Activity 1

At this time, complete Activity 1 in your Study Guide to review the material just covered. After finishing the Activity, compare your answers with the solution provided. When you are satisfied that you understand the material, continue with the Study Guide text.

1. Define time of concentration.

2. Name the three flow components that may exist in a watershed.

3. What is the basic SCS equation for sheet flow?

4. What are the two cover types used by SCS in computing the travel time for shallow concentrated flow?

Activity 2

Worksheet 3- Time of Concentration (T_c) or Travel time (T_t)				
Project I.M. Hipp			**By** DEW	**Date** 3/88
Location Dover, Delaware			**Checked** MH	**Date** 3/88
Cirlcle one:	Present	Developed		
Circle one:	Tc	Tt through subarea		

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.

Flow Sheet(Applicable to Tc only)	**Segment ID**	AB		
1.Surface description (table 3-1)		Dense grass		
2.Manning's roughness coeff, n (table 3-1)		.24		
3.flow length,(total L 300ft)	ft	200		
4.Two-yr 24-hr rainfall, P_2	in	3.45		
5.Land slope, s	ft/ft	.01		
6.$T_t = \frac{007(nL)^{.8}}{(P_2{}^{.5}s^{.4}})$ compute T_t	hr	.53 +		= .53
Shallow concentrated flow	**Segment ID**	BC		
7.Shallow Description (paved or unpaved)		unpaved		
8.Flow length, L	ft	1000		
9. Watercourse slope, s	ft/ft	.01		
10.Average velocity, V (figure 3-1)	ft/s	1.6		
11. T_t = L/3600V compute T_t =	hr	.17 +		= .17
Channel flow	**Segment ID**	CD		
12. Cross sectional flow area, a	ft²	27		
13. Wetted perimeter, p_w	ft	28.2		
14.hydraulic radius, $r=a/p_w$ compute r	ft	.96		
15. Channel slope, s	ft/ft	.004		
16.Manning's roughness coeff., n		.05		
17. $V=\frac{1.49r^{\left(\frac{2}{3}\right)}s^{\left(\frac{1}{2}\right)}}{n}$ compute V	ft/s	1.83		
18. Flow length, L	ft	6500		
19. T_t = L/3600V compute T_t =	hr	.99 +		= .99
20. Watershed or subarea T_c or T_t = (add T_t in step 6,11 and 19)				1.69

Given:

The watershed is near Dover, Delaware and is being urbanized. The urban condition Tc at the outlet is needed to determine the impact of urbanization on peak discharge, The flow path information is as follows:
Segment AB - Sheet flow exists on dense grass where the land slope is 0.01 ftIft and the flow length is 50 feet. The 2-yr, 24-hr precipitation is 3.45 inches.

Segment BC - Shallow concentrated flow exists on paved conditions where the watercourse land slope is 0.01 tV ft, and the flow length is 800 feet.

Segment CD - Channel flow exists in lined channel where Manning's n value is 0.035. The flow area is 30 ft2, the wetted perimeter is 30 ft, and the water .slopeis 0.0047 ftIft. Flow length is 6500 feet.

Find:

T c' using the velocity approach method. Complete Worksheet 3. Show your computations below-and on the following page.

Solution:

Worksheet 3- Time of Concentration (T_c) or Travel time (T_t)				
Project			**By**	**Date**
Location			**Checked**	**Date**
Cirlcle one:	Present	Developed		
Circle one:	Tc	Tt through subarea		

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.

Flow Sheet(Applicable to Tc only)	**Segment ID**					
1.Surface description (table 3-1)						
2.Manning's roughness cieff, n (table 3-1)						
3.flow length,(total L 300ft)	ft					
4.Two-yr 24-hr rainfall, P_2	in					
5.Land slope, s	ft/ft					
6. $T_t = .\frac{007(nL)^{.8}}{(P_2{}^{.5}s^{.4})}$ compute T_t	hr		+		=	
Shallow concentrated flow	**Segment ID**					
7.Shallow 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. $T_t = \frac{L}{3600V}$ compute T_t	hr		+		=	
Channel flow	**Segment ID**					
12. Cross sectional flow area, a	ft²					
13. Wetted perimeter, p_w	ft					
14.hydraulic radius, $r=\frac{a}{p_w}$ compute r	ft					
15. Channel slope, s	ft/ft					
16.Manning's roughness coeff., n						
17. $V = \frac{1.49r^{\left(\frac{2}{3}\right)}s^{\left(\frac{1}{2}\right)}}{n}$ compute V	ft/s					
18. Flow length, L	ft					
19. $T_t = \frac{L}{3600V}$ compute T_t	hr		+		=	
20. Watershed or subarea T_c or T_t (add T_t in step 6,11 and 19)						

Source: 210.VI.TR.55, Second edition, June 1986

Generated by a Trial Version of NetCentric Technologies' CommonLook® Acrobat® Plug-in. www.net-centric.com

Activity 3

At this time, complete Activity 3 in your Study Guide to review the material just covered. After finishing the Activity, compare your answers with the solution provided. When you are satisfied that you understand the material, continue with the Study Guide text

Worksheet 206A-1 Estimating Time of Concentration

(simplified procedure)

Project_____ By_____ Date_____

Location_____ Checked_____ Date_____

Practice_____ Field Office_____

1. Data			
Rainfall distribution type	=		(I,IA,II,III)
Drainage area	A=		Ac
Runoff curve number	CN=		
Watershed slope	Y=		%
Flow length	ℓ		Ft
2. $T_c = \frac{\left[l^{.8}\left(\frac{1000}{CN}-9\right)^{.7}\right]}{1140Y^{.5}} = \frac{668.63*2.56}{1140(1)}$=1.5hr			

Given:

A waterway for a 100 acre drainage area is planned for the I. M. Rich farm. The average curve number is 75, flow length is 4,000 feet, and the average watershed slope is 0.5%. (Rainfall distribution type = II).

Find:

Tc" using the procedure in Chapter 2, EFM. Solution:

Show all work on Worksheet 20GA-1. When you are finished,compare your answer with the solution page.

Generated by a Trial Version of NetCentric Technologies' CommonLook® Acrobat® Plug-in. www.net-centric.com

Example

Worksheet 206A-1 Estimating Time of Concentration

(simplified procedure)

Project____I.M Hipp_____ By_____DEW_____ Date_____8/87____

Location_____ Checked_____MH_____ Date____8/88_____

Practice___Waterway_____ Field Office_____Dover_____

3. Data			
Rainfall distribution type	=	II	(I,IA,II,III)
Drainage area	A=	100	Ac
Runoff curve number	CN=	75	
Watershed slope	Y=	.5	%
Flow length	ℓ	4000	Ft
$T_c = \frac{\left[\ell^{.8}\left(\frac{1000}{CN}-9\right)^{.7}\right]}{1140Y^{.5}} = \frac{761.46*7.79}{1140(.71)}$=2.6hr			

Generated by a Trial Version of NetCentric Technologies' CommonLook® Acrobat® Plug-in. www.net-centric.com