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PROJECT REPORT: **St. Edward the Confessor Church**
21 Brush Hill Road and 1 Margerie Dr, New Fairfield, CT

March 11, 2024

SUMMARY

Scope: The proposal includes site, parking, and storm water improvements to the existing parking lots serving the church. The existing building will remain unchanged.

The proposal will remove 33 existing parking spaces in and along the Town right-of-way and replace them on-site. The total site parking will increase from 226 to 233 total spaces. Improvements to the driveways are also proposed with changes to the existing driveway aprons and the installation of a temporary egress-only driveway.

Landscape and lighting improvements compliment the changes in and around the parking areas.

Storm Drainage: The proposed site improvements include a small increase in impervious area, associated with the parking expansion. A new stormwater management and detention system is proposed to replace and upgrade the existing on-site drainage system. The system is designed to mitigate increases in peak storm discharge levels for the 25-year storm event.

The pre- and post-developed peak discharge levels for the project area are 36.4 cfs and 33.8 cfs, respectively. Attachment A of this report contains details of the drainage analysis and design.

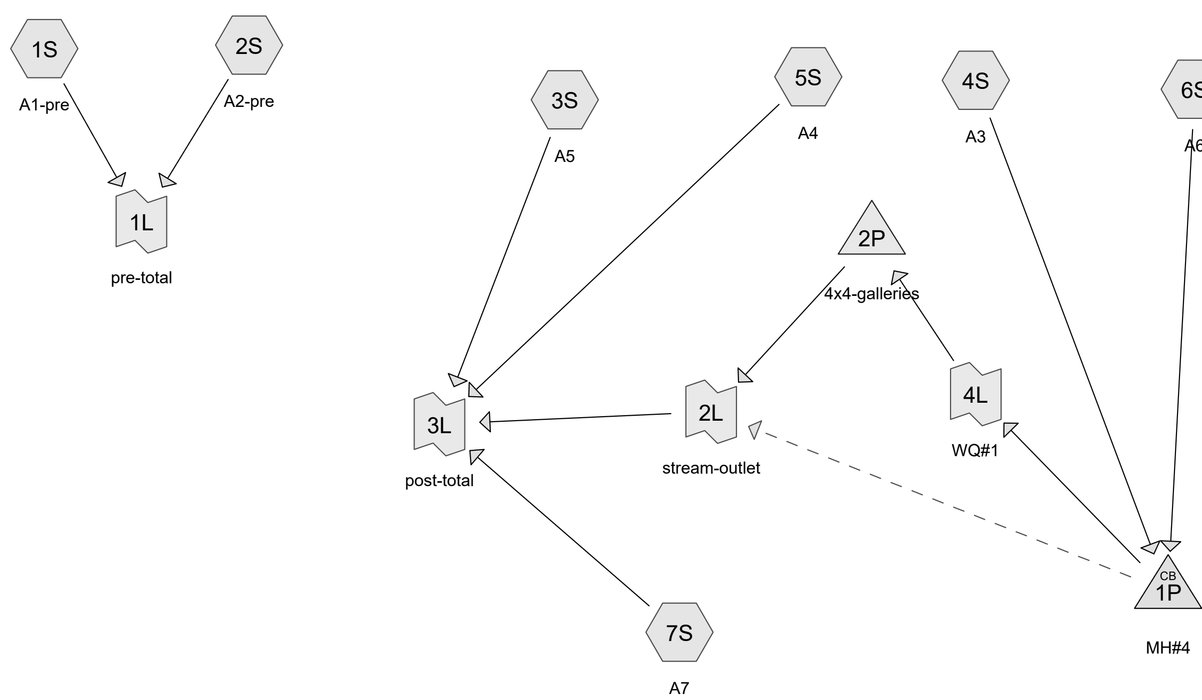
Impervious Areas: The site currently contains no water quality or detention measures, and stormwater is discharged untreated directly to the Town system.

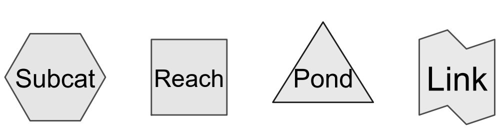
The proposal includes a water quality unit and detention system that treats stormwater flows and reduces the effective impervious area to 8.3% and 0% for the upper and lower lots, respectively. This complies with the Town requirements of 10% maximum effective impervious area.

Wetlands: The lower lot contains wetlands. Activities are proposed in both the regulated area and upland areas. No direct wetland impacts are proposed. Outlet improvements (armored channel at discharge) and the removal of dead trees within the lower swale are also proposed.

ATTACHMENT A

Drainage Analysis / Design
&
Water Quality Sizing
&
Stormwater Management Plan Compliance





Routing Diagram for 211-drainage-r0
Prepared by {enter your company name here}, Printed 1/31/2024
HydroCAD® 10.00-22 s/n 02462 © 2018 HydroCAD Software Solutions LLC

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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 1S: A1-pre Runoff Area=262,308 sf 37.10% Impervious Runoff Depth>3.91"
Tc=6.0 min CN=84 Runoff=27.31 cfs 1.963 af

Subcatchment 2S: A2-pre Runoff Area=91,937 sf 24.45% Impervious Runoff Depth>3.61"
Tc=5.0 min CN=81 Runoff=9.22 cfs 0.635 af

Subcatchment 3S: A5 Runoff Area=114,822 sf 8.70% Impervious Runoff Depth>3.31"
Tc=6.0 min CN=78 Runoff=10.25 cfs 0.727 af

Subcatchment 4S: A3 Runoff Area=125,538 sf 68.37% Impervious Runoff Depth>4.66"
Tc=5.0 min CN=91 Runoff=15.50 cfs 1.119 af

Subcatchment 5S: A4 Runoff Area=21,948 sf 55.83% Impervious Runoff Depth>4.33"
Tc=5.0 min CN=88 Runoff=2.57 cfs 0.182 af

Subcatchment 6S: A6 Runoff Area=24,503 sf 92.04% Impervious Runoff Depth>5.23"
Tc=5.0 min CN=96 Runoff=3.21 cfs 0.245 af

Subcatchment 7S: A7 Runoff Area=67,434 sf 0.13% Impervious Runoff Depth>3.12"
Tc=5.0 min CN=76 Runoff=5.88 cfs 0.402 af

Pond 1P: MH#4 Peak Elev=732.91' Inflow=18.71 cfs 1.364 af
Primary=5.87 cfs 1.088 af Secondary=12.83 cfs 0.276 af Outflow=18.71 cfs 1.364 af

Pond 2P: 4x4-galleries Peak Elev=732.85' Storage=7,341 cf Inflow=5.87 cfs 1.088 af
Discarded=0.47 cfs 0.411 af Primary=2.92 cfs 0.671 af Outflow=3.39 cfs 1.083 af

Link 1L: pre-total Inflow=36.43 cfs 2.598 af
Primary=36.43 cfs 2.598 af

Link 2L: stream-outlet Inflow=15.30 cfs 0.947 af
Primary=15.30 cfs 0.947 af

Link 3L: post-total Inflow=33.84 cfs 2.259 af
Primary=33.84 cfs 2.259 af

Link 4L: WQ#1 Inflow=5.87 cfs 1.088 af
Primary=5.87 cfs 1.088 af

Total Runoff Area = 16.265 ac Runoff Volume = 5.274 af Average Runoff Depth = 3.89"
64.64% Pervious = 10.514 ac 35.36% Impervious = 5.750 ac

Summary for Subcatchment 1S: A1-pre

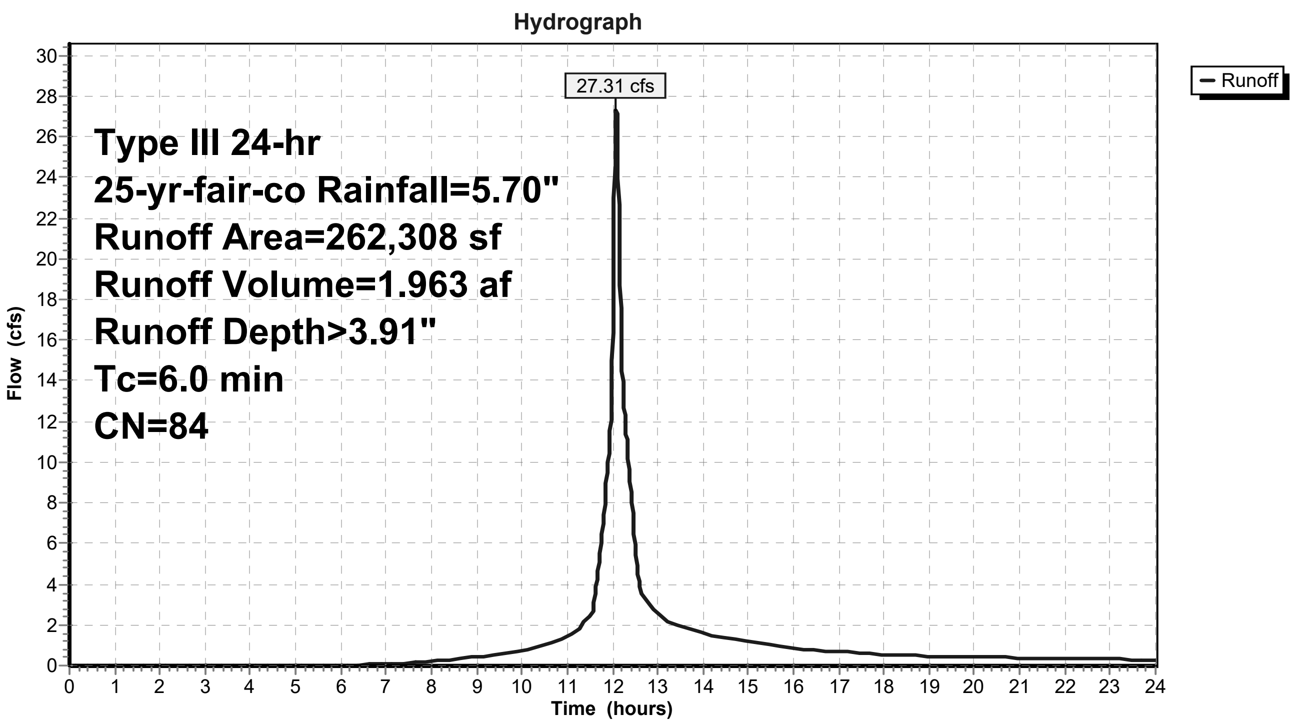
Runoff = 27.31 cfs @ 12.09 hrs, Volume= 1.963 af, Depth> 3.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr-fair-co Rainfall=5.70"

Area (sf)	CN	Description
165,004	76	Woods/grass comb., Fair, HSG C
97,304	98	Paved parking, HSG C
262,308	84	Weighted Average
165,004		62.90% Pervious Area
97,304		37.10% Impervious Area

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

Subcatchment 1S: A1-pre



Summary for Subcatchment 2S: A2-pre

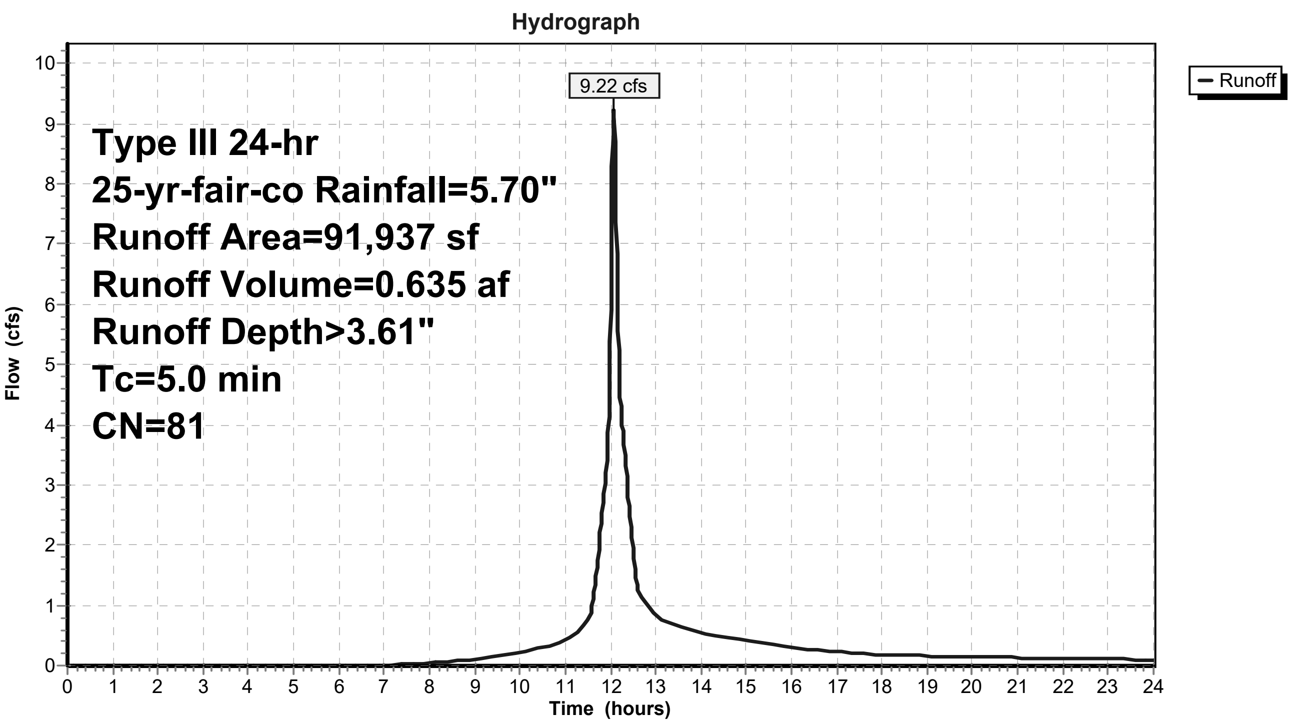
Runoff = 9.22 cfs @ 12.07 hrs, Volume= 0.635 af, Depth> 3.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr-fair-co Rainfall=5.70"

Area (sf)	CN	Description
69,463	76	Woods/grass comb., Fair, HSG C
22,474	98	Paved parking, HSG C
91,937	81	Weighted Average
69,463		75.55% Pervious Area
22,474		24.45% Impervious Area

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

Subcatchment 2S: A2-pre



Summary for Subcatchment 3S: A5

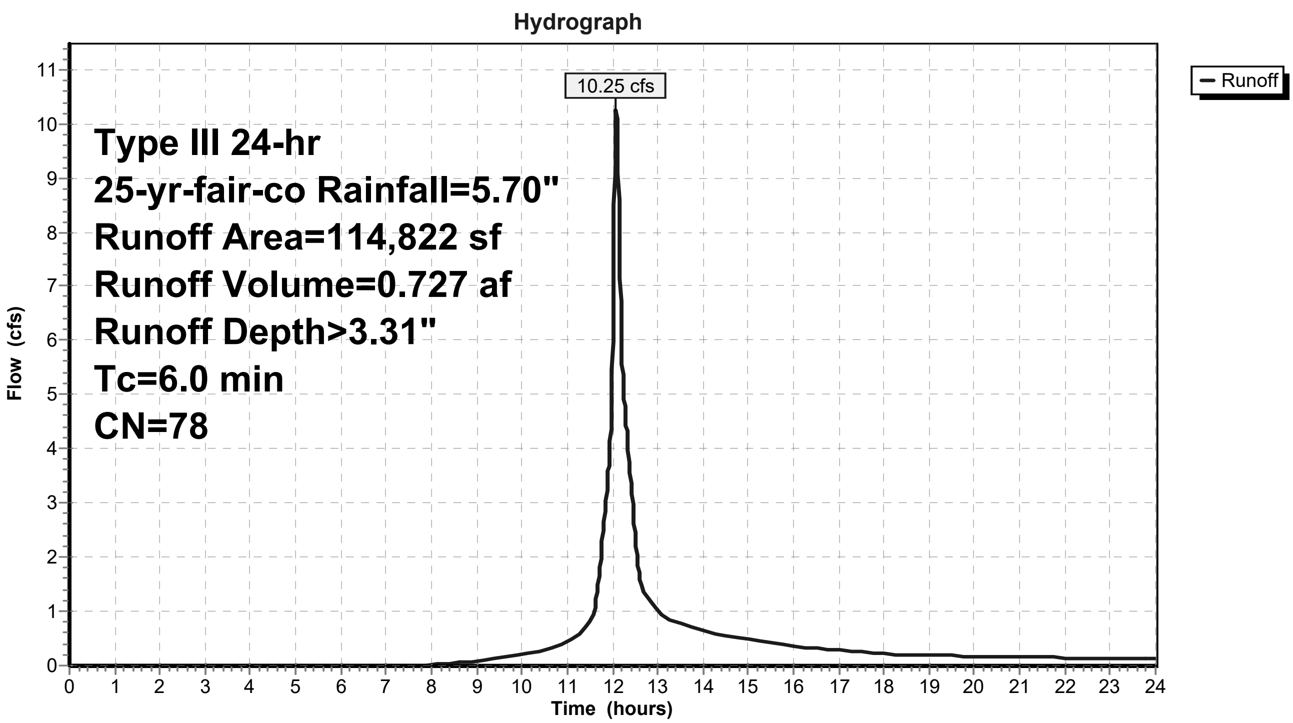
Runoff = 10.25 cfs @ 12.09 hrs, Volume= 0.727 af, Depth> 3.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr-fair-co Rainfall=5.70"

Area (sf)	CN	Description
104,829	76	Woods/grass comb., Fair, HSG C
9,993	98	Paved parking, HSG C
114,822	78	Weighted Average
104,829		91.30% Pervious Area
9,993		8.70% Impervious Area

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

Subcatchment 3S: A5



Summary for Subcatchment 4S: A3

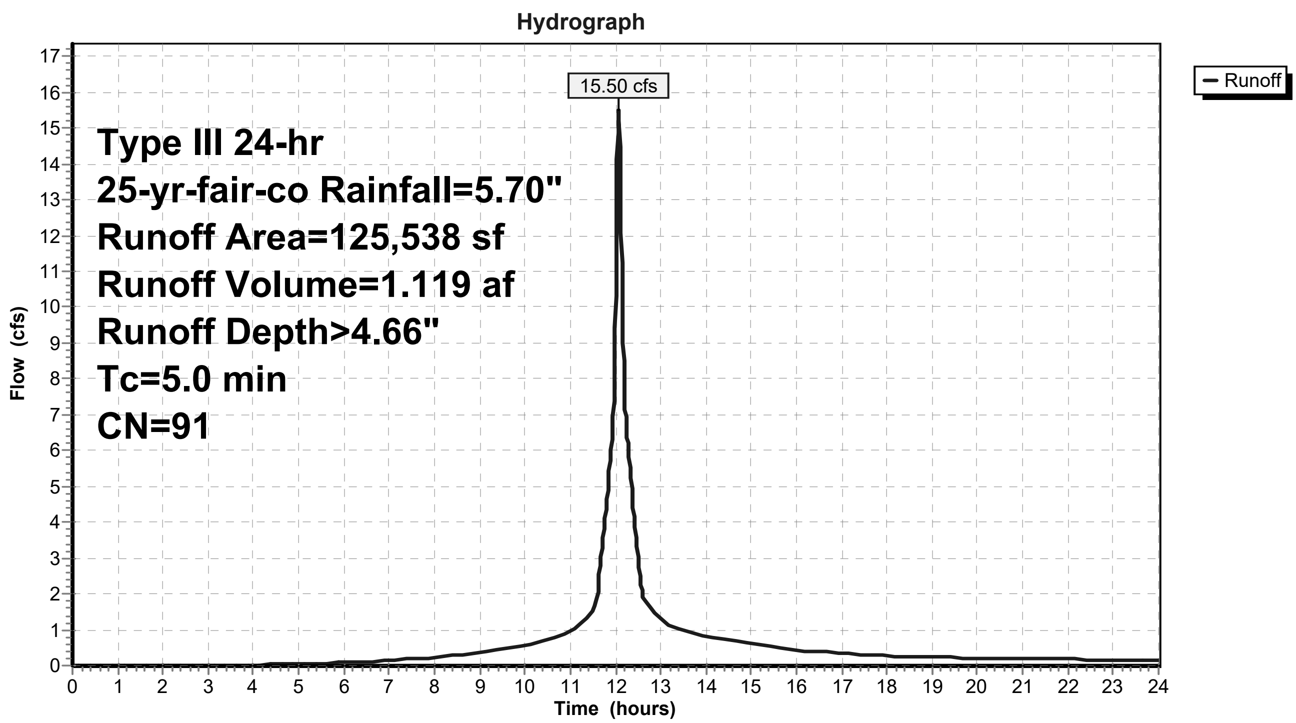
Runoff = 15.50 cfs @ 12.07 hrs, Volume= 1.119 af, Depth> 4.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr-fair-co Rainfall=5.70"

Area (sf)	CN	Description
39,713	76	Woods/grass comb., Fair, HSG C
85,825	98	Paved parking, HSG C
125,538	91	Weighted Average
39,713		31.63% Pervious Area
85,825		68.37% Impervious Area

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

Subcatchment 4S: A3



Summary for Subcatchment 5S: A4

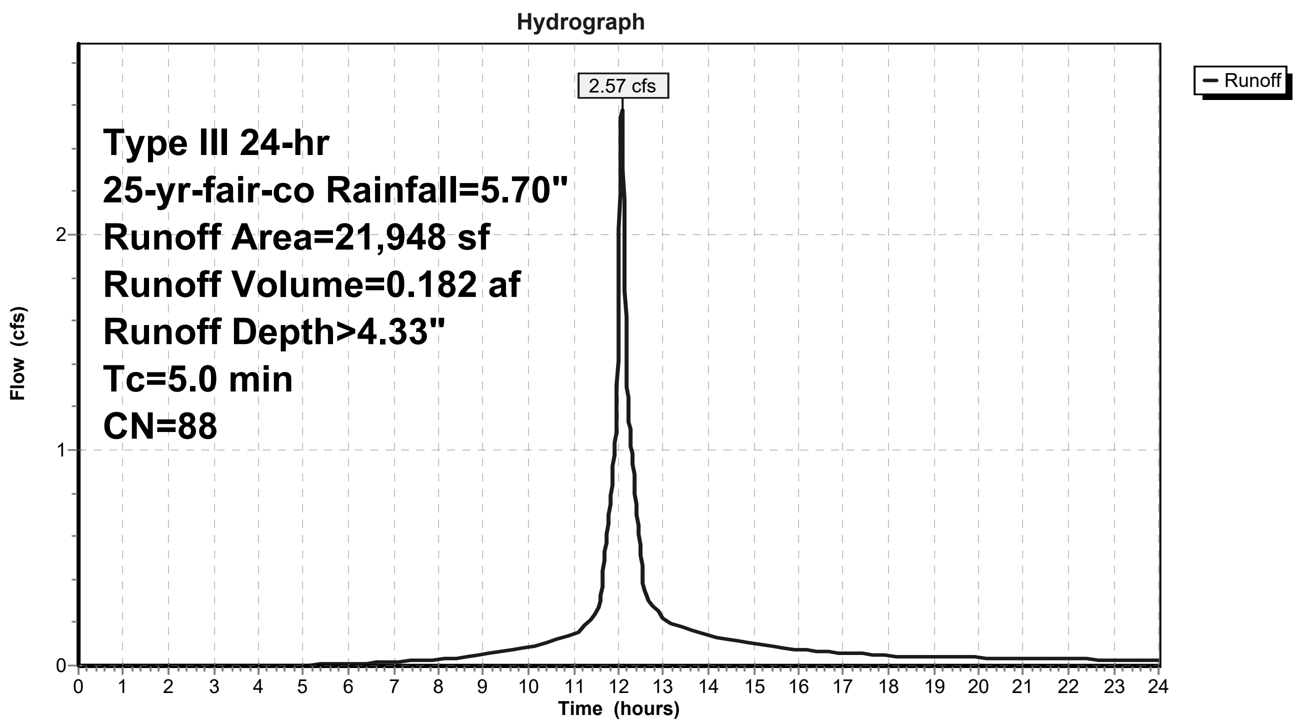
Runoff = 2.57 cfs @ 12.07 hrs, Volume= 0.182 af, Depth> 4.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr-fair-co Rainfall=5.70"

Area (sf)	CN	Description
9,694	76	Woods/grass comb., Fair, HSG C
12,254	98	Paved parking, HSG C
21,948	88	Weighted Average
9,694		44.17% Pervious Area
12,254		55.83% Impervious Area

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

Subcatchment 5S: A4



Summary for Subcatchment 6S: A6

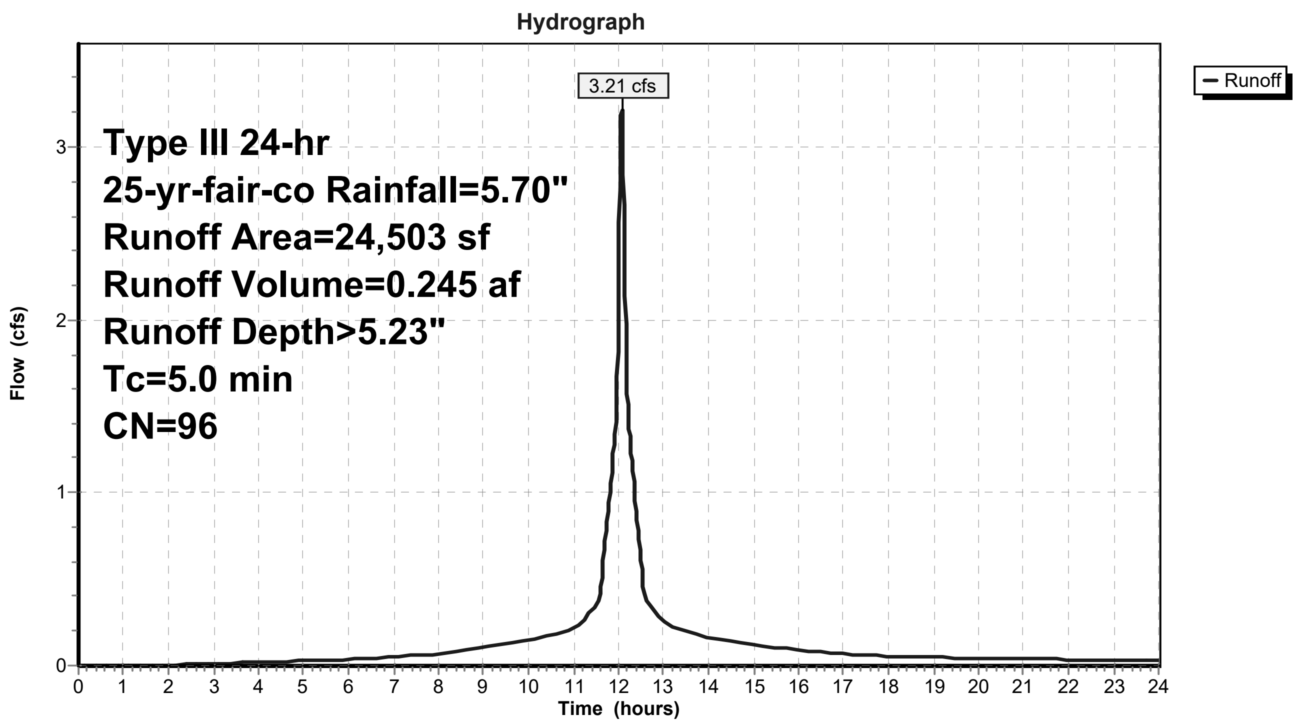
Runoff = 3.21 cfs @ 12.07 hrs, Volume= 0.245 af, Depth> 5.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr-fair-co Rainfall=5.70"

Area (sf)	CN	Description
1,951	76	Woods/grass comb., Fair, HSG C
22,552	98	Paved parking, HSG C
24,503	96	Weighted Average
1,951		7.96% Pervious Area
22,552		92.04% Impervious Area

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

Subcatchment 6S: A6



Summary for Subcatchment 7S: A7

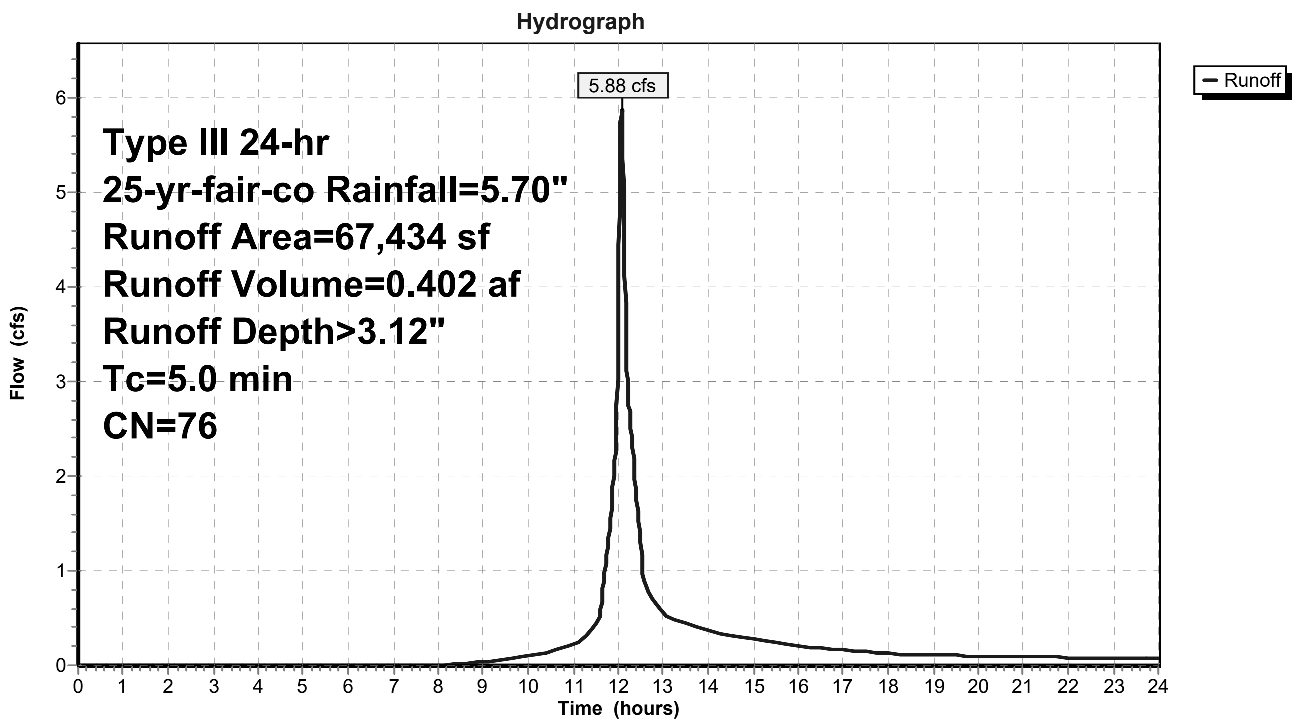
Runoff = 5.88 cfs @ 12.08 hrs, Volume= 0.402 af, Depth> 3.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr-fair-co Rainfall=5.70"

Area (sf)	CN	Description
67,346	76	Woods/grass comb., Fair, HSG C
88	98	Paved parking, HSG C
67,434	76	Weighted Average
67,346		99.87% Pervious Area
88		0.13% Impervious Area

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

Subcatchment 7S: A7



Summary for Pond 1P: MH#4

Inflow Area = 3.444 ac, 72.23% Impervious, Inflow Depth > 4.75" for 25-yr-fair-co event
Inflow = 18.71 cfs @ 12.07 hrs, Volume= 1.364 af
Outflow = 18.71 cfs @ 12.07 hrs, Volume= 1.364 af, Atten= 0%, Lag= 0.0 min
Primary = 5.87 cfs @ 12.07 hrs, Volume= 1.088 af
Secondary = 12.83 cfs @ 12.07 hrs, Volume= 0.276 af

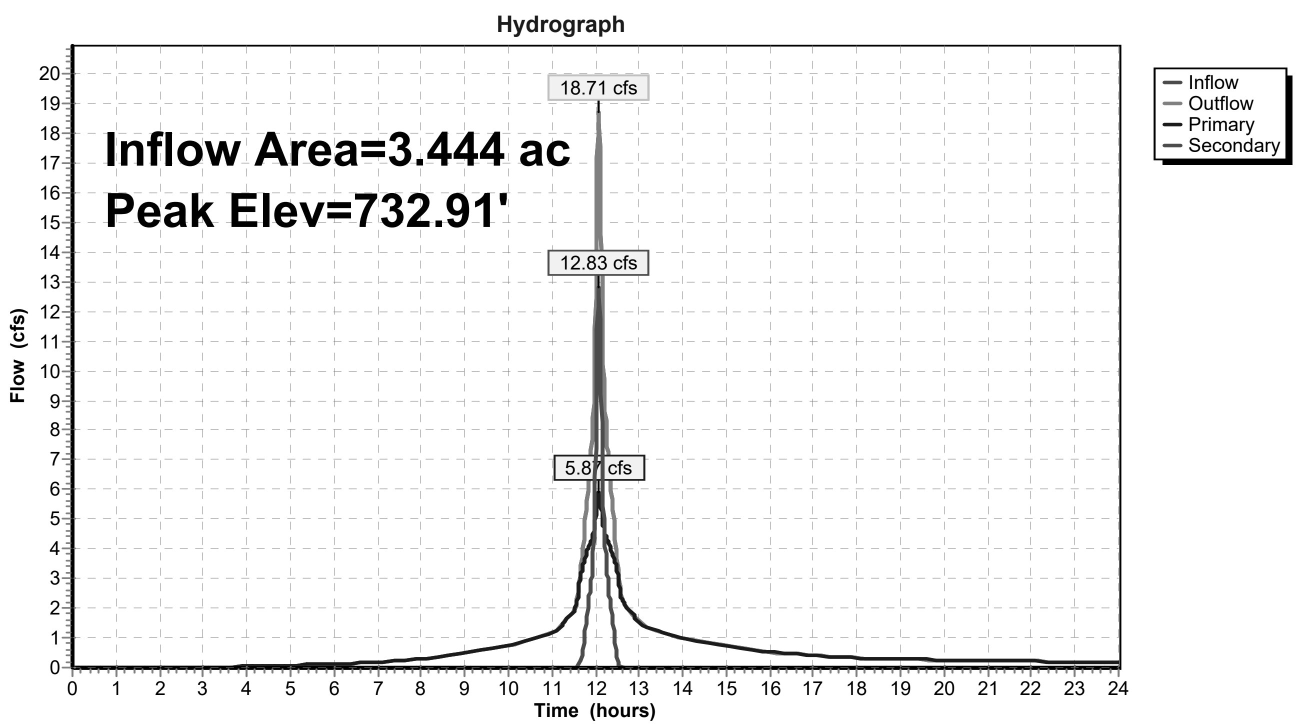
Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 732.91' @ 12.07 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	730.00'	**12.0" Round Culvert** L= 6.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 730.00' / 729.80' S= 0.0333 '/' Cc= 0.900 n= 0.011 cpp-smooth, Flow Area= 0.79 sf
#2	Secondary	731.00'	**24.0" Round Culvert** L= 6.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 731.00' / 730.80' S= 0.0333 '/' Cc= 0.900 n= 0.011, Flow Area= 3.14 sf

Primary OutFlow Max=5.87 cfs @ 12.07 hrs HW=732.91' (Free Discharge)
└─**1=Culvert** (Inlet Controls 5.87 cfs @ 7.48 fps)

Secondary OutFlow Max=12.82 cfs @ 12.07 hrs HW=732.91' (Free Discharge)
└─**2=Culvert** (Barrel Controls 12.82 cfs @ 5.32 fps)

Pond 1P: MH#4



Summary for Pond 2P: 4x4-galleries

Inflow Area = 3.444 ac, 72.23% Impervious, Inflow Depth > 3.79" for 25-yr-fair-co event
Inflow = 5.87 cfs @ 12.07 hrs, Volume= 1.088 af
Outflow = 3.39 cfs @ 12.48 hrs, Volume= 1.083 af, Atten= 42%, Lag= 24.3 min
Discarded = 0.47 cfs @ 12.48 hrs, Volume= 0.411 af
Primary = 2.92 cfs @ 12.48 hrs, Volume= 0.671 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 732.85' @ 12.48 hrs Surf.Area= 3,072 sf Storage= 7,341 cf

Plug-Flow detention time= 31.6 min calculated for 1.082 af (99% of inflow)
Center-of-Mass det. time= 28.4 min (818.6 - 790.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	729.00'	2,704 cf	**6.40'W x 480.00'L x 4.50'H Field A** 13,824 cf Overall - 7,065 cf Embedded = 6,759 cf x 40.0% Voids
#2A	729.50'	5,321 cf	**Concrete Galley 4x4x4** x 120 Inside #1 Inside= 42.0"W x 43.0"H => 12.67 sf x 3.50'L = 44.3 cf Outside= 52.8"W x 48.0"H => 14.72 sf x 4.00'L = 58.9 cf
		8,025 cf	Total Available Storage

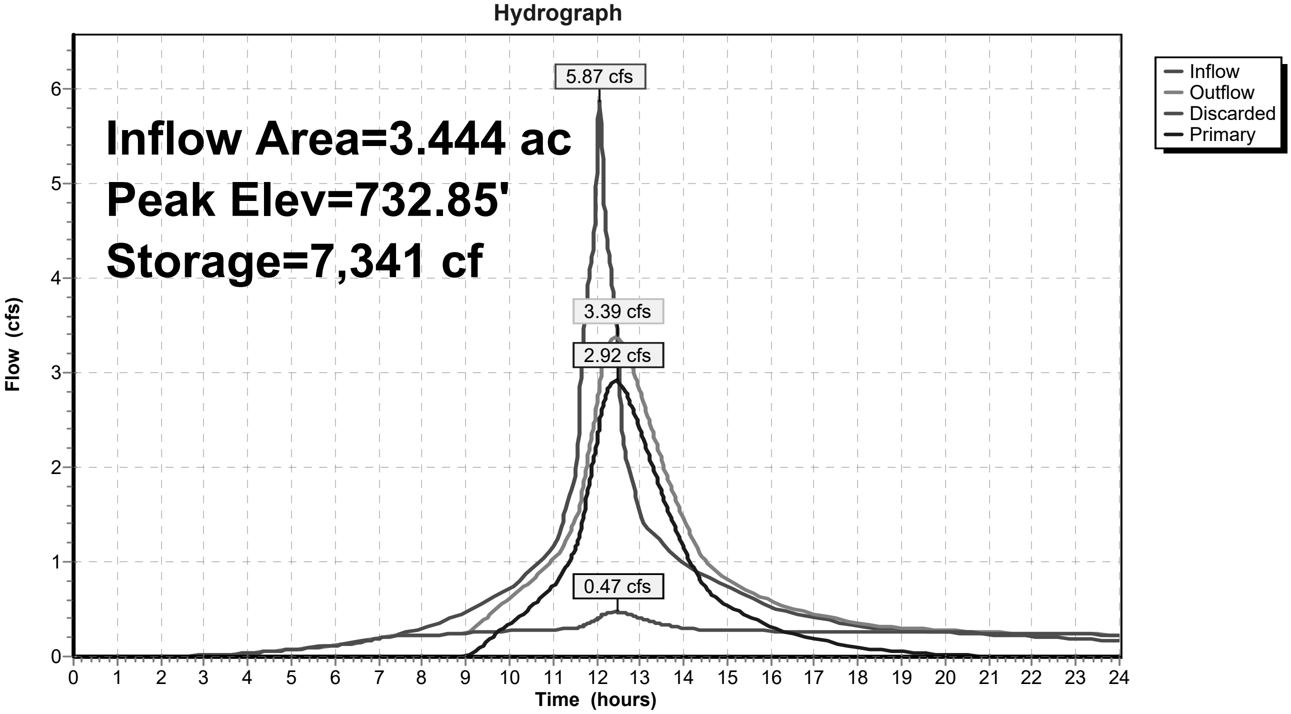
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	729.50'	**12.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 729.50' / 729.20' S= 0.0100 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf
#2	Discarded	729.00'	**3.000 in/hr Exfiltration over Wetted area**
#3	Device 1	729.50'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.47 cfs @ 12.48 hrs HW=732.85' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.47 cfs)

Primary OutFlow Max=2.92 cfs @ 12.48 hrs HW=732.85' (Free Discharge)
└─**1=Culvert** (Passes 2.92 cfs of 5.04 cfs potential flow)
  └─**3=Orifice/Grate** (Orifice Controls 2.92 cfs @ 8.36 fps)

Pond 2P: 4x4-galleries

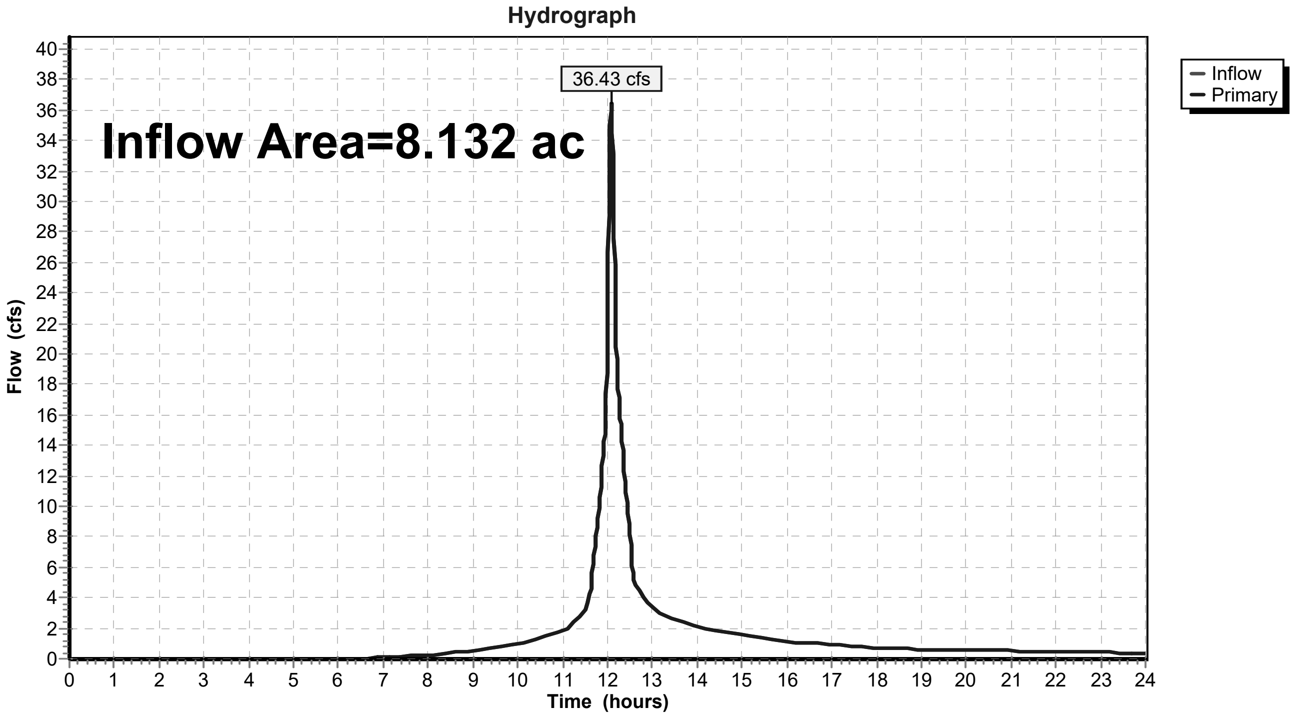


Summary for Link 1L: pre-total

Inflow Area = 8.132 ac, 33.81% Impervious, Inflow Depth > 3.83" for 25-yr-fair-co event
Inflow = 36.43 cfs @ 12.08 hrs, Volume= 2.598 af
Primary = 36.43 cfs @ 12.08 hrs, Volume= 2.598 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 1L: pre-total

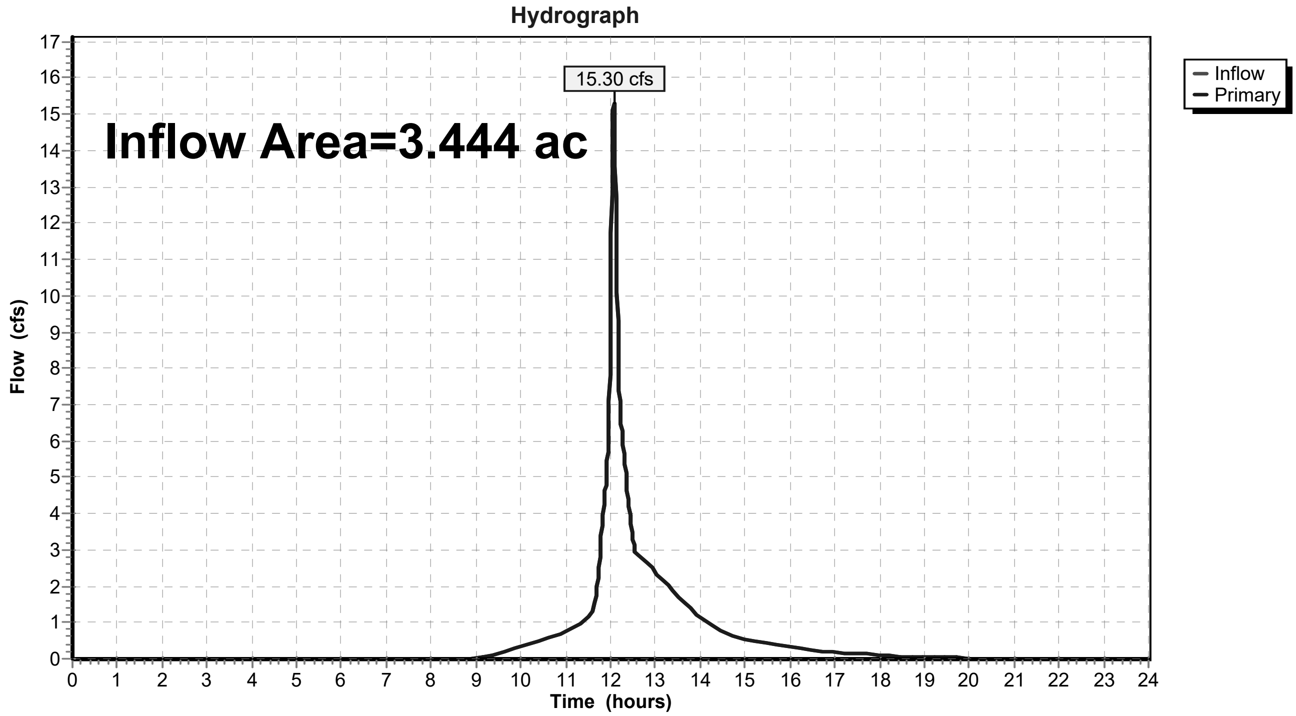


Summary for Link 2L: stream-outlet

Inflow Area =	3.444 ac,	72.23% Impervious,	Inflow Depth = 3.30"		for 25-yr-fair-co event
Inflow =	15.30 cfs @	12.07 hrs,	Volume=	0.947 af	
Primary =	15.30 cfs @	12.07 hrs,	Volume=	0.947 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 2L: stream-outlet

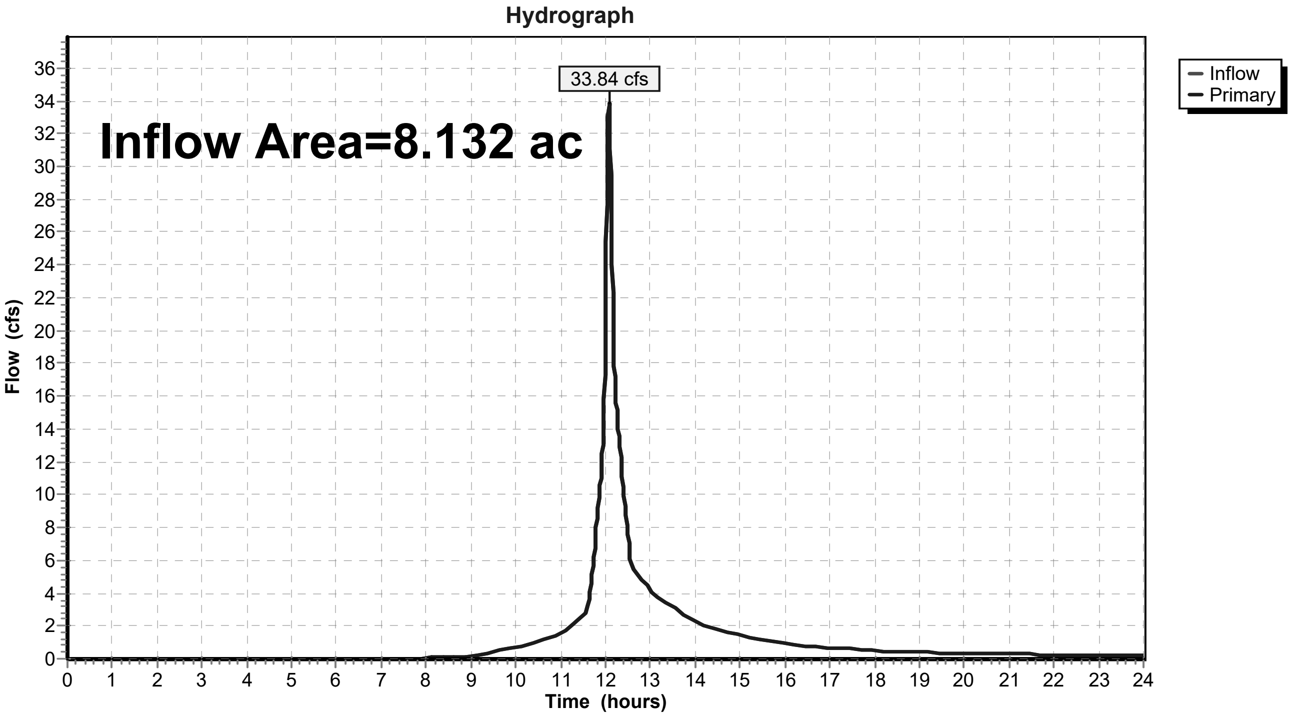


Summary for Link 3L: post-total

Inflow Area = 8.132 ac, 36.90% Impervious, Inflow Depth > 3.33" for 25-yr-fair-co event
Inflow = 33.84 cfs @ 12.08 hrs, Volume= 2.259 af
Primary = 33.84 cfs @ 12.08 hrs, Volume= 2.259 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 3L: post-total

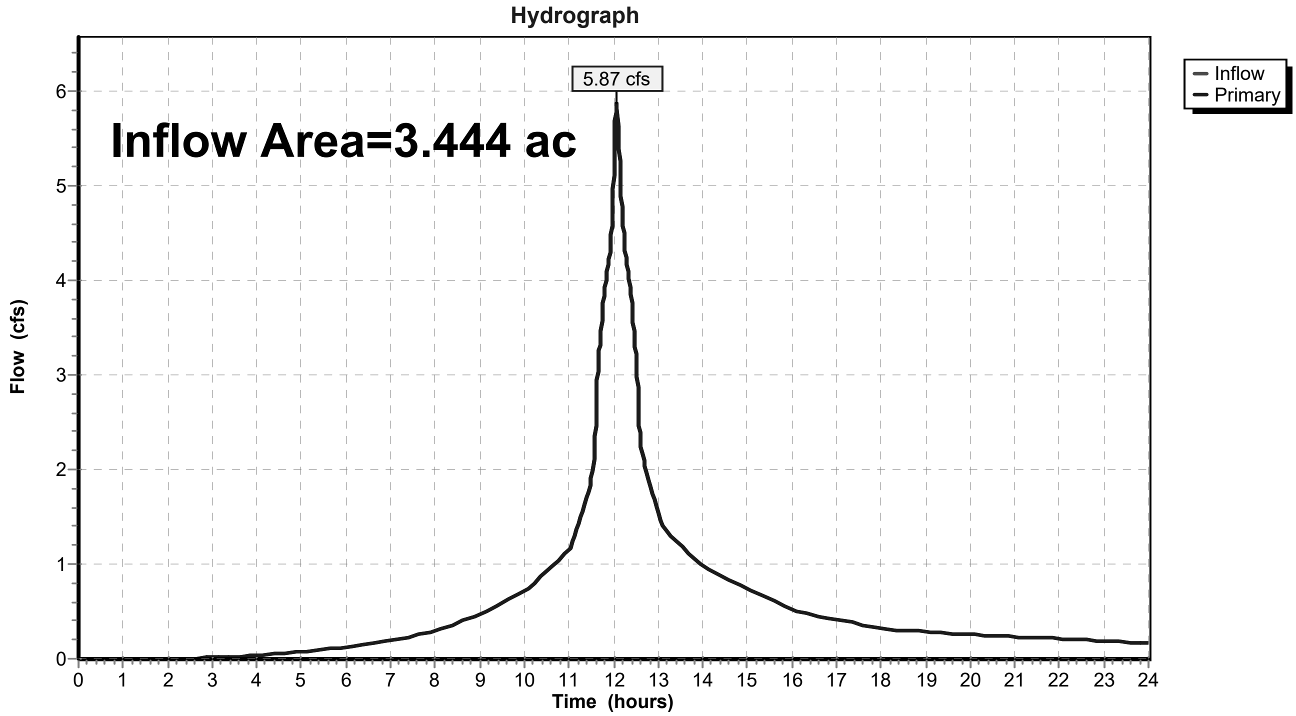


Summary for Link 4L: WQ#1

Inflow Area = 3.444 ac, 72.23% Impervious, Inflow Depth > 3.79" for 25-yr-fair-co event
Inflow = 5.87 cfs @ 12.07 hrs, Volume= 1.088 af
Primary = 5.87 cfs @ 12.07 hrs, Volume= 1.088 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 4L: WQ#1



OBJECTIVE: DETERMINE PRE TO POST DEVELOPED PEAK FLOWS FOR PROPOSED PARKING EXPANSION. SIZE DETENTION, PIPING & WATER QUALITY MEASURES IN ACCORDANCE WITH TOWN OF NEW FAIRFIELD'S "STORM WATER MGMT. PLAN" REQUIREMENTS.

REFERENCE:
- CIVIL SHEETS C01, C01.1, C02 & C05 (JAN 24) (SITE, GRADING & UTILITY, & DRAINAGE MAPS)
- IMPROVEMENT LOCATION SURVEY (NOV 2023)
- FAIRFIELD COUNTY SOIL SURVEY 2/1981
- HYDROCAD MODEL FOR STORM ROUTING, HYDROGRAPHS & DETENTION SIZING - 25 YEAR (TYPE III 24-HR RAINFALL = 5.7")
- RATIONAL METHOD (FOR SUB SHEDS & PIPE FLOW)

$Q = CiA$ Q = FLOW (CFS)
C = RUNOFF COEFF
0.9 = IMPERVIOUS
0.3 = PERVIOUS
i = INTENSITY (IN/HR)
6.7 IN/HR (t_c = 5 MIN)
A = AREA (AC)

- TR-55 FIG. 3-1 FOR OVERLAND FLOW VELOCITIES & TOPOGRAPHY
- MANNING'S EQN (FOR PIPE CAPACITY)

$$Q\,(CFS) = A \cdot V$$
$$= A \cdot \frac{1.49}{n} R_h^{2/3} S^{1/2}$$

EXISTING CONDITIONS:

A_1 = 262,308 ft^2 (UPPER AREA)

$A_{1\,(IMP)}$ = 97,304 ft^2 CN = 98

EXISTING CNTD...

$A_{1\,(FOR)} = 165,004\ ft^2$ CN = 76

WOODS / GRASS, FAIR HSG "C"

SOILS ARE Ud, W_xC, W_zB & W_xB

NO HSG → (Ud); (W_xC, W_zB & W_xB) ALL TYPE "C"

USE TYPE "C" FOR ANALYSIS

$\overline{CN}_1 = 84$

$t_{c_1} = 5.9$ MIN USE $t_{c_1} = 6.0$ MIN

(SEE t_c WORKSHEET)

$Q_{A1} = 27.3$ CFS (SEE HYDROCAD MODEL)

$A_2 = 91,937\ ft^2$ (LOWER AREA)

$A_{2\,(IMP)} = 22,474\ ft^2$ CN = 98

$A_{2\,(FOR)} = 69,463\ ft^2$ CN = 76

$\overline{CN}_2 = 81$ $t_{c_2} = 2.5$ MIN USE $t_{c_2} = 5.0$ MIN

(SEE WORKSHEET)

$Q_{A2} = 9.2$ CFS (SEE HYDROCAD MODEL)

Q_{A1} + Q_{A2} → $Q_{PRE\ TOTAL} = 36.4$ CFS

PROPOSED CONDITIONS:

A_3 = 125,538 FT^2 (UPPER TO DETENTION)

$A_{3(imp)}$ = 85,825 FT^2 CN = 98 $\overline{CN}_3$ = 91

$A_{3(PVR)}$ = 39,713 FT^2 CN = 76

t_{c_3} = 5.1 MIN USE t_{c3} = 5.0 MIN (SEE t_c WORKSHEET)

Q_{A3} = 15.5 CFS

A_4 = 21,948 FT^2 (UPPER BYPASS TO BRUSH RD)

$A_{4(imp)}$ = 12,254 FT^2 CN = 98 $\overline{CN}_4$ = 88

$A_{4(PVR)}$ = 9,694 FT^2 CN = 76

USE t_c = 5.0 MIN (VERY SHORT TRAVEL PATH)

Q_{A4} = 2.6 CFS

A_5 = 114,822 FT^2 (UPPER BYPASS)

$A_{5(imp)}$ = 9,993 FT^2 CN = 98 $\overline{CN}_5$ = 78

$A_{5(PVR)}$ = 104,829 FT^2 CN = 76

t_{c5} = t_{c1} = 6.0 MIN Q_{A5} = 10.3 CFS

PROP. COND CONT'D...

$A_6 = 24{,}503\ ft^2$ (LOWER TO DETENTION)

$A_{6(imp)} = 22{,}552\ ft^2$ CN = 98

$A_{6(PVR)} = 1{,}951\ ft^2$ CN = 76

USE $t_c = 5.0$ min (SIM TO t_{c2})

$Q_6 = 3.2$ cfs $\overline{CN}_6 = 96$

$A_7 = 67{,}434\ ft^2$ (LOWER BYPASS)

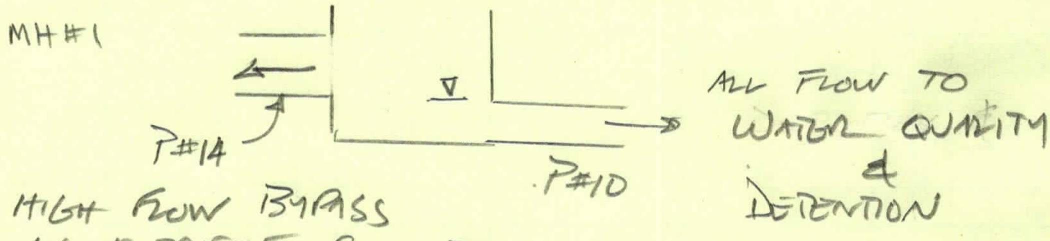
$A_{7(imp)} = 88\ ft^2$ CN = 98

$A_{7(PVR)} = 67{,}346\ ft^2$ CN = 76 $\overline{CN}_7 = 76$

$t_c = 5.0$ min (SHORT PATH)

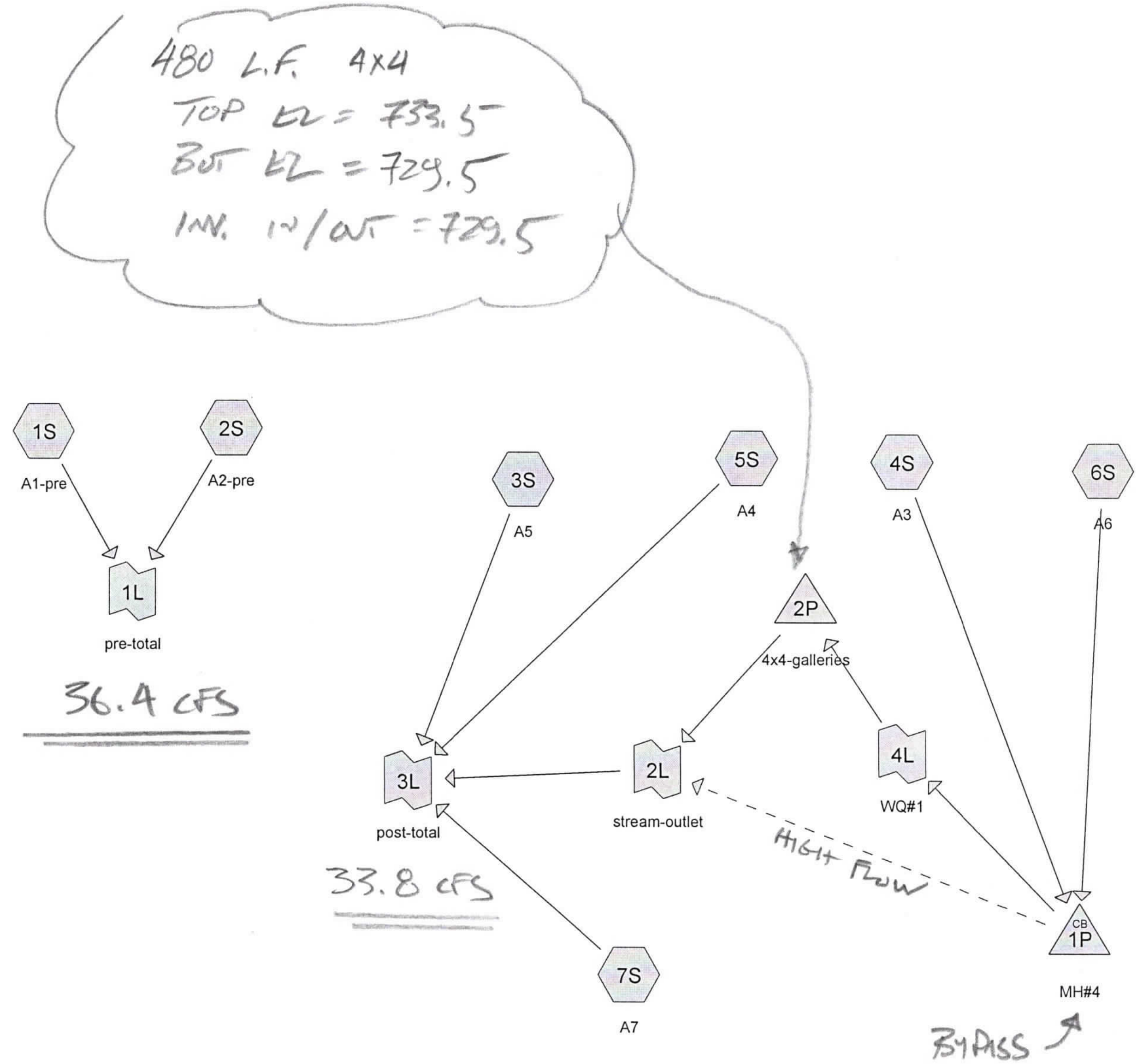
$Q_7 = 5.9$ cfs

ROUTE STORM THROUGH A BYPASS MANHOLE (#1)



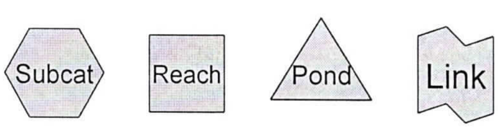
HIGH FLOW BYPASS
IN EXTREME FLOW TO
NOT FLUSH OUT W.Q. UNIT

REF: HYDROCAD MODEL.



* O.K. POST DEV < PRE-DEV

33.8 CFS < 36.4 CFS



Routing Diagram for 211-drainage-r0

Prepared by {enter your company name here}, Printed 12/27/2023

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CHECK IMPERVIOUS SURFACES

⇒ MAIN LOT (21 BRUSH HILL)

$$\frac{\text{ON-SITE IMP AREA}}{\text{TOTAL AREA}} = \frac{105,218 \text{ FT}^2}{234,004 \text{ FT}^2} = 45.0\% \text{ IMP \%}$$

- REQUIRED MAX IMP = 48%* > 45.0%
  - *VARIANCE GRANTED (ZBA #03-23)
- EFFECTIVE IMPERVIOUS = $\frac{19,393 \text{ FT}^2}{234,004 \text{ FT}^2} = 8.3\%$

  8.3% < 10.0% (MAX PERMITTED)

* OK: IMPERVIOUS & EFFECTIVE IMPERVIOUS % SATISFIED

⇒ LOWER LOT (1 MARGERIE DR.)

$$\frac{\text{ON-SITE IMP}}{\text{TOTAL AREA}} = \frac{18,279 \text{ FT}^2}{85,203 \text{ FT}^2} = 21.5\% \text{ IMPER \%}$$

- REQ MAX IMP = 25% > 21.5% ✓
- EFFECTIVE IMPERVIOUS = 0% = $\frac{0}{85,203 \text{ FT}^2}$

  0% < 10.0% (MAX. PERMITTED)

* OK: IMPERVIOUS & EFFECTIVE IMPERVIOUS % SATISFIED.

CHECK PIPE SIZING:

REF:
- MANNING'S PIPE FLOW WORKSHEET
- HYDROCAD (A1 TO A7) HYDROGRAPHS
- RATIONAL WORKSHEET (A8 TO A11) SUBSHEDS

ST. ED'S | DRAINAGE ANAL. | BVD | 1-30-24 | 7/14

PIPE SIZING (CNT'D).

- CHECK P#15 (CAP) VS. Q (P#15) = Q (STREAM OUTLET) = 15.3 CFS
  P#15 (CAP) = 20.8 CFS > 15.3 ∴ OK
- CHECK P#14 (OK - ANALYZED IN HYDROCAD MODEL) ∴ OK
- CHECK P#13 (CAP) VS. Q (P#13) = Q (A6) = 3.21 CFS
  P#13 (CAP) = 4.2 CFS > 3.21 CFS ∴ OK
- CHECK P#12 (OK - ANALYZED IN HYDROCAD MODEL) ∴ OK
- CHECK P#11 (CAP) VS. Q (P#11) = Q (TO GALLERIES) = 5.87 CFS
  P#11 (CAP) = 8.2 CFS > 5.87 CFS ∴ OK
- CHECK P#10 (OK - ANALYZED IN HYDROCAD MODEL) ∴ OK
- CHECK P#9 (CAP) VS. Q (P#9) = Q (A3) = 15.5 CFS
  P#9 (CAP) = 18.5 CFS > 15.5 CFS ∴ OK
- CHECK P#8 (CAP) VS. Q (P#8) = Q (A3) = 15.5 CFS
  P#8 (CAP) = 17.6 CFS > 15.5 CFS ∴ OK
- CHECK P#7 (CAP) VS. Q (P#7) = Q (A8) = 1.1 CFS
  P#7 (CAP) = 6.7 CFS > 1.1 CFS ∴ OK
- CHECK P#6 (CAP) VS. Q (P#6) = Q (A8) = 1.1 CFS ∴ OK
  P#6 (CAP) = 2.0 CFS > 1.1 CFS
- CHECK P#5 (CAP) VS Q (P#5) = Q (A9 + A10 + A11)
  Q (P#5) = (3.81 + 5.67 + 0.91) = 10.39 CFS
  P#5 (CAP) = 11.9 CFS > 10.39 CFS ∴ OK
- CHECK P#4 (CAP) VS. Q (P#4) = Q (A10 + A11)
  Q (P#4) = (5.67 + 0.91) = 6.58 CFS ∴ OK
  P#4 (CAP) = 10.8 CFS > 6.58 CFS

PIPE SIZING CONT'D...

- CHECK P#3 (CAP) VS. Q(P#3) = Q(A11) = 0.91 CFS
  P#3 (CAP) = 6.0 CFS > 0.91 CFS ∴ OK
- CHECK P#2 (CAP) VS. Q(P#2) = Q(A11) = 0.91 CFS
  P#2 (CAP) = 6.4 CFS > 0.91 CFS ∴ OK
- P#1 IS NOT A STORM DRAIN & ONLY CONVEY GROUNDWATER FROM AN EXISTING CURTAIN DRAIN (NO NEED TO SIZE)

SIZE P#15 CHANNEL OUTLET

- TYPE "C" OUTLET REF CT DOT DRAINAGE MANUAL

P#15 Q(P#15) = 15.3 CFS, 24" DIA (FULL FLOW)

TABLE 8-6.1 16 CFS & 24" USE $L_a = 17'$ (MIN)

USE $L_a = 25'$

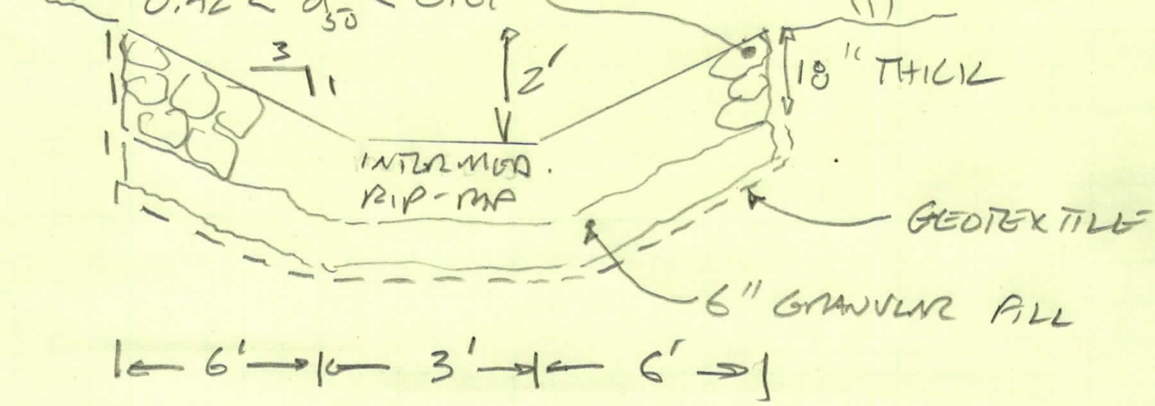
FULL FLOW V = 6.61 FPS

TABLE 8.5

	V =	RIP-RAP
	0 - 8 FPS	MODIFIED
*	8 - 10	INT.
	10 - 14	STD.

* USE NEXT SIZE UP - INTERM. RIP-RAP.

$0.42' < d_{50} < 0.67'$



WATER QUALITY FLOW: COMPARE WQ#1 (ADS BARRACUDA MAX S8) TO WATER QUALITY FLOW RATE.

REFERENCE:
- CT GUIDELINES FOR SEC (2002)
- COMPARE WATER QUALITY FLOW (WQF) FOR WQ #1
- CALCULATE FOR 1ST 1" RUNOFF

$R = 0.05 + 0.009(I)$

$I = A3 + A6 = \frac{108,377}{150,041} = 72.2\%$

$R = 0.05 + 0.009(72.2) = 0.70$

$WQV = \frac{1''(R)(A)}{12} = (1)(.70)(3.44)$

$WQV = 0.20$ AC-FT

P = 1" RAINFALL

$CN = \frac{1,000}{10 + 5P + 10Q - 10(Q^2 + 1.25QP)^{1/2}}$

$Q = \frac{WQV(12)}{A} = \frac{(0.20)(12)}{3.44} = 0.70$

$CN = \frac{1,000}{10 + 5(1) + 10(.7) - 10(.7^2 + 1.25(.7)(1))^{1/2}}$

11.68

CN = 97

- CHECK I_a ON TABLE 4-1 TR-55

$CN = 97 \Rightarrow I_a = 0.062$

WQ. SIZING CNTD.

$P = 1''$ $\quad \frac{I_a}{P} = \frac{0.062}{1} = 0.062$

$t_c = 6\text{ MIN} = 0.1\text{ HRS}$

CHECK EXHIBIT 4-III FOR TYPE III (q_u)

0.1 HRS & $\frac{I_a}{P} = 0.062$

$q_u = 650$ CSM/IN

$WQF = q_u(A)(Q)$

SQ MILES $(3.44\text{ AC}) \times \frac{43560\text{ FT}^2}{\text{AC}} \times \frac{1\text{ SQM}}{5{,}280^2\text{ FT}^2}$

$A = 5.375 \times 10^{-3}$ SQ-M

$= (650)(5.375 \times 10^{-3})(0.7) = 2.45$ CFS

WQF = 2.45 CFS < 5.87 CFS MAX FLOW TO WQ / DETENTION SYS.

∴ OK

WQ #1 TO BE A BARRACUDA MAX MODEL S8

TREATMENT CAPACITY = 6.1 CFS > WQF = 2.45

> 5.87 MAX WQ SYSTEM FLOW

∴ OK - WATER QUALITY FLOW TREATMENT RATE IS MET & EXCEEDED.

Saint Edward The Confessor
21 Brush Hill Road, New Fairfield, CT

1/30/2024

Q = CiA   C (imp) = 0.9, C (per) = 0.3
I(25) = 6.7 in/hr. (Tc = 5 min.), A (acres)

Shed I.D.	area (s.f.)	imp area	per. area	weighted "C"	**25 yr - Q (cfs)**
A8	8,574	7,608	966	0.83	**1.10**
A9	30,526	26,010	4,516	0.81	**3.81**
A10	47,185	37,796	9,389	0.78	**5.67**
A11	17,266	1,280	15,986	0.34	**0.91**

Manning's Pipe Flow Worksheet
Saint Edward The Confessor
21 Brush Hill Road, New Farifield, CT

1/30/2024

Pipe I.D.	diam. (in.)	slope (%)	n (value)	Velocity (fps)	**Capacity (cfs)**
P#1	4	~10%	N/A - this is a curtain drain outlet		
P#2	12	2.3	0.011	8.15	**6.4**
P#3	12	2.0	0.011	7.60	**6.0**
P#4	15	2.0	0.011	8.82	**10.8**
P#5	15	2.4	0.011	9.66	**11.9**
P#6	8	2.0	0.011	5.80	**2.0**
P#7	12	2.5	0.011	8.50	**6.7**
P#8	18	2.0	0.011	9.96	**17.6**
P#9	18	2.2	0.011	10.45	**18.5**
P#10	12	3.3	analyzed in HydroCAD model		
P#11	12	3.8	0.011	10.48	**8.2**
P#12	12	1.0	analyzed in HydroCAD model		
P#13	12	1.0	0.011	5.38	**4.2**
P#14	24	3.3	analyzed in HydroCAD model		
P#15	24	0.6	0.011	6.61	**20.8**

Time of Concentration Worksheet #1 1/30/2024
Saint Edward The Confessor
21 Brush Hill Road, New Fairfield, CT

Tc#	Reach	Description	elev up	elev dn.	length (ft.)	slope (%)	V (fps)	T (sec)
Tc#1	a-b	pasture/grass	792	746	420	11.0	2.3	182.6
	b-c	gutter	746	738	263	3.0	3.5	75.1
	c-d	pipe flow (use v = 3 fps)	n/a	n/a	32	n/a	3.0	10.7
	d-e	stream	733.5	688	424	10.7	5.0	84.8
Total							sec.	353.2
							min.	5.9

Tc#	Reach	Description	elev up	elev dn.	length (ft.)	slope (%)	V (fps)	T (sec)
Tc#2	a-b	gutter	741	734	313	2.2	3.0	104.3
	b-d	stream	734	688	308	14.9	7.0	44.0
Total							sec.	148.3
							min.	2.5

Tc#	Reach	Description	elev up	elev dn.	length (ft.)	slope (%)	V (fps)	T (sec)
Tc#3	a-b	pasture/grass	784	752	315	10.2	2.2	143.2
	b-c	pavement	751.5	746	56	9.8	6.0	9.3
	c-d	pipe flow (use v = 3 fps)	n/a	n/a	461	n/a	3.0	153.7
Total							sec.	306.2
							min.	5.1

then computed by dividing the total overland flow length by the average velocity.

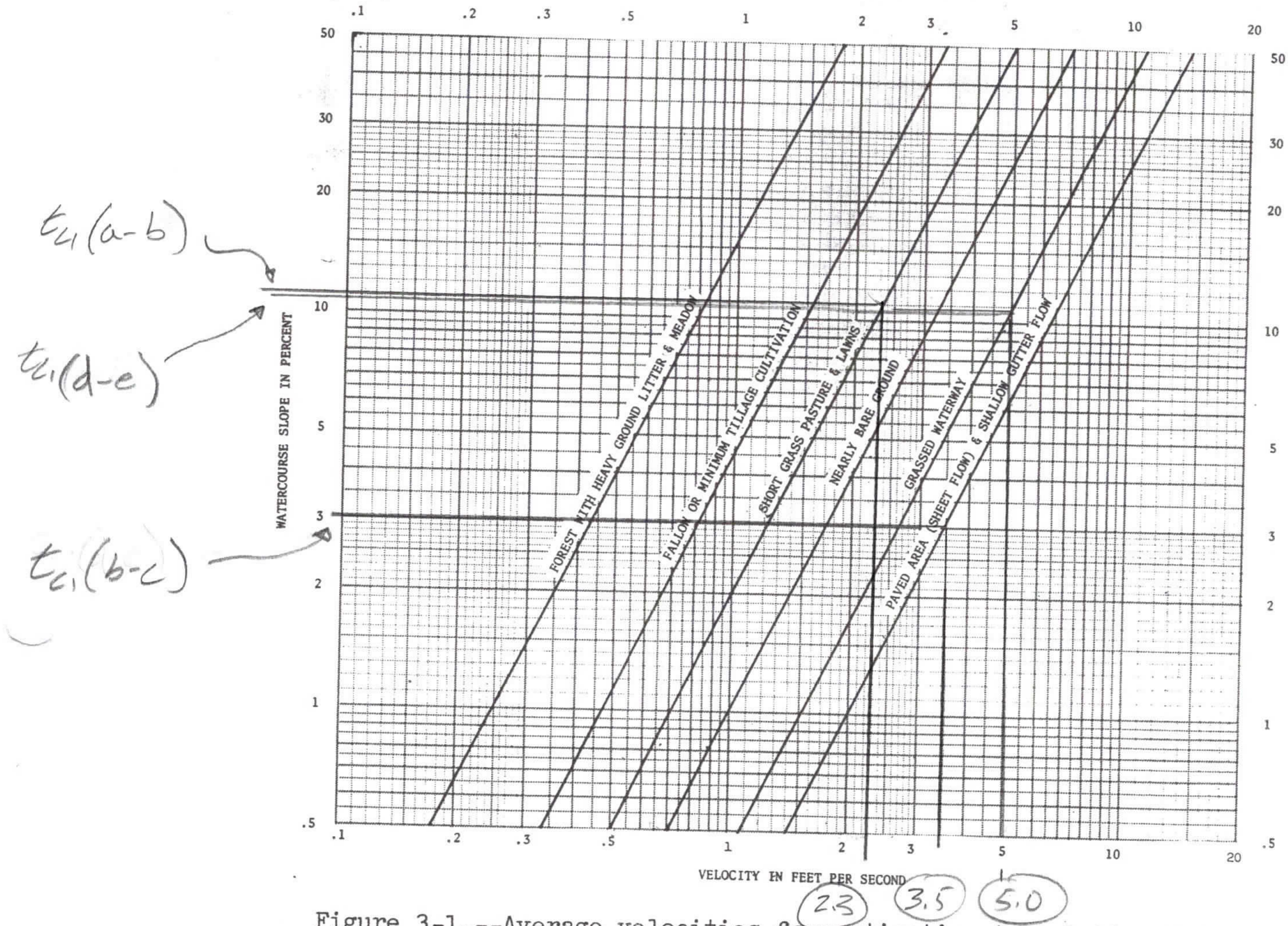


Figure 3-1.--Average velocities for estimating travel time for overland flow.

Storm sewer or road gutter flow

Travel time through the storm sewer or road gutter system to the main open channel is the sum of travel times in each individual component of the system between the uppermost inlet and the outlet. In most cases average velocities can be used without a significant loss of accuracy. During major storm events, the sewer system may be fully taxed and additional overland flow may occur, generally at a significantly lower velocity than the flow in the storm sewers. By using average conduit sizes and an average slope (excluding any vertical drops in the system), the average velocity can be estimated using Manning's formula.

Since the hydraulic radius of a pipe flowing half full is the same as when flowing full, the respective velocities are equal. Travel time may

then computed by dividing the total overland flow length by the average velocity. t_{c2}

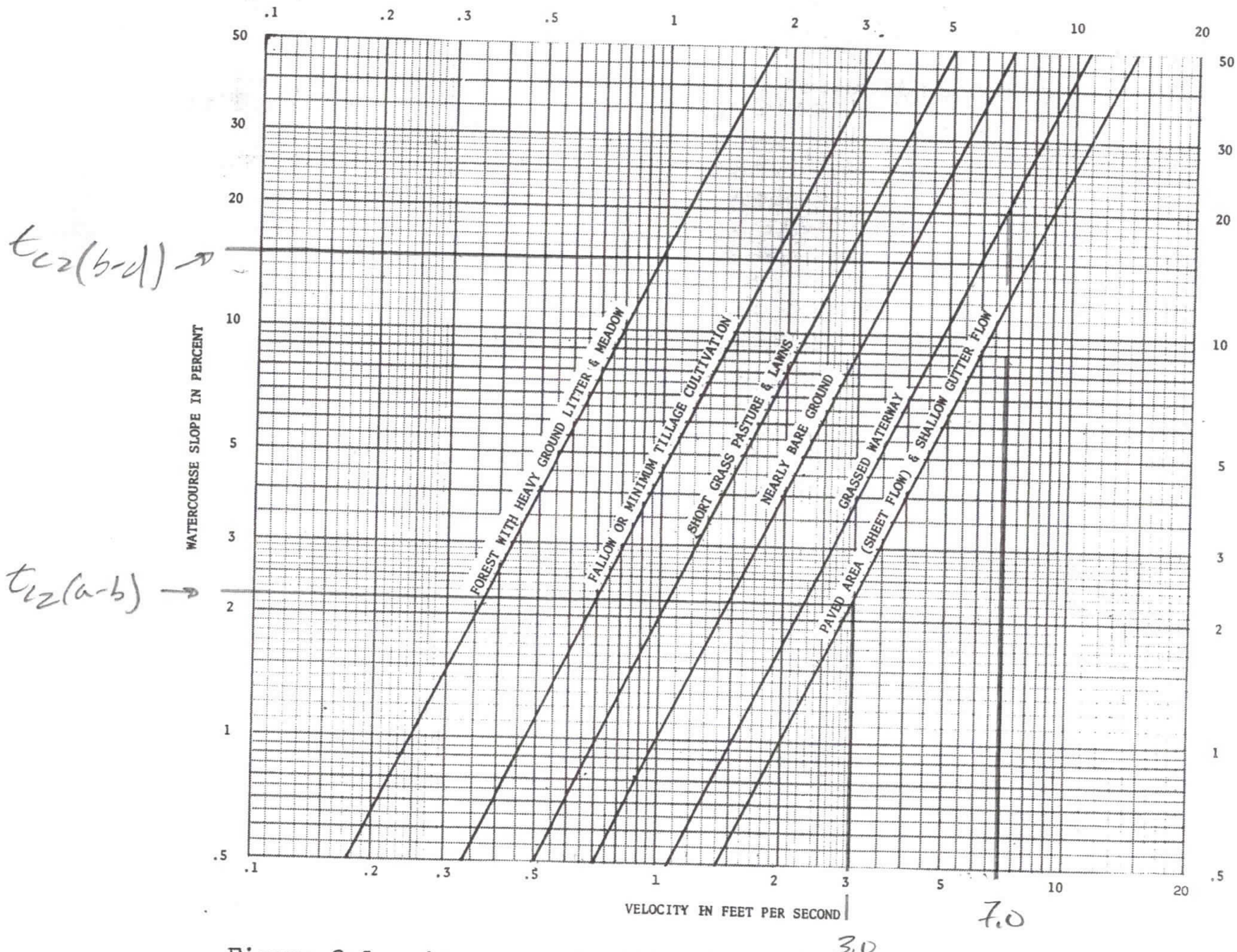


Figure 3-1.--Average velocities for estimating travel time for overland flow.

Storm sewer or road gutter flow

Travel time through the storm sewer or road gutter system to the main open channel is the sum of travel times in each individual component of the system between the uppermost inlet and the outlet. In most cases average velocities can be used without a significant loss of accuracy. During major storm events, the sewer system may be fully taxed and additional overland flow may occur, generally at a significantly lower velocity than the flow in the storm sewers. By using average conduit sizes and an average slope (excluding any vertical drops in the system), the average velocity can be estimated using Manning's formula.

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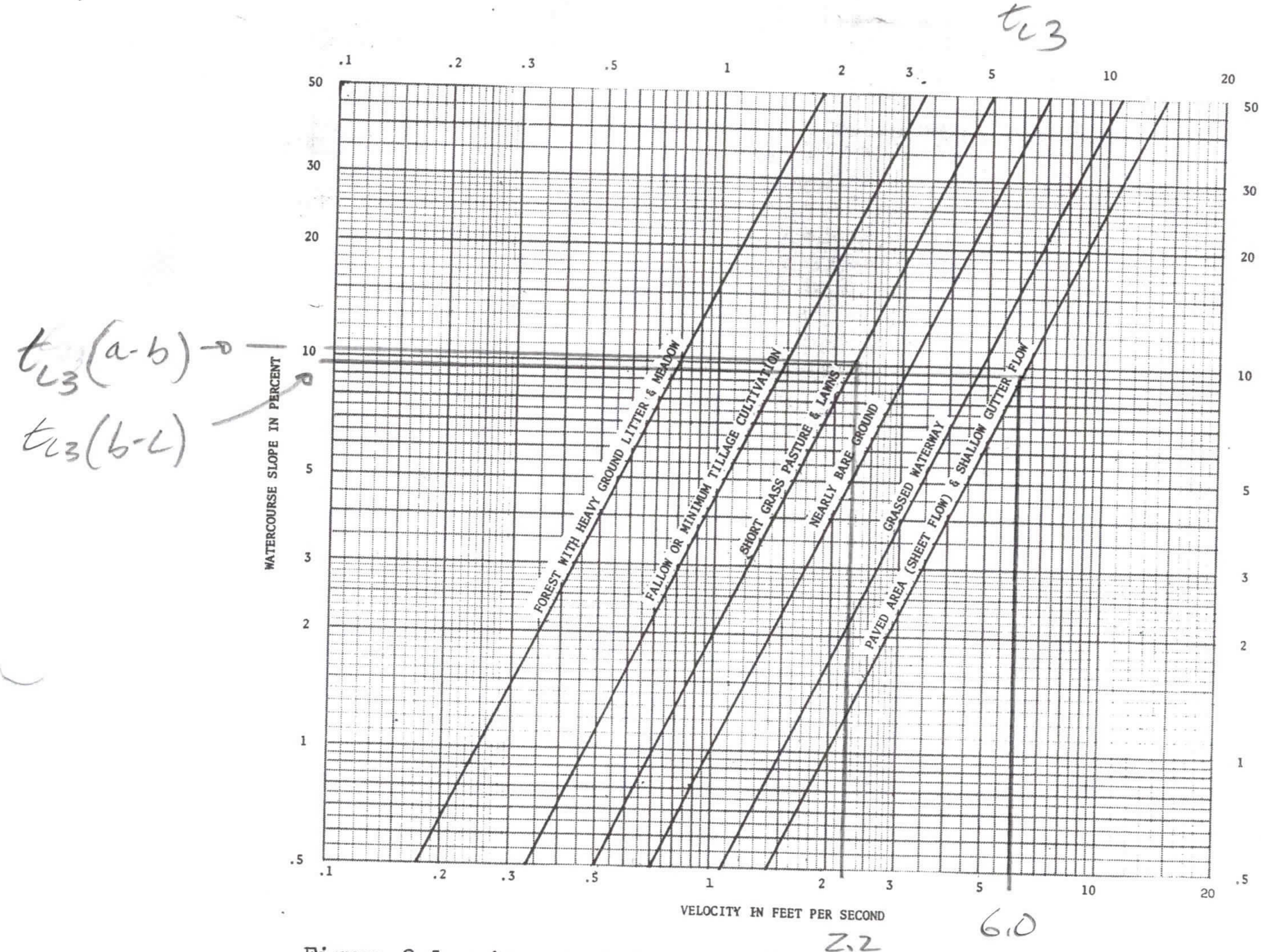


Figure 3-1.--Average velocities for estimating travel time for overland flow.

Storm sewer or road gutter flow

Travel time through the storm sewer or road gutter system to the main open channel is the sum of travel times in each individual component of the system between the uppermost inlet and the outlet. In most cases average velocities can be used without a significant loss of accuracy. During major storm events, the sewer system may be fully taxed and additional overland flow may occur, generally at a significantly lower velocity than the flow in the storm sewers. By using average conduit sizes and an average slope (excluding any vertical drops in the system), the average velocity can be estimated using Manning's formula.

Since the hydraulic radius of a pipe flowing half full is the same as when flowing full, the respective velocities are equal. Travel time may

Chapter 4 Graphical Peak Discharge Method

This chapter presents the Graphical Peak Discharge method for computing peak discharge from rural and urban areas. The Graphical method was developed from hydrograph analyses using TR-20, "Computer Program for Project Formulation—Hydrology" (SCS 1983). The peak discharge equation used is:

$$q_p = q_u A_m Q F_p \quad \text{[eq. 4-1]}$$

where:

q_p = peak discharge (cfs)
q_u = unit peak discharge (csm/in)
A_m = drainage area (mi^2)
Q = runoff (in)
F_p = pond and swamp adjustment factor

The input requirements for the Graphical method are as follows: (1) T_c (hr), (2) drainage area (mi^2), (3) appropriate rainfall distribution (I, IA, II, or III), (4) 24-hour rainfall (in), and (5) CN. If pond and swamp areas are spread throughout the watershed and are not considered in the T_c computation, an adjustment for pond and swamp areas is also needed.

Peak discharge computation

For a selected rainfall frequency, the 24-hour rainfall (P) is obtained from appendix B or more detailed local precipitation maps. CN and total runoff (Q) for the watershed are computed according to the methods outlined in chapter 2. The CN is used to determine the initial abstraction (I_a) from table 4-1. I_a / P is then computed.

If the computed I_a / P ratio is outside the range in exhibit 4 (4-I, 4-IA, 4-II, and 4-III) for the rainfall distribution of interest, then the limiting value should be used. If the ratio falls between the limiting values, use linear interpolation. Figure 4-1 illustrates the sensitivity of I_a / P to CN and P.

Peak discharge per square mile per inch of runoff (q_u) is obtained from exhibit 4-I, 4-IA, 4-II, or 4-III by using T_c (chapter 3), rainfall distribution type, and I_a / P ratio. The pond and swamp adjustment factor is obtained from table 4-2 (rounded to the nearest table value). Use worksheet 4 in appendix D to aid in computing the peak discharge using the Graphical method.

Figure 4-1 Variation of I_a / P for P and CN

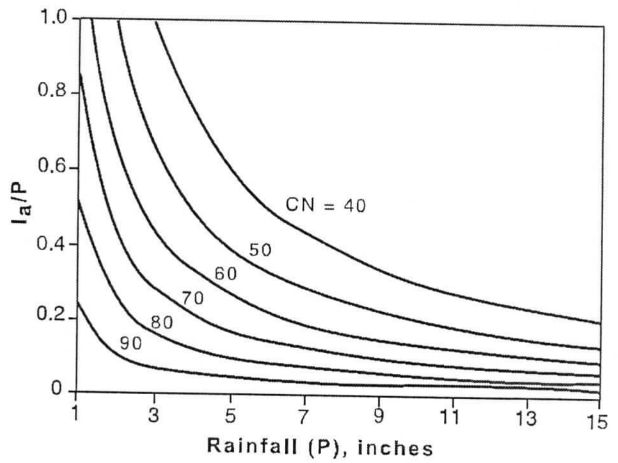
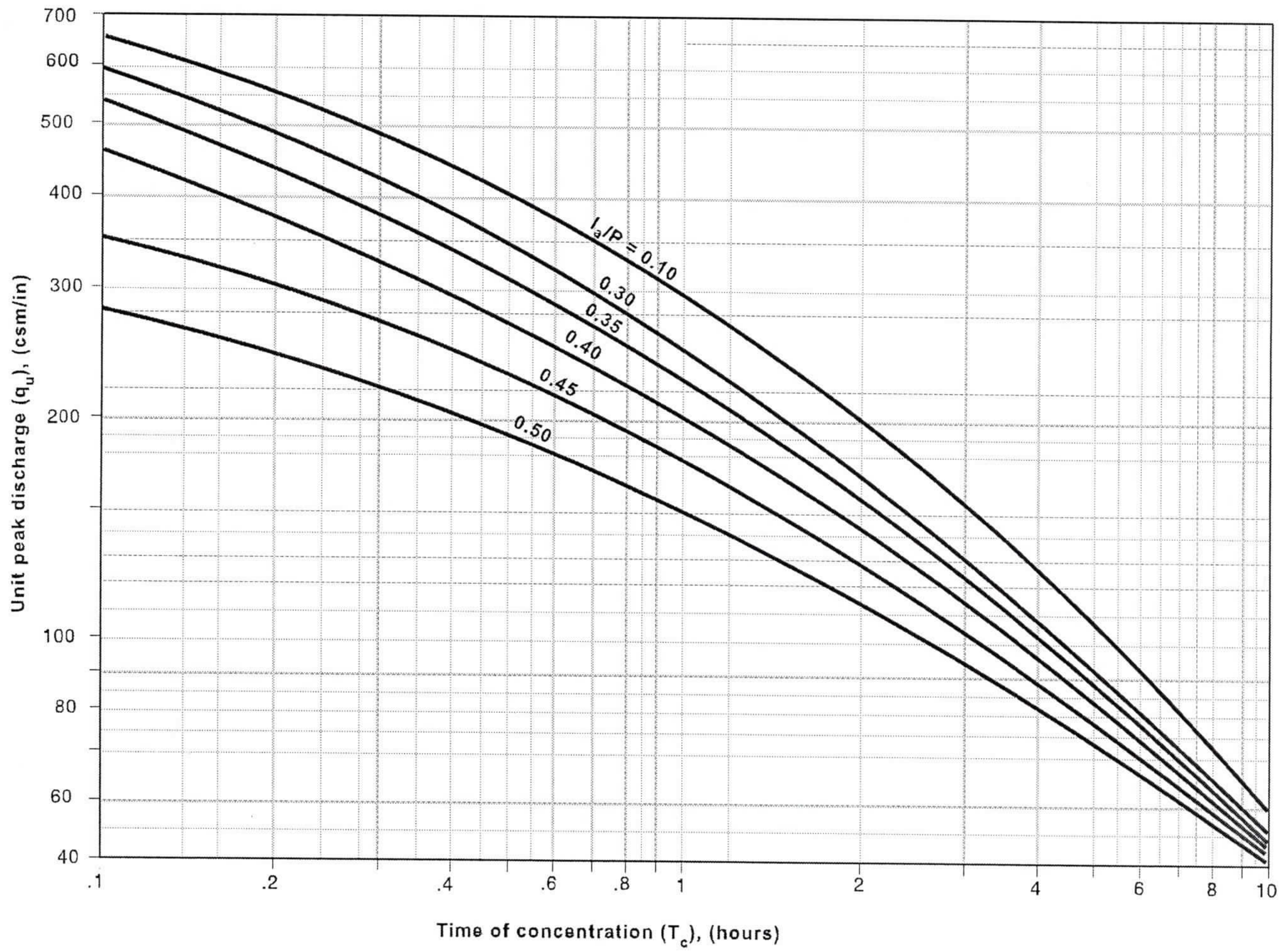


Table 4-1 I_a values for runoff curve numbers

Curve number	I_a (in)	Curve number	I_a (in)
40	3.000	70	0.857
41	2.878	71	0.817
42	2.762	72	0.778
43	2.651	73	0.740
44	2.545	74	0.703
45	2.444	75	0.667
46	2.348	76	0.632
47	2.255	77	0.597
48	2.167	78	0.564
49	2.082	79	0.532
50	2.000	80	0.500
51	1.922	81	0.469
52	1.846	82	0.439
53	1.774	83	0.410
54	1.704	84	0.381
55	1.636	85	0.353
56	1.571	86	0.326
57	1.509	87	0.299
58	1.448	88	0.273
59	1.390	89	0.247
60	1.333	90	0.222
61	1.279	91	0.198
62	1.226	92	0.174
63	1.175	93	0.151
64	1.125	94	0.128
65	1.077	95	0.105
66	1.030	96	0.083
67	0.985	97	0.062
68	0.941	98	0.041
69	0.899		

Exhibit 4-III Unit peal discharge (q_u) for NRCS (SCS) type III rainfall distribution



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Barracuda Max Model	**Manhole Diameter**	**NJDEP (50% removal)**	**OK-110 (80% removal)**
S3	36" (900 mm)	0.85 CFS (24.1 L/s)	0.85 CFS (24.1 L/s)
S4	48" (1200 mm)	1.52 CFS (43.0 L/s)	1.52 CFS (43.0 L/s)
S6	72" (1800 mm)	3.40 CFS (96.3 L/s)	3.42 CFS (96.8 L/s)
→ S8 (*)	96" (2400 mm)	6.08 CFS (172.2 L/s)	6.08 CFS (172.2 L/s)

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