

Pre-Development Hydrology

Hydrograph Return Period Recap

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
2	SCS Runoff	-----	-----	0.057	-----	-----	0.254	0.404	-----	0.636	PRE Sub. 1
3	SCS Runoff	-----	-----	0.001	-----	-----	0.025	0.096	-----	0.262	PRE Sub. 2
4	SCS Runoff	-----	-----	0.003	-----	-----	0.063	0.308	-----	0.895	PRE Sub. 3
5	SCS Runoff	-----	-----	0.001	-----	-----	0.026	0.063	-----	0.143	PRE Sub. 4
6	SCS Runoff	-----	-----	0.000	-----	-----	0.006	0.030	-----	0.129	PRE Sub. 5
8	Combine	2, 3, 4, 5, 6,-----	-----	0.057	-----	-----	0.267	0.716	-----	1.878	Total Runoff PRE

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
2	SCS Runoff	0.057	2	738	409	---	----	----	PRE Sub. 1
3	SCS Runoff	0.001	2	1328	19	---	----	----	PRE Sub. 2
4	SCS Runoff	0.003	2	1328	37	---	----	----	PRE Sub. 3
5	SCS Runoff	0.001	2	918	34	---	----	----	PRE Sub. 4
6	SCS Runoff	0.000	2	n/a	0	---	----	----	PRE Sub. 5
8	Combine	0.057	2	738	499	2, 3, 4, 5, 6,	----	----	Total Runoff PRE
4810 DRAINAGE PRE.gpw					Return Period: 2 Year			Tuesday, Apr 10, 2012	

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
2	SCS Runoff	0.254	2	730	1,174	---	----	----	PRE Sub. 1
3	SCS Runoff	0.025	2	752	443	---	----	----	PRE Sub. 2
4	SCS Runoff	0.063	2	754	1,503	---	----	----	PRE Sub. 3
5	SCS Runoff	0.026	2	744	242	---	----	----	PRE Sub. 4
6	SCS Runoff	0.006	2	1330	79	---	----	----	PRE Sub. 5
8	Combine	0.267	2	732	3,618	2, 3, 4, 5, 6,	----	----	Total Runoff PRE
4810 DRAINAGE PRE.gpw					Return Period: 10 Year			Tuesday, Apr 10, 2012	

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
2	SCS Runoff	0.636	2	730	2,571	---	----	----	PRE Sub. 1
3	SCS Runoff	0.262	2	736	1,719	---	----	----	PRE Sub. 2
4	SCS Runoff	0.895	2	738	6,231	---	----	----	PRE Sub. 3
5	SCS Runoff	0.143	2	732	750	---	----	----	PRE Sub. 4
6	SCS Runoff	0.129	2	826	3,353	---	----	----	PRE Sub. 5
8	Combine	1.878	2	736	13,769	2, 3, 4, 5, 6,	----	----	Total Runoff PRE
4810 DRAINAGE PRE.gpw					Return Period: 100 Year			Tuesday, Apr 10, 2012	

Worksheet 2: Runoff curve number and runoff

4810

Project: The Meadow at Acton By BRE Date 02-09-12

Location: 263-265 Great Road, Acton Checked _____ Date _____

Circle one: Present Developed Subcatchment 1

1. Runoff curve number (CN)

Soil name and hydrologic soil group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
Hinckley Loamy Sand 253B A	Woods (Good Condition)	30			0.00	0.00
Hinckley Loamy Sand & 253B A	Open Space (Good Condition)	39			0.00	0.00
Merrimac-Urban Land 626B A	Woods (Good Condition)	30			0.06	1.80
Merrimac-Urban Land 626B A	Open Space (Good Condition)	39			0.15	5.85
	Impervious	98			0.12	11.76
						0.00
						0.00
						0.00
Totals =					0.33	19.41

1/ Use only one CN source per line.

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{19.41}{0.33} = 58.82 ; \text{ Use CN} = 58.8$$

2. Runoff

Frequency..... yr

Rainfall, P (24-hour)..... in

Runoff, Q..... in

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Runoff, Q..... cf

D-2

Storm #1	Storm #2	Storm #3
2	10	100
3.1	4.5	6.4
0.33	0.95	2.08

398	1139	2495
-----	------	------

(210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

4810

Project: The Meadow at Acton By BRE Date 02-09-12

Location: 263-265 Great Road, Acton Checked _____ Date _____

Circle one: Present Developed
 Circle one: Tc Tt through Subcatchment 1
 subarea

Sheet flow (Applicable to Tc only)

1. Surface Description (table 3-1)
2. Mannings roughness coeff., n (table 3-1)
3. Flow length, L (total L <= 300 ft)
4. Two-yr 24-hr rainfall, P2
5. Land Slope, s
6. $Tt = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ Compute Tt

Segment ID	A-B		
	grass		
	0.24		
ft	50		
in	3:1		
ft/ft	0.01		
hr	0.18		0.18

Shallow concentrated Flow

7. Surface Description (paved or unpaved)
8. Flow Length, L
9. Watercourse slope, s
10. Average Velocity, V (figure 3-1)
11. $Tt = L / 3600V$ Compute Tt

Segment ID	B-C	C-D	
	unpaved	paved	
ft	8	10	
ft/ft	0.01	0.01	
ft/s	1.61	2.03	
hr	0.00	0.00	0.00

Channel flow

12. Cross sectional flow area, a
13. Wetted perimeter, pw
14. Hydraulic radius, $r=a/wp$ Compute r
15. Channel Slope, s
16. Manning's roughness coeff., n
17. $V = 1.49 r^{2/3} s^{1/2} / n$ Compute V
18. Flow length, L
19. $Tt = L / 3600V$ Compute Tt

Segment ID			
sf			
ft			
ft			
ft/ft			
ft/s			
ft			
hr			

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19)

hr	0.19
min	11.2

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Tuesday, Apr 10, 2012

Hyd. No. 2

PRE Sub. 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.057 cfs
Storm frequency	=	2 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	2,571 cuft
Drainage area	=	0.330 ac	Curve number	=	58.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	11.2 min
Total precip.	=	3.10 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time -- Outflow
(min cfs)

736	0.056
738	0.057 <<
740	0.057

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Tuesday, Apr 10, 2012

Hyd. No. 2

PRE Sub. 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.254 cfs
Storm frequency	=	10 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	2,571 cuft
Drainage area	=	0.330 ac	Curve number	=	58.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	11.2 min
Total precip.	=	4.50 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time -- Outflow
(min cfs)

730	0.254 <<
732	0.253

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Tuesday, Apr 10, 2012

Hyd. No. 2

PRE Sub. 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.636 cfs
Storm frequency	=	100 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	2,571 cuft
Drainage area	=	0.330 ac	Curve number	=	58.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	11.2 min
Total precip.	=	6.40 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time -- Outflow
(min cfs)

728	0.625
730	0.636 <<

...End

Worksheet 2: Runoff curve number and runoff

SM-4810

Project: The Meadow at Acton By BRE Date 02-09-12

Location: 263-265 Great Road, Acton Checked _____ Date _____

Circle one: Present Developed Subcatchment 2

1. Runoff curve number (CN)

Soil name and hydrologic soil group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
Hinckley Loamy Sand 253B A	Woods (Good Condition)	30			0.13	3.90
Hinckley Loamy Sand & 253B A	Open Space (Good Condition)	39			0.16	6.24
Merrimac-Urban Land 626B A	Woods (Good Condition)	30			0.06	1.80
Merrimac-Urban Land 626B A	Open Space (Good Condition)	39			0.19	7.41
	Impervious	98			0.06	5.88
						0.00
						0.00
						0.00
Totals =					0.60	25.23

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{25.23}{0.60} = 42.05$; Use CN = 42.1

2. Runoff

Frequency..... yr

Rainfall, P (24-hour)..... in

Runoff, Q..... in

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Runoff, Q..... cf

D-2

Storm #1	Storm #2	Storm #3
2	10	100
3.1	4.5	6.4
0.01	0.20	0.76

18	427	1660
----	-----	------

(210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-4810

Project: The Meadow at Acton By BRE Date 02-09-12

Location: 263-265 Great Road, Acton Checked _____ Date _____

Circle one:

Present
Tc

 Developed Tt through Subcatchment 2
subarea

Sheet flow (Applicable to Tc only)

1. Surface Description (table 3-1)
2. Mannings roughness coeff., n (table 3-1)
3. Flow length, L (total L <= 300 ft)
4. Two-yr 24-hr rainfall, P2
5. Land Slope, s
6. $Tt = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ Compute Tt

Segment ID	A-B		
	woods		
	0.4		
ft	50		
in	3.1		
ft/ft	0.026		
hr	0.19		0.19

Shallow concentrated Flow

7. Surface Description (paved or unpaved)
8. Flow Length, L
9. Watercourse slope, s
10. Average Velocity, V (figure 3-1)
11. $Tt = L / 3600V$ Compute Tt

Segment ID	B-C		
	unpaved		
ft	163		
ft/ft	0.02		
ft/s	2.28		
hr	0.02		0.02

Channel flow

12. Cross sectional flow area, a
13. Wetted perimeter, pw
14. Hydraulic radius, $r=a/wp$ Compute r
15. Channel Slope, s
16. Manning's roughness coeff., n
17. $V = 1.49 r^{2/3} s^{1/2} / n$ Compute V
18. Flow length, L
19. $Tt = L / 3600V$ Compute Tt

Segment ID			
sf			
ft			
ft			
ft/ft			
ft/s			
ft			
hr			

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19)

hr	0.21
min	12.5

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Tuesday, Apr 10, 2012

Hyd. No. 3

PRE Sub. 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.001 cfs
Storm frequency	=	2 yrs	Time to peak	=	1328 min
Time interval	=	2 min	Hyd. volume	=	1,719 cuft
Drainage area	=	0.600 ac	Curve number	=	42.1
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	12.5 min
Total precip.	=	3.10 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484.

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time -- Outflow
(min cfs)

1328 0.001 <<

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Tuesday, Apr 10, 2012

Hyd. No. 3

PRE Sub. 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.025 cfs
Storm frequency	=	10 yrs	Time to peak	=	752 min
Time interval	=	2 min	Hyd. volume	=	1,719 cuft
Drainage area	=	0.600 ac	Curve number	=	42.1
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	12.5 min
Total precip.	=	4.50 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time -- Outflow
(min cfs)

750	0.025
752	0.025 <<

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Tuesday, Apr 10, 2012

Hyd. No. 3

PRE Sub. 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.262 cfs
Storm frequency	=	100 yrs	Time to peak	=	736 min
Time interval	=	2 min	Hyd. volume	=	1,719 cuft
Drainage area	=	0.600 ac	Curve number	=	42.1
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	12.5 min
Total precip.	=	6.40 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

Hydrograph Discharge Table

(Printed values \geq 98.00% of Qp.)

Time -- Outflow
(min cfs)

736	0.262 <<
738	0.260

...End

Worksheet 2: Runoff curve number and runoff

SM-4810

Project: The Meadow at Acton By BRE Date 02-09-12

Location: 263-265 Great Road, Acton Checked _____ Date _____

Circle one: Present Developed Subcatchment 3

1. Runoff curve number (CN)

Soil name and hydrologic soil group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
Hinckley Loamy Sand 253B A	Woods (Good Condition)	30			0.54	16.20
Hinckley Loamy Sand 253B A	Open Space (Good Condition)	39			1.65	64.35
	Impervious	98			0.17	16.66
						0.00
						0.00
						0.00
						0.00
						0.00
Totals =					2.36	97.21

1/ Use only one CN source per line.

$$CN \text{ (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{97.21}{2.36} = 41.19 ; \text{ Use CN} = \boxed{41.2}$$

2. Runoff

Frequency..... yr

Rainfall, P (24-hour)..... in

Runoff, Q..... in
(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Runoff, Q..... cf

D-2

Storm #1	Storm #2	Storm #3
2	10	100
3:1	4:5	6:4
0.00	0.17	0.70

35	1455	6039
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 (210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-4810

Project: The Meadow at Acton

By BRE

Date 02-09-12

Location: 263-265 Great Road, Acton

Checked _____

Date _____

Circle one: Present Developed

Circle one: Tc Tt through Subcatchment 3
subarea

Sheet flow (Applicable to Tc only)

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L <= 300 ft)

4. Two-yr 24-hr rainfall, P2

5. Land Slope, s

6. $Tt = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ Compute Tt

Segment ID	A-B		
	grass		
	0.24		
ft	50		
in	3.1		
ft/ft	0.017		
hr	0.15		0.15

Shallow concentrated Flow

7. Surface Description (paved or unpaved)

8. Flow Length, L

9. Watercourse slope, s

10. Average Velocity, V (figure 3-1)

11. $Tt = L / 3600V$ Compute Tt

Segment ID	B-C		
	unpaved		
ft	417		
ft/ft	0.04		
ft/s	3.23		
hr	0.04		0.04

Channel flow

12. Cross sectional flow area, a

13. Wetted perimeter, pw

14. Hydraulic radius, $r = a/wp$ Compute r

15. Channel Slope, s

16. Manning's roughness coeff., n

17. $V = 1.49 r^{2/3} s^{1/2} / n$ Compute V

18. Flow length, L

19. $Tt = L / 3600V$ Compute Tt

Segment ID			
sf			
ft			
ft			
ft/ft			
ft/s			
ft			
hr			

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19)

hr	0.18
min	11.0

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Tuesday, Apr 10, 2012

Hyd. No. 4

PRE Sub. 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.003 cfs
Storm frequency	=	2 yrs	Time to peak	=	1328 min
Time interval	=	2 min	Hyd. volume	=	6,231 cuft
Drainage area	=	2.360 ac	Curve number	=	41.2
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	11.0 min
Total precip.	=	3.10 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time -- Outflow
(min cfs)

1328 0.003 <<

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Tuesday, Apr 10, 2012

Hyd. No. 4

PRE Sub. 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.063 cfs
Storm frequency	=	10 yrs	Time to peak	=	754 min
Time interval	=	2 min	Hyd. volume	=	6,231 cuft
Drainage area	=	2.360 ac	Curve number	=	41.2
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	11.0 min
Total precip.	=	4.50 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time -- Outflow
(min cfs)

754	0.063 <<
756	0.063

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Tuesday, Apr 10, 2012

Hyd. No. 4

PRE Sub. 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.895 cfs
Storm frequency	=	100 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	6,231 cuft
Drainage area	=	2.360 ac	Curve number	=	41.2
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	11.0 min
Total precip.	=	6.40 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time -- Outflow
(min cfs)

736	0.884
738	0.895 <<
740	0.878

...End

Worksheet 2: Runoff curve number and runoff

SM-4810

Project: The Meadow of Acton By BRE Date 02-09-12

Location: 263-265 Great Road, Acton Checked _____ Date _____

Circle one: Present Developed Subcatchment 4

1. Runoff curve number (CN)

Soil name and hydrologic soil group (appendix)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
Very Loamy 253B A	Woods (Good Condition)	30			0.11	3.30
Very Loamy 253B A	Open Space (Good Condition)	39			0.04	1.56
	Impervious	98			0.04	3.92
						0.00
						0.00
						0.00
						0.00
						0.00
Totals =					0.19	8.78

1/ Use only one CN source per line.

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{8.78}{0.19} = 46.21 ; \text{ Use CN} = \boxed{46.2}$$

2. Runoff

Frequency..... yr

Rainfall, P (24-hour)..... in

Runoff, Q..... in

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Runoff, Q..... cf

D-2

Storm #1	Storm #2	Storm #3
2	10	100
3.1	4.5	6.4
0.05	0.34	1.06

33	236	728
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(210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-4810

Project: The Meadow at Acton By BRE Date 02-09-12

Location: 263-265 Great Road, Acton Checked _____ Date _____

Circle one: Present Developed
 Circle one: Tc Tt through Subcatchment 4
 subarea

Sheet flow (Applicable to Tc only)

1. Surface Description (table 3-1)
2. Mannings roughness coeff., n (table 3-1)
3. Flow length, L (total L <= 300 ft)
4. Two-yr 24-hr rainfall, P2
5. Land Slope, s
6. $Tt = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ Compute Tt

Segment ID	A-B		
	grass		
	0.24		
ft	50		
in	3:1		
ft/ft	0.012		
hr	0.17		0.17

Shallow concentrated Flow

7. Surface Description (paved or unpaved)
8. Flow Length, L
9. Watercourse slope, s
10. Average Velocity, V (figure 3-1)
11. $Tt = L / 3600V$ Compute Tt

Segment ID	B-C	C-D	
	paved	unpaved	
ft	30	69	
ft/ft	0.02	0.10	
ft/s	2.73	5.10	
hr	0.00	0.00	0.01

Channel flow

12. Cross sectional flow area, a
13. Wetted perimeter, pw
14. Hydraulic radius, $r=a/wp$ Compute r
15. Channel Slope, s
16. Manning's roughness coeff., n
17. $V = 1.49 r^{2/3} s^{1/2} / n$ Compute V
18. Flow length, L
19. $Tt = L / 3600V$ Compute Tt

Segment ID			
sf			
ft			
ft			
ft/ft			
ft/s			
ft			
hr			

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19)

hr	0.18
min	10.6

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Tuesday, Apr 10, 2012

Hyd. No. 5

PRE Sub. 4

Hydrograph type	= SCS Runoff	Peak discharge	= 0.001 cfs
Storm frequency	= 2 yrs	Time to peak	= 918 min
Time interval	= 2 min	Hyd. volume	= 750 cuft
Drainage area	= 0.190 ac	Curve number	= 46.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.6 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time -- Outflow
(min cfs)

898	0.001
900	0.001
902	0.001
904	0.001
906	0.001
908	0.001
910	0.001
912	0.001
914	0.001
916	0.001
918	0.001 <<
920	0.001
922	0.001
924	0.001
926	0.001
928	0.001
930	0.001
932	0.001
934	0.001
936	0.001
938	0.001

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Tuesday, Apr 10, 2012

Hyd. No. 5

PRE Sub. 4

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.026 cfs
Storm frequency	=	10 yrs	Time to peak	=	744 min
Time interval	=	2 min	Hyd. volume	=	750 cuft
Drainage area	=	0.190 ac	Curve number	=	46.2
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	10.6 min
Total precip.	=	4.50 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

Hydrograph Discharge Table

(Printed values \geq 98.00% of Qp.)

Time -- Outflow
(min cfs)

742	0.026
744	0.026 <<
746	0.026

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Tuesday, Apr 10, 2012

Hyd. No. 5

PRE Sub. 4

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.143 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	750 cuft
Drainage area	=	0.190 ac	Curve number	=	46.2
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	10.6 min
Total precip.	=	6.40 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time -- Outflow
(min cfs)

732	0.143 <<
734	0.142

...End

Worksheet 2: Runoff curve number and runoff

SM-4810

Project: The Meadow of Acton By BRE Date 02-09-12

Location: 263-265 Great Road, Acton Checked _____ Date _____

Circle one: Present Developed Subcatchment 5

1. Runoff curve number (CN)

Soil name and hydrologic soil group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
Hinckley Loamy Sand 253B A	Woods (Good Condition)	30			0.94	28.20
Hinckley Loamy Sand 253B A	Open Space (Good Condition)	39			1.03	40.17
	Impervious	98			0.02	1.96
Hinckley Loamy Sand 253B A	Woods (Good Condition)-OFFSITE	30			2.42	72.60
						0.00
						0.00
						0.00
						0.00
Totals =					4.41	142.93

1/ Use only one CN source per line.

$$CN \text{ (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{142.93}{4.41} = 32.41 ; \text{ Use CN} = \boxed{32.4}$$

2. Runoff

Frequency..... yr

Rainfall, P (24-hour)..... in

Runoff, Q..... in
(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Runoff, Q..... of
D-2

Storm #1	Storm #2	Storm #3
2	10	100
3.1	4.5	6.4
0.06	0.01	0.22

(210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-4810

Project: The Meadow at Acton By BRE Date 02-09-12

Location: 263-265 Great Road, Acton Checked _____ Date _____

Circle one: Present Developed
 Circle one: Tc Tt through Subcatchment 5
 subarea

Sheet flow (Applicable to Tc only)

1. Surface Description (table 3-1)
2. Mannings roughness coeff., n (table 3-1)
3. Flow length, L (total L <= 300 ft)
4. Two-yr 24-hr rainfall, P2
5. Land Slope, s
6. $Tt = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ Compute Tt

Segment ID	A-B		
	grass		
	0.24		
ft	50		
in	3:1		
ft/ft	0.01		
hr	0.18		0.18

Shallow concentrated Flow

7. Surface Description (paved or unpaved)
8. Flow Length, L
9. Watercourse slope, s
10. Average Velocity, V (figure 3-1)
11. $Tt = L / 3600V$ Compute Tt

Segment ID	B-C		
	unpaved		
ft	305		
ft/ft	0.02		
ft/s	2.04		
hr	0.04		0.04

Channel flow

12. Cross sectional flow area, a
13. Wetted perimeter, pw
14. Hydraulic radius, $r=a/wp$ Compute r
15. Channel Slope, s
16. Manning's roughness coeff., n
17. $V = 1.49 r^{2/3} s^{1/2} / n$ Compute V
18. Flow length, L
19. $Tt = L / 3600V$ Compute Tt

Segment ID			
sf			
ft			
ft			
ft/ft			
ft/s			
ft			
hr			

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19)

hr	0.22
min	13.5

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Tuesday, Apr 10, 2012

Hyd. No. 6

PRE Sub. 5

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.000 cfs
Storm frequency	=	2 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	3,353 cuft
Drainage area	=	4.410 ac	Curve number	=	32.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	13.5 min
Total precip.	=	3.10 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Tuesday, Apr 10, 2012

Hyd. No. 6

PRE Sub. 5

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.006 cfs
Storm frequency	=	10 yrs	Time to peak	=	1330 min
Time interval	=	2 min	Hyd. volume	=	3,353 cuft
Drainage area	=	4.410 ac	Curve number	=	32.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	13.5 min
Total precip.	=	4.50 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time -- Outflow
(min cfs)

1330 0.006 <<

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Tuesday, Apr 10, 2012

Hyd. No. 6

PRE Sub. 5

Hydrograph type	= SCS Runoff	Peak discharge	= 0.129 cfs
Storm frequency	= 100 yrs	Time to peak	= 826 min
Time interval	= 2 min	Hyd. volume	= 3,353 cuft
Drainage area	= 4.410 ac	Curve number	= 32.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 13.5 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time -- Outflow
(min cfs)

810	0.126
812	0.127
814	0.127
816	0.128
818	0.128
820	0.128
822	0.129
824	0.129
826	0.129 <<
828	0.129
830	0.129
832	0.128
834	0.128
836	0.128
838	0.127
840	0.127
842	0.126

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Tuesday, Apr 10, 2012

Hyd. No. 8

Total Runoff PRE

Hydrograph type	= Combine	Peak discharge	= 0.057 cfs
Storm frequency	= 2 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 13,769 cuft
Inflow hyds.	= 2, 3, 4, 5, 6	Contrib. drain. area	= 7.890 ac

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (min)	Hyd. 2 + (cfs)	Hyd. 3 + (cfs)	Hyd. 4 + (cfs)	Hyd. 5 + (cfs)	Hyd. 6 + (cfs)	Outflow (cfs)
736	0.056	0.000	0.000	0.000	0.000 <<	0.056
738	0.057 <<	0.000	0.000	0.000	0.000 <<	0.057 <<
740	0.057	0.000	0.000	0.000	0.000 <<	0.057

...End

Hydrograph Report

Hydraflow Hydrographs by Intellisolve v9.2

Tuesday, Apr 10, 2012

Hyd. No. 8

Total Runoff PRE

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 2, 3, 4, 5, 6

Peak discharge = 0.267 cfs
Time to peak = 732 min
Hyd. volume = 13,769 cuft
Contrib. drain. area = 7.890 ac

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (min)	Hyd. 2 + (cfs)	Hyd. 3 + (cfs)	Hyd. 4 + (cfs)	Hyd. 5 + (cfs)	Hyd. 6 + (cfs)	Outflow (cfs)
730	0.254 <<	0.000	0.000	0.010	0.000	0.263
732	0.253	0.000	0.000	0.013	0.000	0.267 <<
734	0.244	0.001	0.000	0.017	0.000	0.262

...End

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Tuesday, Apr 10, 2012

Hyd. No. 8

Total Runoff PRE

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 2, 3, 4, 5, 6

Peak discharge = 1.878 cfs
Time to peak = 736 min
Hyd. volume = 13,769 cuft
Contrib. drain. area = 7.890 ac

Hydrograph Discharge Table

(Printed values >= 98.00% of Qp.)

Time (min)	Hyd. 2 + (cfs)	Hyd. 3 + (cfs)	Hyd. 4 + (cfs)	Hyd. 5 + (cfs)	Hyd. 6 + (cfs)	Outflow (cfs)
734	0.579	0.256	0.848	0.142	0.000	1.862
736	0.534	0.262 <<	0.884	0.137	0.000	1.878 <<
738	0.484	0.260	0.895 <<	0.130	0.001	1.855

...End

