

Hydrology Report

and

Narrative

of

FAIR PARK CROSSING

for

Gera Development

Prepared by:
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January 08, 2020

File Number: 118111



HYDROLOGY REPORT AND NARRATIVE
GERA DEVELOPMENT – FAIR PARK CROSSING
PAGE 1 OF 1

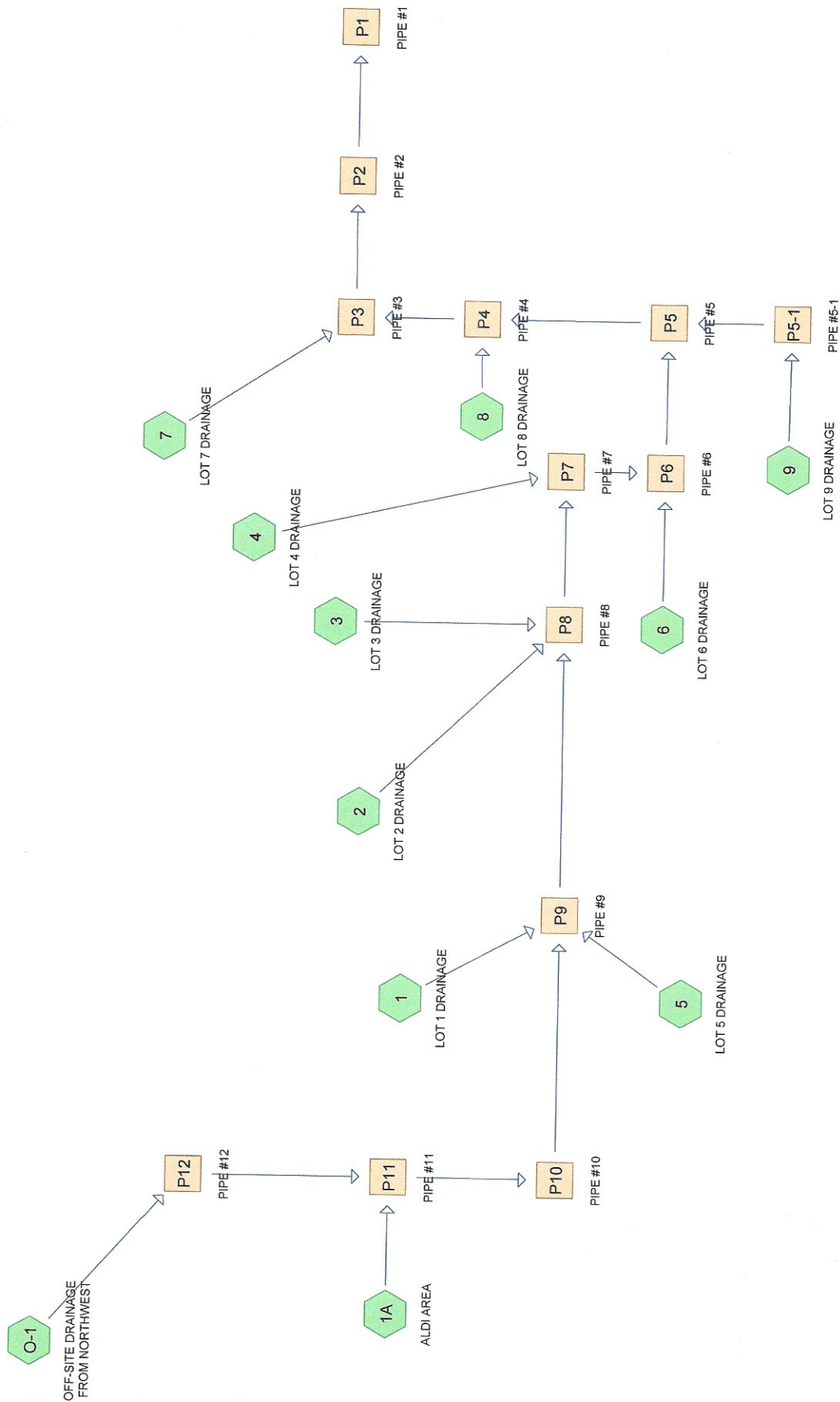
The contents of this report are representative of the captioned site, for the development of this site. The considerations for the drainage include the lot located on the southwest corner of the intersection of Race Street and Fair Park Boulevard. Civilogic is in the process of preparing a specific site plan for FNBC Bank at that location.

There currently exists a drainage problem along the western side of this site for the property fronting Race Street. In addition, the existing drainage facilities at the intersection of Race Street and Fair Park Boulevard are not adequate.

The considerations for this report include alleviating both of the situations mentioned above. For the initial situation listed, the overall drainage plan for the development indicates installation of a pipe along the west side of the site, beginning near Race Street and conveying rainwater runoff to the south. This system continues south then turns to convey the runoff to the east, then north, then east again, crossing Fair Park Boulevard, and continuing into Whiteman Creek. The alleviation of the drainage situation along Race Street, and the additional off-site drainage improvements are considered to be adequate efforts in the arena of drainage in order for storm water detention to be waived for the fourteen acre site as well as the individual lots that are being created.

Naturally, the individual sites are not all completely planned out. Therefore in the drainage analysis we have embraced the conservative theory that if we account for slightly more impervious surface that what will ultimately be developed, the system will still work.

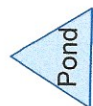
The material provided in this report includes calculation of the runoff of the individual sites, and the flow information within the pipes that will be generated by the runoff.



Drainage Diagram for 118111 DRAINAGE DESIGN

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Type II 24-hr 100-year Rainfall=7.70"

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Summary for Subcatchment O-1: OFF-SITE DRAINAGE FROM NORTHWEST

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 5.40 cfs @ 11.94 hrs, Volume= 0.329 af, Depth> 6.86"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, $dt= 0.10$ hrs
Type II 24-hr 100-year Rainfall=7.70"

Area (sf)	CN	Description
20,056	98	Paved parking & roofs
5,014	74	>75% Grass cover, Good, HSG C
25,070	93	Weighted Average
5,014		Pervious Area
20,056		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	230	0.0043	0.97		Sheet Flow, ALDI PARKING AND RACE STREET
					Smooth surfaces n= 0.011 P2= 3.88"
4.0	230	Total, Increased to minimum Tc = 5.0 min			

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Events for Subcatchment O-1: OFF-SITE DRAINAGE FROM NORTHWEST

Event	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-year	2.56	0.149	3.10
10-year	3.83	0.229	4.77
25-year	4.40	0.265	5.53
50-year	4.88	0.295	6.16
100-year	5.40	0.329	6.86

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Summary for Reach P12: PIPE #12

[52] Hint: Inlet/Outlet conditions not evaluated

[55] Hint: Peak inflow is 103% of Manning's capacity

[88] Warning: $Q_{out} > Q_{in}$ may require Finer Routing > 1

Inflow Area = 0.576 ac, 80.00% Impervious, Inflow Depth > 6.86" for 100-year event
Inflow = 5.40 cfs @ 11.94 hrs, Volume= 0.329 af
Outflow = 5.42 cfs @ 11.96 hrs, Volume= 0.329 af, Atten= 0%, Lag= 1.2 min

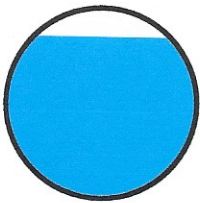
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
Max. Velocity= 3.39 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.13 fps, Avg. Travel Time= 1.8 min

Peak Storage= 195 cf @ 11.96 hrs, Average Depth at Peak Storage= 1.28'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 5.25 cfs

18.0" Diameter Pipe, $n = 0.013$

Length= 120.0' Slope= 0.0025 '/'

Inlet Invert= 263.00', Outlet Invert= 262.70'



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Events for Reach P12: PIPE #12

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-year	2.56	2.57	263.76	107
10-year	3.83	3.85	263.97	145
25-year	4.40	4.42	264.07	163
50-year	4.88	4.90	264.16	177
100-year	5.40	5.42	264.28	195

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Summary for Subcatchment 1A: ALDI AREA

[46] Hint: $T_c=0$ (Instant runoff peak depends on dt)

Runoff = 5.63 cfs @ 11.88 hrs, Volume= 0.296 af, Depth> 7.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, $dt=0.10$ hrs
Type II 24-hr 100-year Rainfall=7.70"

Area (sf)	CN	Description
18,730	98	Paved parking & roofs
3,050	74	>75% Grass cover, Good, HSG C
21,780	95	Weighted Average
3,050		Pervious Area
18,730		Impervious Area

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Events for Subcatchment 1A: ALDI AREA

Event	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-year	2.75	0.138	3.31
10-year	4.03	0.208	4.99
25-year	4.61	0.240	5.76
50-year	5.09	0.266	6.40
100-year	5.63	0.296	7.10

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Summary for Reach P11: PIPE #11

[52] Hint: Inlet/Outlet conditions not evaluated

[61] Hint: Exceeded Reach P12 outlet invert by 0.93' @ 11.90 hrs

Inflow Area = 1.076 ac, 82.79% Impervious, Inflow Depth > 6.97" for 100-year event
Inflow = 10.19 cfs @ 11.90 hrs, Volume= 0.625 af
Outflow = 9.34 cfs @ 11.92 hrs, Volume= 0.624 af, Atten= 8%, Lag= 1.4 min

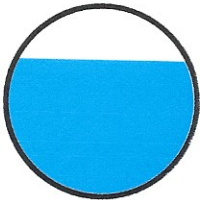
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
Max. Velocity= 4.05 fps, Min. Travel Time= 0.9 min
Avg. Velocity= 1.31 fps, Avg. Travel Time= 2.8 min

Peak Storage= 531 cf @ 11.91 hrs, Average Depth at Peak Storage= 1.44'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 11.31 cfs

24.0" Diameter Pipe, n= 0.013

Length= 220.0' Slope= 0.0025 '/'

Inlet Invert= 262.20', Outlet Invert= 261.65'



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Events for Reach P11: PIPE #11

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-year	4.86	4.40	263.09	299
10-year	7.25	6.62	263.34	405
25-year	8.32	7.61	263.44	451
50-year	9.21	8.44	263.53	489
100-year	10.19	9.34	263.64	531

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Summary for Reach P10: PIPE #10

[52] Hint: Inlet/Outlet conditions not evaluated

[62] Warning: Exceeded Reach P11 OUTLET depth by 0.14' @ 12.10 hrs

Inflow Area = 1.076 ac, 82.79% Impervious, Inflow Depth > 6.97" for 100-year event
Inflow = 9.34 cfs @ 11.92 hrs, Volume= 0.624 af
Outflow = 8.89 cfs @ 11.96 hrs, Volume= 0.624 af, Atten= 5%, Lag= 2.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs

Max. Velocity= 3.96 fps, Min. Travel Time= 0.9 min

Avg. Velocity = 1.31 fps, Avg. Travel Time= 2.7 min

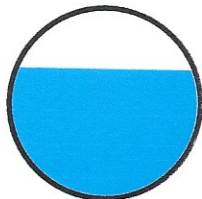
Peak Storage= 479 cf @ 11.94 hrs, Average Depth at Peak Storage= 1.36'

Bank-Full Depth= 2.00', Capacity at Bank-Full= 11.26 cfs

24.0" Diameter Pipe, n= 0.013

Length= 210.0' Slope= 0.0025 '/'

Inlet Invert= 261.65', Outlet Invert= 261.13'



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Events for Reach P10: PIPE #10

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-year	4.40	4.19	262.51	272
10-year	6.62	6.29	262.74	366
25-year	7.61	7.24	262.84	407
50-year	8.44	8.02	262.92	441
100-year	9.34	8.89	263.01	479

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Summary for Subcatchment 1: LOT 1 DRAINAGE

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 16.27 cfs @ 11.94 hrs, Volume= 1.012 af, Depth> 7.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, $dt=0.10$ hrs
Type II 24-hr 100-year Rainfall=7.70"

Area (sf)	CN	Description
64,054	98	Paved parking & roofs
10,428	74	>75% Grass cover, Good, HSG C
74,482	95	Weighted Average
10,428		Pervious Area
64,054		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	220	0.0100	1.34		Sheet Flow, Building Addition Roof
					Smooth surfaces n= 0.011 P2= 3.88"
2.7	220	Total, Increased to minimum Tc = 5.0 min			

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Events for Subcatchment 1: LOT 1 DRAINAGE

Event	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-year	7.91	0.472	3.31
10-year	11.65	0.711	4.99
25-year	13.33	0.820	5.76
50-year	14.73	0.911	6.39
100-year	16.27	1.012	7.10

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Summary for Subcatchment 5: LOT 5 DRAINAGE

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 10.92 cfs @ 11.94 hrs, Volume= 0.679 af, Depth> 7.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, $dt=0.10$ hrs
Type II 24-hr 100-year Rainfall=7.70"

Area (sf)	CN	Description
43,002	98	Paved parking & roofs
7,001	74	>75% Grass cover, Good, HSG C
50,003	95	Weighted Average
7,001		Pervious Area
43,002		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	220	0.0100	1.34		Sheet Flow, Building Addition Roof
					Smooth surfaces n= 0.011 P2= 3.88"
2.7	220	Total, Increased to minimum Tc = 5.0 min			

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Events for Subcatchment 5: LOT 5 DRAINAGE

Event	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-year	5.31	0.317	3.31
10-year	7.82	0.478	4.99
25-year	8.95	0.551	5.76
50-year	9.89	0.612	6.39
100-year	10.92	0.679	7.10

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Summary for Reach P9: PIPE #9

[52] Hint: Inlet/Outlet conditions not evaluated

[55] Hint: Peak inflow is 108% of Manning's capacity

[88] Warning: $Q_{out} > Q_{in}$ may require Finer Routing>1

[62] Warning: Exceeded Reach P10 OUTLET depth by 0.30' @ 12.00 hrs

Inflow Area = 3.933 ac, 85.12% Impervious, Inflow Depth > 7.06" for 100-year event
Inflow = 35.94 cfs @ 11.95 hrs, Volume= 2.315 af
Outflow = 36.17 cfs @ 11.96 hrs, Volume= 2.314 af, Atten= 0%, Lag= 1.0 min

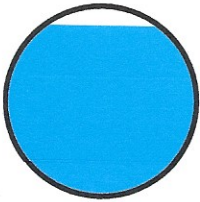
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
Max. Velocity= 5.38 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.85 fps, Avg. Travel Time= 1.3 min

Peak Storage= 1,006 cf @ 11.96 hrs, Average Depth at Peak Storage= 2.70'
Bank-Full Depth= 3.00', Capacity at Bank-Full= 33.35 cfs

36.0" Diameter Pipe, $n = 0.013$

Length= 148.0' Slope= 0.0025 '/'

Inlet Invert= 260.13', Outlet Invert= 259.76'



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Events for Reach P9: PIPE #9

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-year	17.72	17.45	261.70	551
10-year	25.65	25.85	262.14	746
25-year	29.41	29.63	262.35	834
50-year	32.51	32.75	262.55	910
100-year	35.94	36.17	262.83	1,006

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Summary for Subcatchment 2: LOT 2 DRAINAGE

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 10.89 cfs @ 11.94 hrs, Volume= 0.677 af, Depth> 7.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, $dt=0.10$ hrs
Type II 24-hr 100-year Rainfall=7.70"

Area (sf)	CN	Description
42,880	98	Paved parking & roofs
6,981	74	>75% Grass cover, Good, HSG C
49,861	95	Weighted Average
6,981		Pervious Area
42,880		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	220	0.0100	1.34		Sheet Flow, Building Addition Roof
					Smooth surfaces n= 0.011 P2= 3.88"
2.7	220	Total, Increased to minimum Tc = 5.0 min			

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Events for Subcatchment 2: LOT 2 DRAINAGE

Event	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-year	5.30	0.316	3.31
10-year	7.80	0.476	4.99
25-year	8.93	0.549	5.76
50-year	9.86	0.610	6.39
100-year	10.89	0.677	7.10

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Summary for Subcatchment 3: LOT 3 DRAINAGE

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 10.89 cfs @ 11.94 hrs, Volume= 0.677 af, Depth> 7.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, $dt=0.10$ hrs
Type II 24-hr 100-year Rainfall=7.70"

Area (sf)	CN	Description
42,880	98	Paved parking & roofs
6,981	74	>75% Grass cover, Good, HSG C
49,861	95	Weighted Average
6,981		Pervious Area
42,880		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	220	0.0100	1.34		Sheet Flow, Building Addition Roof
					Smooth surfaces n= 0.011 P2= 3.88"
2.7	220	Total, Increased to minimum Tc = 5.0 min			

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Events for Subcatchment 3: LOT 3 DRAINAGE

Event	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-year	5.30	0.316	3.31
10-year	7.80	0.476	4.99
25-year	8.93	0.549	5.76
50-year	9.86	0.610	6.39
100-year	10.89	0.677	7.10

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Summary for Reach P8: PIPE #8

[52] Hint: Inlet/Outlet conditions not evaluated

[55] Hint: Peak inflow is 110% of Manning's capacity

[62] Warning: Exceeded Reach P9 OUTLET depth by 0.03' @ 12.00 hrs

Inflow Area = 6.223 ac, 85.44% Impervious, Inflow Depth > 7.07" for 100-year event
Inflow = 58.32 cfs @ 11.96 hrs, Volume= 3.668 af
Outflow = 56.33 cfs @ 11.98 hrs, Volume= 3.666 af, Atten= 3%, Lag= 1.2 min

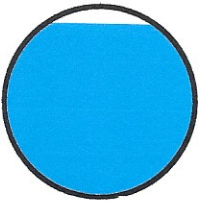
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
Max. Velocity= 6.25 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 2.16 fps, Avg. Travel Time= 2.3 min

Peak Storage= 2,721 cf @ 11.97 hrs, Average Depth at Peak Storage= 3.18'
Bank-Full Depth= 3.50', Capacity at Bank-Full= 52.90 cfs

42.0" Diameter Pipe, n= 0.013

Length= 293.0' Slope= 0.0028 '/'

Inlet Invert= 259.26', Outlet Invert= 258.45'



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Events for Reach P8: PIPE #8

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-year	28.24	27.28	261.08	1,484
10-year	41.72	40.46	261.60	2,009
25-year	47.78	46.36	261.85	2,246
50-year	52.80	51.20	262.09	2,453
100-year	58.32	56.33	262.44	2,721

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Summary for Subcatchment 4: LOT 4 DRAINAGE

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 10.92 cfs @ 11.94 hrs, Volume= 0.679 af, Depth> 7.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, $dt=0.10$ hrs
Type II 24-hr 100-year Rainfall=7.70"

Area (sf)	CN	Description
43,002	98	Paved parking & roofs
7,001	74	>75% Grass cover, Good, HSG C
50,003	95	Weighted Average
7,001		Pervious Area
43,002		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	220	0.0100	1.34		Sheet Flow, Building Addition Roof
					Smooth surfaces n= 0.011 P2= 3.88"
2.7	220	Total, Increased to minimum Tc = 5.0 min			

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Events for Subcatchment 4: LOT 4 DRAINAGE

Event	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-year	5.31	0.317	3.31
10-year	7.82	0.478	4.99
25-year	8.95	0.551	5.76
50-year	9.89	0.612	6.39
100-year	10.92	0.679	7.10

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Summary for Reach P7: PIPE #7

[52] Hint: Inlet/Outlet conditions not evaluated

[55] Hint: Peak inflow is 108% of Manning's capacity

[62] Warning: Exceeded Reach P8 OUTLET depth by 0.11' @ 12.20 hrs

Inflow Area = 7.371 ac, 85.53% Impervious, Inflow Depth > 7.07" for 100-year event
Inflow = 67.24 cfs @ 11.97 hrs, Volume= 4.345 af
Outflow = 66.86 cfs @ 11.97 hrs, Volume= 4.345 af, Atten= 1%, Lag= 0.2 min

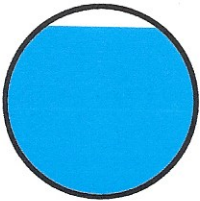
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
Max. Velocity= 7.34 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.55 fps, Avg. Travel Time= 0.4 min

Peak Storage= 548 cf @ 11.97 hrs, Average Depth at Peak Storage= 3.12'
Bank-Full Depth= 3.50', Capacity at Bank-Full= 62.29 cfs

42.0" Diameter Pipe, n= 0.013

Length= 60.0' Slope= 0.0038 '/'

Inlet Invert= 258.45', Outlet Invert= 258.22'



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Type II 24-hr 100-year Rainfall=7.70"

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Events for Reach P7: PIPE #7

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-year	32.57	32.39	260.25	299
10-year	48.27	48.04	260.76	405
25-year	55.30	55.04	261.01	454
50-year	61.08	60.78	261.24	495
100-year	67.24	66.86	261.57	548

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Summary for Subcatchment 6: LOT 6 DRAINAGE

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 10.92 cfs @ 11.94 hrs, Volume= 0.679 af, Depth> 7.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, $dt=0.10$ hrs
Type II 24-hr 100-year Rainfall=7.70"

Area (sf)	CN	Description
43,002	98	Paved parking & roofs
7,001	74	>75% Grass cover, Good, HSG C
50,003	95	Weighted Average
7,001		Pervious Area
43,002		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	220	0.0100	1.34		Sheet Flow, Building Addition Roof
					Smooth surfaces n= 0.011 P2= 3.88"
2.7	220	Total, Increased to minimum Tc = 5.0 min			

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Events for Subcatchment 6: LOT 6 DRAINAGE

Event	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-year	5.31	0.317	3.31
10-year	7.82	0.478	4.99
25-year	8.95	0.551	5.76
50-year	9.89	0.612	6.39
100-year	10.92	0.679	7.10

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Summary for Reach P6: PIPE #6

[52] Hint: Inlet/Outlet conditions not evaluated

[55] Hint: Peak inflow is 108% of Manning's capacity

[61] Hint: Exceeded Reach P7 outlet invert by 3.04' @ 12.00 hrs

Inflow Area = 8.518 ac, 85.59% Impervious, Inflow Depth > 7.08" for 100-year event
Inflow = 77.79 cfs @ 11.97 hrs, Volume= 5.024 af
Outflow = 75.22 cfs @ 11.98 hrs, Volume= 5.021 af, Atten= 3%, Lag= 0.9 min

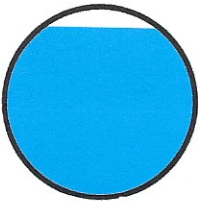
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
Max. Velocity= 6.47 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 2.25 fps, Avg. Travel Time= 1.9 min

Peak Storage= 3,031 cf @ 11.98 hrs, Average Depth at Peak Storage= 3.57'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 71.96 cfs

48.0" Diameter Pipe, n= 0.013

Length= 255.0' Slope= 0.0025 '/'

Inlet Invert= 257.72', Outlet Invert= 257.08'



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Events for Reach P6: PIPE #6

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-year	37.70	36.43	259.77	1,656
10-year	55.86	54.19	260.36	2,246
25-year	64.00	62.10	260.64	2,513
50-year	70.67	68.55	260.90	2,742
100-year	77.79	75.22	261.29	3,031

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Type II 24-hr 100-year Rainfall=7.70"

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Summary for Subcatchment 9: LOT 9 DRAINAGE

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 10.92 cfs @ 11.94 hrs, Volume= 0.679 af, Depth> 7.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, $dt= 0.10$ hrs
Type II 24-hr 100-year Rainfall=7.70"

Area (sf)	CN	Description
43,002	98	Paved parking & roofs
7,001	74	>75% Grass cover, Good, HSG C
50,003	95	Weighted Average
7,001		Pervious Area
43,002		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	220	0.0100	1.34		Sheet Flow, Building Addition Roof
					Smooth surfaces n= 0.011 P2= 3.88"
2.7	220	Total, Increased to minimum Tc = 5.0 min			

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Type II 24-hr 100-year Rainfall=7.70"

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Events for Subcatchment 9: LOT 9 DRAINAGE

Event	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-year	5.31	0.317	3.31
10-year	7.82	0.478	4.99
25-year	8.95	0.551	5.76
50-year	9.89	0.612	6.39
100-year	10.92	0.679	7.10

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Summary for Reach P5-1: PIPE #5-1

[52] Hint: Inlet/Outlet conditions not evaluated

[55] Hint: Peak inflow is 104% of Manning's capacity

[85] Warning: Oscillations may require Finer Routing>1

Inflow Area = 1.148 ac, 86.00% Impervious, Inflow Depth > 7.10" for 100-year event
Inflow = 10.92 cfs @ 11.94 hrs, Volume= 0.679 af
Outflow = 10.84 cfs @ 11.95 hrs, Volume= 0.679 af, Atten= 1%, Lag= 0.3 min

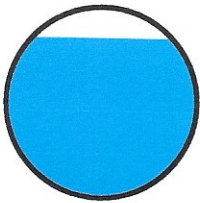
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
Max. Velocity= 6.78 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.29 fps, Avg. Travel Time= 0.2 min

Peak Storage= 54 cf @ 11.95 hrs, Average Depth at Peak Storage= 1.26'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 10.50 cfs

18.0" Diameter Pipe, n= 0.013

Length= 34.0' Slope= 0.0100 '/'

Inlet Invert= 259.92', Outlet Invert= 259.58'



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Events for Reach P5-1: PIPE #5-1

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-year	5.31	5.43	260.68	30
10-year	7.82	7.77	260.88	41
25-year	8.95	8.89	260.98	45
50-year	9.89	9.82	261.07	49
100-year	10.92	10.84	261.18	54

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Summary for Reach P5: PIPE #5

[52] Hint: Inlet/Outlet conditions not evaluated

[55] Hint: Peak inflow is 109% of Manning's capacity

[62] Warning: Exceeded Reach P5-1 OUTLET depth by 0.06' @ 12.00 hrs

[62] Warning: Exceeded Reach P6 OUTLET depth by 0.21' @ 12.10 hrs

Inflow Area = 9.666 ac, 85.64% Impervious, Inflow Depth > 7.08" for 100-year event
Inflow = 85.99 cfs @ 11.98 hrs, Volume= 5.700 af
Outflow = 83.64 cfs @ 11.99 hrs, Volume= 5.698 af, Atten= 3%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs

Max. Velocity= 7.05 fps, Min. Travel Time= 0.4 min

Avg. Velocity = 2.49 fps, Avg. Travel Time= 1.3 min

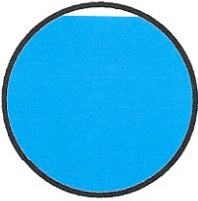
Peak Storage= 2,334 cf @ 11.99 hrs, Average Depth at Peak Storage= 3.76'

Bank-Full Depth= 4.00', Capacity at Bank-Full= 78.68 cfs

48.0" Diameter Pipe, n= 0.013

Length= 190.0' Slope= 0.0030 '/'

Inlet Invert= 257.08', Outlet Invert= 256.51'



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Type II 24-hr 100-year Rainfall=7.70"

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Events for Reach P5: PIPE #5

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-year	41.64	40.62	259.14	1,243
10-year	61.89	60.52	259.75	1,691
25-year	70.93	69.37	260.04	1,895
50-year	78.30	76.54	260.32	2,072
100-year	85.99	83.64	260.84	2,334

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Summary for Subcatchment 8: LOT 8 DRAINAGE

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 10.92 cfs @ 11.94 hrs, Volume= 0.679 af, Depth> 7.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, $dt= 0.10$ hrs
Type II 24-hr 100-year Rainfall=7.70"

Area (sf)	CN	Description
43,002	98	Paved parking & roofs
7,001	74	>75% Grass cover, Good, HSG C
50,003	95	Weighted Average
7,001		Pervious Area
43,002		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	220	0.0100	1.34		Sheet Flow, Building Addition Roof
					Smooth surfaces n= 0.011 P2= 3.88"
2.7	220	Total, Increased to minimum Tc = 5.0 min			

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Type II 24-hr 100-year Rainfall=7.70"

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Events for Subcatchment 8: LOT 8 DRAINAGE

Event	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-year	5.31	0.317	3.31
10-year	7.82	0.478	4.99
25-year	8.95	0.551	5.76
50-year	9.89	0.612	6.39
100-year	10.92	0.679	7.10

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Type II 24-hr 100-year Rainfall=7.70"

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Summary for Reach P4: PIPE #4

[52] Hint: Inlet/Outlet conditions not evaluated

[55] Hint: Peak inflow is 108% of Manning's capacity

[62] Warning: Exceeded Reach P5 OUTLET depth by 0.10' @ 12.10 hrs

Inflow Area = 10.814 ac, 85.68% Impervious, Inflow Depth > 7.08" for 100-year event
Inflow = 94.22 cfs @ 11.98 hrs, Volume= 6.377 af
Outflow = 91.83 cfs @ 11.99 hrs, Volume= 6.374 af, Atten= 3%, Lag= 0.7 min

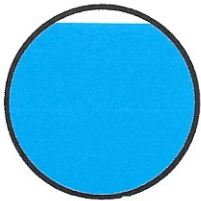
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
Max. Velocity= 7.78 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 2.76 fps, Avg. Travel Time= 1.3 min

Peak Storage= 2,533 cf @ 11.99 hrs, Average Depth at Peak Storage= 3.66'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 86.98 cfs

48.0" Diameter Pipe, n= 0.013

Length= 210.0' Slope= 0.0037 '/'

Inlet Invert= 256.51', Outlet Invert= 255.74'



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Events for Reach P4: PIPE #4

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-year	45.74	44.58	258.57	1,366
10-year	68.10	66.55	259.17	1,861
25-year	78.06	76.29	259.46	2,085
50-year	86.13	84.15	259.73	2,279
100-year	94.22	91.83	260.17	2,533

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Type II 24-hr 100-year Rainfall=7.70"

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Summary for Subcatchment 7: LOT 7 DRAINAGE

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 12.37 cfs @ 11.94 hrs, Volume= 0.769 af, Depth> 7.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, $dt=0.10$ hrs
Type II 24-hr 100-year Rainfall=7.70"

Area (sf)	CN	Description
49,864	98	Paved parking & roofs
6,756	74	>75% Grass cover, Good, HSG C
56,620	95	Weighted Average
6,756		Pervious Area
49,864		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	140	0.0100	1.23		Sheet Flow, Building Addition Roof
					Smooth surfaces n= 0.011 P2= 3.88"
1.9	140	Total, Increased to minimum Tc = 5.0 min			

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Type II 24-hr 100-year Rainfall=7.70"

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Events for Subcatchment 7: LOT 7 DRAINAGE

Event	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-year	6.02	0.359	3.31
10-year	8.86	0.541	4.99
25-year	10.13	0.624	5.76
50-year	11.19	0.693	6.39
100-year	12.37	0.769	7.10

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Summary for Reach P3: PIPE #3

[52] Hint: Inlet/Outlet conditions not evaluated

[55] Hint: Peak inflow is 104% of Manning's capacity

[62] Warning: Exceeded Reach P4 OUTLET depth by 0.04' @ 12.20 hrs

Inflow Area = 12.114 ac, 85.94% Impervious, Inflow Depth > 7.08" for 100-year event
Inflow = 103.67 cfs @ 11.99 hrs, Volume= 7.143 af
Outflow = 103.44 cfs @ 11.99 hrs, Volume= 7.143 af, Atten= 0%, Lag= 0.1 min

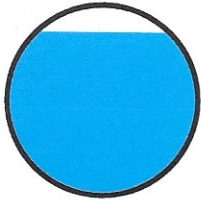
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
Max. Velocity= 9.01 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 3.15 fps, Avg. Travel Time= 0.1 min

Peak Storage= 310 cf @ 11.99 hrs, Average Depth at Peak Storage= 3.43'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 99.67 cfs

48.0" Diameter Pipe, n= 0.013

Length= 27.0' Slope= 0.0048 '/'

Inlet Invert= 255.74', Outlet Invert= 255.61'



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Events for Reach P3: PIPE #3

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-year	50.30	50.18	257.75	171
10-year	75.04	74.87	258.33	233
25-year	86.02	85.83	258.61	260
50-year	94.90	94.69	258.85	284
100-year	103.67	103.44	259.17	310

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Summary for Reach P2: PIPE #2

[52] Hint: Inlet/Outlet conditions not evaluated

[61] Hint: Exceeded Reach P3 outlet invert by 2.91' @ 12.00 hrs

Inflow Area = 12.114 ac, 85.94% Impervious, Inflow Depth > 7.08" for 100-year event
Inflow = 103.44 cfs @ 11.99 hrs, Volume= 7.143 af
Outflow = 103.15 cfs @ 11.99 hrs, Volume= 7.143 af, Atten= 0%, Lag= 0.1 min

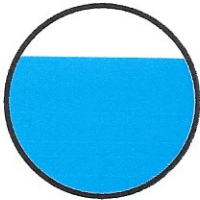
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
Max. Velocity= 10.53 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.53 fps, Avg. Travel Time= 0.2 min

Peak Storage= 442 cf @ 11.99 hrs, Average Depth at Peak Storage= 2.92'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 117.28 cfs

48.0" Diameter Pipe, n= 0.013

Length= 45.0' Slope= 0.0067 '/'

Inlet Invert= 255.61', Outlet Invert= 255.31'



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Events for Reach P2: PIPE #2

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-year	50.18	49.99	257.44	252
10-year	74.87	74.62	257.93	340
25-year	85.83	85.56	258.15	379
50-year	94.69	94.39	258.33	410
100-year	103.44	103.15	258.53	442

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Summary for Reach P1: PIPE #1

[52] Hint: Inlet/Outlet conditions not evaluated

[62] Warning: Exceeded Reach P2 OUTLET depth by 0.01' @ 12.20 hrs

Inflow Area = 12.114 ac, 85.94% Impervious, Inflow Depth > 7.08" for 100-year event
Inflow = 103.15 cfs @ 11.99 hrs, Volume= 7.143 af
Outflow = 101.91 cfs @ 12.00 hrs, Volume= 7.141 af, Atten= 1%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
Max. Velocity= 10.92 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.64 fps, Avg. Travel Time= 0.8 min

Peak Storage= 1,697 cf @ 11.99 hrs, Average Depth at Peak Storage= 2.81'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 122.54 cfs

48.0" Diameter Pipe, n= 0.013

Length= 180.0' Slope= 0.0073 '/'

Inlet Invert= 255.31', Outlet Invert= 254.00'



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Events for Reach P1: PIPE #1

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-year	49.99	49.18	257.09	970
10-year	74.62	73.56	257.56	1,311
25-year	85.56	84.38	257.77	1,458
50-year	94.39	93.14	257.94	1,577
100-year	103.15	101.91	258.12	1,697