

NWCC - Hydrology/Hydraulics - TR-55 - Netscape

File Edit View Go Communicator Help

Back Forward Reload Home Search Netscape Print Security Shop Stop

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United States Department of Agriculture
NRCS Natural Resources Conservation Service
National Water & Climate Center

Hydrology/Hydraulics - TR-55

TR-55, Urban Hydrology for Small Watersheds

Technical Release 55 (TR-55) presents simplified procedures to calculate storm runoff volume, peak rate of discharge, hydrographs, and storage volumes required for floodwater reservoirs. These procedures are applicable in small watersheds, especially urbanizing watersheds, in the United States. Limits: NRCS type distributions, 24-hour duration rainfall, 10 subwatersheds, minimum 0.1 hour and maximum 10-hour time of concentration.

The Natural Resources Conservation Service used government funds to develop the Technical Release 55 (TR55) computer program. It may be downloaded for use and copying at no additional expense or license requirements.

[Download the Y2K Ready TR-55 \(Vers 2.1\) Program \(320k\)](#)

This downloadable file has been compressed to minimize download time and must be expanded into the desired directory on your hard drive prior to use.

- [TR-55 Documentation](#) (PDF - 2.5mb)

This page last revised - 27 September 2002

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Document: Done

Step 1 – Delineate Watershed Area = 10 acres = 0.0156 sq. mi.

Step 2 – Predevelopment Condition – Compute Time of Concentration

Land Use – Wooded

Slope – 0.05 ft/ft

```

C:\ciieg440\TR55_210.EXE
TR-55 TIME OF CONCENTRATION AND TRAVEL TIME          Version 2.10
TIME OF CONCENTRATION COMPUTATION
UD Laird Campus                                     New Castle,DE          GJK 11-30-2002
Predeveloped
Subarea # 1 - 1
Tc Flow Type    2 Year Rain    Length    Slope    Surface    n    Area    Wp    Velocity    Time
                (ft)      (ft/ft)   Code      (Sq Ft) (Ft)   (ft/sec) (hr)
Sheet           3.5      200      0.05      H          .          .          .          .          0.413
Sheet           .         .         .         .          .          .          .          .          .
Shallow Concentrated 600      0.05      .          .          .          .          .          .          .
Shallow Concentrated 600      0.05      u          .          .          .          .          .          0.046
Open Channel    .         .         .         .          .          .          .          .          .          .
Open Channel    .         .         .         .          .          .          .          .          .          .
                .         .         .         .          .          .          .          .          .          TOTAL 0.46

--- Sheet Flow Surface Codes ---
A Smooth Surface          F Grass, Dense           --- Shallow Concentrated ---
B Fallow (No Res.)       G Grass, Bermuda        --- Surface Codes ---
C Cultivated < 20 % Res. H Woods, Light           P Paved
D Cultivated > 20 % Res. I Woods, Dense           U Unpaved
E Grass-Range, Short     J Range, Natural

EscSelect  F1Help  F2Print  F3Load  F4Save  F5DOS  F6Zero
  
```

Step 3 – Predevelopment Condition – Determine CN – Wooded = 65, Class B Soils

Step 4 – Predevelopment Condition – Compute Hydrograph for 100 year Storm.
 Peak flow = 22 cfs. Therefore, design detention basin with peak outlet flow = 22 cfs.

```

C:\cieg440\TR55_210.EXE
TR-55 TABULAR HYDROGRAPH METHOD Version 2.10
User GJK >>>> Identification Data <<<<< Date 12-01-2002
Project UD Laird Campus County New Castle State DE
Subtitle Predeveloped Conditions
>>>> Basic Watershed Data <<<<<
Rainfall-Type <I,IA,II,III> II
Rainfall Frequency 100 years
If constant rainfall over entire watershed, 24-Hour Rain 7.5 in.
<If rainfall varies by subarea enter on next screen.>
Interpolate hydrograph tables based on Ia/P ratio
<Enter Y for yes and N for no>

EscMenu F1Help F2Print F3Load F4Save F5DOS F6Zero F7Compute F9CN F10Tc
    
```

```

C:\cieg440\TR55_210.EXE
TR-55 TABULAR HYDROGRAPH METHOD Version 2.10
SUBAREA CONTRIBUTIONS AND TOTAL DISCHARGE <CFS> AT OUTLET
      Time
Subarea 11.9 12.0 12.1 12.2 12.3 12.4 12.5 12.6 12.7 12.8
A        2   3   6  11  18  22  21  17  13  10
Total   2   3   6  11  18  22  21  17  13  10

Esc Exit compute process < Display earlier time > Display later time
    
```

Predevelopment 100-yr Peak Flow = 22 cfs

Try 18" dia outlet pipe from detention basin.

Compute rating curve for 18" pipe using Culvert Equation: $Q = C * A * (2GH)^{0.5}$.

Detention basin depth should be 3 to 4 feet for safety considerations and to allow for growth of wetland plants.

H	C	A	G	2GH	(2GH)**0.5	Q
0	1.0	1.8	32.2	0	0	0
1	1.0	1.8	32.2	64.4	8.0	14.4
2	1.0	1.8	32.2	128.8	11.3	20.3
3	1.0	1.8	32.2	193.2	13.8	24.8

Step 5 – Postdevelopment – Compute Time of Concentration for New Dorms

```
C:\cieg440\TR55_210.EXE
TR-55 TIME OF CONCENTRATION AND TRAVEL TIME
TIME OF CONCENTRATION COMPUTATION
Laird Campus Detention Basin New Castle, DE GJK 12-01-2002
Postdevelopment Conditions
Subarea # 1 - A
Tc Flow Type 2 Year Rain Length (ft) Slope (ft/ft) Surface Code n Area (Sq Ft) Wp (Ft) Velocity (ft/sec) Time (hr)
Sheet 3.5 200 0.05 f 0.274
Sheet .....
Shallow Concentrated ..... 0.03 .....
Shallow Concentrated 500 0.03 u 0.050
Open Channel .....
Open Channel .....
TOTAL 0.32

--- Sheet Flow Surface Codes ---
A Smooth Surface F Grass, Dense
B Fallow (No Res.) G Grass, Bermuda
C Cultivated < 20 % Res. H Woods, Light
D Cultivated > 20 % Res. I Woods, Dense
E Grass-Range, Short J Range, Natural
--- Shallow Concentrated Surface Codes ---
P Paved
U Unpaved

End of Subarea Tc screen, press PgDn to display subarea It screen
EscSelect F1Help F2Print F3Load F4Save F5DOS F6Zero
```

Step 6 – Postdevelopment – Compute CN for Land Use = Dormitories, Parking Lot.
 CN = 85, Class B Soils

Step 7 - Postdevelopment – Compute inflow hydrograph to detention basin
 Peak 100 year inflow to detention basin = 62 cfs at 12.3 hours.

```

C:\cieg440\TR55_210.EXE
TR-55 TABULAR HYDROGRAPH METHOD Version 2.10
User GJK >>>> Identification Data <<<<< Date 12-01-2002
Project Laird Campus Detention Basin County New Castle State DE
Subtitle Postdevelopment Conditions
>>>> Basic Watershed Data <<<<<
Rainfall-Type <I,IA,II,III> II
Rainfall Frequency 100 years
If constant rainfall over entire watershed, 24-Hour Rain 7.5 in.
<If rainfall varies by subarea enter on next screen.>
Interpolate hydrograph tables based on Ia/P ratio y
<Enter Y for yes and N for no>

EscMenu F1Help F2Print F3Load F4Save F5DOS F6Zero F7Compute F9CN F10Tc
  
```

```

C:\cieg440\TR55_210.EXE
TR-55 TABULAR HYDROGRAPH METHOD Version 2.10
SUBAREA CONTRIBUTIONS AND TOTAL DISCHARGE <CFS> AT OUTLET
Subarea      Time
11.0  11.3  11.6  11.9  12.0  12.1  12.2  12.3  12.4  12.5
A          2    3    4    11   21   41   62   62   42   26
Total      2    3    4    11   21   41   62   62   42   26

Esc Exit compute process <- Display earlier time -> Display later time
  
```

C:\cieg440\TR55_210.EXE

TR-55 TABULAR HYDROGRAPH METHOD Version 2.10

SUBAREA CONTRIBUTIONS AND TOTAL DISCHARGE <CFS> AT OUTLET

Subarea	Time									
	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.2	13.4
A	62	62	42	26	18	13	10	7	6	5
Total	62	62	42	26	18	13	10	7	6	5

Esc Exit compute process ← Display earlier time → Display later time

C:\cieg440\TR55_210.EXE

TR-55 TABULAR HYDROGRAPH METHOD Version 2.10

SUBAREA CONTRIBUTIONS AND TOTAL DISCHARGE <CFS> AT OUTLET

Subarea	Time									
	13.2	13.4	13.6	13.8	14.0	14.3	14.6	15.0	15.5	16.0
A	6	5	5	4	4	3	3	3	3	2
Total	6	5	5	4	4	3	3	3	3	2

Esc Exit compute process ← Display earlier time → Display later time

Step 8 – Route Postdevelopment Inflow Through Detention Basin Using RESRVR.EXE

```

C:\cieg440\RESRVR.EXE
RESERVOIR ROUTING
INFLOW HYDROGRAPH CAPACITY/OUTFLOW RATING
TIME-min FLOW-cfs STAGE-ft VOLUME-cf OUTFLOW-cfs
-----
0 2 0 0 0
20 3 1 30000 14.4
40 4 2 60000 20.3
60 21 3 90000 24.8
80 62 4 100000 25
100 18
120 7
140 5
160 3
180 3

TIME INCREMENT (min) = 20

TIME INFLOW STAGE VOLUME OUTFLOW
(MIN) (CFS) (FT) (CF) (CFS)
-----
1
100.0 2.4 72,787 22.2 <<< MAXIMUM VALUES

<Shift> <Prt Sc> print <P> hydrograph <Ret> repeat <Space> back to menu
-----

```

