

... Fire Protection by Computer Design

EASTERN FIRE PROTECTION
170 KITTYHAWK AVE.
P.O. BOX 1390
AUBURN, MAINE 04210
207-784-1507

Job Name : 1000 RIVERSIDE
Drawing : 2 OF 3
Location : PORTLAND
Remote Area : 2
Contract : 5125
Data File : OFFICE SPACE.WXF

HYDRAULIC CALCULATIONS
for

Project name: 1000 RIVERSIDE ST.
Location: PORTLAND
Drawing no: 2 OF 3
Date: 3/5/14

Design

Remote area number: 2
Remote area location: OFFICE SPACE
Occupancy classification: LIGHT HAZARD
Density: .1 - Gpm/SqFt
Area of application: 983 - SqFt
Coverage per sprinkler: 148/168 - SqFt
Type of sprinklers calculated: TYCO TY-FRB RECESSED PENDENT 5.6K 200
No. of sprinklers calculated: 11
In-rack demand: - GPM
Hose streams: 100 - GPM
Total water required (including hose streams): 338.976 - GPM @ 61.367 - Psi
Type of system: WET
Volume of dry or preaction system: - Gal

Water supply information

Date: 9/25/08
Location: HYDRANT # 1714 ON EVERGREEN ST.
Source: PORTLAND WATER DISTRICT

Name of contractor: EASTERN FIRE PROTECTION
Address: 170 KITTYHAWK AVE. / P.O. BOX 1390 / AUBURN, MAINE 04210
Phone number: 207-784-1507
Name of designer: ROBERT PETERS
Authority having jurisdiction: STATE FIRE MARSHAL
Notes: (Include peaking information or gridded systems here.)
REMOTE AREA REVISED PER NFPA 13 (2013) SECTION 11.2.3.2.3.1

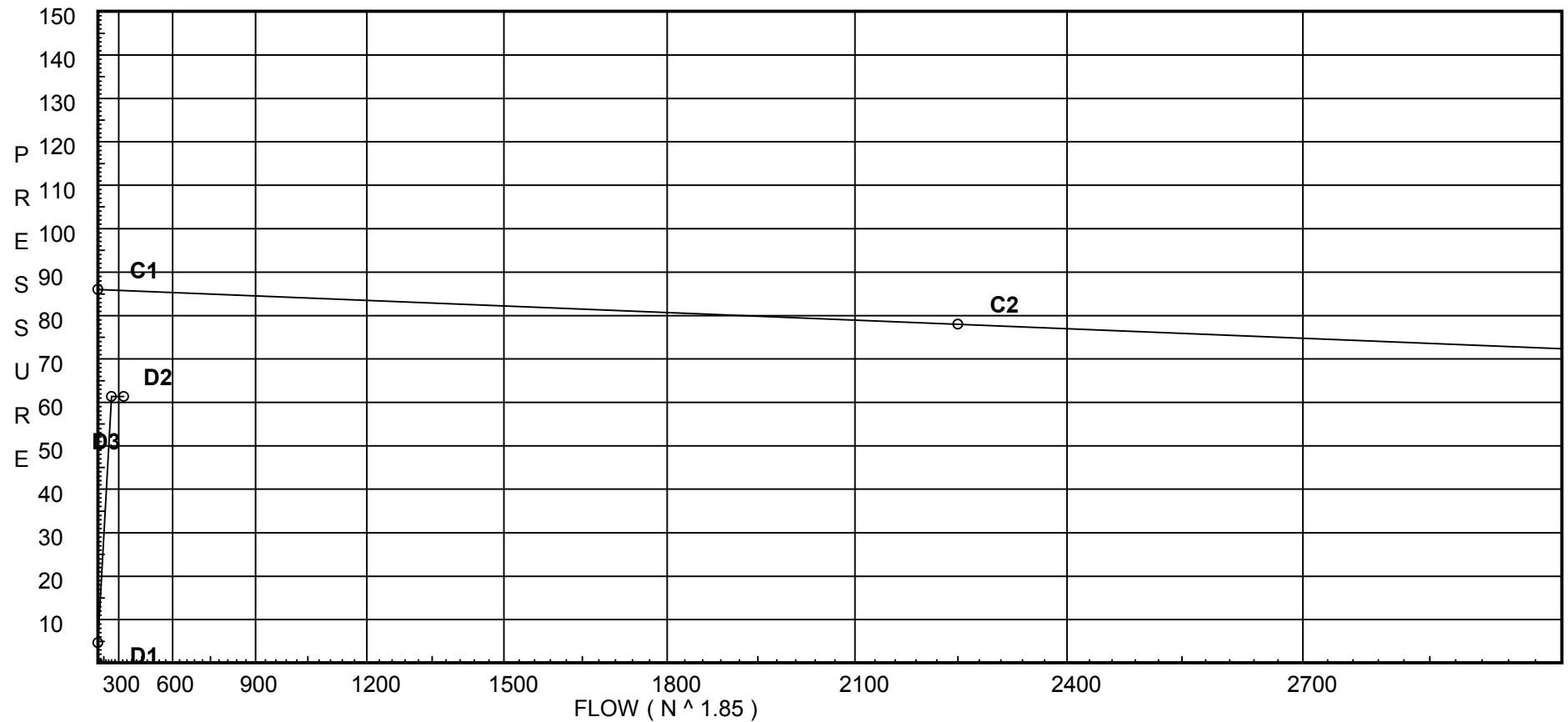
Water Supply Curve C

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City Water Supply:
C1 - Static Pressure : 86
C2 - Residual Pressure: 78
C2 - Residual Flow : 2250

Demand:
D1 - Elevation : 4.692
D2 - System Flow : 238.976
D2 - System Pressure : 61.367
Hose (Demand) : 100
D3 - System Demand : 338.976
Safety Margin : 24.392



Fittings Used Summary

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Fitting Legend		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
Abbrev.	Name																				
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
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
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
I	90° Grvd-Vic Elbow #10	0	0	2	3	4	3.5	6	5	8	7	8.5	10	13	17	20	23	25	33	36	40
J	90° Tee-Branch Grv Vic #20	0	0	4.5	6	8	8.5	10.8	13	17	16	21	25	33	41	50	65	78	88	98	120
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

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
TEST	86.0	78	2250.0	85.759	338.98	61.367

NODE ANALYSIS

Node Tag	Elevation	Node Type	Pressure at Node	Discharge at Node	Notes
LINE	0.0	5.6	9.0	16.8	
19	110.833	5.41	9.66	16.8	K=K @ DRP
20	110.833	5.41	9.84	16.96	K=K @ DRP
21	110.833	5.41	10.27	17.33	K=K @ DRP
23	110.833	5.41	9.75	16.87	K=K @ DRP
22A	110.833		10.55		
22	110.833	5.41	11.66	18.46	K=K @ DRP
24	110.833	5.41	14.11	20.31	K=K @ DRP
24A	110.833		15.26		
25	110.833	5.41	16.66	22.06	K=K @ DRP
26	110.833	5.41	19.95	24.14	K=K @ DRP
27	110.833	5.41	27.68	28.44	K=K @ DRP
28	110.833	5.41	28.04	28.62	K=K @ DRP
29	110.833	5.41	28.77	28.99	K=K @ DRP
H	110.833		33.47		
I	110.833		33.58		
TOW	110.833		42.38		
HDR	103.0		49.16		
E	117.958		44.99		
F	117.958		45.04		
100	117.958		45.12		
101	117.958		45.68		
102	117.958		46.13		
103	117.958		46.57		
104	117.958		46.98		
105	117.958		47.36		
106	117.958		47.71		
107	117.958		48.05		
108	117.958		48.41		
109	117.958		48.78		
110	117.958		49.18		
111	117.958		49.62		
112	117.958		50.09		
113	117.958		51.43		
114	117.958		47.28		
115	117.958		47.29		
116	117.958		47.33		
117	117.958		47.4		
118	117.958		47.51		

NODE ANALYSIS (cont.)

Node Tag	Elevation	Node Type	Pressure at Node	Discharge at Node	Notes
119	117.958		47.65		
120	117.958		47.81		
121	117.958		47.99		
122	117.958		48.16		
123	117.958		48.3		
124	117.958		48.41		
125	117.958		48.49		
126	117.958		48.54		
G	117.833		51.49		
TOR	117.833		51.73		
BASE	102.0		59.43		
TEST	100.0		61.37	100.0	

Final Calculations - Hazen-Williams - 2007

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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	*****
LINE to DRP	0 0	5.60	16.80 16.8	1 1.049	T 0.0	5.0 0.0 7.000	120 0.0943	9.000 0.0 0.660		Vel = 6.24	
DRP			0.0 16.80					9.660		K Factor = 5.41	
19 to 20	110.833 110.833	5.41	16.80 16.8	1.5 1.682	2E 0.0	9.9 0.0 19.358	120 0.0095	9.660 0.0 0.183		K = K @ DRP Vel = 2.43	
20 to 21	110.833 110.833	5.41	16.96 33.76	1.5 1.682	0.0 0.0	12.542 0.0 12.542	120 0.0344	9.843 0.0 0.431		K = K @ DRP Vel = 4.87	
21 to 22A	110.833 110.833	5.41	17.32 51.08	1.5 1.682	0.0 0.0	3.667 0.0 3.667	120 0.0739	10.274 0.0 0.271		K = K @ DRP Vel = 7.38	
22A			0.0 51.08					10.545		K Factor = 15.73	
23 to 22A	110.833 110.833	5.41	16.87 16.87	1 1.049	T 0.0	5.0 0.0 8.417	120 0.0949	9.746 0.0 0.799		K = K @ DRP Vel = 6.26	
22A to 22	110.833 110.833		51.09 67.96	1.5 1.682	0.0 0.0	8.875 0.0 8.875	120 0.1255	10.545 0.0 1.114		Vel = 9.81	
22 to 24A	110.833 110.833	5.41	18.46 86.42	1.5 1.682	E T 0.0	4.95 9.9 14.850 18.392	120 0.1957	11.659 0.0 3.599		K = K @ DRP Vel = 12.48	
24A			0.0 86.42					15.258		K Factor = 22.12	
24 to 24A	110.833 110.833	5.41	20.31 20.31	1 1.049	T 0.0	5.0 0.0 8.542	120 0.1338	14.115 0.0 1.143		K = K @ DRP Vel = 7.54	
24A to 25	110.833 110.833		86.41 106.72	1.5 1.682	0.0 0.0	4.833 0.0 4.833	120 0.2893	15.258 0.0 1.398		Vel = 15.41	
25 to 26	110.833 110.833	5.41	22.06 128.78	1.5 1.682	0.0 0.0	8.042 0.0 8.042	120 0.4094	16.656 0.0 3.292		K = K @ DRP Vel = 18.59	
26 to I	110.833 110.833	5.41	24.15 152.93	1.5 1.682	T 0.0	9.9 0.0 24.233	120 0.5625	19.948 0.0 13.632		K = K @ DRP Vel = 22.08	
I			0.0 152.93					33.580		K Factor = 26.39	
27 to 28	110.833 110.833	5.41	28.44 28.44	1.5 1.682	0.0 0.0	14.333 0.0 14.333	120 0.0250	27.678 0.0 0.358		K = K @ DRP Vel = 4.11	
28 to 29	110.833 110.833	5.41	28.62 57.06	1.5 1.682	0.0 0.0	8.042 0.0 8.042	120 0.0909	28.036 0.0 0.731		K = K @ DRP Vel = 8.24	

Final Calculations - Hazen-Williams

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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 *****
29 to H	110.833 110.833	5.41	28.99 86.05	1.5 1.682	T	9.9 0.0	14.333 9.900	120 0.1942	28.767 0.0 4.705	K = K @ DRP Vel = 12.42
H to I	110.833 110.833		0.0 86.05	3 3.26		0.0 0.0	14.042 0.0	120 0.0077	33.472 0.0 0.108	Vel = 3.31
I to TOW	110.833 110.833		152.93 238.98	3 3.26	2E	18.815 0.0	153.125 18.815	120 0.0512	33.580 0.0 8.803	Vel = 9.19
TOW to HDR	110.833 103		0.0 238.98	3 3.26	S B T	15.347 9.592 14.388	7.833 39.326 47.159	100 0.0717	42.383 3.392 3.383	Vel = 9.19
HDR to E	103 117.958		0.0 238.98	4 4.26	4I J	36.868 21.067	107.958 57.935	120 0.0139	49.158 -6.478 2.308	Vel = 5.38
E to F	117.958 117.958		0.0 238.98	4 4.26		0.0 0.0	3.833 0.0	120 0.0138	44.988 0.0 0.053	Vel = 5.38
F to 100	117.958 117.958		0.0 238.98	3 3.26		0.0 0.0	1.458 0.0	120 0.0514	45.041 0.0 0.075	Vel = 9.19
100 to 114	117.958 117.958		-222.58 16.4	1.25 1.442	4J	29.728 0.0	83.333 29.728	120 0.0191	45.116 0.0 2.164	Vel = 3.22
114			0.0 16.40						47.280	K Factor = 2.39
101 to 115	117.958 117.958		14.00 14.0	1.25 1.442	4J	29.728 0.0	83.333 29.728	120 0.0143	45.677 0.0 1.615	Vel = 2.75
115			0.0 14.00						47.292	K Factor = 2.04
102 to 116	117.958 117.958		11.92 11.92	1.25 1.442	4J	29.728 0.0	83.333 29.728	120 0.0106	46.128 0.0 1.200	Vel = 2.34
116			0.0 11.92						47.328	K Factor = 1.73
103 to 117	117.958 117.958		9.75 9.75	1.25 1.442	4J	29.728 0.0	83.333 29.728	120 0.0073	46.574 0.0 0.828	Vel = 1.92
117			0.0 9.75						47.402	K Factor = 1.42
104 to 118	117.958 117.958		7.66 7.66	1.25 1.442	4J	29.728 0.0	83.333 29.728	120 0.0047	46.981 0.0 0.528	Vel = 1.50
			0.0							

Final Calculations - Hazen-Williams

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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	*****
118			7.66						47.509		K Factor = 1.11	
105 to 119	117.958 117.958		5.58	1.25	4J	29.728	83.333	120	47.356			
						0.0	29.728		0.0			
			5.58	1.442		0.0	113.061	0.0026	0.295		Vel = 1.10	
119			0.0						47.651		K Factor = 0.81	
106 to 120	117.958 117.958		3.12	1.25	4J	29.728	83.333	120	47.711			
						0.0	29.728		0.0			
			3.12	1.442		0.0	113.061	0.0009	0.100		Vel = 0.61	
120			0.0						47.811		K Factor = 0.45	
107 to 121	117.958 117.958		-2.45	1.25	4J	29.728	83.333	120	48.054			
						0.0	29.728		0.0			
			-2.45	1.442		0.0	113.061	-0.0006	-0.064		Vel = 0.48	
121			0.0						47.990		K Factor = -0.35	
108 to 122	117.958 117.958		-5.10	1.25	4J	29.728	83.333	120	48.406			
						0.0	29.728		0.0			
			-5.1	1.442		0.0	113.061	-0.0022	-0.249		Vel = 1.00	
122			0.0						48.157		K Factor = -0.73	
109 to 123	117.958 117.958		-7.24	1.25	4J	29.728	83.333	120	48.777			
						0.0	29.728		0.0			
			-7.24	1.442		0.0	113.061	-0.0042	-0.477		Vel = 1.42	
123			0.0						48.300		K Factor = -1.04	
110 to 124	117.958 117.958		-9.34	1.25	4J	29.728	83.333	120	49.177			
						0.0	29.728		0.0			
			-9.34	1.442		0.0	113.061	-0.0067	-0.763		Vel = 1.83	
124			0.0						48.414		K Factor = -1.34	
111 to 125	117.958 117.958		-11.49	1.25	4J	29.728	83.333	120	49.615			
						0.0	29.728		0.0			
			-11.49	1.442		0.0	113.061	-0.0099	-1.121		Vel = 2.26	
125			0.0						48.494		K Factor = -1.65	
112 to 126	117.958 117.958		-13.71	1.25	4J	29.728	83.333	120	50.092			
						0.0	29.728		0.0			
			-13.71	1.442		0.0	113.061	-0.0137	-1.553		Vel = 2.69	
126			0.0						48.539		K Factor = -1.97	
113 to 127	117.958 0		-19.10	1.25	4J	29.728	83.333	120	51.425			
						0.0	29.728		51.088			
			-19.1	1.442		0.0	113.061	-0.0254	-2.870		Vel = 3.75	
			0.0									

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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	*****
			-19.10					99.643		K Factor = -1.91	
114 to 115	117.958 117.958		16.40 16.4	2.5 2.635	0.0 0.0	12.500 0.0	120 0.0010	47.280 0.0		Vel = 0.96	
115 to 116	117.958 117.958		14.00 30.4	2.5 2.635	0.0 0.0	11.333 11.333	120 0.0032	47.292 0.0		Vel = 1.79	
116 to 117	117.958 117.958		11.92 42.32	2.5 2.635	0.0 0.0	12.500 12.500	120 0.0059	47.328 0.0		Vel = 2.49	
117 to 118	117.958 117.958		9.75 52.07	2.5 2.635	0.0 0.0	12.500 12.500	120 0.0086	47.402 0.0		Vel = 3.06	
118 to 119	117.958 117.958		7.66 59.73	2.5 2.635	0.0 0.0	12.750 12.750	120 0.0111	47.509 0.0		Vel = 3.51	
119 to 120	117.958 117.958		5.58 65.31	2.5 2.635	0.0 0.0	12.250 12.250	120 0.0131	47.651 0.0		Vel = 3.84	
120 to 121	117.958 117.958		3.12 68.43	2.5 2.635	0.0 0.0	12.500 12.500	120 0.0143	47.811 0.0		Vel = 4.03	
121 to 122	117.958 117.958		-2.45 65.98	2.5 2.635	0.0 0.0	12.500 12.500	120 0.0134	47.990 0.0		Vel = 3.88	
122 to 123	117.958 117.958		-5.10 60.88	2.5 2.635	0.0 0.0	12.500 12.500	120 0.0114	48.157 0.0		Vel = 3.58	
123 to 124	117.958 117.958		-7.24 53.64	2.5 2.635	0.0 0.0	12.500 12.500	120 0.0091	48.300 0.0		Vel = 3.16	
124 to 125	117.958 117.958		-9.33 44.31	2.5 2.635	0.0 0.0	12.500 12.500	120 0.0064	48.414 0.0		Vel = 2.61	
125 to 126	117.958 117.958		-11.50 32.81	2.5 2.635	0.0 0.0	12.250 12.250	120 0.0037	48.494 0.0		Vel = 1.93	
126 to 127	117.958 0		-13.71 19.1	2.5 2.635	0.0 0.0	12.167 12.167	120 0.0013	48.539 51.088		Vel = 1.12	
			0.0 19.10					99.643		K Factor = 1.91	
100 to 101	117.958 117.958		222.58 222.58	3 3.26	0.0 0.0	12.500 12.500	120 0.0449	45.116 0.0		Vel = 8.56	

Final Calculations - Hazen-Williams

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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	*****
101 to 102	117.958 117.958		-14.00 208.58	3 3.26	0.0 0.0	11.333 0.0	120 0.0398	45.677 0.0		Vel = 8.02	
102 to 103	117.958 117.958		-11.93 196.65	3 3.26	0.0 0.0	12.500 0.0	120 0.0357	46.128 0.0		Vel = 7.56	
103 to 104	117.958 117.958		-9.75 186.9	3 3.26	0.0 0.0	12.500 0.0	120 0.0326	46.574 0.0		Vel = 7.18	
104 to 105	117.958 117.958		-7.66 179.24	3 3.26	0.0 0.0	12.500 0.0	120 0.0300	46.981 0.0		Vel = 6.89	
105 to 106	117.958 117.958		-5.58 173.66	3 3.26	0.0 0.0	12.500 0.0	120 0.0284	47.356 0.0		Vel = 6.68	
106 to 107	117.958 117.958		-3.11 170.55	3 3.26	0.0 0.0	12.500 0.0	120 0.0274	47.711 0.0		Vel = 6.56	
107 to 108	117.958 117.958		2.44 172.99	3 3.26	0.0 0.0	12.500 0.0	120 0.0282	48.054 0.0		Vel = 6.65	
108 to 109	117.958 117.958		5.10 178.09	3 3.26	0.0 0.0	12.500 0.0	120 0.0297	48.406 0.0		Vel = 6.85	
109 to 110	117.958 117.958		7.24 185.33	3 3.26	0.0 0.0	12.500 0.0	120 0.0320	48.777 0.0		Vel = 7.12	
110 to 111	117.958 117.958		9.34 194.67	3 3.26	0.0 0.0	12.500 0.0	120 0.0350	49.177 0.0		Vel = 7.48	
111 to 112	117.958 117.958		11.49 206.16	3 3.26	0.0 0.0	12.250 12.250	120 0.0389	49.615 0.0		Vel = 7.92	
112 to G	117.958 117.833		13.71 219.87	3 3.26	T 0.0	20.159 20.159	120 0.0439	50.092 0.054		Vel = 8.45	
G			0.0 219.87					51.490		K Factor = 30.64	
113 to G	117.958 117.833		19.10 19.1	3 3.26	T 0.0	20.159 21.867	120 0.0005	51.425 0.054		Vel = 0.73	
G to TOR	117.833 117.833		219.88 238.98	4 4.26	I 0.0	9.217 9.217	120 0.0139	51.490 0.0		Vel = 5.38	
TOR to BASE	117.833 102		0.0 238.98	4 4.26	B S	15.8 28.968	120 0.0139	51.731 6.857		Vel = 5.38	

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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	*****
BASE to TEST	102 100		0.0 238.98	6 6.16	G 2E T	4.304 40.168 43.037	530.000 87.509 617.509	140 0.0017	59.429 0.866 1.072		Vel = 2.57	
TEST			100.00 338.98						61.367		Qa = 100.00 K Factor = 43.27	