TWO RIVER ENGINEERING

Stormwater Management Report

for

Preliminary & Final Major Site Plan

"Colts Neck Community Church"

Block 33, Lot 21

Township of Colts Neck
Monmouth County, New Jersey

February 19, 2020
Revised August 25, 2020

Prepared by:

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I. Description of Site

The project site is known as Lot 20, Block 33 according to the Township of Colts Neck Tax Maps. The site is located on the northerly side of Monmouth County Route 537. The property consists of 13.1+/- acres. The existing property formerly contains five (5) dwellings, four (4) barns, one (1) garage, an asphalt driveway, a concrete pad and a concrete walkway. These improvements have recently been removed.

The property is mostly open space with some impervious and wooded areas.

The site is located in the A-1 Agricultural Zone. It is proposed to construct a new Colts Neck Community Church on the property. The Church will proposes 175 parking stalls, walkways, landscaping and lighting. The new access roadway is proposed to have access from Monmouth County Route 537.

II. Land Characteristics

A. Soils

According to the "Soil Survey of Monmouth County, New Jersey", sheet # 22, the soil types found on site consists of the Tinton Series, Colts Neck Series and Freehold Series. The Tinton Series is a type 'A' soil. The Colts Neck and Freehold Series are a type 'B' soil.

B. Topography

The topography of the property is mild except in the area leading to the wetlands where there is a steep slope. The highest point on the property has an existing elevation of approximately 101.9. This is located near the southern property edge near Route 537. The lowest point on the property is in an existing wetland area in the northerly property with an existing elevation of approximately 50.

III. Hydrologic Methodology

In order to quantify the pre and post development peak rates of runoff, the Natural Resources Conservation Service (formerly SCS) TR-55 Method was used. The N.R.C.S. Method presents simplified procedures to calculate storm water runoff volume, peak rated of discharge, hydrographs, and storage volumes required for floodwater reservoirs. These procedures are applicable in small watersheds, especially urbanizing watersheds, in the Unites States.[1] The TR-55 model is generally used in analyzing watersheds under three (3) square miles (about 2,000 acres). The main parameters are described below:

CN = Curve Number. Based on soils, plant cover, amount of impervious areas, interception, and surface storage.

Tc = Time of Concentration. The time is takes from the most hydraulically distant point in a watershed to travel to a point of interest.

Lag Time = The distance from the center of mass of excess rainfall to the peak discharge. The lag equation is expressed as:

$$T_{lag} = \frac{L^{0.8} \times (S+1)^{0.7}}{1900 \times \sqrt{Y}}$$

L = length of the longest drainage path (feet)
S, the potential maximum retention of the soil in inches is expressed as:

$$S = (1000/CN) - 10$$

Y = Average land slope (percent)

Empirically, the Lag Time has been expressed as 0.6Tc

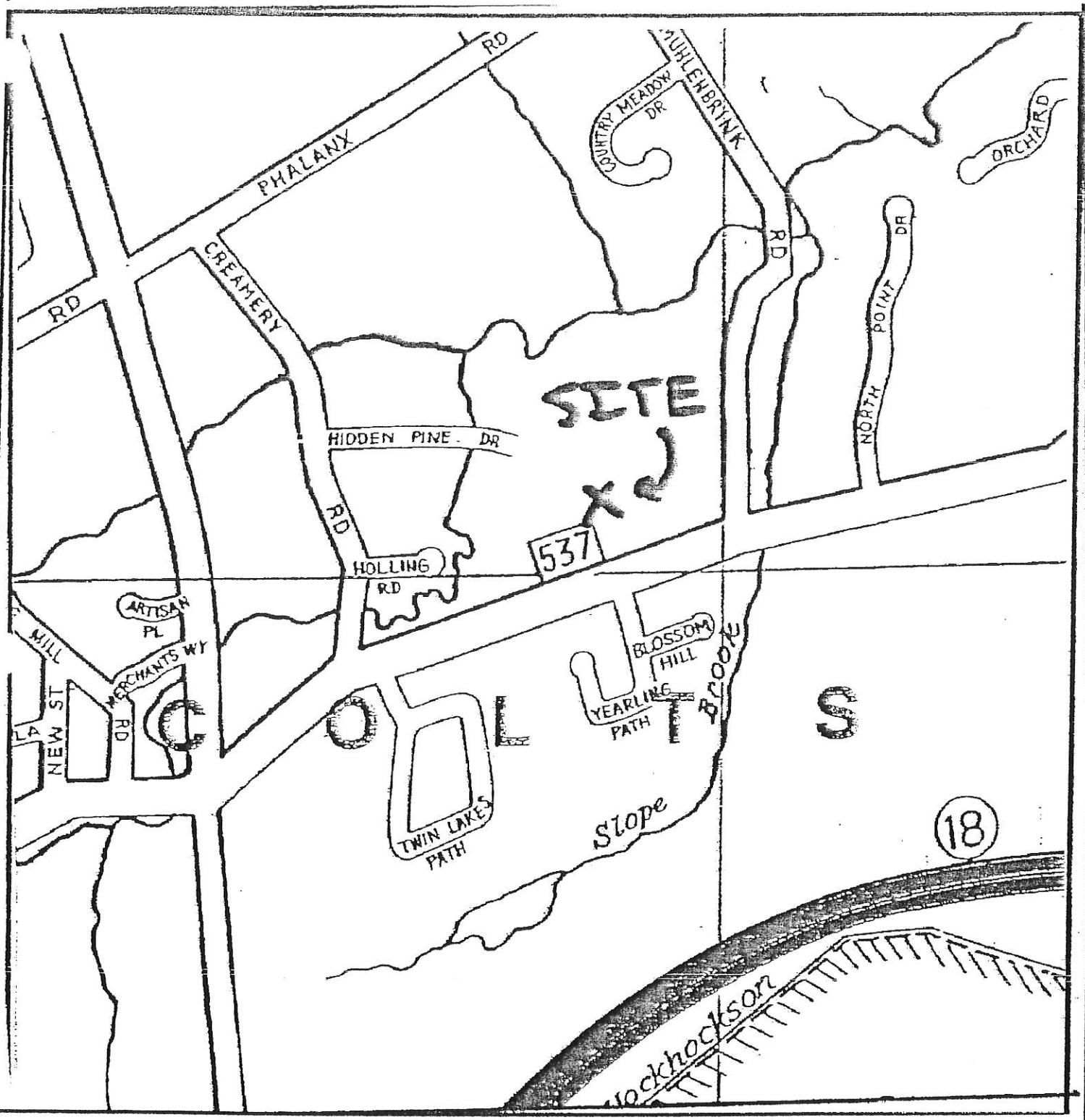
A = Drainage Area (acres). The watershed area that contributes to the point of interest.

Rainfall = The 24-hour uniform rainfall amount imposed on the watershed. The rainfall amounts for Monmouth County, as revised in September 2004 are as follows:

Storm Event	24-hour Rainfall (inches)
1	2.9
2	3.4
5	4.4
10	5.2
25	6.5
100	8.9

[1] United States Department of Agriculture, Soil Conservation Service, Engineering Division, Technical Release 55

IV. Maps



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P.O. BOX 155
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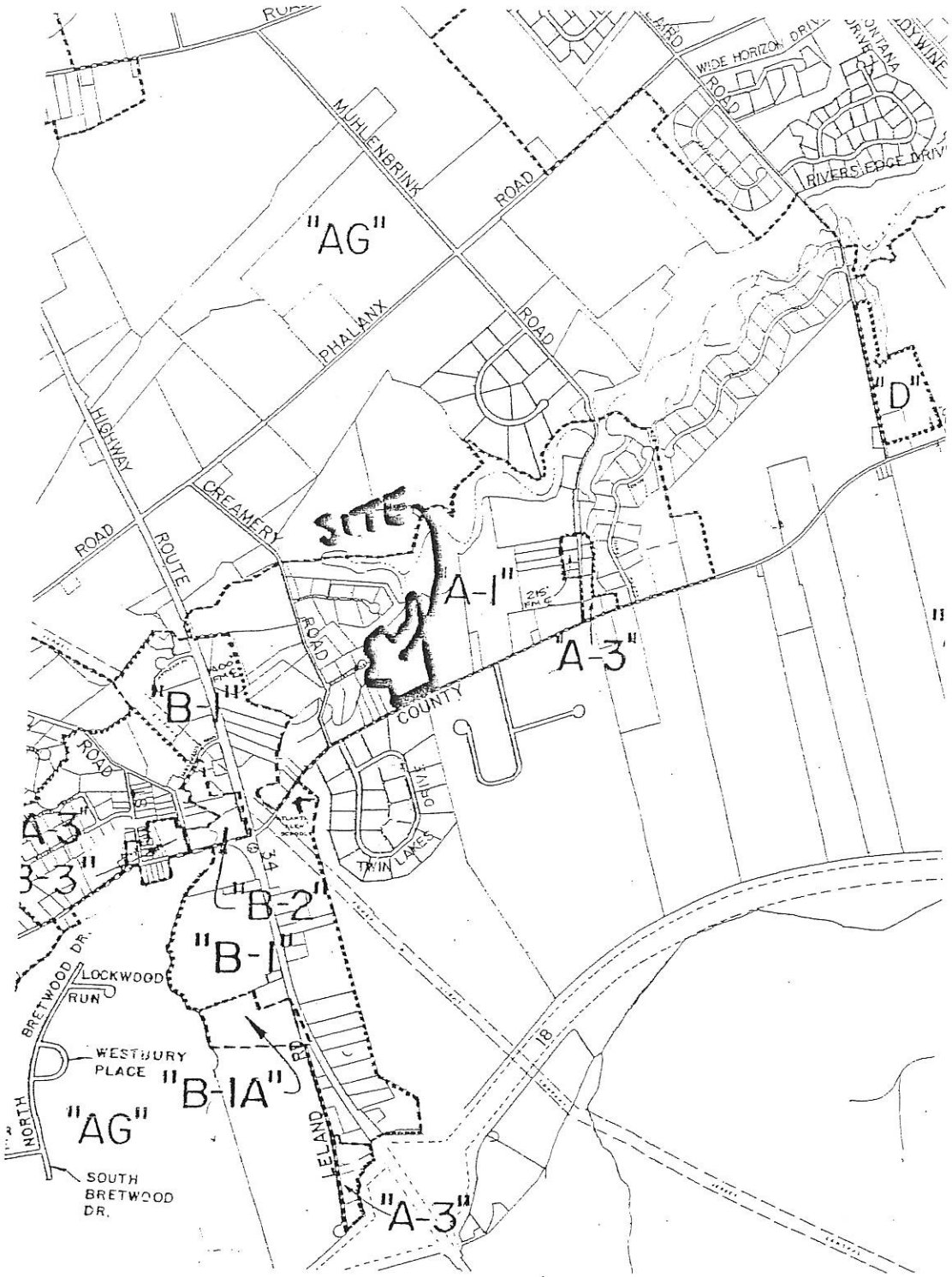
KEY MAP

COLTS NECK COMMUNITY CHURCH
BLOCK 33, LOT 21
TOWNSHIP OF COLTS NECK
MONMOUTH COUNTY, NEW JERSEY
SCALE: 1"=1,000±'



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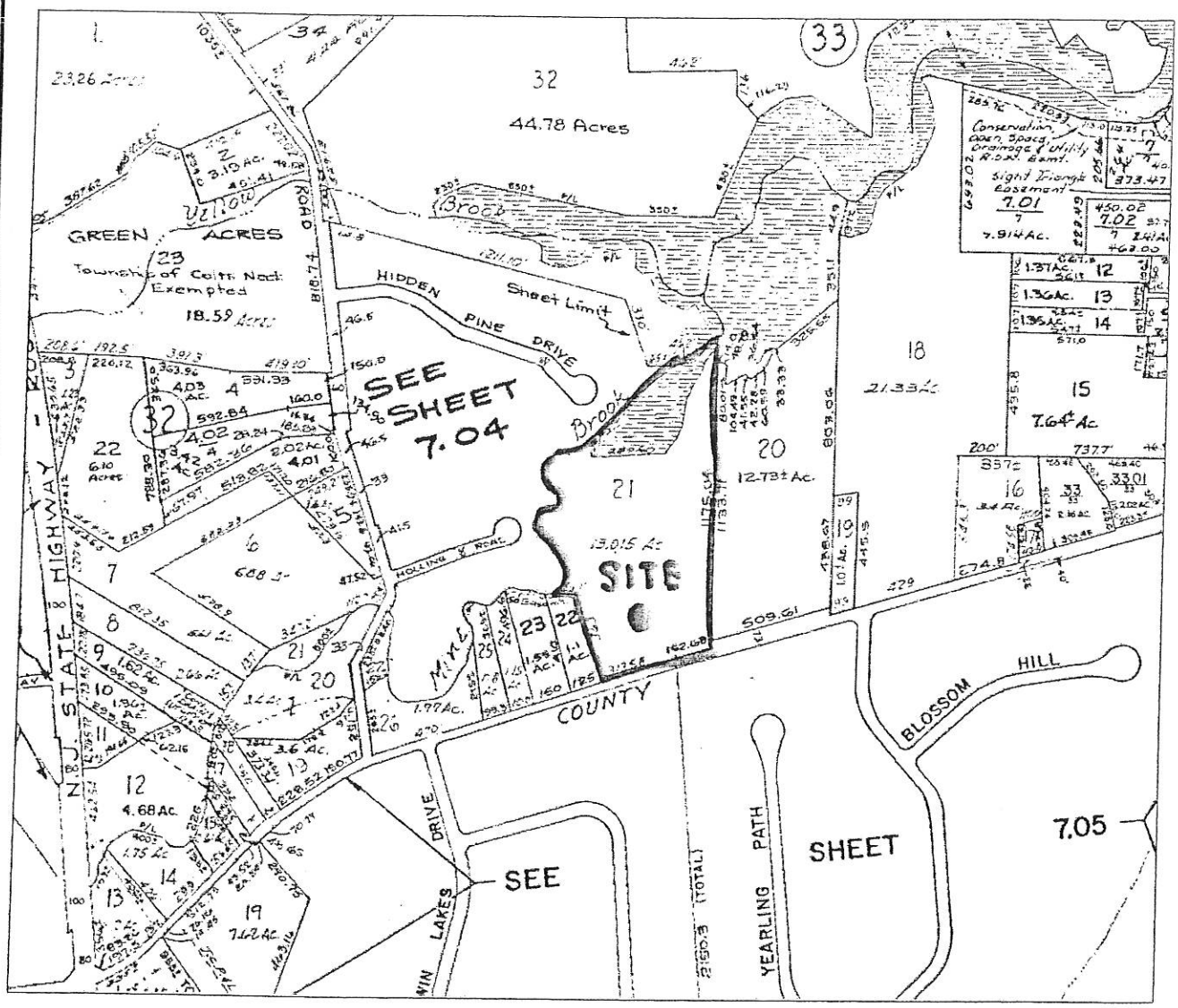
ZONING MAP

COLTS NECK COMMUNITY CHURCH
BLOCK 33, LOT 21
TOWNSHIP OF COLTS NECK
MONMOUTH COUNTY, NEW JERSEY
SCALE: 1"=1,000±'



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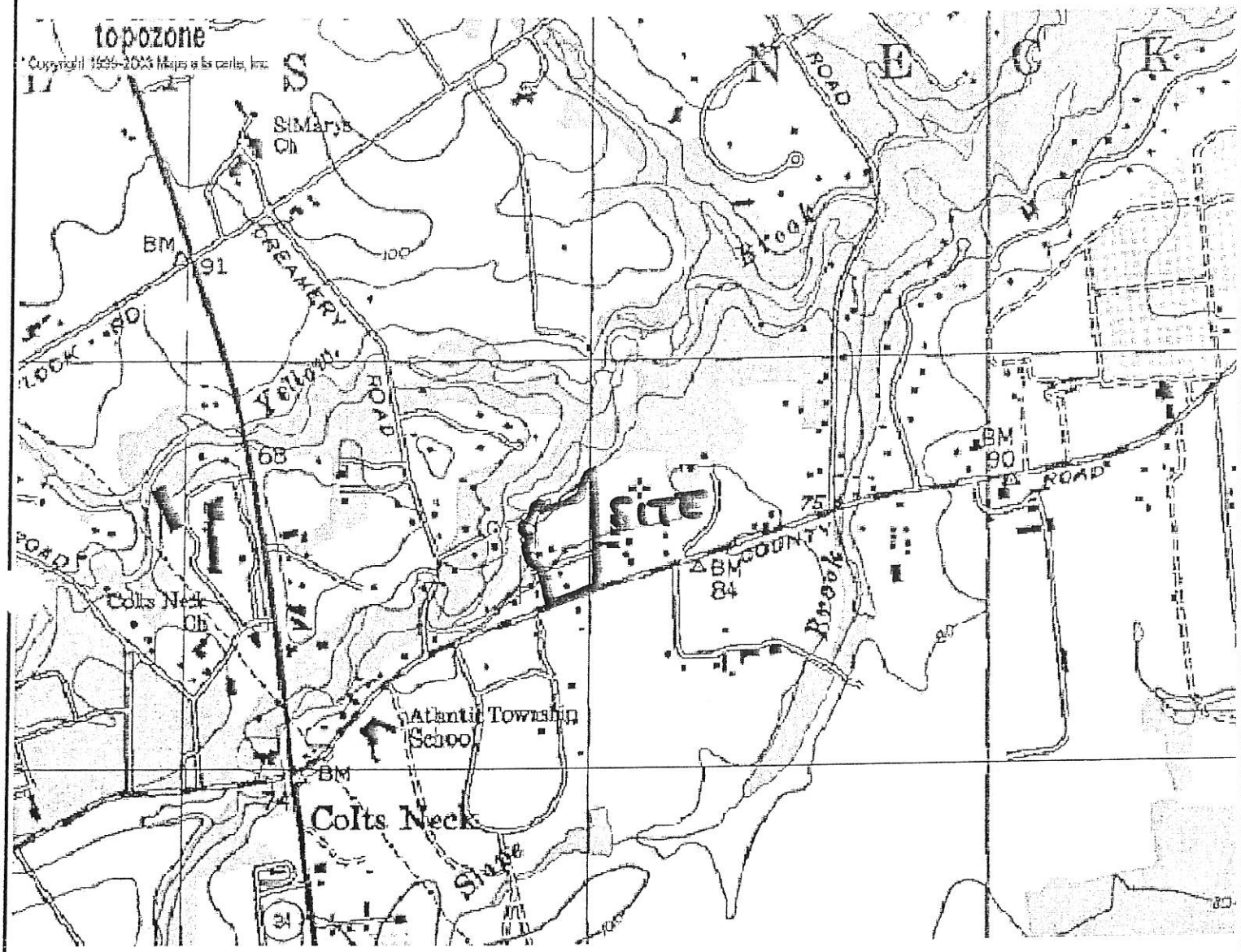
TAX MAP

COLTS NECK COMMUNITY CHURCH

BLOCK 33, LOT 21

TOWNSHIP OF COLTS NECK
MONMOUTH COUNTY, NEW JERSEY

SCALE: 1"=650±'



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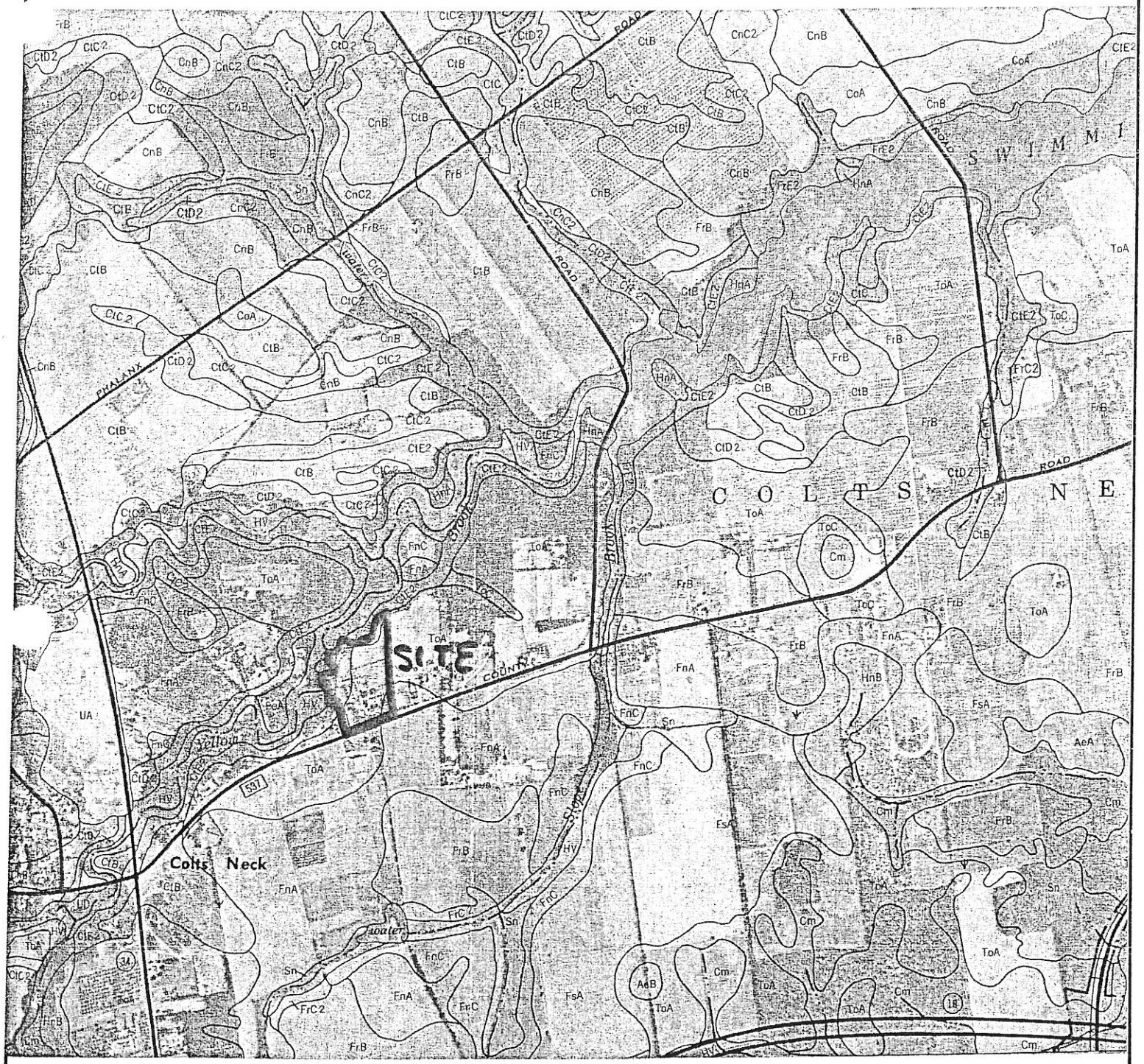
U.S.G.S. MAP

COLTS NECK COMMUNITY CHURCH
BLOCK 33, LOT 21
TOWNSHIP OF COLTS NECK
MONMOUTH COUNTY, NEW JERSEY
SCALE: 1"=1,000±'



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SOILS MAP

COLTS NECK COMMUNITY CHURCH

BLOCK 33, LOT 21
TOWNSHIP OF COLTS NECK
MONMOUTH COUNTY, NEW JERSEY

SCALE: 1"=1,125±'

V. Existing Drainage Conditions

The property has one (1) existing drainage areas. This area (9.39 acres) includes most of the property. This drainage area flows northerly off-site, down a steep bank, and towards a tributary of the Yellow Brook.

TR-55 calculations were performed for the existing conditions. Curve number and time of concentration worksheets are included in the appendix. Calculations were run for the 1, 2, 10, 25 and 100-year storms and are included in the appendix. The storm frequencies and peak flows are illustrated in the table below:

Note: Drainage Area Maps can be found as part of the Drawing Set, Sheets 8, 9 & 10.

Existing Conditions (9.39 acres)

Area = 9.39 acres
Pervious (100%)
Area=9.39 acres
CN=42
Tc=22.1 min.

Storm Frequency (Years)	Peak Discharge (cfs)
1	0.00
2	0.03
10	1.05
25	3.48
100	11.14

Calculate required reductions per R.S.I.S. Standards:

Year Storm	E-1	Req. Reduction	Allowable Post Developed Flows
1	0.00	n/a	**0.00**
2	0.03	50%	**0.00**
10	1.05	25%	**0.8**
25	3.48	n/a	**3.5**
100	11.14	20%	**8.9**

VI. Post Development Drainage Conditions

The developed site will have two (2) post developed drainage areas. Drainage area P1 will be the easterly drainage area. This drainage area will collect storm water from all the proposed impervious surfaces including the building, parking lot and walkways. The area is 5.10 acres. This entire area will drain to a proposed infiltration / detention basin.

Assuming no infiltration in the routing computations, the basin has been designed to completely retain the 1 and 2 year storm events and infiltrate completely into the ground. Larger storms will be routed through an outlet structure and outflow to a proposed single point discharge at the existing wetlands. In the event that a storm exceeds the 100-year design rainfall amount, the additional runoff will flow through an emergency spillway and flow overland to the existing wetlands.

Allowing infiltration as an outflow, all storms analyzed will be retained in the basin in filtrated back to the ground. An infiltration rate of 9"/hour was utilized.

The remaining area of 4.29 acres, (Drainage Area P2) will flow overland towards the existing brook located on the property's northerly property line. This entire area is all open space with no impervious proposed.

Curve number and time of concentration worksheets are included in the appendix. Calculations were run for the 1, 2, 10, 25 and 100-year storms and are included in the appendix. The storm frequencies and peak flows are illustrated in the table below:

Note: Drainage Area Maps can be found as part of the Drawing Set, Sheets 8, 9 & 10.

(Area to Basin)

Proposed Conditions for P-1 (5.10 acres)

Area = 5.10 acres

Pervious	**Impervious**
Area=2.66 acres	**Area=2.44 acres**
CN=44	**CN=98**
Tc=10 min.	**Tc=10 min.**

Storm Frequency (Years)	**Peak Discharge (cfs)**
1	6.01
2	7.08
10	11.11
25	15.11
100	23.58

(Area Overland to Wetlands)

Proposed Conditions for P-2 (4.29 acres)

Pervious
Area=4.29 acres
CN=41
Tc=20.5 min.

Storm Frequency (Years)	Peak Discharge (cfs)
1	0.00
2	0.01
10	0.38
25	1.40
100	4.79

Detention Basin Outflow*
0.5' weir at elev. 68.3
1.2' weir at elev. 68.6

Storm Frequency (Years)	Inflow (cfs)	Outflow (cfs)	Water Surface Elev.
1	6.01	0.00	67.9
2	7.08	0.00	68.2
10	11.11	0.44	68.7
25	15.11	1.25	68.9
100	23.58	4.14	69.5

- No Infiltration used

Year Storm	P-1 Routed Outflow	P-2	Total
1	0.00	0.00	**0.00**
2	0.00	0.01	**0.01**
10	0.44	0.38	**0.8**
25	1.25	1.40	**2.7**
100	4.14	4.79	**8.9**

Year Storm	Existing Total	Post-Dev. Total	Reduction
1	**0.00**	**0.00**	**n/a**
2	**0.03**	**0.01**	**67%**
10	**1.1**	**0.8**	**27%**
25	**3.5**	**2.7**	**23%**
100	**11.1**	**8.9**	**20%**

VII. Compliance with N.J.A.C. 7:8-5 (Water Quality Standards)

The N.J.D.E.P. stormwater management rules (N.J.A.C. 7:8-5 and 6) provide for specific stormwater management measures to reduce peak runoff, attenuate volume increases, and preserve water quality. The proposed retention basins fully infiltrate the water quality storm and all other storms including the 100 year storm, with less post developed impervious flows to the wetlands than in the existing conditions. Therefore, water quality is addressed.

Detention Basin Outflow*

Storm Frequency (Years)	Inflow (cfs)	Outflow (cfs)	Water Surface Elev.
1	6.01	0.00	66.7
2	7.08	0.00	66.7
10	11.11	0.00	67.1
25	15.11	0.00	67.4
100	23.58	0.00	68.1

- With Infiltration rate of (9 in/hr) used

The New Jersey Groundwater Recharge Spreadsheet can be found in Appendix 5. The spreadsheet demonstrates that 100% of the groundwater recharge deficit imposed by the post-developed condition will be re-introduced through infiltration in the basin.

VIII. Soil Erosion and Sediment Control

The project includes design features to prevent the transport of soil into downstream waterways during and after construction. This includes inlet protection devices, stabilized soil stockpiles, construction entrance pads, and silt fence. Soil Erosion and Sediment Control plans are included in the set of drawings and should be referenced for more detail.

IX. Runoff Collection System Design

The site has been designed with a system of pipes and inlets that will convey runoff into a retention basin. This system was design using a 25-year storm frequency. Calculations can be found in Appendix 4, "Storm Sewer Pipe Calculations".

Note: An Inlet Drainage Area Map can be found in plan set sheet 10, "Inlet Area Map".

X. Low Impact Design

Vegetation, Landscaping and Disturbance

The disturbance of existing, naturally vegetated areas has been minimized in the project. In areas in which native ground cover is being removed, a 2:1 replacement ratio is being used, with appropriate native materials to re-vegetate the project. In general, with regards to landscaping, a gradual slope is maintained within the overall limit of disturbance, resulting in a long flow path length, while using the natural grade of the undisturbed portion to direct flow towards the northerly property line. The long flow path will provide natural infiltration into the native soil as well.

Impervious Area Management

The project has been designed to minimize impervious coverage. Less than 19% lot coverage is being proposed. All impervious coverage will flow to a proposed infiltration / detention basin to lessen environmental impacts and provide groundwater re-charge. The Township of Colts Neck has stringent coverage requirements to minimize environmental impact. Grading, with respect to impervious areas, is designed to provide sheet flow over said surfaces and onto vegetated and grass areas, allowing infiltration long prior to introduction to protected waters.

Time of Concentration Modifications

The design slope, on average, from north to south on the property has been maintained with existing to allow proper flow to the rear of the lot. With natural replacement of disturbed vegetation, the roughness coefficient correlating to time of the concentration will be the same as existing or greater.

Preventative Source Controls

Silt fences, inlet protection and professional work and construction practices will be used to prevent the introduction of pollutants into streams and proposed and existing stormwater systems.

Structural BMPs

In addition to the non-structural BMPs discussed above, a large infiltration / detention basin has been designed to provide groundwater infiltration and reduce peak rates of run-off.

XI. Functional Value Analysis

The New Jersey Department of Environmental Protection developed the functional value analysis to assist the regulated community in analyzing whether the functional value and overall condition of a 300-foot Special Water Resource Protection Area (referred to hereon as SWRPA) are maintained.

The assessment is divided into four parts, including habitat impact, nonpoint source pollutant reduction, temperature moderation, and channel integrity. Throughout the analysis, the following continuum will be used to assess existing and proposed conditions. The current level of habitat value will be presumed to increase from greatest to least and human disturbance will be presumed to increase from least to greatest using the following:

Forest
Scrub/Shrub
Pasture/Meadow
Cultivated Agriculture
Maintained Lawn
Unpaved Impervious
Paved Impervious
Other Structures

In addition, a map of the property has been included to display potential habitat for threatened and endangered species as represented on the Landscape Maps of Habitat for Endangered, Threatened, and Other Priority Wildlife and Priority Habitats. It should be noted that the majority of the site contains only Landscape Rank 1 areas, with a small portion of the north being Landscape Rank 5. Landscape Rank 5 areas are federally endangered areas, and no disturbance is planned or proposed in that area.

Habitat

The following table is provided to delineate the various coverages on the property:

	Existing	Proposed	Net Change
Impervious			
Paved	4,077 SF	0 SF	**-4,077 SF**
Unpaved	1,986 SF	0 SF	**-1,986 SF**
Structures	11,142 SF	0 SF	**-11,142 SF**
Subtotal	17,205 SF	0 SF	**-17,205 SF**
Maintained Law	187,150 SF	180,836 SF	**-6,314 SF**
Cultivated Agriculture	-	-	-

Pasture/Meadow	-	-	-
Scrub/Shrub	-	-	-
Forest	150,157 SF	173,676 SF	+23,519
Total	**354,512 SF**	**354,512 SF**	**0 SF**

As shown both in the table and on the included map, no areas with Landscape 3, 4, or 5 are being disturbed.

Additionally, impervious coverage within the SWRPA is being reduced by 3,242 SF, decreasing human disturbance on the property and increasing habitat value with the increase in maintained lawn (a higher value than impervious material on the provided continuum).

Nonpoint Source Pollutant Reduction

Both the existing development condition and the proposed development condition on the property have the same ratio of low density, urban residential development to forest. No forest is being removed as a result of the proposed condition, and the final condition of the property, as shown above, will be more conducive for runoff filtering through mowed law than it was previously because of the decrease in impervious in the SWRPA.

Temperature Moderation

In addition to the table provided above, it should be noted that in the vicinity of the category one stream is covered 100% by canopy, and will remain 100% covered by the existing canopy post-construction. The placement of new impervious surface and structures within the disturbed SWRPA has been compensated by the removal of more area of impervious coverage and structures, as shown in the table.

Channel Integrity

The existing and proposed runoff, drainage areas, and flow paths are shown on the enclosed subdivision plans. Calculations are included as a part of this stormwater management report and demonstrate a significant decrease in runoff volume to the existing category one stream. Additionally, groundwater recharge is maintained as shown in the enclosed groundwater recharge analysis.

Conclusion

A complete functional value analysis has been completed for the proposed conditions of the property in question. It is our assessment the functional value of this site will be maintained, if not improved.

XII. Conclusions

Because the increase in runoff will be captured by a detention pond, the construction of a subdivision will have no detrimental impacts to adjacent properties or downstream drainage areas.

As can be seen, the net effect of this development will decrease peak rates of run-off for all storms analyzed. The reduction is in accordance with the residential site improvement standards. In addition, the proposed subdivision utilizes innovative stormwater management techniques that not only decrease peak rates of runoff but also encourage non-structural and non-pre-manufactured technology to accomplish groundwater infiltration and water quality.

Appendix 1
Existing Drainage Calculations

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Worksheet 2: Runoff curve number and runoff

Project	By	Date
COLTS NECK COMMUNITY CHURCH	AJG	19-Feb-20
Location	**Checked**	**Date**
TOWNSHIP OF COLTS NECK, MONMOUTH COUNTY	AJG	19-Feb-20

Check one: [X] Present [ ] Developed — E-1, EXISTING CONDITIONS (PERVIOUS)

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN[1] Table 2-2	CN[1] Figure 2-3	CN[1] Figure 2-4	Area [X] acres [ ] mi² [ ] %	Product of CN x Area
FnA 'B'	GRASS	61			0.92	56.12
ToA 'A'	GRASS	39			7.70	300.30
ToA 'A'	WOODS	30			0.43	12.90
CtE2 'B'	GRASS	61			0.34	20.74
1. Use only one CN source per line				**Totals** ➡	9.39	390.06

CN (weighted) = tot.prod. / tot. area = 390.06 / 9.39 = 41.5 ; **Use CN** ➡ **42**

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.4	5.3	7.5
Runoff, Q.....	in			

Use P and CN with table 2-1, figure 2-1, or equation 2-3 abd 2-4

Two River Engineering

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Colts Neck, NJ 07722

Tel: 732.866.0111
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Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	By	Date
COLTS NECK COMMUNITY CHURCH	AJG	19-Feb-20
Location	**Checked**	**Date**
COLTS NECK, MONMOUTH COUNTY, NEW JERSEY	AJG	19-Feb-20

Check one: [X] Present [ ] Developed — E-1, EXISTING CONDITIONS (PERVIOUS)

Check one: [X] T_c [ ] T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic or description of flow segments.

Sheet Flow (Applicable to T_c only)

		Segment ID			
1. Surface description (table 3-1)		AB			
2. Manning's roughness coefficient, n (table 3-1)		GRASS			
3. Flow length, L (total L ≤ 300 ft.)	ft	0.240			
4. Two-year 24-hour rainfall, p_2	in	150			
5. Land slope, s	ft/ft	3.4			
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.022			
		0.31	+	=	0.31

Shallow Concentrated Flow

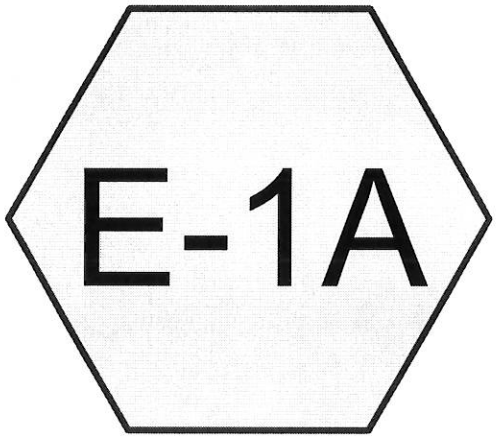
		Segment ID			
7. Surface description (paved or unpaved)		BC			
8. Flow Length, L	ft	UNPAVED			
9. Watercourse slope, s	ft/ft	655			
10. Average velocity, V (figure 3-1)	ft/s	0.035			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	3.0			
		0.06	+	=	0.06

Channel Flow

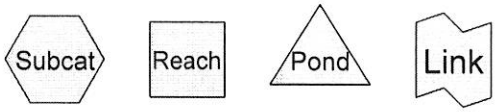
		Segment ID			
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, P_w	ft				
14. Hydraulic radius, $r=a/P_w$ Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coefficient, n					
17. $V = \frac{1.49 r^{2/3} \sqrt{s}}{n}$ Compute V	ft/s				
18. Flow length, L	ft				
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	=	0.00

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr 0.368

min **22.1**



Existing Pervious



Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
9.390	42	(E-1A)
9.390	**42**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
9.390	Other	E-1A
9.390		**TOTAL AREA**

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 E-1A: Existing Pervious Runoff Area=9.390 ac 0.00% Impervious Runoff Depth=0.00"
Tc=22.1 min CN=42 Runoff=0.00 cfs 0.001 af

Total Runoff Area = 9.390 ac Runoff Volume = 0.001 af Average Runoff Depth = 0.00"
100.00% Pervious = 9.390 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment E-1A: Existing Pervious

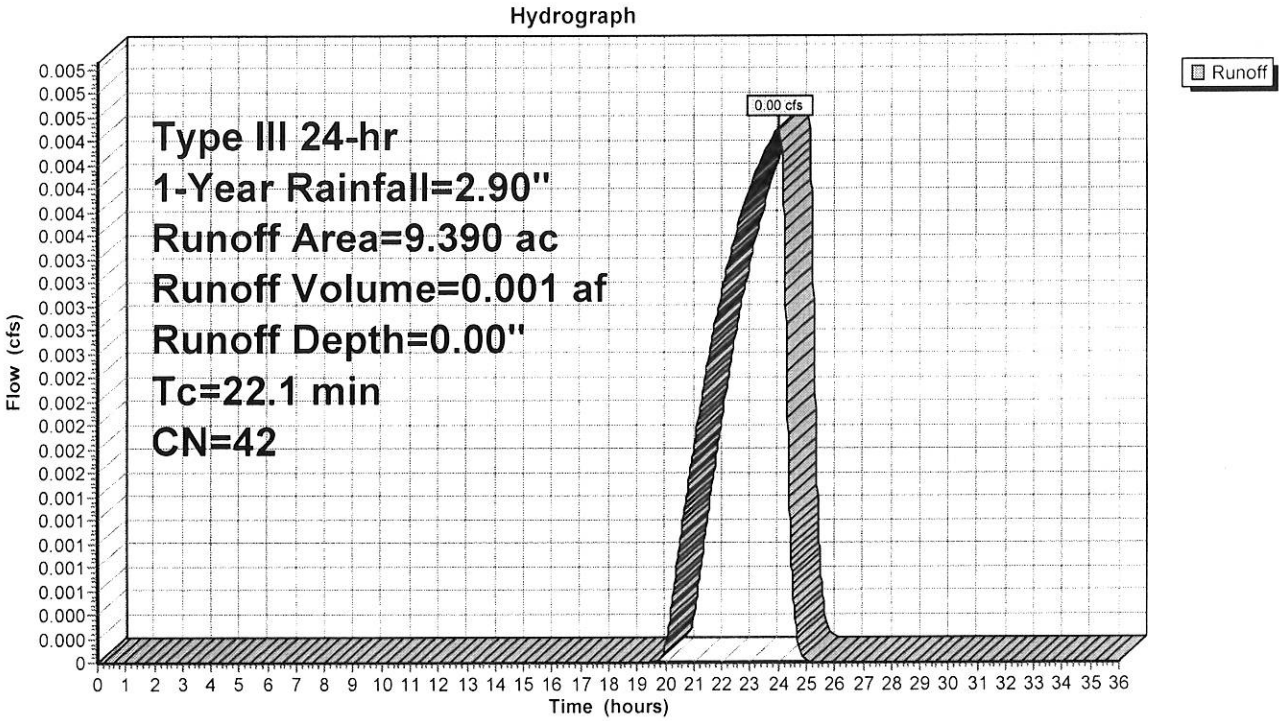
Runoff = 0.00 cfs @ 24.04 hrs, Volume= 0.001 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.90"

	Area (ac)	CN	Description
*	9.390	42	
	9.390		100.00% Pervious Area

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

Subcatchment E-1A: Existing Pervious



Hydrograph for Subcatchment E-1A: Existing Pervious

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.01	0.00	0.00
1.00	0.03	0.00	0.00
1.50	0.04	0.00	0.00
2.00	0.06	0.00	0.00
2.50	0.07	0.00	0.00
3.00	0.09	0.00	0.00
3.50	0.11	0.00	0.00
4.00	0.12	0.00	0.00
4.50	0.14	0.00	0.00
5.00	0.16	0.00	0.00
5.50	0.19	0.00	0.00
6.00	0.21	0.00	0.00
6.50	0.23	0.00	0.00
7.00	0.26	0.00	0.00
7.50	0.29	0.00	0.00
8.00	0.33	0.00	0.00
8.50	0.37	0.00	0.00
9.00	0.42	0.00	0.00
9.50	0.48	0.00	0.00
10.00	0.55	0.00	0.00
10.50	0.63	0.00	0.00
11.00	0.73	0.00	0.00
11.50	0.86	0.00	0.00
12.00	1.45	0.00	0.00
12.50	2.04	0.00	0.00
13.00	2.18	0.00	0.00
13.50	2.27	0.00	0.00
14.00	2.35	0.00	0.00
14.50	2.42	0.00	0.00
15.00	2.48	0.00	0.00
15.50	2.53	0.00	0.00
16.00	2.57	0.00	0.00
16.50	2.61	0.00	0.00
17.00	2.64	0.00	0.00
17.50	2.67	0.00	0.00
18.00	2.69	0.00	0.00
18.50	2.71	0.00	0.00
19.00	2.74	0.00	0.00
19.50	2.76	0.00	0.00
20.00	2.78	0.00	0.00
20.50	2.79	0.00	0.00
21.00	2.81	0.00	0.00
21.50	2.83	0.00	0.00
22.00	2.84	0.00	0.00
22.50	2.86	0.00	0.00
23.00	2.87	0.00	0.00
23.50	2.89	0.00	0.00
24.00	**2.90**	**0.00**	**0.00**
24.50	2.90	0.00	**0.00**
25.00	2.90	0.00	0.00
25.50	2.90	0.00	0.00
26.00	2.90	0.00	0.00
26.50	2.90	0.00	0.00
27.00	2.90	0.00	0.00
27.50	2.90	0.00	0.00
28.00	2.90	0.00	0.00
28.50	2.90	0.00	0.00
29.00	2.90	0.00	0.00
29.50	2.90	0.00	0.00
30.00	2.90	0.00	0.00
30.50	2.90	0.00	0.00
31.00	2.90	0.00	0.00
31.50	2.90	0.00	0.00
32.00	2.90	0.00	0.00
32.50	2.90	0.00	0.00
33.00	2.90	0.00	0.00
33.50	2.90	0.00	0.00
34.00	2.90	0.00	0.00
34.50	2.90	0.00	0.00
35.00	2.90	0.00	0.00
35.50	2.90	0.00	0.00
36.00	2.90	0.00	0.00

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 E-1A: Existing Pervious Runoff Area=9.390 ac 0.00% Impervious Runoff Depth=0.03"
Tc=22.1 min CN=42 Runoff=0.03 cfs 0.022 af

Total Runoff Area = 9.390 ac Runoff Volume = 0.022 af Average Runoff Depth = 0.03"
100.00% Pervious = 9.390 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment E-1A: Existing Pervious

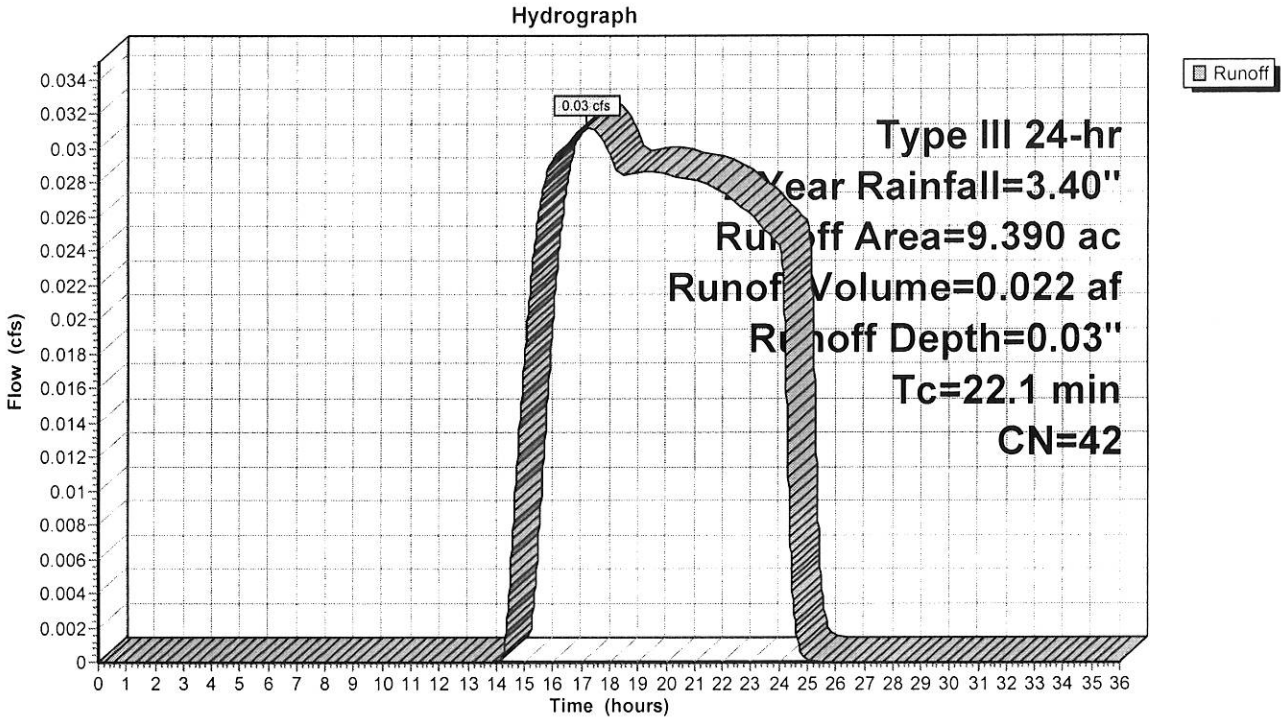
Runoff = 0.03 cfs @ 17.16 hrs, Volume= 0.022 af, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.40"

	Area (ac)	CN	Description
*	9.390	42	
	9.390		100.00% Pervious Area

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

Subcatchment E-1A: Existing Pervious



Hydrograph for Subcatchment E-1A: Existing Pervious

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.00	3.40	0.03	0.00
0.50	0.02	0.00	0.00	26.50	3.40	0.03	0.00
1.00	0.03	0.00	0.00	27.00	3.40	0.03	0.00
1.50	0.05	0.00	0.00	27.50	3.40	0.03	0.00
2.00	0.07	0.00	0.00	28.00	3.40	0.03	0.00
2.50	0.09	0.00	0.00	28.50	3.40	0.03	0.00
3.00	0.10	0.00	0.00	29.00	3.40	0.03	0.00
3.50	0.12	0.00	0.00	29.50	3.40	0.03	0.00
4.00	0.15	0.00	0.00	30.00	3.40	0.03	0.00
4.50	0.17	0.00	0.00	30.50	3.40	0.03	0.00
5.00	0.19	0.00	0.00	31.00	3.40	0.03	0.00
5.50	0.22	0.00	0.00	31.50	3.40	0.03	0.00
6.00	0.24	0.00	0.00	32.00	3.40	0.03	0.00
6.50	0.27	0.00	0.00	32.50	3.40	0.03	0.00
7.00	0.31	0.00	0.00	33.00	3.40	0.03	0.00
7.50	0.35	0.00	0.00	33.50	3.40	0.03	0.00
8.00	0.39	0.00	0.00	34.00	3.40	0.03	0.00
8.50	0.44	0.00	0.00	34.50	3.40	0.03	0.00
9.00	0.50	0.00	0.00	35.00	3.40	0.03	0.00
9.50	0.56	0.00	0.00	35.50	3.40	0.03	0.00
10.00	0.64	0.00	0.00	36.00	3.40	0.03	0.00
10.50	0.74	0.00	0.00				
11.00	0.85	0.00	0.00				
11.50	1.01	0.00	0.00				
12.00	1.70	0.00	0.00				
12.50	2.39	0.00	0.00				
13.00	2.55	0.00	0.00				
13.50	2.66	0.00	0.00				
14.00	2.76	0.00	0.00				
14.50	2.84	0.00	0.01				
15.00	2.90	0.00	0.02				
15.50	2.96	0.00	0.03				
16.00	3.01	0.00	0.03				
16.50	3.05	0.01	0.03				
17.00	3.09	0.01	**0.03**				
17.50	3.13	0.01	**0.03**				
18.00	3.16	0.01	0.03				
18.50	3.18	0.01	0.03				
19.00	3.21	0.01	0.03				
19.50	3.23	0.02	0.03				
20.00	3.25	0.02	0.03				
20.50	3.28	0.02	0.03				
21.00	3.30	0.02	0.03				
21.50	3.32	0.02	0.03				
22.00	3.33	0.02	0.03				
22.50	3.35	0.02	0.03				
23.00	3.37	0.03	0.03				
23.50	3.39	0.03	0.03				
24.00	**3.40**	**0.03**	0.02				
24.50	3.40	0.03	0.00				
25.00	3.40	0.03	0.00				
25.50	3.40	0.03	0.00				

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 E-1A: Existing Pervious Runoff Area=9.390 ac 0.00% Impervious Runoff Depth=0.37"
Tc=22.1 min CN=42 Runoff=1.05 cfs 0.286 af

Total Runoff Area = 9.390 ac Runoff Volume = 0.286 af Average Runoff Depth = 0.37"
100.00% Pervious = 9.390 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment E-1A: Existing Pervious

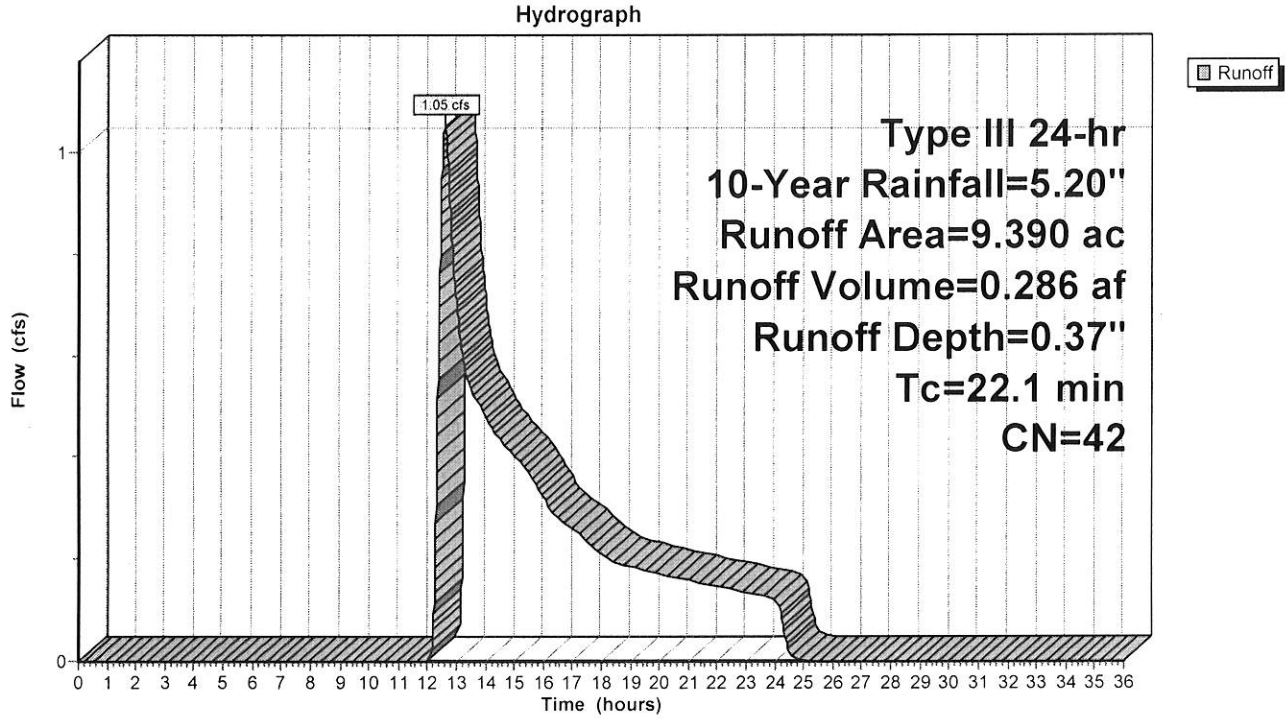
Runoff = 1.05 cfs @ 12.60 hrs, Volume= 0.286 af, Depth= 0.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=5.20"

	Area (ac)	CN	Description
*	9.390	42	
	9.390		100.00% Pervious Area

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

Subcatchment E-1A: Existing Pervious



Hydrograph for Subcatchment E-1A: Existing Pervious

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.03	0.00	0.00
1.00	0.05	0.00	0.00
1.50	0.08	0.00	0.00
2.00	0.10	0.00	0.00
2.50	0.13	0.00	0.00
3.00	0.16	0.00	0.00
3.50	0.19	0.00	0.00
4.00	0.22	0.00	0.00
4.50	0.26	0.00	0.00
5.00	0.30	0.00	0.00
5.50	0.33	0.00	0.00
6.00	0.37	0.00	0.00
6.50	0.42	0.00	0.00
7.00	0.47	0.00	0.00
7.50	0.53	0.00	0.00
8.00	0.59	0.00	0.00
8.50	0.67	0.00	0.00
9.00	0.76	0.00	0.00
9.50	0.86	0.00	0.00
10.00	0.98	0.00	0.00
10.50	1.13	0.00	0.00
11.00	1.30	0.00	0.00
11.50	1.55	0.00	0.00
12.00	2.60	0.00	0.00
12.50	3.65	0.05	**0.97**
13.00	3.90	0.09	**0.69**
13.50	4.07	0.11	0.53
14.00	4.22	0.14	0.48
14.50	4.34	0.16	0.43
15.00	4.44	0.18	0.40
15.50	4.53	0.20	0.37
16.00	4.61	0.22	0.32
16.50	4.67	0.23	0.28
17.00	4.73	0.25	0.26
17.50	4.78	0.26	0.23
18.00	4.83	0.27	0.21
18.50	4.87	0.28	0.19
19.00	4.90	0.29	0.18
19.50	4.94	0.30	0.18
20.00	4.98	0.31	0.17
20.50	5.01	0.31	0.16
21.00	5.04	0.32	0.16
21.50	5.07	0.33	0.15
22.00	5.10	0.34	0.15
22.50	5.13	0.35	0.14
23.00	5.15	0.35	0.13
23.50	5.18	0.36	0.13
24.00	**5.20**	**0.37**	0.12
24.50	5.20	0.37	0.02
25.00	5.20	0.37	0.00
25.50	5.20	0.37	0.00
26.00	5.20	0.37	0.00
26.50	5.20	0.37	0.00
27.00	5.20	0.37	0.00
27.50	5.20	0.37	0.00
28.00	5.20	0.37	0.00
28.50	5.20	0.37	0.00
29.00	5.20	0.37	0.00
29.50	5.20	0.37	0.00
30.00	5.20	0.37	0.00
30.50	5.20	0.37	0.00
31.00	5.20	0.37	0.00
31.50	5.20	0.37	0.00
32.00	5.20	0.37	0.00
32.50	5.20	0.37	0.00
33.00	5.20	0.37	0.00
33.50	5.20	0.37	0.00
34.00	5.20	0.37	0.00
34.50	5.20	0.37	0.00
35.00	5.20	0.37	0.00
35.50	5.20	0.37	0.00
36.00	5.20	0.37	0.00

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 E-1A: Existing Pervious Runoff Area=9.390 ac 0.00% Impervious Runoff Depth=0.80"
Tc=22.1 min CN=42 Runoff=3.48 cfs 0.623 af

Total Runoff Area = 9.390 ac Runoff Volume = 0.623 af Average Runoff Depth = 0.80"
100.00% Pervious = 9.390 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment E-1A: Existing Pervious

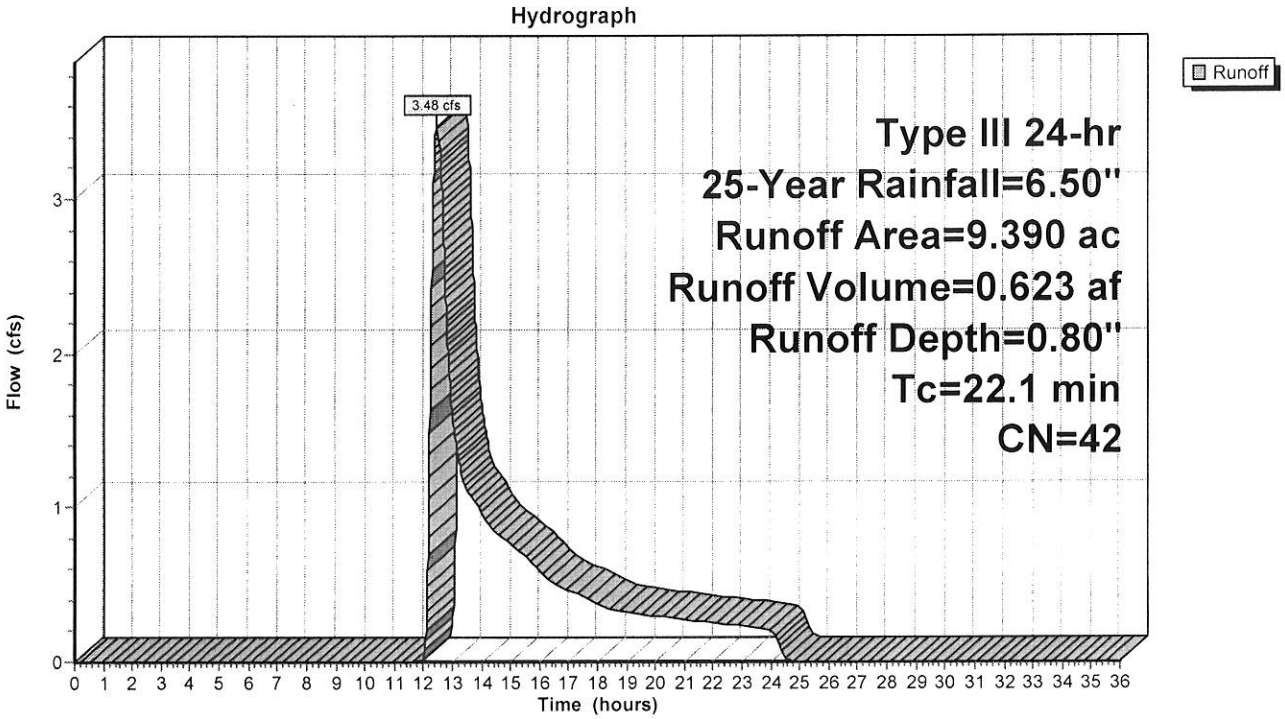
Runoff = 3.48 cfs @ 12.46 hrs, Volume= 0.623 af, Depth= 0.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.50"

	Area (ac)	CN	Description
*	9.390	42	
	9.390		100.00% Pervious Area

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

Subcatchment E-1A: Existing Pervious



Hydrograph for Subcatchment E-1A: Existing Pervious

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.03	0.00	0.00
1.00	0.07	0.00	0.00
1.50	0.10	0.00	0.00
2.00	0.13	0.00	0.00
2.50	0.16	0.00	0.00
3.00	0.20	0.00	0.00
3.50	0.24	0.00	0.00
4.00	0.28	0.00	0.00
4.50	0.32	0.00	0.00
5.00	0.37	0.00	0.00
5.50	0.42	0.00	0.00
6.00	0.47	0.00	0.00
6.50	0.52	0.00	0.00
7.00	0.59	0.00	0.00
7.50	0.66	0.00	0.00
8.00	0.74	0.00	0.00
8.50	0.83	0.00	0.00
9.00	0.95	0.00	0.00
9.50	1.08	0.00	0.00
10.00	1.23	0.00	0.00
10.50	1.41	0.00	0.00
11.00	1.63	0.00	0.00
11.50	1.94	0.00	0.00
12.00	3.25	0.02	**0.01**
12.50	4.56	0.21	**3.46**
13.00	4.87	0.28	1.61
13.50	5.09	0.34	1.10
14.00	5.27	0.39	0.96
14.50	5.42	0.43	0.84
15.00	5.55	0.47	0.77
15.50	5.67	0.50	0.68
16.00	5.76	0.53	0.59
16.50	5.84	0.56	0.51
17.00	5.91	0.59	0.47
17.50	5.98	0.61	0.42
18.00	6.03	0.63	0.37
18.50	6.08	0.64	0.34
19.00	6.13	0.66	0.32
19.50	6.18	0.68	0.31
20.00	6.22	0.69	0.30
20.50	6.26	0.71	0.29
21.00	6.30	0.72	0.28
21.50	6.34	0.74	0.26
22.00	6.37	0.75	0.25
22.50	6.41	0.76	0.24
23.00	6.44	0.77	0.23
23.50	6.47	0.79	0.22
24.00	**6.50**	**0.80**	0.21
24.50	6.50	0.80	0.03
25.00	6.50	0.80	0.00
25.50	6.50	0.80	0.00
26.00	6.50	0.80	0.00
26.50	6.50	0.80	0.00
27.00	6.50	0.80	0.00
27.50	6.50	0.80	0.00
28.00	6.50	0.80	0.00
28.50	6.50	0.80	0.00
29.00	6.50	0.80	0.00
29.50	6.50	0.80	0.00
30.00	6.50	0.80	0.00
30.50	6.50	0.80	0.00
31.00	6.50	0.80	0.00
31.50	6.50	0.80	0.00
32.00	6.50	0.80	0.00
32.50	6.50	0.80	0.00
33.00	6.50	0.80	0.00
33.50	6.50	0.80	0.00
34.00	6.50	0.80	0.00
34.50	6.50	0.80	0.00
35.00	6.50	0.80	0.00
35.50	6.50	0.80	0.00
36.00	6.50	0.80	0.00

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 E-1A: Existing Pervious Runoff Area=9.390 ac 0.00% Impervious Runoff Depth=1.89"
Tc=22.1 min CN=42 Runoff=11.14 cfs 1.478 af

Total Runoff Area = 9.390 ac Runoff Volume = 1.478 af Average Runoff Depth = 1.89"
100.00% Pervious = 9.390 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment E-1A: Existing Pervious

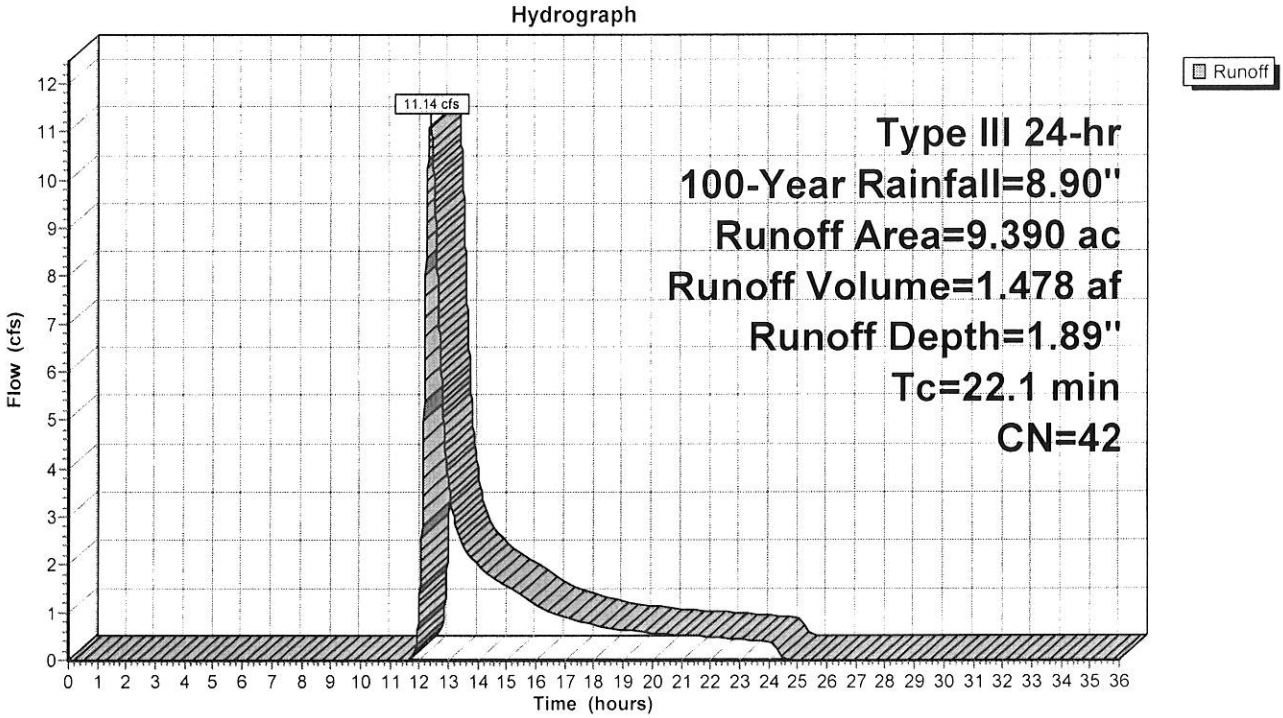
Runoff = 11.14 cfs @ 12.36 hrs, Volume= 1.478 af, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.90"

	Area (ac)	CN	Description
*	9.390	42	
	9.390		100.00% Pervious Area

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

Subcatchment E-1A: Existing Pervious



Hydrograph for Subcatchment E-1A: Existing Pervious

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.04	0.00	0.00
1.00	0.09	0.00	0.00
1.50	0.13	0.00	0.00
2.00	0.18	0.00	0.00
2.50	0.22	0.00	0.00
3.00	0.27	0.00	0.00
3.50	0.33	0.00	0.00
4.00	0.38	0.00	0.00
4.50	0.44	0.00	0.00
5.00	0.51	0.00	0.00
5.50	0.57	0.00	0.00
6.00	0.64	0.00	0.00
6.50	0.72	0.00	0.00
7.00	0.81	0.00	0.00
7.50	0.90	0.00	0.00
8.00	1.01	0.00	0.00
8.50	1.14	0.00	0.00
9.00	1.30	0.00	0.00
9.50	1.48	0.00	0.00
10.00	1.68	0.00	0.00
10.50	1.93	0.00	0.00
11.00	2.23	0.00	0.00
11.50	2.65	0.00	0.00
12.00	4.45	0.18	**1.25**
12.50	6.25	0.70	**9.97**
13.00	6.67	0.86	3.70
13.50	6.97	0.98	2.38
14.00	7.22	1.09	2.01
14.50	7.42	1.18	1.73
15.00	7.60	1.26	1.55
15.50	7.76	1.33	1.37
16.00	7.89	1.39	1.17
16.50	8.00	1.44	1.00
17.00	8.09	1.49	0.91
17.50	8.18	1.53	0.82
18.00	8.26	1.57	0.73
18.50	8.33	1.60	0.65
19.00	8.39	1.63	0.62
19.50	8.46	1.66	0.60
20.00	8.52	1.69	0.57
20.50	8.57	1.72	0.54
21.00	8.63	1.75	0.52
21.50	8.68	1.78	0.50
22.00	8.73	1.80	0.48
22.50	8.78	1.82	0.46
23.00	8.82	1.85	0.43
23.50	8.86	1.87	0.41
24.00	**8.90**	**1.89**	0.39
24.50	8.90	1.89	0.05
25.00	8.90	1.89	0.00
25.50	8.90	1.89	0.00
26.00	8.90	1.89	0.00
26.50	8.90	1.89	0.00
27.00	8.90	1.89	0.00
27.50	8.90	1.89	0.00
28.00	8.90	1.89	0.00
28.50	8.90	1.89	0.00
29.00	8.90	1.89	0.00
29.50	8.90	1.89	0.00
30.00	8.90	1.89	0.00
30.50	8.90	1.89	0.00
31.00	8.90	1.89	0.00
31.50	8.90	1.89	0.00
32.00	8.90	1.89	0.00
32.50	8.90	1.89	0.00
33.00	8.90	1.89	0.00
33.50	8.90	1.89	0.00
34.00	8.90	1.89	0.00
34.50	8.90	1.89	0.00
35.00	8.90	1.89	0.00
35.50	8.90	1.89	0.00
36.00	8.90	1.89	0.00

Appendix 2
Post Developed Drainage Calculations

Appendix 2
Post Developed Drainage Calculations

Two River Engineering

265 Route 34
P.O. Box 155
Colts Neck, NJ 07722

Tel: 732.866.0111
Fax: 732.866.4348

Worksheet 2: Runoff curve number and runoff

Project	By	Date
COLTS NECK COMMUNITY CHURCH	AJG	19-Feb-20
Location	**Checked**	**Date**
TOWNSHIP OF COLTS NECK, MONMOUTH COUNTY	AJG	19-Feb-20

Check one: ☐ Present ☒ Developed — P-1, PROPOSED CONDITIONS (IMPERVIOUS)

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN[1] Table 2-2	CN[1] Figure 2-3	CN[1] Figure 2-4	Area ☒ acres ☐ mi² ☐ %	Product of CN x Area
Toa 'A'	IMPERVIOUS	98			2.44	239.12
				Totals ➡	2.44	239.12

1. Use only one CN source per line

$$\text{CN (weighted)} = \frac{\text{tot.prod.}}{\text{tot. area}} = \frac{239.12}{2.44} = 98.0 \;;$$

Use CN ➡ **98**

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.4	5.3	7.5
Runoff, Q.....	in			

Use P and CN with table 2-1, figure 2-1, or equation 2-3 abd 2-4

Two River Engineering

265 Route 34
P.O. Box 155
Colts Neck, NJ 07722

Tel: 732.866.0111
Fax: 732.866.4348

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	By	Date
COLTS NECK COMMUNITY CHURCH	AJG	19-Feb-20
Location	**Checked**	**Date**
COLTS NECK, MONMOUTH COUNTY, NEW JERSEY	AJG	19-Feb-20

Check one: ☐ Present ☒ Developed — P-1, PROPOSED CONDITIONS (IMPERVIOUS)

Check one: ☒ T_c ☐ T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic or description of flow segments.

Sheet Flow (Applicable to T_c only)

		Segment ID				
1. Surface description (table 3-1)						
2. Manning's roughness coefficient, n (table 3-1)						
3. Flow length, L (total L ≤ 300 ft.)	ft					
4. Two-year 24-hour rainfall, p_2	in					
5. Land slope, s	ft/ft					
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr		+		=	

Shallow Concentrated Flow

		Segment ID				
7. Surface description (paved or unpaved)						
8. Flow Length, L	ft					
9. Watercourse slope, s	ft/ft					
10. Average velocity, V (figure 3-1)	ft/s					
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+		=	

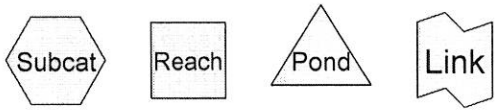
Channel Flow

		Segment ID				
12. Cross sectional flow area, a	ft^2					
13. Wetted perimeter, P_w	ft					
14. Hydraulic radius, $r=a/P_w$ Compute r	ft					
15. Channel slope, s	ft/ft					
16. Manning's roughness coefficient, n						
17. $V = \frac{1.49 r^{2/3} \sqrt{s}}{n}$ Compute V	ft/s					
18. Flow length, L	ft					
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+		=	0.00

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr 0.170

min 10.0

Proposed Drainage Area Impervious



Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.440	98	Impervious (P1-I)
2.440	**98**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
2.440	Other	P1-I
2.440		**TOTAL AREA**

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 P1-I: Proposed Drainage Runoff Area=2.440 ac 100.00% Impervious Runoff Depth=2.67"
Tc=10.0 min CN=98 Runoff=6.01 cfs 0.543 af

Total Runoff Area = 2.440 ac Runoff Volume = 0.543 af Average Runoff Depth = 2.67"
0.00% Pervious = 0.000 ac 100.00% Impervious = 2.440 ac

Summary for Subcatchment P1-I: Proposed Drainage Area Impervious

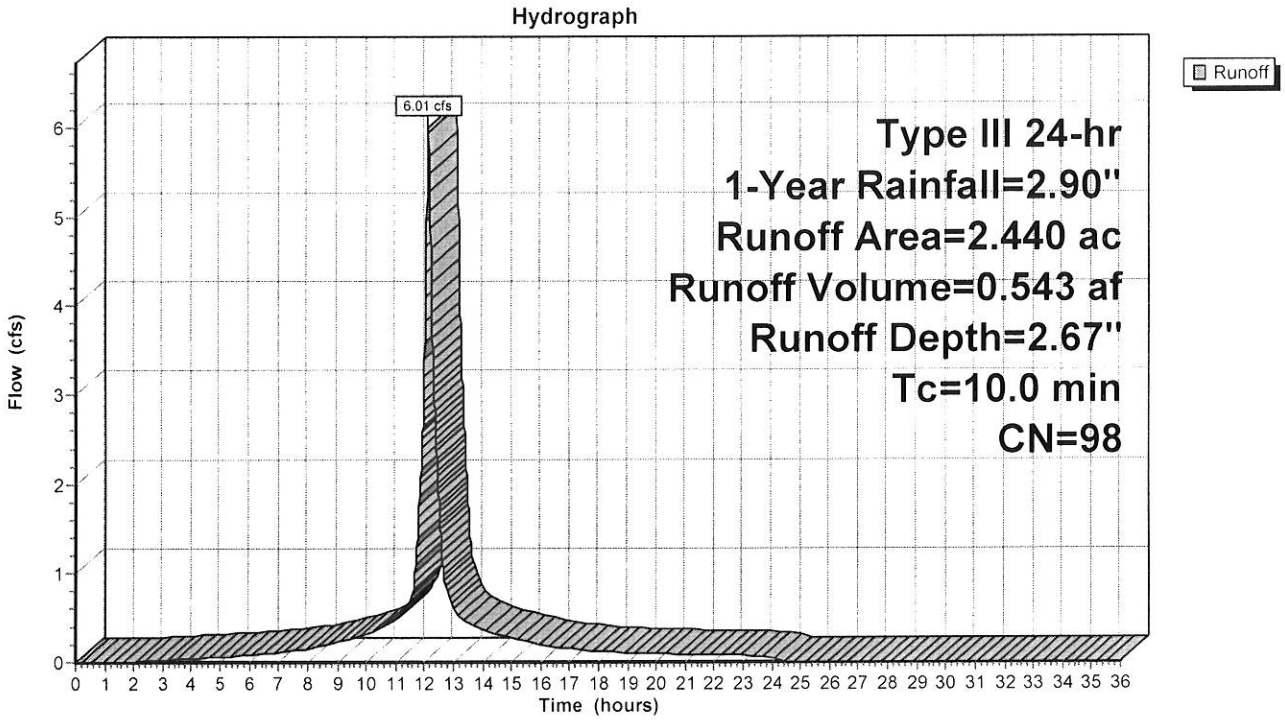
Runoff = 6.01 cfs @ 12.13 hrs, Volume= 0.543 af, Depth= 2.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.90"

	Area (ac)	CN	Description
*	2.440	98	Impervious
	2.440		100.00% Impervious Area

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

Subcatchment P1-I: Proposed Drainage Area Impervious



Hydrograph for Subcatchment P1-I: Proposed Drainage Area Impervious

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.01	0.00	0.00
1.00	0.03	0.00	0.00
1.50	0.04	0.00	0.00
2.00	0.06	0.00	0.01
2.50	0.07	0.00	0.02
3.00	0.09	0.01	0.03
3.50	0.11	0.02	0.03
4.00	0.12	0.02	0.04
4.50	0.14	0.03	0.05
5.00	0.16	0.05	0.06
5.50	0.19	0.06	0.07
6.00	0.21	0.08	0.08
6.50	0.23	0.09	0.09
7.00	0.26	0.12	0.11
7.50	0.29	0.14	0.13
8.00	0.33	0.17	0.15
8.50	0.37	0.21	0.18
9.00	0.42	0.25	0.22
9.50	0.48	0.30	0.26
10.00	0.55	0.36	0.31
10.50	0.63	0.44	0.38
11.00	0.73	0.53	0.47
11.50	0.86	0.66	0.72
12.00	1.45	1.23	**3.20**
12.50	2.04	1.81	**1.82**
13.00	2.18	1.95	0.62
13.50	2.27	2.04	0.46
14.00	2.35	2.12	0.37
14.50	2.42	2.19	0.32
15.00	2.48	2.25	0.28
15.50	2.53	2.30	0.24
16.00	2.57	2.34	0.20
16.50	2.61	2.38	0.17
17.00	2.64	2.41	0.15
17.50	2.67	2.44	0.14
18.00	2.69	2.46	0.12
18.50	2.71	2.48	0.11
19.00	2.74	2.50	0.10
19.50	2.76	2.53	0.10
20.00	2.78	2.54	0.09
20.50	2.79	2.56	0.09
21.00	2.81	2.58	0.09
21.50	2.83	2.60	0.08
22.00	2.84	2.61	0.08
22.50	2.86	2.63	0.07
23.00	2.87	2.64	0.07
23.50	2.89	2.66	0.07
24.00	**2.90**	**2.67**	0.06
24.50	2.90	2.67	0.00
25.00	2.90	2.67	0.00
25.50	2.90	2.67	0.00
26.00	2.90	2.67	0.00
26.50	2.90	2.67	0.00
27.00	2.90	2.67	0.00
27.50	2.90	2.67	0.00
28.00	2.90	2.67	0.00
28.50	2.90	2.67	0.00
29.00	2.90	2.67	0.00
29.50	2.90	2.67	0.00
30.00	2.90	2.67	0.00
30.50	2.90	2.67	0.00
31.00	2.90	2.67	0.00
31.50	2.90	2.67	0.00
32.00	2.90	2.67	0.00
32.50	2.90	2.67	0.00
33.00	2.90	2.67	0.00
33.50	2.90	2.67	0.00
34.00	2.90	2.67	0.00
34.50	2.90	2.67	0.00
35.00	2.90	2.67	0.00
35.50	2.90	2.67	0.00
36.00	2.90	2.67	0.00

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 P1-I: Proposed Drainage Runoff Area=2.440 ac 100.00% Impervious Runoff Depth=3.17"
Tc=10.0 min CN=98 Runoff=7.08 cfs 0.644 af

Total Runoff Area = 2.440 ac Runoff Volume = 0.644 af Average Runoff Depth = 3.17"
0.00% Pervious = 0.000 ac 100.00% Impervious = 2.440 ac

Summary for Subcatchment P1-I: Proposed Drainage Area Impervious

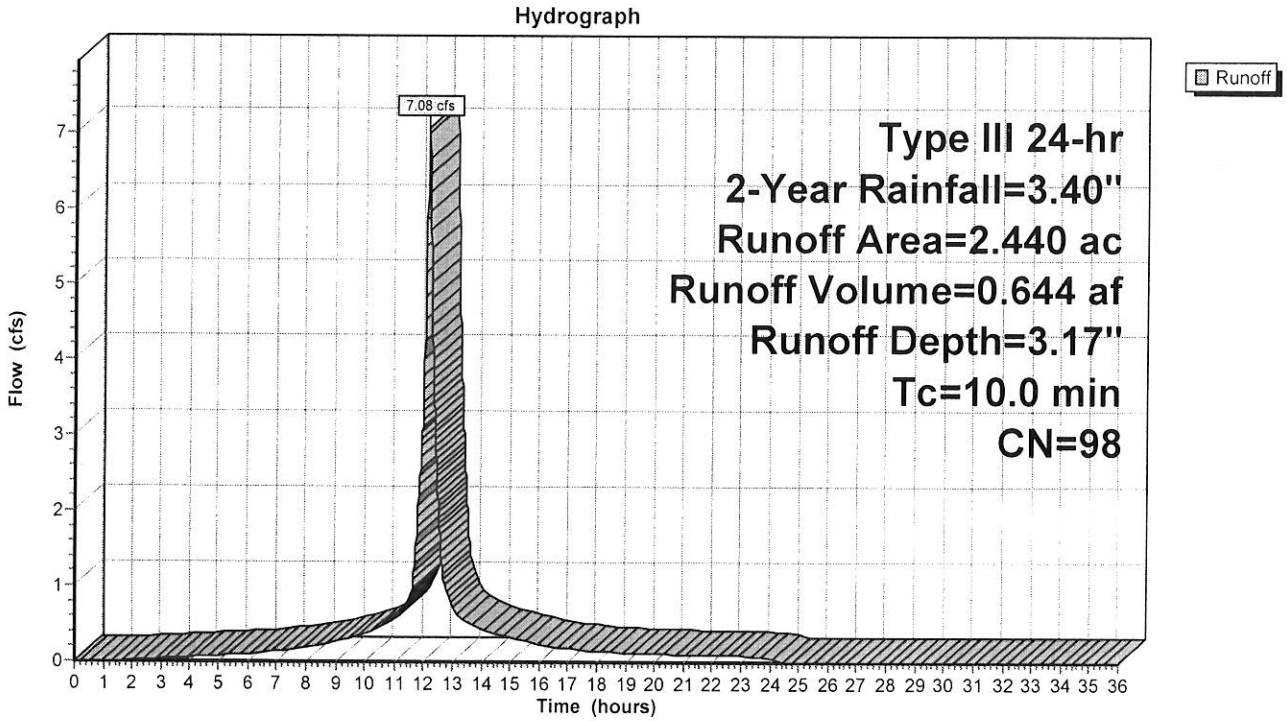
Runoff = 7.08 cfs @ 12.13 hrs, Volume= 0.644 af, Depth= 3.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.40"

	Area (ac)	CN	Description
*	2.440	98	Impervious
	2.440		100.00% Impervious Area

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

Subcatchment P1-I: Proposed Drainage Area Impervious



Hydrograph for Subcatchment P1-I: Proposed Drainage Area Impervious

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.02	0.00	0.00
1.00	0.03	0.00	0.00
1.50	0.05	0.00	0.00
2.00	0.07	0.00	0.02
2.50	0.09	0.01	0.03
3.00	0.10	0.02	0.04
3.50	0.12	0.02	0.05
4.00	0.15	0.04	0.06
4.50	0.17	0.05	0.07
5.00	0.19	0.06	0.08
5.50	0.22	0.08	0.09
6.00	0.24	0.10	0.10
6.50	0.27	0.12	0.11
7.00	0.31	0.15	0.14
7.50	0.35	0.18	0.16
8.00	0.39	0.22	0.18
8.50	0.44	0.26	0.22
9.00	0.50	0.31	0.27
9.50	0.56	0.38	0.32
10.00	0.64	0.45	0.37
10.50	0.74	0.54	0.45
11.00	0.85	0.65	0.55
11.50	1.01	0.80	0.85
12.00	1.70	1.48	**3.78**
12.50	2.39	2.16	**2.14**
13.00	2.55	2.32	0.73
13.50	2.66	2.43	0.54
14.00	2.76	2.53	0.44
14.50	2.84	2.60	0.38
15.00	2.90	2.67	0.33
15.50	2.96	2.73	0.28
16.00	3.01	2.78	0.23
16.50	3.05	2.82	0.20
17.00	3.09	2.86	0.18
17.50	3.13	2.89	0.16
18.00	3.16	2.92	0.14
18.50	3.18	2.95	0.13
19.00	3.21	2.97	0.12
19.50	3.23	3.00	0.12
20.00	3.25	3.02	0.11
20.50	3.28	3.04	0.11
21.00	3.30	3.06	0.10
21.50	3.32	3.08	0.10
22.00	3.33	3.10	0.09
22.50	3.35	3.12	0.09
23.00	3.37	3.14	0.08
23.50	3.39	3.15	0.08
24.00	**3.40**	**3.17**	0.07
24.50	3.40	3.17	0.00
25.00	3.40	3.17	0.00
25.50	3.40	3.17	0.00
26.00	3.40	3.17	0.00
26.50	3.40	3.17	0.00
27.00	3.40	3.17	0.00
27.50	3.40	3.17	0.00
28.00	3.40	3.17	0.00
28.50	3.40	3.17	0.00
29.00	3.40	3.17	0.00
29.50	3.40	3.17	0.00
30.00	3.40	3.17	0.00
30.50	3.40	3.17	0.00
31.00	3.40	3.17	0.00
31.50	3.40	3.17	0.00
32.00	3.40	3.17	0.00
32.50	3.40	3.17	0.00
33.00	3.40	3.17	0.00
33.50	3.40	3.17	0.00
34.00	3.40	3.17	0.00
34.50	3.40	3.17	0.00
35.00	3.40	3.17	0.00
35.50	3.40	3.17	0.00
36.00	3.40	3.17	0.00

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 P1-I: Proposed Drainage Runoff Area=2.440 ac 100.00% Impervious Runoff Depth=4.96"
Tc=10.0 min CN=98 Runoff=10.90 cfs 1.009 af

Total Runoff Area = 2.440 ac Runoff Volume = 1.009 af Average Runoff Depth = 4.96"
0.00% Pervious = 0.000 ac 100.00% Impervious = 2.440 ac

Summary for Subcatchment P1-I: Proposed Drainage Area Impervious

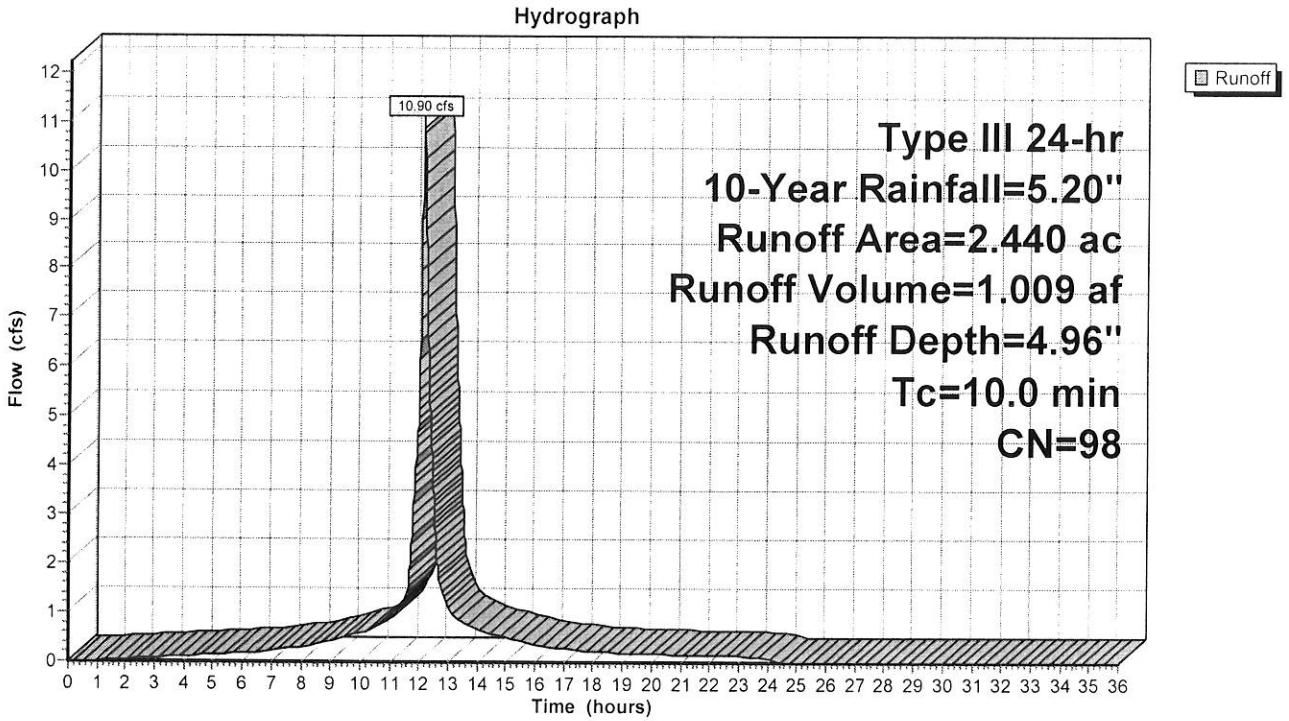
Runoff = 10.90 cfs @ 12.13 hrs, Volume= 1.009 af, Depth= 4.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=5.20"

	Area (ac)	CN	Description
*	2.440	98	Impervious
	2.440		100.00% Impervious Area

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

Subcatchment P1-I: Proposed Drainage Area Impervious



Hydrograph for Subcatchment P1-I: Proposed Drainage Area Impervious

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.03	0.00	0.00
1.00	0.05	0.00	0.00
1.50	0.08	0.01	0.03
2.00	0.10	0.01	0.05
2.50	0.13	0.03	0.07
3.00	0.16	0.04	0.08
3.50	0.19	0.06	0.10
4.00	0.22	0.09	0.12
4.50	0.26	0.11	0.13
5.00	0.30	0.14	0.14
5.50	0.33	0.17	0.16
6.00	0.37	0.21	0.17
6.50	0.42	0.25	0.20
7.00	0.47	0.29	0.23
7.50	0.53	0.34	0.26
8.00	0.59	0.40	0.30
8.50	0.67	0.47	0.36
9.00	0.76	0.56	0.43
9.50	0.86	0.66	0.51
10.00	0.98	0.77	0.58
10.50	1.13	0.91	0.71
11.00	1.30	1.08	0.87
11.50	1.55	1.33	1.32
12.00	2.60	2.37	**5.84**
12.50	3.65	3.42	**3.29**
13.00	3.90	3.67	1.11
13.50	4.07	3.84	0.83
14.00	4.22	3.98	0.67
14.50	4.34	4.10	0.58
15.00	4.44	4.21	0.50
15.50	4.53	4.30	0.43
16.00	4.61	4.37	0.35
16.50	4.67	4.44	0.31
17.00	4.73	4.49	0.28
17.50	4.78	4.54	0.25
18.00	4.83	4.59	0.21
18.50	4.87	4.63	0.20
19.00	4.90	4.67	0.19
19.50	4.94	4.70	0.18
20.00	4.98	4.74	0.17
20.50	5.01	4.77	0.16
21.00	5.04	4.80	0.15
21.50	5.07	4.83	0.15
22.00	5.10	4.86	0.14
22.50	5.13	4.89	0.13
23.00	5.15	4.92	0.13
23.50	5.18	4.94	0.12
24.00	**5.20**	**4.96**	0.11
24.50	5.20	4.96	0.00
25.00	5.20	4.96	0.00
25.50	5.20	4.96	0.00
26.00	5.20	4.96	0.00
26.50	5.20	4.96	0.00
27.00	5.20	4.96	0.00
27.50	5.20	4.96	0.00
28.00	5.20	4.96	0.00
28.50	5.20	4.96	0.00
29.00	5.20	4.96	0.00
29.50	5.20	4.96	0.00
30.00	5.20	4.96	0.00
30.50	5.20	4.96	0.00
31.00	5.20	4.96	0.00
31.50	5.20	4.96	0.00
32.00	5.20	4.96	0.00
32.50	5.20	4.96	0.00
33.00	5.20	4.96	0.00
33.50	5.20	4.96	0.00
34.00	5.20	4.96	0.00
34.50	5.20	4.96	0.00
35.00	5.20	4.96	0.00
35.50	5.20	4.96	0.00
36.00	5.20	4.96	0.00

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 P1-I: Proposed Drainage Runoff Area=2.440 ac 100.00% Impervious Runoff Depth=6.26"
Tc=10.0 min CN=98 Runoff=13.65 cfs 1.273 af

Total Runoff Area = 2.440 ac Runoff Volume = 1.273 af Average Runoff Depth = 6.26"
0.00% Pervious = 0.000 ac 100.00% Impervious = 2.440 ac

Summary for Subcatchment P1-I: Proposed Drainage Area Impervious

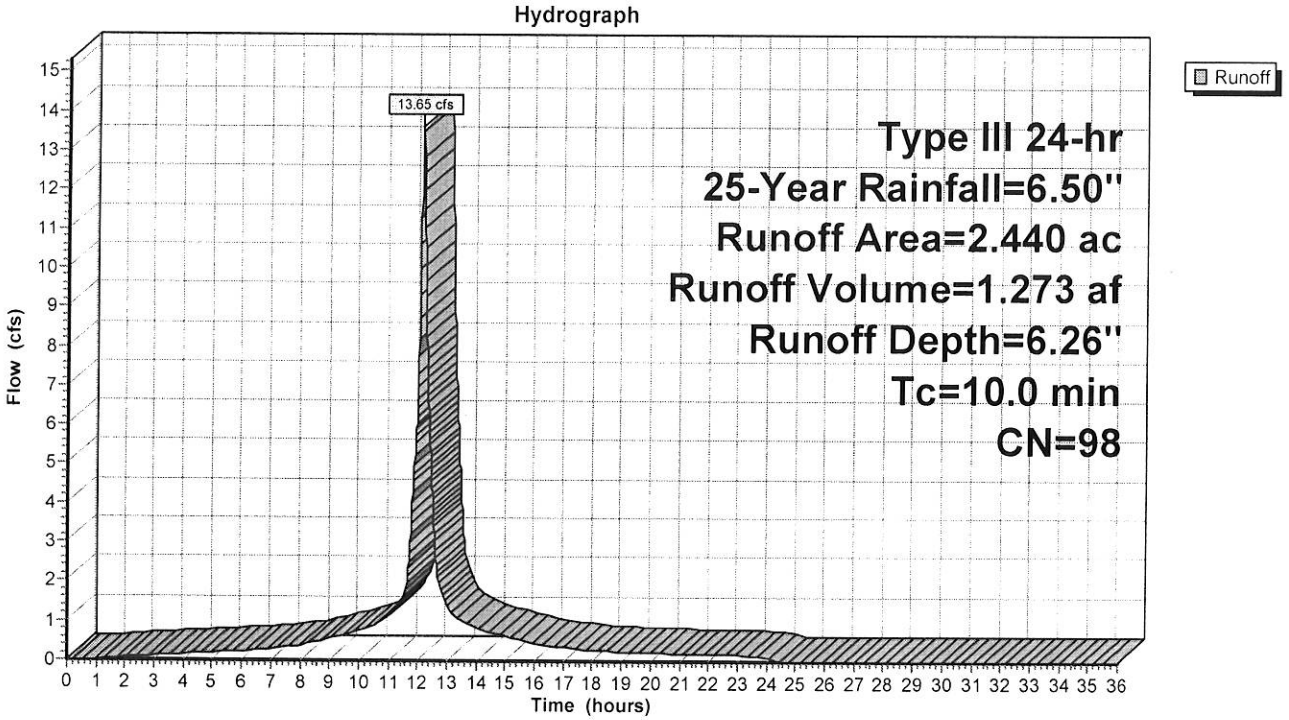
Runoff = 13.65 cfs @ 12.13 hrs, Volume= 1.273 af, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.50"

	Area (ac)	CN	Description
*	2.440	98	Impervious
	2.440		100.00% Impervious Area

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

Subcatchment P1-I: Proposed Drainage Area Impervious



Hydrograph for Subcatchment P1-I: Proposed Drainage Area Impervious

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.03	0.00	0.00
1.00	0.07	0.00	0.02
1.50	0.10	0.01	0.05
2.00	0.13	0.03	0.08
2.50	0.16	0.05	0.10
3.00	0.20	0.07	0.12
3.50	0.24	0.10	0.14
4.00	0.28	0.13	0.16
4.50	0.32	0.16	0.18
5.00	0.37	0.20	0.19
5.50	0.42	0.24	0.21
6.00	0.47	0.29	0.22
6.50	0.52	0.34	0.26
7.00	0.59	0.40	0.30
7.50	0.66	0.47	0.34
8.00	0.74	0.54	0.38
8.50	0.83	0.63	0.46
9.00	0.95	0.74	0.55
9.50	1.08	0.87	0.64
10.00	1.23	1.01	0.74
10.50	1.41	1.19	0.90
11.00	1.63	1.40	1.09
11.50	1.94	1.71	1.66
12.00	3.25	3.02	**7.32**
12.50	4.56	4.33	**4.12**
13.00	4.87	4.64	1.39
13.50	5.09	4.86	1.03
14.00	5.27	5.03	0.84
14.50	5.42	5.18	0.72
15.00	5.55	5.32	0.63
15.50	5.67	5.43	0.54
16.00	5.76	5.52	0.44
16.50	5.84	5.60	0.39
17.00	5.91	5.67	0.35
17.50	5.98	5.74	0.31
18.00	6.03	5.79	0.27
18.50	6.08	5.84	0.25
19.00	6.13	5.89	0.24
19.50	6.18	5.94	0.22
20.00	6.22	5.98	0.21
20.50	6.26	6.02	0.20
21.00	6.30	6.06	0.19
21.50	6.34	6.10	0.18
22.00	6.37	6.14	0.17
22.50	6.41	6.17	0.17
23.00	6.44	6.20	0.16
23.50	6.47	6.23	0.15
24.00	**6.50**	**6.26**	0.14
24.50	6.50	6.26	0.00
25.00	6.50	6.26	0.00
25.50	6.50	6.26	0.00
26.00	6.50	6.26	0.00
26.50	6.50	6.26	0.00
27.00	6.50	6.26	0.00
27.50	6.50	6.26	0.00
28.00	6.50	6.26	0.00
28.50	6.50	6.26	0.00
29.00	6.50	6.26	0.00
29.50	6.50	6.26	0.00
30.00	6.50	6.26	0.00
30.50	6.50	6.26	0.00
31.00	6.50	6.26	0.00
31.50	6.50	6.26	0.00
32.00	6.50	6.26	0.00
32.50	6.50	6.26	0.00
33.00	6.50	6.26	0.00
33.50	6.50	6.26	0.00
34.00	6.50	6.26	0.00
34.50	6.50	6.26	0.00
35.00	6.50	6.26	0.00
35.50	6.50	6.26	0.00
36.00	6.50	6.26	0.00

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 P1-I: Proposed Drainage Runoff Area=2.440 ac 100.00% Impervious Runoff Depth=8.66"
Tc=10.0 min CN=98 Runoff=18.72 cfs 1.761 af

Total Runoff Area = 2.440 ac Runoff Volume = 1.761 af Average Runoff Depth = 8.66"
0.00% Pervious = 0.000 ac 100.00% Impervious = 2.440 ac

Summary for Subcatchment P1-I: Proposed Drainage Area Impervious

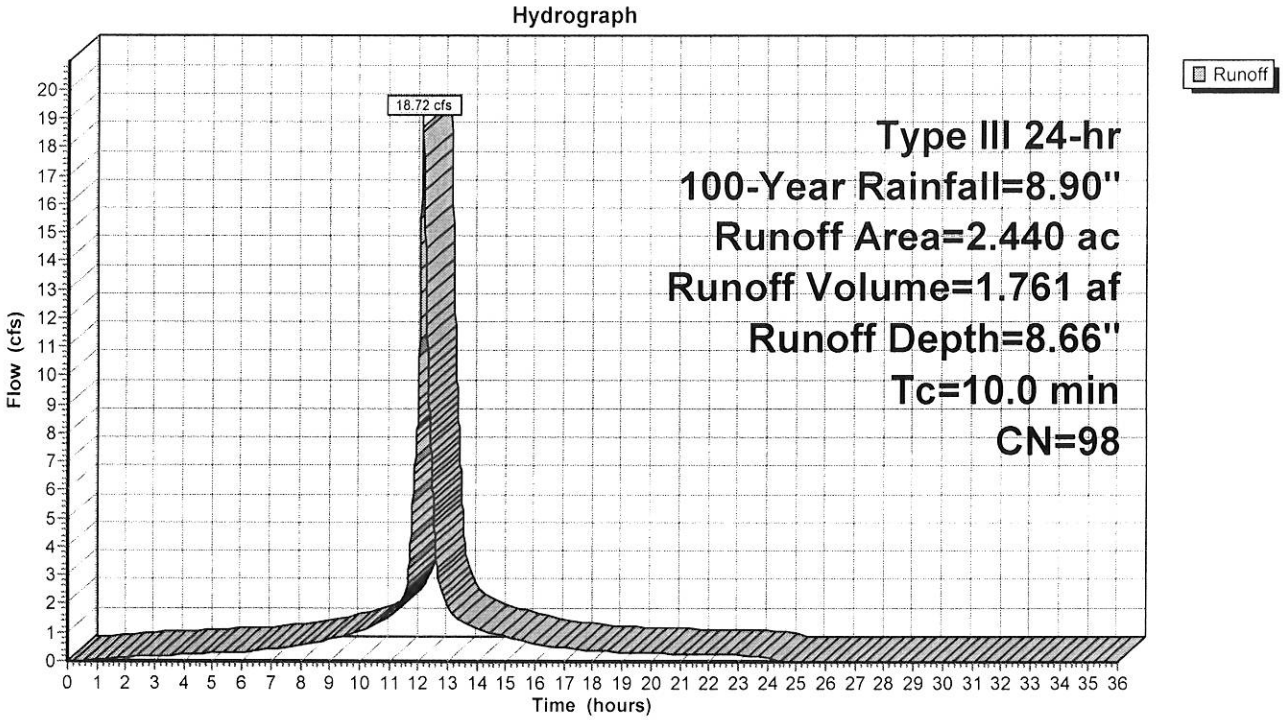
Runoff = 18.72 cfs @ 12.13 hrs, Volume= 1.761 af, Depth= 8.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.90"

	Area (ac)	CN	Description
*	2.440	98	Impervious
	2.440		100.00% Impervious Area

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

Subcatchment P1-I: Proposed Drainage Area Impervious



Hydrograph for Subcatchment P1-I: Proposed Drainage Area Impervious

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.04	0.00	0.00
1.00	0.09	0.01	0.06
1.50	0.13	0.03	0.10
2.00	0.18	0.06	0.13
2.50	0.22	0.09	0.16
3.00	0.27	0.12	0.19
3.50	0.33	0.17	0.21
4.00	0.38	0.21	0.24
4.50	0.44	0.27	0.26
5.00	0.51	0.32	0.28
5.50	0.57	0.38	0.30
6.00	0.64	0.45	0.32
6.50	0.72	0.52	0.37
7.00	0.81	0.60	0.42
7.50	0.90	0.70	0.48
8.00	1.01	0.81	0.53
8.50	1.14	0.93	0.64
9.00	1.30	1.08	0.77
9.50	1.48	1.26	0.89
10.00	1.68	1.46	1.02
10.50	1.93	1.70	1.24
11.00	2.23	2.00	1.50
11.50	2.65	2.42	2.28
12.00	4.45	4.21	**10.04**
12.50	6.25	6.01	**5.64**
13.00	6.67	6.44	1.91
13.50	6.97	6.73	1.42
14.00	7.22	6.98	1.15
14.50	7.42	7.18	0.99
15.00	7.60	7.36	0.86
15.50	7.76	7.52	0.73
16.00	7.89	7.65	0.61
16.50	8.00	7.76	0.53
17.00	8.09	7.85	0.48
17.50	8.18	7.94	0.42
18.00	8.26	8.02	0.37
18.50	8.33	8.09	0.34
19.00	8.39	8.15	0.32
19.50	8.46	8.22	0.31
20.00	8.52	8.28	0.29
20.50	8.57	8.33	0.28
21.00	8.63	8.39	0.26
21.50	8.68	8.44	0.25
22.00	8.73	8.49	0.24
22.50	8.78	8.54	0.23
23.00	8.82	8.58	0.21
23.50	8.86	8.62	0.20
24.00	**8.90**	**8.66**	0.19
24.50	8.90	8.66	0.00
25.00	8.90	8.66	0.00
25.50	8.90	8.66	0.00
26.00	8.90	8.66	0.00
26.50	8.90	8.66	0.00
27.00	8.90	8.66	0.00
27.50	8.90	8.66	0.00
28.00	8.90	8.66	0.00
28.50	8.90	8.66	0.00
29.00	8.90	8.66	0.00
29.50	8.90	8.66	0.00
30.00	8.90	8.66	0.00
30.50	8.90	8.66	0.00
31.00	8.90	8.66	0.00
31.50	8.90	8.66	0.00
32.00	8.90	8.66	0.00
32.50	8.90	8.66	0.00
33.00	8.90	8.66	0.00
33.50	8.90	8.66	0.00
34.00	8.90	8.66	0.00
34.50	8.90	8.66	0.00
35.00	8.90	8.66	0.00
35.50	8.90	8.66	0.00
36.00	8.90	8.66	0.00