



**Humber  
Design  
Group, Inc.**

August 8, 2024

**Subject: Salem Apartments Land Use Stormwater Management Memo**

This memo serves as the documentation for the stormwater report required as part of land use submittal requirements for the Salem Apartments new development located at 891 23<sup>rd</sup> St NE Salem, OR.

Per the City of Salem Department of Public Works Administrative Rules Chapter 109 Division 004 Section 4.2(a)(3) this project qualifies as a "large project" (greater than 10,000 sf of new or replaced impervious surface).

Per the City of Salem Stormwater Design Handbook for Developers and Large Projects Section 5, to meet the Green Stormwater Infrastructure (GSI) to the Maximum Extent Feasible (MFE), the site has been delineated into (2) stormwater drainage basins. These basins can be found in the attached catchment map.

The Basin 1 GSI facility has been sized using the engineered method (see attached HydroCAD model) to meet Salem water quality and flow control requirements. The facility will send overflow from large storm events to the existing stormwater-only sewer mains located in 23<sup>rd</sup> St NE and Center Street NE.

Due to existing topography constraints, basin 2 is unable to be treated with a GSI facility. This basin will be treated with a proprietary filter cartridge catch basin for water quality. Basin 1 flow controls have been sized to account for the Basin 2 area that is unable to be managed for water quantity. The total percentage of impervious area being treated by GSI facilities is greater than 80% which meets Salem's Public Works Design Standards for the MFE.

Sincerely,

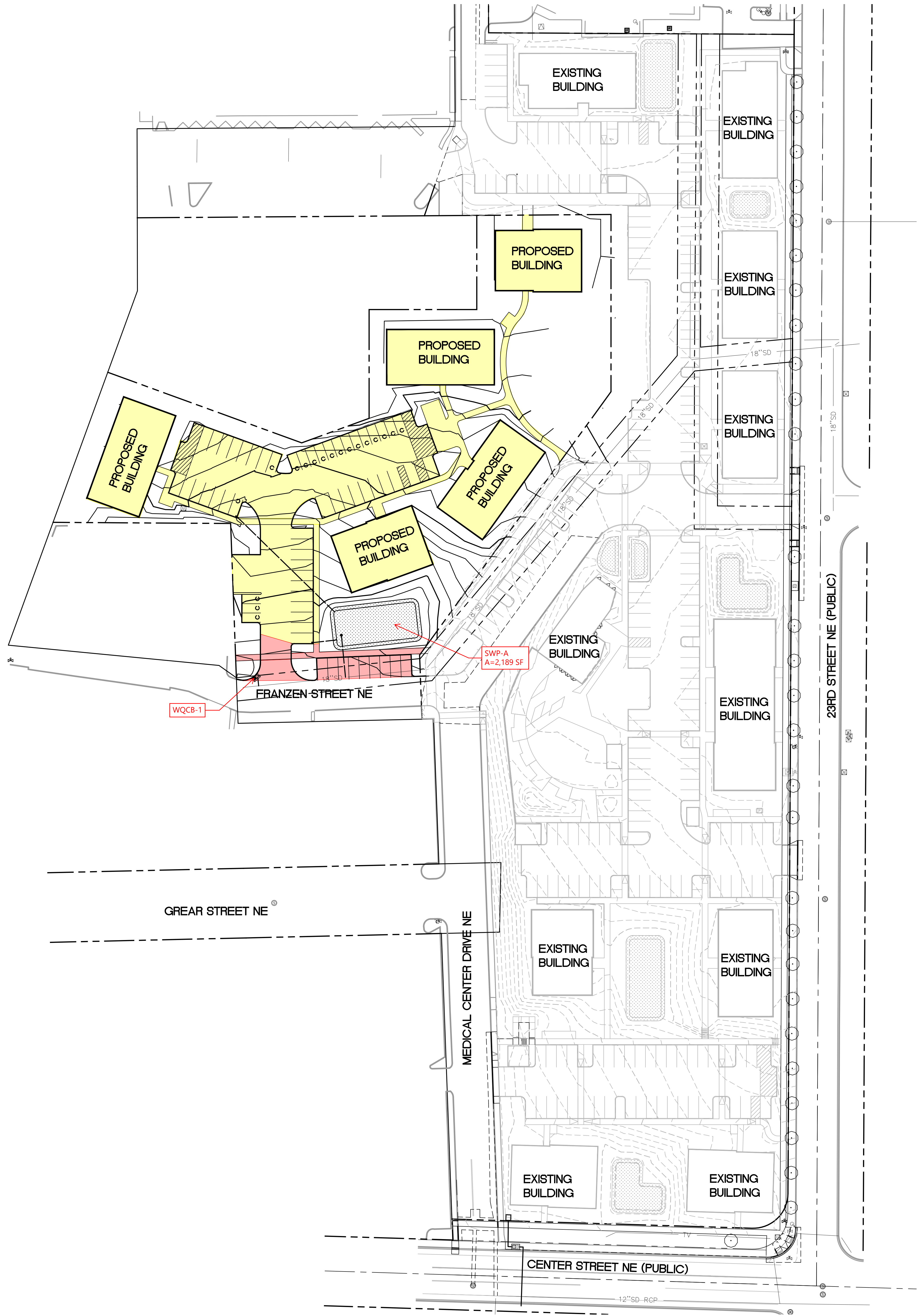
**Humber Design Group, Inc.**

Kristian McCombs, PE

Attachments:

Catchment Map  
HydroCAD Report

SALEM APARTMENTS LAND USE CATCHMENT MAP - PHASE 2



BASIN-1 AREA = 44,688 SF

*BASIN-1 STORMWATER PLANTERS*

SWP-A AREA = 2,189 SF



BASIN-2 AREA = 3,443 SF

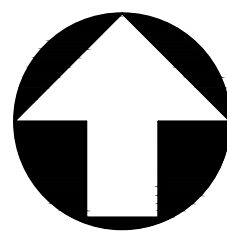
EXISTING SITE SLOPES DO NOT ALLOW FOR THE USE OF A GSI POND FOR THIS BASIN. STORMWATER WILL BE MANAGED THROUGH THE USE OF A MANUFACTURED FILTER CATCH BASIN (WQCB-1)

TOTAL RATIO OF SITE IMPERVIOUS AREA MANAGED THROUGH THE USE OF GSI PONDS:

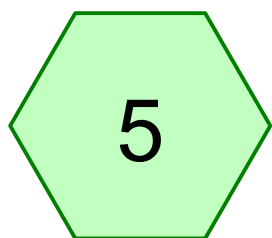
SITE IMPERVIOUS AREA = 48,131 SF  
IMPERVIOUS AREA NOT MANAGED BY GSI POND (BASIN 2)=3,443 SF

$3,443/48,131 = 7.2\%$

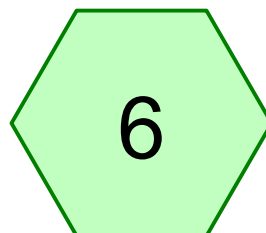
THEREFORE 92.8% OF THE SITE IS MANAGED THROUGH THE USE OF GSI PONDS



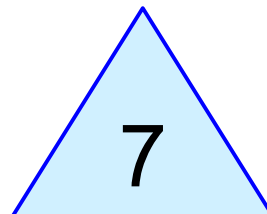
GRAPHIC SCALE  
0 40 80  
1 inch = 40 ft.



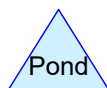
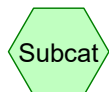
Basin A Pre



Basin A Post - WQ Only



LIDA Planter (Soil Media  
WQ)



**Routing Diagram for HydroCAD Phase 2**

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## HydroCAD Phase 2

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Type IA 24-hr WQ Rainfall=1.38"

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### Summary for Subcatchment 5: Basin A Pre

Runoff = 0.015 cfs @ 16.73 hrs, Volume= 0.019 af, Depth= 0.21"

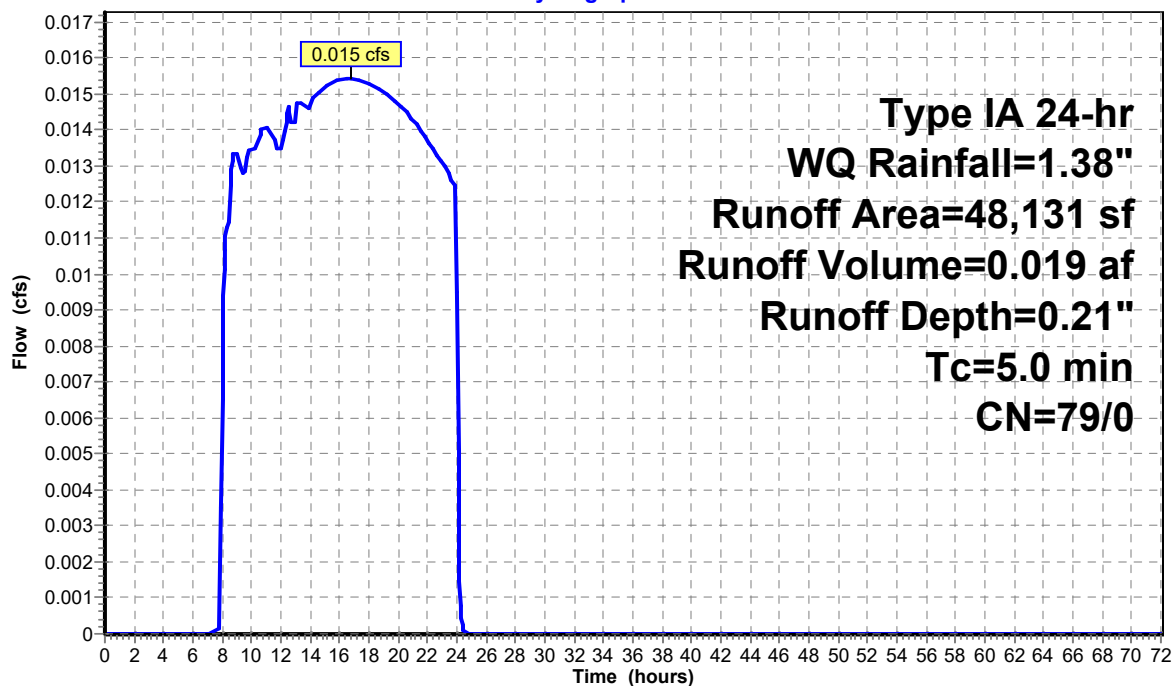
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
Type IA 24-hr WQ Rainfall=1.38"

Area (sf)	CN	Description
48,131	79	<50% Grass cover, Poor, HSG B
48,131	79	100.00% Pervious Area

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

### Subcatchment 5: Basin A Pre

Hydrograph



## HydroCAD Phase 2

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Type IA 24-hr WQ Rainfall=1.38"

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### Summary for Pond 7: LIDA Planter (Soil Media WQ)

Inflow Area = 1.105 ac, 100.00% Impervious, Inflow Depth = 1.16" for WQ event  
Inflow = 0.331 cfs @ 7.91 hrs, Volume= 0.107 af  
Outflow = 0.108 cfs @ 8.97 hrs, Volume= 0.107 af, Atten= 67%, Lag= 63.4 min  
Primary = 0.108 cfs @ 8.97 hrs, Volume= 0.107 af  
Secondary = 0.000 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Peak Elev= 100.24' @ 8.97 hrs Surf.Area= 2,337 sf Storage= 537 cf

Plug-Flow detention time= 25.4 min calculated for 0.107 af (100% of inflow)

Center-of-Mass det. time= 25.4 min ( 722.6 - 697.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	2,500 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
100.00	2,189	0	0
101.00	2,811	2,500	2,500

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	<b>2.000 in/hr Exfiltration over Surface area</b>
#2	Secondary	100.83'	<b>10.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=0.108 cfs @ 8.97 hrs HW=100.24' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.108 cfs)

**Secondary OutFlow** Max=0.000 cfs @ 0.00 hrs HW=100.00' (Free Discharge)

↑**2=Orifice/Grate** ( Controls 0.000 cfs)



## HydroCAD Phase 2

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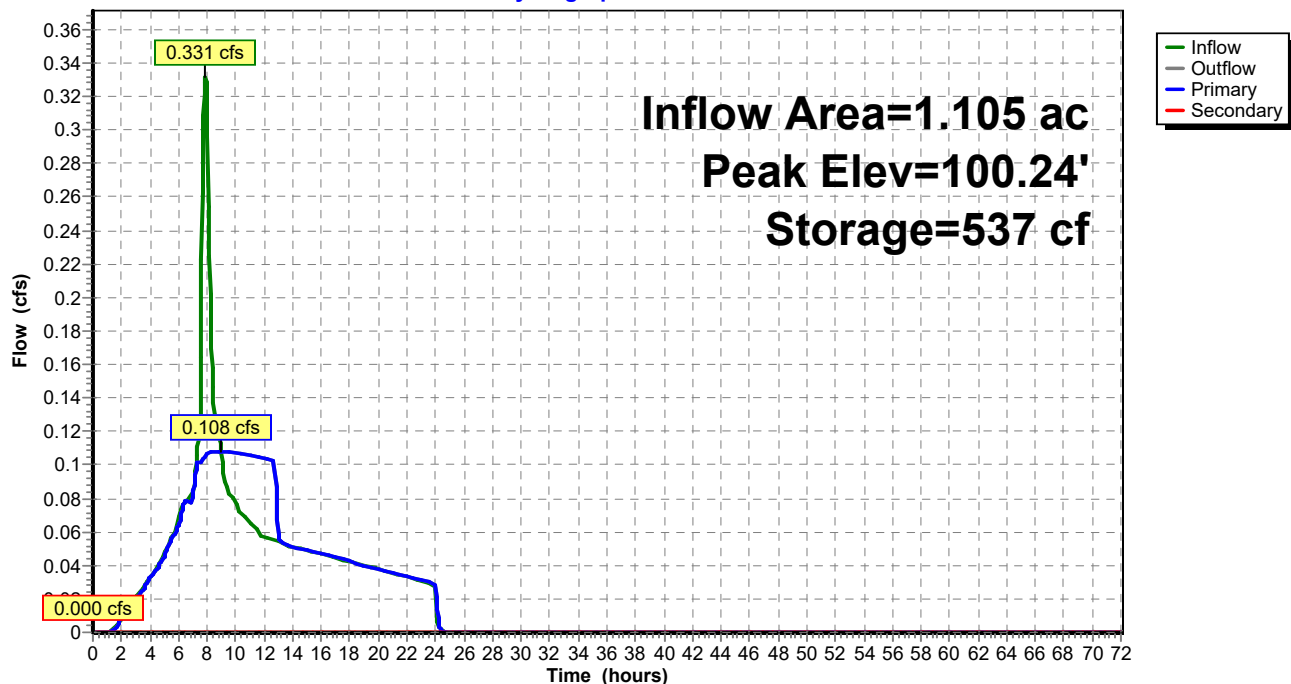
Type IA 24-hr WQ Rainfall=1.38"

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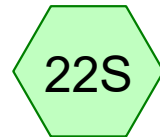
### Pond 7: LIDA Planter (Soil Media WQ)

Hydrograph





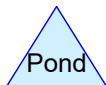
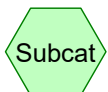
Basin A Pre



Basin A Post - Detention



LIDA Planter (Detention)



**Routing Diagram for HydroCAD Phase 2**

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## HydroCAD Phase 2

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Type IA 24-hr 2 yr Rainfall=2.20"

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### Summary for Subcatchment 5: Basin A Pre

Runoff = 0.123 cfs @ 8.00 hrs, Volume= 0.059 af, Depth= 0.64"

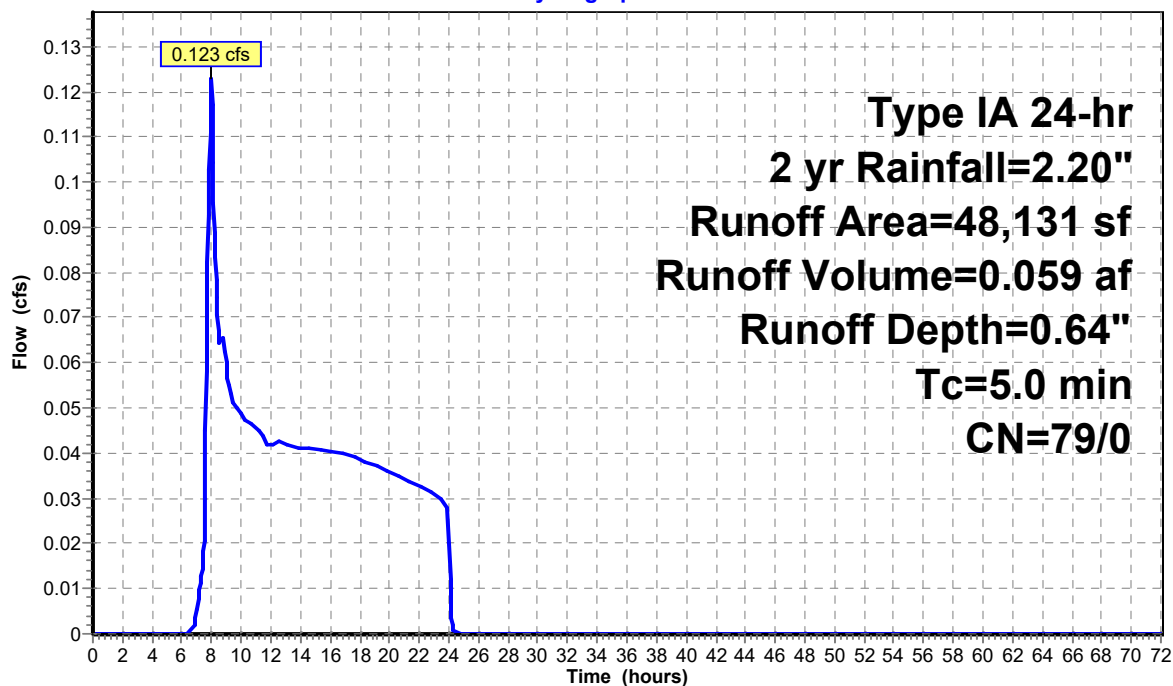
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
Type IA 24-hr 2 yr Rainfall=2.20"

Area (sf)	CN	Description
48,131	79	<50% Grass cover, Poor, HSG B
48,131	79	100.00% Pervious Area

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

### Subcatchment 5: Basin A Pre

Hydrograph





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Type IA 24-hr 2 yr Rainfall=2.20"

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**Summary for Pond 24P: LIDA Planter (Detention)**

Inflow Area = 1.105 ac, 100.00% Impervious, Inflow Depth = 1.97" for 2 yr event  
 Inflow = 0.556 cfs @ 7.90 hrs, Volume= 0.182 af  
 Outflow = 0.058 cfs @ 20.84 hrs, Volume= 0.182 af, Atten= 90%, Lag= 776.2 min  
 Primary = 0.058 cfs @ 20.84 hrs, Volume= 0.182 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
 Peak Elev= 100.80' @ 20.84 hrs Surf.Area= 2,690 sf Storage= 4,153 cf

Plug-Flow detention time= 857.0 min calculated for 0.182 af (100% of inflow)  
 Center-of-Mass det. time= 857.9 min ( 1,536.0 - 678.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	97.50'	4,689 cf	<b>Pond A (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
97.50	2,189	0.0	0	0
100.00	2,189	40.0	2,189	2,189
101.00	2,811	100.0	2,500	4,689

Device	Routing	Invert	Outlet Devices
#1	Primary	97.50'	<b>1.1" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#2	Primary	100.83'	<b>10.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=0.058 cfs @ 20.84 hrs HW=100.80' (Free Discharge)

1=Orifice/Grate (Orifice Controls 0.058 cfs @ 8.75 fps)

2=Orifice/Grate ( Controls 0.000 cfs)

## HydroCAD Phase 2

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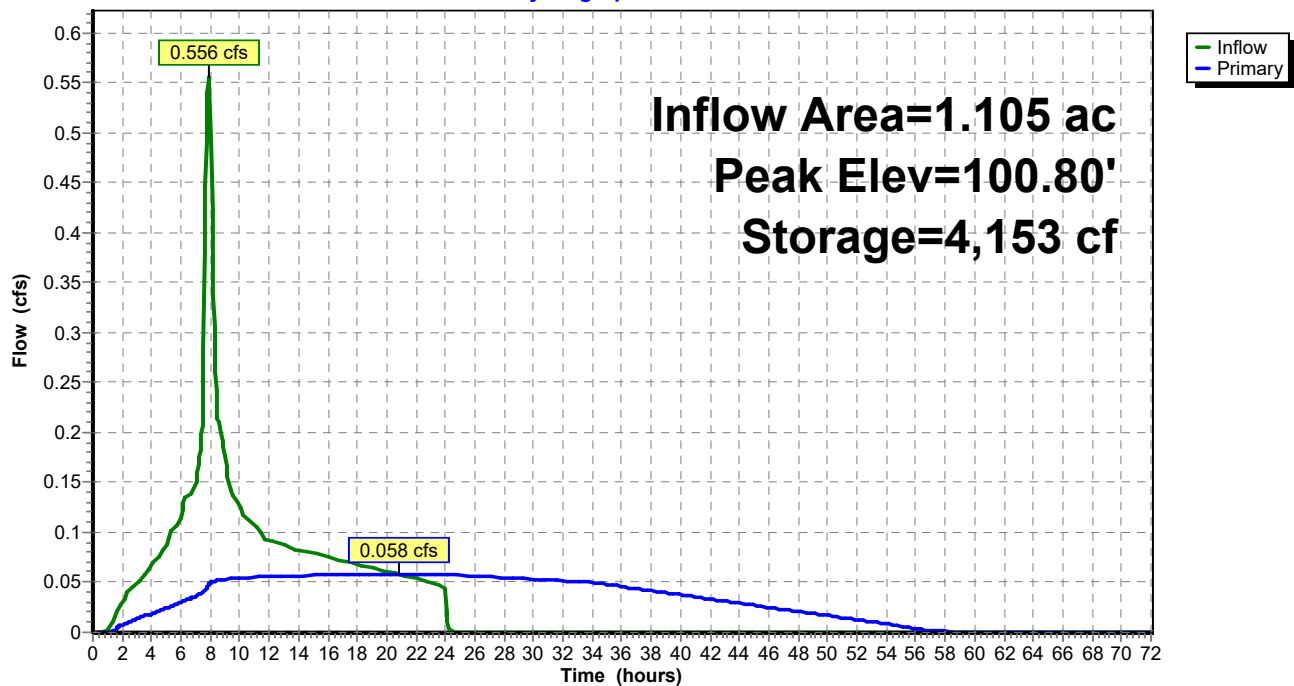
Type IA 24-hr 2 yr Rainfall=2.20"

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### Pond 24P: LIDA Planter (Detention)

Hydrograph



## HydroCAD Phase 2

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Type IA 24-hr 10 yr Rainfall=3.20"

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### Summary for Subcatchment 5: Basin A Pre

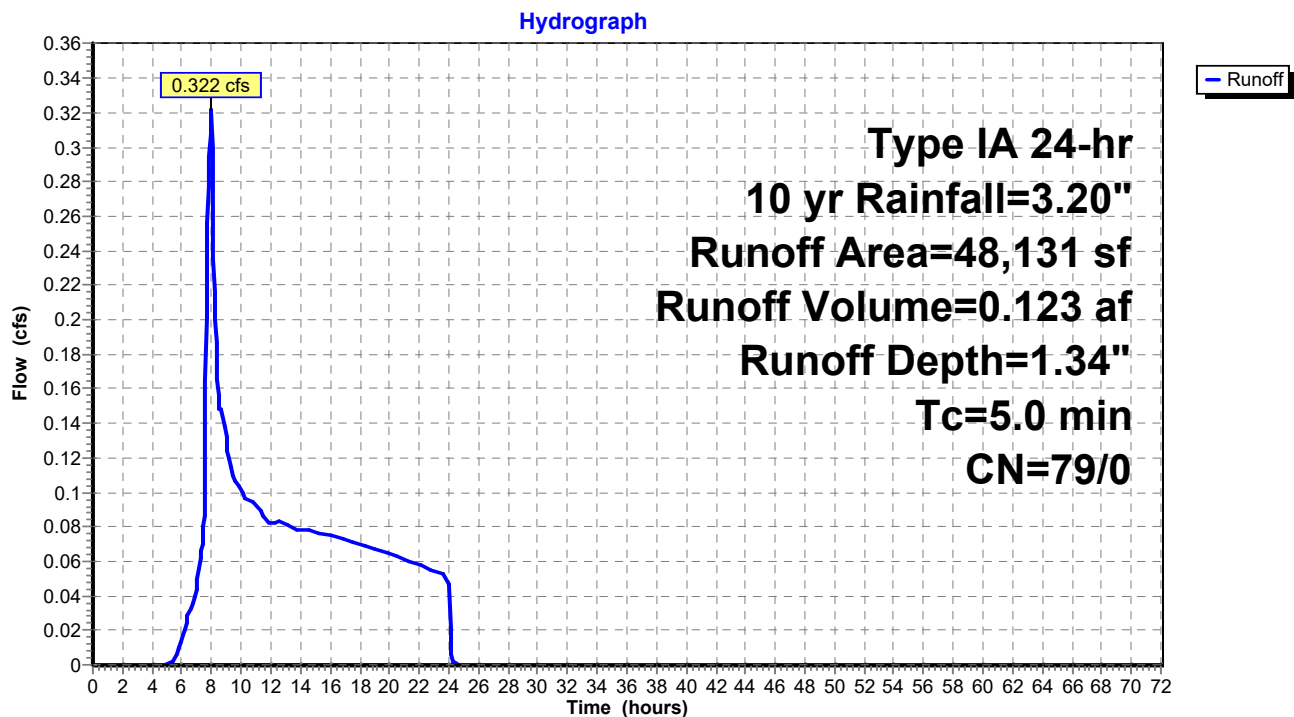
Runoff = 0.322 cfs @ 7.98 hrs, Volume= 0.123 af, Depth= 1.34"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
Type IA 24-hr 10 yr Rainfall=3.20"

Area (sf)	CN	Description
48,131	79	<50% Grass cover, Poor, HSG B
48,131	79	100.00% Pervious Area

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

### Subcatchment 5: Basin A Pre



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Type IA 24-hr 10 yr Rainfall=3.20"

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**Summary for Pond 24P: LIDA Planter (Detention)**

Inflow Area = 1.105 ac, 100.00% Impervious, Inflow Depth = 2.97" for 10 yr event  
 Inflow = 0.825 cfs @ 7.90 hrs, Volume= 0.273 af  
 Outflow = 0.261 cfs @ 8.98 hrs, Volume= 0.273 af, Atten= 68%, Lag= 64.7 min  
 Primary = 0.261 cfs @ 8.98 hrs, Volume= 0.273 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
 Peak Elev= 100.91' @ 8.98 hrs Surf.Area= 2,756 sf Storage= 4,442 cf

Plug-Flow detention time= 641.0 min calculated for 0.273 af (100% of inflow)  
 Center-of-Mass det. time= 642.0 min ( 1,308.4 - 666.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	97.50'	4,689 cf	<b>Pond A (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
97.50	2,189	0.0	0	0
100.00	2,189	40.0	2,189	2,189
101.00	2,811	100.0	2,500	4,689

Device	Routing	Invert	Outlet Devices
#1	Primary	97.50'	<b>1.1" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#2	Primary	100.83'	<b>10.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

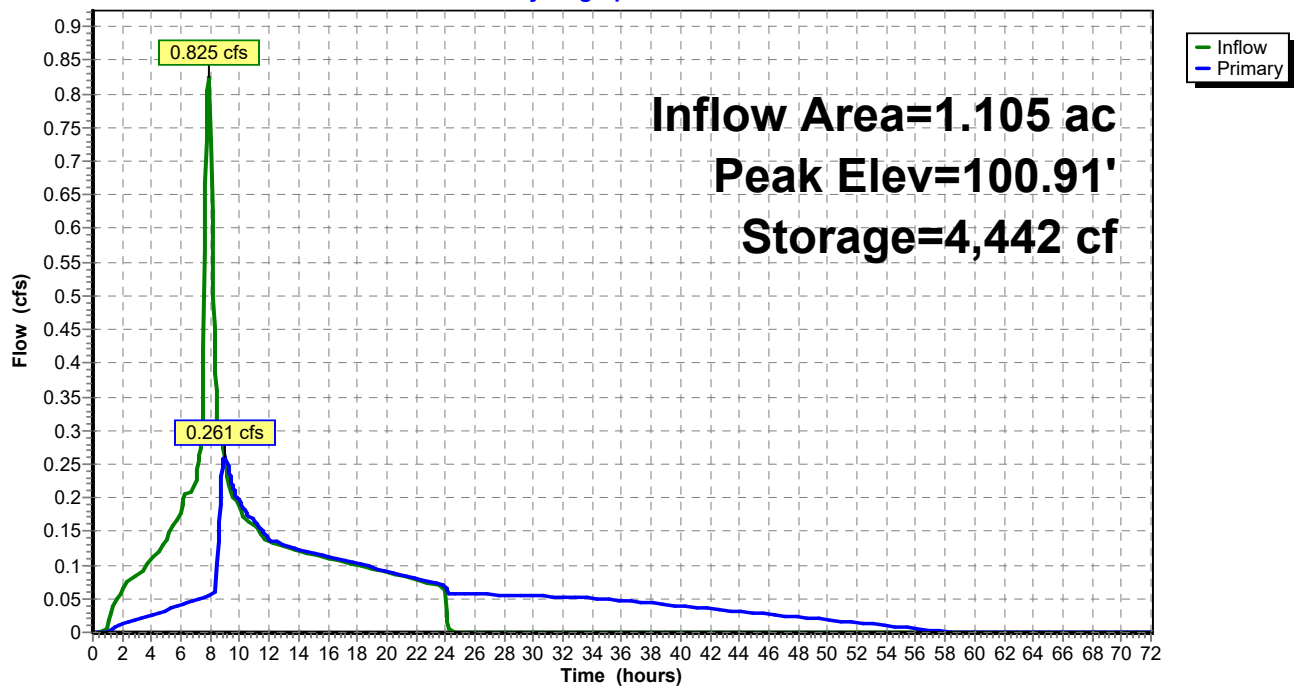
**Primary OutFlow** Max=0.257 cfs @ 8.98 hrs HW=100.91' (Free Discharge)

1=Orifice/Grate (Orifice Controls 0.059 cfs @ 8.89 fps)

2=Orifice/Grate (Weir Controls 0.199 cfs @ 0.93 fps)

**Pond 24P: LIDA Planter (Detention)**

Hydrograph



## HydroCAD Phase 2

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Type IA 24-hr 25 yr Rainfall=3.60"

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### Summary for Subcatchment 5: Basin A Pre

Runoff = 0.412 cfs @ 7.98 hrs, Volume= 0.151 af, Depth= 1.64"

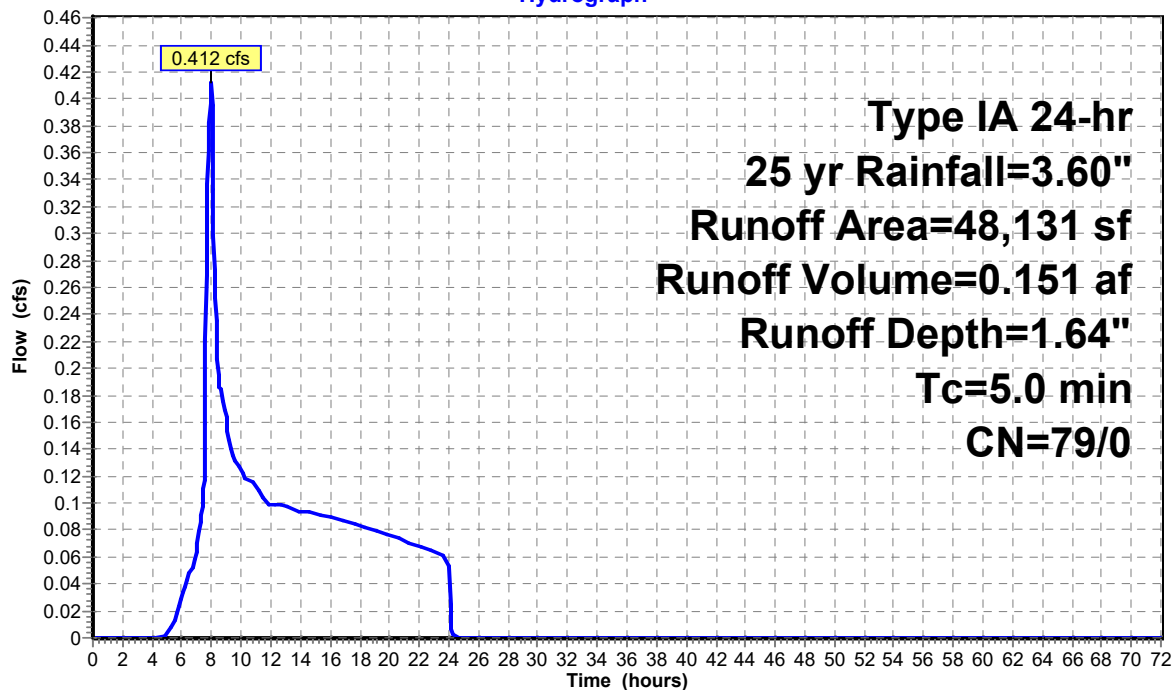
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
Type IA 24-hr 25 yr Rainfall=3.60"

Area (sf)	CN	Description
48,131	79	<50% Grass cover, Poor, HSG B
48,131	79	100.00% Pervious Area

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

### Subcatchment 5: Basin A Pre

Hydrograph



**HydroCAD Phase 2**

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Type IA 24-hr 25 yr Rainfall=3.60"

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**Summary for Pond 24P: LIDA Planter (Detention)**

Inflow Area = 1.105 ac, 100.00% Impervious, Inflow Depth = 3.37" for 25 yr event  
 Inflow = 0.932 cfs @ 7.90 hrs, Volume= 0.310 af  
 Outflow = 0.418 cfs @ 8.38 hrs, Volume= 0.310 af, Atten= 55%, Lag= 29.0 min  
 Primary = 0.418 cfs @ 8.38 hrs, Volume= 0.310 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
 Peak Elev= 100.95' @ 8.38 hrs Surf.Area= 2,780 sf Storage= 4,549 cf

Plug-Flow detention time= 575.5 min calculated for 0.310 af (100% of inflow)  
 Center-of-Mass det. time= 575.3 min ( 1,238.6 - 663.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	97.50'	4,689 cf	<b>Pond A (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
97.50	2,189	0.0	0	0
100.00	2,189	40.0	2,189	2,189
101.00	2,811	100.0	2,500	4,689

Device	Routing	Invert	Outlet Devices
#1	Primary	97.50'	<b>1.1" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#2	Primary	100.83'	<b>10.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=0.414 cfs @ 8.38 hrs HW=100.95' (Free Discharge)

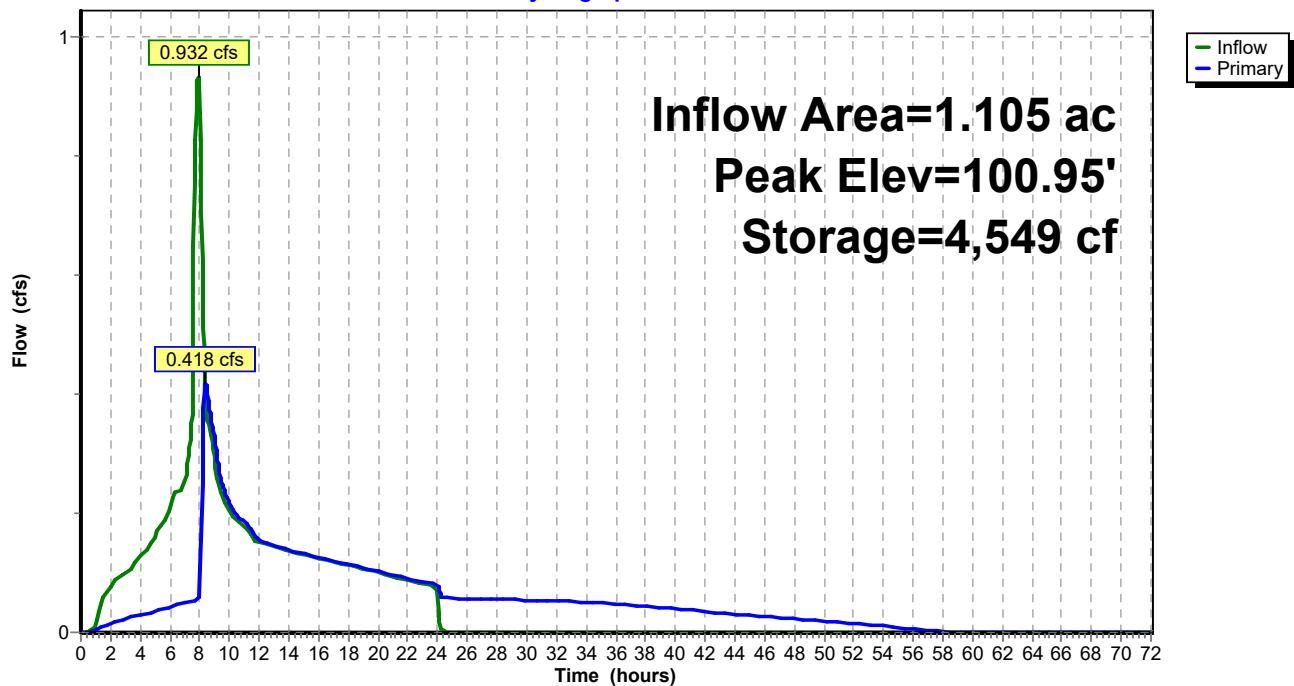
1=Orifice/Grate (Orifice Controls 0.059 cfs @ 8.94 fps)

2=Orifice/Grate (Weir Controls 0.355 cfs @ 1.13 fps)



**Pond 24P: LIDA Planter (Detention)**

Hydrograph



## HydroCAD Phase 2

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Type IA 24-hr 100 yr Rainfall=4.40"

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### Summary for Subcatchment 5: Basin A Pre

Runoff = 0.605 cfs @ 7.98 hrs, Volume= 0.211 af, Depth= 2.29"

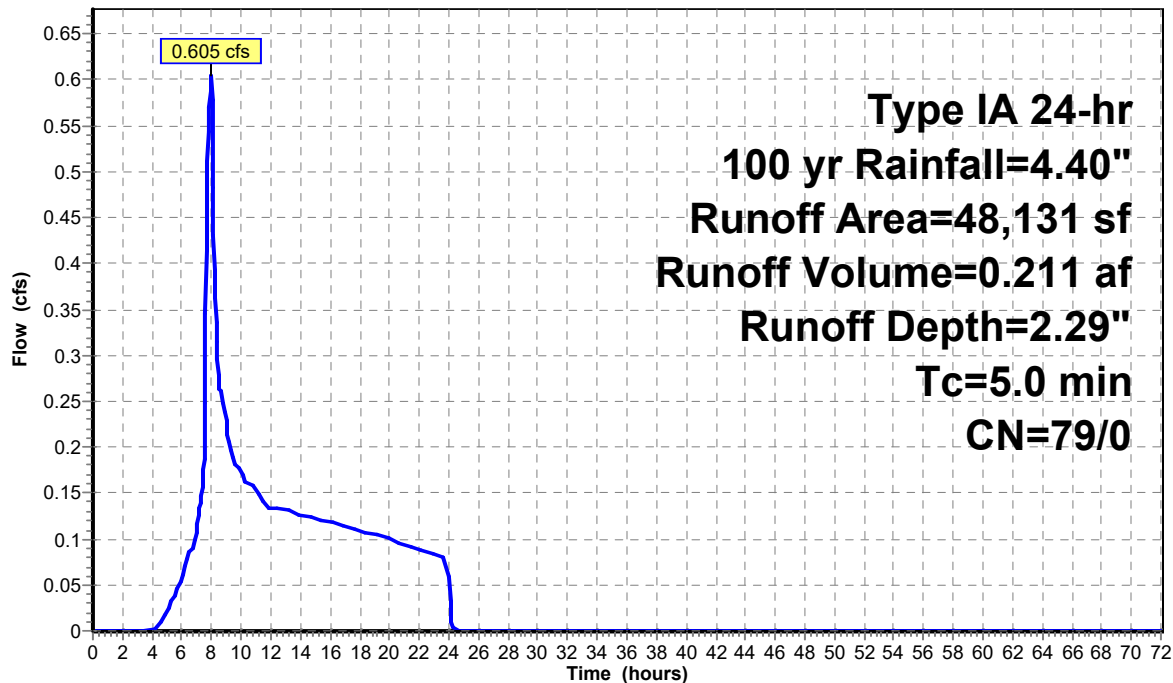
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
Type IA 24-hr 100 yr Rainfall=4.40"

Area (sf)	CN	Description
48,131	79	<50% Grass cover, Poor, HSG B
48,131	79	100.00% Pervious Area

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

### Subcatchment 5: Basin A Pre

Hydrograph



## HydroCAD Phase 2

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Type IA 24-hr 100 yr Rainfall=4.40"

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### Summary for Pond 24P: LIDA Planter (Detention)

Inflow Area = 1.105 ac, 100.00% Impervious, Inflow Depth = 4.16" for 100 yr event  
Inflow = 1.146 cfs @ 7.90 hrs, Volume= 0.383 af  
Outflow = 1.611 cfs @ 7.95 hrs, Volume= 0.383 af, Atten= 0%, Lag= 3.3 min  
Primary = 1.611 cfs @ 7.95 hrs, Volume= 0.383 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
Peak Elev= 101.18' @ 7.95 hrs Surf.Area= 2,811 sf Storage= 4,689 cf

Plug-Flow detention time= 477.1 min calculated for 0.383 af (100% of inflow)  
Center-of-Mass det. time= 478.2 min ( 1,136.8 - 658.6 )

Volume	Invert	Avail.Storage	Storage Description
#1	97.50'	4,689 cf	<b>Pond A (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
97.50	2,189	0.0	0	0
100.00	2,189	40.0	2,189	2,189
101.00	2,811	100.0	2,500	4,689

Device	Routing	Invert	Outlet Devices
#1	Primary	97.50'	<b>1.1" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#2	Primary	100.83'	<b>10.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=1.611 cfs @ 7.95 hrs HW=101.18' (Free Discharge)

1=Orifice/Grate (Orifice Controls 0.061 cfs @ 9.23 fps)

2=Orifice/Grate (Orifice Controls 1.550 cfs @ 2.84 fps)

## HydroCAD Phase 2

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Type IA 24-hr 100 yr Rainfall=4.40"

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### Pond 24P: LIDA Planter (Detention)

Hydrograph

