

# APPENDIX 2

## HYDROLOGIC PARAMETER CALCULATIONS



Shorewood Forest Stormwater Infrastructure Study  
 XP-SWMM Hydrologic and Hydraulic Analysis  
 Subbasin/Hydrologic Parameter Summary

Subbasin ID	Sub-Watershed	Area (acres)	CN	Tc (Min)
1	Lake Louise	160.67	73	17.4
2	Lake Louise	227.11	80	247.2
3	Lake Louise	503.04	87	26.4
4	Lake Louise	12.31	77	22.2
5	Lake Louise	1.45	81	16.2
6	Lake Louise	1.31	83	11.4
7	Lake Louise	3.47	81	16.8
8	Lake Louise	9.94	77	15
9	Lake Louise	1.67	83	19.8
10	Ashford Ravine	12.66	82	24
11	Lake Louise	48.68	86	19.2
12	Roxbury Ravine	29.28	79	21
13	Lake Louise	3.46	84	15.6
14	Lake Louise	5.50	80	15
15	Lake Louise	1.85	82	17.4
16	Lake Louise	2.07	82	11.4
17	Ashford Ravine	1.44	84	12
18	Ashford Ravine	1.88	80	10.2
19	Ashford Ravine	1.43	84	10.2
20	Ashford Ravine	2.30	81	13.2
21A	Roxbury Ravine	16.61	74	12.6
21B	Roxbury Ravine	13.35	74	21
22	Roxbury Ravine	47.92	80	33.6
23	Lake Louise	1.96	82	14.4
24	Lake Louise	1.86	84	10.2
25	Lake Louise	0.61	87	12
26	Lake Louise	0.36	85	9
27	Lake Louise	1.86	85	12
28	Lake Louise	0.56	85	7.8
29	Lake Louise	0.83	85	8.4
30	Ashford Ravine	0.91	86	12.6
31	Ashford Ravine	3.32	75	12
32	Ashford Ravine	5.23	74	20.4
33A	Lake Louise	1.26	78	22.2
33B	Lake Louise	5.14	80	14.4
34	Lake Louise	4.09	82	8.4
35	Ashford Ravine	1.69	86	7.8
36	Ashford Ravine	16.79	73	13.8
37	Ashford Ravine	5.16	72	16.2
38	Ashford Ravine	0.49	86	5.4
39	Lake Louise	0.59	85	7.2
40	Lake Louise	1.95	86	12.6
41	Lake Louise	0.58	92	6.6
42	Lake Louise	1.81	82	19.8
43	Lake Louise	7.64	78	30
44	Lake Louise	0.60	84	30
45	Lake Louise	7.86	81	13.2
46	Roxbury Ravine	2.11	82	10.2
47	Roxbury Ravine	2.69	83	10.2
48	Roxbury Ravine	5.24	85	15.6
49	Chaucer Ravine	26.22	80	28.2
50	Downstream of Lake Louise	115.05	72	49.2
51	Downstream of Lake Louise	10.20	77	24.6
52	Downstream of Lake Louise	5.80	76	24
53	Downstream of Lake Louise	1.43	86	12
54	Downstream of Lake Louise	3.65	83	11.4
55	Downstream of Lake Louise	4.11	77	16.2
56	Downstream of Lake Louise	1.64	84	12.6
57	Downstream of Lake Louise	5.52	77	26.4
58	Lake Louise	2.01	85	7.8
59	Lake Louise	2.16	83	9.6
60	Lake Louise	4.70	79	9.6
61	Lake Louise	5.99	81	24.6
62	Lake Louise	1.12	85	4.2
63	Downstream of Lake Louise	1.39	82	12
64	Lake Louise	1.13	84	18.6
65	Lake Louise	1.39	83	17.4
66	Downstream of Lake Louise	13.49	81	13.8
67	Lake Louise	0.42	89	13.2
68	Lake Louise	1.28	81	4.8
69	Lake Louise	1.21	81	9
70	Lake Louise	0.80	87	10.8
71	Lake Louise	0.97	86	9.6
72	Lake Louise	2.01	84	12
73	Chaucer Ravine	1.50	80	14.4

Shorewood Forest Stormwater Infrastructure Study  
 XP-SWMM Hydrologic and Hydraulic Analysis  
 Subbasin/Hydrologic Parameter Summary

Subbasin ID	Sub-Watershed	Area (acres)	CN	Tc (Min)
74	Westchester Ravine	5.63	77	21
75A	Westchester Ravine	20.94	76	13.2
75B	Westchester Ravine	4.33	76	5
76	Westchester Ravine	6.98	74	21
77	Lake Louise	2.41	83	12
78	Westchester Ravine	3.73	82	22.2
79	Westchester Ravine	1.25	87	15.6
80	Westchester Ravine	1.67	85	15
81	Lake Louise	0.96	86	7.2
82	Lake Louise	1.82	86	9.6
83	Lake Louise	0.81	87	10.2
84	Lake Louise	1.94	84	13.8
85	Lake Louise	7.40	76	15
86	Lake Louise	1.79	84	9
87	Lake Louise	5.52	81	16.8
88	Wilshire Ravine	3.24	82	14.4
89	Wilshire Ravine	2.84	85	13.2
90	Wilshire Ravine	2.38	78	11.4
91	Wilshire Ravine	6.08	76	17.4
92	Wilshire Ravine	3.29	85	9
93	Wilshire Ravine	3.41	78	17.4
94	Wilshire Ravine	1.61	85	13.2
95	Lake Louise	2.00	85	12.6
96	Lake Louise	4.86	83	11.4
97	Wilshire Ravine	1.54	80	7.8
98	Wilshire Ravine	2.35	85	10.8
99	Wilshire Ravine	1.71	77	17.4
100	Wilshire Ravine	1.16	82	12.6
101	Wilshire Ravine	5.03	80	22.8
102	Devon Ravine	1.71	84	12.6
103	Devon Ravine	16.37	76	15.6
104	Devon Ravine	1.04	86	6
105	Devon Ravine	2.55	78	14.4
106	Lake Louise	1.43	85	8.4
107	Lake Louise	0.88	84	13.8
108	Lake Louise	0.51	86	5.4
109	Lake Louise	7.97	76	16.8
110	Lake Louise	1.70	82	5.4
111	Devon Ravine	2.35	82	9
112	Devon Ravine	2.29	86	6.6
113	Devon Ravine	6.75	74	10.8
114	Lake Louise	2.19	74	10.2
115	Lake Louise	0.50	86	12
116	Devon Ravine	0.73	87	11.4
117	Devon Ravine	15.00	70	21
118	Devon Ravine	9.05	71	25.8
119	Devon Ravine	24.91	79	37.2
120	Devon Ravine	37.52	77	39
121	Devon Ravine	18.98	78	11.4
122*	Devon Ravine	30.00	77	34
123*	Devon Ravine	14.76	77	23
124*	Devon Ravine	32.59	77	43
125*	Devon Ravine	2.72	82	7
126*	Devon Ravine	17.44	73	41
127*	Devon Ravine	7.05	75	21
128*	Devon Ravine	23.88	79	32
129	Lake Louise	1.27	84	8.4
130	Ashford Ravine	0.59	84	10.8
131	Lake Louise	4.85	75	25.2
132	Lake Louise	7.08	77	25.8
133	Lake Louise	23.84	80	20.4
134	Downstream of Lake Louise	4.76	81	16.8
135	Downstream of Lake Louise	4.93	76	15.6
136	Downstream of Lake Louise	4.90	71	13.2
137	Downstream of Lake Louise	6.55	74	12
138	Downstream of Lake Louise	27.11	74	34.8
139	Downstream of Lake Louise	16.13	74	23.4
<b>Total</b>	---	<b>1906.95</b>	---	---

\*Hydrologic parameters taken from Arbor Lake Subdivision construction plans/drainage report

# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 1

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	43.98		2682.78
C	Pervious Area - Open Space, Good Condition	74	0.00		0
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	32.19		1770.45
C	Woods/Forest Land (Good Cover)	70	21.48		1503.6
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	21.98		1780.38
C	Cultivated Land	88	2.59		227.92
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	25.81		2529.38
	Impervious Area - Building/Roadway	98	12.64		1238.72
<b>Totals =</b>			<b>160.67</b>		<b>11733.23</b>

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{11733.23}{160.67} = \underline{73.027}$$

Use CN = 73







# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 5

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	1.02		75.48
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	0.00		0
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	0.43		42.14
<b>Totals =</b>			<b>1.45</b>		<b>117.62</b>

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{117.62}{1.45} = \underline{81.117}$$

Use CN = 81

# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 6

Soil Name and Hydrologic Group <small>(Appendix A)</small>	Cover Description <small>(cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)</small>	Curve Number	Area	Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres <input type="checkbox"/> sq. mi. <input type="checkbox"/> %	
A	Pervious Area - Open Space, Good Condition	39	0.00	0
B	Pervious Area - Open Space, Good Condition	61	0.00	0
C	Pervious Area - Open Space, Good Condition	74	0.82	60.68
D	Pervious Area - Open Space, Good Condition	80	0.00	0
A	Woods/Forest Land (Good Cover)	25	0.00	0
B	Woods/Forest Land (Good Cover)	55	0.00	0
C	Woods/Forest Land (Good Cover)	70	0.00	0
D	Woods/Forest Land (Good Cover)	77	0.00	0
A	Cultivated Land	72	0.00	0
B	Cultivated Land	81	0.00	0
C	Cultivated Land	88	0.00	0
D	Cultivated Land	91	0.00	0
	Wetlands/Open Water	98	0.00	0
	Impervious Area - Building/Roadway	98	0.49	48.02
<b>Totals =</b>			1.31	108.7

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{108.7}{1.31} = \underline{82.977}$$

Use CN = 83





# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 9

Soil Name and Hydrologic Group <small>(Appendix A)</small>	Cover Description <small>(cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)</small>	Curve Number	Area	Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres <input type="checkbox"/> sq. mi. <input type="checkbox"/> %	
A	Pervious Area - Open Space, Good Condition	39	0.00	0
B	Pervious Area - Open Space, Good Condition	61	0.00	0
C	Pervious Area - Open Space, Good Condition	74	1.04	76.96
D	Pervious Area - Open Space, Good Condition	80	0.00	0
A	Woods/Forest Land (Good Cover)	25	0.00	0
B	Woods/Forest Land (Good Cover)	55	0.00	0
C	Woods/Forest Land (Good Cover)	70	0.00	0
D	Woods/Forest Land (Good Cover)	77	0.00	0
A	Cultivated Land	72	0.00	0
B	Cultivated Land	81	0.00	0
C	Cultivated Land	88	0.00	0
D	Cultivated Land	91	0.00	0
	Wetlands/Open Water	98	0.00	0
	Impervious Area - Building/Roadway	98	0.63	61.74
<b>Totals =</b>			1.67	138.7

$$CN \text{ (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{138.7}{1.67} = \underline{83.054}$$

Use CN = 83

# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 10

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	6.84		506.16
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	0.00		0
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	3.99		351.12
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	1.83		179.34
<b>Totals =</b>			12.66		1036.62

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{1036.62}{12.66} = \underline{81.882}$$

Use CN = 82

# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 11

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area	Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres <input type="checkbox"/> sq. mi. <input type="checkbox"/> %	
A	Pervious Area - Open Space, Good Condition	39	0.00	0
B	Pervious Area - Open Space, Good Condition	61	0.00	0
C	Pervious Area - Open Space, Good Condition	74	6.84	506.16
D	Pervious Area - Open Space, Good Condition	80	0.00	0
A	Woods/Forest Land (Good Cover)	25	0.00	0
B	Woods/Forest Land (Good Cover)	55	0.00	0
C	Woods/Forest Land (Good Cover)	70	2.47	172.9
D	Woods/Forest Land (Good Cover)	77	0.29	22.33
A	Cultivated Land	72	0.00	0
B	Cultivated Land	81	0.00	0
C	Cultivated Land	88	34.32	3020.16
D	Cultivated Land	91	0.00	0
	Wetlands/Open Water	98	4.32	423.36
	Impervious Area - Building/Roadway	98	0.44	43.12
<b>Totals =</b>			48.68	4188.03

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{4188.03}{48.68} = \underline{86.032}$$

Use CN = 86

# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 12

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	12.34		913.16
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.81		44.55
C	Woods/Forest Land (Good Cover)	70	5.34		373.8
D	Woods/Forest Land (Good Cover)	77	0.29		22.33
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	7.57		666.16
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.61		59.78
	Impervious Area - Building/Roadway	98	2.32		227.36
<b>Totals =</b>			<b>29.28</b>		<b>2307.14</b>

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{2307.14}{29.28} = \underline{78.796}$$

Use CN = 79

# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 13

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	1.97		145.78
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	0.00		0
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	1.49		146.02
<b>Totals =</b>			<b>3.46</b>		<b>291.8</b>

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{291.8}{3.46} = \underline{84.335}$$

Use CN = 84





# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 16

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area	Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres <input type="checkbox"/> sq. mi. <input type="checkbox"/> %	
A	Pervious Area - Open Space, Good Condition	39	0.00	0
B	Pervious Area - Open Space, Good Condition	61	0.00	0
C	Pervious Area - Open Space, Good Condition	74	1.37	101.38
D	Pervious Area - Open Space, Good Condition	80	0.00	0
A	Woods/Forest Land (Good Cover)	25	0.00	0
B	Woods/Forest Land (Good Cover)	55	0.00	0
C	Woods/Forest Land (Good Cover)	70	0.00	0
D	Woods/Forest Land (Good Cover)	77	0.00	0
A	Cultivated Land	72	0.00	0
B	Cultivated Land	81	0.00	0
C	Cultivated Land	88	0.00	0
D	Cultivated Land	91	0.00	0
	Wetlands/Open Water	98	0.00	0
	Impervious Area - Building/Roadway	98	0.70	68.6
<b>Totals =</b>			2.07	169.98

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{169.98}{2.07} = \underline{82.116}$$

Use CN = 82

# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 17

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area	Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres <input type="checkbox"/> sq. mi. <input type="checkbox"/> %	
A	Pervious Area - Open Space, Good Condition	39	0.00	0
B	Pervious Area - Open Space, Good Condition	61	0.00	0
C	Pervious Area - Open Space, Good Condition	74	0.83	61.42
D	Pervious Area - Open Space, Good Condition	80	0.00	0
A	Woods/Forest Land (Good Cover)	25	0.00	0
B	Woods/Forest Land (Good Cover)	55	0.00	0
C	Woods/Forest Land (Good Cover)	70	0.00	0
D	Woods/Forest Land (Good Cover)	77	0.00	0
A	Cultivated Land	72	0.00	0
B	Cultivated Land	81	0.00	0
C	Cultivated Land	88	0.00	0
D	Cultivated Land	91	0.00	0
	Wetlands/Open Water	98	0.00	0
	Impervious Area - Building/Roadway	98	0.61	59.78
<b>Totals =</b>			1.44	121.2

$$CN \text{ (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{121.2}{1.44} = \underline{84.167}$$

Use CN = 84



# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 19

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area	Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres <input type="checkbox"/> sq. mi. <input type="checkbox"/> %	
A	Pervious Area - Open Space, Good Condition	39	0.00	0
B	Pervious Area - Open Space, Good Condition	61	0.00	0
C	Pervious Area - Open Space, Good Condition	74	0.82	60.68
D	Pervious Area - Open Space, Good Condition	80	0.00	0
A	Woods/Forest Land (Good Cover)	25	0.00	0
B	Woods/Forest Land (Good Cover)	55	0.00	0
C	Woods/Forest Land (Good Cover)	70	0.00	0
D	Woods/Forest Land (Good Cover)	77	0.00	0
A	Cultivated Land	72	0.00	0
B	Cultivated Land	81	0.00	0
C	Cultivated Land	88	0.00	0
D	Cultivated Land	91	0.00	0
	Wetlands/Open Water	98	0.00	0
	Impervious Area - Building/Roadway	98	0.61	59.78
<b>Totals =</b>			1.43	120.46

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{120.46}{1.43} = \underline{84.238}$$

Use CN = 84

# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 20

Soil Name and Hydrologic Group  (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area	Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres <input type="checkbox"/> sq. mi. <input type="checkbox"/> %	
A	Pervious Area - Open Space, Good Condition	39	0.00	0
B	Pervious Area - Open Space, Good Condition	61	0.00	0
C	Pervious Area - Open Space, Good Condition	74	1.59	117.66
D	Pervious Area - Open Space, Good Condition	80	0.00	0
A	Woods/Forest Land (Good Cover)	25	0.00	0
B	Woods/Forest Land (Good Cover)	55	0.00	0
C	Woods/Forest Land (Good Cover)	70	0.00	0
D	Woods/Forest Land (Good Cover)	77	0.00	0
A	Cultivated Land	72	0.00	0
B	Cultivated Land	81	0.00	0
C	Cultivated Land	88	0.00	0
D	Cultivated Land	91	0.00	0
	Wetlands/Open Water	98	0.00	0
	Impervious Area - Building/Roadway	98	0.71	69.58
<b>Totals =</b>			2.30	187.24

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{187.24}{2.3} = \underline{81.409}$$

Use CN = 81



# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 21B

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	3.18		235.32
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	8.94		625.8
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	1.23		120.54
<b>Totals =</b>			<b>13.35</b>		<b>981.66</b>

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{981.66}{13.35} = \underline{73.533}$$

Use CN = 74

# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 22

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	13.22		978.28
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	12.19		853.3
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	20.16		1774.08
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	2.35		230.3
<b>Totals =</b>			<b>47.92</b>		<b>3835.96</b>

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{3835.96}{47.92} = \underline{80.049}$$

Use CN = 80











# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 28

Soil Name and Hydrologic Group  (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area	Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres <input type="checkbox"/> sq. mi. <input type="checkbox"/> %	
A	Pervious Area - Open Space, Good Condition	39	0.00	0
B	Pervious Area - Open Space, Good Condition	61	0.00	0
C	Pervious Area - Open Space, Good Condition	74	0.31	22.94
D	Pervious Area - Open Space, Good Condition	80	0.00	0
A	Woods/Forest Land (Good Cover)	25	0.00	0
B	Woods/Forest Land (Good Cover)	55	0.00	0
C	Woods/Forest Land (Good Cover)	70	0.00	0
D	Woods/Forest Land (Good Cover)	77	0.00	0
A	Cultivated Land	72	0.00	0
B	Cultivated Land	81	0.00	0
C	Cultivated Land	88	0.00	0
D	Cultivated Land	91	0.00	0
	Wetlands/Open Water	98	0.00	0
	Impervious Area - Building/Roadway	98	0.25	24.5
<b>Totals =</b>			0.56	47.44

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{47.44}{0.56} = \underline{84.714}$$

Use CN = 85









# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 33A

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area	Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres <input type="checkbox"/> sq. mi. <input type="checkbox"/> %	
A	Pervious Area - Open Space, Good Condition	39	0.00	0
B	Pervious Area - Open Space, Good Condition	61	0.00	0
C	Pervious Area - Open Space, Good Condition	74	0.59	43.66
D	Pervious Area - Open Space, Good Condition	80	0.00	0
A	Woods/Forest Land (Good Cover)	25	0.00	0
B	Woods/Forest Land (Good Cover)	55	0.00	0
C	Woods/Forest Land (Good Cover)	70	0.38	26.6
D	Woods/Forest Land (Good Cover)	77	0.00	0
A	Cultivated Land	72	0.00	0
B	Cultivated Land	81	0.00	0
C	Cultivated Land	88	0.00	0
D	Cultivated Land	91	0.00	0
	Wetlands/Open Water	98	0.00	0
	Impervious Area - Building/Roadway	98	0.29	28.42
<b>Totals =</b>			1.26	98.68

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{98.68}{1.26} = \underline{78.317}$$

Use CN = 78













# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 39

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area	Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres <input type="checkbox"/> sq. mi. <input type="checkbox"/> %	
A	Pervious Area - Open Space, Good Condition	39	0.00	0
B	Pervious Area - Open Space, Good Condition	61	0.00	0
C	Pervious Area - Open Space, Good Condition	74	0.32	23.68
D	Pervious Area - Open Space, Good Condition	80	0.00	0
A	Woods/Forest Land (Good Cover)	25	0.00	0
B	Woods/Forest Land (Good Cover)	55	0.00	0
C	Woods/Forest Land (Good Cover)	70	0.00	0
D	Woods/Forest Land (Good Cover)	77	0.00	0
A	Cultivated Land	72	0.00	0
B	Cultivated Land	81	0.00	0
C	Cultivated Land	88	0.00	0
D	Cultivated Land	91	0.00	0
	Wetlands/Open Water	98	0.00	0
	Impervious Area - Building/Roadway	98	0.27	26.46
<b>Totals =</b>			0.59	50.14

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{50.14}{0.59} = \underline{84.983}$$

Use CN = 85







# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 43

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	2.95		218.3
D	Pervious Area - Open Space, Good Condition	80	0.36		28.8
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	2.73		191.1
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	1.60		156.8
<b>Totals =</b>			7.64		595

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{595}{7.64} = \underline{77.88}$$

Use CN = 78



# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 45

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area	Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres <input type="checkbox"/> sq. mi. <input type="checkbox"/> %	
A	Pervious Area - Open Space, Good Condition	39	0.00	0
B	Pervious Area - Open Space, Good Condition	61	0.00	0
C	Pervious Area - Open Space, Good Condition	74	3.36	248.64
D	Pervious Area - Open Space, Good Condition	80	1.14	91.2
A	Woods/Forest Land (Good Cover)	25	0.00	0
B	Woods/Forest Land (Good Cover)	55	0.00	0
C	Woods/Forest Land (Good Cover)	70	1.09	76.3
D	Woods/Forest Land (Good Cover)	77	0.00	0
A	Cultivated Land	72	0.00	0
B	Cultivated Land	81	0.00	0
C	Cultivated Land	88	0.00	0
D	Cultivated Land	91	0.00	0
	Wetlands/Open Water	98	0.00	0
	Impervious Area - Building/Roadway	98	2.27	222.46
<b>Totals =</b>			7.86	638.6

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{638.6}{7.86} = \underline{81.247}$$

Use CN = 81

# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 46

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area	Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres <input type="checkbox"/> sq. mi. <input type="checkbox"/> %	
A	Pervious Area - Open Space, Good Condition	39	0.00	0
B	Pervious Area - Open Space, Good Condition	61	0.00	0
C	Pervious Area - Open Space, Good Condition	74	1.35	99.9
D	Pervious Area - Open Space, Good Condition	80	0.00	0
A	Woods/Forest Land (Good Cover)	25	0.00	0
B	Woods/Forest Land (Good Cover)	55	0.00	0
C	Woods/Forest Land (Good Cover)	70	0.00	0
D	Woods/Forest Land (Good Cover)	77	0.00	0
A	Cultivated Land	72	0.00	0
B	Cultivated Land	81	0.00	0
C	Cultivated Land	88	0.19	16.72
D	Cultivated Land	91	0.00	0
	Wetlands/Open Water	98	0.00	0
	Impervious Area - Building/Roadway	98	0.57	55.86
<b>Totals =</b>			2.11	172.48

$$CN \text{ (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{172.48}{2.11} = \underline{81.744}$$

Use CN = 82









# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 51

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area	Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres <input type="checkbox"/> sq. mi. <input type="checkbox"/> %	
A	Pervious Area - Open Space, Good Condition	39	0.00	0
B	Pervious Area - Open Space, Good Condition	61	4.04	246.44
C	Pervious Area - Open Space, Good Condition	74	2.88	213.12
D	Pervious Area - Open Space, Good Condition	80	0.00	0
A	Woods/Forest Land (Good Cover)	25	0.00	0
B	Woods/Forest Land (Good Cover)	55	0.00	0
C	Woods/Forest Land (Good Cover)	70	0.00	0
D	Woods/Forest Land (Good Cover)	77	0.00	0
A	Cultivated Land	72	0.00	0
B	Cultivated Land	81	0.00	0
C	Cultivated Land	88	0.00	0
D	Cultivated Land	91	0.00	0
	Wetlands/Open Water	98	0.00	0
	Impervious Area - Building/Roadway	98	3.28	321.44
<b>Totals =</b>			10.20	781

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{781}{10.2} = \underline{76.569}$$

Use CN = 77













# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 58

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	1.10		81.4
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	0.00		0
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	0.91		89.18
<b>Totals =</b>			2.01		170.58

$$CN \text{ (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{170.58}{2.01} = \underline{84.866}$$

Use CN = 85



# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 60

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	2.76		204.24
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	0.85		59.5
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	1.09		106.82
<b>Totals =</b>			4.70		370.56

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{370.56}{4.7} = \underline{78.843}$$

Use CN = 79



# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 62

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	0.60		44.4
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	0.00		0
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	0.52		50.96
<b>Totals =</b>			1.12		95.36

$$CN \text{ (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{95.36}{1.12} = \underline{85.143}$$

Use CN = 85

# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 63

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	0.91		67.34
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	0.00		0
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	0.48		47.04
<b>Totals =</b>			1.39		114.38

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{114.38}{1.39} = \underline{82.288}$$

Use CN = 82

# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 64

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area	Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres <input type="checkbox"/> sq. mi. <input type="checkbox"/> %	
A	Pervious Area - Open Space, Good Condition	39	0.00	0
B	Pervious Area - Open Space, Good Condition	61	0.00	0
C	Pervious Area - Open Space, Good Condition	74	0.67	49.58
D	Pervious Area - Open Space, Good Condition	80	0.00	0
A	Woods/Forest Land (Good Cover)	25	0.00	0
B	Woods/Forest Land (Good Cover)	55	0.00	0
C	Woods/Forest Land (Good Cover)	70	0.00	0
D	Woods/Forest Land (Good Cover)	77	0.00	0
A	Cultivated Land	72	0.00	0
B	Cultivated Land	81	0.00	0
C	Cultivated Land	88	0.00	0
D	Cultivated Land	91	0.00	0
	Wetlands/Open Water	98	0.00	0
	Impervious Area - Building/Roadway	98	0.46	45.08
<b>Totals =</b>			1.13	94.66

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{94.66}{1.13} = \underline{83.77}$$

Use CN = 84













# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 71

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	0.50		37
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	0.00		0
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	0.47		46.06
<b>Totals =</b>			0.97		83.06

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{83.06}{0.97} = \underline{85.629}$$

Use CN = 86

# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 72

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area	Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres <input type="checkbox"/> sq. mi. <input type="checkbox"/> %	
A	Pervious Area - Open Space, Good Condition	39	0.00	0
B	Pervious Area - Open Space, Good Condition	61	0.00	0
C	Pervious Area - Open Space, Good Condition	74	0.66	48.84
D	Pervious Area - Open Space, Good Condition	80	0.65	52
A	Woods/Forest Land (Good Cover)	25	0.00	0
B	Woods/Forest Land (Good Cover)	55	0.00	0
C	Woods/Forest Land (Good Cover)	70	0.00	0
D	Woods/Forest Land (Good Cover)	77	0.00	0
A	Cultivated Land	72	0.00	0
B	Cultivated Land	81	0.00	0
C	Cultivated Land	88	0.00	0
D	Cultivated Land	91	0.00	0
	Wetlands/Open Water	98	0.00	0
	Impervious Area - Building/Roadway	98	0.70	68.6
<b>Totals =</b>			2.01	169.44

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{169.44}{2.01} = \underline{84.299}$$

Use CN = 84





# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 75

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area	Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres <input type="checkbox"/> sq. mi. <input type="checkbox"/> %	
A	Pervious Area - Open Space, Good Condition	39	0.00	0
B	Pervious Area - Open Space, Good Condition	61	0.00	0
C	Pervious Area - Open Space, Good Condition	74	1.26	93.24
D	Pervious Area - Open Space, Good Condition	80	0.00	0
A	Woods/Forest Land (Good Cover)	25	0.00	0
B	Woods/Forest Land (Good Cover)	55	0.00	0
C	Woods/Forest Land (Good Cover)	70	17.76	1243.2
D	Woods/Forest Land (Good Cover)	77	0.00	0
A	Cultivated Land	72	0.00	0
B	Cultivated Land	81	0.00	0
C	Cultivated Land	88	3.26	286.88
D	Cultivated Land	91	0.00	0
	Wetlands/Open Water	98	1.18	115.64
	Impervious Area - Building/Roadway	98	1.81	177.38
<b>Totals =</b>			25.27	1916.34

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{1916.34}{25.27} = \underline{75.835}$$

Use CN = 76



# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 77

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	1.53		113.22
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	0.00		0
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	0.88		86.24
<b>Totals =</b>			2.41		199.46

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{199.46}{2.41} = \underline{82.763}$$

Use CN = 83







# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 81

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	0.47		34.78
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	0.00		0
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	0.49		48.02
<b>Totals =</b>			0.96		82.8

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{82.8}{0.96} = \underline{86.25}$$

Use CN = 86



# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 83

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	0.38		28.12
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	0.00		0
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	0.43		42.14
<b>Totals =</b>			0.81		70.26

$$CN \text{ (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{70.26}{0.81} = \underline{86.741}$$

Use CN = 87









# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 88

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	2.15		159.1
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	0.00		0
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	1.09		106.82
<b>Totals =</b>			3.24		265.92

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{265.92}{3.24} = \underline{82.074}$$

Use CN = 82

# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 89

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area	Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres <input type="checkbox"/> sq. mi. <input type="checkbox"/> %	
A	Pervious Area - Open Space, Good Condition	39	0.00	0
B	Pervious Area - Open Space, Good Condition	61	0.00	0
C	Pervious Area - Open Space, Good Condition	74	1.52	112.48
D	Pervious Area - Open Space, Good Condition	80	0.00	0
A	Woods/Forest Land (Good Cover)	25	0.00	0
B	Woods/Forest Land (Good Cover)	55	0.00	0
C	Woods/Forest Land (Good Cover)	70	0.00	0
D	Woods/Forest Land (Good Cover)	77	0.00	0
A	Cultivated Land	72	0.00	0
B	Cultivated Land	81	0.00	0
C	Cultivated Land	88	0.00	0
D	Cultivated Land	91	0.00	0
	Wetlands/Open Water	98	0.00	0
	Impervious Area - Building/Roadway	98	1.32	129.36
<b>Totals =</b>			2.84	241.84

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{241.84}{2.84} = \underline{85.155}$$

Use CN = 85









# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 94

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	0.89		65.86
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	0.00		0
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	0.72		70.56
<b>Totals =</b>			1.61		136.42

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{136.42}{1.61} = \underline{84.733}$$

Use CN = 85

# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 95

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	1.06		78.44
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	0.00		0
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	0.94		92.12
<b>Totals =</b>			2.00		170.56

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{170.56}{2} = \underline{85.28}$$

Use CN = 85





# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 98

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	1.28		94.72
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	0.00		0
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	1.07		104.86
<b>Totals =</b>			2.35		199.58

$$CN \text{ (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{199.58}{2.35} = \underline{84.928}$$

Use CN = 85

# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 99

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	1.16		85.84
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	0.30		21
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	0.25		24.5
<b>Totals =</b>			1.71		131.34

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{131.34}{1.71} = \underline{76.807}$$

Use CN = 77





# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 102

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	0.99		73.26
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	0.00		0
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	0.72		70.56
<b>Totals =</b>			1.71		143.82

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{143.82}{1.71} = \underline{84.105}$$

Use CN = 84



# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 104

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	0.54		39.96
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	0.00		0
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	0.50		49
<b>Totals =</b>			1.04		88.96

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{88.96}{1.04} = \underline{85.538}$$

Use CN = 86



# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 106

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	0.78		57.72
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	0.00		0
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	0.65		63.7
<b>Totals =</b>			1.43		121.42

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{121.42}{1.43} = \underline{84.909}$$

Use CN = 85







# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 110

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	1.13		83.62
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	0.00		0
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	0.57		55.86
<b>Totals =</b>			1.70		139.48

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{139.48}{1.7} = \underline{82.047}$$

Use CN = 82

# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 111

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	1.58		116.92
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	0.00		0
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	0.77		75.46
<b>Totals =</b>			<b>2.35</b>		<b>192.38</b>

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{192.38}{2.35} = \underline{81.864}$$

Use CN = 82











# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 117

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.21		8.19
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	2.63		194.62
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	2.62		65.5
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	5.22		365.4
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	2.98		292.04
	Impervious Area - Building/Roadway	98	1.34		131.32
<b>Totals =</b>			15.00		1057.07

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{1057.07}{15} = \underline{70.471}$$

Use CN = 70

# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 118

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	4.73		350.02
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	1.42		99.4
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	2.90		284.2
<b>Totals =</b>			9.05		733.62

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{733.62}{9.05} = \underline{81.063}$$

Use CN = 81





# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 121

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	5.82		430.68
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	7.80		546
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	1.83		161.04
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	2.50		245
	Impervious Area - Building/Roadway	98	1.03		100.94
<b>Totals =</b>			<b>18.98</b>		<b>1483.66</b>

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{1483.66}{18.98} = \underline{78.17}$$

Use CN = 78

# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 129

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	0.75		55.5
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	0.00		0
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	0.52		50.96
<b>Totals =</b>			1.27		106.46

$$CN \text{ (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{106.46}{1.27} = \underline{83.827}$$

Use CN = 84

# Runoff Curve Number

Project: Shorewood Forest Stormwater Study  
 Location: Porter County, Indiana  
 File: Curve Number.xlsx

By: LJS Date: 12/22/2020  
 Checked: JMG Date: 12/23/2020

Circle One: Present    Developed    Description: Subbasin 130

Soil Name and Hydrologic Group (Appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	Curve Number	Area		Product of Curve Number and Area
			<input checked="" type="checkbox"/> acres	<input type="checkbox"/> sq. mi.	
A	Pervious Area - Open Space, Good Condition	39	0.00		0
B	Pervious Area - Open Space, Good Condition	61	0.00		0
C	Pervious Area - Open Space, Good Condition	74	0.34		25.16
D	Pervious Area - Open Space, Good Condition	80	0.00		0
A	Woods/Forest Land (Good Cover)	25	0.00		0
B	Woods/Forest Land (Good Cover)	55	0.00		0
C	Woods/Forest Land (Good Cover)	70	0.00		0
D	Woods/Forest Land (Good Cover)	77	0.00		0
A	Cultivated Land	72	0.00		0
B	Cultivated Land	81	0.00		0
C	Cultivated Land	88	0.00		0
D	Cultivated Land	91	0.00		0
	Wetlands/Open Water	98	0.00		0
	Impervious Area - Building/Roadway	98	0.25		24.5
<b>Totals =</b>			0.59		49.66

$$CN \text{ (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{49.66}{0.59} = \underline{84.169}$$

Use CN = 84

















## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 1

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Cultivated Soil				
Manning's roughness coeff., n		0.17				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.017				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.20	+			= <span style="border: 1px solid black; padding: 2px;">0.20</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		886				
Watercourse slope, s (ft/ft)		0.032				
Average velocity, V (ft/s)		2.89				
$T_t = L / 3600 V$ (hr)		0.09	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.09</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.29 hr  
 = 17.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 2

### SHEET FLOW

	Segment ID	I	
Surface Description (table 3-1)		Woods/Brush	
Manning's roughness coeff., n		0.4	
Flow Length, L (total L ≤ 100') (ft)		100	
Two-yr 24-hr rainfall, P2 (in)		2.89	
Land slope, s (ft/ft)		0.01	
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.50	
		+	
			= 0.50 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III	IV	V
Surface Description (paved or unpaved)		unp.	unp.	unp.	unp.
Flow Length, L (ft)		3916	607	313	1626
Watercourse slope, s (ft/ft)		0.011	0.0066	0.0096	0.0001
Average velocity, V (ft/s)		1.69	1.31	1.58	0.16
$T_t = L / 3600 V$ (hr)		0.64	0.13	0.05	2.80
		+	+	+	+
					= 3.62 hr

### CHANNEL FLOW

	Segment ID		
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)			
Flow length, L (ft)			
$T_t = L / 3600 V$ (hr)			
		+	
			= [ ] hr

Watershed or subarea  $T_c$  or  $T_t$  = 4.12 hr

= 247.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 3

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Woods/Brush				
Manning's roughness coeff., n		0.4				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.02				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.38	+			= <span style="border: 1px solid black; padding: 2px;">0.38</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		864				
Watercourse slope, s (ft/ft)		0.057				
Average velocity, V (ft/s)		3.85				
$T_t = L / 3600 V$ (hr)		0.06	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.06</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.44 hr

= 26.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 4

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Woods/Brush				
Manning's roughness coeff., n		0.4				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.03				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.32	+			= 0.32 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		709				
Watercourse slope, s (ft/ft)		0.056				
Average velocity, V (ft/s)		3.82				
$T_t = L / 3600 V$ (hr)		0.05	+		+	+
						= 0.05 hr

### CHANNEL FLOW

	Segment ID			
Cross-sectional flow area, a (ft <sup>2</sup> )				
Wetted perimeter, Pw (ft)				
Hydraulic radius, r = a/Pw (ft)				
Channel slope, s (ft/ft)				
Manning's roughness coeff., n				
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)				
Flow length, L (ft)				
$T_t = L / 3600 V$ (hr)			+	= [ ] hr

**Watershed or subarea  $T_c$  or  $T_t$**  = **0.37** hr  
 = **22.2** min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 5

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Woods/Brush				
Manning's roughness coeff., n		0.4				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.07				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.23	+			= 0.23 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		318				
Watercourse slope, s (ft/ft)		0.022				
Average velocity, V (ft/s)		2.39				
$T_t = L / 3600 V$ (hr)		0.04	+		+	+
						= 0.04 hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= [ ] hr

Watershed or subarea  $T_c$  or  $T_t$  = 0.27 hr

= 16.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 6

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.03				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.21	+			= <span style="border: 1px solid black; padding: 2px;">0.21</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III			
Surface Description (paved or unpaved)		unp.	pav.			
Flow Length, L (ft)		280	105			
Watercourse slope, s (ft/ft)		0.086	0.057			
Average velocity, V (ft/s)		4.73	4.85			
$T_t = L / 3600 V$ (hr)		0.02	0.01	+		= <span style="border: 1px solid black; padding: 2px;">0.03</span> hr

### CHANNEL FLOW

	Segment ID					
Cross-sectional flow area, a (ft <sup>2</sup> )						
Wetted perimeter, Pw (ft)						
Hydraulic radius, r = a/Pw (ft)						
Channel slope, s (ft/ft)						
Manning's roughness coeff., n						
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)						
Flow length, L (ft)						
$T_t = L / 3600 V$ (hr)			+			= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.24 hr  
 = 14.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 7

### SHEET FLOW

Segment ID	I			
Surface Description (table 3-1)	Grass			
Manning's roughness coeff., n	0.24			
Flow Length, L (total L ≤ 100') (ft)	100			
Two-yr 24-hr rainfall, P2 (in)	2.89			
Land slope, s (ft/ft)	0.04			
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)	0.19	+		= 0.19 hr

### SHALLOW CONCENTRATED FLOW

Segment ID	II			
Surface Description (paved or unpaved)	unp.			
Flow Length, L (ft)	27			
Watercourse slope, s (ft/ft)	0.02			
Average velocity, V (ft/s)	2.28			
$T_t = L / 3600 V$ (hr)	0.00	+		=

### CHANNEL FLOW

Segment ID	III	
Cross-sectional flow area, a (ft <sup>2</sup> )		
Wetted perimeter, Pw (ft)		
Hydraulic radius, r = a/Pw (ft)		
Channel slope, s (ft/ft)		
Manning's roughness coeff., n		
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)	2.00	
Flow length, L (ft)	630	
$T_t = L / 3600 V$ (hr)	0.09	= 0.09 hr

Watershed or subarea  $T_c$  or  $T_t$  = 0.28 hr  
 = 16.8 min

# Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 8

## SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.07				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.15	+			= <span style="border: 1px solid black; padding: 2px;">0.15</span> hr

## SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		165				
Watercourse slope, s (ft/ft)		0.13				
Average velocity, V (ft/s)		5.82				
$T_t = L / 3600 V$ (hr)		0.01	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

## CHANNEL FLOW

	Segment ID	III			
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)		667			
$T_t = L / 3600 V$ (hr)		0.09	+		= <span style="border: 1px solid black; padding: 2px;">0.09</span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.25 hr

= 15.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 9

### SHEET FLOW

	Segment ID	I	II		
Surface Description (table 3-1)		Woods/Brush	Grass		
Manning's roughness coeff., n		0.4	0.24		
Flow Length, L (total L ≤ 100') (ft)		77	23		
Two-yr 24-hr rainfall, P2 (in)		2.89	2.89		
Land slope, s (ft/ft)		0.035	0.03		
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.24	0.07	+	0.31 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	III				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		195				
Watercourse slope, s (ft/ft)		0.041				
Average velocity, V (ft/s)		3.27				
$T_t = L / 3600 V$ (hr)		0.02		+		+
						0.02 hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)		0			
$T_t = L / 3600 V$ (hr)		0.00		+	

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.33 hr  
 = 19.8 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 10

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.01				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.33	+			= <span style="border: 1px solid black; padding: 2px;">0.33</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		773				
Watercourse slope, s (ft/ft)		0.036				
Average velocity, V (ft/s)		3.06				
$T_t = L / 3600 V$ (hr)		0.07	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.07</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)		0			
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.40 hr

= 24.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 11

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Cultivated Soil				
Manning's roughness coeff., n		0.17				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.015				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.21	+			= <span style="border: 1px solid black; padding: 2px;">0.21</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		1264				
Watercourse slope, s (ft/ft)		0.04				
Average velocity, V (ft/s)		3.23				
$T_t = L / 3600 V$ (hr)		0.11	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.11</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)		0			
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.32 hr  
 = 19.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 12

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Cultivated Soil				
Manning's roughness coeff., n		0.17				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.02				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.19	+			= <span style="border: 1px solid black; padding: 2px;">0.19</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		1569				
Watercourse slope, s (ft/ft)		0.028				
Average velocity, V (ft/s)		2.70				
$T_t = L / 3600 V$ (hr)		0.16	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.16</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)		0			
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.35 hr  
 = 21.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 13

### SHEET FLOW

	Segment ID	I	
Surface Description (table 3-1)		Woods/Brush	
Manning's roughness coeff., n		0.4	
Flow Length, L (total L ≤ 100') (ft)		100	
Two-yr 24-hr rainfall, P2 (in)		2.89	
Land slope, s (ft/ft)		0.07	
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.23	
		+	
			= 0.23 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III		
Surface Description (paved or unpaved)		unp.	pav.		
Flow Length, L (ft)		114	223		
Watercourse slope, s (ft/ft)		0.06	0.02		
Average velocity, V (ft/s)		3.95	2.87		
$T_t = L / 3600 V$ (hr)		0.01	0.02		
		+	+	+	+
					= 0.03 hr

### CHANNEL FLOW

	Segment ID		
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00	
Flow length, L (ft)		0	
$T_t = L / 3600 V$ (hr)		0.00	
		+	
			= [ ] hr

Watershed or subarea  $T_c$  or  $T_t$  = 0.26 hr

= 15.6 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 14

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.03				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.21	+			= <span style="border: 1px solid black; padding: 2px;">0.21</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III			
Surface Description (paved or unpaved)		unp.	pav.			
Flow Length, L (ft)		114	198			
Watercourse slope, s (ft/ft)		0.09	0.01			
Average velocity, V (ft/s)		4.84	2.03			
$T_t = L / 3600 V$ (hr)		0.01	0.03	+		= <span style="border: 1px solid black; padding: 2px;">0.04</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)		0			
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.25 hr

= 15.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 15

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.015				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.28	+			= <span style="border: 1px solid black; padding: 2px;">0.28</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III			
Surface Description (paved or unpaved)		unp.	pav.			
Flow Length, L (ft)		39	25			
Watercourse slope, s (ft/ft)		0.015	0.01			
Average velocity, V (ft/s)		1.98	2.03			
$T_t = L / 3600 V$ (hr)		0.01	0.00	+		= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)		0			
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.29 hr

= 17.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 16

### SHEET FLOW

	Segment ID	I					
Surface Description (table 3-1)		Grass					
Manning's roughness coeff., n		0.24					
Flow Length, L (total L ≤ 100') (ft)		100					
Two-yr 24-hr rainfall, P2 (in)		2.89					
Land slope, s (ft/ft)		0.05					
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.17	+				= <span style="border: 1px solid black; padding: 2px;">0.17</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III				
Surface Description (paved or unpaved)		unp.	pav.				
Flow Length, L (ft)		123	191				
Watercourse slope, s (ft/ft)		0.04	0.04				
Average velocity, V (ft/s)		3.23	4.07				
$T_t = L / 3600 V$ (hr)		0.01	0.01	+		+	= <span style="border: 1px solid black; padding: 2px;">0.02</span> hr

### CHANNEL FLOW

	Segment ID						
Cross-sectional flow area, a (ft <sup>2</sup> )							
Wetted perimeter, Pw (ft)							
Hydraulic radius, r = a/Pw (ft)							
Channel slope, s (ft/ft)							
Manning's roughness coeff., n							
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00					
Flow length, L (ft)		0					
$T_t = L / 3600 V$ (hr)		0.00	+				= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.19 hr  
 = 11.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 17

### SHEET FLOW

	Segment ID	I	
Surface Description (table 3-1)		Grass	
Manning's roughness coeff., n		0.24	
Flow Length, L (total L ≤ 100') (ft)		100	
Two-yr 24-hr rainfall, P2 (in)		2.89	
Land slope, s (ft/ft)		0.05	
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.17	
		+	
			= 0.17 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III		
Surface Description (paved or unpaved)		unp.	pav.		
Flow Length, L (ft)		116	271		
Watercourse slope, s (ft/ft)		0.05	0.033		
Average velocity, V (ft/s)		3.61	3.69		
$T_t = L / 3600 V$ (hr)		0.01	0.02		
		+	+	+	+
					= 0.03 hr

### CHANNEL FLOW

	Segment ID		
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00	
Flow length, L (ft)		0	
$T_t = L / 3600 V$ (hr)		0.00	
		+	
			= [ ] hr

Watershed or subarea  $T_c$  or  $T_t$  = 0.20 hr

= 12.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 18

### SHEET FLOW

	Segment ID	I	
Surface Description (table 3-1)		Grass	
Manning's roughness coeff., n		0.24	
Flow Length, L (total L ≤ 100') (ft)		100	
Two-yr 24-hr rainfall, P2 (in)		2.89	
Land slope, s (ft/ft)		0.07	
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.15	
		+	
			= 0.15 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III		
Surface Description (paved or unpaved)		unp.	pav.		
Flow Length, L (ft)		140	96		
Watercourse slope, s (ft/ft)		0.06	0.01		
Average velocity, V (ft/s)		3.95	2.03		
$T_t = L / 3600 V$ (hr)		0.01	0.01		
		+	+	+	+
					= 0.02 hr

### CHANNEL FLOW

	Segment ID		
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00	
Flow length, L (ft)		0	
$T_t = L / 3600 V$ (hr)		0.00	
		+	
			= [ ] hr

Watershed or subarea  $T_c$  or  $T_t$  = 0.17 hr

= 10.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 19

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		75				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.047				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.14	+			= <span style="border: 1px solid black; padding: 2px;">0.14</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		247				
Watercourse slope, s (ft/ft)		0.01				
Average velocity, V (ft/s)		2.03				
$T_t = L / 3600 V$ (hr)		0.03	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.03</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)		0			
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.17 hr  
 = 10.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 20

### SHEET FLOW

	Segment ID	I			
Surface Description (table 3-1)		Grass			
Manning's roughness coeff., n		0.24			
Flow Length, L (total L ≤ 100') (ft)		100			
Two-yr 24-hr rainfall, P2 (in)		2.89			
Land slope, s (ft/ft)		0.035			
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.20	+		= <span style="border: 1px solid black; padding: 2px;">0.20</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II			
Surface Description (paved or unpaved)		unp.			
Flow Length, L (ft)		173			
Watercourse slope, s (ft/ft)		0.037			
Average velocity, V (ft/s)		3.10			
$T_t = L / 3600 V$ (hr)		0.02	+		= <span style="border: 1px solid black; padding: 2px;">0.02</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)		0			
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.22 hr  
 = 13.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 21A

### SHEET FLOW

	Segment ID	I			
Surface Description (table 3-1)		Grass			
Manning's roughness coeff., n		0.24			
Flow Length, L (total L ≤ 100') (ft)		100			
Two-yr 24-hr rainfall, P2 (in)		2.89			
Land slope, s (ft/ft)		0.06			
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.16	+		= <span style="border: 1px solid black; padding: 2px;">0.16</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II			
Surface Description (paved or unpaved)		unp.			
Flow Length, L (ft)		201			
Watercourse slope, s (ft/ft)		0.067			
Average velocity, V (ft/s)		4.18			
$T_t = L / 3600 V$ (hr)		0.01	+		= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

### CHANNEL FLOW

	Segment ID	III			
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)		313			
$T_t = L / 3600 V$ (hr)		0.04	+		= <span style="border: 1px solid black; padding: 2px;">0.04</span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.21 hr  
 = 12.6 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 21B

### SHEET FLOW

	Segment ID	I	
Surface Description (table 3-1)		Woods/Brush	
Manning's roughness coeff., n		0.4	
Flow Length, L (total L ≤ 100') (ft)		100	
Two-yr 24-hr rainfall, P2 (in)		2.89	
Land slope, s (ft/ft)		0.04	
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.29	
		+	
			= 0.29 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II			
Surface Description (paved or unpaved)		unp.			
Flow Length, L (ft)		115			
Watercourse slope, s (ft/ft)		0.06			
Average velocity, V (ft/s)		3.95			
$T_t = L / 3600 V$ (hr)		0.01			
		+		+	
					= 0.01 hr

### CHANNEL FLOW

	Segment ID	III	
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00	
Flow length, L (ft)		381	
$T_t = L / 3600 V$ (hr)		0.05	
		+	
			= 0.05 hr

Watershed or subarea  $T_c$  or  $T_t$  = 0.35 hr

= 21.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 22

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Cultivated Soil				
Manning's roughness coeff., n		0.17				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.02				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.19	+			= 0.19 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		803				
Watercourse slope, s (ft/ft)		0.011				
Average velocity, V (ft/s)		1.69				
$T_t = L / 3600 V$ (hr)		0.13	+		+	+
						= 0.13 hr

### CHANNEL FLOW

	Segment ID	III		
Cross-sectional flow area, a (ft <sup>2</sup> )				
Wetted perimeter, Pw (ft)				
Hydraulic radius, r = a/Pw (ft)				
Channel slope, s (ft/ft)				
Manning's roughness coeff., n				
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00		
Flow length, L (ft)		1709		
$T_t = L / 3600 V$ (hr)		0.24	+	
				= 0.24 hr

**Watershed or subarea  $T_c$  or  $T_t$**  = **0.56** hr  
 = **33.6** min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 23

### SHEET FLOW

	Segment ID	I		
Surface Description (table 3-1)		Woods/Brush		
Manning's roughness coeff., n		0.4		
Flow Length, L (total L ≤ 100') (ft)		100		
Two-yr 24-hr rainfall, P2 (in)		2.89		
Land slope, s (ft/ft)		0.06		
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.24	+	
				= 0.24 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		66				
Watercourse slope, s (ft/ft)		0.06				
Average velocity, V (ft/s)		3.95				
$T_t = L / 3600 V$ (hr)		0.00	+		+	
						=

### CHANNEL FLOW

	Segment ID		
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00	
Flow length, L (ft)		0	
$T_t = L / 3600 V$ (hr)		0.00	+
			=

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.24 hr  
 = 14.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 24

### SHEET FLOW

	Segment ID	I	
Surface Description (table 3-1)		Grass	
Manning's roughness coeff., n		0.24	
Flow Length, L (total L ≤ 100') (ft)		100	
Two-yr 24-hr rainfall, P2 (in)		2.89	
Land slope, s (ft/ft)		0.06	
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.16	
		+	
			= 0.16 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II			
Surface Description (paved or unpaved)		unp.			
Flow Length, L (ft)		97			
Watercourse slope, s (ft/ft)		0.06			
Average velocity, V (ft/s)		3.95			
$T_t = L / 3600 V$ (hr)		0.01			
		+		+	
					= 0.01 hr

### CHANNEL FLOW

	Segment ID		
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00	
Flow length, L (ft)		0	
$T_t = L / 3600 V$ (hr)		0.00	
		+	
			= [ ] hr

Watershed or subarea  $T_c$  or  $T_t$  = 0.17 hr

= 10.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 25

### SHEET FLOW

	Segment ID	I					
Surface Description (table 3-1)		Grass					
Manning's roughness coeff., n		0.24					
Flow Length, L (total L ≤ 100') (ft)		85					
Two-yr 24-hr rainfall, P2 (in)		2.89					
Land slope, s (ft/ft)		0.035					
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.18	+				= <span style="border: 1px solid black; padding: 2px;">0.18</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II					
Surface Description (paved or unpaved)		pav.					
Flow Length, L (ft)		214					
Watercourse slope, s (ft/ft)		0.02					
Average velocity, V (ft/s)		2.87					
$T_t = L / 3600 V$ (hr)		0.02	+		+		= <span style="border: 1px solid black; padding: 2px;">0.02</span> hr

### CHANNEL FLOW

	Segment ID						
Cross-sectional flow area, a (ft <sup>2</sup> )							
Wetted perimeter, Pw (ft)							
Hydraulic radius, r = a/Pw (ft)							
Channel slope, s (ft/ft)							
Manning's roughness coeff., n							
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00					
Flow length, L (ft)		0					
$T_t = L / 3600 V$ (hr)		0.00	+				= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.20 hr

= 12.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 26

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		85				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.06				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.14	+			= <span style="border: 1px solid black; padding: 2px;">0.14</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		123				
Watercourse slope, s (ft/ft)		0.057				
Average velocity, V (ft/s)		4.85				
$T_t = L / 3600 V$ (hr)		0.01	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)		0			
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.15 hr

= 9.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 27

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.07				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.15	+			= <span style="border: 1px solid black; padding: 2px;">0.15</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		592				
Watercourse slope, s (ft/ft)		0.03				
Average velocity, V (ft/s)		3.52				
$T_t = L / 3600 V$ (hr)		0.05	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.05</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)		0			
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.20 hr  
 = 12.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 28

### SHEET FLOW

	Segment ID	I					
Surface Description (table 3-1)		Grass					
Manning's roughness coeff., n		0.24					
Flow Length, L (total L ≤ 100') (ft)		89					
Two-yr 24-hr rainfall, P2 (in)		2.89					
Land slope, s (ft/ft)		0.09					
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.12	+				= <span style="border: 1px solid black; padding: 2px;">0.12</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II					
Surface Description (paved or unpaved)		pav.					
Flow Length, L (ft)		192					
Watercourse slope, s (ft/ft)		0.047					
Average velocity, V (ft/s)		4.41					
$T_t = L / 3600 V$ (hr)		0.01	+		+		= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

### CHANNEL FLOW

	Segment ID					
Cross-sectional flow area, a (ft <sup>2</sup> )						
Wetted perimeter, Pw (ft)						
Hydraulic radius, r = a/Pw (ft)						
Channel slope, s (ft/ft)						
Manning's roughness coeff., n						
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00				
Flow length, L (ft)		0				
$T_t = L / 3600 V$ (hr)		0.00	+			= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.13 hr

= 7.8 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 29

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		85				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.09				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.12	+			= <span style="border: 1px solid black; padding: 2px;">0.12</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		315				
Watercourse slope, s (ft/ft)		0.057				
Average velocity, V (ft/s)		4.85				
$T_t = L / 3600 V$ (hr)		0.02	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.02</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)		0			
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.14 hr

= 8.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 30

### SHEET FLOW

	Segment ID	I					
Surface Description (table 3-1)		Grass					
Manning's roughness coeff., n		0.24					
Flow Length, L (total L ≤ 100') (ft)		100					
Two-yr 24-hr rainfall, P2 (in)		2.89					
Land slope, s (ft/ft)		0.03					
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.21	+				= <span style="border: 1px solid black; padding: 2px;">0.21</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III				
Surface Description (paved or unpaved)		unp.	pav.				
Flow Length, L (ft)		11	35				
Watercourse slope, s (ft/ft)		0.03	0.03				
Average velocity, V (ft/s)		2.79	3.52				
$T_t = L / 3600 V$ (hr)		0.00	0.00	+		+	+
							= <span style="border: 1px solid black; padding: 2px;"> </span> hr

### CHANNEL FLOW

	Segment ID						
Cross-sectional flow area, a (ft <sup>2</sup> )							
Wetted perimeter, Pw (ft)							
Hydraulic radius, r = a/Pw (ft)							
Channel slope, s (ft/ft)							
Manning's roughness coeff., n							
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00					
Flow length, L (ft)		0					
$T_t = L / 3600 V$ (hr)		0.00	+				= <span style="border: 1px solid black; padding: 2px;"> </span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.21 hr  
 = 12.6 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 31

### SHEET FLOW

	Segment ID	I			
Surface Description (table 3-1)		Grass			
Manning's roughness coeff., n		0.24			
Flow Length, L (total L ≤ 100') (ft)		100			
Two-yr 24-hr rainfall, P2 (in)		2.89			
Land slope, s (ft/ft)		0.04			
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.19	+		= <span style="border: 1px solid black; padding: 2px;">0.19</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II			
Surface Description (paved or unpaved)		unp.			
Flow Length, L (ft)		158			
Watercourse slope, s (ft/ft)		0.07			
Average velocity, V (ft/s)		4.27			
$T_t = L / 3600 V$ (hr)		0.01	+		= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)		0			
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.20 hr

= 12.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 32

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.01				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.33	+			= <span style="border: 1px solid black; padding: 2px;">0.33</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		158				
Watercourse slope, s (ft/ft)		0.1				
Average velocity, V (ft/s)		5.10				
$T_t = L / 3600 V$ (hr)		0.01	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)		0			
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.34 hr  
 = 20.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 33A

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.01				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.33	+			= <span style="border: 1px solid black; padding: 2px;">0.33</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		55				
Watercourse slope, s (ft/ft)		0.05				
Average velocity, V (ft/s)		3.61				
$T_t = L / 3600 V$ (hr)		0.00	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.37</span> hr

### CHANNEL FLOW

	Segment ID	III			
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)		311			
$T_t = L / 3600 V$ (hr)		0.04	+		= <span style="border: 1px solid black; padding: 2px;">0.04</span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.37 hr

= 22.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 33B

### SHEET FLOW

	Segment ID	I		
Surface Description (table 3-1)		Grass		
Manning's roughness coeff., n		0.24		
Flow Length, L (total L ≤ 100') (ft)		100		
Two-yr 24-hr rainfall, P2 (in)		2.89		
Land slope, s (ft/ft)		0.055		
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.17	+	
				= 0.17 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		334				
Watercourse slope, s (ft/ft)		0.05				
Average velocity, V (ft/s)		3.61				
$T_t = L / 3600 V$ (hr)		0.03	+		+	
						= 0.03 hr

### CHANNEL FLOW

	Segment ID	III		
Cross-sectional flow area, a (ft <sup>2</sup> )				
Wetted perimeter, Pw (ft)				
Hydraulic radius, r = a/Pw (ft)				
Channel slope, s (ft/ft)				
Manning's roughness coeff., n				
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00		
Flow length, L (ft)		261		
$T_t = L / 3600 V$ (hr)		0.04	+	
				= 0.04 hr

Watershed or subarea  $T_c$  or  $T_t$  = 0.24 hr

= 14.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 34

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.13				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.12	+			= <span style="border: 1px solid black; padding: 2px;">0.12</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		254				
Watercourse slope, s (ft/ft)		0.059				
Average velocity, V (ft/s)		3.92				
$T_t = L / 3600 V$ (hr)		0.02	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.02</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.14 hr

= 8.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 35

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		87				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.086				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.12	+			= <span style="border: 1px solid black; padding: 2px;">0.12</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		153				
Watercourse slope, s (ft/ft)		0.072				
Average velocity, V (ft/s)		5.45				
$T_t = L / 3600 V$ (hr)		0.01	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.13 hr

= 7.8 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 36

### SHEET FLOW

	Segment ID	I			
Surface Description (table 3-1)		Woods/Brush			
Manning's roughness coeff., n		0.4			
Flow Length, L (total L ≤ 100') (ft)		87			
Two-yr 24-hr rainfall, P2 (in)		2.89			
Land slope, s (ft/ft)		0.06			
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.22	+		= <span style="border: 1px solid black; padding: 2px;">0.22</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II			
Surface Description (paved or unpaved)		unp.			
Flow Length, L (ft)		153			
Watercourse slope, s (ft/ft)		0.13			
Average velocity, V (ft/s)		5.82			
$T_t = L / 3600 V$ (hr)		0.01	+		= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.23 hr

= 13.8 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 37

### SHEET FLOW

	Segment ID	I			
Surface Description (table 3-1)		Woods/Brush			
Manning's roughness coeff., n		0.4			
Flow Length, L (total L ≤ 100') (ft)		87			
Two-yr 24-hr rainfall, P2 (in)		2.89			
Land slope, s (ft/ft)		0.04			
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.26	+		= <span style="border: 1px solid black; padding: 2px;">0.26</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II			
Surface Description (paved or unpaved)		unp.			
Flow Length, L (ft)		225			
Watercourse slope, s (ft/ft)		0.08			
Average velocity, V (ft/s)		4.56			
$T_t = L / 3600 V$ (hr)		0.01	+		= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.27 hr

= 16.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 38

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		35				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.042				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.08	+			= <span style="border: 1px solid black; padding: 2px;">0.08</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		181				
Watercourse slope, s (ft/ft)		0.028				
Average velocity, V (ft/s)		3.40				
$T_t = L / 3600 V$ (hr)		0.01	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.09 hr

= 5.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 39

### SHEET FLOW

Segment ID	I				
Surface Description (table 3-1)	Grass				
Manning's roughness coeff., n	0.24				
Flow Length, L (total L ≤ 100') (ft)	50				
Two-yr 24-hr rainfall, P2 (in)	2.89				
Land slope, s (ft/ft)	0.03				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)	0.12	+			
					= 0.12 hr

### SHALLOW CONCENTRATED FLOW

Segment ID	II				
Surface Description (paved or unpaved)	pav.				
Flow Length, L (ft)	68				
Watercourse slope, s (ft/ft)	0.044				
Average velocity, V (ft/s)	4.26				
$T_t = L / 3600 V$ (hr)	0.00	+			
					= [ ] hr

### CHANNEL FLOW

Segment ID					
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)	2.00				
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)	0.00	+			
					= [ ] hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.12 hr  
 = 7.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 40

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		49				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.03				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.12	+			= <span style="border: 1px solid black; padding: 2px;">0.12</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		967				
Watercourse slope, s (ft/ft)		0.023				
Average velocity, V (ft/s)		3.08				
$T_t = L / 3600 V$ (hr)		0.09	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.09</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.21 hr

= 12.6 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 41

### SHEET FLOW

	Segment ID	I					
Surface Description (table 3-1)		Grass					
Manning's roughness coeff., n		0.24					
Flow Length, L (total L ≤ 100') (ft)		34					
Two-yr 24-hr rainfall, P2 (in)		2.89					
Land slope, s (ft/ft)		0.04					
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.08	+				= <span style="border: 1px solid black; padding: 2px;">0.08</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II					
Surface Description (paved or unpaved)		pav.					
Flow Length, L (ft)		196					
Watercourse slope, s (ft/ft)		0.01					
Average velocity, V (ft/s)		2.03					
$T_t = L / 3600 V$ (hr)		0.03	+		+		= <span style="border: 1px solid black; padding: 2px;">0.03</span> hr

### CHANNEL FLOW

	Segment ID					
Cross-sectional flow area, a (ft <sup>2</sup> )						
Wetted perimeter, Pw (ft)						
Hydraulic radius, r = a/Pw (ft)						
Channel slope, s (ft/ft)						
Manning's roughness coeff., n						
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00				
Flow length, L (ft)						
$T_t = L / 3600 V$ (hr)		0.00	+			= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.11 hr

= 6.6 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 42

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Woods/Brush				
Manning's roughness coeff., n		0.4				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.03				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.32	+			= <span style="border: 1px solid black; padding: 2px;">0.32</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III			
Surface Description (paved or unpaved)		unp.	pav.			
Flow Length, L (ft)		82	37			
Watercourse slope, s (ft/ft)		0.038	0.027			
Average velocity, V (ft/s)		3.15	3.34			
$T_t = L / 3600 V$ (hr)		0.01	0.00	+		= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.33 hr

= 19.8 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 43

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Woods/Brush				
Manning's roughness coeff., n		0.4				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.015				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.42	+			= 0.42 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III			
Surface Description (paved or unpaved)		unp.	pav.			
Flow Length, L (ft)		447	82			
Watercourse slope, s (ft/ft)		0.012	0.03			
Average velocity, V (ft/s)		1.77	3.52			
$T_t = L / 3600 V$ (hr)		0.07	0.01	+		= 0.08 hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= [ ] hr

**Watershed or subarea  $T_c$  or  $T_t$**  = **0.50** hr

= **30.0** min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 44

### SHEET FLOW

	Segment ID	I	
Surface Description (table 3-1)		Woods/Brush	
Manning's roughness coeff., n		0.4	
Flow Length, L (total L ≤ 100') (ft)		100	
Two-yr 24-hr rainfall, P2 (in)		2.89	
Land slope, s (ft/ft)		0.015	
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.42	
		+	
			= 0.42 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III		
Surface Description (paved or unpaved)		unp.	pav.		
Flow Length, L (ft)		447	82		
Watercourse slope, s (ft/ft)		0.012	0.03		
Average velocity, V (ft/s)		1.77	3.52		
$T_t = L / 3600 V$ (hr)		0.07	0.01		
		+	+	+	+
					= 0.08 hr

### CHANNEL FLOW

	Segment ID		
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00	
Flow length, L (ft)			
$T_t = L / 3600 V$ (hr)		0.00	
		+	
			= [ ] hr

Watershed or subarea  $T_c$  or  $T_t$  = 0.50 hr

= 30.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 45

### SHEET FLOW

	Segment ID	I	
Surface Description (table 3-1)		Grass	
Manning's roughness coeff., n		0.24	
Flow Length, L (total L ≤ 100') (ft)		100	
Two-yr 24-hr rainfall, P2 (in)		2.89	
Land slope, s (ft/ft)		0.05	
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.17	
		+	
			= 0.17 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III		
Surface Description (paved or unpaved)		unp.	pav.		
Flow Length, L (ft)		448	247		
Watercourse slope, s (ft/ft)		0.089	0.025		
Average velocity, V (ft/s)		4.81	3.21		
$T_t = L / 3600 V$ (hr)		0.03	0.02		
		+	+	+	+
					= 0.05 hr

### CHANNEL FLOW

	Segment ID		
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00	
Flow length, L (ft)			
$T_t = L / 3600 V$ (hr)		0.00	
		+	
			= [ ] hr

Watershed or subarea  $T_c$  or  $T_t$  = 0.22 hr

= 13.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 46

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Cultivated Soil				
Manning's roughness coeff., n		0.17				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.04				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.14	+			= <span style="border: 1px solid black; padding: 2px;">0.14</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III			
Surface Description (paved or unpaved)		unp.	pav.			
Flow Length, L (ft)		195	140			
Watercourse slope, s (ft/ft)		0.07	0.014			
Average velocity, V (ft/s)		4.27	2.41			
$T_t = L / 3600 V$ (hr)		0.01	0.02	+		= <span style="border: 1px solid black; padding: 2px;">0.03</span> hr

### CHANNEL FLOW

	Segment ID					
Cross-sectional flow area, a (ft <sup>2</sup> )						
Wetted perimeter, Pw (ft)						
Hydraulic radius, r = a/Pw (ft)						
Channel slope, s (ft/ft)						
Manning's roughness coeff., n						
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00				
Flow length, L (ft)						
$T_t = L / 3600 V$ (hr)		0.00	+			= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.17 hr

= 10.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 47

### SHEET FLOW

	Segment ID	I	
Surface Description (table 3-1)		Cultivated Soil	
Manning's roughness coeff., n		0.17	
Flow Length, L (total L ≤ 100') (ft)		100	
Two-yr 24-hr rainfall, P2 (in)		2.89	
Land slope, s (ft/ft)		0.05	
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.13	
		+	
			= 0.13 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II			
Surface Description (paved or unpaved)		unp.			
Flow Length, L (ft)		320			
Watercourse slope, s (ft/ft)		0.041			
Average velocity, V (ft/s)		3.27			
$T_t = L / 3600 V$ (hr)		0.03			
		+		+	
					= 0.03 hr

### CHANNEL FLOW

	Segment ID	III	
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00	
Flow length, L (ft)		83	
$T_t = L / 3600 V$ (hr)		0.01	
		+	
			= 0.01 hr

Watershed or subarea  $T_c$  or  $T_t$  = 0.17 hr

= 10.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 48

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Cultivated Soil				
Manning's roughness coeff., n		0.17				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.025				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.17	+			= <span style="border: 1px solid black; padding: 2px;">0.17</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		595				
Watercourse slope, s (ft/ft)		0.07				
Average velocity, V (ft/s)		4.27				
$T_t = L / 3600 V$ (hr)		0.04	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.04</span> hr

### CHANNEL FLOW

	Segment ID	III		
Cross-sectional flow area, a (ft <sup>2</sup> )				
Wetted perimeter, Pw (ft)				
Hydraulic radius, r = a/Pw (ft)				
Channel slope, s (ft/ft)				
Manning's roughness coeff., n				
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00		
Flow length, L (ft)		376		
$T_t = L / 3600 V$ (hr)		0.05	+	
				= <span style="border: 1px solid black; padding: 2px;">0.05</span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.26 hr

= 15.6 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 49

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Cultivated Soil				
Manning's roughness coeff., n		0.17				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.025				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.17	+			= <span style="border: 1px solid black; padding: 2px;">0.17</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		545				
Watercourse slope, s (ft/ft)		0.028				
Average velocity, V (ft/s)		2.70				
$T_t = L / 3600 V$ (hr)		0.06	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.06</span> hr

### CHANNEL FLOW

	Segment ID	III			
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)		1742			
$T_t = L / 3600 V$ (hr)		0.24	+		= <span style="border: 1px solid black; padding: 2px;">0.24</span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.47 hr

= 28.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 50

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Woods/Brush				
Manning's roughness coeff., n		0.4				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.03				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.32	+			= <span style="border: 1px solid black; padding: 2px;">0.32</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		4272				
Watercourse slope, s (ft/ft)		0.022				
Average velocity, V (ft/s)		2.39				
$T_t = L / 3600 V$ (hr)		0.50	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.50</span> hr

### CHANNEL FLOW

	Segment ID	III		
Cross-sectional flow area, a (ft <sup>2</sup> )				
Wetted perimeter, Pw (ft)				
Hydraulic radius, r = a/Pw (ft)				
Channel slope, s (ft/ft)				
Manning's roughness coeff., n				
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00		
Flow length, L (ft)				
$T_t = L / 3600 V$ (hr)		0.00	+	
				= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.82 hr  
 = 49.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 51

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Woods/Brush				
Manning's roughness coeff., n		0.4				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.035				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.30	+			= 0.30 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III			
Surface Description (paved or unpaved)		unp.	pav.			
Flow Length, L (ft)		189	74			
Watercourse slope, s (ft/ft)		0.038	0.02			
Average velocity, V (ft/s)		3.15	2.87			
$T_t = L / 3600 V$ (hr)		0.02	0.01	+		= 0.03 hr

### CHANNEL FLOW

	Segment ID	IV		
Cross-sectional flow area, a (ft <sup>2</sup> )				
Wetted perimeter, Pw (ft)				
Hydraulic radius, r = a/Pw (ft)				
Channel slope, s (ft/ft)				
Manning's roughness coeff., n				
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00		
Flow length, L (ft)		598		
$T_t = L / 3600 V$ (hr)		0.08	+	= 0.08 hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.41 hr  
 = 24.6 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 52

### SHEET FLOW

	Segment ID	I			
Surface Description (table 3-1)		Woods/Brush			
Manning's roughness coeff., n		0.4			
Flow Length, L (total L ≤ 100') (ft)		100			
Two-yr 24-hr rainfall, P2 (in)		2.89			
Land slope, s (ft/ft)		0.03			
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.32	+		= <span style="border: 1px solid black; padding: 2px;">0.32</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II					
Surface Description (paved or unpaved)		unp.					
Flow Length, L (ft)		676					
Watercourse slope, s (ft/ft)		0.024					
Average velocity, V (ft/s)		2.50					
$T_t = L / 3600 V$ (hr)		0.08	+		+		= <span style="border: 1px solid black; padding: 2px;">0.08</span> hr

### CHANNEL FLOW

	Segment ID		
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)			
Flow length, L (ft)			
$T_t = L / 3600 V$ (hr)			= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.40 hr

= 24.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 53

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		80				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.05				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.15	+			= <span style="border: 1px solid black; padding: 2px;">0.15</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		562				
Watercourse slope, s (ft/ft)		0.025				
Average velocity, V (ft/s)		3.21				
$T_t = L / 3600 V$ (hr)		0.05	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.05</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.20 hr  
 = 12.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 54

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		66				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.05				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.12	+			= <span style="border: 1px solid black; padding: 2px;">0.12</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		815				
Watercourse slope, s (ft/ft)		0.023				
Average velocity, V (ft/s)		3.08				
$T_t = L / 3600 V$ (hr)		0.07	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.07</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.19 hr

= 11.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 55

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Woods/Brush				
Manning's roughness coeff., n		0.4				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.07				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.23	+			= 0.23 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		638				
Watercourse slope, s (ft/ft)		0.065				
Average velocity, V (ft/s)		4.11				
$T_t = L / 3600 V$ (hr)		0.04	+		+	+
						= 0.04 hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= [ ] hr

Watershed or subarea  $T_c$  or  $T_t$  = 0.27 hr

= 16.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 56

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.03				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.21	+			= <span style="border: 1px solid black; padding: 2px;">0.21</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III			
Surface Description (paved or unpaved)		unp.	pav.			
Flow Length, L (ft)		59	217			
Watercourse slope, s (ft/ft)		0.045	0.023			
Average velocity, V (ft/s)		3.42	3.08			
$T_t = L / 3600 V$ (hr)		0.00	0.02	+		= <span style="border: 1px solid black; padding: 2px;"> </span> hr

### CHANNEL FLOW

	Segment ID					
Cross-sectional flow area, a (ft <sup>2</sup> )						
Wetted perimeter, Pw (ft)						
Hydraulic radius, r = a/Pw (ft)						
Channel slope, s (ft/ft)						
Manning's roughness coeff., n						
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)						
Flow length, L (ft)						
$T_t = L / 3600 V$ (hr)			+			= <span style="border: 1px solid black; padding: 2px;"> </span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.21 hr  
 = 12.6 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 57

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Woods/Brush				
Manning's roughness coeff., n		0.4				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.04				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.29	+			= <span style="border: 1px solid black; padding: 2px;">0.29</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III	III		
Surface Description (paved or unpaved)		unp.	unp.	pav.		
Flow Length, L (ft)		517	113	30		
Watercourse slope, s (ft/ft)		0.0039	0.035	0.1		
Average velocity, V (ft/s)		1.01	3.02	6.43		
$T_t = L / 3600 V$ (hr)		0.14	+	0.01	+	0.00
					+	= <span style="border: 1px solid black; padding: 2px;">0.15</span> hr

### CHANNEL FLOW

	Segment ID			
Cross-sectional flow area, a (ft <sup>2</sup> )				
Wetted perimeter, Pw (ft)				
Hydraulic radius, r = a/Pw (ft)				
Channel slope, s (ft/ft)				
Manning's roughness coeff., n				
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)				
Flow length, L (ft)				
$T_t = L / 3600 V$ (hr)			+	
				= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.44 hr

= 26.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 58

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		52				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.08				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.09	+			= <span style="border: 1px solid black; padding: 2px;">0.09</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		582				
Watercourse slope, s (ft/ft)		0.038				
Average velocity, V (ft/s)		3.96				
$T_t = L / 3600 V$ (hr)		0.04	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.04</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.13 hr

= 7.8 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 59

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		52				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.035				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.12	+			= <span style="border: 1px solid black; padding: 2px;">0.12</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		471				
Watercourse slope, s (ft/ft)		0.032				
Average velocity, V (ft/s)		3.64				
$T_t = L / 3600 V$ (hr)		0.04	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.04</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.16 hr

= 9.6 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 60

### SHEET FLOW

	Segment ID	I			
Surface Description (table 3-1)		Grass			
Manning's roughness coeff., n		0.24			
Flow Length, L (total L ≤ 100') (ft)		100			
Two-yr 24-hr rainfall, P2 (in)		2.89			
Land slope, s (ft/ft)		0.08			
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.14	+		= <span style="border: 1px solid black; padding: 2px;">0.14</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	II		
Surface Description (paved or unpaved)		unp.	pav.		
Flow Length, L (ft)		207	143		
Watercourse slope, s (ft/ft)		0.078	0.028		
Average velocity, V (ft/s)		4.51	3.40		
$T_t = L / 3600 V$ (hr)		0.01	0.01	+	= <span style="border: 1px solid black; padding: 2px;">0.02</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.16 hr

= 9.6 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 61

### SHEET FLOW

	Segment ID	I					
Surface Description (table 3-1)		Woods/Brush					
Manning's roughness coeff., n		0.4					
Flow Length, L (total L ≤ 100') (ft)		100					
Two-yr 24-hr rainfall, P2 (in)		2.89					
Land slope, s (ft/ft)		0.02					
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.38	+				= <span style="border: 1px solid black; padding: 2px;">0.38</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II					
Surface Description (paved or unpaved)		unp.					
Flow Length, L (ft)		316					
Watercourse slope, s (ft/ft)		0.026					
Average velocity, V (ft/s)		2.60					
$T_t = L / 3600 V$ (hr)		0.03	+		+		= <span style="border: 1px solid black; padding: 2px;">0.03</span> hr

### CHANNEL FLOW

	Segment ID						
Cross-sectional flow area, a (ft <sup>2</sup> )							
Wetted perimeter, Pw (ft)							
Hydraulic radius, r = a/Pw (ft)							
Channel slope, s (ft/ft)							
Manning's roughness coeff., n							
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)							
Flow length, L (ft)							
$T_t = L / 3600 V$ (hr)			+				= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.41 hr

= 24.6 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 62

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		18				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.06				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.04	+			= <span style="border: 1px solid black; padding: 2px;">0.04</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		460				
Watercourse slope, s (ft/ft)		0.057				
Average velocity, V (ft/s)		4.85				
$T_t = L / 3600 V$ (hr)		0.03	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.03</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.07 hr

= 4.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 63

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.04				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.19	+			= <span style="border: 1px solid black; padding: 2px;">0.19</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III			
Surface Description (paved or unpaved)		unp.	pav.			
Flow Length, L (ft)		62	117			
Watercourse slope, s (ft/ft)		0.09	0.06			
Average velocity, V (ft/s)		4.84	4.98			
$T_t = L / 3600 V$ (hr)		0.00	0.01	+		= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

### CHANNEL FLOW

	Segment ID					
Cross-sectional flow area, a (ft <sup>2</sup> )						
Wetted perimeter, Pw (ft)						
Hydraulic radius, r = a/Pw (ft)						
Channel slope, s (ft/ft)						
Manning's roughness coeff., n						
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)						
Flow length, L (ft)						
$T_t = L / 3600 V$ (hr)			+			= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.20 hr

= 12.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 64

### SHEET FLOW

	Segment ID	I					
Surface Description (table 3-1)		Grass					
Manning's roughness coeff., n		0.24					
Flow Length, L (total L ≤ 100') (ft)		96					
Two-yr 24-hr rainfall, P2 (in)		2.89					
Land slope, s (ft/ft)		0.015					
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.27	+				= <span style="border: 1px solid black; padding: 2px;">0.27</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II					
Surface Description (paved or unpaved)		pav.					
Flow Length, L (ft)		534					
Watercourse slope, s (ft/ft)		0.04					
Average velocity, V (ft/s)		4.07					
$T_t = L / 3600 V$ (hr)		0.04	+		+		= <span style="border: 1px solid black; padding: 2px;">0.04</span> hr

### CHANNEL FLOW

	Segment ID						
Cross-sectional flow area, a (ft <sup>2</sup> )							
Wetted perimeter, Pw (ft)							
Hydraulic radius, r = a/Pw (ft)							
Channel slope, s (ft/ft)							
Manning's roughness coeff., n							
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)							
Flow length, L (ft)							
$T_t = L / 3600 V$ (hr)			+				= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.31 hr

= 18.6 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 65

### SHEET FLOW

	Segment ID	I			
Surface Description (table 3-1)		Grass			
Manning's roughness coeff., n		0.24			
Flow Length, L (total L ≤ 100') (ft)		100			
Two-yr 24-hr rainfall, P2 (in)		2.89			
Land slope, s (ft/ft)		0.015			
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.28	+		= <span style="border: 1px solid black; padding: 2px;">0.28</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II			
Surface Description (paved or unpaved)		unp.			
Flow Length, L (ft)		118			
Watercourse slope, s (ft/ft)		0.037			
Average velocity, V (ft/s)		3.10			
$T_t = L / 3600 V$ (hr)		0.01	+		= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.29 hr  
 = 17.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 66

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.03				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.21	+			= <span style="border: 1px solid black; padding: 2px;">0.21</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		446				
Watercourse slope, s (ft/ft)		0.11				
Average velocity, V (ft/s)		5.35				
$T_t = L / 3600 V$ (hr)		0.02	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.02</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.23 hr  
 = 13.8 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
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By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 67

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		69				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.02				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.19	+			= <span style="border: 1px solid black; padding: 2px;">0.19</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		251				
Watercourse slope, s (ft/ft)		0.024				
Average velocity, V (ft/s)		2.50				
$T_t = L / 3600 V$ (hr)		0.03	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.03</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.22 hr

= 13.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
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 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 68

### SHEET FLOW

	Segment ID	I			
Surface Description (table 3-1)		Grass			
Manning's roughness coeff., n		0.24			
Flow Length, L (total L ≤ 100') (ft)		59			
Two-yr 24-hr rainfall, P2 (in)		2.89			
Land slope, s (ft/ft)		0.27			
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.06	+		= <span style="border: 1px solid black; padding: 2px;">0.06</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II			
Surface Description (paved or unpaved)		pav.			
Flow Length, L (ft)		456			
Watercourse slope, s (ft/ft)		0.092			
Average velocity, V (ft/s)		6.17			
$T_t = L / 3600 V$ (hr)		0.02	+		= <span style="border: 1px solid black; padding: 2px;">0.02</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.08 hr

= 4.8 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 69

### SHEET FLOW

	Segment ID	I			
Surface Description (table 3-1)		Grass			
Manning's roughness coeff., n		0.24			
Flow Length, L (total L ≤ 100') (ft)		100			
Two-yr 24-hr rainfall, P2 (in)		2.89			
Land slope, s (ft/ft)		0.09			
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.14	+		= <span style="border: 1px solid black; padding: 2px;">0.14</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III				
Surface Description (paved or unpaved)		unp.	pav.				
Flow Length, L (ft)		48	178				
Watercourse slope, s (ft/ft)		0.089	0.051				
Average velocity, V (ft/s)		4.81	4.59				
$T_t = L / 3600 V$ (hr)		0.00	0.01	+		+	+
							= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

### CHANNEL FLOW

	Segment ID		
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)			
Flow length, L (ft)			
$T_t = L / 3600 V$ (hr)			= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.15 hr

= 9.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 Tc through subarea

Subbasin 70

### SHEET FLOW

	Segment ID	I			
Surface Description (table 3-1)		Grass			
Manning's roughness coeff., n		0.24			
Flow Length, L (total L ≤ 100') (ft)		43			
Two-yr 24-hr rainfall, P2 (in)		2.89			
Land slope, s (ft/ft)		0.012			
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.16	+		= <span style="border: 1px solid black; padding: 2px;">0.16</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II			
Surface Description (paved or unpaved)		pav.			
Flow Length, L (ft)		270			
Watercourse slope, s (ft/ft)		0.041			
Average velocity, V (ft/s)		4.12			
$T_t = L / 3600 V$ (hr)		0.02	+		= <span style="border: 1px solid black; padding: 2px;">0.02</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.18 hr

= 10.8 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 71

### SHEET FLOW

	Segment ID	I					
Surface Description (table 3-1)		Grass					
Manning's roughness coeff., n		0.24					
Flow Length, L (total L ≤ 100') (ft)		100					
Two-yr 24-hr rainfall, P2 (in)		2.89					
Land slope, s (ft/ft)		0.07					
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.15	+				= <span style="border: 1px solid black; padding: 2px;">0.15</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III				
Surface Description (paved or unpaved)		unp.	pav.				
Flow Length, L (ft)		58	114				
Watercourse slope, s (ft/ft)		0.08	0.053				
Average velocity, V (ft/s)		4.56	4.68				
$T_t = L / 3600 V$ (hr)		0.00	0.01	+		+	= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

### CHANNEL FLOW

	Segment ID						
Cross-sectional flow area, a (ft <sup>2</sup> )							
Wetted perimeter, Pw (ft)							
Hydraulic radius, r = a/Pw (ft)							
Channel slope, s (ft/ft)							
Manning's roughness coeff., n							
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)							
Flow length, L (ft)							
$T_t = L / 3600 V$ (hr)			+				= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.16 hr

= 9.6 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 72

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.05				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.17	+			= <span style="border: 1px solid black; padding: 2px;">0.17</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III			
Surface Description (paved or unpaved)		unp.	pav.			
Flow Length, L (ft)		220	77			
Watercourse slope, s (ft/ft)		0.05	0.006			
Average velocity, V (ft/s)		3.61	1.57			
$T_t = L / 3600 V$ (hr)		0.02	0.01	+		= <span style="border: 1px solid black; padding: 2px;">0.03</span> hr

### CHANNEL FLOW

	Segment ID					
Cross-sectional flow area, a (ft <sup>2</sup> )						
Wetted perimeter, Pw (ft)						
Hydraulic radius, r = a/Pw (ft)						
Channel slope, s (ft/ft)						
Manning's roughness coeff., n						
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)						
Flow length, L (ft)						
$T_t = L / 3600 V$ (hr)			+			= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.20 hr

= 12.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 73

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Woods/Brush				
Manning's roughness coeff., n		0.4				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.07				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.23	+			= <span style="border: 1px solid black; padding: 2px;">0.23</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		228				
Watercourse slope, s (ft/ft)		0.07				
Average velocity, V (ft/s)		4.27				
$T_t = L / 3600 V$ (hr)		0.01	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.24 hr  
 = 14.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 74

### SHEET FLOW

	Segment ID	I	
Surface Description (table 3-1)		Woods/Brush	
Manning's roughness coeff., n		0.4	
Flow Length, L (total L ≤ 100') (ft)		100	
Two-yr 24-hr rainfall, P2 (in)		2.89	
Land slope, s (ft/ft)		0.05	
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.26	
		+	
			= 0.26 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III		
Surface Description (paved or unpaved)		unp.	pav.		
Flow Length, L (ft)		758	203		
Watercourse slope, s (ft/ft)		0.055	0.01		
Average velocity, V (ft/s)		3.78	2.03		
$T_t = L / 3600 V$ (hr)		0.06	0.03		
		+	+	+	+
					= 0.09 hr

### CHANNEL FLOW

	Segment ID		
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)			
Flow length, L (ft)			
$T_t = L / 3600 V$ (hr)			
		+	
			= [ ] hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.35 hr

= 21.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 75

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Cultivated Soil				
Manning's roughness coeff., n		0.17				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.03				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.16	+			= 0.16 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		688				
Watercourse slope, s (ft/ft)		0.034				
Average velocity, V (ft/s)		2.98				
$T_t = L / 3600 V$ (hr)		0.06	+		+	+
						= 0.06 hr

### CHANNEL FLOW

	Segment ID			
Cross-sectional flow area, a (ft <sup>2</sup> )				
Wetted perimeter, Pw (ft)				
Hydraulic radius, r = a/Pw (ft)				
Channel slope, s (ft/ft)				
Manning's roughness coeff., n				
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)				
Flow length, L (ft)				
$T_t = L / 3600 V$ (hr)			+	= [ ] hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.22 hr

= 13.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 75

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Cultivated Soil				
Manning's roughness coeff., n		0.17				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.03				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.16	+			= <span style="border: 1px solid black; padding: 2px;">0.16</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		688				
Watercourse slope, s (ft/ft)		0.034				
Average velocity, V (ft/s)		2.98				
$T_t = L / 3600 V$ (hr)		0.06	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.06</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.22 hr

= 13.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 76

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Woods/Brush				
Manning's roughness coeff., n		0.4				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.025				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.34	+			= 0.34 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		192				
Watercourse slope, s (ft/ft)		0.09				
Average velocity, V (ft/s)		4.84				
$T_t = L / 3600 V$ (hr)		0.01	+		+	+
						= 0.01 hr

### CHANNEL FLOW

	Segment ID			
Cross-sectional flow area, a (ft <sup>2</sup> )				
Wetted perimeter, Pw (ft)				
Hydraulic radius, r = a/Pw (ft)				
Channel slope, s (ft/ft)				
Manning's roughness coeff., n				
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)				
Flow length, L (ft)				
$T_t = L / 3600 V$ (hr)			+	
				= [ ] hr

**Watershed or subarea  $T_c$  or  $T_t$**  = **0.35** hr

= **21.0** min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 77

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.05				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.17	+			= <span style="border: 1px solid black; padding: 2px;">0.17</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III			
Surface Description (paved or unpaved)		unp.	pav.			
Flow Length, L (ft)		34	608			
Watercourse slope, s (ft/ft)		0.05	0.066			
Average velocity, V (ft/s)		3.61	5.22			
$T_t = L / 3600 V$ (hr)		0.00	0.03	+		= <span style="border: 1px solid black; padding: 2px;">0.03</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.20 hr

= 12.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 78

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.01				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.33	+			= <span style="border: 1px solid black; padding: 2px;">0.33</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III			
Surface Description (paved or unpaved)		unp.	pav.			
Flow Length, L (ft)		218	165			
Watercourse slope, s (ft/ft)		0.06	0.015			
Average velocity, V (ft/s)		3.95	2.49			
$T_t = L / 3600 V$ (hr)		0.02	0.02	+		= <span style="border: 1px solid black; padding: 2px;">0.04</span> hr

### CHANNEL FLOW

	Segment ID					
Cross-sectional flow area, a (ft <sup>2</sup> )						
Wetted perimeter, Pw (ft)						
Hydraulic radius, r = a/Pw (ft)						
Channel slope, s (ft/ft)						
Manning's roughness coeff., n						
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)						
Flow length, L (ft)						
$T_t = L / 3600 V$ (hr)			+			= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.37 hr  
 = 22.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 79

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		83				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.024				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.20	+			= <span style="border: 1px solid black; padding: 2px;">0.20</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		318				
Watercourse slope, s (ft/ft)		0.006				
Average velocity, V (ft/s)		1.57				
$T_t = L / 3600 V$ (hr)		0.06	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.06</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.26 hr

= 15.6 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 80

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		95				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.021				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.24	+			= 0.24 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		154				
Watercourse slope, s (ft/ft)		0.032				
Average velocity, V (ft/s)		3.64				
$T_t = L / 3600 V$ (hr)		0.01	+		+	+
						= 0.01 hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= [ ] hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.25 hr

= 15.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 81

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.21				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.10	+			= <span style="border: 1px solid black; padding: 2px;">0.10</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		451				
Watercourse slope, s (ft/ft)		0.078				
Average velocity, V (ft/s)		5.68				
$T_t = L / 3600 V$ (hr)		0.02	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.02</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.12 hr

= 7.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 82

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		97				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.1				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.13	+			= <span style="border: 1px solid black; padding: 2px;">0.13</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		612				
Watercourse slope, s (ft/ft)		0.067				
Average velocity, V (ft/s)		5.26				
$T_t = L / 3600 V$ (hr)		0.03	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.03</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.16 hr

= 9.6 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 83

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		89				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.045				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.16	+			= <span style="border: 1px solid black; padding: 2px;">0.16</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		115				
Watercourse slope, s (ft/ft)		0.052				
Average velocity, V (ft/s)		4.64				
$T_t = L / 3600 V$ (hr)		0.01	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.17 hr

= 10.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 84

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		75				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.027				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.18	+			= <span style="border: 1px solid black; padding: 2px;">0.18</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		792				
Watercourse slope, s (ft/ft)		0.043				
Average velocity, V (ft/s)		4.22				
$T_t = L / 3600 V$ (hr)		0.05	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.05</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)					
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)			+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.23 hr

= 13.8 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 85

### SHEET FLOW

	Segment ID	I					
Surface Description (table 3-1)		Grass					
Manning's roughness coeff., n		0.24					
Flow Length, L (total L ≤ 100') (ft)		100					
Two-yr 24-hr rainfall, P2 (in)		2.89					
Land slope, s (ft/ft)		0.03					
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.21	+				= <span style="border: 1px solid black; padding: 2px;">0.21</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II					
Surface Description (paved or unpaved)		unp.					
Flow Length, L (ft)		665					
Watercourse slope, s (ft/ft)		0.065					
Average velocity, V (ft/s)		4.11					
$T_t = L / 3600 V$ (hr)		0.04	+		+		= <span style="border: 1px solid black; padding: 2px;">0.04</span> hr

### CHANNEL FLOW

	Segment ID						
Cross-sectional flow area, a (ft <sup>2</sup> )							
Wetted perimeter, Pw (ft)							
Hydraulic radius, r = a/Pw (ft)							
Channel slope, s (ft/ft)							
Manning's roughness coeff., n							
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)							
Flow length, L (ft)							
$T_t = L / 3600 V$ (hr)			+				= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.25 hr

= 15.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 86

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.12				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.12	+			= <span style="border: 1px solid black; padding: 2px;">0.12</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		125				
Watercourse slope, s (ft/ft)		0.12				
Average velocity, V (ft/s)		5.59				
$T_t = L / 3600 V$ (hr)		0.01	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

### CHANNEL FLOW

	Segment ID	III			
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)		134			
$T_t = L / 3600 V$ (hr)		0.02	+		= <span style="border: 1px solid black; padding: 2px;">0.02</span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.15 hr

= 9.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 87

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.02				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.25	+			= <span style="border: 1px solid black; padding: 2px;">0.25</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III			
Surface Description (paved or unpaved)		unp.	pav.			
Flow Length, L (ft)		265	196			
Watercourse slope, s (ft/ft)		0.075	0.077			
Average velocity, V (ft/s)		4.42	5.64			
$T_t = L / 3600 V$ (hr)		0.02	0.01	+		= <span style="border: 1px solid black; padding: 2px;">0.03</span> hr

### CHANNEL FLOW

	Segment ID					
Cross-sectional flow area, a (ft <sup>2</sup> )						
Wetted perimeter, Pw (ft)						
Hydraulic radius, r = a/Pw (ft)						
Channel slope, s (ft/ft)						
Manning's roughness coeff., n						
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00				
Flow length, L (ft)						
$T_t = L / 3600 V$ (hr)		0.00	+			= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.28 hr

= 16.8 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 88

### SHEET FLOW

	Segment ID	I		
Surface Description (table 3-1)		Grass		
Manning's roughness coeff., n		0.24		
Flow Length, L (total L ≤ 100') (ft)		100		
Two-yr 24-hr rainfall, P2 (in)		2.89		
Land slope, s (ft/ft)		0.04		
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.19	+	
				= <span style="border: 1px solid black; padding: 2px;">0.19</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III				
Surface Description (paved or unpaved)		unp.	pav.				
Flow Length, L (ft)		256	301				
Watercourse slope, s (ft/ft)		0.059	0.023				
Average velocity, V (ft/s)		3.92	3.08				
$T_t = L / 3600 V$ (hr)		0.02	0.03	+		+	
							= <span style="border: 1px solid black; padding: 2px;">0.05</span> hr

### CHANNEL FLOW

	Segment ID		
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00	
Flow length, L (ft)			
$T_t = L / 3600 V$ (hr)		0.00	+
			= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.24 hr

= 14.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 89

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		74				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.05				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.14	+			= <span style="border: 1px solid black; padding: 2px;">0.14</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		615				
Watercourse slope, s (ft/ft)		0.0098				
Average velocity, V (ft/s)		2.01				
$T_t = L / 3600 V$ (hr)		0.08	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.08</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.22 hr  
 = 13.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 90

### SHEET FLOW

	Segment ID	I			
Surface Description (table 3-1)		Grass			
Manning's roughness coeff., n		0.24			
Flow Length, L (total L $\leq$ 100') (ft)		100			
Two-yr 24-hr rainfall, P2 (in)		2.89			
Land slope, s (ft/ft)		0.06			
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.16	+		= <span style="border: 1px solid black; padding: 2px;">0.16</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		447				
Watercourse slope, s (ft/ft)		0.068				
Average velocity, V (ft/s)		4.21				
$T_t = L / 3600 V$ (hr)		0.03	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.03</span> hr

### CHANNEL FLOW

	Segment ID		
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00	
Flow length, L (ft)			
$T_t = L / 3600 V$ (hr)		0.00	+
			= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.19 hr

= 11.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 91

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Woods/Brush				
Manning's roughness coeff., n		0.4				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.05				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.27	+			= <span style="border: 1px solid black; padding: 2px;">0.27</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		299				
Watercourse slope, s (ft/ft)		0.08				
Average velocity, V (ft/s)		4.56				
$T_t = L / 3600 V$ (hr)		0.02	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.02</span> hr

### CHANNEL FLOW

	Segment ID			
Cross-sectional flow area, a (ft <sup>2</sup> )				
Wetted perimeter, Pw (ft)				
Hydraulic radius, r = a/Pw (ft)				
Channel slope, s (ft/ft)				
Manning's roughness coeff., n				
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00		
Flow length, L (ft)				
$T_t = L / 3600 V$ (hr)		0.00	+	
				= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.29 hr  
 = 17.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 92

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		70				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.04				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.14	+			= <span style="border: 1px solid black; padding: 2px;">0.14</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		267				
Watercourse slope, s (ft/ft)		0.067				
Average velocity, V (ft/s)		5.26				
$T_t = L / 3600 V$ (hr)		0.01	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.15 hr

= 9.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 93

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.03				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.21	+			= <span style="border: 1px solid black; padding: 2px;">0.21</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		393				
Watercourse slope, s (ft/ft)		0.056				
Average velocity, V (ft/s)		3.82				
$T_t = L / 3600 V$ (hr)		0.03	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.03</span> hr

### CHANNEL FLOW

	Segment ID	III			
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)		327			
$T_t = L / 3600 V$ (hr)		0.05	+		= <span style="border: 1px solid black; padding: 2px;">0.05</span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.29 hr

= 17.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 94

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		95				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.04				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.19	+			= <span style="border: 1px solid black; padding: 2px;">0.19</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		331				
Watercourse slope, s (ft/ft)		0.021				
Average velocity, V (ft/s)		2.95				
$T_t = L / 3600 V$ (hr)		0.03	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.03</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.22 hr  
 = 13.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 Tc through subarea

Subbasin 95

### SHEET FLOW

	Segment ID	I	
Surface Description (table 3-1)		Grass	
Manning's roughness coeff., n		0.24	
Flow Length, L (total L ≤ 100') (ft)		100	
Two-yr 24-hr rainfall, P2 (in)		2.89	
Land slope, s (ft/ft)		0.04	
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.19	
		+	
			= 0.19 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III		
Surface Description (paved or unpaved)		unp.	pav.		
Flow Length, L (ft)		77	100		
Watercourse slope, s (ft/ft)		0.06	0.01		
Average velocity, V (ft/s)		3.95	2.03		
$T_t = L / 3600 V$ (hr)		0.01	0.01		
		+	+	+	+
					= 0.02 hr

### CHANNEL FLOW

	Segment ID		
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00	
Flow length, L (ft)			
$T_t = L / 3600 V$ (hr)		0.00	
		+	
			= [ ] hr

Watershed or subarea  $T_c$  or  $T_t$  = 0.21 hr

= 12.6 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 96

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.05				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.17	+			= <span style="border: 1px solid black; padding: 2px;">0.17</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		246				
Watercourse slope, s (ft/ft)		0.058				
Average velocity, V (ft/s)		3.89				
$T_t = L / 3600 V$ (hr)		0.02	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.02</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.19 hr  
 = 11.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 97

### SHEET FLOW

	Segment ID	I			
Surface Description (table 3-1)		Grass			
Manning's roughness coeff., n		0.24			
Flow Length, L (total L ≤ 100') (ft)		100			
Two-yr 24-hr rainfall, P2 (in)		2.89			
Land slope, s (ft/ft)		0.11			
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.13	+		= <span style="border: 1px solid black; padding: 2px;">0.13</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II					
Surface Description (paved or unpaved)		unp.					
Flow Length, L (ft)		44					
Watercourse slope, s (ft/ft)		0.12					
Average velocity, V (ft/s)		5.59					
$T_t = L / 3600 V$ (hr)		0.00	+		+		+
							= <span style="border: 1px solid black; padding: 2px;">0.00</span> hr

### CHANNEL FLOW

	Segment ID		
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00	
Flow length, L (ft)			
$T_t = L / 3600 V$ (hr)		0.00	+
			= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.13 hr

= 7.8 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 98

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.06				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.16	+			= <span style="border: 1px solid black; padding: 2px;">0.16</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III			
Surface Description (paved or unpaved)		unp.	pav.			
Flow Length, L (ft)		55	315			
Watercourse slope, s (ft/ft)		0.065	0.032			
Average velocity, V (ft/s)		4.11	3.64			
$T_t = L / 3600 V$ (hr)		0.00	0.02	+		= <span style="border: 1px solid black; padding: 2px;">0.02</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.18 hr

= 10.8 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 99

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.02				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.25	+			= <span style="border: 1px solid black; padding: 2px;">0.25</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		415				
Watercourse slope, s (ft/ft)		0.041				
Average velocity, V (ft/s)		3.27				
$T_t = L / 3600 V$ (hr)		0.04	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.04</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.29 hr  
 = 17.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 100

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.05				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.17	+			= <span style="border: 1px solid black; padding: 2px;">0.17</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III			
Surface Description (paved or unpaved)		unp.	pav.			
Flow Length, L (ft)		20	483			
Watercourse slope, s (ft/ft)		0.06	0.027			
Average velocity, V (ft/s)		3.95	3.34			
$T_t = L / 3600 V$ (hr)		0.00	0.04	+		= <span style="border: 1px solid black; padding: 2px;">0.04</span> hr

### CHANNEL FLOW

	Segment ID					
Cross-sectional flow area, a (ft <sup>2</sup> )						
Wetted perimeter, Pw (ft)						
Hydraulic radius, r = a/Pw (ft)						
Channel slope, s (ft/ft)						
Manning's roughness coeff., n						
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00				
Flow length, L (ft)						
$T_t = L / 3600 V$ (hr)		0.00	+			= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.21 hr

= 12.6 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 101

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Woods/Brush				
Manning's roughness coeff., n		0.4				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.04				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.30	+			= <span style="border: 1px solid black; padding: 2px;">0.30</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III			
Surface Description (paved or unpaved)		unp.	pav.			
Flow Length, L (ft)		549	216			
Watercourse slope, s (ft/ft)		0.026	0.019			
Average velocity, V (ft/s)		2.60	2.80			
$T_t = L / 3600 V$ (hr)		0.06	0.02	+		= <span style="border: 1px solid black; padding: 2px;">0.08</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.38 hr

= 22.8 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 102

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		96				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.05				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.18	+			= <span style="border: 1px solid black; padding: 2px;">0.18</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		368				
Watercourse slope, s (ft/ft)		0.033				
Average velocity, V (ft/s)		3.69				
$T_t = L / 3600 V$ (hr)		0.03	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.03</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.21 hr

= 12.6 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 103

### SHEET FLOW

	Segment ID	I	
Surface Description (table 3-1)		Woods/Brush	
Manning's roughness coeff., n		0.4	
Flow Length, L (total L ≤ 100') (ft)		100	
Two-yr 24-hr rainfall, P2 (in)		2.89	
Land slope, s (ft/ft)		0.09	
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.21	
		+	
			= 0.21 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II			
Surface Description (paved or unpaved)		unp.			
Flow Length, L (ft)		188			
Watercourse slope, s (ft/ft)		0.016			
Average velocity, V (ft/s)		2.04			
$T_t = L / 3600 V$ (hr)		0.03			
		+		+	
					= 0.03 hr

### CHANNEL FLOW

	Segment ID	III	
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00	
Flow length, L (ft)		168	
$T_t = L / 3600 V$ (hr)		0.02	
		+	
			= 0.02 hr

Watershed or subarea  $T_c$  or  $T_t$  = 0.26 hr

= 15.6 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 104

### SHEET FLOW

	Segment ID	I						
Surface Description (table 3-1)		Grass						
Manning's roughness coeff., n		0.24						
Flow Length, L (total L ≤ 100') (ft)		50						
Two-yr 24-hr rainfall, P2 (in)		2.89						
Land slope, s (ft/ft)		0.08						
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.08	+					= <span style="border: 1px solid black; padding: 2px;">0.08</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II						
Surface Description (paved or unpaved)		pav.						
Flow Length, L (ft)		317						
Watercourse slope, s (ft/ft)		0.06						
Average velocity, V (ft/s)		4.98						
$T_t = L / 3600 V$ (hr)		0.02	+		+		+	= <span style="border: 1px solid black; padding: 2px;">0.02</span> hr

### CHANNEL FLOW

	Segment ID							
Cross-sectional flow area, a (ft <sup>2</sup> )								
Wetted perimeter, Pw (ft)								
Hydraulic radius, r = a/Pw (ft)								
Channel slope, s (ft/ft)								
Manning's roughness coeff., n								
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00						
Flow length, L (ft)								
$T_t = L / 3600 V$ (hr)		0.00	+					= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.10 hr

= 6.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 105

### SHEET FLOW

	Segment ID	I	
Surface Description (table 3-1)		Woods/Brush	
Manning's roughness coeff., n		0.4	
Flow Length, L (total L $\leq$ 100') (ft)		100	
Two-yr 24-hr rainfall, P2 (in)		2.89	
Land slope, s (ft/ft)		0.09	
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.21	
		+	
			= 0.21 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II			
Surface Description (paved or unpaved)		unp.			
Flow Length, L (ft)		432			
Watercourse slope, s (ft/ft)		0.073			
Average velocity, V (ft/s)		4.36			
$T_t = L / 3600 V$ (hr)		0.03			
		+		+	
					= 0.03 hr

### CHANNEL FLOW

	Segment ID		
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00	
Flow length, L (ft)			
$T_t = L / 3600 V$ (hr)		0.00	
		+	
			= [ ] hr

Watershed or subarea  $T_c$  or  $T_t$  = 0.24 hr

= 14.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 106

### SHEET FLOW

Segment ID	I			
Surface Description (table 3-1)	Grass			
Manning's roughness coeff., n	0.24			
Flow Length, L (total L ≤ 100') (ft)	76			
Two-yr 24-hr rainfall, P2 (in)	2.89			
Land slope, s (ft/ft)	0.09			
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)	0.11	+		= 0.11 hr

### SHALLOW CONCENTRATED FLOW

Segment ID	II			
Surface Description (paved or unpaved)	pav.			
Flow Length, L (ft)	340			
Watercourse slope, s (ft/ft)	0.018			
Average velocity, V (ft/s)	2.73			
$T_t = L / 3600 V$ (hr)	0.03	+		= 0.03 hr

### CHANNEL FLOW

Segment ID		
Cross-sectional flow area, a (ft <sup>2</sup> )		
Wetted perimeter, Pw (ft)		
Hydraulic radius, r = a/Pw (ft)		
Channel slope, s (ft/ft)		
Manning's roughness coeff., n		
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)	2.00	
Flow length, L (ft)		
$T_t = L / 3600 V$ (hr)	0.00	+

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.14 hr  
 = 8.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 107

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		92				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.02				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.23	+			= <span style="border: 1px solid black; padding: 2px;">0.23</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		21				
Watercourse slope, s (ft/ft)		0.033				
Average velocity, V (ft/s)		3.69				
$T_t = L / 3600 V$ (hr)		0.00	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.00</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.23 hr  
 = 13.8 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 108

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		74				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.15				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.09	+			= <span style="border: 1px solid black; padding: 2px;">0.09</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID					
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)						
Watercourse slope, s (ft/ft)		0.033				
Average velocity, V (ft/s)		3.69				
$T_t = L / 3600 V$ (hr)		0.00	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.00</span> hr

### CHANNEL FLOW

	Segment ID			
Cross-sectional flow area, a (ft <sup>2</sup> )				
Wetted perimeter, Pw (ft)				
Hydraulic radius, r = a/Pw (ft)				
Channel slope, s (ft/ft)				
Manning's roughness coeff., n				
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00		
Flow length, L (ft)				
$T_t = L / 3600 V$ (hr)		0.00	+	
				= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.09 hr

= 5.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 109

### SHEET FLOW

	Segment ID	I	
Surface Description (table 3-1)		Woods/Brush	
Manning's roughness coeff., n		0.4	
Flow Length, L (total L ≤ 100') (ft)		100	
Two-yr 24-hr rainfall, P2 (in)		2.89	
Land slope, s (ft/ft)		0.08	
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.22	
		+	
			= 0.22 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III		
Surface Description (paved or unpaved)		unp.	pav.		
Flow Length, L (ft)		748	22		
Watercourse slope, s (ft/ft)		0.054	0.01		
Average velocity, V (ft/s)		3.75	2.03		
$T_t = L / 3600 V$ (hr)		0.06	0.00		
		+	+	+	+
					= 0.06 hr

### CHANNEL FLOW

	Segment ID		
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00	
Flow length, L (ft)			
$T_t = L / 3600 V$ (hr)		0.00	
		+	
			= [ ] hr

Watershed or subarea  $T_c$  or  $T_t$  = 0.28 hr

= 16.8 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 110

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		60				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.12				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.08	+			= <span style="border: 1px solid black; padding: 2px;">0.08</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III			
Surface Description (paved or unpaved)		unp.	pav.			
Flow Length, L (ft)		61	47			
Watercourse slope, s (ft/ft)		0.36	0.01			
Average velocity, V (ft/s)		9.68	2.03			
$T_t = L / 3600 V$ (hr)		0.00	0.01	+		= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.09 hr

= 5.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 111

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.10				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.13	+			= <span style="border: 1px solid black; padding: 2px;">0.13</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		275				
Watercourse slope, s (ft/ft)		0.088				
Average velocity, V (ft/s)		4.79				
$T_t = L / 3600 V$ (hr)		0.02	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.02</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.15 hr

= 9.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 112

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		42				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.05				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.09	+			= <span style="border: 1px solid black; padding: 2px;">0.09</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		344				
Watercourse slope, s (ft/ft)		0.041				
Average velocity, V (ft/s)		4.12				
$T_t = L / 3600 V$ (hr)		0.02	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.02</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.11 hr  
 = 6.6 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 113

### SHEET FLOW

	Segment ID	I			
Surface Description (table 3-1)		Grass			
Manning's roughness coeff., n		0.24			
Flow Length, L (total L ≤ 100') (ft)		100			
Two-yr 24-hr rainfall, P2 (in)		2.89			
Land slope, s (ft/ft)		0.07			
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.15	+		= <span style="border: 1px solid black; padding: 2px;">0.15</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II					
Surface Description (paved or unpaved)		unp.					
Flow Length, L (ft)		448					
Watercourse slope, s (ft/ft)		0.09					
Average velocity, V (ft/s)		4.84					
$T_t = L / 3600 V$ (hr)		0.03	+		+		+
							= <span style="border: 1px solid black; padding: 2px;">0.03</span> hr

### CHANNEL FLOW

	Segment ID		
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00	
Flow length, L (ft)			
$T_t = L / 3600 V$ (hr)		0.00	+
			= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.18 hr

= 10.8 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 114

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.06				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.16	+			= <span style="border: 1px solid black; padding: 2px;">0.16</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		140				
Watercourse slope, s (ft/ft)		0.055				
Average velocity, V (ft/s)		3.78				
$T_t = L / 3600 V$ (hr)		0.01	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.17 hr  
 = 10.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 115

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100')	(ft)	49				
Two-yr 24-hr rainfall, P2	(in)	2.89				
Land slope, s	(ft/ft)	0.01				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$	(hr)	0.19	+			= <span style="border: 1px solid black; padding: 2px;">0.19</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L	(ft)	92				
Watercourse slope, s	(ft/ft)	0.022				
Average velocity, V	(ft/s)	3.02				
$T_t = L / 3600 V$	(hr)	0.01	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a	(ft <sup>2</sup> )				
Wetted perimeter, Pw	(ft)				
Hydraulic radius, r = a/Pw	(ft)				
Channel slope, s	(ft/ft)				
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$	(ft/s)	2.00			
Flow length, L	(ft)				
$T_t = L / 3600 V$	(hr)	0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.20 hr  
 = 12.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 116

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		75				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.03				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.18	+			= <span style="border: 1px solid black; padding: 2px;">0.18</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		127				
Watercourse slope, s (ft/ft)		0.031				
Average velocity, V (ft/s)		3.58				
$T_t = L / 3600 V$ (hr)		0.01	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.01</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.19 hr  
 = 11.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 117

### SHEET FLOW

	Segment ID	I	
Surface Description (table 3-1)		Woods/Brush	
Manning's roughness coeff., n		0.4	
Flow Length, L (total L ≤ 100') (ft)		100	
Two-yr 24-hr rainfall, P2 (in)		2.89	
Land slope, s (ft/ft)		0.03	
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.32	
		+	
			= 0.32 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II			
Surface Description (paved or unpaved)		unp.			
Flow Length, L (ft)		427			
Watercourse slope, s (ft/ft)		0.057			
Average velocity, V (ft/s)		3.85			
$T_t = L / 3600 V$ (hr)		0.03			
		+		+	
					= 0.03 hr

### CHANNEL FLOW

	Segment ID		
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00	
Flow length, L (ft)			
$T_t = L / 3600 V$ (hr)		0.00	
		+	
			= [ ] hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.35 hr

= 21.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 118

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.01				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.33	+			= <span style="border: 1px solid black; padding: 2px;">0.33</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		470				
Watercourse slope, s (ft/ft)		0.053				
Average velocity, V (ft/s)		3.71				
$T_t = L / 3600 V$ (hr)		0.04	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.04</span> hr

### CHANNEL FLOW

	Segment ID	III			
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)		467			
$T_t = L / 3600 V$ (hr)		0.06	+		
					= <span style="border: 1px solid black; padding: 2px;">0.06</span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.43 hr

= 25.8 min



## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 120

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Cultivated Soil				
Manning's roughness coeff., n		0.17				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.01				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.25	+			= <span style="border: 1px solid black; padding: 2px;">0.25</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		1582				
Watercourse slope, s (ft/ft)		0.015				
Average velocity, V (ft/s)		1.98				
$T_t = L / 3600 V$ (hr)		0.22	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.22</span> hr

### CHANNEL FLOW

	Segment ID	III			
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)		1261			
$T_t = L / 3600 V$ (hr)		0.18	+		= <span style="border: 1px solid black; padding: 2px;">0.18</span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.65 hr

= 39.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 121

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.06				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.16	+			= <span style="border: 1px solid black; padding: 2px;">0.16</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		421				
Watercourse slope, s (ft/ft)		0.074				
Average velocity, V (ft/s)		4.39				
$T_t = L / 3600 V$ (hr)		0.03	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.03</span> hr

### CHANNEL FLOW

	Segment ID	III			
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.19 hr

= 11.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 128

### SHEET FLOW

	Segment ID	I	
Surface Description (table 3-1)		Cultivated Soil	
Manning's roughness coeff., n		0.17	
Flow Length, L (total L ≤ 100') (ft)		100	
Two-yr 24-hr rainfall, P2 (in)		2.89	
Land slope, s (ft/ft)		0.01	
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.25	
		+	
			= 0.25 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III	IV	
Surface Description (paved or unpaved)		unp.	unp.	unp.	
Flow Length, L (ft)		205	396	363	
Watercourse slope, s (ft/ft)		0.024	0.0025	0.0055	
Average velocity, V (ft/s)		2.50	0.81	1.20	
$T_t = L / 3600 V$ (hr)		0.02	0.14	0.08	
		+	+	+	
					= 0.24 hr

### CHANNEL FLOW

	Segment ID	V	
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00	
Flow length, L (ft)		1042	
$T_t = L / 3600 V$ (hr)		0.14	
		+	
			= 0.14 hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.63 hr

= 37.8 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 129

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		88				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.07				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.14	+			= <span style="border: 1px solid black; padding: 2px;">0.14</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		pav.				
Flow Length, L (ft)		39				
Watercourse slope, s (ft/ft)		0.025				
Average velocity, V (ft/s)		3.21				
$T_t = L / 3600 V$ (hr)		0.00	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.00</span> hr

### CHANNEL FLOW

	Segment ID	V			
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.14 hr

= 8.4 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 130

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.06				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.16	+			= <span style="border: 1px solid black; padding: 2px;">0.16</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III			
Surface Description (paved or unpaved)		unp.	pav.			
Flow Length, L (ft)		81	83			
Watercourse slope, s (ft/ft)		0.055	0.024			
Average velocity, V (ft/s)		3.78	3.15			
$T_t = L / 3600 V$ (hr)		0.01	0.01	+		= <span style="border: 1px solid black; padding: 2px;">0.02</span> hr

### CHANNEL FLOW

	Segment ID	V			
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.18 hr  
 = 10.8 min

# Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 131

## SHEET FLOW

	Segment ID	I	
Surface Description (table 3-1)		Woods/Brush	
Manning's roughness coeff., n		0.4	
Flow Length, L (total L ≤ 100') (ft)		100	
Two-yr 24-hr rainfall, P2 (in)		2.89	
Land slope, s (ft/ft)		0.03	
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.32	
		+	
			= 0.32 hr

## SHALLOW CONCENTRATED FLOW

	Segment ID	II			
Surface Description (paved or unpaved)		unp.			
Flow Length, L (ft)		13			
Watercourse slope, s (ft/ft)		0.06			
Average velocity, V (ft/s)		3.95			
$T_t = L / 3600 V$ (hr)		0.00			
		+		+	
					= 0.00 hr

## CHANNEL FLOW

	Segment ID	III	
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00	
Flow length, L (ft)		700	
$T_t = L / 3600 V$ (hr)		0.10	
		+	
			= 0.10 hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.42 hr

= 25.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 132

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Woods/Brush				
Manning's roughness coeff., n		0.4				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.02				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.38	+			= 0.38 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II	III			
Surface Description (paved or unpaved)		unp.	pav.			
Flow Length, L (ft)		283	371			
Watercourse slope, s (ft/ft)		0.061	0.03			
Average velocity, V (ft/s)		3.98	3.52			
$T_t = L / 3600 V$ (hr)		0.02	0.03	+		= 0.05 hr

### CHANNEL FLOW

	Segment ID			
Cross-sectional flow area, a (ft <sup>2</sup> )				
Wetted perimeter, Pw (ft)				
Hydraulic radius, r = a/Pw (ft)				
Channel slope, s (ft/ft)				
Manning's roughness coeff., n				
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00		
Flow length, L (ft)				
$T_t = L / 3600 V$ (hr)		0.00	+	

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.43 hr  
 = 25.8 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 133

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Woods/Brush				
Manning's roughness coeff., n		0.4				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.03				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.32	+			= 0.32 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		283				
Watercourse slope, s (ft/ft)		0.1				
Average velocity, V (ft/s)		5.10				
$T_t = L / 3600 V$ (hr)		0.02	+		+	+
						= 0.02 hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= [ ] hr

**Watershed or subarea  $T_c$  or  $T_t$**  = **0.34** hr  
 = **20.4** min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 134

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Grass				
Manning's roughness coeff., n		0.24				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.03				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.21	+			= <span style="border: 1px solid black; padding: 2px;">0.21</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		618				
Watercourse slope, s (ft/ft)		0.026				
Average velocity, V (ft/s)		2.60				
$T_t = L / 3600 V$ (hr)		0.07	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.07</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.28 hr  
 = 16.8 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 135

### SHEET FLOW

	Segment ID	I	II	
Surface Description (table 3-1)		Woods/Brush	Grass	
Manning's roughness coeff., n		0.4	0.24	
Flow Length, L (total L ≤ 100') (ft)		75	25	
Two-yr 24-hr rainfall, P2 (in)		2.89	2.89	
Land slope, s (ft/ft)		0.09	0.04	
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.16	0.06	= 0.22 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	III			
Surface Description (paved or unpaved)		unp.			
Flow Length, L (ft)		515			
Watercourse slope, s (ft/ft)		0.049			
Average velocity, V (ft/s)		3.57			
$T_t = L / 3600 V$ (hr)		0.04			= 0.04 hr

### CHANNEL FLOW

	Segment ID			
Cross-sectional flow area, a (ft <sup>2</sup> )				
Wetted perimeter, Pw (ft)				
Hydraulic radius, r = a/Pw (ft)				
Channel slope, s (ft/ft)				
Manning's roughness coeff., n				
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00		
Flow length, L (ft)				
$T_t = L / 3600 V$ (hr)		0.00		= [ ] hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.26 hr

= 15.6 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 136

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Woods/Brush				
Manning's roughness coeff., n		0.4				
Flow Length, L (total L ≤ 100') (ft)		75				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.07				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.19	+			= <span style="border: 1px solid black; padding: 2px;">0.19</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		521				
Watercourse slope, s (ft/ft)		0.077				
Average velocity, V (ft/s)		4.48				
$T_t = L / 3600 V$ (hr)		0.03	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.03</span> hr

### CHANNEL FLOW

	Segment ID			
Cross-sectional flow area, a (ft <sup>2</sup> )				
Wetted perimeter, Pw (ft)				
Hydraulic radius, r = a/Pw (ft)				
Channel slope, s (ft/ft)				
Manning's roughness coeff., n				
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00		
Flow length, L (ft)				
$T_t = L / 3600 V$ (hr)		0.00	+	
				= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.22 hr

= 13.2 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 137

### SHEET FLOW

	Segment ID	I	II	
Surface Description (table 3-1)		Grass	Grass	
Manning's roughness coeff., n		0.24	0.24	
Flow Length, L (total L ≤ 100') (ft)		20	80	
Two-yr 24-hr rainfall, P2 (in)		2.89	2.89	
Land slope, s (ft/ft)		0.01	0.14	
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.09	0.10	= 0.19 hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	III			
Surface Description (paved or unpaved)		unp.			
Flow Length, L (ft)		264			
Watercourse slope, s (ft/ft)		0.137			
Average velocity, V (ft/s)		5.97			
$T_t = L / 3600 V$ (hr)		0.01			= 0.01 hr

### CHANNEL FLOW

	Segment ID		
Cross-sectional flow area, a (ft <sup>2</sup> )			
Wetted perimeter, Pw (ft)			
Hydraulic radius, r = a/Pw (ft)			
Channel slope, s (ft/ft)			
Manning's roughness coeff., n			
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00	
Flow length, L (ft)			
$T_t = L / 3600 V$ (hr)		0.00	= [ ] hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.20 hr

= 12.0 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 138

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Woods/Brush				
Manning's roughness coeff., n		0.4				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.01				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.50	+			= <span style="border: 1px solid black; padding: 2px;">0.50</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		1048				
Watercourse slope, s (ft/ft)		0.05				
Average velocity, V (ft/s)		3.61				
$T_t = L / 3600 V$ (hr)		0.08	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.08</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.58 hr  
 = 34.8 min

## Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ )

Project: Shorewood Forest Stormwater Infrastructure Study  
 Location: Porter County, IN  
 File: TimeofConcentration.xlsx

By: LJS  
 Checked: JSG

Date: 12/21/2020  
 Date: 12/22/2020

Present / Developed  
 $T_c$  through subarea

Subbasin 139

### SHEET FLOW

	Segment ID	I				
Surface Description (table 3-1)		Woods/Brush				
Manning's roughness coeff., n		0.4				
Flow Length, L (total L ≤ 100') (ft)		100				
Two-yr 24-hr rainfall, P2 (in)		2.89				
Land slope, s (ft/ft)		0.03				
$T_t = (0.007(nL)^{0.8}) / (P_2^{0.5} s^{0.4})$ (hr)		0.34	+			= <span style="border: 1px solid black; padding: 2px;">0.34</span> hr

### SHALLOW CONCENTRATED FLOW

	Segment ID	II				
Surface Description (paved or unpaved)		unp.				
Flow Length, L (ft)		815				
Watercourse slope, s (ft/ft)		0.083				
Average velocity, V (ft/s)		4.65				
$T_t = L / 3600 V$ (hr)		0.05	+		+	+
						= <span style="border: 1px solid black; padding: 2px;">0.05</span> hr

### CHANNEL FLOW

	Segment ID				
Cross-sectional flow area, a (ft <sup>2</sup> )					
Wetted perimeter, Pw (ft)					
Hydraulic radius, r = a/Pw (ft)					
Channel slope, s (ft/ft)					
Manning's roughness coeff., n					
$V = (1.49 r^{0.667} s^{0.5}) / n$ (ft/s)		2.00			
Flow length, L (ft)					
$T_t = L / 3600 V$ (hr)		0.00	+		= <span style="border: 1px solid black; padding: 2px;"></span> hr

**Watershed or subarea  $T_c$  or  $T_t$**  = 0.39 hr  
 = 23.4 min