HOWARD STEIN HUDSON

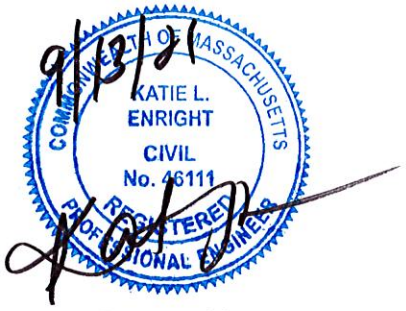
Engineers + Planners

SUPPLEMENTAL DATA REPORT

Proposed Parking Lot Expansion

120 Constitution Blvd

Franklin, Massachusetts



Prepared by:

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September 2021

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Project Overview

Zoning Summary

120 Constitution Blvd, Franklin, MA
Map 319, Lot 16
Industrial Zone
Existing Building: Industrial Use

Dimensional Requirements Industrial Zone	Required	Existing (Proposed)
Lot Area	40,000 SF min.	141,387 SF
Lot Width (By-Right)	157.5' dia. min.	316.7'±
Lot Depth	200'	317'±
Lot Frontage	175' min.	420.3'±
Front Yard Setback	40' min.	115.8'±
Side Yard Setback	30' min.	104'±
Rear Yard Setback	30' min.	50'±
Building Coverage	70% max.	21.4%
Structure plus Paving	80% max	36.5% (47%)
Building Stories	3 max.	1
Parking Requirements	**Required**	**Proposed**
Number of Parking Spaces	75 spaces	23 (69 spaces)**

*Special Permit needed through CEIOD
**Waiver needed through Planning Board

Existing Conditions

The existing property at 120 Constitution Blvd in Franklin, MA is currently used as an industrial factory building and was constructed in the 1980's. The entrance to the parking lot is off of Constitution Blvd. There is a parking lot on the west side of the building and loading bays on the west side of the building in the rear. The building is located in a depression on site, with a first floor elevation of 381.30.

Proposed Conditions

The existing building is to remain, there is no proposed work to the footprint of the building. The proposed work includes restriping the existing parking lot to bring the parking spaces and handicap spaces to current standards. The proposed site plan consists of a new parking lot located in the front of the building along Constitution Blvd. The existing curb cut will remain, and part of the existing parking lot will be transformed to the new drive aisle to the expanded parking lot. The proposed lot will meet current parking space and aisle width standards. The sidewalk from the handicap spaces will be upgraded to meet ADA standards after regrading the parking area in the area of the new handicap spaces. Although the parking area proposes to increase the number of parking spaces by 23 to 69 total spaces, it is still below the 75 spaces required under current zoning. This will require a waiver by the Planning Board from section 185-21C(7)(a) of the Zoning By-laws.

The proposed project does not propose any changes to the existing building or new utilities, with the only modification to the drainage being adding a Stormwater Treatment Unit to remove Total Suspended Solids from the existing parking area and the removal of one yard drain in the lawn of where the proposed parking area is proposed to be constructed.

Hydrology Overview

Pre-Development Conditions

The existing conditions of the site consist of a high elevation closest to the property line ay elevation 396 +/- and the slope runs downwards towards the building to elevation 379 +/-. The existing condition has a network of catch basins around the building that connect to each other and terminate to the drainage culvert in the southwestern corner of the site that leads to the drainage culvert in Constitution Blvd. The stormwater runoff from the parking lot and surrounding grass areas are collected through catch basins and area drains and terminates to the drainage culvert in Constitution Blvd. to the west of the entrance to the site.

Post-Development Conditions

The post development conditions in the rear and portions of the east are remaining unchanged. The existing parking lots shall be restriped, but the grading of the parking lot will remain mostly unchanged. The proposed parking lot will be bituminous concrete for the beginning portion, and the 24-foot wide drive aisle will also be Type I bituminous concrete. The proposed 18 end parking spaces

(36 total) on each side will be constructed with pervious pavement. A large portion of the parking lot will run towards the parking areas and be collected via the pervious pavement on the 36 parking spaces. Beneath all the parking spaces and the drive aisle will be an extended reservoir course of crushed stone to provide storage to infiltrate the stormwater runoff. The remainder of the parking lot will run into the existing parking lot and the catch basin located on the west side of the lot. This runoff will be treated by the STU to remove TSS. Two swales are proposed to direct stormwater runoff from the grass and wood area to existing catch basins. The small remainder of the water will flow over the proposed retaining wall and into the proposed parking lot area.

Stormwater Management Standards

Standard 1: No Untreated Discharges or Erosion to Wetland

The Massachusetts Stormwater Handbook requires that the project demonstrates that no new stormwater conveyances (e.g. outfalls) discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

The proposed project will not discharge stormwater directly to, or cause erosion in, wetlands or water of the Commonwealth and will treat stormwater prior to discharge or infiltration.

Standard 2: Peak Rate Attenuation

Stormwater management systems must be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. Evaluation of 100-year 24-hour storm to determine if off-site flooding will result for peak discharges from this storm.

The following table is a summary of the hydrologic calculations performed using HydroCAD© v.10.0 an USSCS TR-20 modeling system.

Peak Flow Summary Tables

Analysis Points – AP1 – Street Drainage Network

Storm Event	2-year	10-year	100-year
Pre-Development Rates (cfs) AP1	3.82	7.14	12.54
Volume (cf) AP1	12,807	24,122	43,192
Post-Development Rates (cfs) AP1	3.35	5.98	10.21
Volume (cf) AP1	11,096	20,155	35,180
Rate Reductions (cfs)	**-0.47**	**-1.16**	**-2.33**
Volume Reductions (cf)	**-1,711**	**-3,967**	**-8,012**

Standard 3: Stormwater Recharge

Loss of annual recharge to groundwater should be minimized through the use of infiltration measures to the maximum extent practicable. The annual recharge from the post-development site should approximate the annual recharge from the pre-development or existing site conditions, based on soil types.

The prescribed stormwater runoff volume to be recharged to groundwater has been determined using the hydrologic soil classification and the proposed post development *increase* in impervious area:

Hydrologic Group Volume to Recharge (x Total Impervious Area)

A 0.60 inches of runoff	No A soils were found on site
B 0.35 inches of runoff	No B soils were found on site
C 0.25 inches of runoff	No C soils were found on site
D 0.10 inches of runoff	14,771 SF x 0.10 in = 123 CF

The total infiltration volume provided in proposed stone reservoir provides a volume of approximately 1,319 cubic feet of storage. The site will have a total recharge volume of 1,319 cubic feet. **1,319 CF > 132 CF Req'd OK**

Drawdown Within 72 Hours

To determine whether an infiltration BMP will drain within 72 hours, the following formula must be used:

$$Time_{drawdown} = \frac{Rv}{(K)\ (Bottom\ Area)}$$

Where:
Rv= Storage Volume
K = Saturated Hydraulic Conductivity For "Static" and "Simply Dynamic" Methods
Bottom Area = Bottom Area of Recharge Structure

Pervious Pavement Stone Reservoir
Time = 1,319 cf/(1.02 in/hr x 1/12ft/in x 9,990 sf)
1.55 hours required to fully draw down

Standard 4: Water Quality Treatment Volume

Water Quality Treatment Volume
Calculated as Vwq = (Dwq / 12 inches/foot) * (A_{imp}), where:
Vwq = required water quality volume (cubic feet)
Dwq = water quality depth: one-inch for discharges within a Zone II or Interim Wellhead Protection Area, to or near another critical area, runoff from a LUHPPL, of exfiltration to soils with infiltration rates greater than 2.4 inches/hour or greater; ½ inch for discharges near or to other areas.
A_{imp} = Impervious area
$V_{sf} = 0.1 * V_{wq}$
**Sediment Forebay's may hold as little as 10% of the required water quality volume provided that the infiltration basin they discharge to holds the remaining required water quality volume.*

Pervious Pavement:
V_{wq} = (0.5 inch / 12 in/ft) * (10,401 sf) = 433.4 cf
WQV Required = 433.4 cf
WQV Provided = 1,319 cf

Flow Rate Calculation

Q = (qu)*(A)*(WQV), where:

Q = Peak flow rate associated with first 1-inch of runoff
qu = the unit peak discharge, in csm/in (774 csm/in for Tc associated with 6 minutes)
A = impervious surface drainage area (in square miles)
WQV = water quality volume in watershed inches (1 inch or ½ inch)

CDS Unit

Q(1/2)=(774 csm/in) * (0.83 AC) * (0.0015625 mi2/AC) * (1/2 in)
Q(1/2)=0.50 cfs
CDS 2015-4 Water Quality Unit is rated for 1.0 cfs
Volume Provided = 1.0 cfs

1.0 cfs > 0.50 cfs OK

The stormwater management system is designed to remove 80% annual total suspended solids (TSS) from the proposed roadway, driveways, and sidewalks.

TSS Removal Calculation

Train 1

BMP	TSS Removal Rate	Starting TSS Load	Amount Removed	Remaining Load
Pervious Pavement	0.80	1.00	0.80	0.20
		Total TSS Removal	**80.0%**	

Train 2

BMP	TSS Removal Rate	Starting TSS Load	Amount Removed	Remaining Load
Deep Sump Hooded Catch Basin	0.25	1.00	0.25	0.75
CDS Unit	0.80	0.75	0.60	0.15
		Total TSS Removal	**85.0%**	

Standard 5: Land Uses with High Potential Pollutant Loads

The proposed use is not considered a use with a higher potential pollutant load as defined by the Stormwater Management Standards.

Standard 6: Critical Areas

This site is not located within or adjacent to a Critical Area.

Standard 7: Redevelopment

The project is considered a redevelopment project and the stormwater system has been designed to the maximum extent practicable.

Standard 8: Construction Period Controls

The project will install erosion and sediment controls prior to any earthwork activity. Erosion control barriers will be placed down slope from the proposed construction to prevent erosion and sedimentation into the surrounding areas. The barriers will be maintained and inspected periodically during construction; sediment buildup will be removed, and any damaged barrier will be replaced as needed.

Standard 9: Operation and Maintenance Plan

See Appendix A for the operation and maintenance requirements of the stormwater management system.

Standard 10: No Illicit Discharge

An illicit discharge compliance statement will be provided by the property owner under separate cover.

Appendix A: Operation and Maintenance Plan

Porous Pavement

System Owner: LRF2 BOS Constitution Blvd, LLC

The following shall be done for proper maintenance of porous pavement:

- Minimize salt use during winter months.
- No winter sanding is allowed.
- Keep landscaped areas well maintained to prevent soil from being transported onto the pavement
- Clean the surface and vacuum sweeping machines quarterly.
- Regularly monitor the permeable paving surface and inspection catch basin to make sure it drains properly after storms.
- Never reseal or repave impermeable surfaces.

Date	Inspector	Condition	Maintenance Performed*

**Evidence of maintenance (i.e. receipts) must be provided.*

Contech CDS Water Quality Unit (2015-4)

System Owner: LRF2 BOS Constitution Blvd, LLC

(See Manufacturer specific documentation)

CONTECH®
ENGINEERED SOLUTIONS

CDS® Inspection and Maintenance Guide

CDS TECHNOLOGIES

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

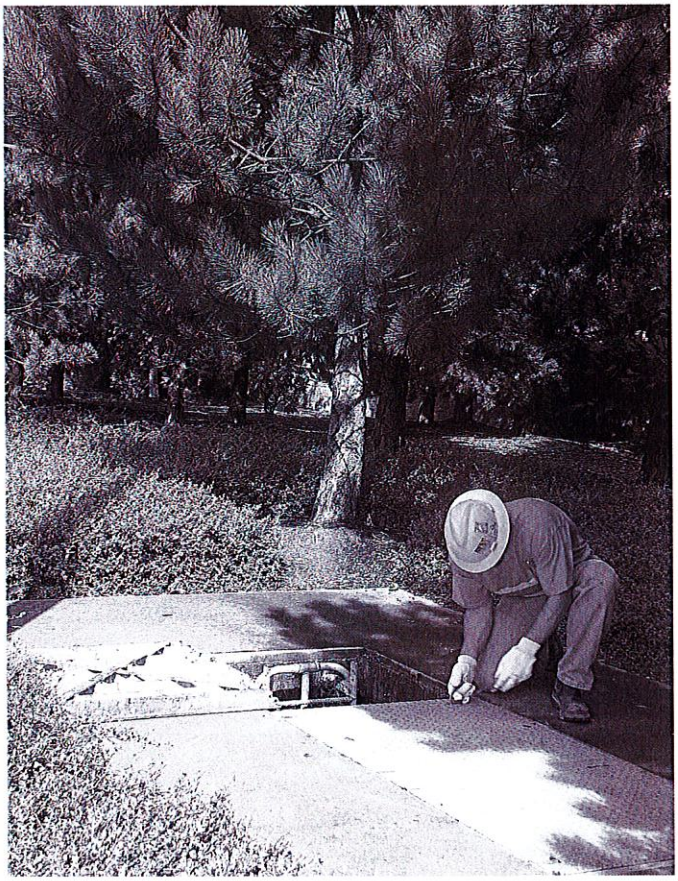
The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

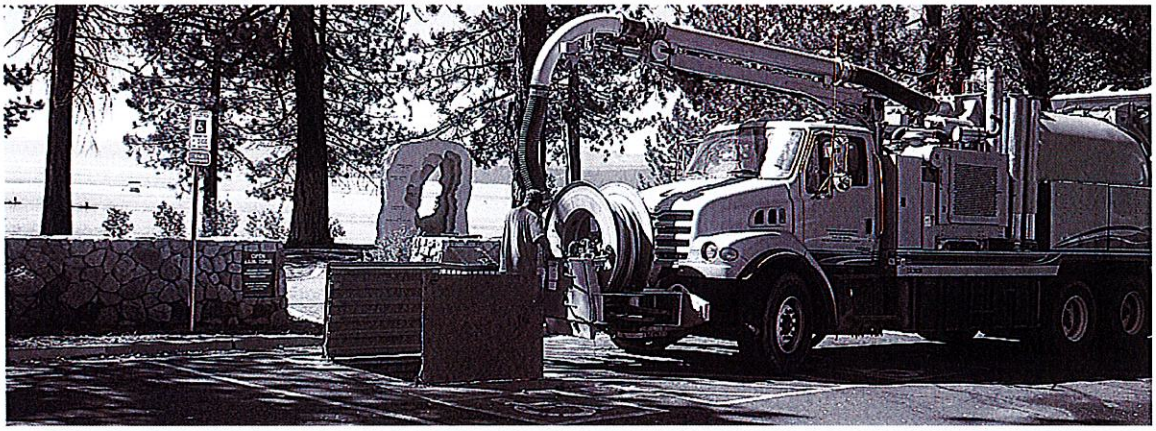
In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes.



CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y^3	m^3
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.3	3.0	0.9	1.3	1.0
CDS2020	5	1.3	3.5	1.1	1.3	1.0
CDS2025	5	1.3	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities



Support

- Drawings and specifications are available at www.contechstormwater.com.
- Site-specific design support is available from our engineers.

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, earth stabilization and wastewater treament products. For information, visit www.ContechES.com or call 800.338.1122

The product(s) described may be protected by one or more of the following US patents: 5,322,629; 5,624,576; 5,707,527; 5,759,415; 5,788,848; 5,985,157; 6,027,639; 6,350,374; 6,406,218; 6,641,720; 6,511,595; 6,649,048; 6,991,114; 6,998,038; 7,186,058; 7,296,692; 7,297,266; 7,517,450 related foreign patents or other patents pending.

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CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

Appendix B: Erosion and Sediment Control Notes and General Construction Sequence

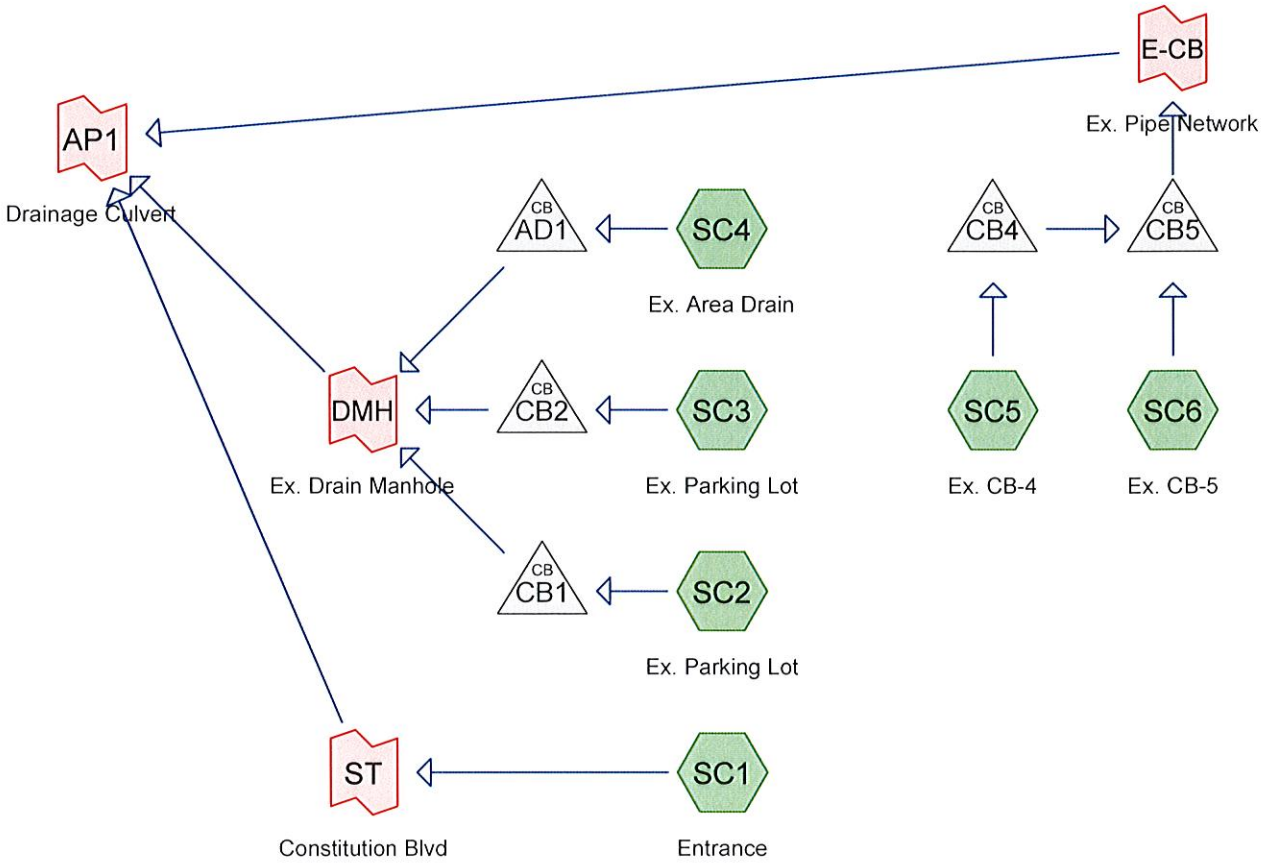
Erosion and Sediment Control Notes

1) Erosion and sediment control measures must be installed prior to the start of construction and maintained and upgraded as necessary during construction by the contractor. It is the contractor's responsibility to inspect and install additional control measures as needed during construction.
2) All catch basins receiving drainage from the project site must be provided with a catch basin filter.
3) Stabilization of all re-graded and soil stockpile areas must be maintained during all phases of construction.
4) Sediment removed from erosion and sediment control devices must be properly removed and disposed. All damaged erosion controls must be removed and replaced.
5) The contractor is responsible for implementing the erosion and sediment control plan. This includes the installation and maintenance of control measures, informing all parties engaged on the construction site of the requirements and objectives of the plan, and notifying the proper city agency of any transfer of this responsibility.
6) The contractor shall be responsible for controlling wind erosion and dust throughout the life of his contract. Dust control may include, but is not limited to, sprinkling of water on exposed soils and street sweeping adjacent roadways.
7) If final grading is to be delayed for more than 21 days after land disturbance activities cease, temporary vegetation or mulch shall be used to stabilize soils within 14 days of the last disturbance.
8) If a disturbed area will be exposed for greater than one year, permanent grasses or other approved cover must be installed.
9) The contractor must keep on-site at all times additional silt fence and hay bales for the installation at the direction of the engineer or the city to mitigate any emergency condition.
10) The construction fencing and erosion and sediment controls as shown may not be practical during all stages of construction. Earthwork activity on-site must be done in a manner such that runoff is directed to a sediment control device or infiltrated to the ground.
11) Demolition and construction debris must be properly contained and disposed of.
12) Disposal of all demolished materials is the responsibility of the contractor and must be hauled off-site in accordance with all federal, state and local requirements.

General Construction Sequence

1) Install erosion and sediment controls prior to starting any earthworks activity.
2) Begin clearing, grubbing and demolition.
3) Begin road grading and utility installations.
4) Install site furnishings.
5) Install landscaping.
6) Erosion and sediment controls shall be maintained until permanent cover is established.

Appendix C: HydroCAD



Subcat Reach Pond Link

Routing Diagram for 21123 - Pre-Development
Prepared by Howard Stein Hudson, Printed 9/13/2021

21123 - Pre-Development
Prepared by Howard Stein Hudson

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
41,111	80	>75% Grass cover, Good, HSG D (SC2, SC3, SC4, SC5, SC6)
21,336	98	Paved parking, HSG D (SC1, SC2, SC3, SC4)
20,100	77	Woods, Good, HSG D (SC3, SC5, SC6)
82,547	**84**	**TOTAL AREA**

21123 - Pre-Development

Prepared by Howard Stein Hudson

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
0	HSG C	
82,547	HSG D	SC1, SC2, SC3, SC4, SC5, SC6
0	Other	
82,547		**TOTAL AREA**

21123 - Pre-Development

Prepared by Howard Stein Hudson

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
0	0	0	41,111	0	41,111	>75% Grass cover, Good
0	0	0	21,336	0	21,336	Paved parking
0	0	0	20,100	0	20,100	Woods, Good
0	**0**	**0**	**82,547**	**0**	**82,547**	**TOTAL AREA**

21123 - Pre-Development

Type III 24-hr 100-yr Rainfall=8.19"

Prepared by Howard Stein Hudson

Time span=2.00-24.00 hrs, dt=0.05 hrs, 441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment SC1: Entrance Runoff Area=634 sf 100.00% Impervious Runoff Depth>7.90"
Tc=6.0 min CN=98 Runoff=0.11 cfs 418 cf

Subcatchment SC2: Ex. Parking Lot Runoff Area=7,450 sf 57.95% Impervious Runoff Depth>6.99"
Tc=6.0 min CN=90 Runoff=1.28 cfs 4,338 cf

Subcatchment SC3: Ex. Parking Lot Runoff Area=21,755 sf 73.56% Impervious Runoff Depth>7.35"
Tc=6.0 min CN=93 Runoff=3.83 cfs 13,319 cf

Subcatchment SC4: Ex. Area Drain Runoff Area=17,557 sf 2.18% Impervious Runoff Depth>5.80"
Flow Length=414' Tc=6.0 min CN=80 Runoff=2.64 cfs 8,484 cf

Subcatchment SC5: Ex. CB-4 Runoff Area=14,740 sf 0.00% Impervious Runoff Depth>5.68"
Flow Length=265' Tc=9.2 min CN=79 Runoff=1.96 cfs 6,974 cf

Subcatchment SC6: Ex. CB-5 Runoff Area=20,411 sf 0.00% Impervious Runoff Depth>5.68"
Flow Length=159' Tc=7.8 min CN=79 Runoff=2.86 cfs 9,659 cf

Pond AD1: Peak Elev=378.76' Inflow=2.64 cfs 8,484 cf
8.0" Round Culvert n=0.010 L=64.2' S=0.0199 '/' Outflow=2.64 cfs 8,484 cf

Pond CB1: Peak Elev=373.81' Inflow=1.28 cfs 4,338 cf
12.0" Round Culvert n=0.011 L=15.3' S=0.0203 '/' Outflow=1.28 cfs 4,338 cf

Pond CB2: Peak Elev=370.72' Inflow=3.83 cfs 13,319 cf
12.0" Round Culvert n=0.011 L=110.8' S=0.0216 '/' Outflow=3.83 cfs 13,319 cf

Pond CB4: Peak Elev=370.42' Inflow=1.96 cfs 6,974 cf
12.0" Round Culvert n=0.011 L=96.7' S=0.0029 '/' Outflow=1.96 cfs 6,974 cf

Pond CB5: Peak Elev=371.53' Inflow=4.81 cfs 16,633 cf
12.0" Round Culvert n=0.011 L=170.5' S=0.0100 '/' Outflow=4.81 cfs 16,633 cf

Link AP1: Drainage Culvert Inflow=12.54 cfs 43,192 cf
Primary=12.54 cfs 43,192 cf

Link DMH: Ex. Drain Manhole Inflow=7.74 cfs 26,141 cf
Primary=7.74 cfs 26,141 cf

Link E-CB: Ex. Pipe Network Inflow=4.81 cfs 16,633 cf
Primary=4.81 cfs 16,633 cf

Link ST: Constitution Blvd Inflow=0.11 cfs 418 cf
Primary=0.11 cfs 418 cf

Total Runoff Area = 82,547 sf Runoff Volume = 43,192 cf Average Runoff Depth = 6.28"
74.15% Pervious = 61,211 sf 25.85% Impervious = 21,336 sf

21123 - Pre-Development
Prepared by Howard Stein Hudson

Summary for Subcatchment SC1: Entrance

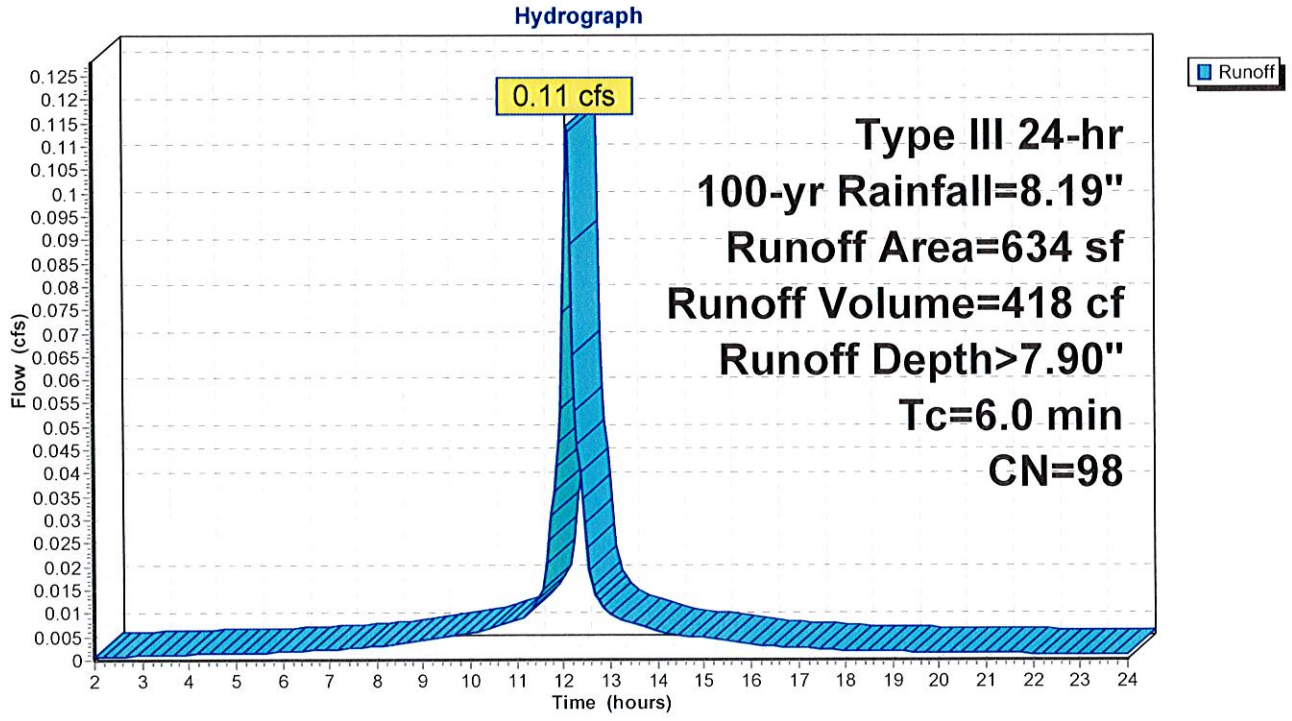
Runoff = 0.11 cfs @ 12.09 hrs, Volume= 418 cf, Depth> 7.90"
Routed to Link ST : Constitution Blvd

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.19"

Area (sf)	CN	Description
634	98	Paved parking, HSG D
634		100.00% Impervious Area

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

Subcatchment SC1: Entrance



Summary for Subcatchment SC2: Ex. Parking Lot

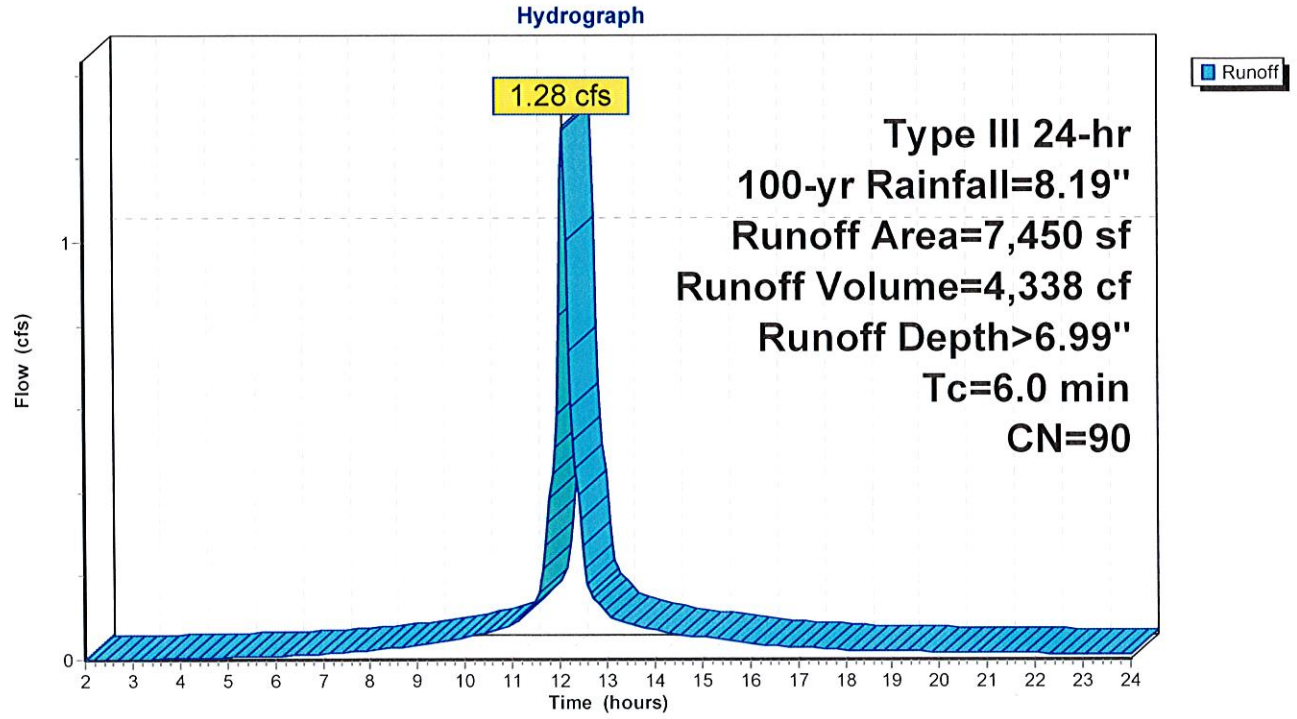
Runoff = 1.28 cfs @ 12.09 hrs, Volume= 4,338 cf, Depth> 6.99"
Routed to Pond CB1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.19"

Area (sf)	CN	Description
4,317	98	Paved parking, HSG D
3,133	80	>75% Grass cover, Good, HSG D
7,450	90	Weighted Average
3,133		42.05% Pervious Area
4,317		57.95% Impervious Area

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

Subcatchment SC2: Ex. Parking Lot



Summary for Subcatchment SC3: Ex. Parking Lot

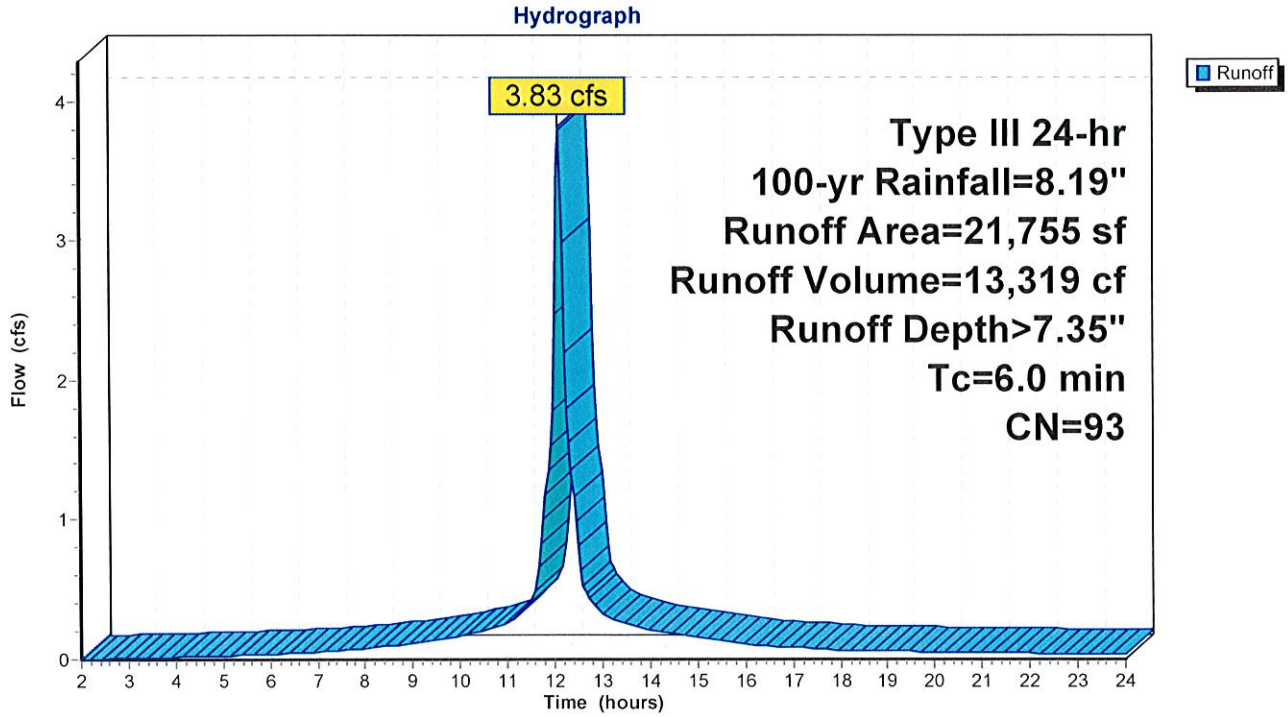
Runoff = 3.83 cfs @ 12.09 hrs, Volume= 13,319 cf, Depth> 7.35"
Routed to Pond CB2 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.19"

Area (sf)	CN	Description
16,003	98	Paved parking, HSG D
1,453	80	>75% Grass cover, Good, HSG D
4,299	77	Woods, Good, HSG D
21,755	93	Weighted Average
5,752		26.44% Pervious Area
16,003		73.56% Impervious Area

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

Subcatchment SC3: Ex. Parking Lot



Summary for Subcatchment SC4: Ex. Area Drain

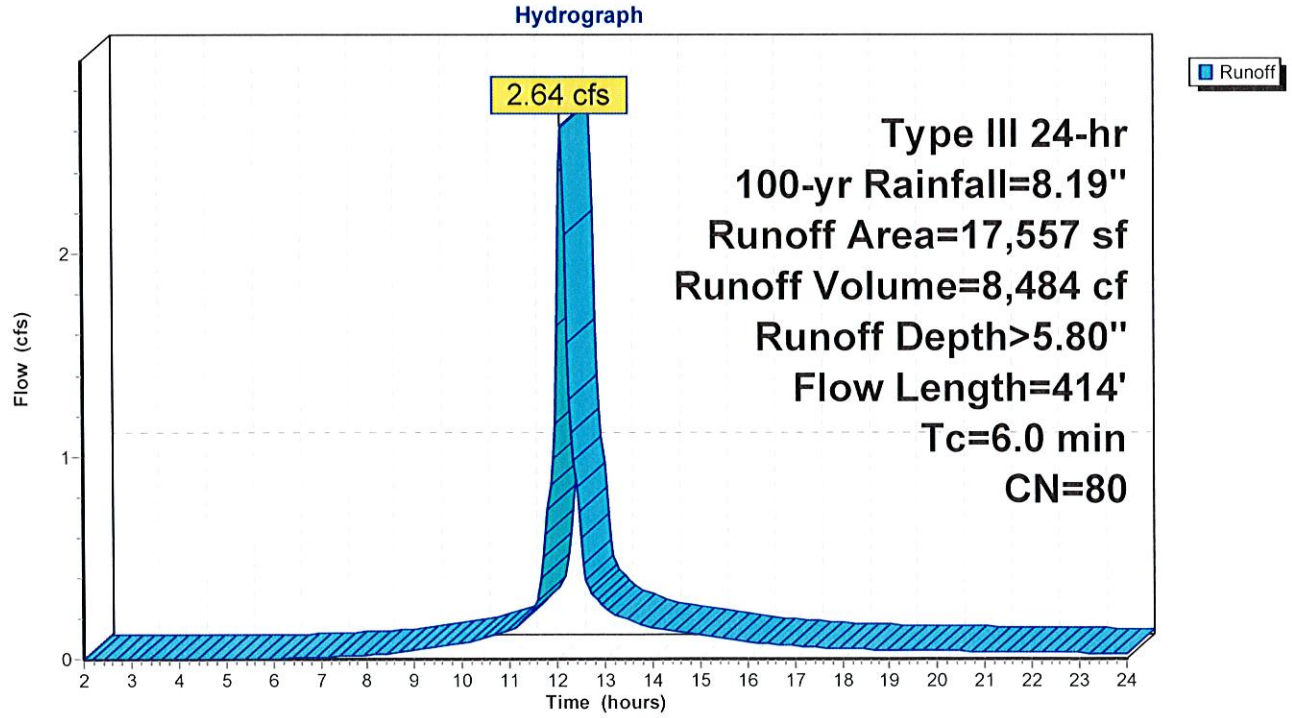
Runoff = 2.64 cfs @ 12.09 hrs, Volume= 8,484 cf, Depth> 5.80"
Routed to Pond AD1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.19"

Area (sf)	CN	Description
382	98	Paved parking, HSG D
17,175	80	>75% Grass cover, Good, HSG D
17,557	80	Weighted Average
17,175		97.82% Pervious Area
382		2.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.0700	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.36"
1.2	221	0.0430	3.11		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.7	143	0.0490	3.32		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
5.2	414	Total, Increased to minimum Tc = 6.0 min			

Subcatchment SC4: Ex. Area Drain



Summary for Subcatchment SC5: Ex. CB-4

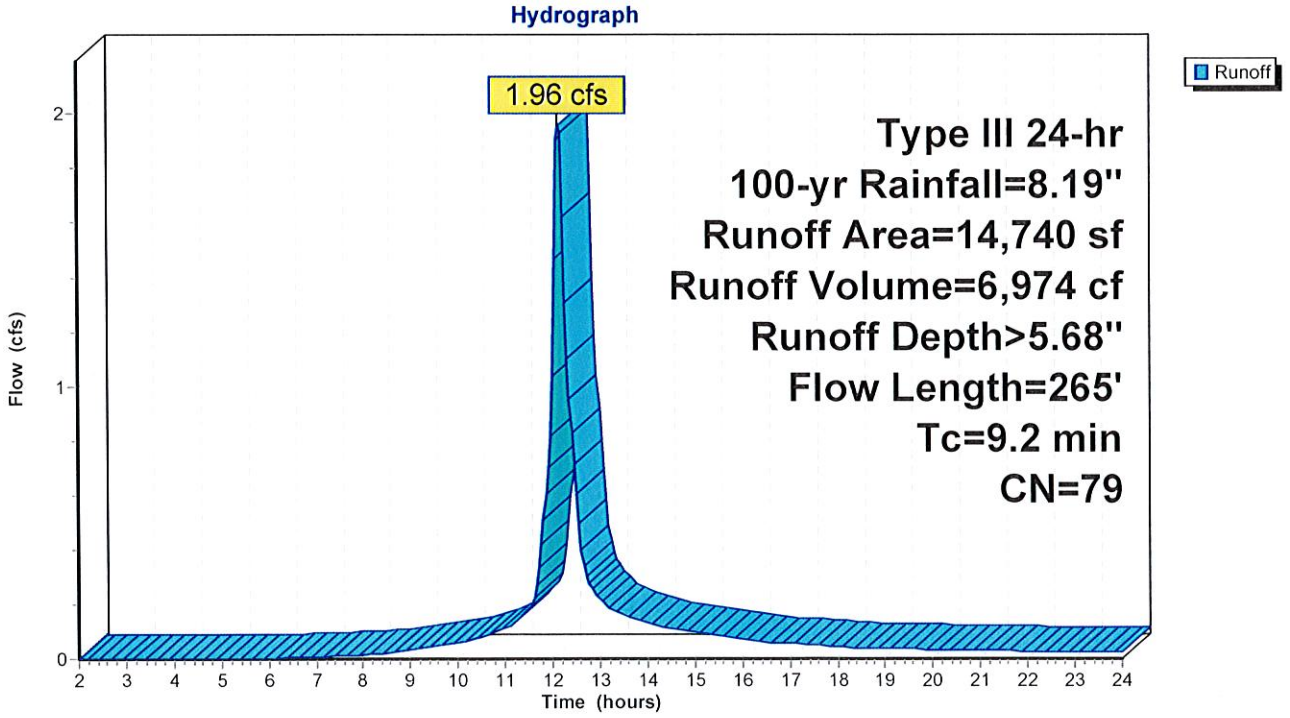
Runoff = 1.96 cfs @ 12.13 hrs, Volume= 6,974 cf, Depth> 5.68"
Routed to Pond CB4 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.19"

Area (sf)	CN	Description
7,505	80	>75% Grass cover, Good, HSG D
7,235	77	Woods, Good, HSG D
14,740	79	Weighted Average
14,740		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	50	0.0800	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
2.1	150	0.0566	1.19		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	65	0.1150	5.09		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
9.2	265	Total			

Subcatchment SC5: Ex. CB-4



Summary for Subcatchment SC6: Ex. CB-5

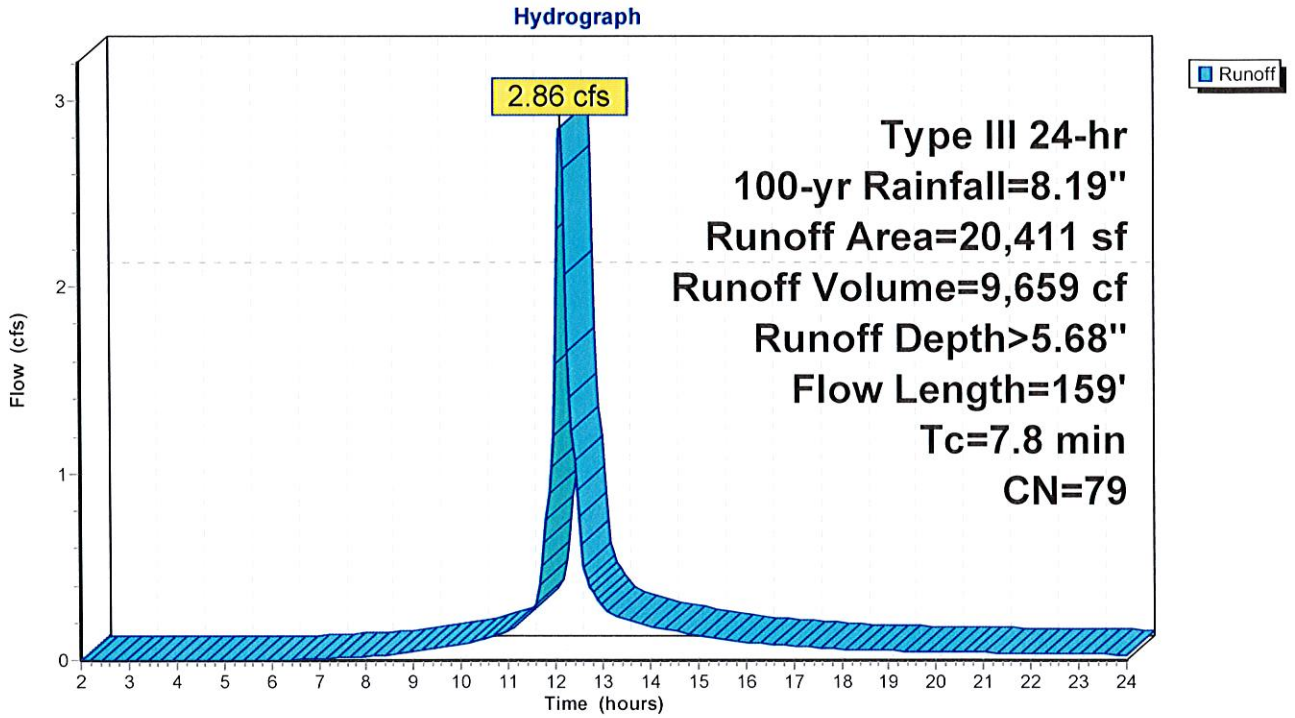
Runoff = 2.86 cfs @ 12.11 hrs, Volume= 9,659 cf, Depth> 5.68"
Routed to Pond CB5 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.19"

Area (sf)	CN	Description
11,845	80	>75% Grass cover, Good, HSG D
8,566	77	Woods, Good, HSG D
20,411	79	Weighted Average
20,411		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	50	0.0800	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
0.8	63	0.0630	1.25		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	46	0.2600	7.65		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
7.8	159	Total			

Subcatchment SC6: Ex. CB-5



21123 - Pre-Development
Prepared by Howard Stein Hudson

Summary for Pond AD1:

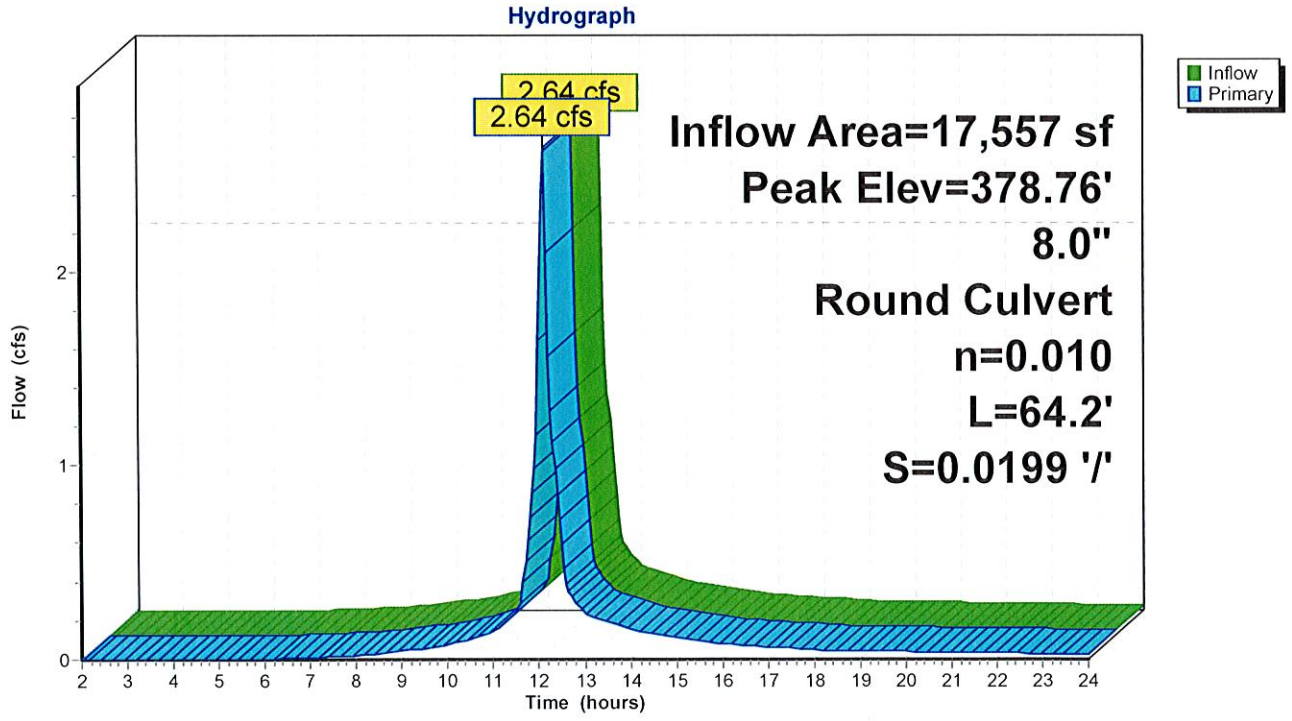
Inflow Area = 17,557 sf, 2.18% Impervious, Inflow Depth > 5.80" for 100-yr event
Inflow = 2.64 cfs @ 12.09 hrs, Volume= 8,484 cf
Outflow = 2.64 cfs @ 12.09 hrs, Volume= 8,484 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.64 cfs @ 12.09 hrs, Volume= 8,484 cf
Routed to Link DMH : Ex. Drain Manhole

Routing by Stor-Ind method, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 378.76' @ 12.09 hrs
Flood Elev= 379.47'

Device	Routing	Invert	Outlet Devices
#1	Primary	374.49'	**8.0" Round Culvert** L= 64.2' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 374.49' / 373.21' S= 0.0199 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=2.58 cfs @ 12.09 hrs HW=378.60' (Free Discharge)
1=Culvert (Inlet Controls 2.58 cfs @ 7.38 fps)

Pond AD1:



Summary for Pond CB1:

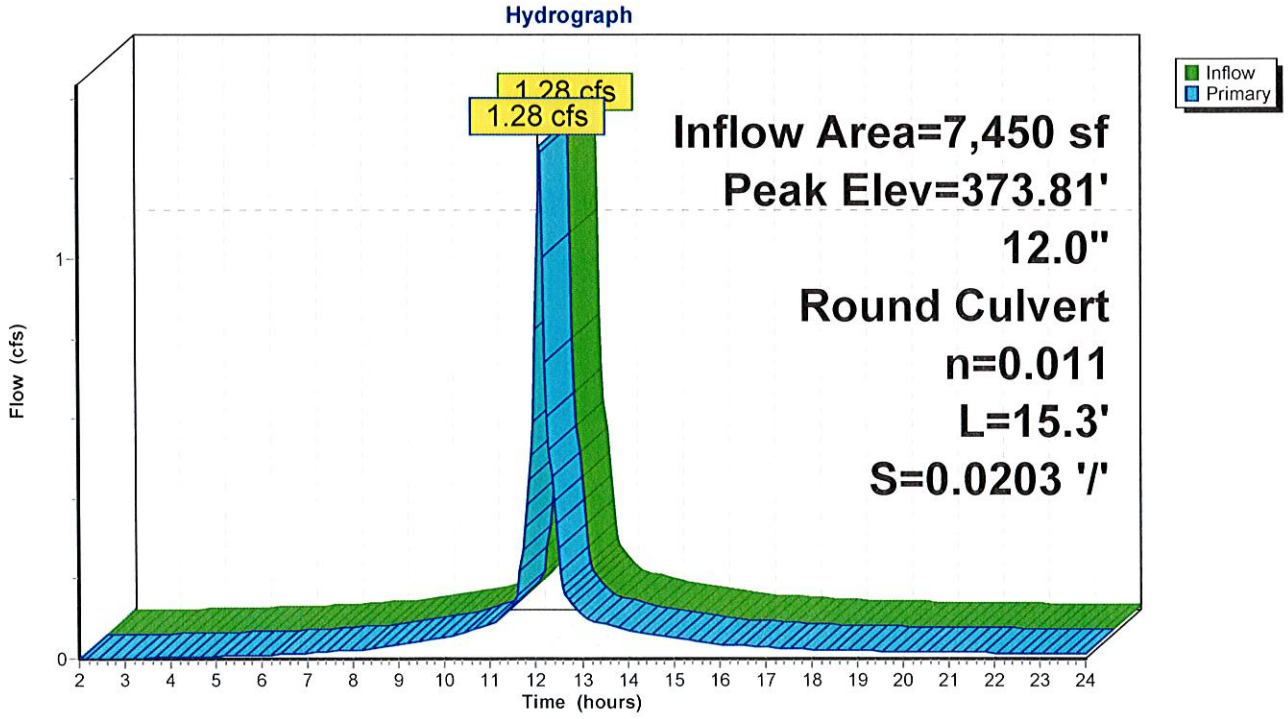
Inflow Area = 7,450 sf, 57.95% Impervious, Inflow Depth > 6.99" for 100-yr event
Inflow = 1.28 cfs @ 12.09 hrs, Volume= 4,338 cf
Outflow = 1.28 cfs @ 12.09 hrs, Volume= 4,338 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.28 cfs @ 12.09 hrs, Volume= 4,338 cf
Routed to Link DMH : Ex. Drain Manhole

Routing by Stor-Ind method, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 373.81' @ 12.09 hrs
Flood Elev= 377.18'

Device	Routing	Invert	Outlet Devices
#1	Primary	373.22'	**12.0" Round Culvert** L= 15.3' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 373.22' / 372.91' S= 0.0203 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=1.24 cfs @ 12.09 hrs HW=373.81' (Free Discharge)
1=Culvert (Inlet Controls 1.24 cfs @ 2.61 fps)

Pond CB1:



Summary for Pond CB2:

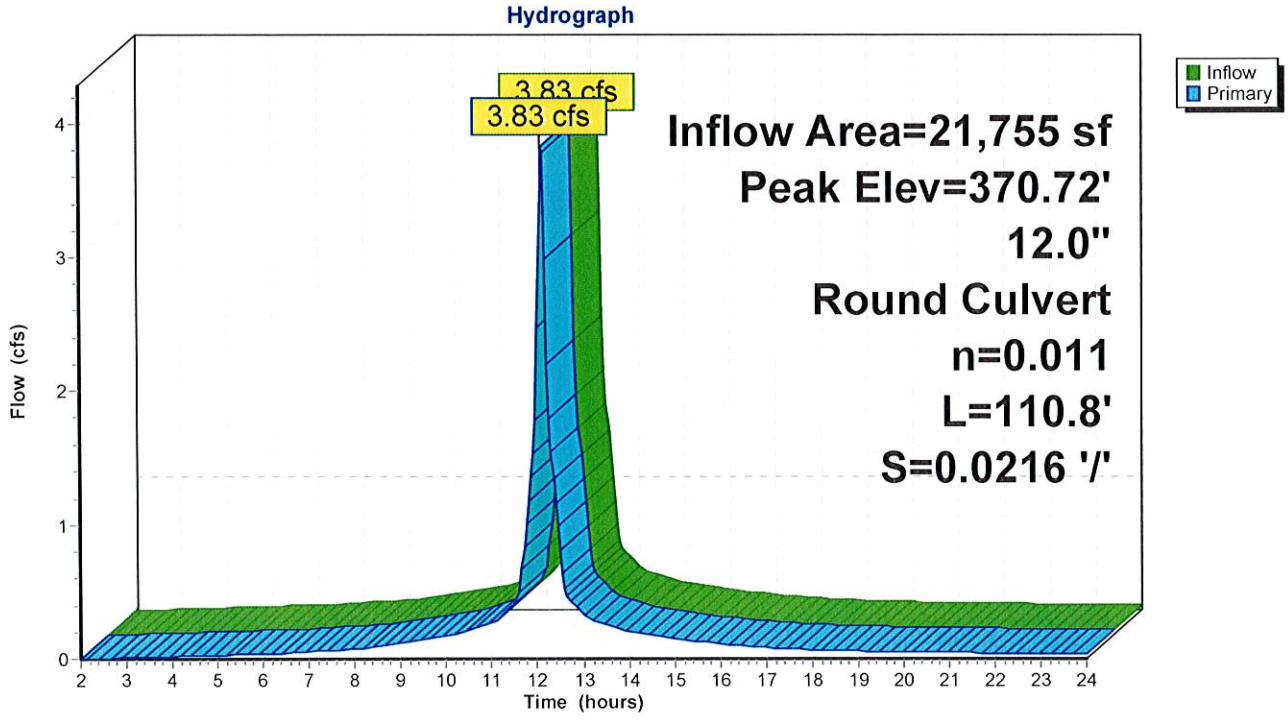
Inflow Area = 21,755 sf, 73.56% Impervious, Inflow Depth > 7.35" for 100-yr event
Inflow = 3.83 cfs @ 12.09 hrs, Volume= 13,319 cf
Outflow = 3.83 cfs @ 12.09 hrs, Volume= 13,319 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.83 cfs @ 12.09 hrs, Volume= 13,319 cf
Routed to Link DMH : Ex. Drain Manhole

Routing by Stor-Ind method, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 370.72' @ 12.09 hrs
Flood Elev= 375.29'

Device	Routing	Invert	Outlet Devices
#1	Primary	369.20'	**12.0" Round Culvert** L= 110.8' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 369.20' / 366.81' S= 0.0216 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=3.73 cfs @ 12.09 hrs HW=370.67' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 3.73 cfs @ 4.75 fps)

Pond CB2:



Summary for Pond CB4:

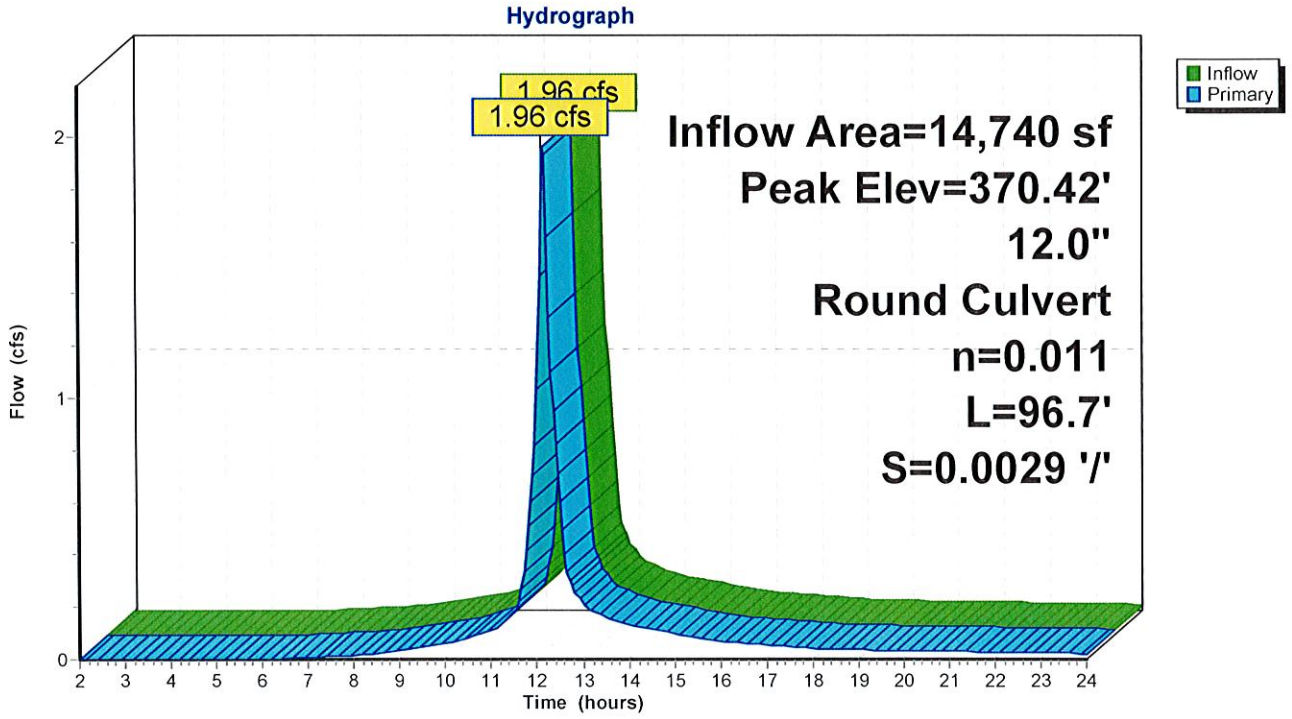
Inflow Area = 14,740 sf, 0.00% Impervious, Inflow Depth > 5.68" for 100-yr event
Inflow = 1.96 cfs @ 12.13 hrs, Volume= 6,974 cf
Outflow = 1.96 cfs @ 12.13 hrs, Volume= 6,974 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.96 cfs @ 12.13 hrs, Volume= 6,974 cf
Routed to Pond CB5 :

Routing by Stor-Ind method, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 370.42' @ 12.13 hrs
Flood Elev= 379.45'

Device	Routing	Invert	Outlet Devices
#1	Primary	369.46'	**12.0" Round Culvert** L= 96.7' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 369.46' / 369.18' S= 0.0029 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=1.92 cfs @ 12.13 hrs HW=370.41' (Free Discharge)
1=Culvert (Barrel Controls 1.92 cfs @ 3.21 fps)

Pond CB4:



21123 - Pre-Development
Prepared by Howard Stein Hudson

Summary for Pond CB5:

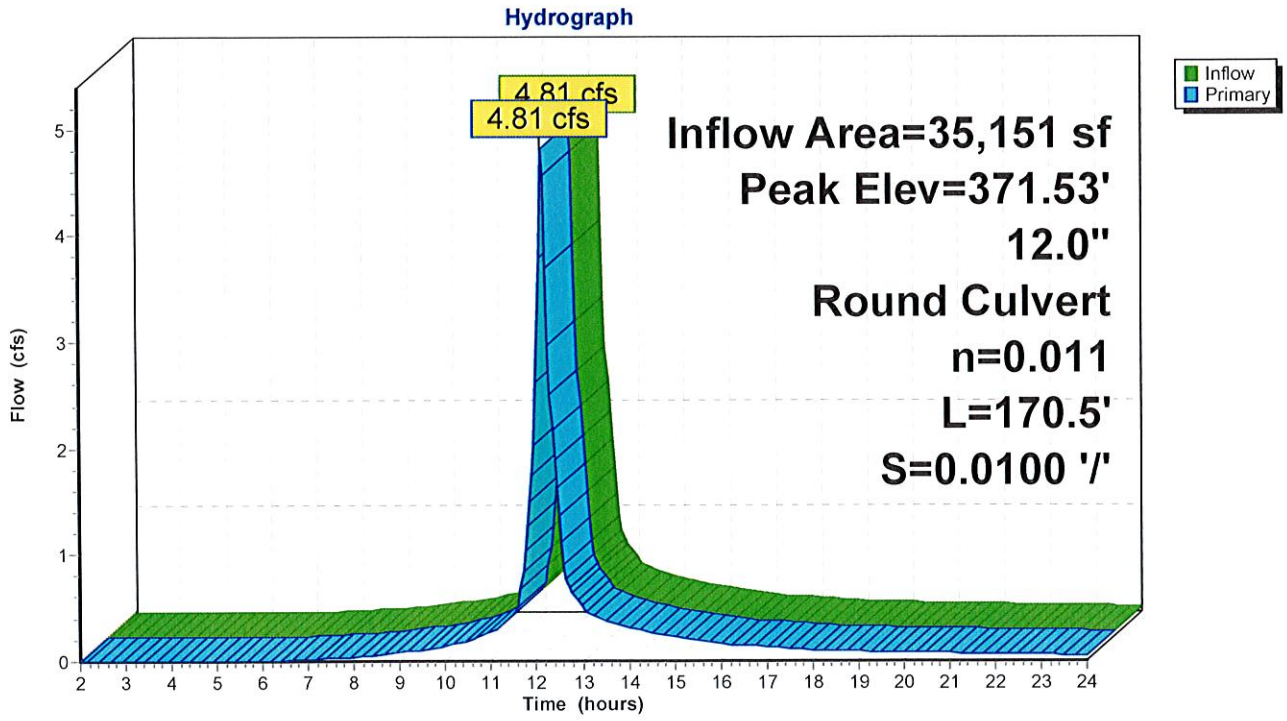
Inflow Area = 35,151 sf, 0.00% Impervious, Inflow Depth > 5.68" for 100-yr event
Inflow = 4.81 cfs @ 12.12 hrs, Volume= 16,633 cf
Outflow = 4.81 cfs @ 12.12 hrs, Volume= 16,633 cf, Atten= 0%, Lag= 0.0 min
Primary = 4.81 cfs @ 12.12 hrs, Volume= 16,633 cf
Routed to Link E-CB : Ex. Pipe Network

Routing by Stor-Ind method, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 371.53' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	369.18'	**12.0" Round Culvert** L= 170.5' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 369.18' / 367.47' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=4.68 cfs @ 12.12 hrs HW=371.41' (Free Discharge)
↑**1=Culvert** (Barrel Controls 4.68 cfs @ 5.96 fps)

Pond CB5:

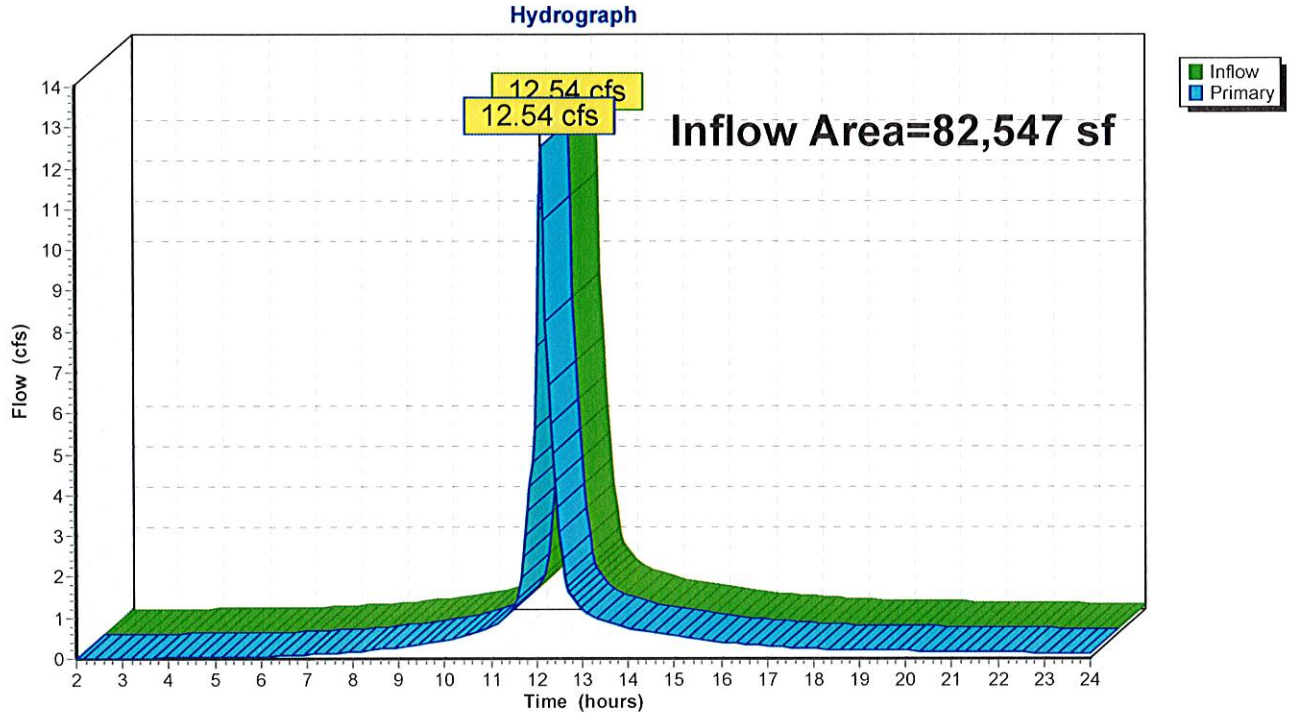


Summary for Link AP1: Drainage Culvert

Inflow Area = 82,547 sf, 25.85% Impervious, Inflow Depth > 6.28" for 100-yr event
Inflow = 12.54 cfs @ 12.10 hrs, Volume= 43,192 cf
Primary = 12.54 cfs @ 12.10 hrs, Volume= 43,192 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs

Link AP1: Drainage Culvert

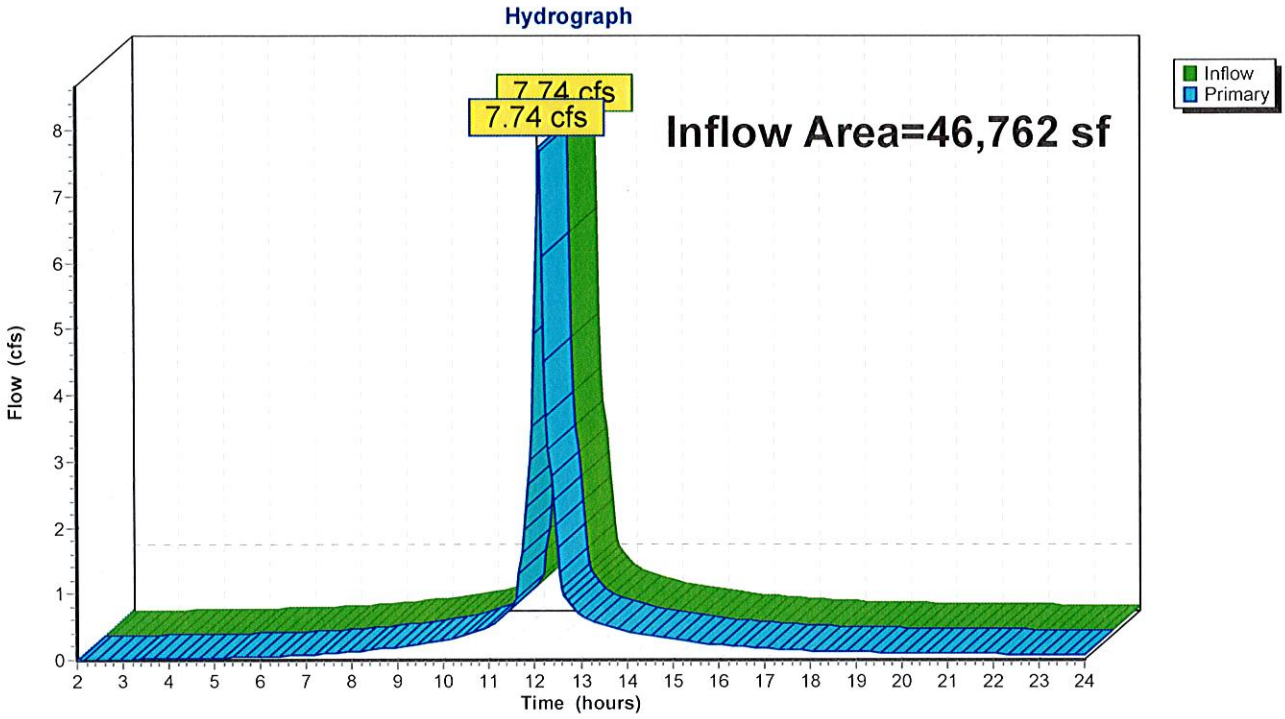


Summary for Link DMH: Ex. Drain Manhole

Inflow Area = 46,762 sf, 44.27% Impervious, Inflow Depth > 6.71" for 100-yr event
Inflow = 7.74 cfs @ 12.09 hrs, Volume= 26,141 cf
Primary = 7.74 cfs @ 12.09 hrs, Volume= 26,141 cf, Atten= 0%, Lag= 0.0 min
Routed to Link AP1 : Drainage Culvert

Primary outflow = Inflow, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs

Link DMH: Ex. Drain Manhole

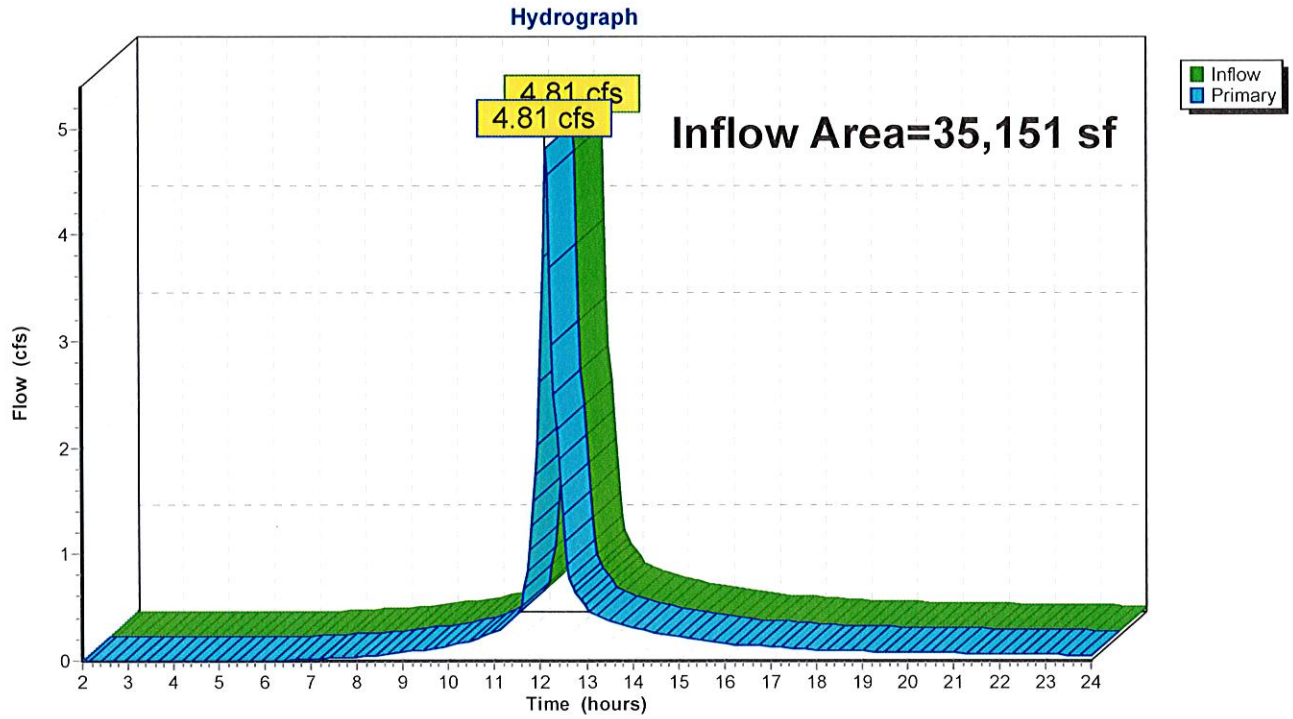


Summary for Link E-CB: Ex. Pipe Network

Inflow Area = 35,151 sf, 0.00% Impervious, Inflow Depth > 5.68" for 100-yr event
Inflow = 4.81 cfs @ 12.12 hrs, Volume= 16,633 cf
Primary = 4.81 cfs @ 12.12 hrs, Volume= 16,633 cf, Atten= 0%, Lag= 0.0 min
Routed to Link AP1 : Drainage Culvert

Primary outflow = Inflow, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs

Link E-CB: Ex. Pipe Network

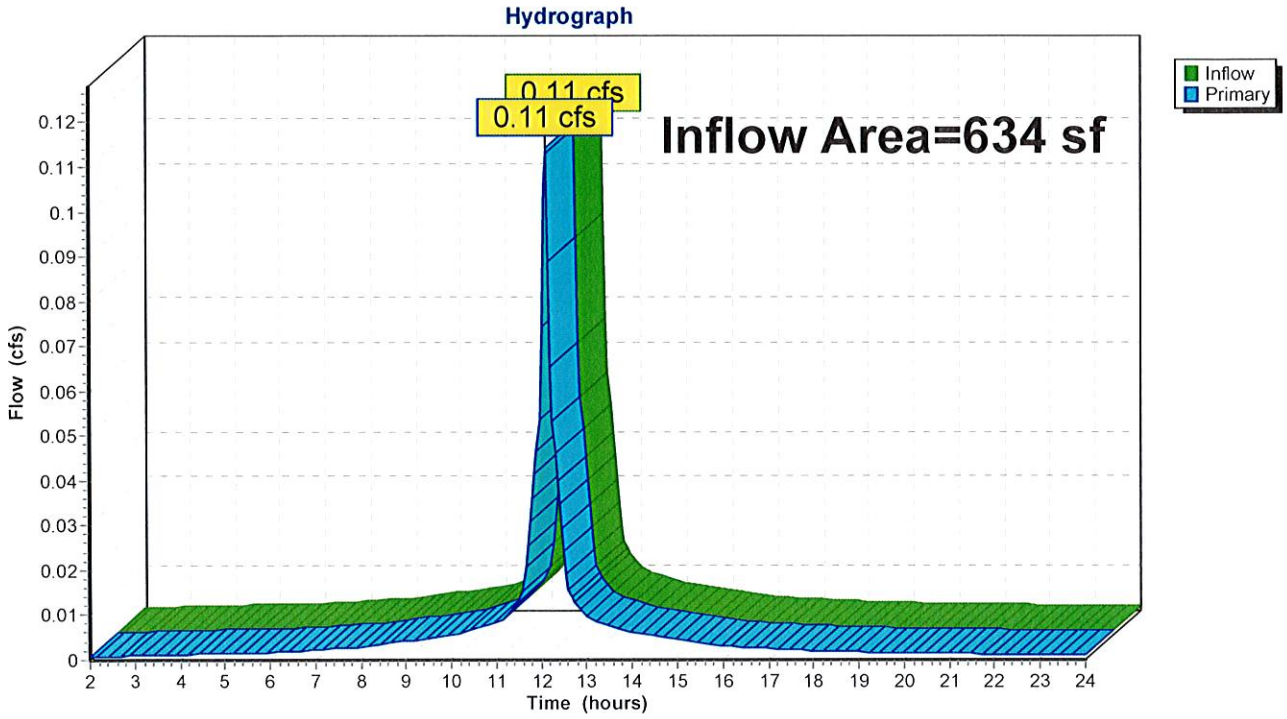


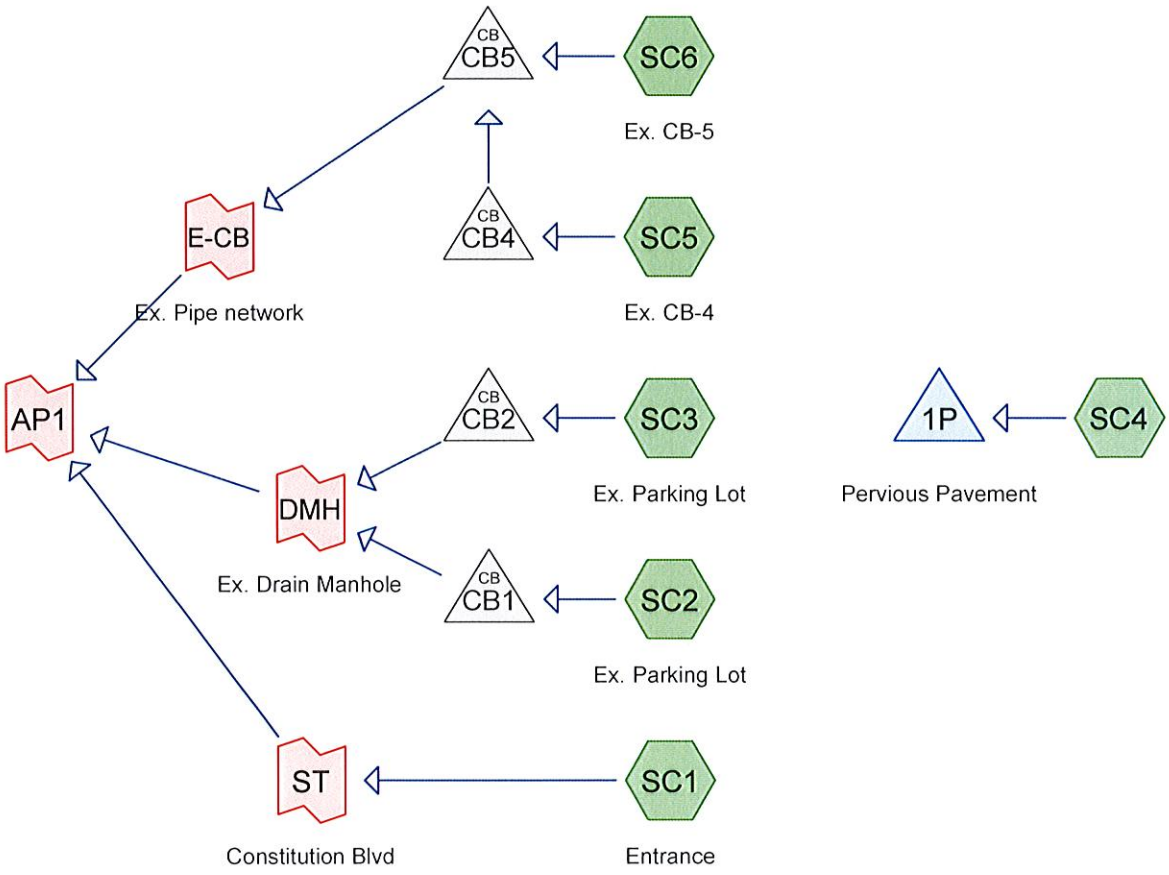
Summary for Link ST: Constitution Blvd

Inflow Area = 634 sf, 100.00% Impervious, Inflow Depth > 7.90" for 100-yr event
Inflow = 0.11 cfs @ 12.09 hrs, Volume= 418 cf
Primary = 0.11 cfs @ 12.09 hrs, Volume= 418 cf, Atten= 0%, Lag= 0.0 min
Routed to Link AP1 : Drainage Culvert

Primary outflow = Inflow, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs

Link ST: Constitution Blvd





Subcat Reach Pond Link

Routing Diagram for 21123 - Post-Development
Prepared by Howard Stein Hudson, Printed 9/13/2021

21123 - Post-Development
Prepared by Howard Stein Hudson

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
30,341	80	>75% Grass cover, Good, HSG D (SC2, SC3, SC4, SC5, SC6)
36,107	98	Paved parking, HSG D (SC1, SC2, SC3, SC4, SC5)
16,099	77	Woods, Good, HSG D (SC3, SC6)
82,547	**87**	**TOTAL AREA**

21123 - Post-Development
Prepared by Howard Stein Hudson

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
0	HSG C	
82,547	HSG D	SC1, SC2, SC3, SC4, SC5, SC6
0	Other	
82,547		**TOTAL AREA**

21123 - Post-Development
Prepared by Howard Stein Hudson

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	S N
0	0	0	30,341	0	30,341	>75% Grass cover, Good	
0	0	0	36,107	0	36,107	Paved parking	
0	0	0	16,099	0	16,099	Woods, Good	
0	**0**	**0**	**82,547**	**0**	**82,547**	**TOTAL AREA**	

Time span=2.00-24.00 hrs, dt=0.05 hrs, 441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment SC1: Entrance Runoff Area=695 sf 100.00% Impervious Runoff Depth>7.90"
Tc=6.0 min CN=98 Runoff=0.13 cfs 458 cf

Subcatchment SC2: Ex. Parking Lot Runoff Area=14,442 sf 62.02% Impervious Runoff Depth>7.11"
Tc=6.0 min CN=91 Runoff=2.50 cfs 8,554 cf

Subcatchment SC3: Ex. Parking Lot Runoff Area=21,531 sf 72.95% Impervious Runoff Depth>7.35"
Tc=6.0 min CN=93 Runoff=3.79 cfs 13,181 cf

Subcatchment SC4: Runoff Area=18,613 sf 55.88% Impervious Runoff Depth>5.86"
Tc=443.0 min CN=90 Runoff=0.34 cfs 9,095 cf

Subcatchment SC5: Ex. CB-4 Runoff Area=2,822 sf 12.33% Impervious Runoff Depth>6.04"
Tc=6.0 min CN=82 Runoff=0.44 cfs 1,419 cf

Subcatchment SC6: Ex. CB-5 Runoff Area=24,444 sf 0.00% Impervious Runoff Depth>5.68"
Flow Length=159' Tc=7.8 min CN=79 Runoff=3.43 cfs 11,568 cf

Pond 1P: Pervious Pavement Peak Elev=381.10' Storage=1,182 cf Inflow=0.34 cfs 9,095 cf
Outflow=0.24 cfs 8,780 cf

Pond CB1: Peak Elev=374.15' Inflow=2.50 cfs 8,554 cf
12.0" Round Culvert n=0.011 L=15.3' S=0.0203 '/' Outflow=2.50 cfs 8,554 cf

Pond CB2: Peak Elev=370.70' Inflow=3.79 cfs 13,181 cf
12.0" Round Culvert n=0.011 L=110.8' S=0.0216 '/' Outflow=3.79 cfs 13,181 cf

Pond CB4: Peak Elev=369.86' Inflow=0.44 cfs 1,419 cf
12.0" Round Culvert n=0.011 L=96.7' S=0.0029 '/' Outflow=0.44 cfs 1,419 cf

Pond CB5: Peak Elev=370.72' Inflow=3.85 cfs 12,987 cf
12.0" Round Culvert n=0.011 L=170.5' S=0.0100 '/' Outflow=3.85 cfs 12,987 cf

Link AP1: Inflow=10.21 cfs 35,180 cf
Primary=10.21 cfs 35,180 cf

Link DMH: Ex. Drain Manhole Inflow=6.29 cfs 21,735 cf
Primary=6.29 cfs 21,735 cf

Link E-CB: Ex. Pipe network Inflow=3.85 cfs 12,987 cf
Primary=3.85 cfs 12,987 cf

Link ST: Constitution Blvd Inflow=0.13 cfs 458 cf
Primary=0.13 cfs 458 cf

Total Runoff Area = 82,547 sf Runoff Volume = 44,275 cf Average Runoff Depth = 6.44"
56.26% Pervious = 46,440 sf 43.74% Impervious = 36,107 sf

Summary for Subcatchment SC1: Entrance

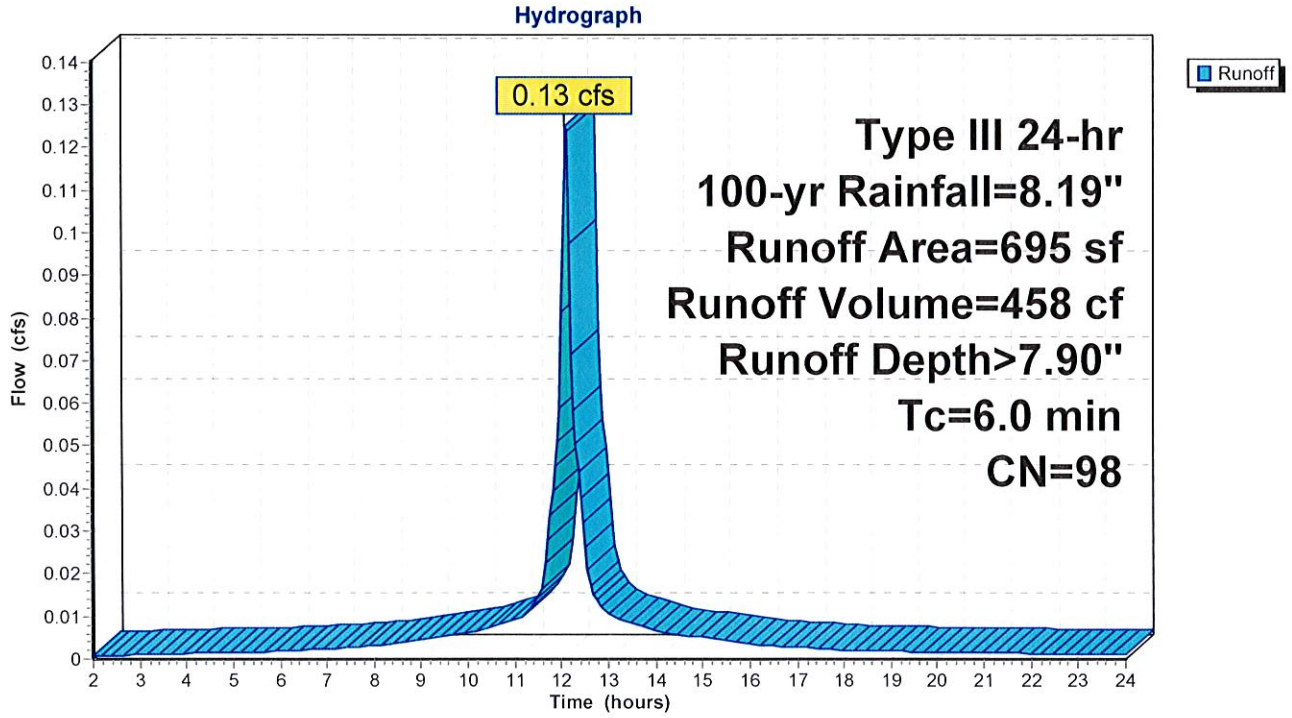
Runoff = 0.13 cfs @ 12.09 hrs, Volume= 458 cf, Depth> 7.90"
Routed to Link ST : Constitution Blvd

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.19"

Area (sf)	CN	Description
695	98	Paved parking, HSG D
695		100.00% Impervious Area

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

Subcatchment SC1: Entrance



Summary for Subcatchment SC2: Ex. Parking Lot

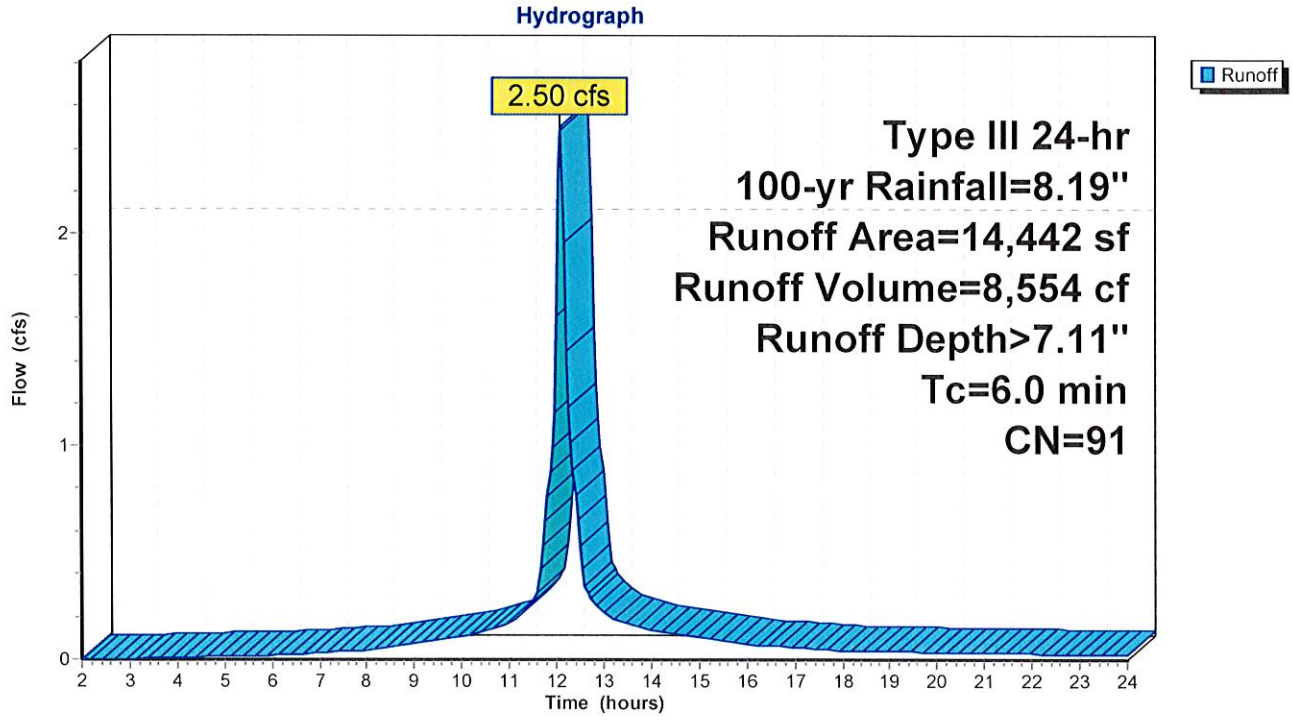
Runoff = 2.50 cfs @ 12.09 hrs, Volume= 8,554 cf, Depth> 7.11"
Routed to Pond CB1 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.19"

Area (sf)	CN	Description
8,957	98	Paved parking, HSG D
5,485	80	>75% Grass cover, Good, HSG D
14,442	91	Weighted Average
5,485		37.98% Pervious Area
8,957		62.02% Impervious Area

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

Subcatchment SC2: Ex. Parking Lot



Summary for Subcatchment SC3: Ex. Parking Lot

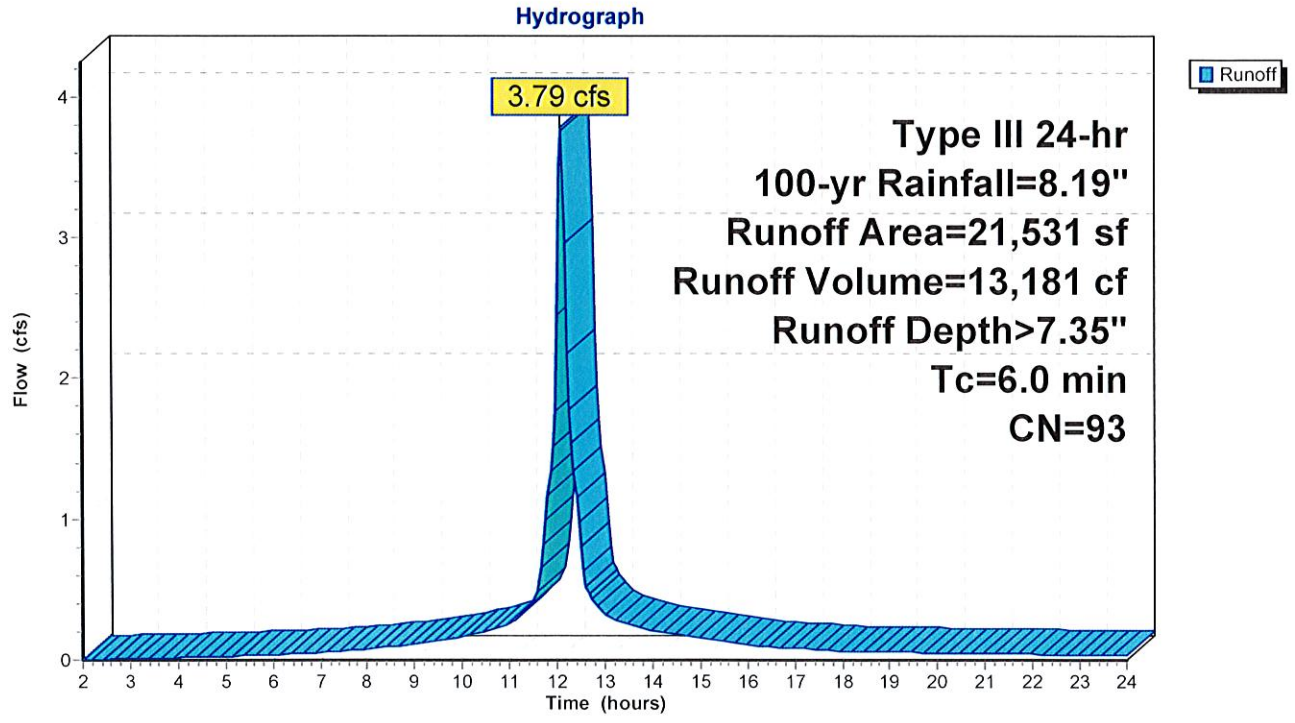
Runoff = 3.79 cfs @ 12.09 hrs, Volume= 13,181 cf, Depth> 7.35"
Routed to Pond CB2 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.19"

Area (sf)	CN	Description
15,706	98	Paved parking, HSG D
1,526	80	>75% Grass cover, Good, HSG D
4,299	77	Woods, Good, HSG D
21,531	93	Weighted Average
5,825		27.05% Pervious Area
15,706		72.95% Impervious Area

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

Subcatchment SC3: Ex. Parking Lot



Summary for Subcatchment SC4:

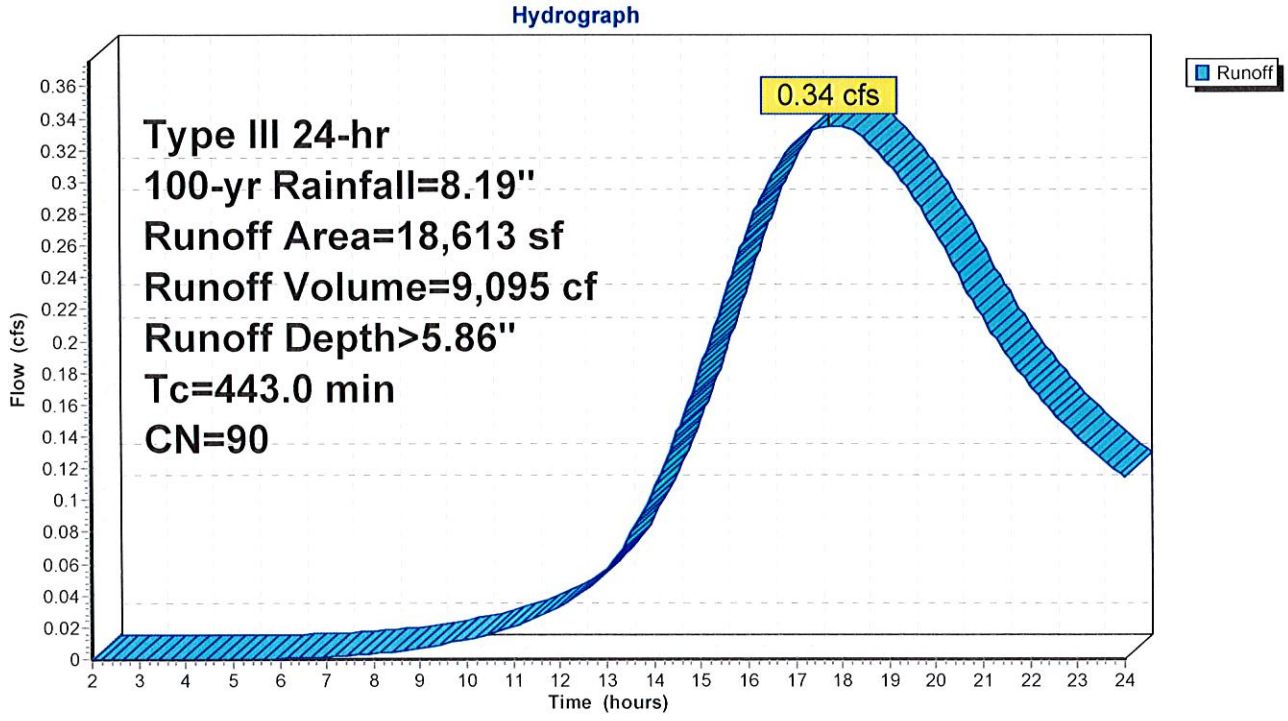
Runoff = 0.34 cfs @ 17.74 hrs, Volume= 9,095 cf, Depth> 5.86"
Routed to Pond 1P : Pervious Pavement

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.19"

Area (sf)	CN	Description
10,401	98	Paved parking, HSG D
8,212	80	>75% Grass cover, Good, HSG D
18,613	90	Weighted Average
8,212		44.12% Pervious Area
10,401		55.88% Impervious Area

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

Subcatchment SC4:



Summary for Subcatchment SC5: Ex. CB-4

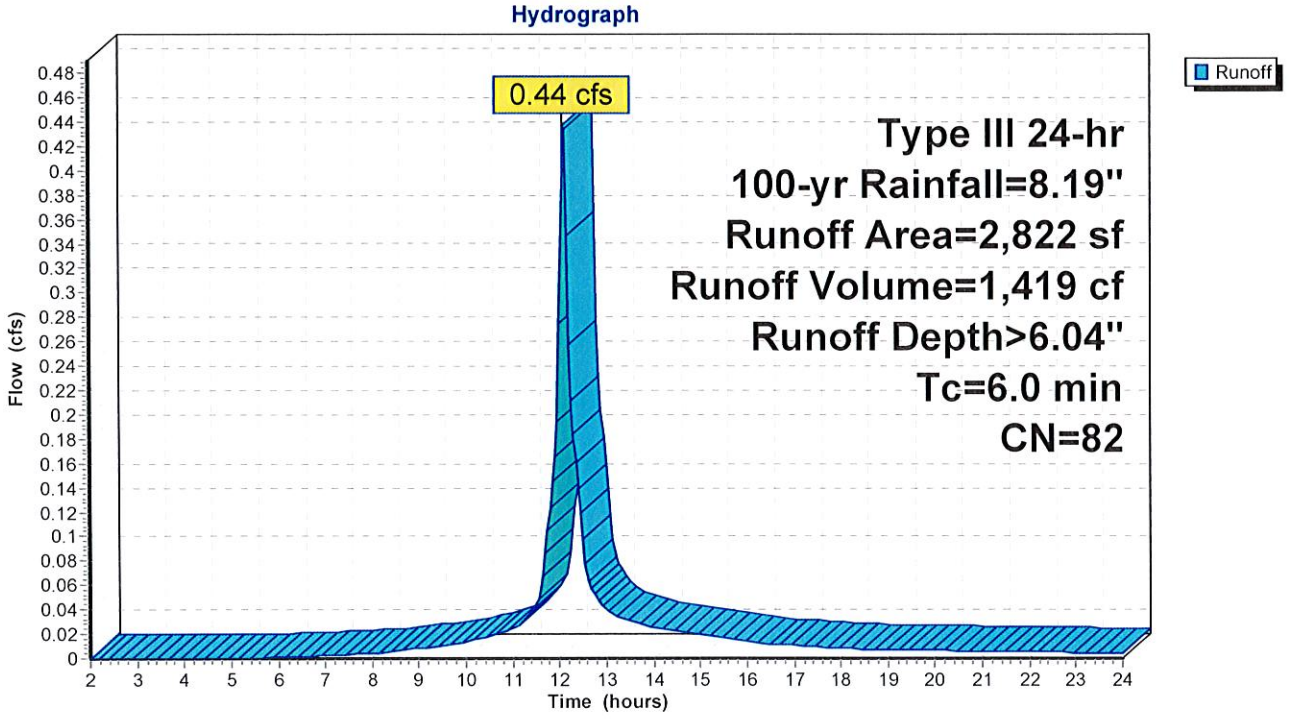
Runoff = 0.44 cfs @ 12.09 hrs, Volume= 1,419 cf, Depth> 6.04"
Routed to Pond CB4 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.19"

Area (sf)	CN	Description
2,474	80	>75% Grass cover, Good, HSG D
348	98	Paved parking, HSG D
2,822	82	Weighted Average
2,474		87.67% Pervious Area
348		12.33% Impervious Area

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

Subcatchment SC5: Ex. CB-4



Summary for Subcatchment SC6: Ex. CB-5

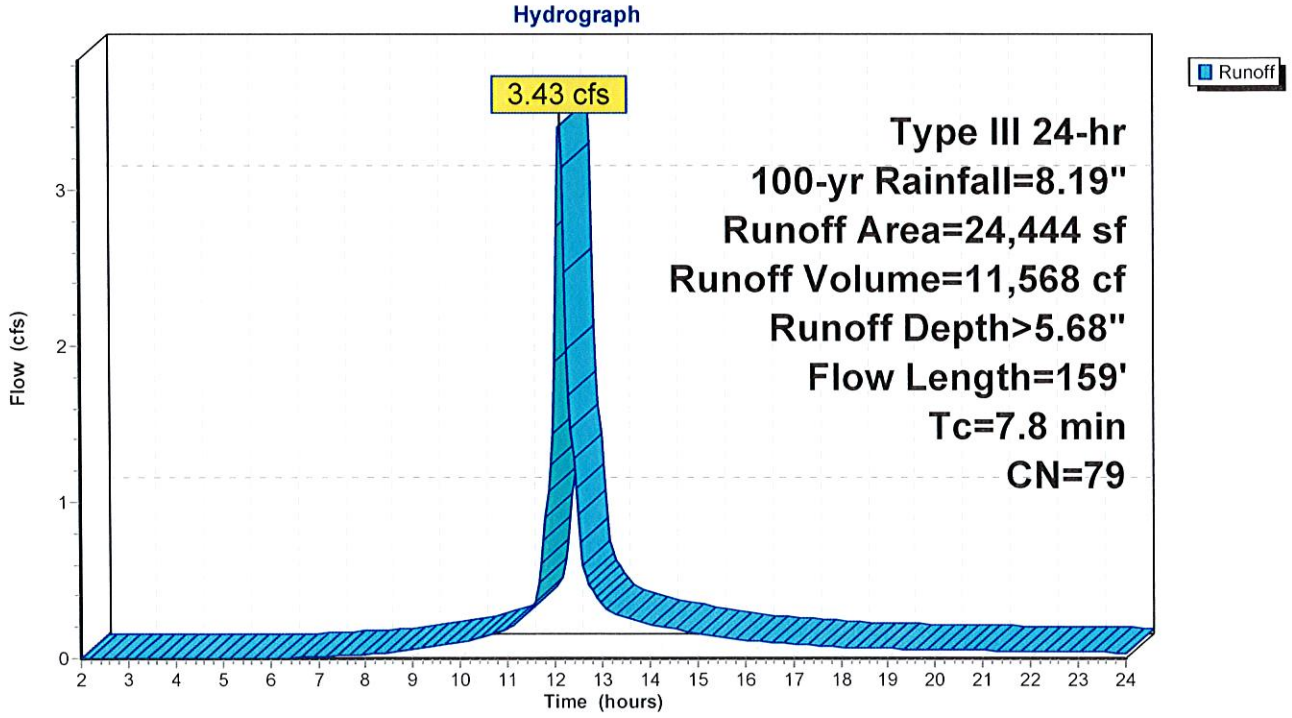
Runoff = 3.43 cfs @ 12.11 hrs, Volume= 11,568 cf, Depth> 5.68"
Routed to Pond CB5 :

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.19"

Area (sf)	CN	Description
12,644	80	>75% Grass cover, Good, HSG D
11,800	77	Woods, Good, HSG D
24,444	79	Weighted Average
24,444		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	50	0.0800	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.36"
0.8	63	0.0630	1.25		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	46	0.2600	7.65		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
7.8	159	Total			

Subcatchment SC6: Ex. CB-5



Summary for Pond 1P: Pervious Pavement

Inflow Area = 18,613 sf, 55.88% Impervious, Inflow Depth > 5.86" for 100-yr event
Inflow = 0.34 cfs @ 17.74 hrs, Volume= 9,095 cf
Outflow = 0.24 cfs @ 15.60 hrs, Volume= 8,780 cf, Atten= 30%, Lag= 0.0 min
Discarded = 0.24 cfs @ 15.60 hrs, Volume= 8,780 cf

Routing by Stor-Ind method, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 381.10' @ 20.58 hrs Surf.Area= 9,990 sf Storage= 1,182 cf

Plug-Flow detention time= 41.3 min calculated for 8,760 cf (96% of inflow)
Center-of-Mass det. time= 29.6 min (1,122.3 - 1,092.7)

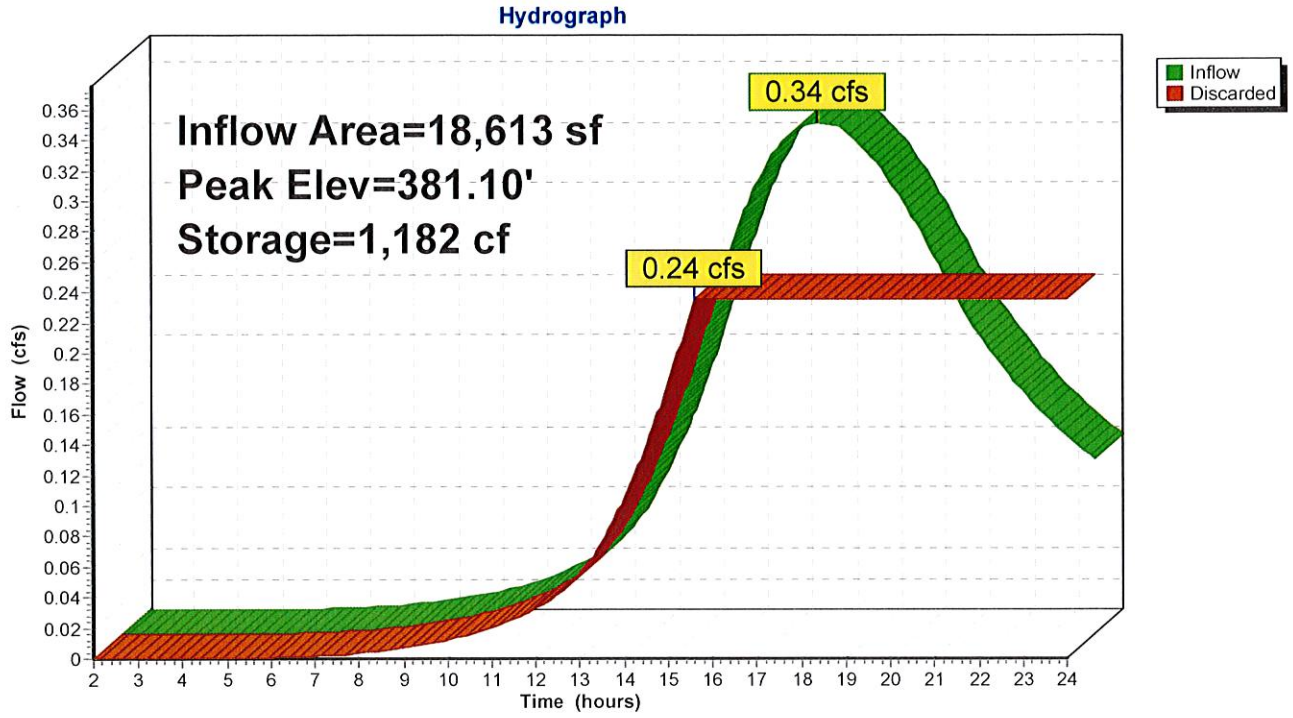
Volume	Invert	Avail.Storage	Storage Description
#1	380.80'	1,319 cf	**Stone Reservoir (Prismatic)**Listed below (Recalc) 3,297 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
380.80	9,990	0	0
381.13	9,990	3,297	3,297

Device	Routing	Invert	Outlet Devices
#1	Discarded	380.80'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.24 cfs @ 15.60 hrs HW=380.80' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.24 cfs)

Pond 1P: Pervious Pavement



Summary for Pond CB1:

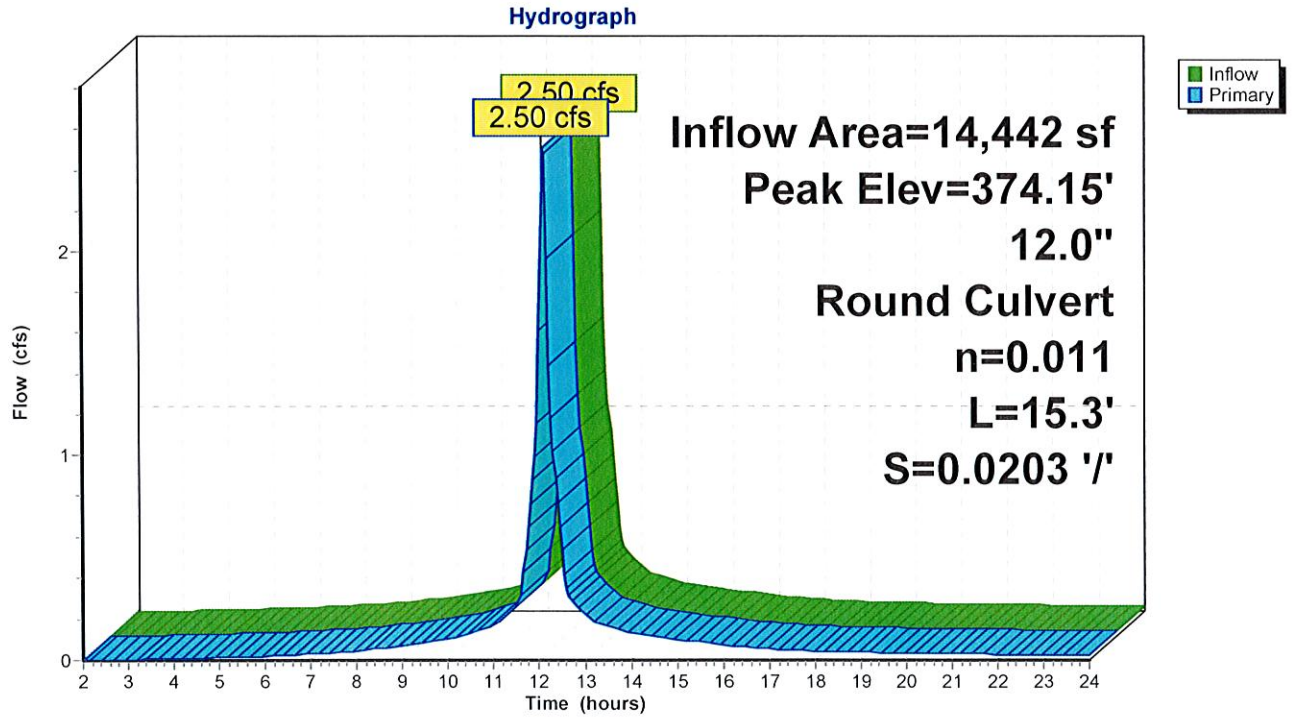
Inflow Area = 14,442 sf, 62.02% Impervious, Inflow Depth > 7.11" for 100-yr event
Inflow = 2.50 cfs @ 12.09 hrs, Volume= 8,554 cf
Outflow = 2.50 cfs @ 12.09 hrs, Volume= 8,554 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.50 cfs @ 12.09 hrs, Volume= 8,554 cf
Routed to Link DMH : Ex. Drain Manhole

Routing by Stor-Ind method, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 374.15' @ 12.09 hrs
Flood Elev= 377.18'

Device	Routing	Invert	Outlet Devices
#1	Primary	373.22'	**12.0" Round Culvert** L= 15.3' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 373.22' / 372.91' S= 0.0203 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=2.44 cfs @ 12.09 hrs HW=374.13' (Free Discharge)
1=Culvert (Inlet Controls 2.44 cfs @ 3.25 fps)

Pond CB1:



Summary for Pond CB2:

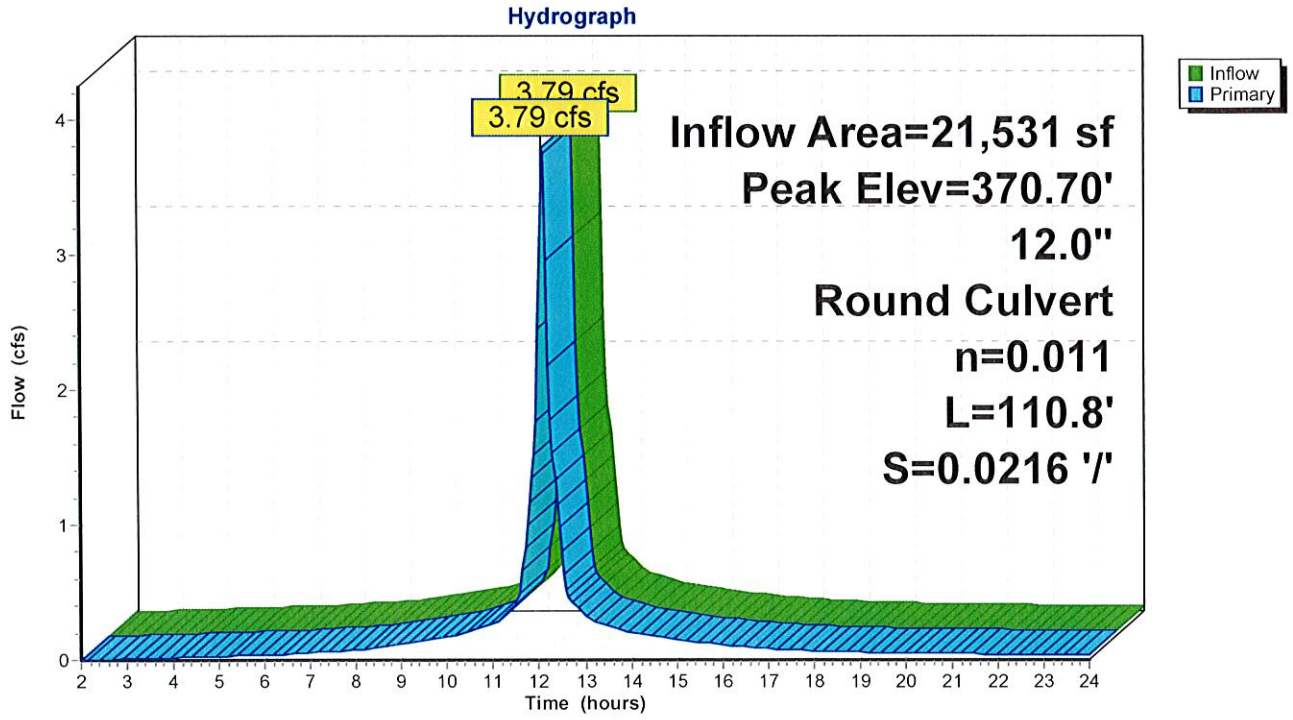
Inflow Area = 21,531 sf, 72.95% Impervious, Inflow Depth > 7.35" for 100-yr event
Inflow = 3.79 cfs @ 12.09 hrs, Volume= 13,181 cf
Outflow = 3.79 cfs @ 12.09 hrs, Volume= 13,181 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.79 cfs @ 12.09 hrs, Volume= 13,181 cf
Routed to Link DMH : Ex. Drain Manhole

Routing by Stor-Ind method, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 370.70' @ 12.09 hrs
Flood Elev= 375.29'

Device	Routing	Invert	Outlet Devices
#1	Primary	369.20'	**12.0" Round Culvert** L= 110.8' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 369.20' / 366.81' S= 0.0216 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=3.69 cfs @ 12.09 hrs HW=370.65' (Free Discharge)
1=Culvert (Inlet Controls 3.69 cfs @ 4.70 fps)

Pond CB2:



Summary for Pond CB4:

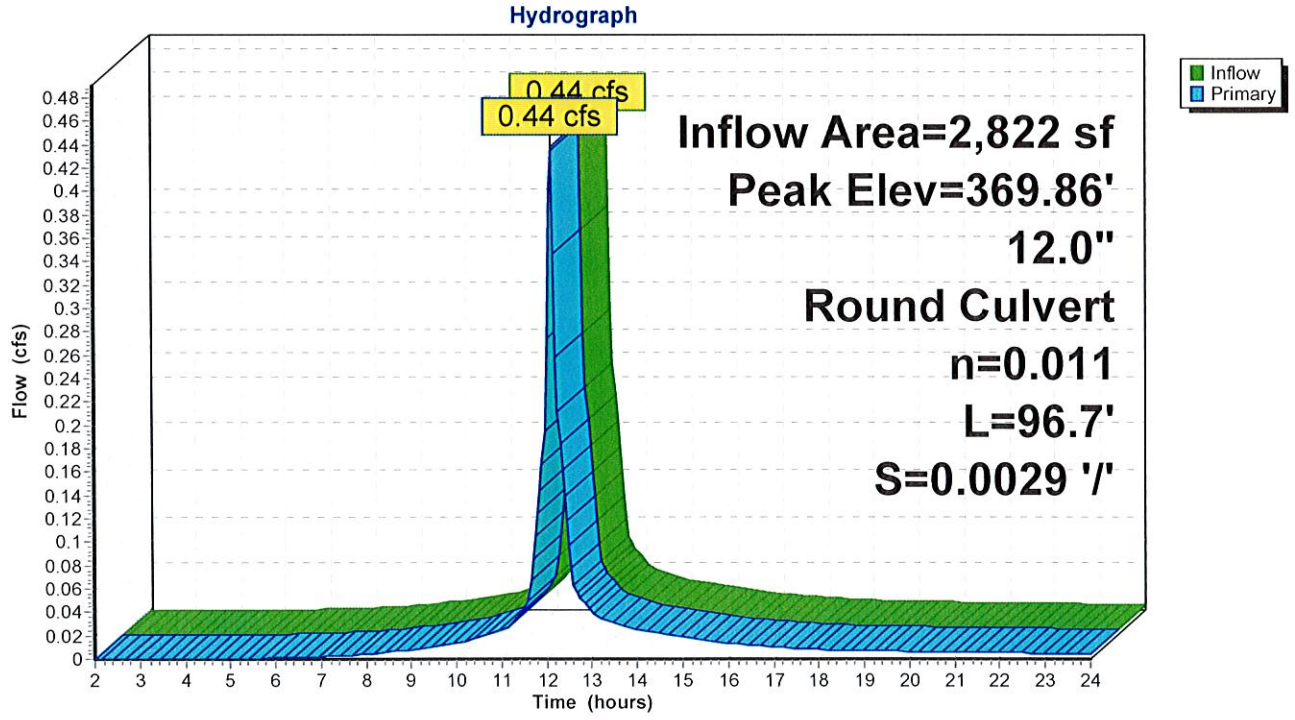
Inflow Area = 2,822 sf, 12.33% Impervious, Inflow Depth > 6.04" for 100-yr event
Inflow = 0.44 cfs @ 12.09 hrs, Volume= 1,419 cf
Outflow = 0.44 cfs @ 12.09 hrs, Volume= 1,419 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.44 cfs @ 12.09 hrs, Volume= 1,419 cf
Routed to Pond CB5 :

Routing by Stor-Ind method, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 369.86' @ 12.09 hrs
Flood Elev= 379.45'

Device	Routing	Invert	Outlet Devices
#1	Primary	369.46'	**12.0" Round Culvert** L= 96.7' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 369.46' / 369.18' S= 0.0029 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=0.43 cfs @ 12.09 hrs HW=369.86' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 0.43 cfs @ 2.18 fps)

Pond CB4:



Summary for Pond CB5:

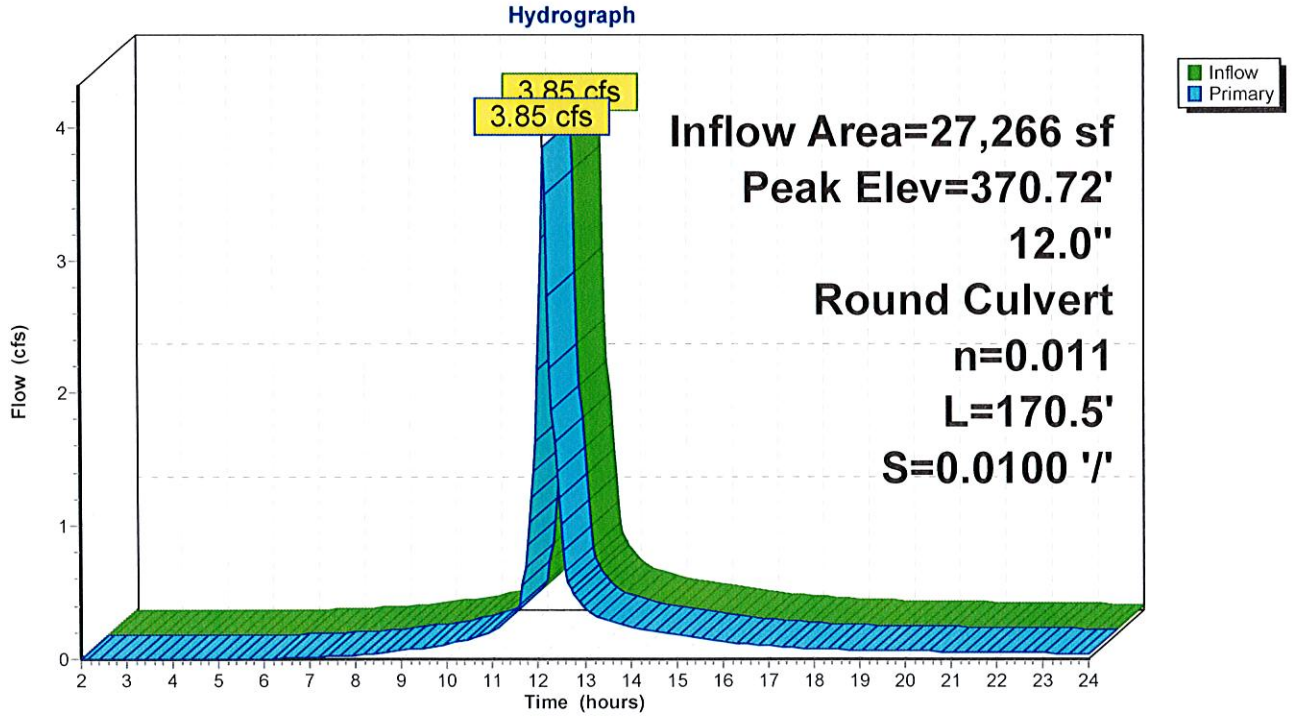
Inflow Area = 27,266 sf, 1.28% Impervious, Inflow Depth > 5.72" for 100-yr event
Inflow = 3.85 cfs @ 12.11 hrs, Volume= 12,987 cf
Outflow = 3.85 cfs @ 12.11 hrs, Volume= 12,987 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.85 cfs @ 12.11 hrs, Volume= 12,987 cf
Routed to Link E-CB : Ex. Pipe network

Routing by Stor-Ind method, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 370.72' @ 12.11 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	369.18'	**12.0" Round Culvert** L= 170.5' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 369.18' / 367.47' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=3.79 cfs @ 12.11 hrs HW=370.68' (Free Discharge)
1=Culvert (Inlet Controls 3.79 cfs @ 4.82 fps)

Pond CB5:

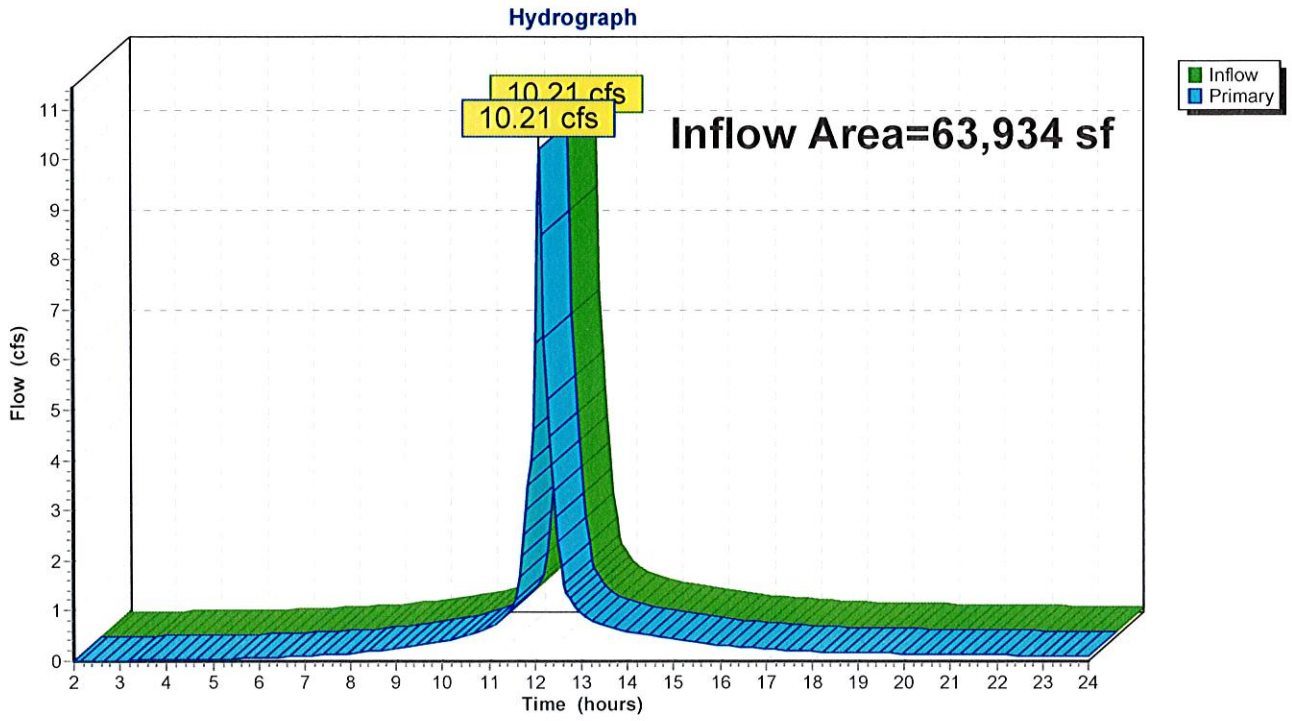


Summary for Link AP1:

Inflow Area = 63,934 sf, 40.21% Impervious, Inflow Depth > 6.60" for 100-yr event
Inflow = 10.21 cfs @ 12.09 hrs, Volume= 35,180 cf
Primary = 10.21 cfs @ 12.09 hrs, Volume= 35,180 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs

Link AP1:

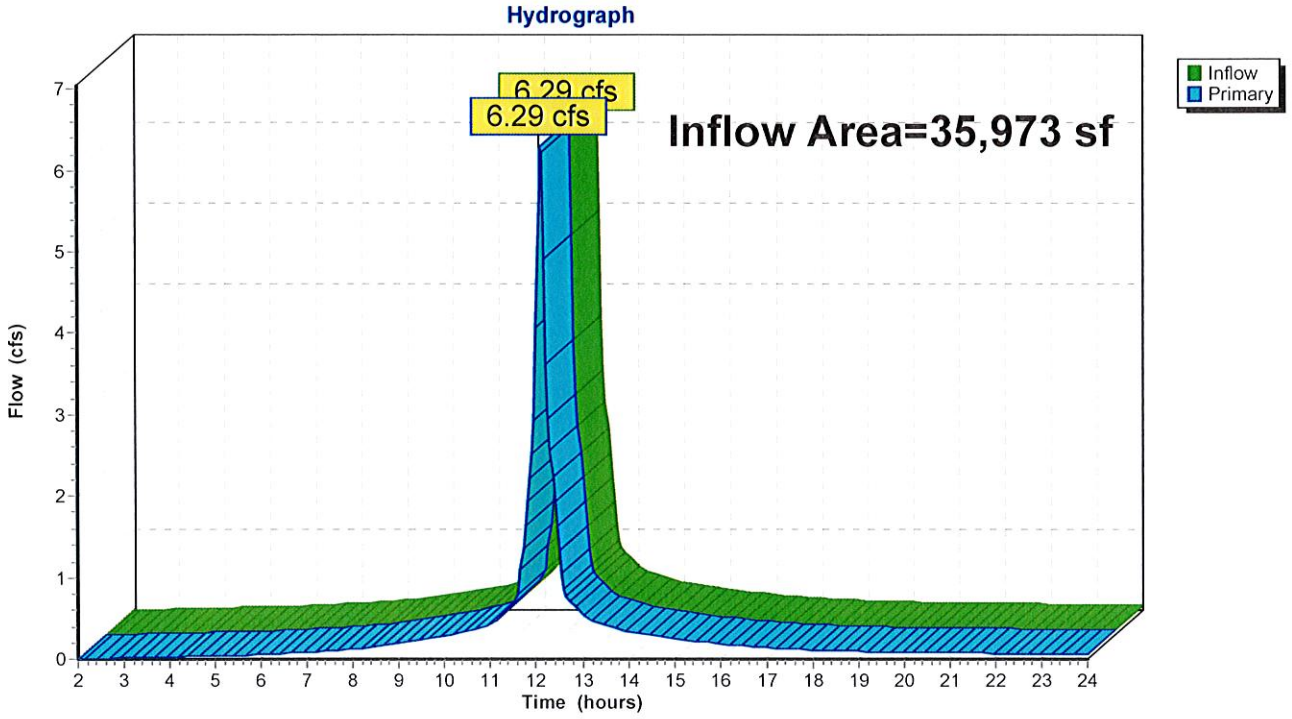


Summary for Link DMH: Ex. Drain Manhole

Inflow Area = 35,973 sf, 68.56% Impervious, Inflow Depth > 7.25" for 100-yr event
Inflow = 6.29 cfs @ 12.09 hrs, Volume= 21,735 cf
Primary = 6.29 cfs @ 12.09 hrs, Volume= 21,735 cf, Atten= 0%, Lag= 0.0 min
Routed to Link AP1 :

Primary outflow = Inflow, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs

Link DMH: Ex. Drain Manhole

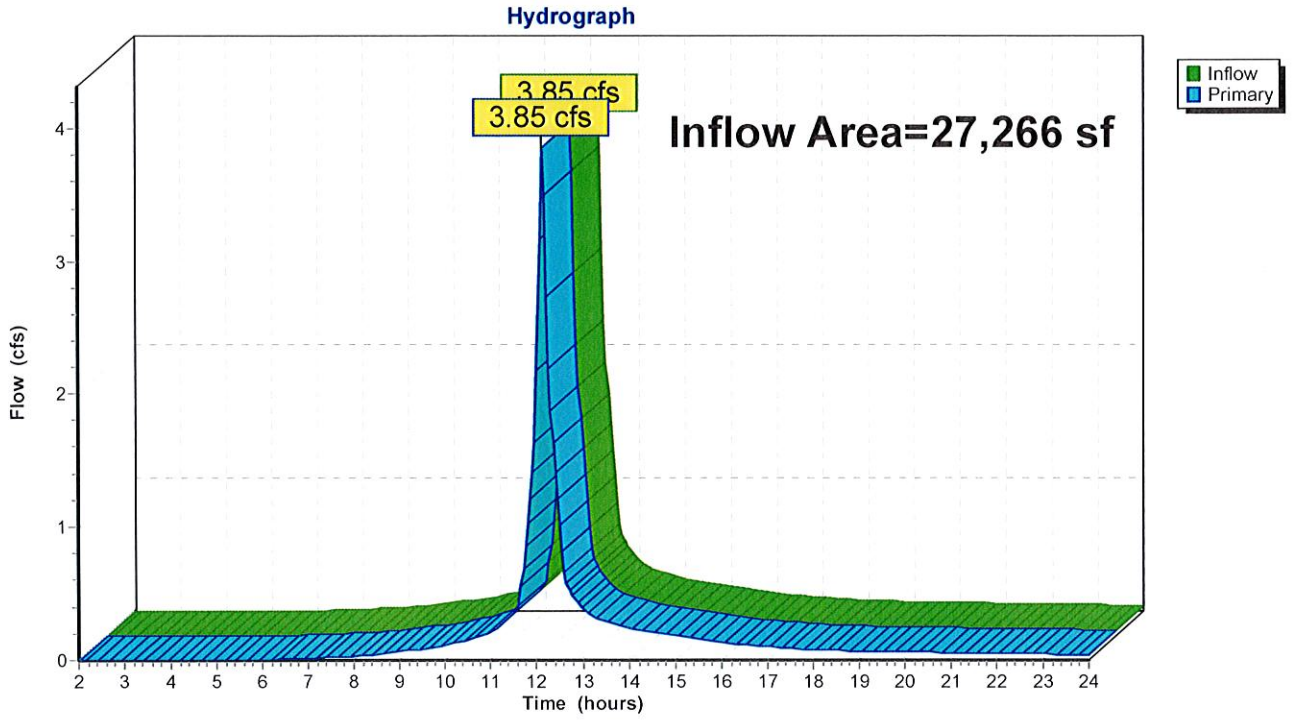


Summary for Link E-CB: Ex. Pipe network

Inflow Area = 27,266 sf, 1.28% Impervious, Inflow Depth > 5.72" for 100-yr event
Inflow = 3.85 cfs @ 12.11 hrs, Volume= 12,987 cf
Primary = 3.85 cfs @ 12.11 hrs, Volume= 12,987 cf, Atten= 0%, Lag= 0.0 min
Routed to Link AP1 :

Primary outflow = Inflow, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs

Link E-CB: Ex. Pipe network

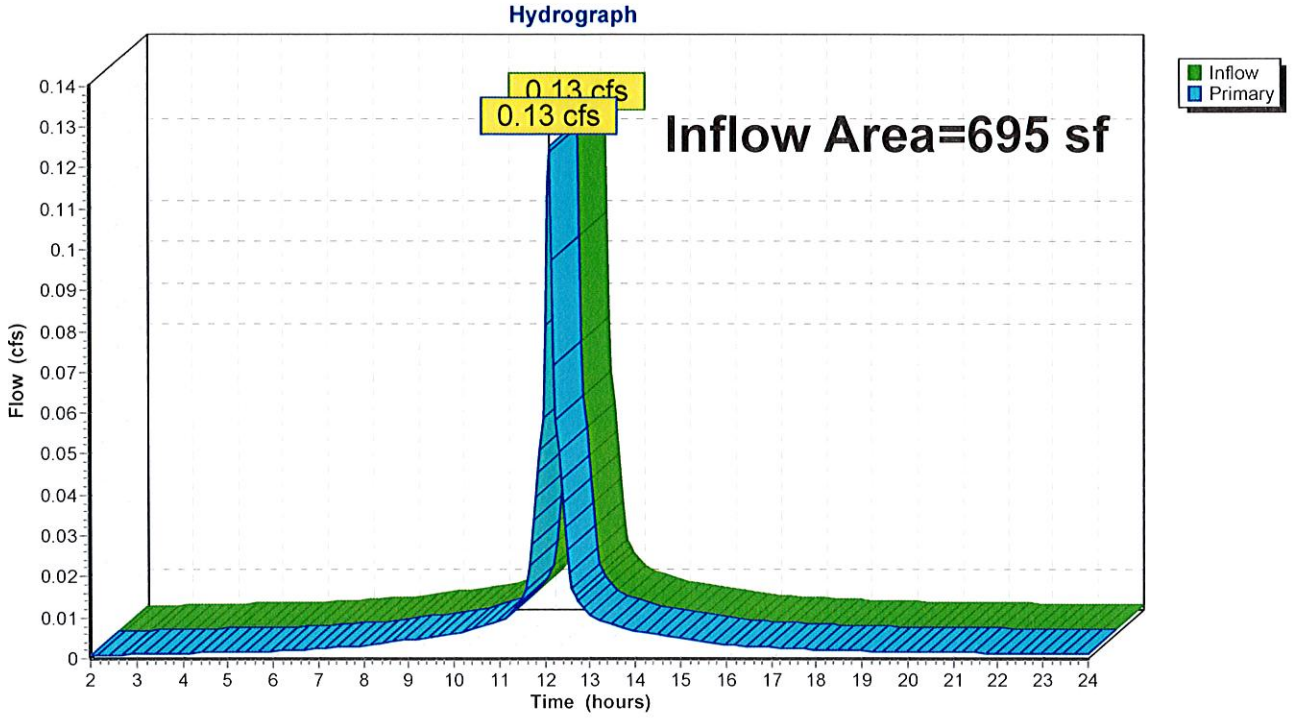


Summary for Link ST: Constitution Blvd

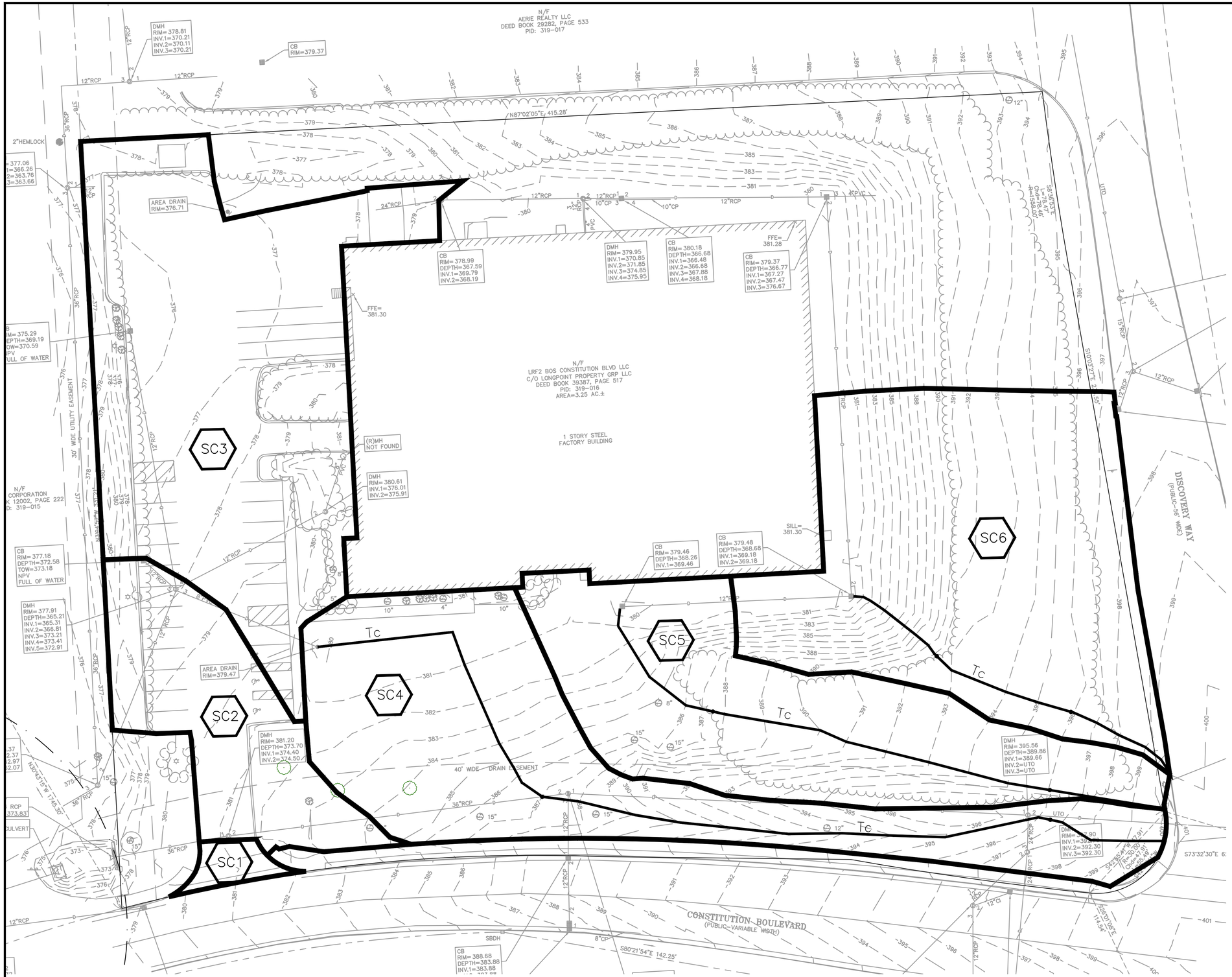
Inflow Area = 695 sf,100.00% Impervious, Inflow Depth > 7.90" for 100-yr event
Inflow = 0.13 cfs @ 12.09 hrs, Volume= 458 cf
Primary = 0.13 cfs @ 12.09 hrs, Volume= 458 cf, Atten= 0%, Lag= 0.0 min
Routed to Link AP1 :

Primary outflow = Inflow, Time Span= 2.00-24.00 hrs, dt= 0.05 hrs

Link ST: Constitution Blvd



Appendix D: Drainage Maps



HOWARD STEIN HUDSON
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Boston, MA 02108
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PREPARED FOR:

PARKING LOT EXPANSION

120 CONSTITUTION BLVD
FRANKLIN, MA, 02038

REVISIONS:

NO	BY	DATE	DESCRIPTION

SITE PLAN

PRE-DEVELOPMENT MAP

DATE:	9/13/2021
PROJECT NUMBER:	21123
DESIGNED BY:	KL
DRAWN BY:	KL
CHECKED BY:	KE

C1.0

SHEET 1 OF 2

9/14/2021 L:\21123\CURRENT\21123 - Drainage Maps.dwg
Last Saved by: KLARGE
Printed by: Katie Enright

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11 Beacon Street, Suite 1010
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PREPARED FOR:

PARKING LOT EXPANSION
120 CONSTITUTION BLVD
FRANKLIN, MA, 02038

REVISIONS:

NO	BY	DATE	DESCRIPTION

SITE PLAN

POST-DEVELOPMENT MAP

DATE:	9/13/2021
PROJECT NUMBER:	21123
DESIGNED BY:	KL
DRAWN BY:	KL
CHECKED BY:	KE

C2.0

SHEET 2 OF 2

9/14/2021 L:\21123\CURRENT\21123 - Drainage Maps.dwg
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