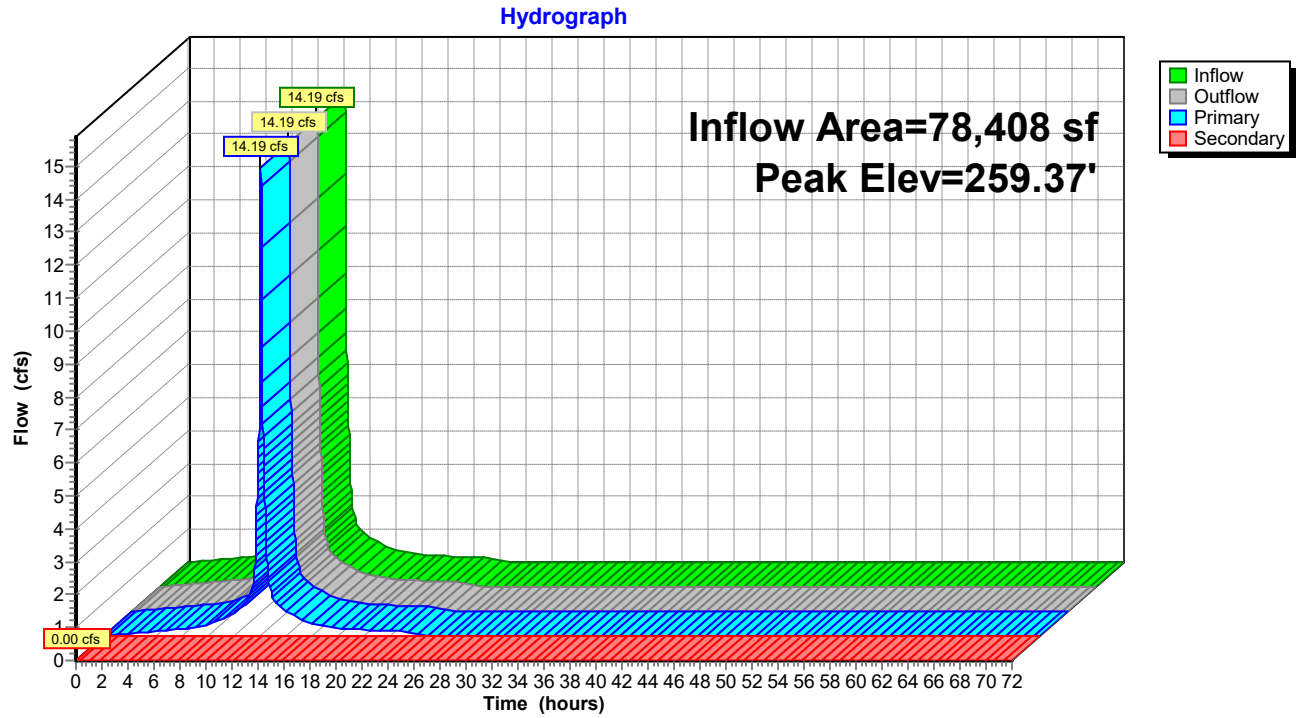
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Peak Elev= 259.37' @ 12.07 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	257.50'	**24.0" Round 24" Outlet Pipe** L= 118.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 257.50' / 255.80' S= 0.0144 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Secondary	265.50'	**3.0" Horiz. Top of Frame** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=14.08 cfs @ 12.07 hrs HW=259.35' TW=256.24' (Dynamic Tailwater)
└**1=24" Outlet Pipe** (Inlet Controls 14.08 cfs @ 4.64 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=257.50' (Free Discharge)
└**2=Top of Frame** (Controls 0.00 cfs)

Pond DMH: PR-DMH



Attachment B –
Pipe Flow Velocity Calculations

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Inputs:

Pipe Diameter, d_o	24.0000	in
Manning Roughness, n	0.0130	
Pressure slope (possibly equal to pipe slope), S_o	1.4400	% slope
Percent of (or ratio to) full depth (100% or 1 if flowing full)	0.5134	fraction

Results:

Flow, Q	14.1923	ft^3/s
Velocity, v	8.7370	ft/s
Velocity head, hv	1.1864	ft
Flow Area, A	1.6244	ft^2
Wetted Perimeter, P	3.1952	ft
Hydraulic Radius	0.5084	ft
Top Width, T	1.9993	ft
Froude Number, F	1.71	
Shear Stress (tractive force), τ	0.9230	psf

Version 2.0 (20 June 2017)

HawsEDC Calculators

Attachment C –
Riprap Apron Sizing Calculations

Outlet Protection Design Outlet FES-1

Reference: Connecticut Department of Transportation Drainage Manual, Dated October 2000

A. Apron width at culvert end (W_1) = 3 Sp where Sp = outlet pipe diameter

B. Apron length (La) = $\frac{1.8\ (Q-5)}{(Sp)^{3/2}}$ + 10

C. Apron width at downstream end (W) = 3Sp + 0.7La where La = apron length

Type A Riprap Apron (Tailwater Condition) : TW<0.5 dia of outlet

Peak Q (25-yr) = 14.19 cfs PIPE DIA= 2 ft

A. W_1= 3(Sp) = ft 6 ft

B. La = $\frac{1.8\ (Q-5)}{(Sp)^{1.5}}$ + 10 = ft 16 ft

C. W_2 = 3(Sp) + 0.7(La) = ft 18 ft

Table 11.11 Allowable Outlet Velocities for Type A and B Riprap Aprons

Outlet Velocity - mps (fps)	Riprap Specification
0-2.44 (0-8)	Modified
2.44-3.05 (8-10)	Intermediate
3.05-4.27 (10-14)	Standard

V(25yr)= 8.74 fps Therfore; Use Intermediate Riprap