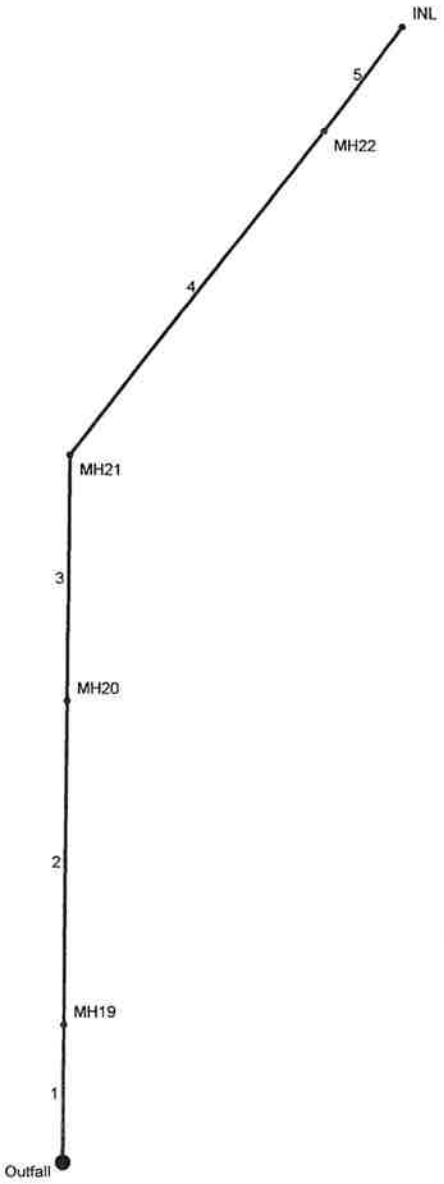
Hydraulic Analysis

Outfall 4 (Drainage Area 7)

Outfall 4 - normal_stage



- Maximum flow of 200 cfs with river at normal stage

Project File: Outfall 4 - normal_stage.stm	Number of lines: 5	Date: 11-30-2010

Hydraflow Storm Sewers Extension v6.066

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr line No.	Line length (ft)	Defl angle (deg)	Junc type	Known Q (cfs)	Drng area (ac)	Runoff coeff (C)	Inlet time (min)	Invert El Dn (ft)	Line slope (%)	Invert El Up (ft)	Line size (in)	Line shape	N value (n)	J-loss coeff (K)	Inlet/ Rim El (ft)	
1	End	153.00	-89.35	MH	0.00	0.00	0.00	0.0	0.50	0.92	1.90	48x48	Box	0.013	0.15	10.00	OUT - MH19
2	1	360.00	0.00	MH	0.00	0.00	0.00	0.0	1.90	0.14	2.40	48	Cir	0.013	0.15	17.00	MH19 - MH20
3	2	272.00	0.00	MH	0.00	0.00	0.00	0.0	6.80	1.36	10.50	48	Cir	0.013	0.66	16.00	MH20 - MH21
4	3	460.00	37.56	MH	0.00	0.00	0.00	0.0	10.50	0.65	13.50	48	Cir	0.013	0.15	35.00	MH21 - MH22
5	4	145.00	-1.22	MH	200.00	0.00	0.00	0.0	21.00	2.76	25.00	48	Cir	0.013	1.00	34.00	MH22 - INL

Q_T

Outfall 4 - normal_stage | Number of lines: 5 | Date: 11-30-2010

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	153.00	0.00	0.00	0.00	0.00	0.00	0.0	1.3	0.0	200.0	174.9	12.50	48 x 48 b	0.92	0.50	1.90	4.50	5.90	4.50	10.00	OUT - MH19
2	1	360.00	0.00	0.00	0.00	0.00	0.00	0.0	0.9	0.0	200.0	53.53	15.92	48	0.14	1.90	2.40	5.90	12.88	10.00	17.00	MH19 - MH20
3	2	272.00	0.00	0.00	0.00	0.00	0.00	0.0	0.6	0.0	200.0	167.5	15.92	48	1.36	6.80	10.50	13.47	18.75	17.00	16.00	MH20 - MH21
4	3	460.00	0.00	0.00	0.00	0.00	0.00	0.0	0.2	0.0	200.0	116.0	15.92	48	0.65	10.50	13.50	21.35	30.27	16.00	35.00	MH21 - MH22
5	4	145.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	200.0	238.6	15.92	48	2.76	21.00	25.00	30.86	33.67	35.00	34.00	MH22 - INL

pipe full

below overtopping elev.

Outfall 4 - normal_stage

Number of lines: 5

Run Date: 11-30-2010

NOTES: Intensity = 106.59 / (Inlet time + 17.00) ^ 0.85; Return period = 100 Yrs. ; c = cir e = ellip b = box

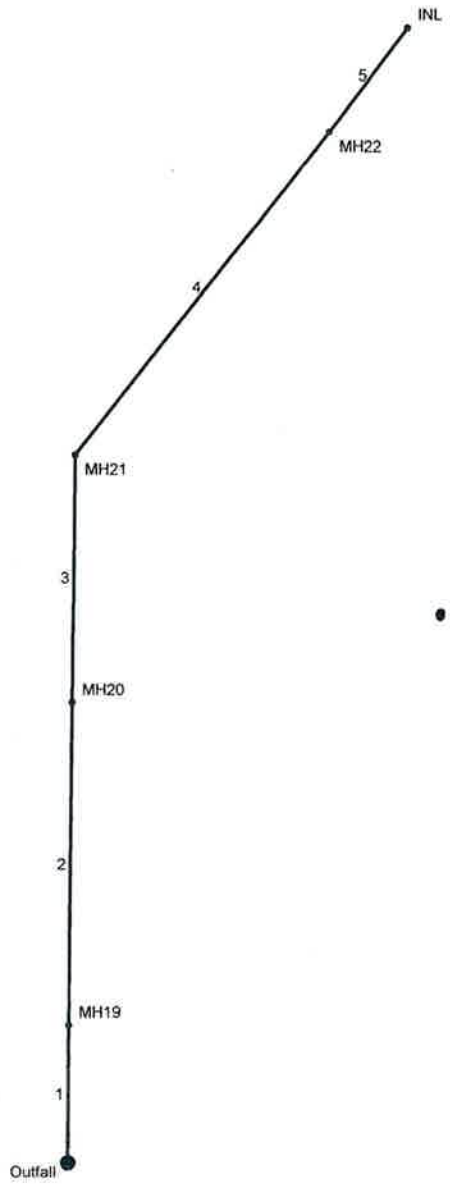
Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
1	48 48 b	200.0	0.50	4.50	4.00	16.00	12.50	2.43	6.93	1.196	153.00	1.90	5.90	4.00**	16.00	12.50	2.43	8.33	1.196	1.196	n/a	0.15	n/a
2	48	200.0	1.90	5.90	4.00*	12.56	15.92	3.94	9.84	1.939	360.00	2.40	12.88	4.00	12.57	15.92	3.94	16.82	1.939	1.939	6.980	0.15	0.59
3	48	200.0	6.80	13.47	4.00	12.56	15.92	3.94	17.41	1.939	272.00	10.50	18.75	4.00	12.57	15.92	3.94	22.69	1.939	1.939	5.274	0.66	2.60
4	48	200.0	10.50	21.35	4.00	12.56	15.92	3.94	25.29	1.939	460.00	13.50	30.27	4.00	12.57	15.92	3.94	34.21	1.939	1.939	8.919	0.15	0.59
5	48	200.0	21.00	30.86	4.00	12.56	15.92	3.94	34.80	1.939	145.00	25.00	33.67	4.00	12.57	15.92	3.94	37.61	1.939	1.939	2.812	1.00	3.94

Outfall 4 - normal_stage | Number of lines: 5 | Run Date: 11-30-2010

Notes: * Normal depth assumed.; ** Critical depth. ; c = cir e = ellip b = box

Outfall 4 - 10-yr_stage



- Maximum flow of 155 cfs with river at 10-yr storm stage

Project File: Outfall 4 - 10-yr_stage.stm	Number of lines: 5	Date: 11-30-2010

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr line No.	Line length (ft)	Defl angle (deg)	Junc type	Known Q (cfs)	Drng area (ac)	Runoff coeff (C)	Inlet time (min)	Invert El Dn (ft)	Line slope (%)	Invert El Up (ft)	Line size (in)	Line shape	N value (n)	J-loss coeff (K)	Inlet/ Rim El (ft)	
1	End	153.00	-89.35	MH	0.00	0.00	0.00	0.0	0.50	0.92	1.90	48x48	Box	0.013	0.15	10.00	OUT - MH19
2	1	360.00	0.00	MH	0.00	0.00	0.00	0.0	1.90	0.14	2.40	48	Cir	0.013	0.15	17.00	MH19 - MH20
3	2	272.00	0.00	MH	0.00	0.00	0.00	0.0	6.80	1.36	10.50	48	Cir	0.013	0.66	16.00	MH20 - MH21
4	3	460.00	37.56	MH	0.00	0.00	0.00	0.0	10.50	0.65	13.50	48	Cir	0.013	0.15	35.00	MH21 - MH22
5	4	145.00	-1.22	MH	155.00	0.00	0.00	0.0	21.00	2.76	25.00	48	Cir	0.013	1.00	34.00	MH22 - INL

Q_T

Outfall 4 - 10-yr_stage

Number of lines: 5

Date: 11-30-2010

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	153.00	0.00	0.00	0.00	0.00	0.00	0.0	1.7	0.0	155.0	174.9	9.69	48 x 48 b	0.92	0.50	1.90	15.50	16.60	4.50	10.00	OUT - MH19
2	1	360.00	0.00	0.00	0.00	0.00	0.00	0.0	1.2	0.0	155.0	53.53	12.34	48	0.14	1.90	2.40	16.82	21.01	10.00	17.00	MH19 - MH20
3	2	272.00	0.00	0.00	0.00	0.00	0.00	0.0	0.8	0.0	155.0	167.5	12.34	48	1.36	6.80	10.50	21.37	24.53	17.00	16.00	MH20 - MH21
4	3	460.00	0.00	0.00	0.00	0.00	0.00	0.0	0.2	0.0	155.0	116.0	12.34	48	0.65	10.50	13.50	26.10	31.45	16.00	35.00	MH21 - MH22
5	4	145.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	155.0	238.6	12.34	48	2.76	21.00	25.00	31.81	33.50	35.00	34.00	MH22 - INL

below overtopping elev.

Nauguatuck River
10-yr storm elev.
(10% annual chance)

Outfall 4 - 10-yr_stage	Number of lines: 5	Run Date: 11-30-2010

NOTES: Intensity = 106.59 / (Inlet time + 17.00) ^ 0.85; Return period = 100 Yrs. ; c = cir e = ellip b = box

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
1	48 48 b	155.0	0.50	15.50	4.00	16.00	9.69	1.46	16.96	0.718	153.00	1.90	16.60	4.00	16.00	9.69	1.46	18.06	0.718	0.718	1.099	0.15	0.22
2	48	155.0	1.90	16.82	4.00	12.56	12.34	2.37	19.18	1.165	360.00	2.40	21.01	4.00	12.57	12.33	2.37	23.38	1.164	1.165	4.193	0.15	0.35
3	48	155.0	6.80	21.37	4.00	12.56	12.34	2.37	23.73	1.165	272.00	10.50	24.53	4.00	12.57	12.33	2.37	26.90	1.164	1.165	3.168	0.66	1.56
4	48	155.0	10.50	26.10	4.00	12.56	12.34	2.37	28.46	1.165	460.00	13.50	31.45	4.00	12.57	12.33	2.37	33.82	1.164	1.165	5.357	0.15	0.35
5	48	155.0	21.00	31.81	4.00	12.56	12.34	2.37	34.17	1.165	145.00	25.00	33.50	4.00	12.57	12.33	2.37	35.86	1.164	1.165	1.689	1.00	2.37

Outfall 4 - 10-yr_stage | Number of lines: 5 | Run Date: 11-30-2010

; c = cir e = ellip b = box

Engineering,
Landscape Architecture
and Environmental Science

MILONE & MACBROOM®
99 Realty Drive
Cheshire, Connecticut 06410
(203) 271-1773 Fax (203) 272-9733

JOB Derby / Ansonia Levee Certification (1560-119)
SHEET NO. 1 OF 1
CALCULATED BY FAB DATE 11/19/10
CHECKED BY DATE
SCALE Discharges from BJ's site (D.A. 7)

- Discharge from BJ's site:

  - D.A. = 484,340 ft^2 ≈ 11.20 acres //

  - $C_{COMP} = \frac{(0.17 \times 0.45) + (11.03 \times 0.60)}{11.20}$

  - $C_{COMP} = 0.60$ //

  - $T_c = 5$ min ≈ $I_{10} = 6.0$ in/hr

    $I_{100} = 7.8$ in/hr

  - $Q_{10} = 0.60 \times 6.0 \times 11.20 = 40.32$ cfs

  - $Q_{100} = 0.60 \times 7.8 \times 11.20 = 52.42$ cfs

Engineering,
Landscape Architecture
and Environmental Science

MILONE & MACBROOM®
99 Realty Drive
Cheshire, Connecticut 06410
(203) 271-1773 Fax (203) 272-9733

JOB Derby / Ansonia Levee Certification (1560-119)
SHEET NO. 1 OF 1
CALCULATED BY FAB DATE 11/13/10
CHECKED BY _____ DATE _____
SCALE Analysis of 48-inch pressure conduit

- Analysis of 48-inch pressure conduit:
  - 100-yr storm runoff for Area 7 = 281.5 cfs (Outfall 4)
  - 100-yr storm runoff from DJ's = 52.4 cfs

    281.5 - 52.4 ≈ 229 cfs

  - Capacity of pressure conduit = 155 cfs

    229 - 155 = 74 cfs (additional flow to Outfall 2 - Derby Pump Station)

  - 8'x6' gravity conduit in Derby Pump Station:

    100-yr storm runoff = 475.9 cfs (Outfall 2)

  - Maximum capacity of gravity conduit = ± 548 cfs

    548 - 475.9 ≈ 72 cfs ≈ 74 cfs OK //

Hydraulic Analysis

Outfall 5 (Drainage Area 8)

Manning Pipe Calculator

Given Input Data:

Shape	Rectangular
Solving for	Depth of Flow
Height	60.0000 in
Width	72.0000 in
Flowrate	290.0000 cfs
Slope	0.0031 ft/ft
Manning's n	0.0130

Computed Results:

Depth	59.9469 in
Area	30.0000 ft2
Wetted Area	29.9735 ft2
Wetted Perimeter	191.8939 in
Perimeter	264.0000 in
Velocity	9.6752 fps
Hydraulic Radius	22.4925 in
Percent Full	99.9115 %
Full flow Flowrate	234.7884 cfs
Full flow velocity	7.8263 fps

- Outfall 5
  - Maximum capacity = 290 cfs
  - pump capacity (2/3 operating) = 90 cfs (45 cfs each pump)
  - 100-yr storm runoff = 364 cfs

Overall Watershed Area Map