

. . . Fire Protection by Computer Design

EASTERN FIRE PROTECTION
170 KITTY HAWK AVE.
AUBURN/LEWISTON IND. PARK
AUBURN, MAINE
207-784-1507

Job Name : CUMBERLAND COUNTY CIVIC CENTER EVENT LEVEL C LOADING/TRASH
Drawing : 3 OF 5
Location : PORTLAND, MAINE
Remote Area : 2
Contract : 4949
Data File : 7-4949 PHASE II.WXF

HYDRAULIC CALCULATIONS
for

Project name: CUMBERLAND COUNTY CIVIC CENTER EVENT LEVEL C
Location: PORTLAND, MAINE
Drawing no: 3 OF 5
Date: 4/21/13

Design

Remote area number: 2
Remote area location: 2
Occupancy classification: ORDINARY HAZARD I
Density: .15 - Gpm/SqFt
Area of application: 1100 - SqFt
Coverage per sprinkler: 125/106 - SqFt
Type of sprinklers calculated: 5.6K 200DEG. UPRIGHTS
No. of sprinklers calculated: 13
In-rack demand: - GPM
Hose streams: 250 - GPM
Total water required (including hose streams): 561.31 - GPM @ 146.55 - Psi
Type of system: WET
Volume of dry or preaction system: - Gal

Water supply information

Date: 9/20/2010
Location: FREE ST PORTLAND, ME
Source: FIRE SPEC. INC.

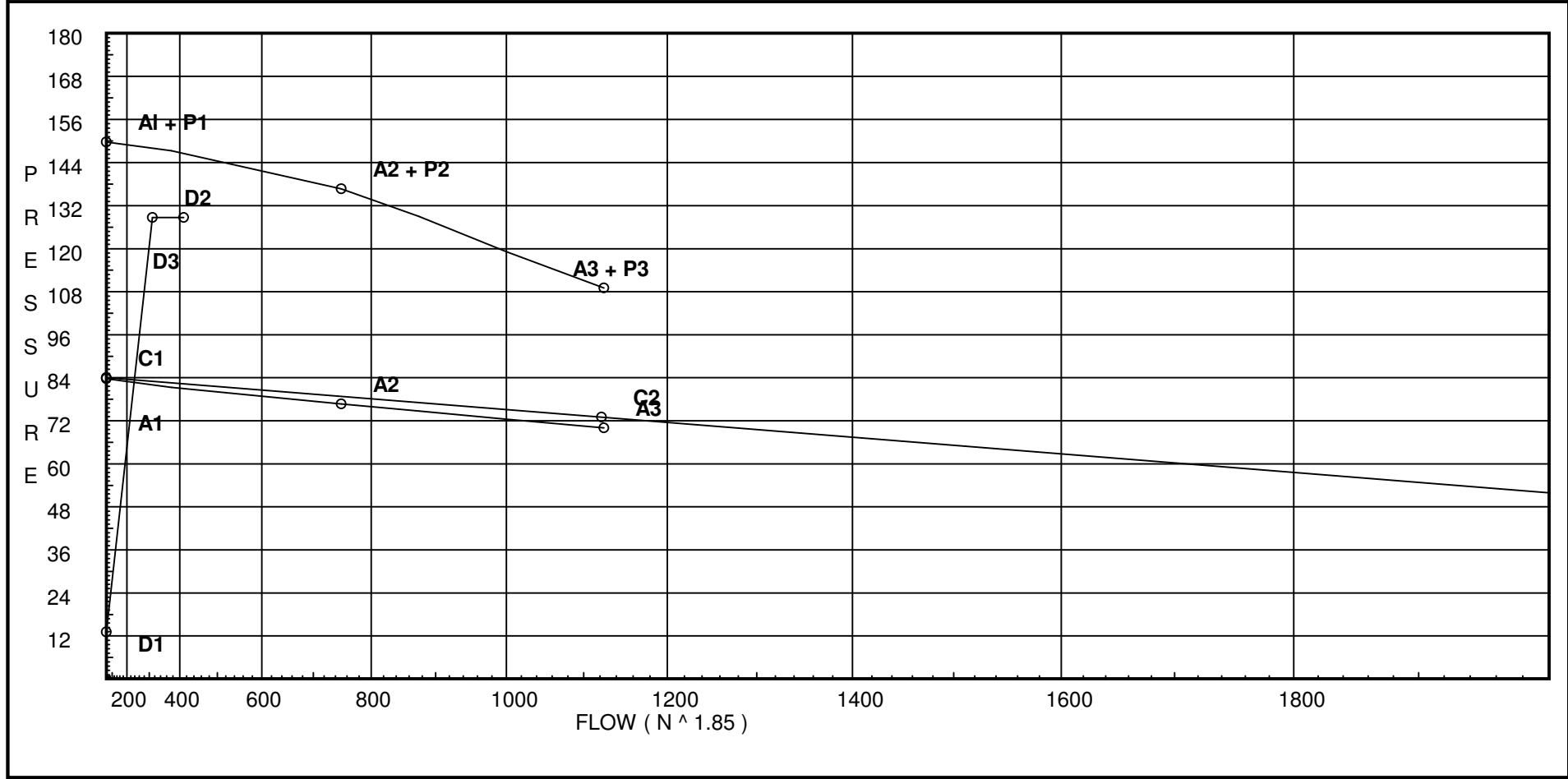
Name of contractor: EASTERN FIRE PROTECTION
Address: 170 KITTY HAWK AVE. / AUBURN/LEWISTON IND. PARK / AUBURN, MA
Phone number: 207-784-1507
Name of designer: JWD
Authority having jurisdiction: SFMO, PORTLAND FIRE DEPT.
Notes: (Include peaking information or gridded systems here.) HYDRAULICALLY REMOTE
AREA REVISED PER NFPA#13 2010 ED. SEC.11.2.3.2.3.1
TOTAL SYSTEM DEMAND INDICATED AT PUMP OUTLET (PO)

Water Supply Curve (C)

EASTERN FIRE PROTECTION
 CUMBERLAND COUNTY CIVIC CENTER EVENT LEVEL C LOADING/TRASH

Page 2
 Date

City Water Supply: C1 - Static Pressure : 84 C2 - Residual Pressure: 73 C2 - Residual Flow : 1122 City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow A1 - Adjusted Static: 83.734 A2 - Adj Resid : 76.68 @ 750 A3 - Adj Resid : 70.056 @ 1125	Pump Data: P1 - Pump Churn Pressure : 66 P2 - Pump Rated Pressure : 60 P2 - Pump Rated Flow : 750 P3 - Pump Pressure @ Max Flow : 39 P3 - Pump Max Flow : 1125 City Residual Flow @ 0 = 3366.89 City Residual Flow @ 20 = 2906.64 City Water @ 150% of Pump = 72.95	Demand: D1 - Elevation : 13.121 D2 - System Flow : 311.31 D2 - System Pressure : 128.711 Hose (Demand) : 100 D3 - System Demand : 411.31 Hose (Adj City) : 150 Safety Margin : 17.795
---	--	---



Fittings Used Summary

EASTERN FIRE PROTECTION
 CUMBERLAND COUNTY CIVIC CENTER EVENT LEVEL C LOADING/TRASH

Page 3
 Date

Fitting Legend

Abbrev.	Name	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12	14	16	18	20	24	
A	Alarm Rel E1 & E3							7.7	21.5		17		27	29								
B	NFPA 13 Butterfly Valve	0	0	0	0	0	6	7	10	0	12	9	10	12	19	21	0	0	0	0	0	0
E	NFPA 13 90' Standard Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61	61
F	NFPA 13 45' Elbow	1	1	1	1	2	2	3	3	3	4	5	7	9	11	13	17	19	21	24	28	28
Fsp	Flow Switch Potter VSR	Fitting generates a Fixed Loss Based on Flow																				
G	NFPA 13 Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13	13
L	NFPA 13 Long Turn Elbow	0.5	1	2	2	2	3	4	5	5	6	8	9	13	16	18	24	27	30	34	40	40
S	NFPA 13 Swing Check	0	0	5	7	9	11	14	16	19	22	27	32	45	55	65						
T	NFPA 13 90' Flow thru Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121	121

Units Summary

Diameter Units	Inches
Length Units	Feet
Flow Units	US Gallons per Minute
Pressure Units	Pounds per Square Inch

Note: Fitting Legend provides equivalent pipe lengths for fittings types of various diameters. Equivalent lengths shown are standard for actual diameters of Sched 40 pipe and CFactors of 120 except as noted with *. The fittings marked with a * show equivalent lengths values supplied by manufacturers based on specific pipe diameters and CFactors and they require no adjustment. All values for fittings not marked with a * will be adjusted in the calculation for CFactors of other than 120 and diameters other than Sched 40 per NFPA.

SUPPLY ANALYSIS

Node at Source	Static Pressure	Residual Pressure	Flow	Available Pressure	Total Demand	Required Pressure
PO	See Information on Pump Curve				411.31	128.711
TEST	84.0	73	1122.0	80.946	561.31	80.946

NODE ANALYSIS

Node Tag	Elevation	Node Type	Pressure at Node	Discharge at Node	Notes
DROP	0.0	5.6	7.0	14.82	
DR	0.0	5.6	7.0	14.82	
DR3	0.0	5.6	7.0	14.82	
DR4	0.0	5.6	11.21	18.75	
DR5	0.0	5.6	7.18	15.0	
DR6	0.0	5.6	9.0	16.8	
DR7	0.0	5.6	7.0	14.82	
SPR	0.0	5.6	11.39	18.9	
SR2	0.0	5.6	8.06	15.9	
697	82.125	5.45	20.2	24.51	K=K @ UP
698	82.125	5.45	21.31	25.17	K=K @ UP
699	82.125		22.52		
700	82.125	5.45	24.52	27.0	K=K @ UP
701	82.125		24.74		
702	82.125	5.45	26.69	28.17	K=K @ UP
703	82.125		28.5		
704	76.625		42.83		
707	82.125	5.45	14.39	20.68	K=K @ UP
709	82.125	5.45	15.8	21.67	K=K @ UP
712	82.125	5.45	21.63	25.36	K=K @ UP
714	82.125	5.45	19.24	23.9	K=K @ UP2
715	82.125	5.45	19.43	24.02	K=K @ UP2
716	82.125		20.65		
705	82.125	5.45	10.68	17.81	K=K @ UP2
706	82.125	5.45	12.02	18.9	K=K @ UP
708	82.125		15.85		
710	82.125		17.49		
711	82.125	5.45	19.78	24.25	K=K @ UP
713	82.125		24.09		
717	82.125		27.97		
718	82.125	5.45	30.06	29.87	K=K @ UP2
721	82.125		38.56		
722	76.625		45.57		
723	76.625		47.43		
724	76.625		50.51		
725	76.625		61.46		
13A	76.625		72.5		
14	76.625		75.06		
15	76.625		77.68		
16	75.21		82.9		
17	75.21		92.67		

NODE ANALYSIS (cont.)

Node Tag	Elevation	Node Type	Pressure at Node	Discharge at Node	Notes
18	75.21		96.21		
19	75.21		105.42		
CM	75.21		106.37		
CN	59.83		119.11		
CO	59.83		119.19		
K	59.83		119.89		
RT	59.83		124.74		
RB	59.83		124.75		
L	51.83		128.49	100.0	
PO	51.83		128.71		
PI	51.83		80.94		
TEST	51.83		80.95	150.0	

Final Calculations - Hazen-Williams - 2007

EASTERN FIRE PROTECTION
 CUMBERLAND COUNTY CIVIC CENTER EVENT LEVEL C LOADING/TRASH

Page 6
 Date

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqv. Ln.	Pipe Ftng's Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
DROP to LINE	0 0	5.60	14.82 14.82	1 1.049	1E 0.0 0.0	2.0 2.000 4.000	120 0.0748	7.000 0.0 0.299		Vel = 5.50	
LINE			0.0 14.82					7.299		K Factor = 5.49	
DR to LN2	0 0	5.60	14.82 14.82	1 1.049	1T 0.0 0.0	5.0 68.000 73.000	120 0.0747	7.000 0.0 5.453		Vel = 5.50	
LN2			0.0 14.82					12.453		K Factor = 4.20	
DR3 to LN3	0 0	5.60	14.82 14.82	1 1.049	1T 0.0 0.0	5.0 68.000 73.000	120 0.0747	7.000 0.0 5.453		Vel = 5.50	
LN3			0.0 14.82					12.453		K Factor = 4.20	
DR4 to LN4	0 0	5.60	18.75 18.75	1 1.049	1T 0.0 0.0	5.0 68.000 73.000	120 0.1155	11.210 0.0 8.431		Vel = 6.96	
LN4			0.0 18.75					19.641		K Factor = 4.23	
DR5 to LN5	0 0	5.60	15.00 15.0	1 1.049	1T 0.0 0.0	5.0 68.000 73.000	120 0.0764	7.175 0.0 5.579		Vel = 5.57	
LN5			0.0 15.00					12.754		K Factor = 4.20	
DR6 to LN6	0 0	5.60	16.80 16.8	1 1.049	1T 0.0 0.0	5.0 3.000 8.000	120 0.0942	9.000 0.0 0.754		Vel = 6.24	
LN6			0.0 16.80					9.754		K Factor = 5.38	
DR7 to LN7	0 0	5.60	14.82 14.82	1 1.049	1E 0.0 0.0	2.0 3.000 5.000	120 0.0748	7.000 0.0 0.374		Vel = 5.50	
LN7			0.0 14.82					7.374		K Factor = 5.46	
SPR to UP	0 0	5.60	18.90 18.9	1 1.049	1T 0.0 0.0	5.0 0.330 5.330	120 0.1171	11.391 0.0 0.624		Vel = 7.02	
UP			0.0 18.90					12.015		K Factor = 5.45	
SR2 to UP2	0 0	5.60	15.90 15.9	1 1.049	1T 0.0 0.0	5.0 0.330 5.330	120 0.0850	8.062 0.0 0.453		Vel = 5.90	
UP2			0.0 15.90					8.515		K Factor = 5.45	
697 to 699	82.125 82.125	5.45	24.51 24.51	1 1.049	1T 0.0 0.0	5.0 7.210 12.210	120 0.1895	20.203 0.0 2.314		K = K @ UP Vel = 9.10	

Final Calculations - Hazen-Williams - 2007

EASTERN FIRE PROTECTION
 CUMBERLAND COUNTY CIVIC CENTER EVENT LEVEL C LOADING/TRASH

Page 7
 Date

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqv.	Ln.	Pipe Ftng's Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
699			0.0 24.51						22.517		K Factor = 5.17	
698 to 699	82.125 82.125	5.45	25.17	1		0.0	6.040	120	21.314		K = K @ UP	
						0.0	0.0		0.0			
			25.17	1.049		0.0	6.040	0.1992	1.203		Vel = 9.34	
699 to 701	82.125 82.125		24.51	1.25	1T	6.0	6.080	120	22.517			
						0.0	6.000		0.0			
			49.68	1.38		0.0	12.080	0.1843	2.226		Vel = 10.66	
701			0.0 49.68						24.743		K Factor = 9.99	
700 to 701	82.125 82.125	5.45	27.00	1		0.0	1.000	120	24.516		K = K @ UP	
						0.0	0.0		0.0			
			27.0	1.049		0.0	1.000	0.2270	0.227		Vel = 10.02	
701 to 703	82.125 82.125		49.68	1.25	1T	6.0	3.125	120	24.743			
						0.0	6.000		0.0			
			76.68	1.38		0.0	9.125	0.4112	3.752		Vel = 16.45	
703			0.0 76.68						28.495		K Factor = 14.36	
702 to 703	82.125 82.125	5.45	28.17	1	1T	5.0	2.375	120	26.687		K = K @ UP	
						0.0	5.000		0.0			
			28.17	1.049		0.0	7.375	0.2452	1.808		Vel = 10.46	
703 to 704	82.125 76.625		76.67	1.25	2E	6.0	10.290	120	28.495			
						0.0	6.000		2.382			
			104.84	1.38		0.0	16.290	0.7336	11.950		Vel = 22.49	
704 to 723	76.625 76.625		0.0	1.5	1T	8.0	5.290	120	42.827			
						0.0	8.000		0.0			
			104.84	1.61		0.0	13.290	0.3463	4.602		Vel = 16.52	
723			0.0 104.84						47.429		K Factor = 15.22	
707 to 708	82.125 82.125	5.45	20.68	1	1T	5.0	5.540	120	14.390		K = K @ UP	
						0.0	5.000		0.0			
			20.68	1.049		0.0	10.540	0.1385	1.460		Vel = 7.68	
708			0.0 20.68						15.850		K Factor = 5.19	
709 to 710	82.125 82.125	5.45	21.67	1	1T	5.0	6.250	120	15.795		K = K @ UP	
						0.0	5.000		0.0			
			21.67	1.049		0.0	11.250	0.1509	1.698		Vel = 8.04	
710			0.0 21.67						17.493		K Factor = 5.18	
712 to 713	82.125 82.125	5.45	25.36	1	1T	5.0	7.170	120	21.633		K = K @ UP	
						0.0	5.000		0.0			
			25.36	1.049		0.0	12.170	0.2019	2.457		Vel = 9.41	
713			0.0 25.36						24.090		K Factor = 5.17	
714 to 716	82.125 82.125	5.45	23.90	1	1E	2.0	5.790	120	19.245		K = K @ UP2	
						0.0	2.000		0.0			
			23.9	1.049		0.0	7.790	0.1809	1.409		Vel = 8.87	

Final Calculations - Hazen-Williams - 2007

EASTERN FIRE PROTECTION
 CUMBERLAND COUNTY CIVIC CENTER EVENT LEVEL C LOADING/TRASH

Page 8
 Date

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqv.	Ln.	Pipe Ftng's Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
716			0.0 23.90						20.654		K Factor = 5.26	
715 to 716	82.125 82.125	5.45	24.02	1	1T	5.0 0.0	1.710 5.000	120	19.429 0.0		K = K @ UP2	
716 to 717	82.125 82.125		24.02	1.049		0.0	6.710	0.1826	1.225		Vel = 8.92	
716 to 717	82.125 82.125		23.90	1	1T	5.0 0.0	6.170 5.000	120	20.654 0.0			
717			0.0 47.92						27.974		K Factor = 9.06	
705 to 706	82.125 82.125	5.45	17.81	1	1E	2.0 0.0	10.670 2.000	120	10.685 0.0		K = K @ UP2	
706 to 708	82.125 82.125	5.45	17.81	1.049		0.0	12.670	0.1050	1.330		Vel = 6.61	
706 to 708	82.125 82.125	5.45	18.90	1	1E	2.0 0.0	7.580 2.000	120	12.015 0.0		K = K @ UP	
708 to 710	82.125 82.125		36.71	1.049		0.0	9.580	0.4003	3.835		Vel = 13.63	
708 to 710	82.125 82.125		20.68	1.25		0.0 0.0	6.830 0.0	120	15.850 0.0			
710 to 711	82.125 82.125		57.39	1.38		0.0	6.830	0.2406	1.643		Vel = 12.31	
710 to 711	82.125 82.125		21.67	1.25		0.0 0.0	5.250 0.0	120	17.493 0.0			
711 to 713	82.125 82.125		79.06	1.38		0.0	5.250	0.4352	2.285		Vel = 16.96	
711 to 713	82.125 82.125	5.45	24.25	1.25		0.0	6.040	120	19.778		K = K @ UP	
713 to 717	82.125 82.125		103.31	1.38		0.0	6.040	0.7139	4.312		Vel = 22.16	
713 to 717	82.125 82.125		25.36	1.25		0.0 0.0	3.625 0.0	120	24.090 0.0			
717 to 718	82.125 82.125		128.67	1.38		0.0	3.625	1.0714	3.884		Vel = 27.60	
717 to 718	82.125 82.125		47.92	1.5		0.0 0.0	2.290 0.0	120	27.974 0.0			
718 to 721	82.125 82.125	5.45	176.59	1.61		0.0	2.290	0.9087	2.081		Vel = 27.83	
718 to 721	82.125 82.125	5.45	29.87	2	2E	10.0 0.0	13.670 10.000	120	30.055 0.0		K = K @ UP2	
721 to 722	82.125 82.125		206.46	2.067		0.0	23.670	0.3592	8.503		Vel = 19.74	
721 to 722	82.125 82.125		0.0	2	1T	10.0 0.0	2.875 10.000	120	38.558 2.382			
722 to 723	76.625 76.625		206.46	2.067		0.0	12.875	0.3593	4.626		Vel = 19.74	
722 to 723	76.625 76.625		0.0	2.5		0.0	16.920	120	45.566 0.0			
723 to 724	76.625 76.625		206.46	2.635		0.0	16.920	0.1101	1.863		Vel = 12.15	
723 to 724	76.625 76.625		104.85	2.5	1F 1L	4.119 5.491	3.460 9.610	120	47.429 0.0			
724 to 725	76.625 76.625		311.31	2.635		0.0	13.070	0.2354	3.077		Vel = 18.32	
724 to 725	76.625 76.625		0.0	2.5	3L 1S	16.474 19.22	10.830 35.694	120	50.506 0.0			
725 to 13A	76.625 76.625		311.31	2.635		0.0	46.524	0.2354	10.954		Vel = 18.32	
725 to 13A	76.625 76.625		0.0	2.5	1B 1T	9.61 16.474	20.830 26.084	120	61.460 0.0			
13A	76.625		311.31	2.635		0.0	46.914	0.2354	11.044		Vel = 18.32	

Final Calculations - Hazen-Williams - 2007

EASTERN FIRE PROTECTION
 CUMBERLAND COUNTY CIVIC CENTER EVENT LEVEL C LOADING/TRASH

Page 9
 Date

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqv.	Ln.	Pipe Ftng's Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
13A to 14	76.625 76.625		0.0 311.31	2.5 2.635		0.0 0.0	10.875 0.0	120 0.2355	72.504 0.0			
14 to 15	76.625 76.625		0.0 311.31	2.5 2.635		0.0 0.0	11.125 11.125	120 0.2354	75.065 0.0		Vel = 18.32	
15 to 16	76.625 75.210		0.0 311.31	2.5 2.635	2L	10.983 0.0	8.580 10.983	120 0.2354	77.684 0.613		Vel = 18.32	
16 to 17	75.210 75.210		0.0 311.31	2.5 2.635	2L	10.983 0.0	30.500 10.983	120 0.2354	82.902 0.0		Vel = 18.32	
17 to 18	75.210 75.210		0.0 311.31	2.5 2.635	1F	4.119 0.0	10.920 4.119	120 0.2354	92.669 0.0		Vel = 18.32	
18 to 19	75.210 75.210		0.0 311.31	2.5 2.635	1F 1T	4.119 16.474	18.540 20.593	120 0.2354	96.209 0.0		Vel = 18.32	
19 to CM	75.210 75.210		0.0 311.31	3 3.26	1L	6.72 0.0	4.580 6.720	120 0.0835	105.422 0.0		Vel = 11.97	
CM to CN	75.210 59.830		0.0 311.31	3 3.26	3L 1T	20.159 20.159	32.580 40.318	120 0.0835	106.366 6.661		Vel = 11.97	
CN to CO	59.830 59.830		0.0 311.31	4 4.26		0.0 0.0	3.210 3.210	120 0.0227	119.114 0.0		Vel = 7.01	
CO to K	59.830 59.830		0.0 311.31	4 4.26	2L	15.8 0.0	15.000 15.800	120 0.0227	119.187 0.0		Vel = 7.01	
K to RT	59.830 59.830		0.0 311.31	4 4.26	1A 1G 1B 1L 1T 1Fsp	22.384 2.633 15.8 7.9 26.334 0.0	6.580 75.051 81.631	120 0.0227	119.886 3.000		* Fixed loss = 3 Vel = 7.01	
RT to RB	59.830 59.830		0.0 311.31	6 6.357		0.0 0.0	4.000 4.000	120 0.0032	124.738 0.0		Vel = 3.15	
RB to L	59.830 51.830		0.0 311.31	6 6.357	3L 1T	33.948 37.72	14.000 71.668	120 0.0032	124.751 3.465		Vel = 3.15	
L to PO	51.830 51.830	H100	100.00 411.31	8 8.249	3G 1S 2L 1T	14.094 52.853 30.537 41.108	5.000 138.592	120 0.0015	128.492 0.0		Vel = 2.47	
PO			0.0 411.31						128.711		K Factor = 36.25	

Final Calculations - Hazen-Williams - 2007

EASTERN FIRE PROTECTION
 CUMBERLAND COUNTY CIVIC CENTER EVENT LEVEL C LOADING/TRASH

Page 10
 Date

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqv.	Ln.	Pipe Ftng's Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
System Demand Pressure									128.711			
Safety Margin									17.795			
Continuation Pressure									146.506			
Pressure @ Pump Outlet									146.506			
Pressure From Pump Curve									-65.562			
Pressure @ Pump Inlet									80.944			
PI to TEST	51.830		0.0	8			0.0 0.0 1.000	120	80.944 0.0			
			411.31	8.249			0.0 1.000	0.0020	0.002	Vel =	2.47	
			150.00							Qa =	150.00	
TEST			561.31						80.946	K Factor =	62.39	