

July 13, 2021

City of New Bedford
Conservation Commission
New Bedford City Hall
133 William Street
New Bedford, MA 02744

RE: Panagakos Development
Development Review
CEC Project: 304-118

Dear Commissioners:

Please see the attached revised plan sets and drainage reports for the Panagakos Development project on Phillips Road. In response to the July 6th comment letter from Nitsch Engineering, SITEC has revised the plan set and drainage report and prepared the following responses to each comment:

Nitsch Engineering comments, May 27, 2021

- 1) The proposed contours have been labeled.
- 2) This item has been addressed.
- 3) This item has been addressed.
- 4) The leader location has been revised on Sheet 5 of 9.
- 5) This item has been addressed.
- 6) This item has been addressed
- 7) This item has been addressed.
- 8) The discharge elevation has been revised to 90.6, resulting in a 1% slope for the 40' pipe.
- 9) The rip rap has been labeled on the plan set with the proposed lengths.
- 10) This item has been addressed.
- 11) This item has been addressed.
- 12) The requested information has been added to the revised report.
- 13) This item has been addressed.
- 14) The recharge volume has been recalculated using a Rawl's Rate of 2.41 in/hr.
- 15) The drainage calculations have been revised to use a Rawl's Rate of 2.41 in/hr.
- 16) This item has been addressed.
- 17) This item has been addressed.

If you should have any further questions or comments, please feel free to contact me.

Sincerely,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.



Daniel S. Gioiosa
Project Manager II



Steven D. Gioiosa, P.E.
Vice President

July 6, 2021

Mr. Dennis Audette
Chairman
New Bedford Conservation Commission
New Bedford City Hall
133 William Street
New Bedford, MA 02744

RE: Nitsch Project #9972
Panagakos Development
Phillips Road
Stormwater Review
New Bedford, MA

Dear Mr. Audette:

This letter is regarding the stormwater review associated with the Notice of Intent (NOI) submitted for the proposed commercial building development located at the corner of Theodore Rice Boulevard and Phillips Road. In response to our comment letter issued on May 27, 2021, Nitsch Engineering received and reviewed the following documents:

- Plans entitled "Assessor's Map 136 – Lot 468, Phillips Road, New Bedford, Massachusetts," prepared by SITEC, dated March 26, 2021, revised June 15, 2021;
- Stormwater Report entitled "Drainage Report – Proposed Commercial Building, Phillips Road, New Bedford, MA," prepared by SITEC, dated March 26, 2021, revised June 15, 2021;
- A letter entitled "Panagakos Development," prepared by SITEC, dated June 29, 2021; and
- A MassDEP Stormwater Report Checklist.

For clarity, we have provided our initial comments from May 27, 2021 in **blue font**, the SITEC response in black font, and our updated response is provided in **blue bolded font**.

GENERAL COMMENTS

1. The southeast corner of the lot near the loading delivery area appears to have contours that are not labeled. Please label these contours.

The contours have been labeled just beyond the subject property line for clarification.

The contours do not appear to have been labeled. To clarify, southeast of the loading delivery area there appear to be contours that drop off at a 3:1 slope towards the property line. Nitsch Engineering recommends at a minimum labeling the major contours in this area to clarify the grading.

2. All impervious areas to drain towards the proposed inlets.

All proposed impervious areas will drain towards the two catch basins.

This item has been addressed.

3. Add inverts to roof drains exiting the building.

The requested inverts have been added to the Site Utilities sheet (SU-1, 5 of 9).

This item has been addressed.

4. Rename the proposed inlets so that there is a CB#1 and a CB#2.

The catch basins have been renamed as requested.

The leader for CB#2 does not point to the location of the catch basin. Please address.

5. Label all drainage pipe sizes.

Drainage pipes have been labeled on the Site Utilities sheet (SU-1, 5 of 9).

This item has been addressed.

6. The TSS removal summary table located under Stormwater Standard No.4 – Water Quality Volume and the TSS Removal Calculation Worksheet in the Drainage Report includes deep sump catch basins. Deep sump catch basins are not proposed for the project. The Applicant shall update the report to remove reference to the deep sump catch basins.

Deep sump catch basins have been removed from the report and worksheet.

This item has been addressed.

7. The southernmost CB outlet pipe has a pipe slope of 27%. Nitsch Engineering recommends lowering the invert out of the Stormceptor structure to reduce the pipe slope and discharge velocity to prevent downstream erosion.

Catch Basin #2 has been revised to a 10' length with a 2% slope

This item has been addressed.

8. The HydroCAD model shows the stormwater infiltration system has an 8-inch outlet pipe with an invert of 91.20 feet, which is consistent with the plans. Per the "Cultec Contactor 330xLHD Typical Cross Section Detail" the top of chamber is 91.54 feet. The invert for the outlet pipe appears to be too high to work with the proposed system and header configuration. Nitsch Engineering recommends lowering the invert out of the system as necessary and maintaining a minimum 1% pipe slope to the discharge point or provide a manhole structure to allow for the crown of the outlet pipe to be higher than the top of chamber elevation. The infiltration system outlet pipe elevation shall also be checked to confirm a minimum of 2 feet of cover is provided.

The hydrocad model has been revised, along with the plan set and detail to address the concern. The invert has been revised to 91.00 with 4" pvc pipe connected to the 8" HDPE header. This will provide more than 2 feet of cover over the outlet pipe.

The 8" HDPE outlet pipe exits the system at an elevation of 91 feet and discharges to a riprap at an elevation of 90.9 feet. This results in a slope of 0.33 percent. Nitsch recommends lowering the discharge invert elevation to maintain a minimum slope of 1 percent.

9. All work shall be outside the 25-foot wetland buffer zone, including the retaining wall and discharge points. Per the "Flared End W/ Riprap Detail" the riprap shall have a minimum length of approximately 12 feet. The riprap on the plans is shown to be approximately 4.5 feet to avoid the 25-foot wetland buffer zone, which contrasts from the detail. Nitsch Engineering recommends updating the detail to reflect the plan or relocating the discharge points to meet the 12-foot requirement per the detail. If the former option is chosen, please explain how slope stabilization in this area is adequate to prevent erosion.

All work has been moved outside of the 25 foot buffer zone. The detail has been revised and the rip rap length from the outlet of catch basin #2 has been increased to 9 feet. The 10 year flow rate to this catch basin is 0.3 cfs, resulting in a velocity through the proposed 10" HDPE discharge pipe of 4.5 fps.

Nitsch Engineering recommends labeling the riprap ramp on the plans or specifying the lengths in the detail.

MASSDEP STORMWATER MANAGEMENT STANDARDS

10. The MassDEP Stormwater Management Standards require that Applicants consider environmentally sensitive site design and low impact development (LID) techniques to manage stormwater. These should include reducing impervious surfaces, disconnecting flow paths, treating stormwater at its source, using decentralized systems, maximizing open space, minimizing disturbance, protecting natural features and processes, and enhancing wildlife habitat. There appears to be opportunities to consider additional LID techniques within the proposed project site. These may include considering making the parking lot one-way to reduce pavement widths and use of vegetated areas and natural processes to provide stormwater treatment (i.e., rain gardens, bioretention, bioswales, or tree filters). These types of systems may offset the need for catch basins and proprietary water quality structures and will reduce the size of the subsurface infiltration system.

With the unique shape of the lot, impervious areas and the limit of work have been minimized to provide the greatest open space possible while maintaining a 25 buffer zone to the bordering vegetated wetland. In order to avoid a one way traffic circulation the minimum required drive aisle width of 22 feet is proposed. The parking layout has been approved by the Planning Board.

This item has been addressed.

11. The Applicant shall provide a stamped and signed Stormwater Report Certification and Checklist per the Stormwater Management Standards.

A stamped and signed copy of the Stormwater Report certification and checklist is attached as requested.

This item has been addressed.

12. The Applicant should provide an Illicit Discharge Compliance Statement as required per Standard 10 in the Checklist for Stormwater Report.

An Illicit Discharge Compliance Statement has been included with the revised report.

This item has been addressed. Nitsch Engineering recommends updating the Stormwater Standard No. 10 on Page 4 of the Drainage Report to reflect that an Illicit Discharge Statement has been provided.

13. Page 2 of the drainage report states that the 25-year storm was analyzed, but it does not appear that it was accounted for in the HydroCAD calculations. Nitsch Engineering recommends including the 25-year storm in the HydroCAD calculations or updating the text so that it is consistent with the calculations.

The Stormwater Report has been revised to reflect the storms analysis.

This item has been addressed.

14. The Applicant shall provide calculations for the required recharge volume and the recharge volume provided. Additionally, the Applicant shall provide drawdown calculations confirming that the infiltration system will drain completely within 72 hours.

The required recharge volume is 0.018 Acre-feet. 0.084 Acre-feet of recharge is provided for the 2-year storm. The calculation for the complete drain drawdown within 72 hours has been added to the end of the hydrocad report.

Per Comment No. 15 below, the recharge volume shall be recalculated using a Rawl's Rate of 2.41 in/hr.

15. The Drainage Report appears to use the Natural Resources Conservation Service (NRCS) Web Soil survey to obtain soil information for the HydroCAD model. The stormwater infiltration system appears to be within soil type 260A – Sudbury Fine Sandy Loam per the Proposed Conditions Drainage Plan which is a Hydrologic Soil Group B. Per the Massachusetts Stormwater Handbook, the infiltration rate for this type of soil is 1.02 inches per hour. The HydroCAD model appears to use an infiltration rate of 8.27 inches per hour which is indicative of a Hydrologic Soil Group A – sand soil. Nitsch Engineering recommends updating the infiltration rate to reflect Sandy Loam, or conduct test pits by a licensed soil evaluator showing that sand is present in the proposed stormwater infiltration area or perform field infiltration testing.

Test pit information used for this design, conducted by Field Engineering during a previous submittal for the subject property, has been added to sheets 3, 5 and 6 to confirm the soil conditions, water table and percolation rates. This information is also consistent with the soils encountered during construction of the recently constructed gas station, directly across the street on Theodore Rice Boulevard.

Per the test pit information provided, the soils appear to be a loamy sand which has a corresponding Rawl's Rate of 2.41 in/hour. Nitsch Engineering recommends updating the HydroCAD to use a Rawl's Rate of 2.41 in/hour.

16. The Applicant calculates the Water Quality Volume using 0.5 inches of runoff. Per Oliver Geographic Information System (GIS), the site appears to be within an Outstanding Resource Water. The Massachusetts Stormwater Standards require project sites within Outstanding Resource Water areas to calculate Water Quality Volume using 1-inch of runoff times the total impervious area of the post-development project site. The Applicant shall update the calculations to use 1-inch of runoff.

Water Quality calculations have been revised to use one inch of runoff.

This item has been addressed.

Mr. Dennis Audette: Nitsch Project #9972
July 6, 2021
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17. The Applicant shall confirm that there is a 2-foot separation between the bottom of the Stormwater Infiltration system and the seasonal high groundwater table, per the Massachusetts Stormwater Handbook.

Test Pit 102 on the plan set, performed by Field Engineering, confirms the 2 foot separation to groundwater.

This item has been addressed.

If you have any questions, please call us at (617) 338-0063.

Very truly yours,

Nitsch Engineering, Inc.



Brian Biagini, EIT
Senior Project Designer

Joshua Soares, PE
Project Manager

BJB/jms/anl

DRAINAGE REPORT

**PROPOSED COMMERCIAL BUILDING
PHILLIPS ROAD
NEW BEDFORD, MA**

Prepared For:

PANAGAKOS DEVELOPMENT

Prepared By:

**SITEC, INC. - CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
DARTMOUTH, MA**

CEC Project 304-118

**MARCH 26, 2021
REVISED: JUNE 15, 2021
REVISED: JULY 12, 2021**

SITEC

Part of Civil & Environmental Consultants, Inc.



The Phillips Road site is a 1.9-acre parcel of land situated in New Bedford, on the west side of Phillips Road. The project site will consist of a 3500 square foot commercial building, along with associated parking facilities, utilities and drainage improvements.

EXISTING CONDITIONS

The project site currently is a wooded vacant lot. The topography of the site is fairly consistent, generally sloping from east to west. Stormwater runoff generated on site flows to the west to a bordering vegetated wetland system.

A review of the soils survey map of Bristol County prepared by the U.S.D.A. Natural Resources Conservation Service indicates that the following soil classifications exist within the area of the site being developed:

- 242A Hinckley Loamy Sand
- 260A Sudbury fine Sandy Loam

The Hinckley soil series is a Hydrologic Group A soil that is found over eastern portion of the proposed site development. The Sudbury soil series is a Hydrologic Group B soil found on the western portion of the proposed site development.

For the purpose of these calculations a single design point will be analyzed for the existing conditions. Design Point No. 1 (DP-1) is the edge of the bordering vegetated wetland. Existing condition runoff hydrographs for the 2, 10, and 100-year storm events have been computed using the SCS TR20 methodology and the results as measured at each design point are summarized below:

Design Point No. 1	
<u>Storm Frequency</u>	<u>Peak Rate of Runoff</u>
2 yr.	0.1 CFS
10 yr.	0.6 CFS
100 yr.	2.2 CFS

DEVELOPED CONDITIONS

The applicant is proposing the construction of a 3500 commercial building with associated parking facility, utilities, and drainage improvements. There will be 31 parking spaces added to the property with three access points off of an existing access road.

The improvements being proposed as part of this development will add impervious surfaces to the project site. As a result of these improvements, without proper site design the development of this project would result in an increase in the rate of runoff from the project site. The flow of runoff through the watershed will follow the same general pattern as existing conditions. The majority of the site (PC-1) will drain to an onsite water treatment unit that will overflow into a subsurface detention/recharge system. The overflow from this system will be directed to the east side of the site, matching the existing conditions flow path. A small portion of the site (PC-2) will by-pass the drainage systems and the runoff will be directed to the bordering vegetated wetland that borders the site in the east.

The developed condition runoff hydrographs for the 2-, 10-, and 100-year storm events as measured at the design point have been computed using the SCS TR20 methodology and are summarized below:

Design Point No. 1	
<u>Storm Frequency</u>	<u>Peak Rate of Runoff</u>
2 yr.	0.1 CFS
10 yr.	0.6 CFS
100 yr.	2.0 CFS

STORMWATER STANDARD NO. 2 – PEAK RATE MITIGATION

The comparison of the pre- and post-development runoff rates summarized below illustrates the proper mitigation of post-development stormwater runoff.

Design Point No. 1

	Existing Conditions	Developed Conditions
<u>Storm Frequency</u>	<u>Peak Rate of Runoff</u>	<u>Peak Rate Runoff</u>
2 yr.	0.1 CFS	0.1 CFS
10 yr.	0.6 CFS	0.6 CFS
100 yr.	2.2 CFS	2.0 CFS

STORMWATER STANDARD NO. 3 - GROUNDWATER RECHARGE

Groundwater recharge will take place in the proposed infiltration system consisting of 48 Cultec 330XLHD units. Supporting calculations are included within the Hydrocad drainage report attached.

STORMWATER STANDARD NO. 4 - WATER QUALITY VOLUME

Total Suspended Solid Removal:

The proposed development will result in an increase of impervious area being added to the project site. Therefore, the TSS removal calculation for each watershed is as follows:

Design Point No. 1 (TSS Removal = 86%)

	TSS	Starting	Amount	Remaining
<u>BMP</u>	<u>Removal Rate</u>	<u>TSS Load</u>	<u>Removed</u>	<u>Load</u>
Stormceptor	0.86	1.00	0.86	0.14

Water Quality Volume:

The required water quality volume has been converted to a water quality flow rate per the Massachusetts standard method for proprietary stormwater treatment practices. The calculations for the Stormceptor unit are attached to this report.

STORMWATER STANDARD NO. 5 – Land with Higher Potential Pollutant Loads

Does not apply to this project.

STORMWATER STANDARD NO. 6 – CRITICAL AREAS

Does not apply to this project.

STORMWATER STANDARD NO. 7 – REDEVELOPMENT PROJECTS

Does not apply to this project.

STORMWATER STANDARD NO. 8 – Construction Impact Control Plan

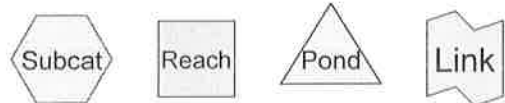
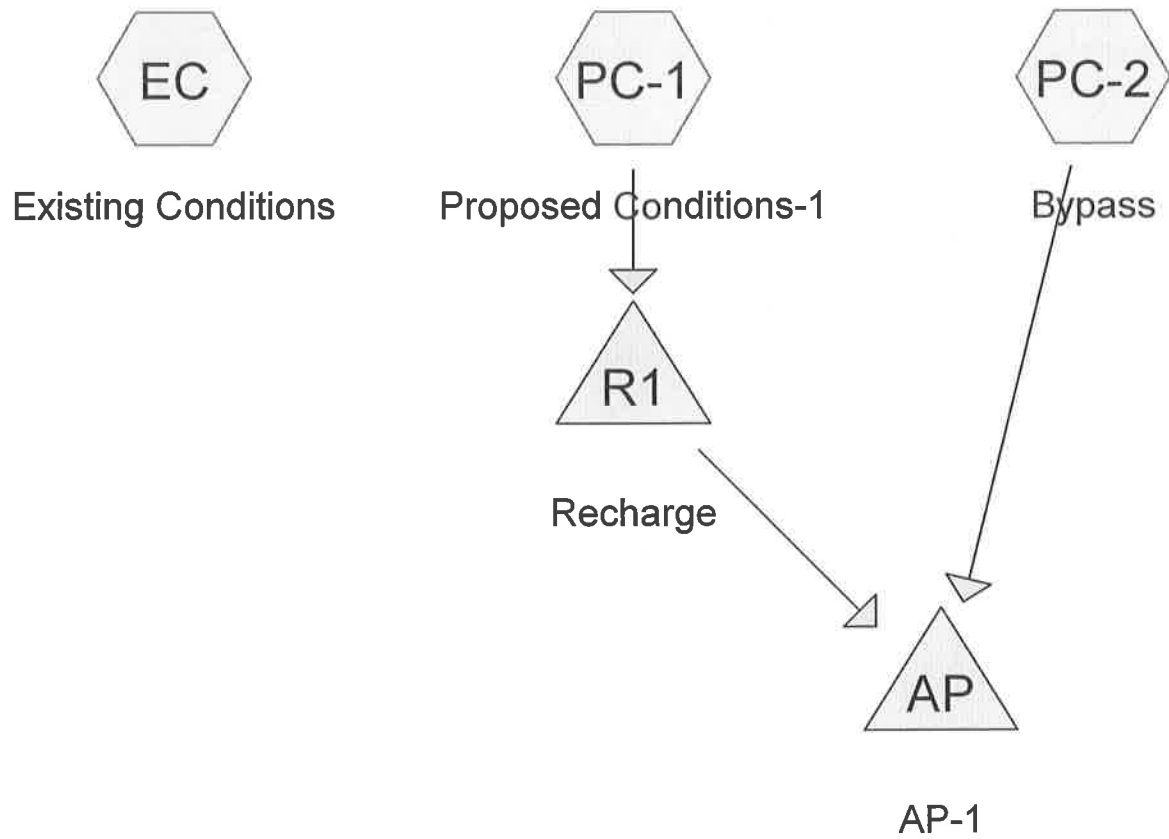
See the Erosion and Sediment Control Plan on Sheet 9 of 9 of the plan set.

STORMWATER STANDARD NO. 9 – OPERATION AND MAINTENANCE PLAN

Refer to the Operation and Maintenance Plan on Sheet 9 of 9 of the plan set.

STORMWATER STANDARD NO. 10 – ILLICIT DISCHARGES

There are no existing or proposed illicit discharges located on the site. An Illicit discharge statement has been provided.



Panagakos-Phillips-Rd-current-LS

Type III 24-hr 2-YR. STORM Rainfall=3.40"

Prepared by CEC, Inc.

Printed 7/13/2021

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Page 2

Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points x 2

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 EC: Existing ConditionsRunoff Area=1.420 ac 0.00% Impervious Runoff Depth=0.17"
Flow Length=146' Tc=7.8 min CN=50 Runoff=0.06 cfs 0.020 af**Subcatchment PC-1: Proposed**Runoff Area=0.590 ac 66.10% Impervious Runoff Depth=1.70"
Tc=6.0 min CN=82 Runoff=1.15 cfs 0.084 af**Subcatchment PC-2: Bypass**Runoff Area=0.830 ac 6.02% Impervious Runoff Depth=0.31"
Flow Length=110' Tc=7.8 min CN=55 Runoff=0.12 cfs 0.022 af**Pond AP: AP-1**Inflow=0.12 cfs 0.022 af
Primary=0.12 cfs 0.022 af**Pond R1: Recharge**Peak Elev=89.69' Storage=0.033 af Inflow=1.15 cfs 0.084 af
Discarded=0.10 cfs 0.084 af Primary=0.00 cfs 0.000 af Outflow=0.10 cfs 0.084 af**Total Runoff Area = 2.840 ac Runoff Volume = 0.126 af Average Runoff Depth = 0.53"**
84.51% Pervious = 2.400 ac 15.49% Impervious = 0.440 ac

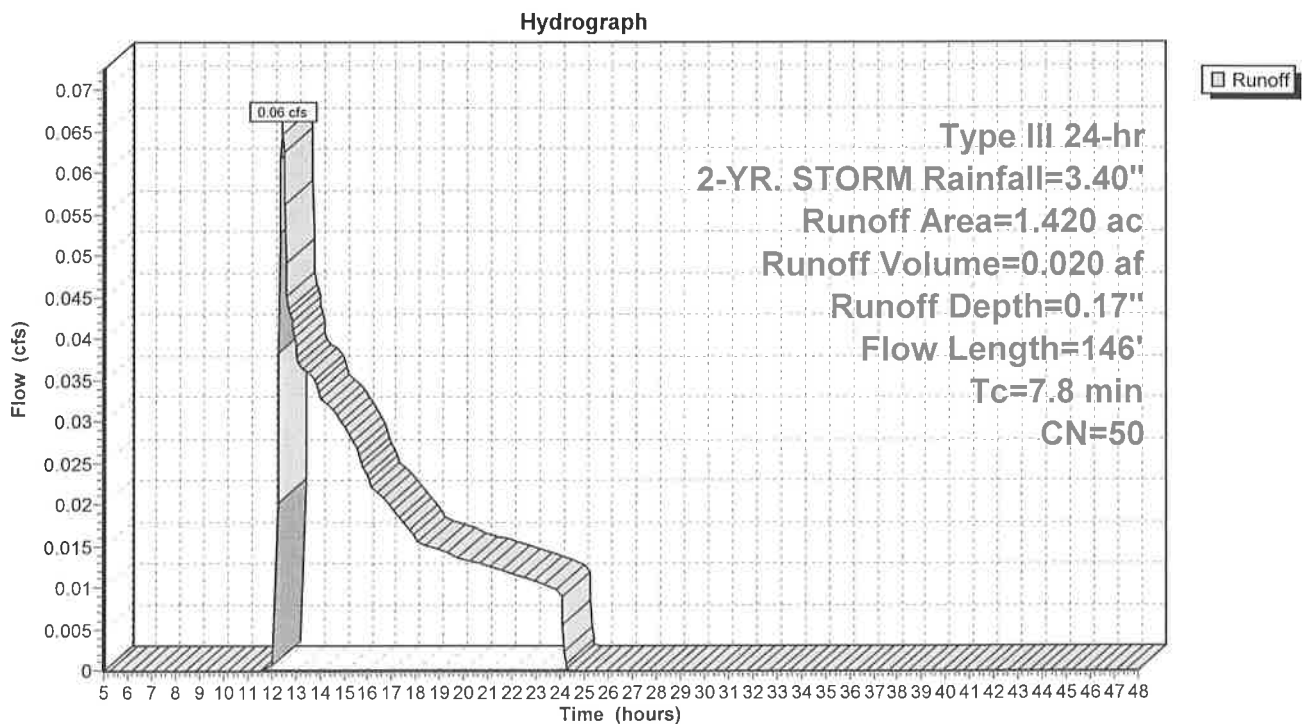
Summary for Subcatchment EC: Existing Conditions

Runoff = 0.06 cfs @ 12.45 hrs, Volume= 0.020 af, Depth= 0.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR. STORM Rainfall=3.40"

Area (ac)	CN	Description
0.600	36	Woods, Fair, HSG A
0.820	60	Woods, Fair, HSG B
1.420	50	Weighted Average
1.420		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	50	0.1080	0.14		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.40"
1.7	96	0.0360	0.95		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
7.8	146	Total			

Subcatchment EC: Existing Conditions

Summary for Subcatchment PC-1: Proposed Conditions-1

Runoff = 1.15 cfs @ 12.09 hrs, Volume= 0.084 af, Depth= 1.70"

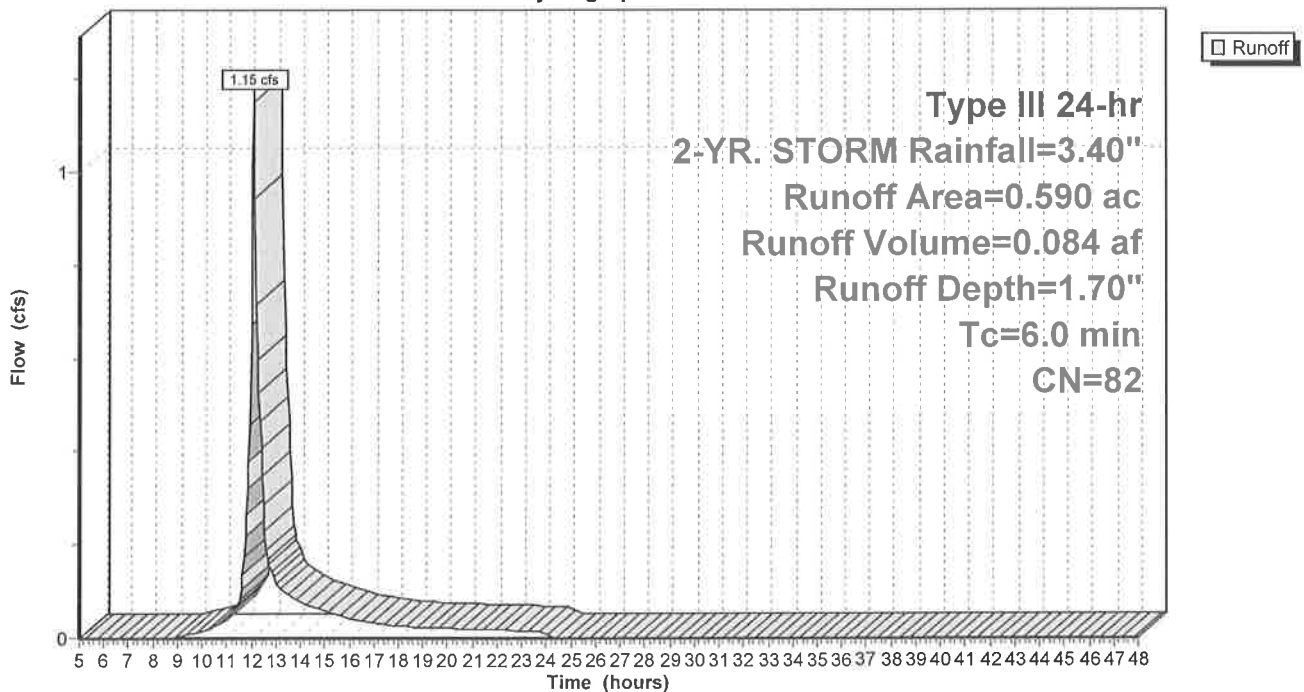
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR. STORM Rainfall=3.40"

Area (ac)	CN	Description
0.090	39	>75% Grass cover, Good, HSG A
0.110	61	>75% Grass cover, Good, HSG B
0.180	98	Paved parking, HSG A
0.210	98	Paved parking, HSG B
0.590	82	Weighted Average
0.200		33.90% Pervious Area
0.390		66.10% Impervious Area

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

Subcatchment PC-1: Proposed Conditions-1

Hydrograph



Summary for Subcatchment PC-2: Bypass

Runoff = 0.12 cfs @ 12.32 hrs, Volume= 0.022 af, Depth= 0.31"

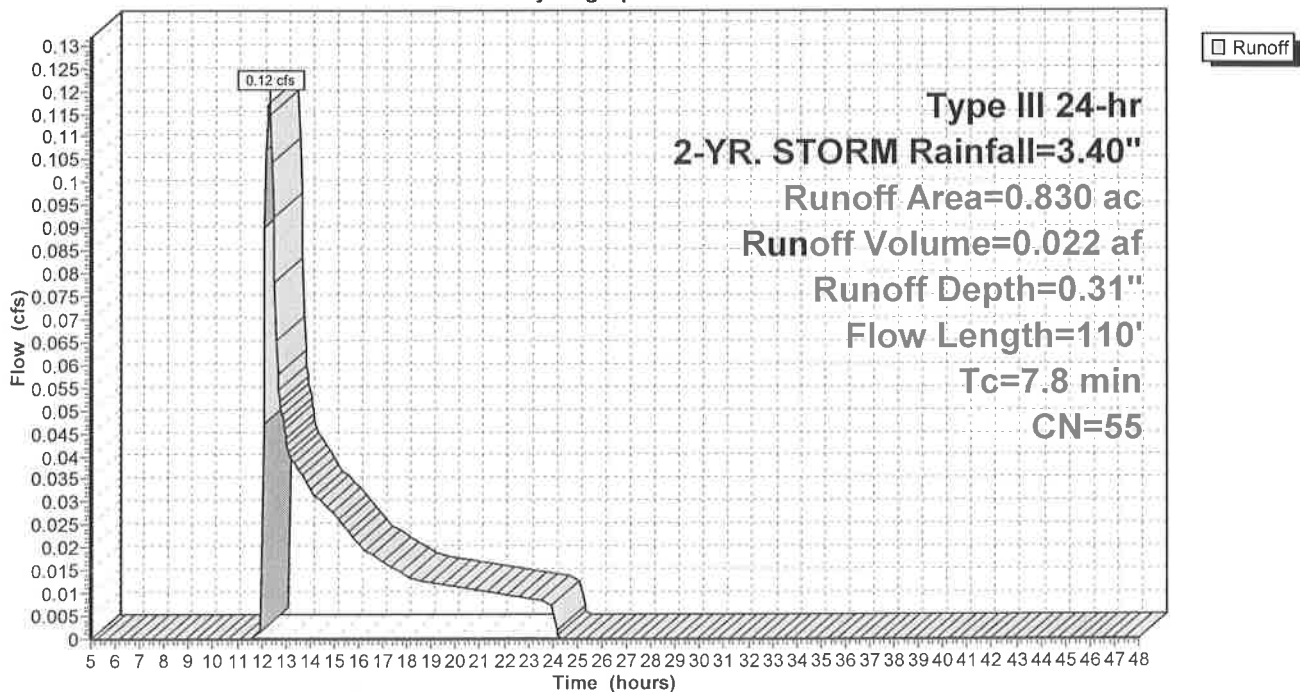
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR. STORM Rainfall=3.40"

Area (ac)	CN	Description
0.220	36	Woods, Fair, HSG A
0.510	60	Woods, Fair, HSG B
0.050	98	Paved parking, HSG A
0.050	39	>75% Grass cover, Good, HSG A
0.830	55	Weighted Average
0.780		93.98% Pervious Area
0.050		6.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0740	0.12		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.40"
0.7	60	0.0920	1.52		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
7.8	110	Total			

Subcatchment PC-2: Bypass

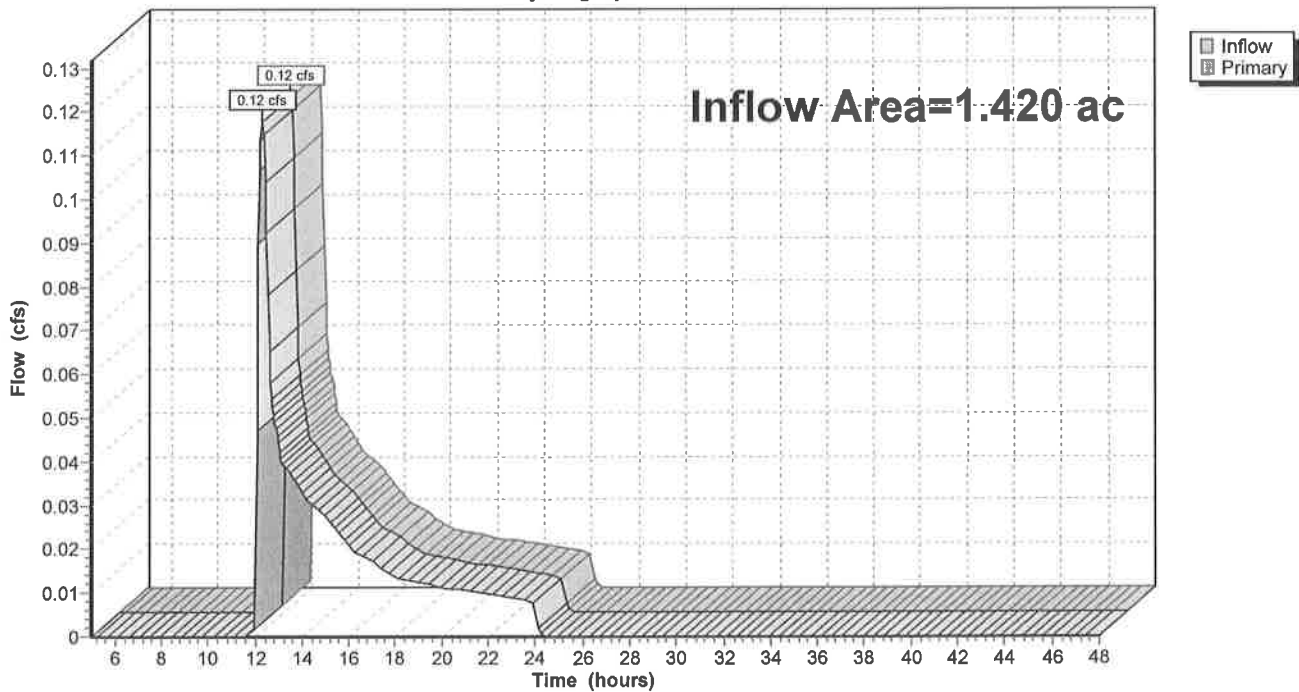
Hydrograph



Summary for Pond AP: AP-1

Inflow Area = 1.420 ac, 30.99% Impervious, Inflow Depth = 0.18" for 2-YR. STORM event
Inflow = 0.12 cfs @ 12.32 hrs, Volume= 0.022 af
Primary = 0.12 cfs @ 12.32 hrs, Volume= 0.022 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs / 2

Pond AP: AP-1**Hydrograph**

Summary for Pond R1: Recharge

Inflow Area = 0.590 ac, 66.10% Impervious, Inflow Depth = 1.70" for 2-YR. STORM event
 Inflow = 1.15 cfs @ 12.09 hrs, Volume= 0.084 af
 Outflow = 0.10 cfs @ 11.75 hrs, Volume= 0.084 af, Atten= 91%, Lag= 0.0 min
 Discarded = 0.10 cfs @ 11.75 hrs, Volume= 0.084 af
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 89.69' @ 13.34 hrs Surf.Area= 0.042 ac Storage= 0.033 af

Plug-Flow detention time= 125.4 min calculated for 0.084 af (100% of inflow)
 Center-of-Mass det. time= 125.2 min (958.6 - 833.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	88.50'	0.035 af	30.50'W x 59.50'L x 3.54'H Field A 0.148 af Overall - 0.059 af Embedded = 0.089 af x 40.0% Voids
#2A	89.00'	0.059 af	Cultec R-330XLHD x 48 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
		0.094 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	88.50'	2.410 in/hr Exfiltration over Surface area Phase-In= 0.01'
#2	Primary	91.00'	8.0" Round Culvert L= 40.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 91.00' / 90.60' S= 0.0100 ' /' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.10 cfs @ 11.75 hrs HW=88.55' (Free Discharge)

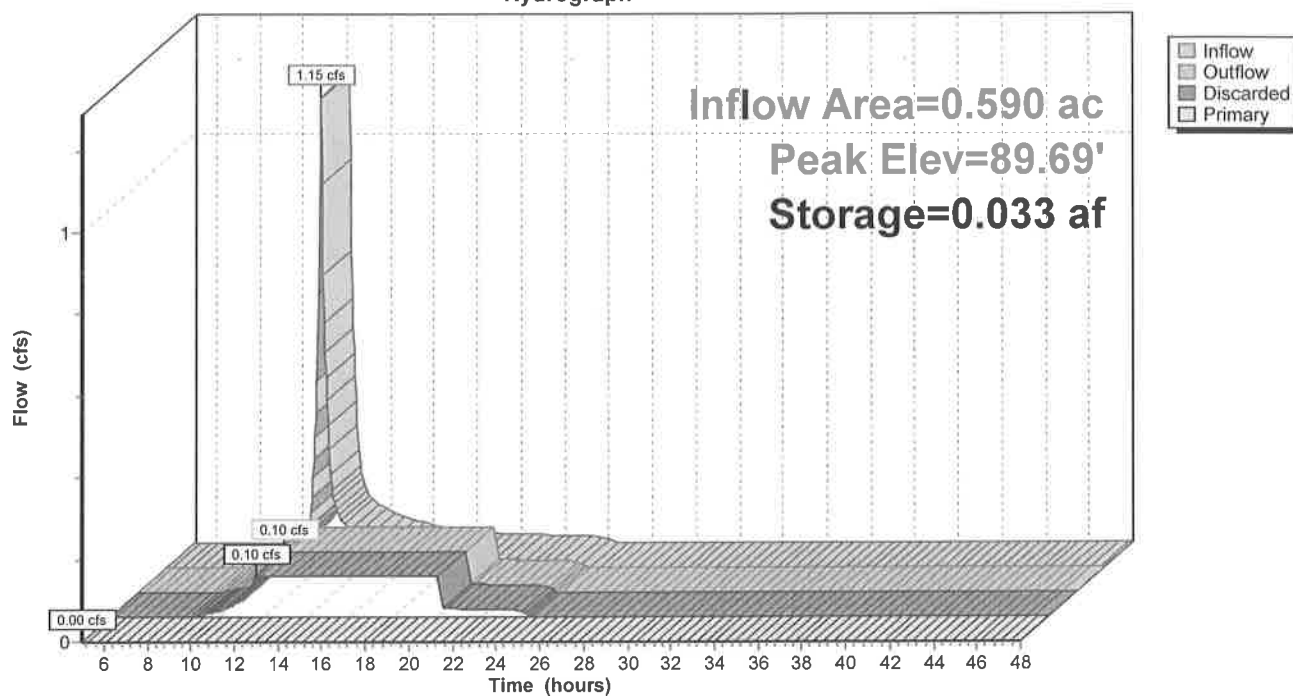
↑ **1=Exfiltration** (Exfiltration Controls 0.10 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=88.50' TW=0.00' (Dynamic Tailwater)

↑ **2=Culvert** (Controls 0.00 cfs)

Pond R1: Recharge

Hydrograph



Panagakos-Phillips-Rd-current-LS

Type III 24-hr 10-YR. STORM Rainfall=4.80"

Prepared by CEC, Inc.

Printed 7/13/2021

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Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points x 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

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Tc=6.0 min CN=82 Runoff=1.96 cfs 0.143 af**Subcatchment PC-2: Bypass**Runoff Area=0.830 ac 6.02% Impervious Runoff Depth=0.88"
Flow Length=110' Tc=7.8 min CN=55 Runoff=0.61 cfs 0.061 af**Pond AP: AP-1**Inflow=0.61 cfs 0.061 af
Primary=0.61 cfs 0.061 af**Pond R1: Recharge**Peak Elev=90.84' Storage=0.070 af Inflow=1.96 cfs 0.143 af
Discarded=0.10 cfs 0.143 af Primary=0.00 cfs 0.000 af Outflow=0.10 cfs 0.143 af**Total Runoff Area = 2.840 ac Runoff Volume = 0.276 af Average Runoff Depth = 1.17"**
84.51% Pervious = 2.400 ac 15.49% Impervious = 0.440 ac

Summary for Subcatchment EC: Existing Conditions

Runoff = 0.55 cfs @ 12.17 hrs, Volume= 0.072 af, Depth= 0.61"

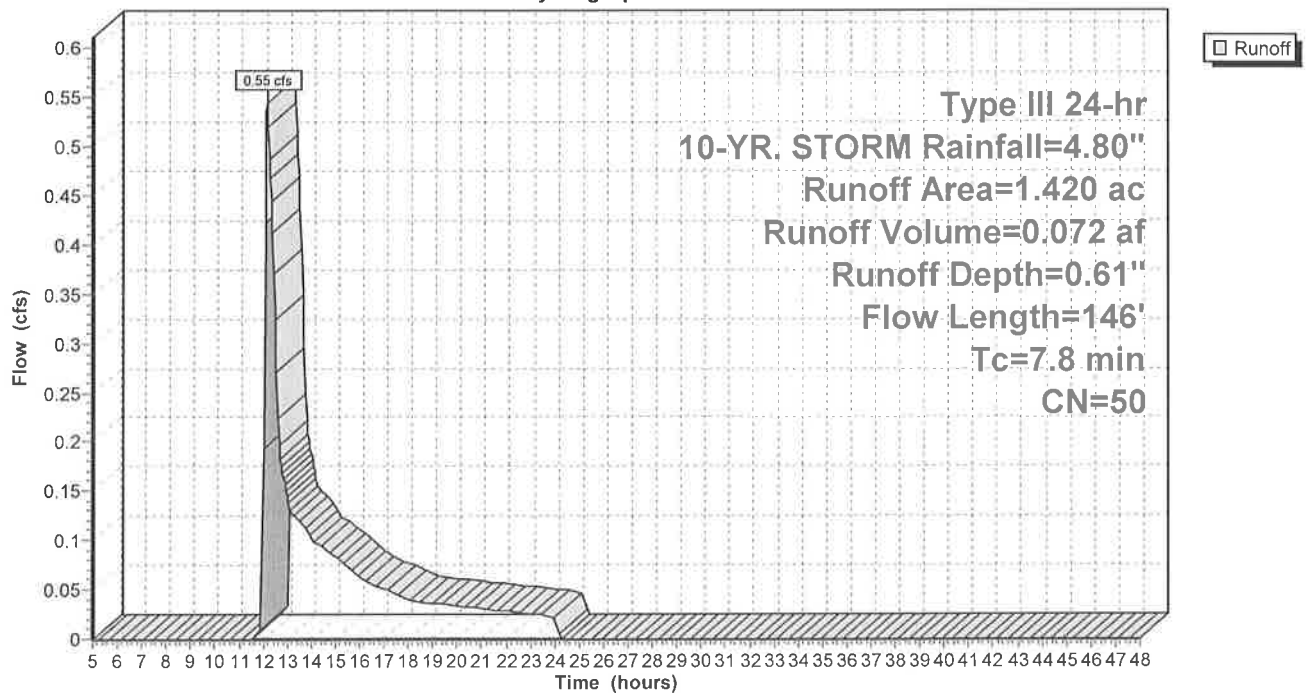
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR. STORM Rainfall=4.80"

Area (ac)	CN	Description
0.600	36	Woods, Fair, HSG A
0.820	60	Woods, Fair, HSG B
1.420	50	Weighted Average
1.420		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	50	0.1080	0.14		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.40"
1.7	96	0.0360	0.95		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
7.8	146	Total			

Subcatchment EC: Existing Conditions

Hydrograph



Summary for Subcatchment PC-1: Proposed Conditions-1

Runoff = 1.96 cfs @ 12.09 hrs, Volume= 0.143 af, Depth= 2.90"

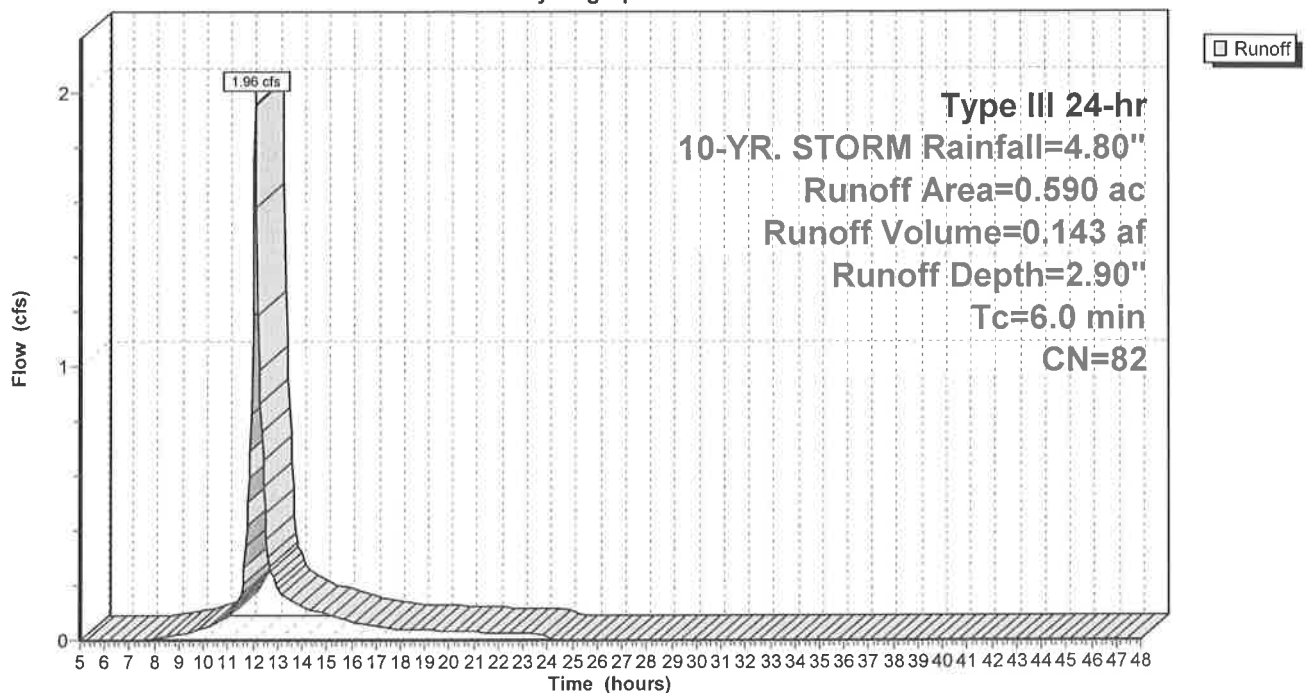
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR. STORM Rainfall=4.80"

Area (ac)	CN	Description
0.090	39	>75% Grass cover, Good, HSG A
0.110	61	>75% Grass cover, Good, HSG B
0.180	98	Paved parking, HSG A
0.210	98	Paved parking, HSG B
0.590	82	Weighted Average
0.200		33.90% Pervious Area
0.390		66.10% Impervious Area

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

Subcatchment PC-1: Proposed Conditions-1

Hydrograph



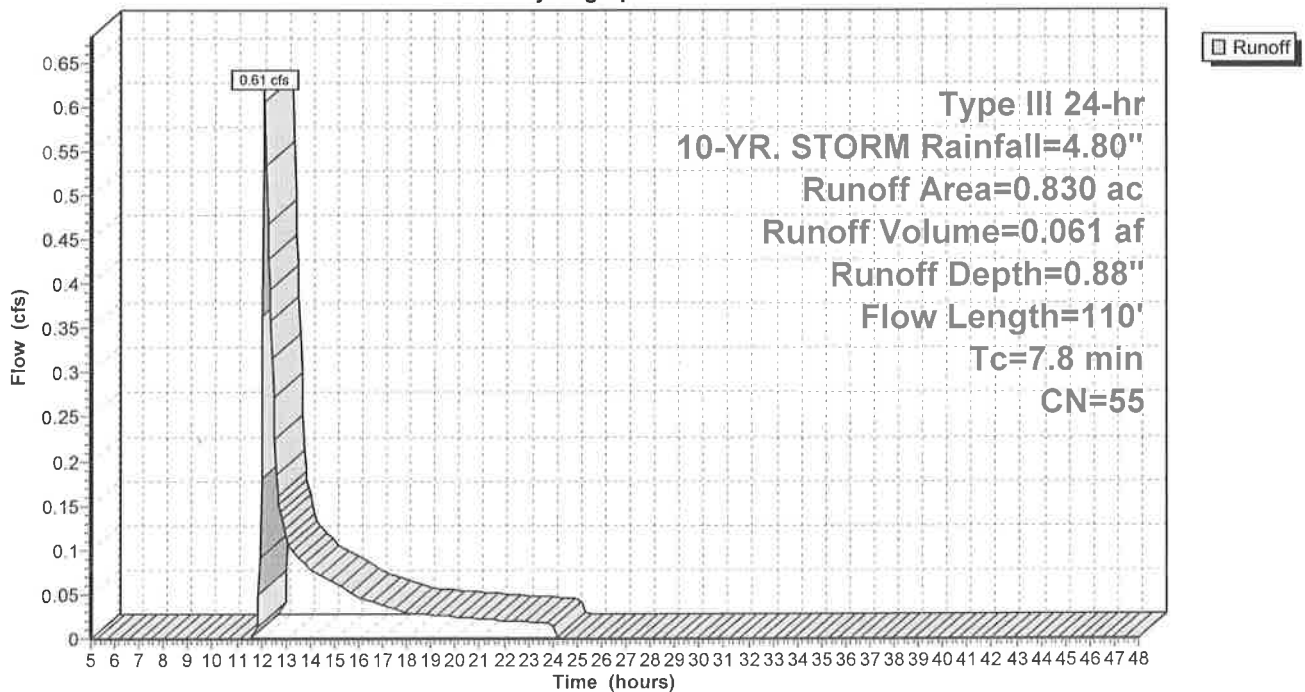
Summary for Subcatchment PC-2: Bypass

Runoff = 0.61 cfs @ 12.14 hrs, Volume= 0.061 af, Depth= 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR. STORM Rainfall=4.80"

Area (ac)	CN	Description
0.220	36	Woods, Fair, HSG A
0.510	60	Woods, Fair, HSG B
0.050	98	Paved parking, HSG A
0.050	39	>75% Grass cover, Good, HSG A
0.830	55	Weighted Average
0.780		93.98% Pervious Area
0.050		6.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0740	0.12		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.40"
0.7	60	0.0920	1.52		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
7.8	110	Total			

Subcatchment PC-2: Bypass**Hydrograph**

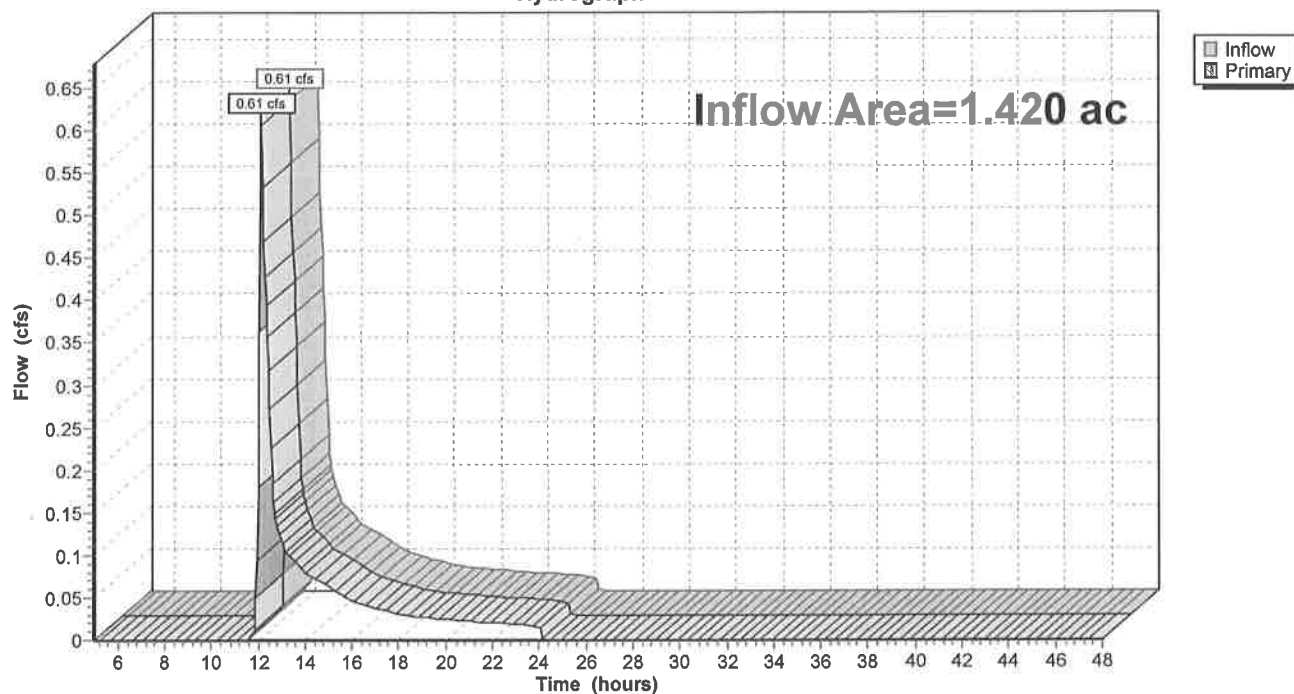
Summary for Pond AP: AP-1

Inflow Area = 1.420 ac, 30.99% Impervious, Inflow Depth = 0.52" for 10-YR. STORM event
Inflow = 0.61 cfs @ 12.14 hrs, Volume= 0.061 af
Primary = 0.61 cfs @ 12.14 hrs, Volume= 0.061 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs / 2

Pond AP: AP-1

Hydrograph



Summary for Pond R1: Recharge

Inflow Area = 0.590 ac, 66.10% Impervious, Inflow Depth = 2.90" for 10-YR. STORM event
 Inflow = 1.96 cfs @ 12.09 hrs, Volume= 0.143 af
 Outflow = 0.10 cfs @ 11.40 hrs, Volume= 0.143 af, Atten= 95%, Lag= 0.0 min
 Discarded = 0.10 cfs @ 11.40 hrs, Volume= 0.143 af
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 90.84' @ 14.75 hrs Surf.Area= 0.042 ac Storage= 0.070 af

Plug-Flow detention time= 289.4 min calculated for 0.142 af (100% of inflow)
 Center-of-Mass det. time= 289.4 min (1,107.4 - 818.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	88.50'	0.035 af	30.50'W x 59.50'L x 3.54'H Field A 0.148 af Overall - 0.059 af Embedded = 0.089 af x 40.0% Voids
#2A	89.00'	0.059 af	Cultec R-330XLHD x 48 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
		0.094 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	88.50'	2.410 in/hr Exfiltration over Surface area Phase-In= 0.01'
#2	Primary	91.00'	8.0" Round Culvert L= 40.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 91.00' / 90.60' S= 0.0100 ' / Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.10 cfs @ 11.40 hrs HW=88.54' (Free Discharge)

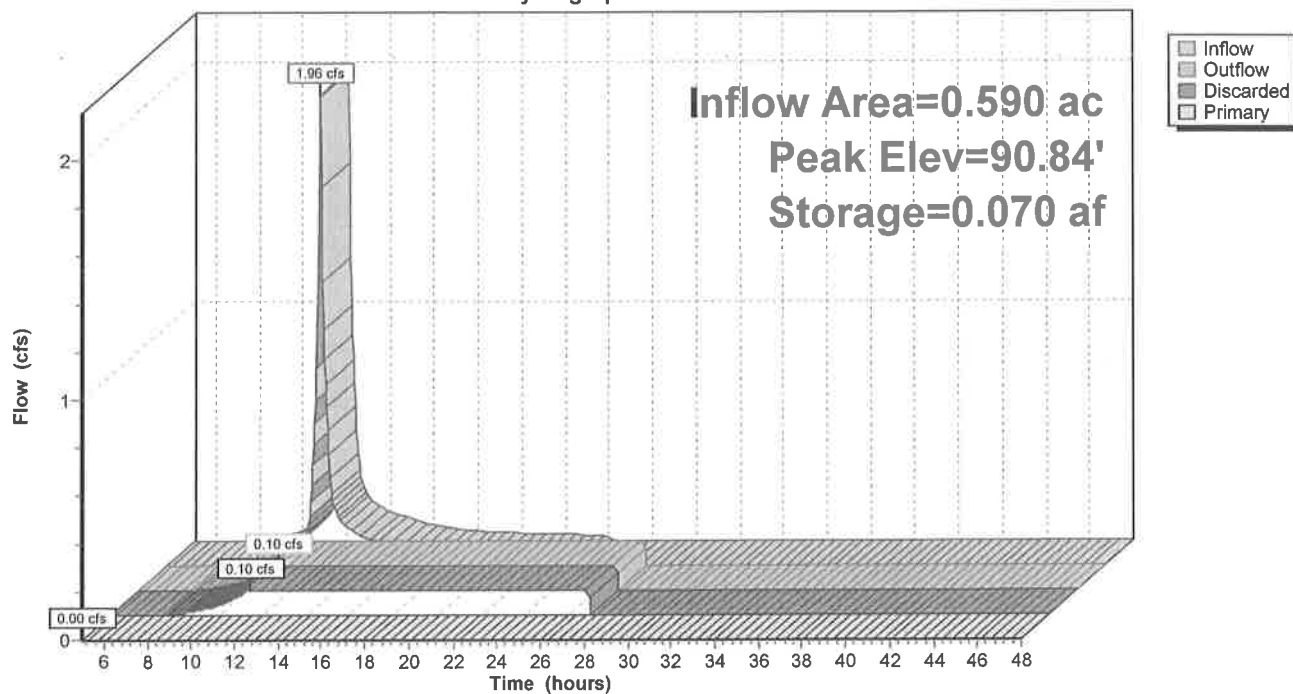
↑1=Exfiltration (Exfiltration Controls 0.10 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=88.50' TW=0.00' (Dynamic Tailwater)

↑2=Culvert (Controls 0.00 cfs)

Pond R1: Recharge

Hydrograph



Panagakos-Phillips-Rd-current-LS

Type III 24-hr 100-YR. STORM Rainfall=7.00"

Prepared by CEC, Inc.

Printed 7/13/2021

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Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points x 2

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 EC: Existing ConditionsRunoff Area=1.420 ac 0.00% Impervious Runoff Depth=1.67"
Flow Length=146' Tc=7.8 min CN=50 Runoff=2.20 cfs 0.197 af**Subcatchment PC-1: Proposed**Runoff Area=0.590 ac 66.10% Impervious Runoff Depth=4.92"
Tc=6.0 min CN=82 Runoff=3.27 cfs 0.242 af**Subcatchment PC-2: Bypass**Runoff Area=0.830 ac 6.02% Impervious Runoff Depth=2.12"
Flow Length=110' Tc=7.8 min CN=55 Runoff=1.78 cfs 0.147 af**Pond AP: AP-1**Inflow=2.04 cfs 0.214 af
Primary=2.04 cfs 0.214 af**Pond R1: Recharge**Peak Elev=91.73' Storage=0.089 af Inflow=3.27 cfs 0.242 af
Discarded=0.10 cfs 0.175 af Primary=1.06 cfs 0.067 af Outflow=1.16 cfs 0.242 af**Total Runoff Area = 2.840 ac Runoff Volume = 0.586 af Average Runoff Depth = 2.48"**
84.51% Pervious = 2.400 ac 15.49% Impervious = 0.440 ac

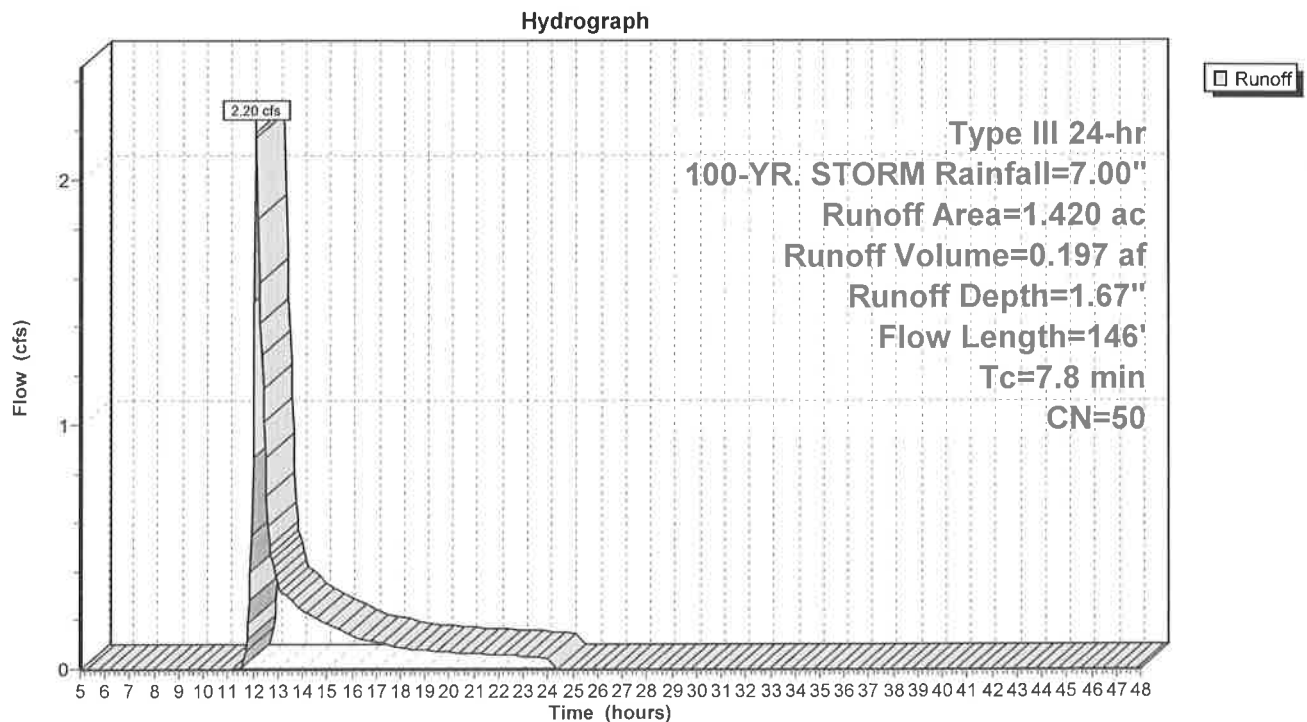
Summary for Subcatchment EC: Existing Conditions

Runoff = 2.20 cfs @ 12.13 hrs, Volume= 0.197 af, Depth= 1.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR. STORM Rainfall=7.00"

Area (ac)	CN	Description
0.600	36	Woods, Fair, HSG A
0.820	60	Woods, Fair, HSG B
1.420	50	Weighted Average
1.420		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	50	0.1080	0.14		Sheet Flow, A-B
					Woods: Light underbrush n= 0.400 P2= 3.40"
1.7	96	0.0360	0.95		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
7.8	146	Total			

Subcatchment EC: Existing Conditions

Summary for Subcatchment PC-1: Proposed Conditions-1

Runoff = 3.27 cfs @ 12.09 hrs, Volume= 0.242 af, Depth= 4.92"

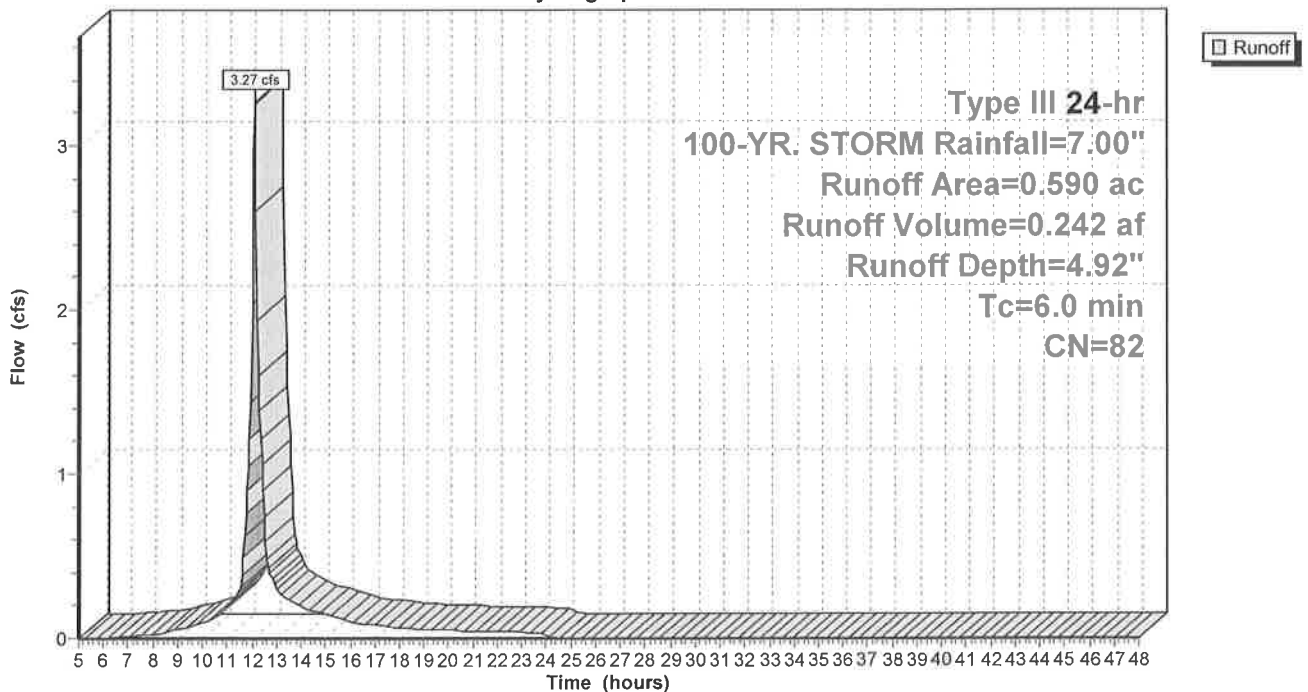
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR. STORM Rainfall=7.00"

Area (ac)	CN	Description
0.090	39	>75% Grass cover, Good, HSG A
0.110	61	>75% Grass cover, Good, HSG B
0.180	98	Paved parking, HSG A
0.210	98	Paved parking, HSG B
0.590	82	Weighted Average
0.200		33.90% Pervious Area
0.390		66.10% Impervious Area

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

Subcatchment PC-1: Proposed Conditions-1

Hydrograph



Summary for Subcatchment PC-2: Bypass

Runoff = 1.78 cfs @ 12.12 hrs, Volume= 0.147 af, Depth= 2.12"

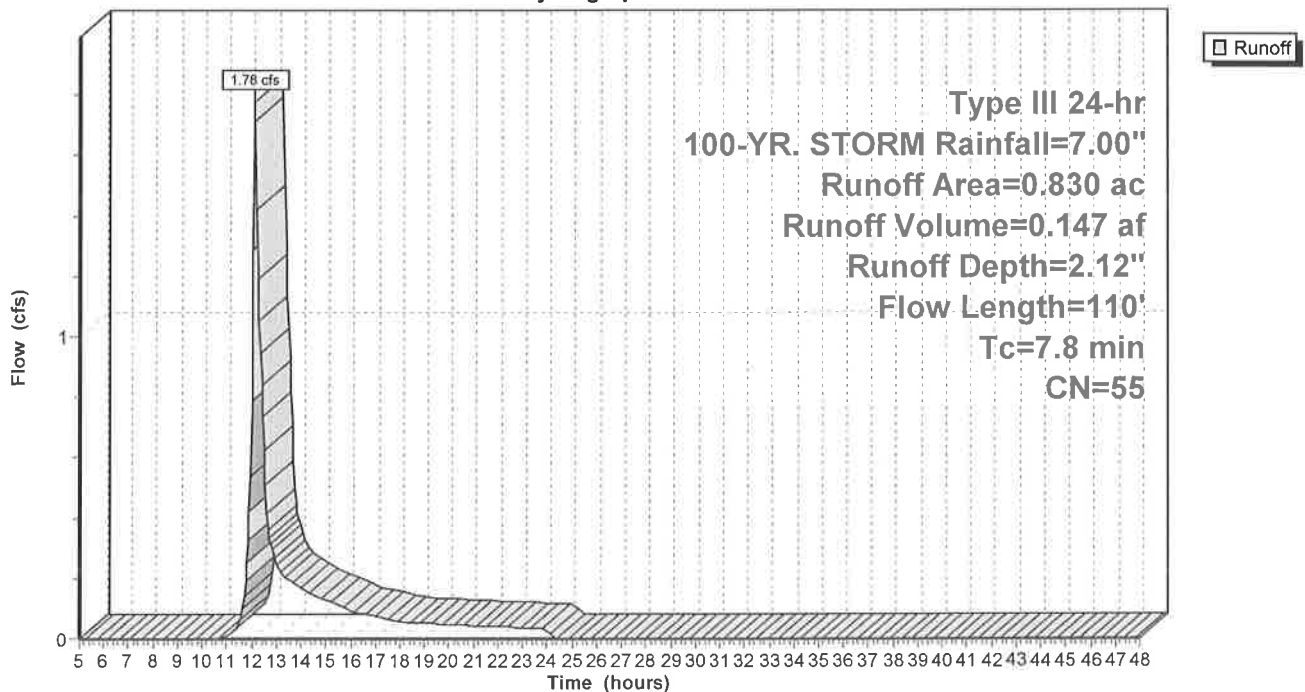
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR. STORM Rainfall=7.00"

Area (ac)	CN	Description
0.220	36	Woods, Fair, HSG A
0.510	60	Woods, Fair, HSG B
0.050	98	Paved parking, HSG A
0.050	39	>75% Grass cover, Good, HSG A
0.830	55	Weighted Average
0.780		93.98% Pervious Area
0.050		6.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0740	0.12		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.40"
0.7	60	0.0920	1.52		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
7.8	110	Total			

Subcatchment PC-2: Bypass

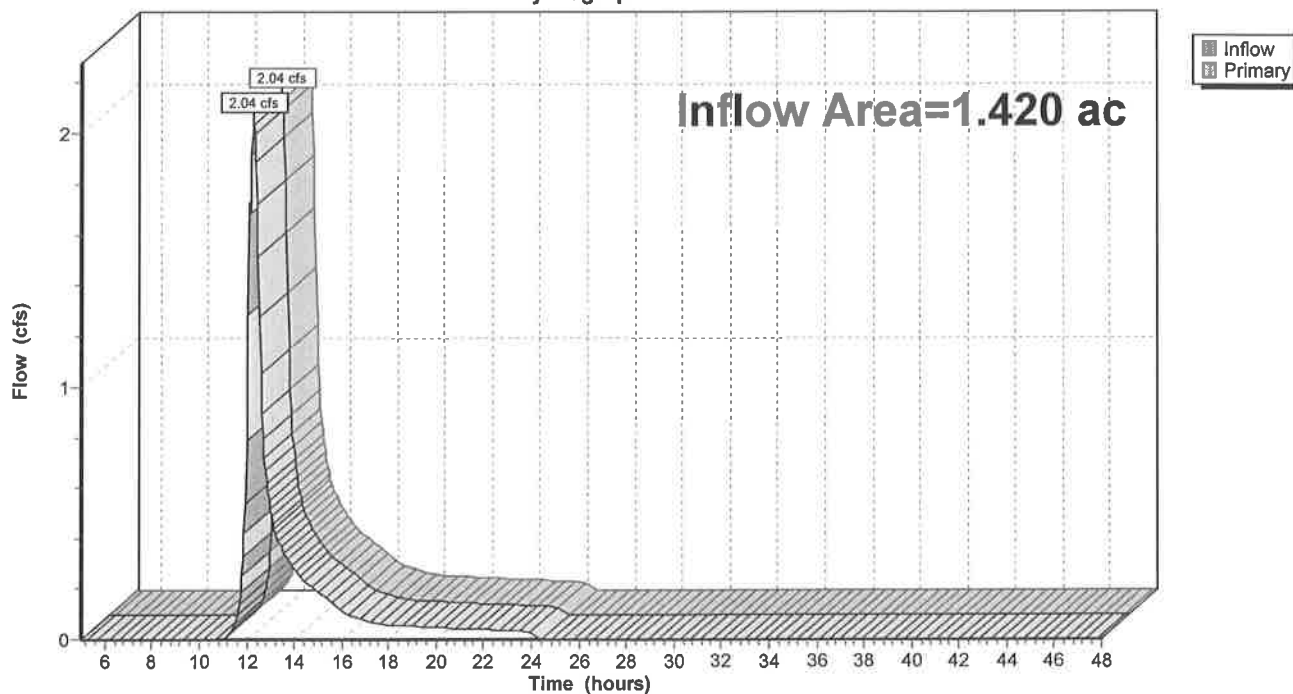
Hydrograph



Summary for Pond AP: AP-1

Inflow Area = 1.420 ac, 30.99% Impervious, Inflow Depth = 1.81" for 100-YR. STORM event
Inflow = 2.04 cfs @ 12.31 hrs, Volume= 0.214 af
Primary = 2.04 cfs @ 12.31 hrs, Volume= 0.214 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs / 2

Pond AP: AP-1**Hydrograph**

Summary for Pond R1: Recharge

Inflow Area = 0.590 ac, 66.10% Impervious, Inflow Depth = 4.92" for 100-YR. STORM event
 Inflow = 3.27 cfs @ 12.09 hrs, Volume= 0.242 af
 Outflow = 1.16 cfs @ 12.37 hrs, Volume= 0.242 af, Atten= 64%, Lag= 16.9 min
 Discarded = 0.10 cfs @ 10.50 hrs, Volume= 0.175 af
 Primary = 1.06 cfs @ 12.37 hrs, Volume= 0.067 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 91.73' @ 12.37 hrs Surf.Area= 0.042 ac Storage= 0.089 af

Plug-Flow detention time= 239.9 min calculated for 0.241 af (100% of inflow)
 Center-of-Mass det. time= 240.1 min (1,043.1 - 803.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	88.50'	0.035 af	30.50'W x 59.50'L x 3.54'H Field A 0.148 af Overall - 0.059 af Embedded = 0.089 af x 40.0% Voids
#2A	89.00'	0.059 af	Cultec R-330XLHD x 48 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
		0.094 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	88.50'	2.410 in/hr Exfiltration over Surface area Phase-In= 0.01'
#2	Primary	91.00'	8.0" Round Culvert L= 40.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 91.00' / 90.60' S= 0.0100 ' /' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.10 cfs @ 10.50 hrs HW=88.54' (Free Discharge)

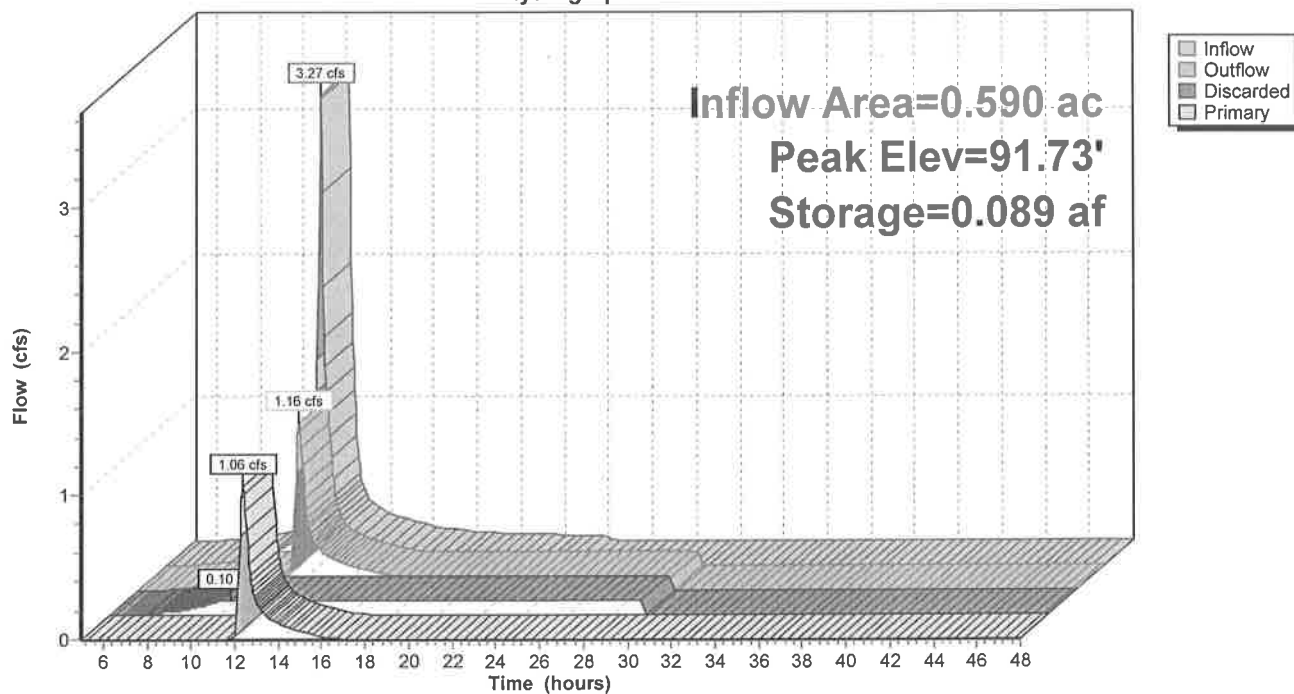
↑ **1=Exfiltration** (Exfiltration Controls 0.10 cfs)

Primary OutFlow Max=1.05 cfs @ 12.37 hrs HW=91.73' TW=0.00' (Dynamic Tailwater)

↑ **2=Culvert** (Barrel Controls 1.05 cfs @ 3.44 fps)

Pond R1: Recharge

Hydrograph



Panagakos-Phillips-Rd-current-LS

Type III 24-hr 100-YR. STORM Rainfall=7.00"

Prepared by CEC, Inc.

Printed 7/14/2021

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Hydrograph for Pond R1: Recharge

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
5.00	0.00	0.000	88.50	0.00	0.00	0.00
6.00	0.00	0.000	88.50	0.00	0.00	0.00
7.00	0.01	0.000	88.50	0.01	0.01	0.00
8.00	0.03	0.000	88.50	0.03	0.03	0.00
9.00	0.06	0.000	88.51	0.05	0.05	0.00
10.00	0.10	0.000	88.51	0.10	0.10	0.00
11.00	0.18	0.003	88.67	0.10	0.10	0.00
12.00	2.04	0.039	89.87	0.10	0.10	0.00
13.00	0.31	0.082	91.30	0.37	0.10	0.27
14.00	0.19	0.079	91.19	0.22	0.10	0.11
15.00	0.15	0.078	91.14	0.16	0.10	0.06
16.00	0.10	0.076	91.09	0.12	0.10	0.02
17.00	0.08	0.075	91.03	0.10	0.10	0.00
18.00	0.06	0.073	90.94	0.10	0.10	0.00
19.00	0.06	0.069	90.82	0.10	0.10	0.00
20.00	0.05	0.065	90.69	0.10	0.10	0.00
21.00	0.05	0.061	90.55	0.10	0.10	0.00
22.00	0.04	0.056	90.40	0.10	0.10	0.00
23.00	0.04	0.051	90.24	0.10	0.10	0.00
24.00	0.03	0.046	90.08	0.10	0.10	0.00
25.00	0.00	0.038	89.84	0.10	0.10	0.00
26.00	0.00	0.029	89.60	0.10	0.10	0.00
27.00	0.00	0.021	89.36	0.10	0.10	0.00
28.00	0.00	0.013	89.12	0.10	0.10	0.00
29.00	0.00	0.004	88.75	0.10	0.10	0.00
30.00	0.00	0.000	88.50	0.00	0.00	0.00
31.00	0.00	0.000	88.50	0.00	0.00	0.00
32.00	0.00	0.000	88.50	0.00	0.00	0.00
33.00	0.00	0.000	88.50	0.00	0.00	0.00
34.00	0.00	0.000	88.50	0.00	0.00	0.00
35.00	0.00	0.000	88.50	0.00	0.00	0.00
36.00	0.00	0.000	88.50	0.00	0.00	0.00
37.00	0.00	0.000	88.50	0.00	0.00	0.00
38.00	0.00	0.000	88.50	0.00	0.00	0.00
39.00	0.00	0.000	88.50	0.00	0.00	0.00
40.00	0.00	0.000	88.50	0.00	0.00	0.00
41.00	0.00	0.000	88.50	0.00	0.00	0.00
42.00	0.00	0.000	88.50	0.00	0.00	0.00
43.00	0.00	0.000	88.50	0.00	0.00	0.00
44.00	0.00	0.000	88.50	0.00	0.00	0.00
45.00	0.00	0.000	88.50	0.00	0.00	0.00
46.00	0.00	0.000	88.50	0.00	0.00	0.00
47.00	0.00	0.000	88.50	0.00	0.00	0.00
48.00	0.00	0.000	88.50	0.00	0.00	0.00