

Section 4 – Supplemental Calculations

Storm Sewer Calculations

**Homestead Properties, LLC
Windsor at Hillview
Eastview Drive and Upper Shelbyville Road
City of Franklin, Indiana**

**Submitted:
November 3, 2022**

By:



**CrossRoad Engineers, PC
115 N. 17th Ave.
Beech Grove, IN 46107
Phone No.: (317) 780-1555
Email: gilko@crossroadengineers.com**

Section 1: Pipe Sizing Calculations

Pipe Sizing Summary

The Rational Method and Manning's Equation were used to size the pipes to convey the peak runoff from the 10-year storm. The TR-55 Method was used to calculate the Times of Concentration. The Inlet Basin Map, pipe sizing calculations, and time of concentration worksheets are included within this section. Additionally, the inlet basin maps for the previous three (3) sections of the subdivision are also included for reference of how those sections were designed to accommodate portions of the Section 4 development.

Hillview - Section 4 Pipe Sizing Calculations																												
Structure	Pipe Data						Inlet Watershed Data												Contributing Watershed Data						Pipe Analysis			
	Downstream Structure	Length (ft)	Pipe Diameter (in)	Pipe Material	Invert Slope (%)	Mannings Number n	Catchment Area (ac) Impervious	Runoff Coefficient C Impervious	Catchment Area (ac) Grass	Runoff Coefficient C Grass	Catchment Area (ac) Residence	Runoff Coefficient C Residence	Total Area A (ac)	Composite Coefficient C	Tc (min)	Rainfall Intensity (i) in/hr	Manual Input Flow Q (cfs)	Q=CiA (cfs)	Total Area A (ac)	Runoff Coefficient C	Time in Upstream Pipe (min)	Total Time of Concentration Tc (min)	Intensity I (in/hr)	Total Pipe Flow (cfs)	Pipe Capacity Qmax (cfs)	Pipe Velocity (ft/s)	% of Full Flow Capacity	
Str. 202	Str. 203	26	12	RCP	0.40	0.012	0.086	0.850	0.033	0.20	0.223	0.45	0.343	0.53	8.94	5.80	--	1.04	0.343	0.526	0.50	15.15	4.54	0.82	2.44	3.11	33.51%	
Str. 203	Str. 213	150	15	RCP	0.42	0.012	0.086	0.850	0.039	0.20	0.155	0.45	0.280	0.54	9.62	5.59	--	0.84	1.260	0.490	0.14	15.29	4.52	2.79	4.53	3.70	61.60%	
Str. 204	Str. 202	133	12	RCP	0.82	0.012	0.000	0.850	0.000	0.20	0.637	0.45	0.637	0.45	14.65	4.62	--	1.32	0.637	0.450	N/A	14.65	4.62	1.32	3.49	4.45	37.90%	
Str. 205	Str. 206	26	12	RCP	0.40	0.012	0.108	0.850	0.069	0.20	0.251	0.45	0.428	0.51	8.06	6.07	0.11	1.44	0.428	0.511	N/A	8.06	6.07	1.33	2.44	3.11	54.37%	
Str. 206	Str. 213	16	15	RCP	0.40	0.012	0.106	0.850	0.071	0.20	0.237	0.45	0.414	0.51	11.25	5.25	0.00	1.11	0.842	0.510	0.14	8.20	6.02	2.59	4.42	3.61	58.50%	
Str. 207	Str. 208	26	12	RCP	0.40	0.012	0.061	0.850	0.024	0.20	0.267	0.45	0.352	0.50	10.19	5.44	--	0.96	0.352	0.503	N/A	10.19	5.44	0.96	2.44	3.11	39.44%	
Str. 208	Str. 209	16	12	RCP	0.40	0.012	0.062	0.850	0.023	0.20	0.094	0.45	0.179	0.56	7.61	6.20	--	0.62	0.530	0.521	0.14	10.33	5.42	1.50	2.44	3.11	61.33%	
Str. 209	Str. 212	108	12	RCP	0.40	0.012	NO INLET												0.530	0.521	0.02	10.35	5.41	1.49	2.44	3.11	61.22%	
Str. 210	Str. 211	26	12	RCP	0.40	0.012	0.043	0.850	0.017	0.20	0.167	0.45	0.227	0.51	8.57	5.91	--	0.68	0.227	0.508	N/A	8.57	5.91	0.68	2.44	3.11	27.98%	
Str. 211	Str. 212	17	12	RCP	0.70	0.012	0.042	0.850	0.018	0.20	0.111	0.45	0.171	0.52	6.45	6.55	--	0.58	0.398	0.514	0.14	8.71	5.87	1.20	3.23	4.11	37.17%	
Str. 212	Str. 213	125	15	RCP	0.30	0.012	NO INLET												0.928	0.518	0.57	10.92	5.31	2.55	3.83	3.12	66.63%	
Str. 213	Outlet	175	18	RCP	0.40	0.012	NO INLET												3.030	0.504	0.02	8.22	4.50	6.87	7.20	4.07	95.47%	
Str. 214	Str. 215	26	12	RCP	0.40	0.012	0.070	0.850	0.031	0.20	0.236	0.45	0.337	0.51	10.53	5.38	--	0.93	0.337	0.510	N/A	10.53	5.38	0.93	2.44	3.11	37.91%	
Str. 215	Str. 216	17	12	RCP	0.40	0.012	0.068	0.850	0.029	0.20	0.156	0.45	0.253	0.53	8.56	5.91	--	0.79	0.590	0.518	0.14	10.67	5.36	1.64	2.44	3.11	67.20%	
Str. 216	Str. 231A	116	12	RCP	0.40	0.012	NO INLET												0.590	0.518	0.02	10.69	5.36	1.64	2.44	3.11	67.20%	
Str. 217	Str. 218	45	12	RCP	0.40	0.012	0.048	0.850	0.057	0.20	0.000	0.45	0.105	0.50	6.36	6.58	--	0.34	0.105	0.496	N/A	6.36	6.58	0.34	2.44	3.11	14.07%	
Str. 218	Str. 219	45	12	RCP	0.40	0.012	0.064	0.850	0.035	0.20	0.235	0.45	0.334	0.50	12.68	4.98	--	0.83	0.439	0.499	N/A	12.68	4.98	1.09	2.44	3.11	44.73%	
Str. 219	Str. 220	17	15	RCP	0.40	0.012	0.150	0.850	0.105	0.20	0.513	0.45	0.768	0.49	12.90	4.94	--	1.87	1.207	0.496	0.24	12.92	4.94	2.96	4.43	3.61	66.73%	
Str. 220	Str. 224	213	15	RCP	0.40	0.012	NO INLET												1.207	0.496	0.02	12.94	4.93	2.95	4.43	3.61	66.59%	
Str. 222	Str. 223	26	12	RCP	0.30	0.012	0.103	0.850	0.067	0.20	0.288	0.45	0.458	0.50	10.68	5.35	--	1.23	0.458	0.503	0.82	10.68	5.35	1.23	2.11	2.69	58.47%	
Str. 223	Str. 224	17	15	RCP	0.30	0.012	0.090	0.850	0.062	0.20	0.166	0.45	0.318	0.51	9.94	5.50	--	0.90	0.776	0.508	0.16	10.84	5.32	2.10	3.83	3.12	54.74%	
Str. 224	Str. 225	16	18	RCP	0.30	0.012	NO INLET												1.983	0.500	0.02	10.86	5.31	5.27	6.23	3.53	84.59%	
Str. 225	Str. 237	173	18	RCP	0.30	0.012	NO INLET												1.983	0.500	0.14	11.00	5.29	5.25	6.23	3.53	84.27%	
Str. 226	Str. 227	26	12	RCP	0.40	0.012	0.081	0.850	0.049	0.20	0.315	0.45	0.445	0.50	11.20	5.26	0.29	1.45	0.445	0.496	N/A	11.20	5.26	1.45	2.44	3.11	59.41%	
Str. 227	Str. 228	20	12	RCP	0.40	0.012	0.080	0.850	0.051	0.20	0.117	0.45	0.248	0.53	9.58	5.61	--	0.73	0.693	0.507	0.14	11.34	5.23	1.84	2.44	3.11	75.33%	
Str. 228	Str. 231	162	15	RCP	0.40	0.012	NO INLET												1.138	0.503	0.02	11.36	5.22	2.99	4.42	3.61	67.56%	
Str. 229	Str. 230	26	12	RCP	0.40	0.012	0.134	0.850	0.082	0.20	0.302	0.45	0.518	0.51	11.46	5.21	0.54	1.93	0.518	0.514	N/A	11.46	5.21	1.93	2.44	3.11	78.96%	
Str. 230	Str. 231	17	15	RCP	0.50	0.012	0.131	0.850	0.085	0.20	0.210	0.45	0.426	0.52	8.35	5.98	--	1.33	0.944	0.518	0.14	11.60	5.18	2.53	4.42	3.61	57.30%	
Str. 231A	Outlet	169	18	RCP	0.50	0.012	NO INLET												2.673	0.511	0.14	11.82	5.14	7.86	8.05	4.55	97.59%	
Str. 232	Str. 233	26	12	RCP	0.40	0.012	0.035	0.850	0.019	0.20	0.113	0.45	0.167	0.51	9.84	5.53	--	0.47	0.167	0.505	N/A	9.84	5.53	0.47	2.44	3.11	19.12%	
Str. 233	Str. 234	17	12	RCP	0.40	0.012	0.019	0.850	0.009	0.20	0.073	0.45	0.101	0.50	8.94	5.80	--	0.29	0.268	0.504	0.14	9.98	5.49	0.74	2.44	3.11	30.40%	
Str. 234	Str. 235	85	30	RCP	0.39	0.012	NO INLET												--	--	--	--	--	15.56	27.75	5.65	56.07%	
Str. 235	Str. 236	146	30	RCP	0.39	0.012	NO INLET												0.268	0.504	0.09	10.07	5.47	16.30	27.75	5.65	58.74%	
Str. 236	Str. 237	90	30	RCP	0.53	0.012	NO INLET												0.268	0.504	0.43	10.50	5.39	16.29	32.35	6.59	50.35%	
Str. 237	Outlet	28	30	RCP	0.39	0.012	NO INLET												2.251	0.501	0.82	11.82	3.68	19.71	27.75	5.65	71.02%	
Str. 238	Str. 239	26	12	RCP	0.40	0.012	0.044	0.850	0.031	0.20	0.134	0.45	0.209	0.50	10.46	5.39	--	0.56	0.209	0.497	N/A	10.46	5.39	0.56	2.44	3.11	22.97%	
Str. 239	Str. 240	4	12	RCP	0.40	0.012	0.034	0.850	0.029	0.20	0.100	0.45	0.163	0.49	9.25	5.71	--	0.45	0.372	0.494	0.14	10.60	5.37	0.99	2.44	3.11	40.41%	
Str. 240	Str. 243	150	12	RCP	0.40	0.012	NO INLET												0.372	0.494	0.02	10.62	5.37	0.99	2.44	3.11	40.41%	
Str. 241	Str. 242	26	12	RCP	0.40	0.012	0.132	0.850	0.084	0.20	0.303	0.45	0.519	0.51	11.09	5.28	--	1.40	0.519	0.511	N/A	11.09	5.28	1.40	2.44	3.11	57.39%	
Str. 242	Str. 243	4	15	RCP	0.40	0.012	0.130	0.850	0.082	0.20	0.289	0.45	0.501	0.51	10.94	5.31	--	1.36	1.020	0.512	0.14	11.23	5.25	2.74	4.42	3.61	62.04%	
Str. 243	Outlet	174	15	RCP	0.40	0.012	NO INLET												1.392	0.507	0.02	11.25	5.25	3.71	4.42	3.61	83.85%	
Str. 244	Str. 245	26	12	RCP	0.40	0.012	0.054	0.850	0.027	0.20	0.088	0.45	0.169	0.54	9.44	5.65	--	0.51	0.									

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #202

Sheet Flow

1. Surface Description	grass	pvmnt	pvmnt
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L<= 100 ft	44.21 ft.	55.79 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0190 ft./ft.	0.0083 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) ($Tt = [0.007(nL)^{0.8}]/[P2^{0.5}s^{0.4}]$)	0.106 hr	0.020 hr	0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	124.60 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0083 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) ($Vp = 20.3282(s)^{0.5}$) ($Vup = 16.1345(s)^{0.5}$)	1.470 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) ($Tt = L/3600V$)	0.024 hr	0.000 hr	0.000 hr

Watershed or
Subarea Tc or Tt =

0.149 hr

or

8.94 min

Channel Flow

12. Cross Sectional Flow Area, (a)	9.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	8.54 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) ($r = a/Pw$)	1.054 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.170	0.027	0.027
17. Velocity, (V) ($V = [1.49*r^{0.67}*s^{0.5}]/n$)	0.908 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	0.000 hr	0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #203

Sheet Flow

1. Surface Description	grass	pvmnt	pvmnt
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L<= 100 ft	64.22 ft.	33.64 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0175 ft./ft.	0.0083 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) ($Tt = [0.007(nL)^{0.8}]/[P2^{0.5}s^{0.4}]$)	0.147 hr	+ 0.013 hr	+ 0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0083 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) ($Vp = 20.3282(s)^{0.5}$) ($Vup = 16.1345(s)^{0.5}$)	1.470 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	+ 0.000 hr	+ 0.000 hr

Watershed or
Subarea Tc or Tt =

0.160 hr

or

9.62 min

Channel Flow

12. Cross Sectional Flow Area, (a)	9.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	8.54 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) ($r = a/Pw$)	1.054 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.170	0.027	0.027
17. Velocity, (V) ($V = [1.49*r^{0.67}*s^{0.5}]/n$)	0.908 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	+ 0.000 hr	+ 0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #204

Sheet Flow

1. Surface Description	grass	pvm	pvm
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L<= 100 ft	82.72 ft.	0.00 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0450 ft./ft.	0.0083 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) (Tt = [0.007(nL)^0.8]/[P2^0.5*s^0.4])	0.123 hr	0.000 hr	0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0083 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) (Vp = 20.3282(s)^0.5) (Vup = 16.1345(s)^0.5)	1.470 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) (Tt = L/3600V)	0.000 hr	0.000 hr	0.000 hr

Watershed or
Subarea Tc or Tt =

0.244 hr

or

14.65 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) (r = a/Pw)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) (V = [1.49*r^0.67*s^0.5]/n)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	196.45 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) (Tt = L/3600V)	0.121 hr	0.000 hr	0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #205

Sheet Flow

1. Surface Description	grass	pvmr	pvmr
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L <= 100 ft	44.18 ft.	55.82 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0270 ft./ft.	0.0083 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) ($Tt = [0.007(nL)^{0.8}]/[P2^{0.5}s^{0.4}]$)	0.092 hr	+ 0.020 hr	+ 0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	120.35 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0083 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) ($Vp = 20.3282(s)^{0.5}$) ($Vup = 16.1345(s)^{0.5}$)	1.470 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) ($Tt = L/3600V$)	0.023 hr	+ 0.000 hr	+ 0.000 hr

Watershed or
Subarea Tc or Tt =

0.134 hr

or

8.06 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) ($r = a/Pw$)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) ($V = [1.49r^{0.67}s^{0.5}]/n$)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	+ 0.000 hr	+ 0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: **Hillview - Section 3**

Designer: **DJM**

Date: **1/26/2018**

Scenario/Structure: **Str. #206**

Sheet Flow

1. Surface Description	grass	pvm	pvm
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L<= 100 ft	75.99 ft.	24.01 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0210 ft./ft.	0.0083 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) ($Tt = [0.007(nL)^{0.8}]/[P2^{0.5}s^{0.4}]$)	0.156 hr	+ 0.010 hr	+ 0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	110.61 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0083 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) ($Vp = 20.3282(s)^{0.5}$) ($Vup = 16.1345(s)^{0.5}$)	1.470 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) ($Tt = L/3600V$)	0.021 hr	+ 0.000 hr	+ 0.000 hr

Watershed or
Subarea Tc or Tt =

0.187 hr

or

11.25 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) ($r = a/Pw$)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) ($V = [1.49r^{0.67}s^{0.5}]/n$)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	+ 0.000 hr	+ 0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #207

Sheet Flow

1. Surface Description	grass	pvmr	pvmr
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L<= 100 ft	67.70 ft.	32.30 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0250 ft./ft.	0.0065 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) ($Tt = [0.007(nL)^{0.8}]/[P2^{0.5}s^{0.4}]$)	0.133 hr	+ 0.014 hr	+ 0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	106.10 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0065 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) ($Vp = 20.3282(s)^{0.5}$) ($Vup = 16.1345(s)^{0.5}$)	1.301 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) ($Tt = L/3600V$)	0.023 hr	+ 0.000 hr	+ 0.000 hr

Watershed or
Subarea Tc or Tt =

0.170 hr

or

10.19 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) ($r = a/Pw$)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) ($V = [1.49*r^{0.67}*s^{0.5}]/n$)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	+ 0.000 hr	+ 0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #208

Sheet Flow

1. Surface Description	grass	pvm	pvm
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L<= 100 ft	39.24 ft.	60.76 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0220 ft./ft.	0.0065 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) (Tt = [0.007(nL)^0.8]/[P2^0.5*s^0.4])	0.091 hr	+ 0.023 hr	+ 0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	60.20 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0065 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) (Vp = 20.3282(s)^0.5) (Vup = 16.1345(s)^0.5)	1.301 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) (Tt = L/3600V)	0.013 hr	+ 0.000 hr	+ 0.000 hr

Watershed or
Subarea Tc or Tt =

0.127 hr

or

7.61 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) (r = a/Pw)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) (V = [1.49*r^0.67*s^0.5]/n)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) (Tt = L/3600V)	0.000 hr	+ 0.000 hr	+ 0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #210

Sheet Flow

1. Surface Description	grass	pvmnt	pvmnt
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L<= 100 ft	64.43 ft.	35.57 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0310 ft./ft.	0.0065 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) ($Tt = [0.007(nL)^{0.8}]/[P2^{0.5}s^{0.4}]$)	0.117 hr	+	0.015 hr + 0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	48.19 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0065 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) ($Vp = 20.3282(s)^{0.5}$) ($Vup = 16.1345(s)^{0.5}$)	1.301 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) ($Tt = L/3600V$)	0.010 hr	+	0.000 hr + 0.000 hr

Watershed or
Subarea Tc or Tt =

0.143 hr

or

8.57 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) ($r = a/Pw$)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) ($V = [1.49*r^{0.67}*s^{0.5}]/n$)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	+	0.000 hr + 0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #211

Sheet Flow

1. Surface Description	grass	pvmr	pvmr
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L <= 100 ft	41.94 ft.	58.06 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0320 ft./ft.	0.0065 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) ($Tt = [0.007(nL)^{0.8}]/[P2^{0.5}s^{0.4}]$)	0.082 hr	0.023 hr	0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	13.26 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0065 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) ($Vp = 20.3282(s)^{0.5}$) ($Vup = 16.1345(s)^{0.5}$)	1.301 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) ($Tt = L/3600V$)	0.003 hr	0.000 hr	0.000 hr

Watershed or
Subarea Tc or Tt =

0.108 hr

or

6.45 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) ($r = a/Pw$)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) ($V = [1.49*r^{0.67}*s^{0.5}]/n$)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	0.000 hr	0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #214

Sheet Flow

1. Surface Description	grass	pvmnt	pvmnt
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L<= 100 ft	63.38 ft.	36.62 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0180 ft./ft.	0.0109 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) ($Tt = [0.007(nL)^{0.8}]/[P2^{0.5}s^{0.4}]$)	0.144 hr	+	0.013 hr + 0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	114.57 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0109 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) ($Vp = 20.3282(s)^{0.5}$) ($Vup = 16.1345(s)^{0.5}$)	1.684 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) ($Tt = L/3600V$)	0.019 hr	+	0.000 hr + 0.000 hr

Watershed or
Subarea Tc or Tt =

0.175 hr

or

10.53 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) ($r = a/Pw$)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) ($V = [1.49*r^{0.67}s^{0.5}]/n$)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	+	0.000 hr + 0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #215

Sheet Flow

1. Surface Description	grass	pvm	pvm
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L<= 100 ft	43.51 ft.	56.49 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0165 ft./ft.	0.0109 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) (Tt = [0.007(nL)^0.8]/[P2^0.5*s^0.4])	0.110 hr	+ 0.018 hr	+ 0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	87.65 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0109 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) (Vp = 20.3282(s)^0.5) (Vup = 16.1345(s)^0.5)	1.684 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) (Tt = L/3600V)	0.014 hr	+ 0.000 hr	+ 0.000 hr

Watershed or
Subarea Tc or Tt =

0.143 hr

or

8.56 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) (r = a/Pw)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) (V = [1.49*r^0.67*s^0.5]/n)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) (Tt = L/3600V)	0.000 hr	+ 0.000 hr	+ 0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #217

Sheet Flow

1. Surface Description	grass	pvmr	pvmr
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L <= 100 ft	24.13 ft.	75.87 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0150 ft./ft.	0.0060 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) ($Tt = [0.007(nL)^{0.8}]/[P2^{0.5} \cdot s^{0.4}]$)	0.071 hr	+	0.029 hr + 0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	25.70 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0060 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) ($Vp = 20.3282(s)^{0.5}$) ($Vup = 16.1345(s)^{0.5}$)	1.250 ft/s	2.748 ft/s	1.250 ft/s
11. Travel Time, (Tt) ($Tt = L/3600V$)	0.006 hr	+	0.000 hr + 0.000 hr

Watershed or
Subarea Tc or Tt =

0.106 hr

or

6.36 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) ($r = a/Pw$)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) ($V = [1.49 \cdot r^{0.67} \cdot s^{0.5}]/n$)	0.452 ft/s	16.136 ft/s	12.769 ft/s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	+	0.000 hr + 0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #218

Sheet Flow

1. Surface Description	grass	pvmt	pvmt
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L <= 100 ft	72.39 ft.	27.61 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0145 ft./ft.	0.0060 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) ($Tt = [0.007(nL)^{0.8}]/[P2^{0.5}s^{0.4}]$)	0.175 hr	+ 0.013 hr	+ 0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	107.69 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0060 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) ($Vp = 20.3282(s)^{0.5}$) ($Vup = 16.1345(s)^{0.5}$)	1.250 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) ($Tt = L/3600V$)	0.024 hr	+ 0.000 hr	+ 0.000 hr

Watershed or
Subarea Tc or Tt =

0.211 hr

or

12.68 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) ($r = a/Pw$)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) ($V = [1.49*r^{0.67}s^{0.5}]/n$)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	+ 0.000 hr	+ 0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #219

Sheet Flow

1. Surface Description	grass	pvm	pvm
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L<= 100 ft	66.28 ft.	33.72 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0145 ft./ft.	0.0090 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) ($Tt = [0.007(nL)^{0.8}]/[P2^{0.5}s^{0.4}]$)	0.163 hr	+ 0.013 hr	+ 0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	218.07 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0090 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) ($Vp = 20.3282(s)^{0.5}$) ($Vup = 16.1345(s)^{0.5}$)	1.531 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) ($Tt = L/3600V$)	0.040 hr	+ 0.000 hr	+ 0.000 hr

Watershed or
Subarea Tc or Tt =

0.215 hr

or

12.90 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) ($r = a/Pw$)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) ($V = [1.49*r^{0.67}*s^{0.5}]/n$)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	+ 0.000 hr	+ 0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #221

Sheet Flow

1. Surface Description	grass	pvmnt	pvmnt
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L<= 100 ft	73.75 ft.	0.00 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0210 ft./ft.	0.0090 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) (Tt = [0.007(nL)^0.8]/[P2^0.5*s^0.4])	0.153 hr	0.000 hr	0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0090 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) (Vp = 20.3282(s)^0.5) (Vup = 16.1345(s)^0.5)	1.531 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) (Tt = L/3600V)	0.000 hr	0.000 hr	0.000 hr

Watershed or
Subarea Tc or Tt =

0.367 hr

or

22.00 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) (r = a/Pw)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) (V = [1.49*r^0.67*s^0.5]/n)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	348.29 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) (Tt = L/3600V)	0.214 hr	0.000 hr	0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #222

Sheet Flow

1. Surface Description	grass	pvm	pvm
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L <= 100 ft	53.29 ft.	46.71 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0200 ft./ft.	0.0060 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) (Tt = [0.007(nL)^0.8]/[P2^0.5*s^0.4])	0.120 hr	+ 0.020 hr	+ 0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	172.33 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0060 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) (Vp = 20.3282(s)^0.5) (Vup = 16.1345(s)^0.5)	1.250 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) (Tt = L/3600V)	0.038 hr	+ 0.000 hr	+ 0.000 hr

Watershed or
Subarea Tc or Tt =

0.178 hr

or

10.68 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) (r = a/Pw)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) (V = [1.49*r^0.67*s^0.5]/n)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) (Tt = L/3600V)	0.000 hr	+ 0.000 hr	+ 0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #223

Sheet Flow

1. Surface Description	grass	pvm	pvm
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L <= 100 ft	49.34 ft.	50.66 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0170 ft./ft.	0.0060 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) ($Tt = [0.007(nL)^{0.8}]/[P2^{0.5}s^{0.4}]$)	0.121 hr	+ 0.021 hr	+ 0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	108.83 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0060 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) ($Vp = 20.3282(s)^{0.5}$) ($Vup = 16.1345(s)^{0.5}$)	1.250 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) ($Tt = L/3600V$)	0.024 hr	+ 0.000 hr	+ 0.000 hr

Watershed or
Subarea Tc or Tt =

0.166 hr

or

9.94 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) ($r = a/Pw$)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) ($V = [1.49*r^{0.67}*s^{0.5}]/n$)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	+ 0.000 hr	+ 0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #226

Sheet Flow

1. Surface Description	grass	pvm	pvm
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L <= 100 ft	59.44 ft.	40.56 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0180 ft./ft.	0.0060 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) ($Tt = [0.007(nL)^{0.8}]/[P2^{0.5}s^{0.4}]$)	0.137 hr	0.017 hr	0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	145.87 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0060 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) ($Vp = 20.3282(s)^{0.5}$) ($Vup = 16.1345(s)^{0.5}$)	1.250 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) ($Tt = L/3600V$)	0.032 hr	0.000 hr	0.000 hr

Watershed or
Subarea Tc or Tt =

0.187 hr

or

11.20 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) ($r = a/Pw$)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) ($V = [1.49*r^{0.67}s^{0.5}]/n$)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	0.000 hr	0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #227

Sheet Flow

1. Surface Description	grass	pvm	pvm
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L <= 100 ft	43.78 ft.	56.22 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0160 ft./ft.	0.0060 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) (Tt = [0.007(nL)^0.8]/[P2^0.5*s^0.4])	0.112 hr	0.023 hr	0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	111.06 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0060 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) (Vp = 20.3282(s)^0.5) (Vup = 16.1345(s)^0.5)	1.250 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) (Tt = L/3600V)	0.025 hr	0.000 hr	0.000 hr

Watershed or
Subarea Tc or Tt =

0.160 hr

or

9.58 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) (r = a/Pw)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) (V = [1.49*r^0.67*s^0.5]/n)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) (Tt = L/3600V)	0.000 hr	0.000 hr	0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #229

Sheet Flow

1. Surface Description	grass	pvm	pvm
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L <= 100 ft	62.34 ft.	37.66 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0165 ft./ft.	0.0060 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) ($Tt = [0.007(nL)^{0.8}]/[P2^{0.5}s^{0.4}]$)	0.147 hr	+ 0.016 hr	+ 0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	123.36 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0060 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) ($Vp = 20.3282(s)^{0.5}$) ($Vup = 16.1345(s)^{0.5}$)	1.250 ft/s	2.748 ft/s	1.250 ft/s
11. Travel Time, (Tt) ($Tt = L/3600V$)	0.027 hr	+ 0.000 hr	+ 0.000 hr

Watershed or
Subarea Tc or Tt =

0.191 hr

or

11.46 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) ($r = a/Pw$)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) ($V = [1.49*r^{0.67}s^{0.5}]/n$)	0.452 ft/s	16.136 ft/s	12.769 ft/s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	+ 0.000 hr	+ 0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #230

Sheet Flow

1. Surface Description	grass	pvm	pvm
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L <= 100 ft	38.10 ft.	61.90 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0150 ft./ft.	0.0060 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) ($Tt = [0.007(nL)^{0.8}]/[P2^{0.5}s^{0.4}]$)	0.103 hr	+ 0.025 hr	+ 0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	52.53 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0060 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) ($Vp = 20.3282(s)^{0.5}$) ($Vup = 16.1345(s)^{0.5}$)	1.250 ft/s	2.748 ft/s	1.250 ft/s
11. Travel Time, (Tt) ($Tt = L/3600V$)	0.012 hr	+ 0.000 hr	+ 0.000 hr

Watershed or
Subarea Tc or Tt =

0.139 hr

or

8.35 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) ($r = a/Pw$)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) ($V = [1.49*r^{0.67}s^{0.5}]/n$)	0.452 ft/s	16.136 ft/s	12.769 ft/s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	+ 0.000 hr	+ 0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #232

Sheet Flow

1. Surface Description	grass	pvm	pvm
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L <= 100 ft	58.71 ft.	41.29 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0160 ft./ft.	0.0063 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) (Tt = [0.007(nL)^0.8]/[P2^0.5*s^0.4])	0.142 hr	+ 0.017 hr	+ 0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	21.98 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0063 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) (Vp = 20.3282(s)^0.5) (Vup = 16.1345(s)^0.5)	1.281 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) (Tt = L/3600V)	0.005 hr	+ 0.000 hr	+ 0.000 hr

Watershed or
Subarea Tc or Tt =

0.164 hr

or

9.84 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) (r = a/Pw)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) (V = [1.49*r^0.67*s^0.5]/n)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) (Tt = L/3600V)	0.000 hr	+ 0.000 hr	+ 0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #233

Sheet Flow

1. Surface Description	grass	pvm	pvm
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L <= 100 ft	57.67 ft.	35.86 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0180 ft./ft.	0.0063 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) ($Tt = [0.007(nL)^{0.8}]/[P2^{0.5}s^{0.4}]$)	0.133 hr	+ 0.016 hr	+ 0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0063 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) ($Vp = 20.3282(s)^{0.5}$) ($Vup = 16.1345(s)^{0.5}$)	1.281 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	+ 0.000 hr	+ 0.000 hr

Watershed or
Subarea Tc or Tt =

0.149 hr

or

8.94 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) ($r = a/Pw$)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) ($V = [1.49*r^{0.67}s^{0.5}]/n$)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	+ 0.000 hr	+ 0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #238

Sheet Flow

1. Surface Description	grass	pvm	pvm
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L <= 100 ft	64.35 ft.	35.65 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0160 ft./ft.	0.0063 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) ($Tt = [0.007(nL)^{0.8}]/[P2^{0.5}s^{0.4}]$)	0.153 hr	0.015 hr	0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	28.61 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0063 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) ($Vp = 20.3282(s)^{0.5}$) ($Vup = 16.1345(s)^{0.5}$)	1.281 ft/s	2.748 ft/s	1.250 ft/s
11. Travel Time, (Tt) ($Tt = L/3600V$)	0.006 hr	0.000 hr	0.000 hr

Watershed or
Subarea Tc or Tt =

0.174 hr

or

10.46 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) ($r = a/Pw$)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) ($V = [1.49*r^{0.67}s^{0.5}]/n$)	0.452 ft/s	16.136 ft/s	12.769 ft/s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	0.000 hr	0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #239

Sheet Flow

1. Surface Description	grass	pvm	pvm
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L <= 100 ft	58.45 ft.	42.21 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0175 ft./ft.	0.0063 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) ($Tt = [0.007(nL)^{0.8}]/[P2^{0.5}s^{0.4}]$)	0.136 hr	+ 0.018 hr	+ 0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0063 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) ($Vp = 20.3282(s)^{0.5}$) ($Vup = 16.1345(s)^{0.5}$)	1.281 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	+ 0.000 hr	+ 0.000 hr

Watershed or
Subarea Tc or Tt =

0.154 hr

or

9.25 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) ($r = a/Pw$)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) ($V = [1.49*r^{0.67}*s^{0.5}]/n$)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	+ 0.000 hr	+ 0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #241

Sheet Flow

1. Surface Description	grass	pvm	pvm
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L <= 100 ft	65.65 ft.	34.35 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0170 ft./ft.	0.0063 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) ($Tt = [0.007(nL)^{0.8}]/[P2^{0.5}s^{0.4}]$)	0.151 hr	0.015 hr	0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	84.37 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0063 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) ($Vp = 20.3282(s)^{0.5}$) ($Vup = 16.1345(s)^{0.5}$)	1.281 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) ($Tt = L/3600V$)	0.018 hr	0.000 hr	0.000 hr

Watershed or
Subarea Tc or Tt =

0.185 hr

or

11.09 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) ($r = a/Pw$)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) ($V = [1.49*r^{0.67}s^{0.5}]/n$)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	0.000 hr	0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #242

Sheet Flow

1. Surface Description	grass	pvm	pvm
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L <= 100 ft	64.04 ft.	35.96 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0170 ft./ft.	0.0063 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) ($Tt = [0.007(nL)^{0.8}]/[P2^{0.5}s^{0.4}]$)	0.148 hr	+ 0.016 hr	+ 0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	84.18 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0063 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) ($Vp = 20.3282(s)^{0.5}$) ($Vup = 16.1345(s)^{0.5}$)	1.281 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) ($Tt = L/3600V$)	0.018 hr	+ 0.000 hr	+ 0.000 hr

Watershed or
Subarea Tc or Tt =

0.182 hr

or

10.94 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) ($r = a/Pw$)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) ($V = [1.49*r^{0.67}s^{0.5}]/n$)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	+ 0.000 hr	+ 0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #244

Sheet Flow

1. Surface Description	grass	pvm	pvm
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L <= 100 ft	58.45 ft.	41.55 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0170 ft./ft.	0.0114 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) ($Tt = [0.007(nL)^{0.8}]/[P2^{0.5}s^{0.4}]$)	0.138 hr	0.014 hr	0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	34.14 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0114 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) ($Vp = 20.3282(s)^{0.5}$) ($Vup = 16.1345(s)^{0.5}$)	1.723 ft/s	2.748 ft/s	1.250 ft/s
11. Travel Time, (Tt) ($Tt = L/3600V$)	0.006 hr	0.000 hr	0.000 hr

Watershed or
Subarea Tc or Tt =

0.157 hr

or

9.44 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) ($r = a/Pw$)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) ($V = [1.49*r^{0.67}s^{0.5}]/n$)	0.452 ft/s	16.136 ft/s	12.769 ft/s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	0.000 hr	0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #245

Sheet Flow

1. Surface Description	grass	pvmr	pvmr
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L <= 100 ft	54.49 ft.	45.51 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0168 ft./ft.	0.0114 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) (Tt = [0.007(nL)^0.8]/[P2^0.5*s^0.4])	0.131 hr	0.015 hr	0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	65.45 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0114 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) (Vp = 20.3282(s)^0.5) (Vup = 16.1345(s)^0.5)	1.723 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) (Tt = L/3600V)	0.011 hr	0.000 hr	0.000 hr

Watershed or
Subarea Tc or Tt =

0.156 hr

or

9.39 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) (r = a/Pw)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) (V = [1.49*r^0.67*s^0.5]/n)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) (Tt = L/3600V)	0.000 hr	0.000 hr	0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #247

Sheet Flow

1. Surface Description	grass	pvm	pvm
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L <= 100 ft	62.81 ft.	37.19 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0155 ft./ft.	0.0114 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) ($Tt = [0.007(nL)^{0.8}]/[P2^{0.5}s^{0.4}]$)	0.152 hr	0.013 hr	0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	126.95 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0114 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) ($Vp = 20.3282(s)^{0.5}$) ($Vup = 16.1345(s)^{0.5}$)	1.723 ft/s	2.748 ft/s	1.250 ft/s
11. Travel Time, (Tt) ($Tt = L/3600V$)	0.020 hr	0.000 hr	0.000 hr

Watershed or
Subarea Tc or Tt =

0.185 hr

or

11.09 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) ($r = a/Pw$)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) ($V = [1.49*r^{0.67}s^{0.5}]/n$)	0.452 ft/s	16.136 ft/s	12.769 ft/s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	0.000 hr	0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #248

Sheet Flow

1. Surface Description	grass	pvm	pvm
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L <= 100 ft	55.97 ft.	44.03 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0155 ft./ft.	0.0114 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) (Tt = [0.007(nL)^0.8]/[P2^0.5*s^0.4])	0.138 hr	+ 0.014 hr	+ 0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	126.10 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0114 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) (Vp = 20.3282(s)^0.5) (Vup = 16.1345(s)^0.5)	1.723 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) (Tt = L/3600V)	0.020 hr	+ 0.000 hr	+ 0.000 hr

Watershed or
Subarea Tc or Tt =

0.173 hr

or

10.39 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) (r = a/Pw)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) (V = [1.49*r^0.67*s^0.5]/n)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) (Tt = L/3600V)	0.000 hr	+ 0.000 hr	+ 0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #250

Sheet Flow

1. Surface Description	grass	pvm	pvm
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L <= 100 ft	50.94 ft.	49.06 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0170 ft./ft.	0.0107 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) (Tt = [0.007(nL)^0.8]/[P2^0.5*s^0.4])	0.124 hr	+ 0.016 hr	+ 0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	124.58 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0107 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) (Vp = 20.3282(s)^0.5) (Vup = 16.1345(s)^0.5)	1.669 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) (Tt = L/3600V)	0.021 hr	+ 0.000 hr	+ 0.000 hr

Watershed or
Subarea Tc or Tt =

0.161 hr

or

9.63 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) (r = a/Pw)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) (V = [1.49*r^0.67*s^0.5]/n)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) (Tt = L/3600V)	0.000 hr	+ 0.000 hr	+ 0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #250

Sheet Flow

1. Surface Description	grass	pvm	pvm
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L <= 100 ft	50.94 ft.	49.06 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0170 ft./ft.	0.0107 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) (Tt = [0.007(nL)^0.8]/[P2^0.5*s^0.4])	0.124 hr	+ 0.016 hr	+ 0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	124.58 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0107 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) (Vp = 20.3282(s)^0.5) (Vup = 16.1345(s)^0.5)	1.669 ft./s	2.748 ft./s	1.250 ft./s
11. Travel Time, (Tt) (Tt = L/3600V)	0.021 hr	+ 0.000 hr	+ 0.000 hr

Watershed or
Subarea Tc or Tt =

0.161 hr

or

9.63 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) (r = a/Pw)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) (V = [1.49*r^0.67*s^0.5]/n)	0.452 ft./s	16.136 ft./s	12.769 ft./s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) (Tt = L/3600V)	0.000 hr	+ 0.000 hr	+ 0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Hillview - Section 3

Designer: DJM

Date: 1/26/2018

Scenario/Structure: Str. #251

Sheet Flow

1. Surface Description	grass	pvm	pvm
2. Manning's Roughness Coeff., (n)	0.170	0.011	0.011
3. Flow Length, (L) **total L <= 100 ft	49.46 ft.	50.54 ft.	0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5. Land Slope, (s)	0.0175 ft./ft.	0.0107 ft./ft.	0.0366 ft./ft.
6. Travel Time, (Tt) ($Tt = [0.007(nL)^{0.8}]/[P2^{0.5}s^{0.4}]$)	0.119 hr	+ 0.017 hr	+ 0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved	unpaved	unpaved
8. Flow Length, (L)	122.59 ft.	0.00 ft.	0.00 ft.
9. Watercourse Slope, (s)	0.0107 ft./ft.	0.0290 ft./ft.	0.0060 ft./ft.
10. Average Velocity, (V) ($Vp = 20.3282(s)^{0.5}$) ($Vup = 16.1345(s)^{0.5}$)	1.669 ft/s	2.748 ft/s	1.250 ft/s
11. Travel Time, (Tt) ($Tt = L/3600V$)	0.020 hr	+ 0.000 hr	+ 0.000 hr

Watershed or
Subarea Tc or Tt =

0.156 hr

or

9.38 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.00 ft.^2	132.12 ft.^2	174.24 ft.^2
13. Wetted Perimeter, Pw	6.32 ft.	30.71 ft.	43.74 ft.
14. Hydraulic Radius, (r) ($r = a/Pw$)	0.475 ft.	4.302 ft.	3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.	0.0121 ft./ft.	0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.200	0.027	0.027
17. Velocity, (V) ($V = [1.49*r^{0.67}s^{0.5}]/n$)	0.452 ft/s	16.136 ft/s	12.769 ft/s
18. Flow Length, (L)	0.00 ft.	0.00 ft.	0.00 ft.
19. Travel Time, (Tt) ($Tt = L/3600V$)	0.000 hr	+ 0.000 hr	+ 0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Windsor at Hillview - Section 3

Designer: DJM

Date: 6/30/2021

Scenario/Structure: Str. #255

Sheet Flow

1. Surface Description	grass		pvm		pvm
2. Manning's Roughness Coeff., (n)	0.170		0.011		0.011
3. Flow Length, (L) **total L<= 100 ft	70.35 ft.		0.00 ft.		0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.		2.64 in.		2.64 in.
5. Land Slope, (s)	0.0200 ft./ft.		0.0107 ft./ft.		0.0366 ft./ft.
6. Travel Time, (Tt) (Tt = [0.007(nL)^0.8]/[P2^0.5*s^0.4])	0.150 hr	+	0.000 hr	+	0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved		unpaved		unpaved
8. Flow Length, (L)	0.00 ft.		0.00 ft.		0.00 ft.
9. Watercourse Slope, (s)	0.0107 ft./ft.		0.0290 ft./ft.		0.0060 ft./ft.
10. Average Velocity, (V) (Vp = 20.3282(s)^0.5) (Vup = 16.1345(s)^0.5)	1.669 ft./s		2.748 ft./s		1.250 ft./s
11. Travel Time, (Tt) (Tt = L/3600V)	0.000 hr	+	0.000 hr	+	0.000 hr

Watershed or
Subarea Tc or Tt =

0.396 hr

or

23.76 min

Channel Flow

12. Cross Sectional Flow Area, (a)	3.96 ft.^2		132.12 ft.^2		174.24 ft.^2
13. Wetted Perimeter, Pw	15.86 ft.		30.71 ft.		43.74 ft.
14. Hydraulic Radius, (r) (r = a/Pw)	0.250 ft.		4.302 ft.		3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.		0.0121 ft./ft.		0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.170		0.027		0.027
17. Velocity, (V) (V = [1.49*r^0.67*s^0.5]/n)	0.346 ft./s		16.136 ft./s		12.769 ft./s
18. Flow Length, (L)	306.41 ft.		0.00 ft.		0.00 ft.
19. Travel Time, (Tt) (Tt = L/3600V)	0.246 hr	+	0.000 hr	+	0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Windsor at Hillview - Section 3

Designer: DJM

Date: 6/30/2021

Scenario/Structure: Str. #256

Sheet Flow

1. Surface Description	grass		pvm		pvm
2. Manning's Roughness Coeff., (n)	0.170		0.011		0.011
3. Flow Length, (L) **total L<= 100 ft	76.68 ft.		0.00 ft.		0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.		2.64 in.		2.64 in.
5. Land Slope, (s)	0.0200 ft./ft.		0.0107 ft./ft.		0.0366 ft./ft.
6. Travel Time, (Tt) (Tt = [0.007(nL)^0.8]/[P2^0.5*s^0.4])	0.161 hr	+	0.000 hr	+	0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved		unpaved		unpaved
8. Flow Length, (L)	0.00 ft.		0.00 ft.		0.00 ft.
9. Watercourse Slope, (s)	0.0107 ft./ft.		0.0290 ft./ft.		0.0060 ft./ft.
10. Average Velocity, (V) (Vp = 20.3282(s)^0.5) (Vup = 16.1345(s)^0.5)	1.669 ft./s		2.748 ft./s		1.250 ft./s
11. Travel Time, (Tt) (Tt = L/3600V)	0.000 hr	+	0.000 hr	+	0.000 hr

Watershed or
Subarea Tc or Tt =

0.227 hr

or

13.61 min

Channel Flow

12. Cross Sectional Flow Area, (a)	4.29 ft.^2		132.12 ft.^2		174.24 ft.^2
13. Wetted Perimeter, Pw	17.33 ft.		30.71 ft.		43.74 ft.
14. Hydraulic Radius, (r) (r = a/Pw)	0.248 ft.		4.302 ft.		3.984 ft.
15. Channel Slope, (s)	0.0150 ft./ft.		0.0121 ft./ft.		0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.170		0.027		0.027
17. Velocity, (V) (V = [1.49*r^0.67*s^0.5]/n)	0.421 ft./s		16.136 ft./s		12.769 ft./s
18. Flow Length, (L)	100.27 ft.		0.00 ft.		0.00 ft.
19. Travel Time, (Tt) (Tt = L/3600V)	0.066 hr	+	0.000 hr	+	0.000 hr

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Windsor at Hillview - Section 3

Designer: DJM

Date: 6/30/2021

Scenario/Structure: Str. #257

Sheet Flow

1. Surface Description	grass		pvm		pvm
2. Manning's Roughness Coeff., (n)	0.170		0.011		0.011
3. Flow Length, (L) **total L<= 100 ft	90.96 ft.		0.00 ft.		0.00 ft.
4. Two-yr 24-hr Rainfall, (P2)	2.64 in.		2.64 in.		2.64 in.
5. Land Slope, (s)	0.0165 ft./ft.		0.0107 ft./ft.		0.0366 ft./ft.
6. Travel Time, (Tt) (Tt = [0.007(nL)^0.8]/[P2^0.5*s^0.4])	0.199 hr	+	0.000 hr	+	0.000 hr

Shallow Concentrated Flow

7. Surface Description (paved or unpaved)	paved		unpaved		unpaved
8. Flow Length, (L)	0.00 ft.		0.00 ft.		0.00 ft.
9. Watercourse Slope, (s)	0.0107 ft./ft.		0.0290 ft./ft.		0.0060 ft./ft.
10. Average Velocity, (V) (Vp = 20.3282(s)^0.5) (Vup = 16.1345(s)^0.5)	1.669 ft./s		2.748 ft./s		1.250 ft./s
11. Travel Time, (Tt) (Tt = L/3600V)	0.000 hr	+	0.000 hr	+	0.000 hr

Watershed or
Subarea Tc or Tt =

0.409 hr

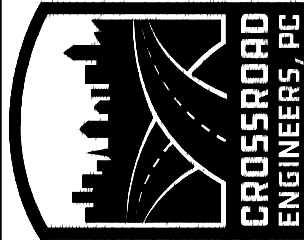
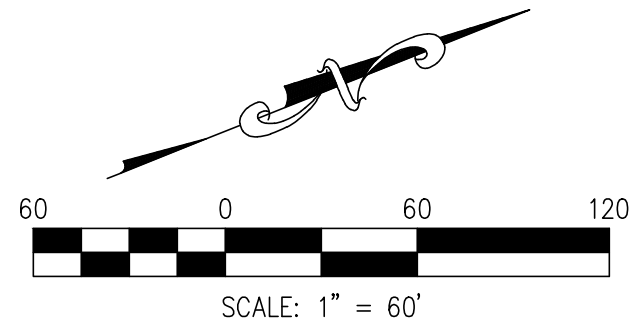
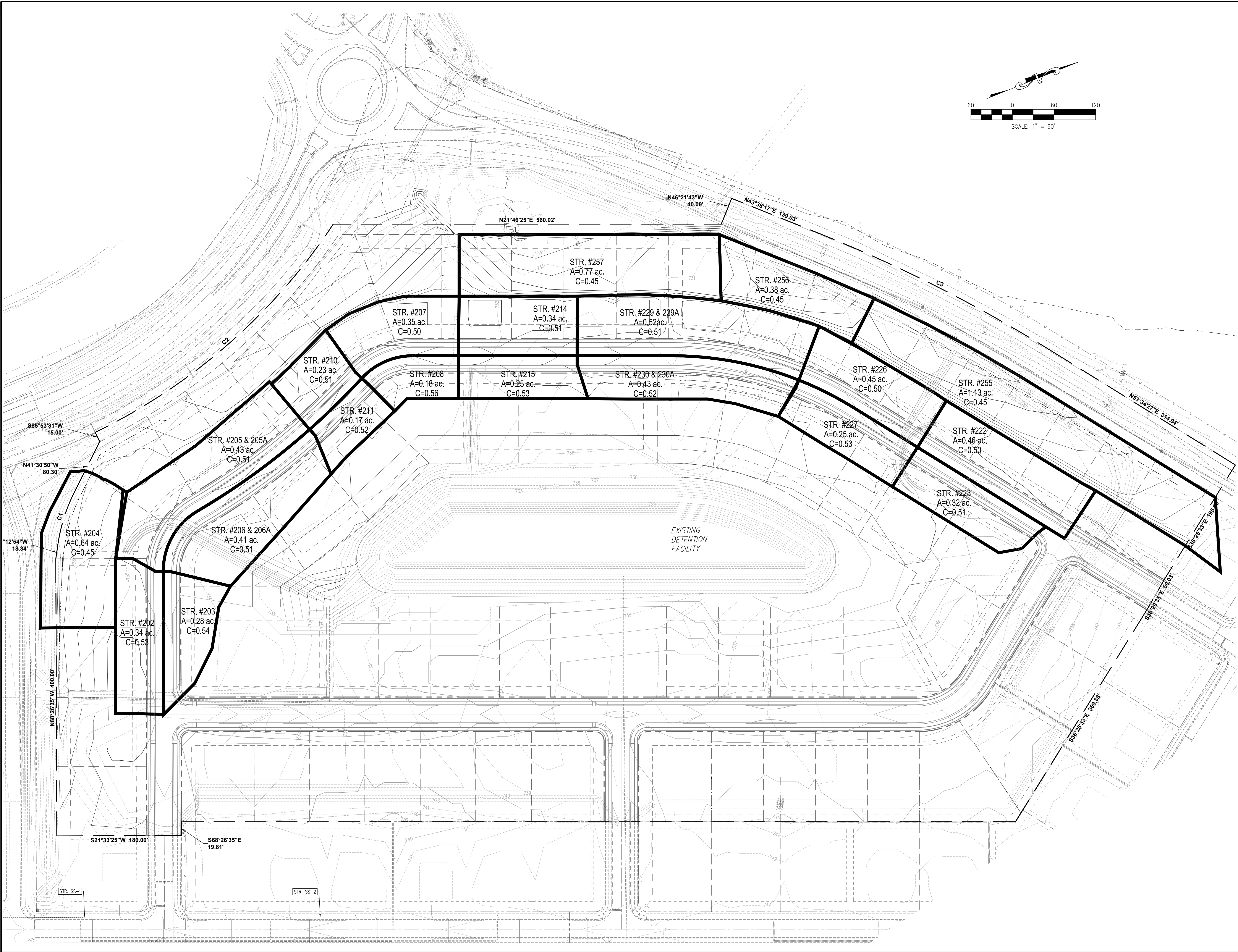
or

24.53 min

Channel Flow

12. Cross Sectional Flow Area, (a)	4.94 ft.^2		132.12 ft.^2		174.24 ft.^2
13. Wetted Perimeter, Pw	19.11 ft.		30.71 ft.		43.74 ft.
14. Hydraulic Radius, (r) (r = a/Pw)	0.259 ft.		4.302 ft.		3.984 ft.
15. Channel Slope, (s)	0.0100 ft./ft.		0.0121 ft./ft.		0.0084 ft./ft.
16. Manning's Roughness Coeff., (n)	0.170		0.027		0.027
17. Velocity, (V) (V = [1.49*r^0.67*s^0.5]/n)	0.354 ft./s		16.136 ft./s		12.769 ft./s
18. Flow Length, (L)	267.62 ft.		0.00 ft.		0.00 ft.
19. Travel Time, (Tt) (Tt = L/3600V)	0.210 hr	+	0.000 hr	+	0.000 hr

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FILE NAME : 11.02.22.dwg
DATE/USER : 11/2/2022 11:49 AM / Dmgm



Development Consultants
115 N. 17th Street, Suite 100
Denver, CO 80202

SHEET 1 OF 1

INLET BASIN MAP

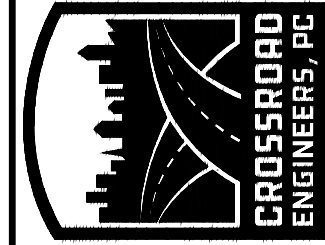
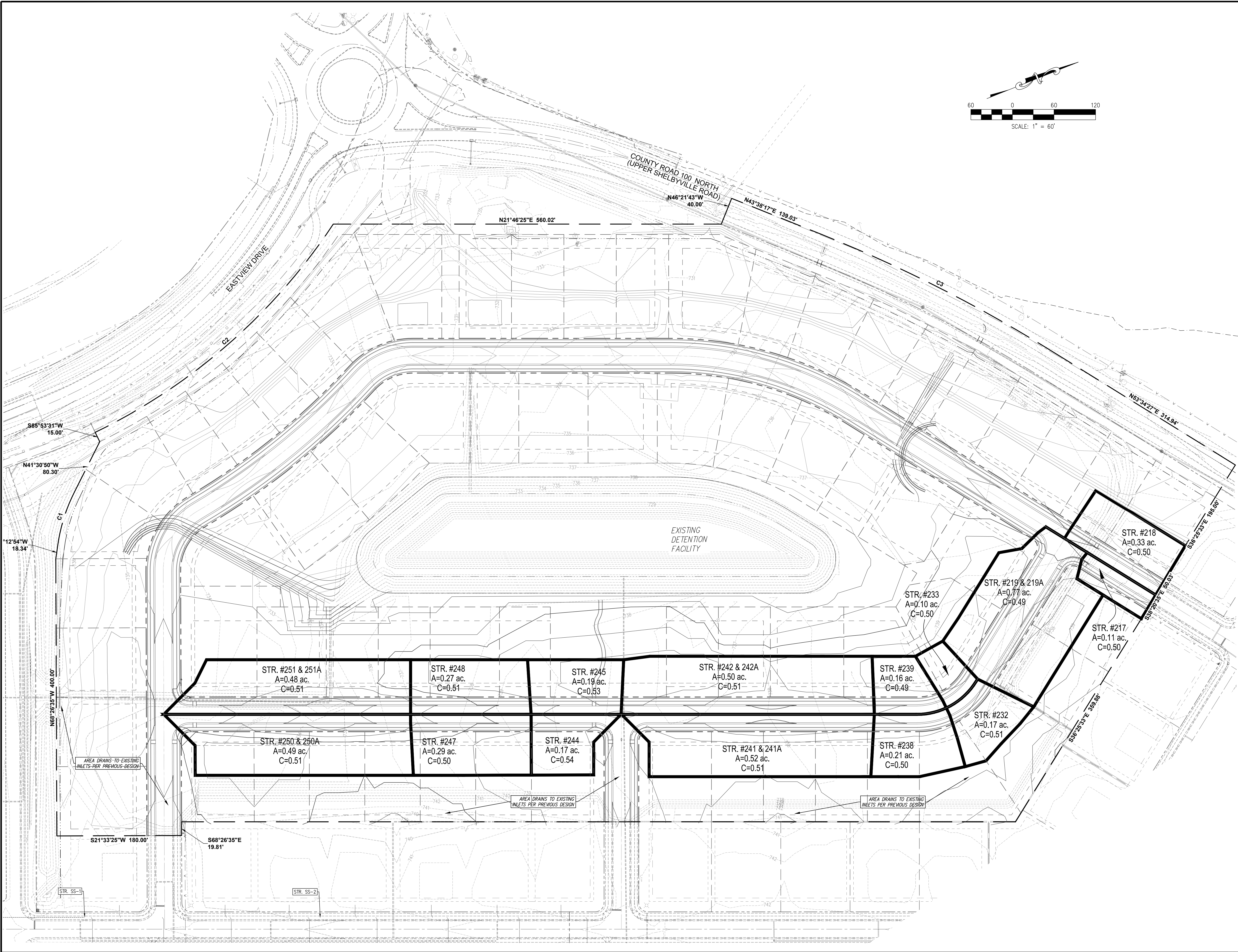
WINDSOR AT HILLVIEW - SECTION 4

JOB No.	DRAWN	KLF/JMC/DEP	CHECKED	TEN
DATE	NOVEMBER 3, 2022	DESIGNED	DJM	GJJ

PRELIMINARY
NOT FOR
CONSTRUCTION

NO.	DATE	REVISIONS	BY	APPR.
9				
8				
7				
6				
5				
4				
3				
2				
1				

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DATE/USER : 11/2/2022 11:40 AM / Dmg



CROSSROAD
ENGINEERS, PC
TRANSPORTATION
Development Consultants
115 E. 17th Street, Suite 400
Indianapolis, IN 46204

SHEET 1 OF 1

INLET BASIN MAP

WINDSOR AT HILLVIEW - SECTION 3

JOB No.	DRAWN	KLF/LMC/DEP	CHECKED	TEN
DATE	NOVEMBER 3, 2022	DESIGNED	DJM	GJJ

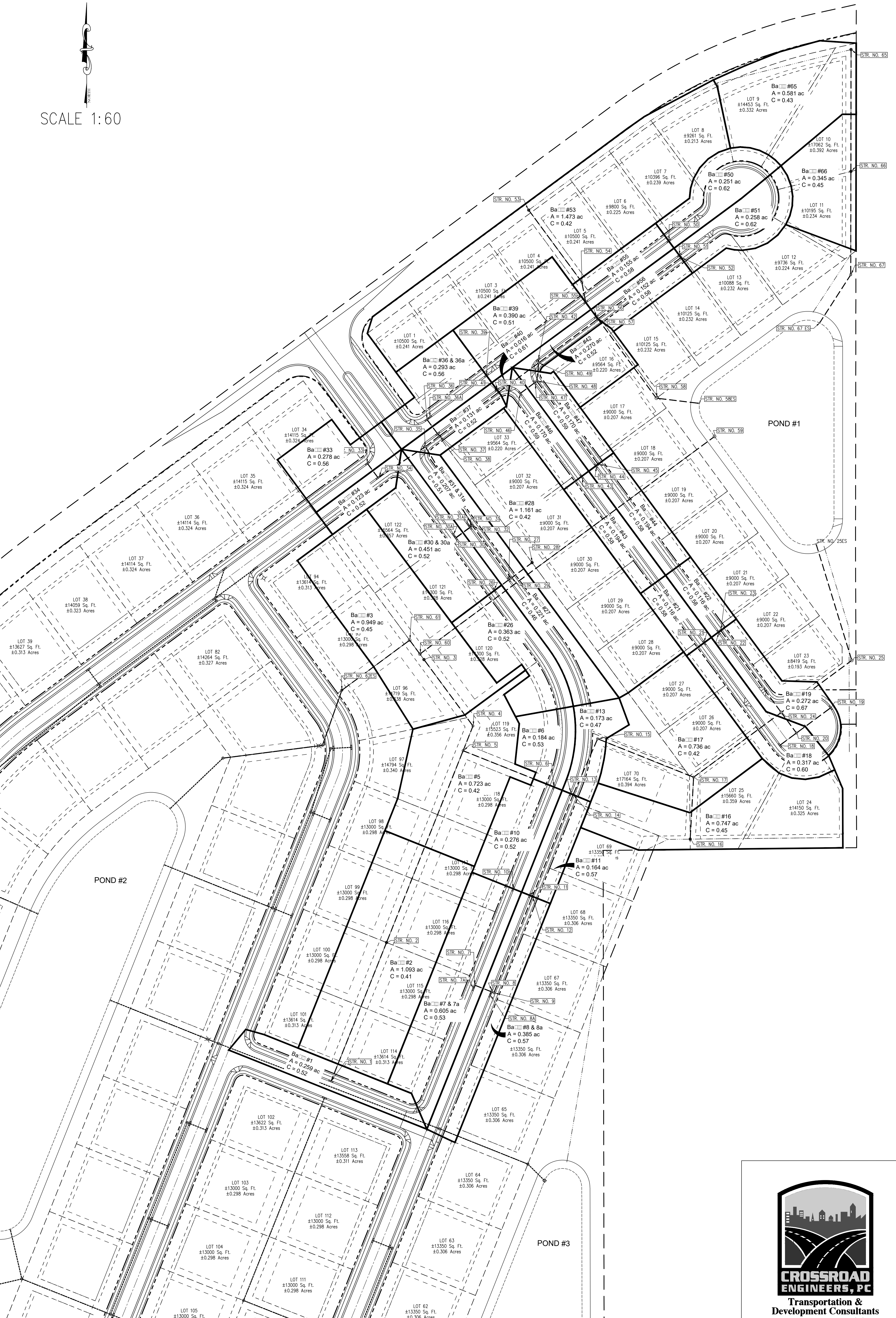
PRELIMINARY
NOT FOR
CONSTRUCTION

NO.	DATE	REVISIONS		BY	APPR.
9					
8					
7					
6					
5					
4					
3					
2					
1					

EXHIBIT 1: INLET BASIN MAP



SCALE 1:60



Transportation &
Development Consultants

3417 SHERMAN DR. BEECH GROVE, IN 46107 (317) 780-1555

[illegible]

Section 2: Storm Inlet Calculations

Storm inlets were placed throughout the site to ensure that there will be adequate capacity to pass the design 10-year flow with 50% of the sag inlet clogged with the maximum depth of water not exceeding six inches, or maintaining a 10' travel lane in paved areas. The attached charts are a Discharge vs. Depth provided by Neenah Foundry Company. Charts are attached for sag inlets located in grassed areas with 50% of the inlet clogged and for inlets located on grade.

The weir and orifice equations were utilized to determine the maximum inlet capacity. The weir equation was used when depth of flow is less than 4" and the orifice equation was utilized for depths 4" or greater.

The weir equation is as follows: $Q = 3.3P(h)^{1.5}$

Where: P = perimeter of the grate; h = head above the casting; Q = Capacity

The orifice equation is as follows: $Q = 0.6A(2gh)^{0.5}$

Where: A = open area of the grate; h = head above the casting; g = 32.2 ft/sec²

The casting used for all road inlets, located in a sag, is a Neenah R-3501-TB, which has a perimeter of 5.7 feet. This length was reduced by 50% to simulate a clogged inlet. Therefore, the perimeter length used in the weir equation is 2.85 feet.

The castings utilized for inlets within swales, or grassed areas, is a Neenah R-4215-C, which has a perimeter of 11.3 feet (5.65 feet assuming 50% clogged) and an open area of 3.3 sft (1.65 sft assuming 50% clogged).

The following table indicates the inlets capacity and corresponding roadway spread at each inlet.

Structure No.	Casting Type	Watershed Runoff	Inlet Capacity	Depth Over Grate	Spread	Bypass
202	R-3501-TR	1.04 cfs	0.93 cfs	0.15'	7.60'	0.11 cfs
203	R-3501-TL	0.84 cfs	0.93 cfs	0.14'	7.00'	0.00 cfs
205 & 205A	R-3501-TB	1.33+0.11 = 1.44 cfs	1.44 cfs	0.18'	7.18'	0.00 cfs
206 & 206A	R-3501-TB	1.11 cfs	1.20 cfs	0.16'	7.80'	0.00 cfs
207	R-3501-TL	0.96 cfs	0.95 cfs	0.15'	7.70'	0.00 cfs
208	R-3501-TR	0.62 cfs	0.65 cfs	0.13'	6.55'	0.00 cfs
210	R-3501-TL	0.68 cfs	0.71 cfs	0.14'	6.75'	0.00 cfs
211	R-3501-TR	0.58 cfs	0.62 cfs	0.13'	6.35'	0.00 cfs
214	R-3501-TR	0.93 cfs	0.88 cfs	0.14'	6.90'	0.05 cfs
215	R-3501-TL	0.79 cfs	0.88 cfs	0.14'	6.90'	0.00 cfs
222	R-3501-TL	1.23 cfs	0.94 cfs	0.17'	8.00'	0.29 cfs
223	R-3501-TR	0.90 cfs	0.92 cfs	0.15'	7.65'	0.00 cfs
226	R-3501-RL	1.16+0.29 = 1.45 cfs	0.96 cfs	0.18'	9.10'	0.49 cfs
227	R-3501-TR	0.73 cfs	0.88 cfs	0.14'	7.05'	0.00 cfs
229 & 229A	R-3501-TB	1.39+0.54 = 1.93 cfs	2.08 cfs	0.23'	8.00'	0.00 cfs
230 & 230A	R-3501-TB	1.33 cfs	1.44 cfs	0.18'	7.18'	0.00 cfs

Manning Equation Calculator

Company
Name: CrossRoad Engineers, P.C.

Project
Name: HillMew - Section 3

Notes: Str. 202

The Modified Manning Equation is used to calculate flow velocities and volume (in cubic feet per second or cfs). This information is vitally important when selecting a grate type and size for a given project.



$$Q = \frac{0.56}{N} Z D^{4/3} S^{1/2}$$

Where...

- D = Depth of flow in feet
- Q = Channel flow in cfs (calculated)
- Z = Reciprocal of transverse slope (1/ST)
- S = Longitudinal slope
- N = Roughness coefficient at constant 0.016 (value for concrete and asphalt)

Instructions

Step 1

Enter the Longitudinal and Transverse Slopes. Enter one of the remaining variables and then press calculate:

- Depth of Flow (D)
- Total flow in cfs (Q)
- Spread of flow in feet

Step 2

To Calculate flow capture of specific Neenah Grates, select a catalog number and grate style from the K Chart drop-down.

1. Select the catalog number for the appropriate "K" chart and from the chart "Determine the "K" value based on the Longitudinal and Transverse slopes entered in Step 1.
2. Derive the Grate Coefficient by plotting the Transverse Slope (ST) and Longitudinal Slope factors onto the K Chart.
3. Enter the "K" value in the space provided.
4. Press Calculate.

Step 1

	Alternate One	Alternate Two	Alternate Three
Depth of flow in feet (D): [2]	0.152		
Transverse Slope in ft./ft. (ST): [2]	0.02		
Longitudinal Slope in ft./ft. (SL): [2]	0.0083		
Roughness coefficient (N): (value for concrete or asphalt)	0.016	0.016	0.016
Total flow in cfs (Q): [2]	1.04		
Spread of flow in feet: [2]	7.800		

Calculate Reset Calculate Reset Calculate Reset

Step 2

numbers and grate types that have	3085-V		
K-charts:	[?]		
Grate Coefficient from K-chart (K):	14		
Grate capacity in cfs: [?]	0.93		
Bypass flow in cfs:	0.11		
Percent captured:	90.38		
	Calculate	Reset	Calculate
	Reset	Calculate	Reset

For additional information regarding Neenah Inlet Grate Capacities, please contact Joe Falle P.E., at (920)729.3653 or email at joseph.falle@neenahenterprises.com.

[Program Methodology](#)

If your inlet is not capturing enough of the flow, some improvement options include:

- Utilizing the improved efficiency of vane style grates Pg 112
- Improve spread of flow capture utilizing the Neenah R-3599 Slotted Vane Drain System
- Remove significant amounts of water utilizing Neenah's R-4999 Vane Style Transverse Drainage Structure Series

Manning Equation Calculator

Company

Name: CrossRoad Engineers, P.C.

Project

Name: Hillview - Section 3

Notes: Str. 203

The Modified Manning Equation is used to calculate flow velocities and volume (in cubic feet per second or cfs). This information is vitally important when selecting a grate type and size for a given project.



$$Q = \frac{0.56}{N} Z D^{8/3} S^{1/2}$$

Where...

- **D** = Depth of flow in feet
- **Q** = Channel flow in cfs (calculated)
- **Z** = Reciprocal of transverse slope (1/ST)
- **S** = Longitudinal slope
- **N** = Roughness coefficient at constant 0.016 (value for concrete and asphalt)

Instructions

Step 1

Enter the Longitudinal and Transverse Slopes. Enter one of the remaining variables and then press calculate:

- Depth of Flow (D)
- Total flow in cfs (Q)
- Spread of flow in feet

Step 2

To Calculate flow capture of specific Neenah Grates, select a catalog number and grate style from the K Chart drop-down.

1. Select the catalog number for the appropriate "K" chart and from the chart "Determine the "K" value based on the Longitudinal and Transverse slopes entered in Step 1.
2. Derive the Grate Coefficient by plotting the Transverse Slope (ST) and Longitudinal Slope factors onto the K Chart.
3. Enter the "K" value in the space provided.
4. Press Calculate.

Step 1

	Alternate One	Alternate Two	Alternate Three
Depth of flow in feet (D): [?]	0.140		
Transverse Slope in ft./ft. (ST): [?]	0.02		
Longitudinal Slope in ft./ft. (SL): [?]	0.0083		
Roughness coefficient (N): (value for	0.016	0.016	0.016

concrete or asphalt)		
Total flow in cfs (Q):	0.84	
Spread of flow in feet:	7.000	
	Calculate	Reset
	Calculate	Reset
	Calculate	Reset

Step 2

Catalog numbers and grate types that have K-charts:	3065-V	
Grate Coefficient from K-chart (K):	14	
Grate capacity in cfs:	0.93	
Bypass flow in cfs:	0.00	
Percent captured:	110.71	
	Calculate	Reset
	Calculate	Reset
	Calculate	Reset

For additional information regarding Neenah Inlet Grate Capacities, please contact Joe Falle P.E., at (920)729-3653 or email at joseph.falle@neenahenterprises.com.

Program Methodology

If your inlet is not capturing enough of the flow, some improvement options include:

- Utilizing the improved efficiency of vane style [grates Pg 112](#)
- Improve spread of flow capture utilizing the Neenah [R-3599](#) Slotted Vane Drain System
- Remove significant amounts of water utilizing Neenah's [R-4999](#) Vane Style Transverse Drainage Structure Series

Manning Equation Calculator

Company

Name: CrossRoad Engineers, PC

Project

Name: Hillview - Section 3

Notes: Str. 207

The Modified Manning Equation is used to calculate flow velocities and volume (in cubic feet per second or cfs). This information is vitally important when selecting a grate type and size for a given project.



$$Q = \frac{0.56}{N} Z D^{3/2} S^{1/2}$$

Where...

- D = Depth of flow in feet
- Q = Channel flow in cfs (calculated)
- Z = Reciprocal of transverse slope (1/ST)
- S = Longitudinal slope
- N = Roughness coefficient at constant 0.016 (value for concrete and asphalt)

Instructions

Step 1

Enter the Longitudinal and Transverse Slopes. Enter one of the remaining variables and then press calculate:

- Depth of Flow (D)
- Total flow in cfs (Q)
- Spread of flow in feet

Step 2

To Calculate flow capture of specific Neenah Grates, select a catalog number and grate style from the K Chart drop-down.

1. Select the catalog number for the appropriate "K" chart and from the chart "Determine the "K" value based on the Longitudinal and Transverse slopes entered in Step 1.
2. Derive the Grate Coefficient by plotting the Transverse Slope (ST) and Longitudinal Slope factors onto the K Chart.
3. Enter the "K" value in the space provided.
4. Press Calculate.

Step 1

	Alternate One	Alternate Two	Alternate Three
Depth of flow in feet (D): [?]	0.154		
Transverse Slope in ft./ft. (ST): [?]	0.02		
Longitudinal Slope in ft./ft. (SL): [?]	0.0065		
Roughness coefficient (N): (value for concrete or asphalt)	0.016	0.016	0.016
Total flow in cfs (Q): [?]	0.96		
Spread of flow in feet: [?]	7.700		

Calculate
Reset
Calculate
Reset
Calculate
Reset

Step 2

numbers and grate types that have K-charts:	3085-V		
Grate Coefficient from K-chart (K):	14		
Grate capacity in cfs:	0.95		
Bypass flow in cfs:	0.01		
Percent captured:	98.96		
	Calculate	Reset	Calculate
	Reset	Calculate	Reset

For additional information regarding Neenah Inlet Grate Capacities, please contact Joe Falle P.E., at (920)729-3653 or email at joseph.falle@neenahenterprises.com.

Program Methodology

If your Inlet Is not capturing enough of the flow, some improvement options include:

- Utilizing the improved efficiency of vane style grates Pg. 112
- Improve spread of flow capture utilizing the Neenah R-3599 Slotted Vane Drain System
- Remove significant amounts of water utilizing Neenah's R-4999 Vane Style Transverse Drainage Structure Series

Manning Equation Calculator

Company

Name: CrossRoad Engineers, PC

Project

Name: Hillview - Section 3

Notes: Str. 208

The Modified Manning Equation is used to calculate flow velocities and volume (in cubic feet per second or cfs). This information is vitally important when selecting a grate type and size for a given project.



$$Q = \frac{0.56}{N} Z D^{3/2} S^{1/2}$$

Where...

- **D** = Depth of flow in feet
- **Q** = Channel flow in cfs (calculated)
- **Z** = Reciprocal of transverse slope (1/ST)
- **S** = Longitudinal slope
- **N** = Roughness coefficient at constant 0.016 (value for concrete and asphalt)

Instructions

Step 1

Enter the Longitudinal and Transverse Slopes. Enter one of the remaining variables and then press calculate:

- Depth of Flow (D)
- Total flow in cfs (Q)
- Spread of flow in feet

Step 2

To Calculate flow capture of specific Neenah Grates, select a catalog number and grate style from the K Chart drop-down.

1. Select the catalog number for the appropriate "K" chart and from the chart "Determine the "K" value based on the Longitudinal and Transverse slopes entered in Step 1.
2. Derive the Grate Coefficient by plotting the Transverse Slope (ST) and Longitudinal Slope factors onto the K Chart.
3. Enter the "K" value in the space provided.
4. Press Calculate.

Step 1

	Alternate One	Alternate Two	Alternate Three
Depth of flow in feet (D): [?]	0.131		
Transverse Slope in ft./ft. (ST): [?]	0.02		
Longitudinal Slope in ft./ft. (SL): [?]	0.0085		
Roughness coefficient (N): (value for concrete or asphalt)	0.016	0.016	0.016
Total flow in cfs (Q): [?]	0.82		
Spread of flow in feet: [?]	6.550		
	Calculate	Reset	Calculate
	Reset	Calculate	Reset

Step 2

numbers and grate types that have K-charts:	3065-V		
Grate Coefficient from K-chart (K):	14		
Grate capacity in cfs: (?)	0.65		
Bypass flow in cfs:	0.00		
Percent captured:	104.84		
	Calculate	Reset	Calculate
	Reset	Calculate	Reset

For additional information regarding Neenah Inlet Grate Capacities, please contact Joe Falle P.E., at (920)729.3653 or email at joseph.falle@neenahenterprises.com.

Program Methodology

If your Inlet is not capturing enough of the flow, some improvement options include:

- Utilizing the improved efficiency of vane style grates [Pg. 112](#)
- Improve spread of flow capture utilizing the Neenah [R-3599 Slotted Vane Drain System](#)
- Remove significant amounts of water utilizing Neenah's [R-4999 Vane Style Transverse Drainage Structure Series](#)

Manning Equation Calculator

Company
Name: CrossRoad Engineers, PC

Project
Name: Hillview - Section 3

Notes: Str. 210

The Modified Manning Equation is used to calculate flow velocities and volume (in cubic feet per second or cfs). This information is vitally important when selecting a grate type and size for a given project.



$$Q = \frac{0.56}{N} (2DZ + B)^{2/3} S^{1/2}$$

Where...

- D = Depth of flow in feet
- Q = Channel flow in cfs (calculated)
- Z = Reciprocal of transverse slope (1/ST)
- S = Longitudinal slope
- N = Roughness coefficient at constant 0.016 (value for concrete and asphalt)

Instructions

Step 1

Enter the Longitudinal and Transverse Slopes. Enter one of the remaining variables and then press calculate:

- Depth of Flow (D)
- Total flow in cfs (Q)
- Spread of flow in feet

Step 2

To Calculate flow capture of specific Neenah Grates, select a catalog number and grate style from the K Chart drop-down.

1. Select the catalog number for the appropriate "K" chart and from the chart "Determine the "K" value based on the Longitudinal and Transverse slopes entered in Step 1.
2. Derive the Grate Coefficient by plotting the Transverse Slope (ST) and Longitudinal Slope factors onto the K Chart.
3. Enter the "K" value in the space provided.
4. Press Calculate.

Step 1

	Alternate One	Alternate Two	Alternate Three
Depth of flow in feet (D): [?]	0.135		
Transverse Slope in ft./ft. (ST): [?]	0.02		
Longitudinal Slope in ft./ft. (SL): [?]	0.0065		
Roughness coefficient (N): (value for concrete or asphalt)	0.016	0.016	0.016
Total flow in cfs (Q): [?]	0.68		
Spread of flow in feet: [?]	6.750		
	Calculate	Reset	Calculate
	Reset	Calculate	Reset

Step 2

numbers and grate types that have K-charts:	3065-V		
Grate Coefficient from K-chart (K):	14		
Grate capacity in cfs: (?)	0.71		
Bypass flow in cfs:	0.00		
Percent captured:	104.41		
	Calculate	Reset	Calculate
	Reset	Calculate	Reset

For additional information regarding Neenah Inlet Grate Capacities, please contact Joe Falle P.E., at (920)729-3653 or email at joseph.falle@neenahenterprises.com.

Program Methodology

If your Inlet is not capturing enough of the flow, some improvement options include:

- Utilizing the improved efficiency of vane style grates P-112
- Improve spread of flow capture utilizing the Neenah R-3599 Slotted Vane Drain System
- Remove significant amounts of water utilizing Neenah's R-4999 Vane Style Transverse Drainage Structure Series

Manning Equation Calculator

Company
Name: CrossRoad Engineers, PC

Project
Name: Hillview - Section 3

Notes: Str. 211

The Modified Manning Equation is used to calculate flow velocities and volume (in cubic feet per second or cfs). This information is vitally important when selecting a grate type and size for a given project.



$$Q = \frac{0.56}{N} Z D^{5/3} S^{1/2}$$

Where...

- D = Depth of flow in feet
- Q = Channel flow in cfs (calculated)
- Z = Reciprocal of transverse slope (1/ST)
- S = Longitudinal slope
- N = Roughness coefficient at constant 0.016 (value for concrete and asphalt)

Instructions

Step 1

Enter the Longitudinal and Transverse Slopes. Enter one of the remaining variables and then press calculate:

- Depth of Flow (D)
- Total flow in cfs (Q)
- Spread of flow in feet

Step 2

To Calculate flow capture of specific Neenah Grates, select a catalog number and grate style from the K Chart drop-down.

1. Select the catalog number for the appropriate "K" chart and from the chart "Determine the "K" value based on the Longitudinal and Transverse slopes entered in Step 1.
2. Derive the Grate Coefficient by plotting the Transverse Slope (ST) and Longitudinal Slope factors onto the K Chart.
3. Enter the "K" value in the space provided.
4. Press Calculate.

Step 1

	Alternate One	Alternate Two	Alternate Three
Depth of flow in feet (D): [?]	0.127		
Transverse Slope in ft./ft. (ST): [?]	0.02		
Longitudinal Slope in ft./ft. (SL): [?]	0.0065		
Roughness coefficient (N): (value for concrete or asphalt)	0.016	0.016	0.016
Total flow in cfs (Q): [?]	0.58		
Spread of flow in feet: [?]	8.350		

Calculate Reset Calculate Reset Calculate Reset

Step 2

numbers and grate types that have K-charts:	3065-V		
Grate Coefficient from K-chart (K):	14		
Grate capacity in cfs: (Q)	0.62		
Bypass flow in cfs:	0.00		
Percent captured:	108.90		
	Calculate	Reset	Calculate
	Reset	Calculate	Reset

For additional information regarding Neenah Inlet Grate Capacities, please contact Joe Falle P.E., at (920)729-3653 or email at joseph.falle@neenahenterprises.com.

Program Methodology

If your Inlet is not capturing enough of the flow, some improvement options include:

- Utilizing the improved efficiency of vane style grates Pg. 112
- Improve spread of flow capture utilizing the Neenah R-3599 Slotted Vane Drain System
- Remove significant amounts of water utilizing Neenah's R-4999 Vane Style Transverse Drainage Structure Series

Manning Equation Calculator

Company
Name: CrossRoad Engineers, PC

Project
Name: HillView - Section 3

Notes: Str. 214

The Modified Manning Equation is used to calculate flow velocities and volume (in cubic feet per second or cfs). This information is vitally important when selecting a grate type and size for a given project.


$$Q = \frac{0.56}{N} Z D^{3/2} S^{1/2}$$

Where...

- **D** = Depth of flow in feet
- **Q** = Channel flow in cfs (calculated)
- **Z** = Reciprocal of transverse slope (1/ST)
- **S** = Longitudinal slope
- **N** = Roughness coefficient at constant 0.016 (value for concrete and asphalt)

Instructions

Step 1

Enter the Longitudinal and Transverse Slopes. Enter one of the remaining variables and then press calculate:

- Depth of Flow (D)
- Total flow in cfs (Q)
- Spread of flow in feet

Step 2

To Calculate flow capture of specific Neenah Grates, select a catalog number and grate style from the K Chart drop-down.

1. Select the catalog number for the appropriate "K" chart and from the chart "Determine the "K" value based on the Longitudinal and Transverse slopes entered in Step 1.
2. Derive the Grate Coefficient by plotting the Transverse Slope (ST) and Longitudinal Slope factors onto the K Chart.
3. Enter the "K" value in the space provided.
4. Press Calculate.

Step 1

	Alternate One	Alternate Two	Alternate Three
Depth of flow in feet (D): [?]	0.138		
Transverse Slope in ft./ft. (ST): [?]	0.02		
Longitudinal Slope in ft./ft. (SL): [?]	0.0100		
Roughness coefficient (N): (value for concrete or asphalt)	0.016	0.016	0.016
Total flow in cfs (Q): [?]	0.93		
Spread of flow in feet: [?]	6.900		
	Calculate	Reset	Calculate
	Reset	Calculate	Reset

Step 2

numbers and grate types that have K-charts:	3085-V		
Grate Coefficient from K-chart (K):	14		
Grate capacity in cfs: [?]	0.88		
Bypass flow in cfs:	0.05		
Percent captured:	94.82		
	Calculate	Reset	Calculate
	Reset	Calculate	Reset
	Calculate	Reset	Calculate
	Reset	Calculate	Reset

For additional information regarding Neenah Inlet Grate Capacities, please contact Joe Falle P.E., at (920)729-3653 or email at joseph.falle@neenahenterprises.com.

Program Methodology

If your inlet is not capturing enough of the flow, some improvement options include:

- Utilizing the improved efficiency of vane style grates Pg. 112
- Improve spread of flow capture utilizing the Neenah R-3599 Slotted Vane Drain System
- Remove significant amounts of water utilizing Neenah's R-4999 Vane Style Transverse Drainage Structure Series

Manning Equation Calculator

Company
Name: CrossRoad Engineers, PC

Project
Name: Hillview - Section 3

Notes: Str. 215

The Modified Manning Equation is used to calculate flow velocities and volume (in cubic feet per second or cfs). This information is vitally important when selecting a grate type and size for a given project.



$$Q = \frac{0.56}{N} D^{3/2} S^{1/2}$$

Where...

- D = Depth of flow in feet
- Q = Channel flow in cfs (calculated)
- Z = Reciprocal of transverse slope (1/ST)
- S = Longitudinal slope
- N = Roughness coefficient at constant 0.016 (value for concrete and asphalt)

Instructions

Step 1

Enter the Longitudinal and Transverse Slopes. Enter one of the remaining variables and then press calculate:

- Depth of Flow (D)
- Total flow in cfs (Q)
- Spread of flow in feet

Step 2

To Calculate flow capture of specific Neenah Grates, select a catalog number and grate style from the K Chart drop-down.

1. Select the catalog number for the appropriate "K" chart and from the chart "Determine the "K" value based on the Longitudinal and Transverse slopes entered in Step 1.
2. Derive the Grate Coefficient by plotting the Transverse Slope (ST) and Longitudinal Slope factors onto the K Chart.
3. Enter the "K" value in the space provided.
4. Press Calculate.

Step 1

	Alternate One	Alternate Two	Alternate Three
Depth of flow in feet (D): [2]	0.130		
Transverse Slope in ft./ft. (ST): [2]	0.02		
Longitudinal Slope in ft./ft. (SL): [2]	0.0100		
Roughness coefficient (N): (value for concrete or asphalt)	0.016	0.016	0.016
Total flow in cfs (Q): [2]	0.79		
Spread of flow in feet: [2]	6.500		
	Calculate	Reset	Calculate

Step 2

numbers and grate types that have K-charts:	3065-V		
Grate Coefficient from K-chart (K):	14		
Grate capacity in cfs:	0.88		
Bypass flow in cfs:	0.00		
Percent captured:	111.39		
	Calculate	Reset	Calculate
	Reset	Calculate	Reset

For additional information regarding Neenah Inlet Grate Capacities, please contact Joe Falle P.E., at (920)729-3653 or email at joseph.falle@neenahenterprises.com.

Program Methodology

If your Inlet is not capturing enough of the flow, some improvement options include:

- Utilizing the improved efficiency of vane style [grates P-112](#)
- Improve spread of flow capture utilizing the Neenah [R-3599 Slotted Vane Drain System](#)
- Remove significant amounts of water utilizing Neenah's [R-4999 Vane Style Transverse Drainage Structure Series](#)

Manning Equation Calculator

Company
Name: CrossRoad Engineers, PC

Project
Name: Hillview - Section 3

Notes: Str. 222

The Modified Manning Equation is used to calculate flow velocities and volume (in cubic feet per second or cfs). This information is vitally important when selecting a grate type and size for a given project.



$$Q = \frac{0.56}{N} Z D^{3/2} S^{1/2}$$

Where...

- D = Depth of flow in feet
- Q = Channel flow in cfs (calculated)
- Z = Reciprocal of transverse slope (1/ST)
- S = Longitudinal slope
- N = Roughness coefficient at constant 0.016 (value for concrete and asphalt)

Instructions

Step 1

Enter the Longitudinal and Transverse Slopes. Enter one of the remaining variables and then press calculate:

- Depth of Flow (D)
- Total flow in cfs (Q)
- Spread of flow in feet

Step 2

To Calculate flow capture of specific Neenah Grates, select a catalog number and grate style from the K Chart drop-down.

1. Select the catalog number for the appropriate "K" chart and from the chart "Determine the "K" value based on the Longitudinal and Transverse slopes entered in Step 1.
2. Derive the Grate Coefficient by plotting the Transverse Slope (ST) and Longitudinal Slope factors onto the K Chart.
3. Enter the "K" value in the space provided.
4. Press Calculate.

Step 1

	Alternate One	Alternate Two	Alternate Three			
Depth of flow in feet (D): [?]	0.171					
Transverse Slope in ft./ft. (ST): [?]	0.02					
Longitudinal Slope in ft./ft. (SL): [?]	0.008					
Roughness coefficient (N): (value for concrete or asphalt)	0.016	0.016	0.016			
Total flow in cfs (Q): [?]	1.23					
Spread of flow in feet: [?]	8.550					
	Calculate	Reset	Calculate	Reset	Calculate	Reset

Step 2

numbers and grate types that have	3085-V		
K-charts:	[?]		
Grate Coefficient from K-chart (K):	14		
Grate capacity in cfs: [?]	0.84		
Bypass flow in cfs:	0.29		
Percent captured:	78.42		
	Calculate	Reset	Calculate

For additional information regarding Neenah Inlet Grate Capacities, please contact Joe Falle P.E., at (920)729.3653 or email at joseph.falle@neenahenterprises.com.

[Program Methodology](#)

If your inlet is not capturing enough of the flow, some improvement options include:

- Utilizing the improved efficiency of vane style [grates Pg 112](#)
- Improve spread of flow capture utilizing the Neenah [R-3599 Slotted Vane Drain System](#)
- Remove significant amounts of water utilizing Neenah's [R-4999 Vane Style Transverse Drainage Structure Series](#)

Manning Equation Calculator

Company

Name: CrossRoad Engineers, PC

Project

Name: Hillview - Section 3

Notes: Str. 223

The Modified Manning Equation is used to calculate flow velocities and volume (in cubic feet per second or cfs). This information is vitally important when selecting a grate type and size for a given project.



$$Q = \frac{0.56}{N} Z D^{3/2} S^{1/2}$$

Where...

- D = Depth of flow in feet
- Q = Channel flow in cfs (calculated)
- Z = Reciprocal of transverse slope (1/ST)
- S = Longitudinal slope
- N = Roughness coefficient at constant 0.016 (value for concrete and asphalt)

Instructions

Step 1

Enter the Longitudinal and Transverse Slopes. Enter one of the remaining variables and then press calculate:

- Depth of Flow (D)
- Total flow in cfs (Q)
- Spread of flow in feet

Step 2

To Calculate flow capture of specific Neenah Grates, select a catalog number and grate style from the K Chart drop-down.

1. Select the catalog number for the appropriate "K" chart and from the chart "Determine the "K" value based on the Longitudinal and Transverse slopes entered in Step 1.
2. Derive the Grate Coefficient by plotting the Transverse Slope (ST) and Longitudinal Slope factors onto the K Chart.
3. Enter the "K" value in the space provided.
4. Press Calculate.

Step 1

	Alternate One	Alternate Two	Alternate Three
Depth of flow in feet (D): [?]	0.153		
Transverse Slope in ft./ft. (ST): [?]	0.02		
Longitudinal Slope in ft./ft. (SL): [?]	0.008		
Roughness coefficient (N): (value for concrete or asphalt)	0.016	0.016	0.016
Total flow in cfs (Q): [?]	0.90		
Spread of flow in feet: [?]	7.680		
	Calculate	Reset	Calculate
	Reset	Calculate	Reset

Step 2

numbers and grate types that have K-charts: [?]	3085-V		
Grate Coefficient from K-chart (K):	14		
Grate capacity in cfs: [?]	0.92		
Bypass flow in cfs:	-0.02		
Percent captured:	102.22		
	Calculate	Reset	Calculate
	Reset	Calculate	Reset

For additional information regarding Neenah Inlet Grate Capacities, please contact Joe Falle P.E., at (920)729-3653 or email at joseph.falle@neenahenterprises.com.

Program Methodology

If your inlet is not capturing enough of the flow, some improvement options include:

- Utilizing the improved efficiency of vane style grates Pg. 112
- Improve spread of flow capture utilizing the Neenah R-3599 Slotted Vane Drain System
- Remove significant amounts of water utilizing Neenah's R-4999 Vane Style Transverse Drainage Structure Series

Manning Equation Calculator

Company
Name: CrossRoad Engineers, P.C.

Project
Name: Hillview - Section 3

Notes: Str. 228

The Modified Manning Equation is used to calculate flow velocities and volume (in cubic feet per second or cfs). This information is vitally important when selecting a grate type and size for a given project.



$$Q = \frac{0.56}{N} Z^2 S^{1/2}$$

Where...

- D = Depth of flow in feet
- Q = Channel flow in cfs (calculated)
- Z = Reciprocal of transverse slope (1/ST)
- S = Longitudinal slope
- N = Roughness coefficient at constant 0.016 (value for concrete and asphalt)

Instructions

Step 1

Enter the Longitudinal and Transverse Slopes. Enter one of the remaining variables and then press calculate:

- Depth of Flow (D)
- Total flow in cfs (Q)
- Spread of flow in feet

Step 2

To Calculate flow capture of specific Neenah Grates, select a catalog number and grate style from the K Chart drop-down.

1. Select the catalog number for the appropriate "K" chart and from the chart "Determine the "K" value based on the Longitudinal and Transverse slopes entered in Step 1.
2. Derive the Grate Coefficient by plotting the Transverse Slope (ST) and Longitudinal Slope factors onto the K Chart.
3. Enter the "K" value in the space provided.
4. Press Calculate.

Step 1

	Alternate One	Alternate Two	Alternate Three
Depth of flow in feet (D): [?]	0.182		
Transverse Slope in ft./ft. (ST): [?]	0.02		
Longitudinal Slope in ft./ft. (SL): [?]	0.008		
Roughness coefficient (N): (value for concrete or asphalt)	0.016	0.016	0.016
Total flow in cfs (Q): [?]	1.45		
Spread of flow in feet: [?]	9.100		
	Calculate	Reset	Calculate
	Reset	Calculate	Reset

Step 2

numbers and grate types that have K-charts: [?]	3085-V		
Grate Coefficient from K-chart (K):	14		
Grate capacity in cfs: [?]	0.86		
Bypass flow in cfs:	0.49		
Percent captured:	66.21		
	Calculate	Reset	Calculate
	Reset	Calculate	Reset

For additional information regarding Neenah Inlet Grate Capacities, please contact Joe Falle P.E., at (920)729.3653 or email at joseph.falle@neenahenterprises.com.

Program Methodology

If your Inlet is not capturing enough of the flow, some improvement options include:

- Utilizing the improved efficiency of vane style grates P-112
- Improve spread of flow capture utilizing the Neenah R-3599 Slotted Vane Drain System
- Remove significant amounts of water utilizing Neenah's R-4999 Vane Style Transverse Drainage Structure Series

Manning Equation Calculator

Company
Name: CrossRoad Engineers, P.C.
Project
Name: Hillview - Section 3
Notes: Str. 227

The Modified Manning Equation is used to calculate flow velocities and volume (in cubic feet per second or cfs). This information is vitally important when selecting a grate type and size for a given project.



$$Q = \frac{0.56}{N} Z D^{3/2} S^{1/2}$$

Where...

- D = Depth of flow in feet
- Q = Channel flow in cfs (calculated)
- Z = Reciprocal of transverse slope (1/ST)
- S = Longitudinal slope
- N = Roughness coefficient at constant 0.016 (value for concrete and asphalt)

Instructions

Step 1

Enter the Longitudinal and Transverse Slopes. Enter one of the remaining variables and then press calculate:

- Depth of Flow (D)
- Total flow in cfs (Q)
- Spread of flow in feet

Step 2

To Calculate flow capture of specific Neenah Grates, select a catalog number and grate style from the K Chart drop-down.

1. Select the catalog number for the appropriate "K" chart and from the chart "Determine the "K" value based on the Longitudinal and Transverse slopes entered in Step 1.
2. Derive the Grate Coefficient by plotting the Transverse Slope (ST) and Longitudinal Slope factors onto the K Chart.
3. Enter the "K" value in the space provided.
4. Press Calculate.

Step 1

	Alternate One	Alternate Two	Alternate Three
Depth of flow in feet (D): [?]	0.141		
Transverse Slope in ft./ft. (ST): [?]	0.02		
Longitudinal Slope in ft./ft. (SL): [?]	0.008		
Roughness coefficient (N): (value for concrete or asphalt)	0.016	0.016	0.016
Total flow in cfs (Q): [?]	0.73		
Spread of flow in feet: [?]	7.050		
	Calculate	Reset	Calculate

Step 2

numbers and grate types that have K-charts: [?]	3065-V		
Grate Coefficient from K-chart (K):	14		
Grate capacity in cfs: [?]	0.88		
Bypass flow in cfs:	-0.13		
Percent captured:	120.55		
	Calculate	Reset	Calculate
	Reset	Calculate	Reset

For additional information regarding Neenah Inlet Grate Capacities, please contact Joe Falle P.E., at (920)729.3653 or email at joseph.falle@neenahenterprises.com.

Program Methodology

If your Inlet is not capturing enough of the flow, some improvement options include:

- Utilizing the improved efficiency of vane style grates Pg. 112
- Improve spread of flow capture utilizing the Neenah R-3599 Slotted Vane Drain System
- Remove significant amounts of water utilizing Neenah's R-4999 Vane Style Transverse Drainage Structure Series