

F. E. Moran, Inc. Fire Protection



3001 Research Road, Suite A ♦ Champaign, Illinois 61822 ♦ (217)356-0700 ♦ Fax (217) 356-0777

Hydraulic Calculations

For

Lee's Summit Commerce Center
Building 1

1120 NW Main St
Lee's Summit, MO 64086

FEM Job # 212189000

Date: 08/29/2022

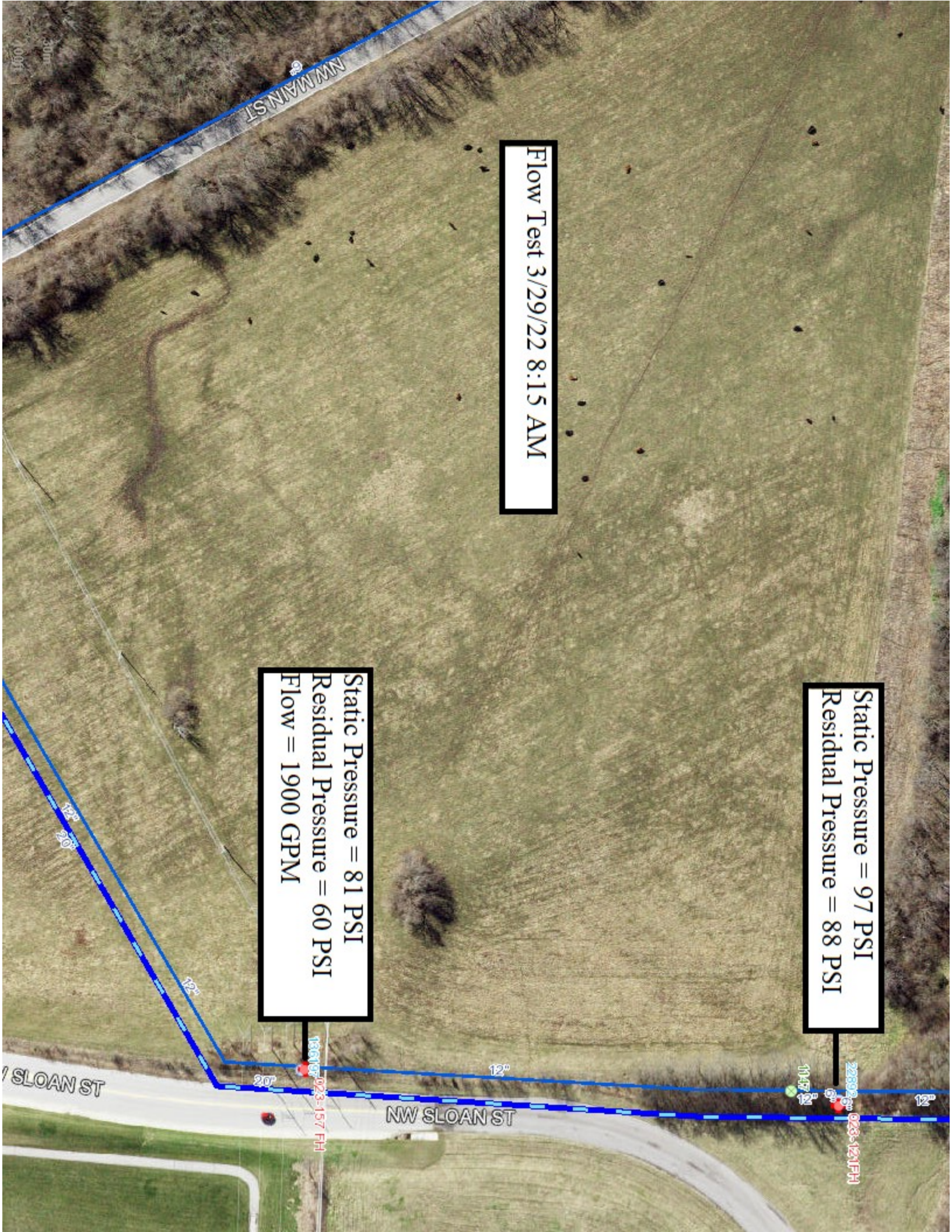
Jay Colbert



Flow Test 3/29/22 8:15 AM

Static Pressure = 97 PSI
Residual Pressure = 88 PSI

Static Pressure = 81 PSI
Residual Pressure = 60 PSI
Flow = 1900 GPM



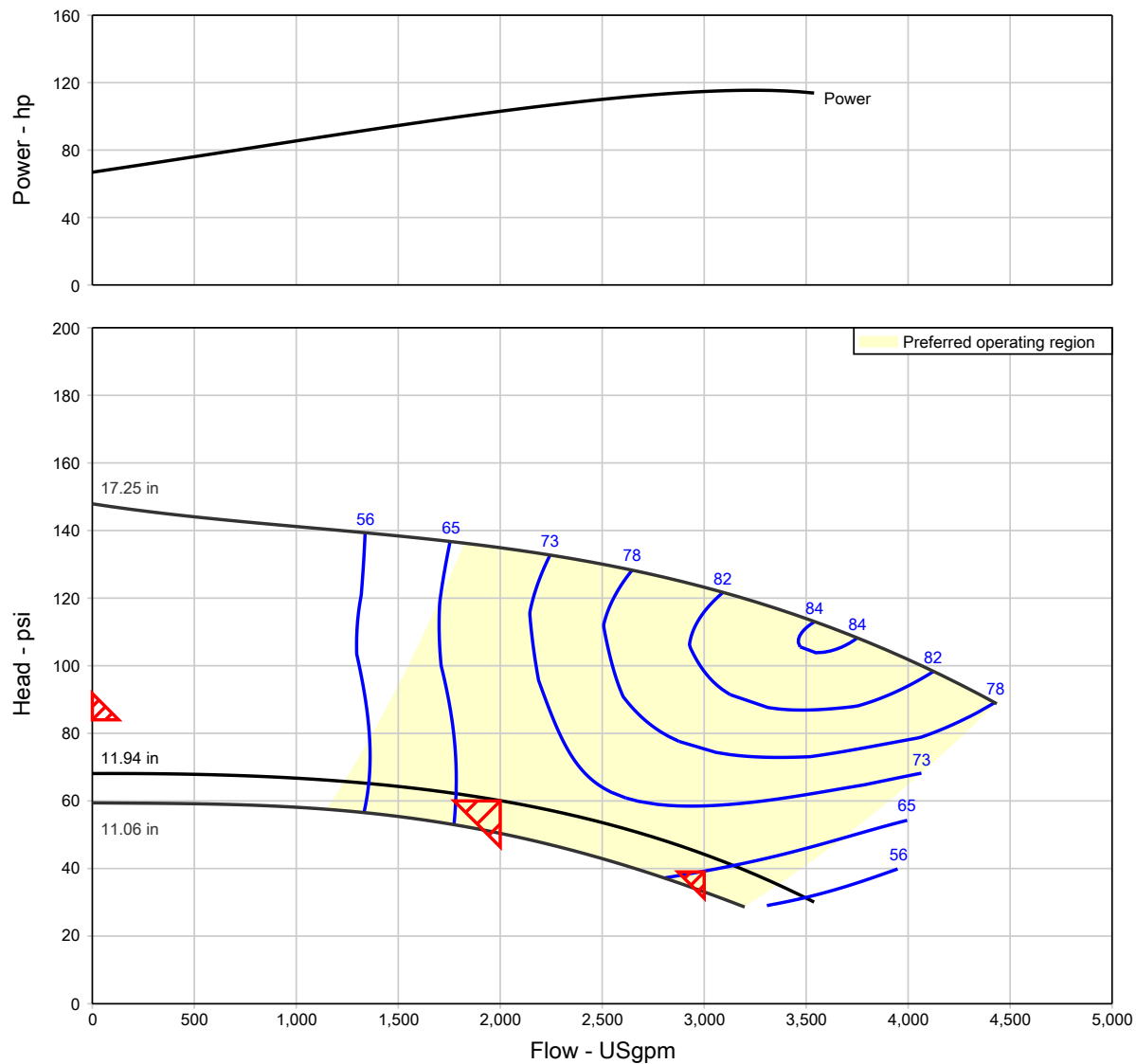


PENTAIR

Customer : FE Moran
Project name : Lees Summit

Pump Performance Curve

Encompass 2.0 - 22.0.0



Item number	: 001	Size	: 8-481-17B
Service	:	Stages	: 1
Quantity	: 1	Driver type	: Motor
Quote number	: 220317TJ01	Frequency	: 60 Hz
Date last saved	: April 01, 2022 8:14 AM	Speed, rated	: 1770 rpm
Flow, rated	: 2,000.0 USgpm	Based on curve number	: 184-8X10X17B-1770
Differential head / pressure, rated	: 60.00 psi	Efficiency	: 68.06 %
Flange rating (suction / discharge)	: 125/125	Max working pressure, allowable	: 175.0 psi.g
Secondary Point (150% of rated flow)	: 3,000.0 USgpm	Shutoffhead, Typical	: 68.11 psi
Secondary Point (65% of rated head)	: 39.00 psi	Max suction pressure, allowable	: 106.9 psi.g
Max Shutoff per NFPA	: 84.00 psi	Suction pressure, max (user specified)	: 60.00 psi.g
		Pump shutoff w/ suction pressure	: 128.1 psi.g
		Power driver, minimum	: 100 hp

Curve performance is typical. Contact factory for guaranteed performance curve.



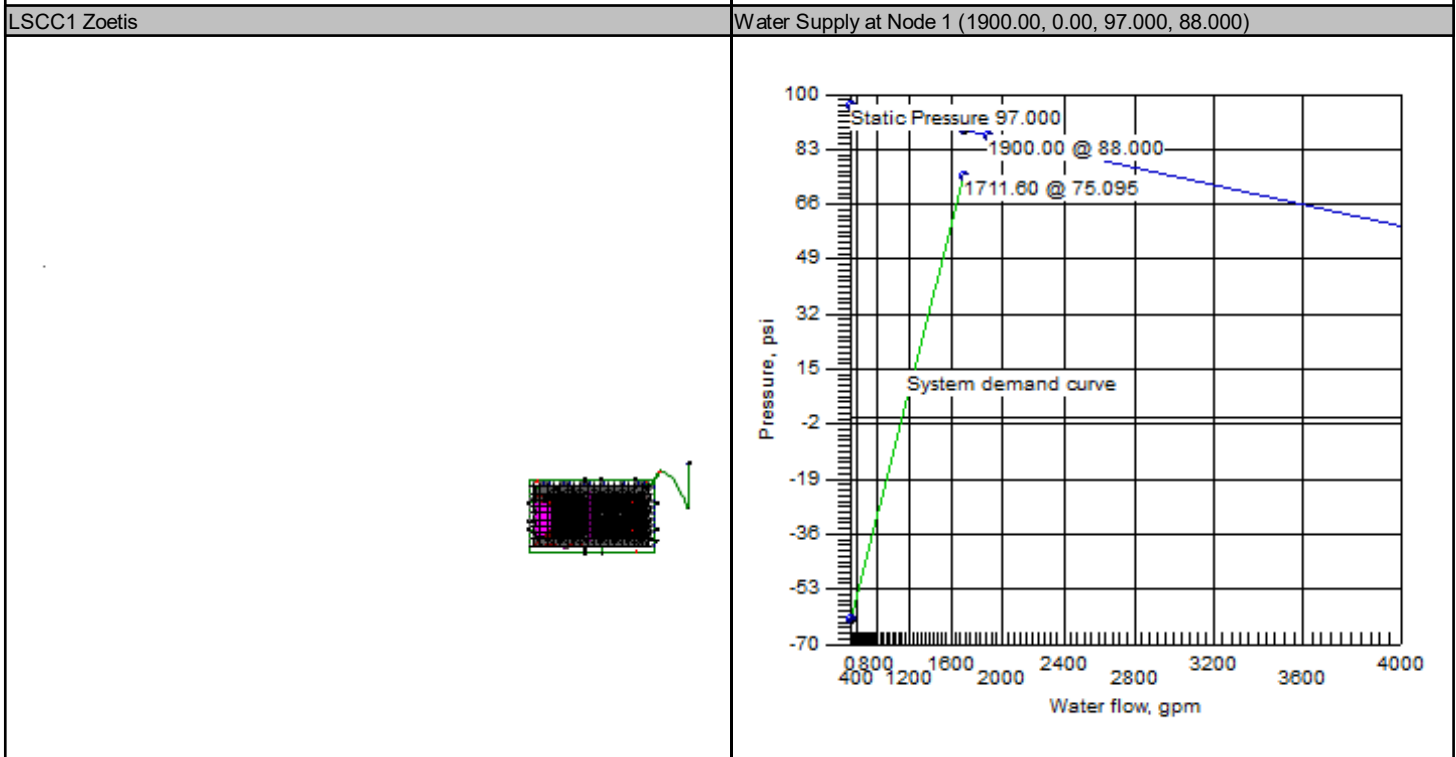
Hydraulic Overview

Job Number: 212189000
Report Description: Remote Area 01 (16.8K)

Job		
Job Number 212189000	Design Engineer Jay Colbert	
Job Name: Lee's Summit Commerce Center	Phone 913.242.0057	FAX
Address 1 1120 NW Main St	State Certification/License Number	
Address 2	AHJ City of Lee's Summit	
Address 3 Lee's Summit, MO 64086	Job Site/Building Building A	

System	
Pressure 52.000	Area of Application NA
Most Demanding Sprinkler Data 16.8 K-Factor 121.15 at 52.000	Hose Streams 250.00
Coverage Per Sprinkler 100ft ²	Number Of Sprinklers Calculated 12 0
System Pressure Demand 75.095	System Flow Demand 1711.60
Total Demand 1711.60 @ 75.095	Pressure Result +14.486 (16.2%)

Supplies						Check Point Gauges			
Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)	Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)
1	Water Supply	1900.00		97.000	88.000	Pump Inlet	60.021	220.93	1711.60
4	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									





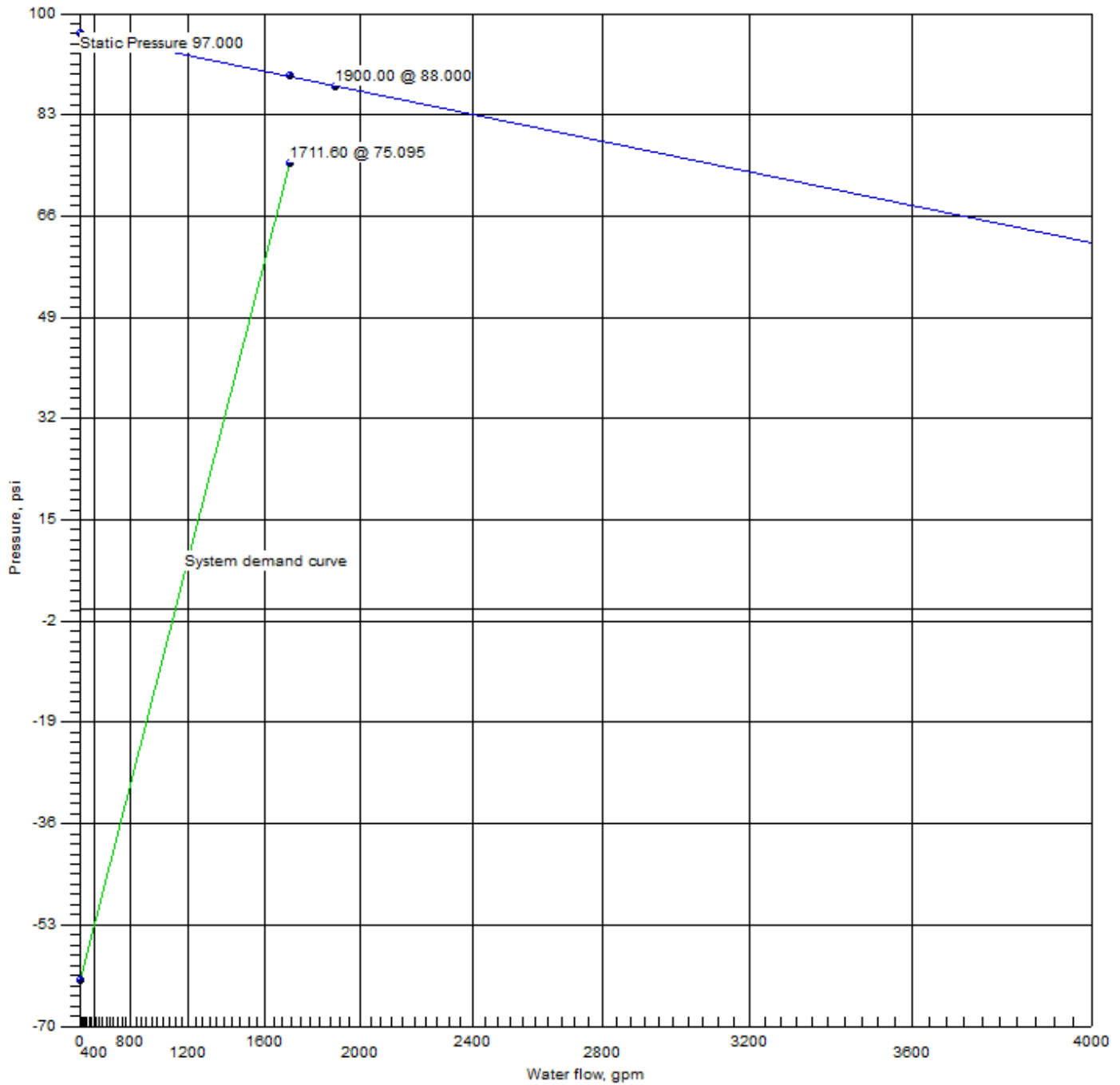
Hydraulic Summary

Job Number: 212189000
Report Description: Remote Area 01 (16.8K)

Job											
Job Number 212189000				Design Engineer Jay Colbert							
Job Name: Lee's Summit Commerce Center				State Certification/License Number							
Address 1 1120 NW Main St				AHJ City of Lee's Summit							
Address 2				Job Site/Building Building A							
Address 3 Lee's Summit, MO 64086				Drawing Name LSCC1 Zoetis							
System				Remote Area(s)							
Most Demanding Sprinkler Data 16.8 K-Factor 121.15 at 52.000				Occupancy ESFR			Job Suffix				
Hose Allowance At Source 0.00				Pressure 52.000			Area of Application NA				
Additional Hose Supplies Node Hydrant At Node 54				Flow(gpm) 250.00		Number Of Sprinklers Calculated 12		Number Of Nozzles Calculated 0		Coverage Per Sprinkler 100ft ²	
				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 75.072 Right: 75.049							
Total Hose Streams 250.00											
System Flow Demand 1711.60		Total Water Required (Including Hose Allowance) 1711.60									
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 20.73 between nodes 110 and 108											
Maximum Velocity Under Ground 9.93 between nodes 224 and 7											
Volume capacity of Wet Pipes 34293.86gal		Volume capacity of Dry Pipes									
Supplies											
Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@	Flow (gpm)	Available (psi)	@	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply		97.000	88.000		1900.00	89.581		1711.60	75.095	14.486
4	Pump		84.000	60.000		2000.00	139.357		1711.60	124.871	14.486
Pumps: Static = Churn (Pressure @ Zero Flow)											
Contractor											
Contractor Number 21		Contact Name Jay Colbert				Contact Title					
Name of Contractor: F.E. Moran Fire Protection Inc.				Phone 913.242.0057				Extension			
Address 1 16815 College Blvd.				FAX							
Address 2				E-mail jay.colbert@femoran.com							
Address 3 Lenexa, KS 66219				Web-Site femoranfp.com							



Water Supply at Node 1



Hydraulic Graph

Water Supply at Node 1

Static: Pressure

97.000

Residual: Pressure

88.000 @ 1900.00

Available Pressure at System Demand

89.581 @ 1711.60

Required Pressure at System Demand

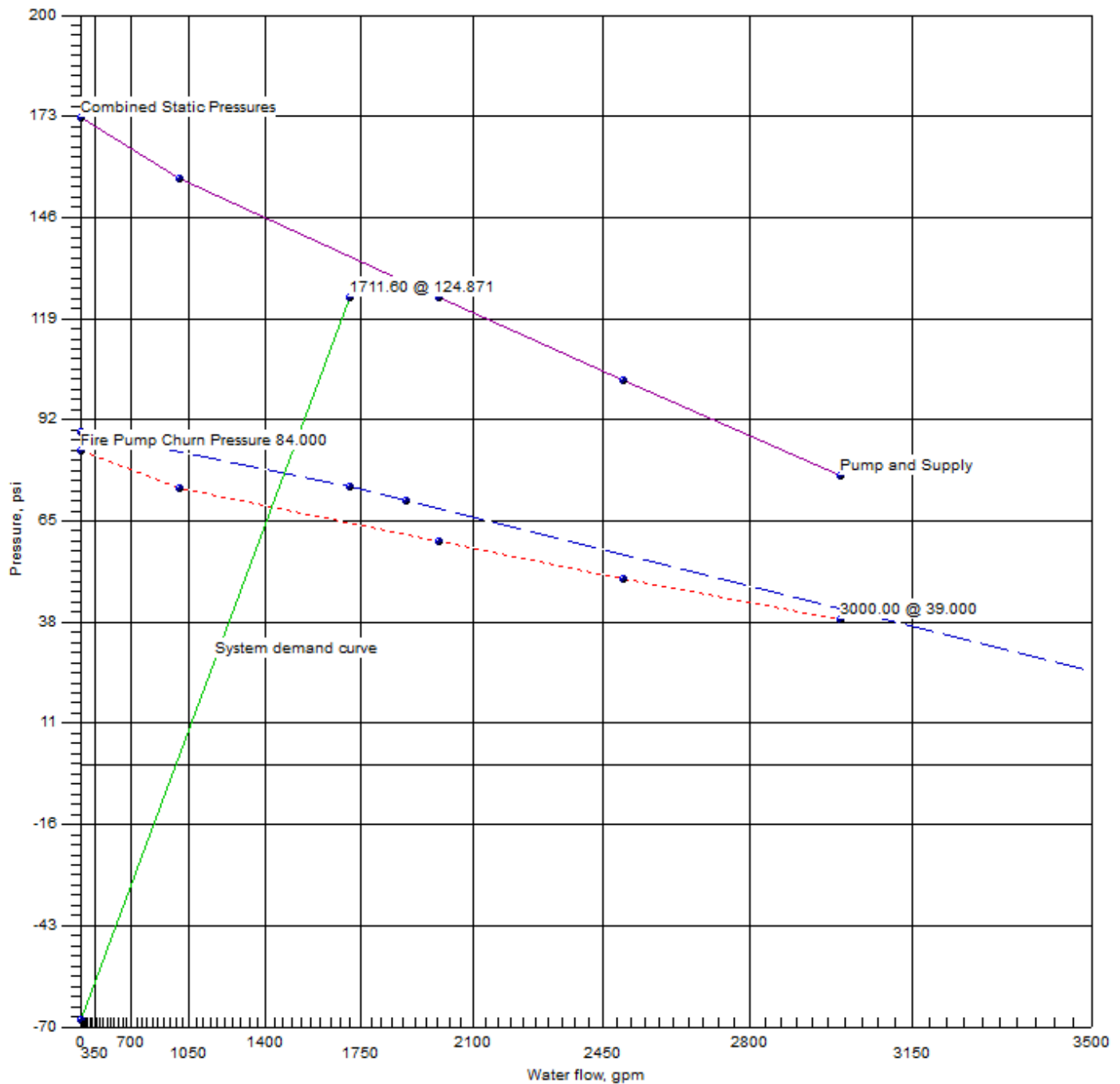
75.095 @ 1711.60

Required Pressure at System Demand (Including Hose Allowance at Source)

75.095 @ 1711.60



Pump at Node 4



Hydraulic Graph
Pump at Node 4

Static + Churn Pressure
173.256
Fire Pump Churn Pressure
84.000

Fire Pump Rating
60.000 @ 2000.00

Residual: Pressure
64.849 @ 1711.60
Available Pressure at System Demand
139.357 @ 1711.60
Required Pressure at System Demand
124.871 @ 1711.60



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: Remote Area 01 (16.8K)

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Hydrant	54	250.00	250.00	250	115.568		
⇒ Sprinkler	1111	121.15	121.15	16.8	52.000		
Sprinkler	1113	121.15	121.15	16.8	52.000		
Sprinkler	1115	121.53	121.15	16.8	52.327		
Sprinkler	1117	121.52	121.15	16.8	52.324		
Sprinkler	1119	121.55	121.15	16.8	52.349		
Sprinkler	1121	121.55	121.15	16.8	52.349		
Sprinkler	1123	121.93	121.15	16.8	52.679		
Sprinkler	1125	121.93	121.15	16.8	52.675		
Sprinkler	1127	122.13	121.15	16.8	52.847		
Sprinkler	1129	122.46	121.15	16.8	53.136		
Sprinkler	1131	122.13	121.15	16.8	52.849		
Sprinkler	1133	122.56	121.15	16.8	53.223		

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: Remote Area 01 (16.8K)

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
128	37'-0	PO(18'-8½)	73.624	
130	37'-0	PO(18'-8½)	74.639	
132	37'-0	PO(18'-8½)	75.495	
134	37'-0	PO(18'-8½)	76.198	
136	37'-2	PO(18'-8½)	76.684	
138	37'-5	PO(18'-8½)	76.977	
140	37'-8½	PO(22'-6)	77.152	
142	38'-0	PO(22'-6)	77.178	
144	38'-3	PO(22'-6)	77.103	
146	37'-0	PO(18'-8½)	73.020	
148	37'-10	T(18'-8½)	73.421	
150	37'-0	PO(18'-8½)	77.009	
152	37'-0	PO(18'-8½)	76.986	
224	1'-0		123.193	
309	-8'-0	E(35'-1)	72.805	
1	-11'-6	S	75.095	1711.60
54	1'-0	Hyd(-1.000)	115.568	250.00
1111	37'-10	Spr(-52.000)	52.000	121.15
1113	37'-10	Spr(-52.000)	52.000	121.15
1115	37'-10	Spr(-52.327)	52.327	121.53
1117	37'-10	Spr(-52.324)	52.324	121.52
1119	37'-10	Spr(-52.349)	52.349	121.55
1121	37'-10	Spr(-52.349)	52.349	121.55
1123	37'-10	Spr(-52.679)	52.679	121.93
1125	37'-10	Spr(-52.675)	52.675	121.93
1127	37'-10	Spr(-52.847)	52.847	122.13
1129	37'-10	Spr(-53.136)	53.136	122.46
1131	37'-10	Spr(-52.849)	52.849	122.13
1133	37'-10	Spr(-53.223)	53.223	122.56
2	1'-9	T(65'-4½)	60.401	
3	1'-9	P1, Pump Inlet	60.021	
4	1'-9	P2(-60.886)	124.871	
5	1'-9		124.871	
6	6'-8½		120.839	
7	-8'-0	T(59'-4½)	125.650	
8	-8'-0	T(59'-4½)	123.794	
9	-8'-0	T(47'-3½)	123.138	
10	-8'-0	T(59'-4½)	119.439	
11	-8'-0	T(47'-3½)	119.631	
12	-8'-0	T(59'-4½)	119.803	
13	-8'-0	T(47'-3½)	121.685	
14	-8'-0	T(59'-4½)	122.022	
15	-8'-0	T(47'-3½)	123.575	
16	-8'-0	T(59'-4½)	123.835	
17	-8'-0	T(59'-4½)	124.442	
52	1'-0	Hyd	1.000	
55	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
100	37'-0	PO(18'-8½)	77.126	
102	37'-0	PO(18'-8½)	77.634	
104	37'-0	PO(18'-8½)	78.697	
106	37'-0	PO(18'-8½)	79.936	
108	37'-0	PO(18'-8½)	81.372	
110	37'-0		82.121	
112	37'-2	PO(18'-8½)	82.193	
114	37'-5	PO(18'-8½)	82.362	
116	37'-8½	PO(22'-6)	82.571	
118	38'-0	PO(22'-6)	82.847	
120	38'-3	PO(22'-6)	83.199	
122	1'-8½	PO(37'-8½)	113.143	
124	1'-0		114.122	
126	37'-0	PO(18'-8½)	73.149	



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 01 (16.8K)

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
BL	2.7050	0.37	0.02	120		0.000001	9'-0	Pf 0.000
1111	37'-10	121.15	16.8	52.000		Sprinkler		Pe
1113	37'-10			52.000			9'-0	Pv
BL	2.7050	121.52	6.78	120		0.036357	9'-0	Pf 0.327
1113	37'-10	121.15	16.8	52.000		Sprinkler		Pe
1115	37'-10			52.327			9'-0	Pv
BL	2.7050	243.05	13.57	120		0.131076	149'-0	Pf 24.437
1115	37'-10	121.53	16.8	52.327		Sprinkler,	37'-5	Pe 0.361
100	37'-0			77.126		2PO(18'-8½)	186'-5	Pv
CM	4.3100	496.13	10.91	120		0.050769	10'-0	Pf 0.508
100	37'-0	253.08		77.126		Flow (q) from Route 6		Pe
102	37'-0			77.634			10'-0	Pv
CM	4.3100	740.01	16.27	120		0.106375	10'-0	Pf 1.064
102	37'-0	243.88		77.634		Flow (q) from Route 3		Pe -0.000
104	37'-0			78.697			10'-0	Pv
CM	4.3100	803.55	17.67	120		0.123886	10'-0	Pf 1.239
104	37'-0	63.54		78.697		Flow (q) from Route 12		Pe
106	37'-0			79.936			10'-0	Pv
CM	4.3100	870.26	19.14	120		0.143581	10'-0	Pf 1.436
106	37'-0	66.71		79.936		Flow (q) from Route 13		Pe
108	37'-0			81.372			10'-0	Pv
CM	4.3100	942.71	20.73	120		0.166476	4'-6	Pf 0.749
108	37'-0	72.45		81.372		Flow (q) from Route 14		Pe
110	37'-0			82.121			4'-6	Pv
CM	6.3570	942.71	9.53	120		0.025085	5'-6½	Pf 0.139
110	37'-0			82.121				Pe -0.066
112	37'-2			82.193			5'-6½	Pv
CM	6.3570	1017.66	10.29	120		0.028899	10'-0	Pf 0.289
112	37'-2	74.95		82.193		Flow (q) from Route 16		Pe -0.120
114	37'-5			82.362			10'-0	Pv
CM	6.3570	1091.70	11.04	120		0.032908	10'-0	Pf 0.329
114	37'-5	74.03		82.362		Flow (q) from Route 15		Pe -0.121
116	37'-8½			82.571			10'-0	Pv
CM	6.3570	1208.04	12.21	120		0.039688	10'-0	Pf 0.397
116	37'-8½	116.34		82.571		Flow (q) from Route 8		Pe -0.120
118	38'-0			82.847			10'-0	Pv
CM	6.3570	1327.26	13.42	120		0.047237	10'-0	Pf 0.473
118	38'-0	119.22		82.847		Flow (q) from Route 9		Pe -0.120
120	38'-3			83.199			10'-0	Pv
CM	6.3570	1461.60	14.77	120		0.056461	71'-0½	Pf 14.091
120	38'-3	134.34		83.199		Flow (q) from Route 2	178'-6½	Pe 15.853
122	1'-8½			113.143		5E(17'-7), 2f(-0.000), CV(40'-3), BV(12'-7), PO(37'-8½)	249'-7	Pv
CM	8.2490	1461.60	8.77	120		0.015875	1'-6	Pf 0.676
122	1'-8½			113.143			41'-1½	Pe 0.303
124	1'-0			114.122		PO(41'-1½)	42'-7½	Pv
UG	8.3900	1461.60	8.48	140		0.010990	38'-9½	Pf 1.415
124	1'-0			114.122			89'-11	Pe 3.902
10	-8'-0			119.439		E(30'-6½), T(59'-4½)	128'-8½	Pv
UG	8.3900	1010.31	5.86	140		0.005550	635'-11½	Pf 3.699
10	-8'-0			119.439			30'-6½	Pe
9	-8'-0			123.138		E(30'-6½)	666'-6	Pv
UG	8.3900	1010.31	5.86	140		0.005550	118'-2	Pf 0.656
9	-8'-0			123.138				Pe
8	-8'-0			123.794			118'-2	Pv
UG	8.3900	1010.31	5.86	140		0.005550	275'-0	Pf 1.856
8	-8'-0			123.794			59'-4½	Pe
7	-8'-0			125.650		T(59'-4½)	334'-4½	Pv
UG	8.3900	1711.60	9.93	140		0.014719	67'-8	Pf 1.445
7	-8'-0	701.29		125.650		Flow (q) from Route 7	30'-6½	Pe -3.902
224	1'-0			123.193		E(30'-6½)	98'-2½	Pv
FR	8.2490	1711.60	10.28	120		0.021260	5'-8½	Pf 0.121
224	1'-0			123.193				Pe -2.476
6	6'-8½			120.839			5'-8½	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 01 (16.8K)

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Fittings	Eq. Length	Summary
Upstream						Total Length	
DY	10.3700	1711.60	6.50	120	0.006976	13'-10½"	Pf 1.881
6	6'-8½"			120.839		255'-9"	Pe 2.151
5	1'-9"			124.871	4E(26'-0"), T(48'-5½"), BV(21'-3½"), Tr(17'-0"), CV(65'-0")	269'-8"	Pv
DY	7.9810	1711.60	10.98	120	0.024971	0'-0"	Pf 0.000
5	1'-9"			124.871			Pe 0.000
4	1'-9"			124.871		0'-0"	Pv
Pump		Velocity					
4		1711.60		124.871	Rating: 60.000 @ 2000.00		
3		Q=1711.60	6.46	60.021	Fire Pump Churn Pressure: 84.000		
DY	10.4000	1711.60	6.46	140	0.005172	0'-0"	Pf 0.379
3	1'-9"			60.021		73'-4"	Pe 0.000
2	1'-9"			60.401	GV(7'-11½"), T(65'-4½")	73'-4"	Pv
UG	10.4000	1711.60	6.46	140	0.005172	696'-3½"	Pf 8.177
2	1'-9"			60.401		175'-4½"	Pe 4.227
309	-8'-0"			72.805	4E(35'-1"), 2EE(17'-6½"), BFP(-3.948)	871'-8"	Pv
UG	12.4600	1711.60	4.50	140	0.002145	360'-2½"	Pf 0.773
309	-8'-0"			72.805			Pe 1.517
1	-11'-6"			75.095	Water Supply	360'-2½"	Pv
		0.00			Hose Allowance At Source		
1		1711.60					
***** Route 2 *****							
BL	2.7050	120.77	6.74	120	0.035946	9'-0"	Pf 0.324
1111	37'-10"	121.15	16.8	52.000	Sprinkler		Pe
1117	37'-10"			52.324		9'-0"	Pv
BL	2.7050	242.30	13.53	120	0.130329	119'-7"	Pf 20.464
1117	37'-10"	121.52	16.8	52.324	Sprinkler,	37'-5"	Pe 0.361
126	37'-0"			73.149	2PO(18'-8½")	157'-0"	Pv
CM	4.3100	478.50	10.52	120	0.047483	10'-0"	Pf 0.475
126	37'-0"	236.21		73.149	Flow (q) from Route 5		Pe
128	37'-0"			73.624		10'-0"	Pv
CM	4.3100	721.59	15.87	120	0.101528	10'-0"	Pf 1.015
128	37'-0"	243.09		73.624	Flow (q) from Route 4		Pe
130	37'-0"			74.639		10'-0"	Pv
CM	4.3100	658.05	14.47	120	0.085611	10'-0"	Pf 0.856
130	37'-0"			74.639			Pe
132	37'-0"			75.495		10'-0"	Pv
CM	4.3100	591.34	13.00	120	0.070251	10'-0"	Pf 0.703
132	37'-0"			75.495			Pe
134	37'-0"			76.198		10'-0"	Pv
CM	4.3100	518.89	11.41	120	0.055161	10'-0½"	Pf 0.553
134	37'-0"			76.198			Pe -0.067
136	37'-2"			76.684		10'-0½"	Pv
CM	4.3100	443.94	9.76	120	0.041332	10'-0"	Pf 0.413
136	37'-2"			76.684			Pe -0.120
138	37'-5"			76.977		10'-0"	Pv
CM	4.3100	369.90	8.13	120	0.029493	10'-0"	Pf 0.295
138	37'-5"			76.977			Pe -0.120
140	37'-8½"			77.152		10'-0"	Pv
CM	4.3100	253.56	5.58	120	0.014666	10'-0"	Pf 0.147
140	37'-8½"			77.152			Pe -0.120
142	38'-0"			77.178		10'-0"	Pv
CM	4.3100	134.34	2.95	120	0.004528	10'-0"	Pf 0.045
142	38'-0"			77.178			Pe -0.120
144	38'-3"			77.103		10'-0"	Pv
BL	3.3340	134.34	4.94	120	0.015813	295'-7"	Pf 6.096
144	38'-3"			77.103	PO(22'-6")	89'-11½"	Pe -0.000
120	38'-3"			83.199	3PO(22'-6")	385'-6½"	Pv
***** Route 3 *****							
BL	2.7050	0.40	0.02	120	0.000001	9'-0"	Pf 0.000
1119	37'-10"	121.55	16.8	52.349	Sprinkler		Pe
1121	37'-10"			52.349		9'-0"	Pv
BL	2.7050	121.95	6.81	120	0.036596	9'-0"	Pf 0.329
1121	37'-10"	121.55	16.8	52.349	Sprinkler		Pe
1123	37'-10"			52.679		9'-0"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 01 (16.8K)

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
BL	2.7050	243.88	13.62	120		0.131914	149'-0	Pf 24.593
1123	37'-10	121.93	16.8	52.679		Sprinkler,	37'-5	Pe 0.361
102	37'-0			77.634		2PO(18'-8½)	186'-5	Pv
Route 4								
BL	2.7050	121.16	6.76	120		0.036156	9'-0	Pf 0.325
1119	37'-10	121.55	16.8	52.349		Sprinkler		Pe
1125	37'-10			52.675			9'-0	Pv
BL	2.7050	243.09	13.57	120		0.131115	119'-7	Pf 20.588
1125	37'-10	121.93	16.8	52.675		Sprinkler,	37'-5	Pe 0.361
128	37'-0			73.624		2PO(18'-8½)	157'-0	Pv
Route 5								
BL	2.7050	113.74	6.35	120		0.032170	9'-0	Pf 0.290
1127	37'-10	122.13	16.8	52.847		Sprinkler		Pe
1129	37'-10			53.136			9'-0	Pv
BL	2.7050	236.21	13.19	120		0.124333	119'-7	Pf 19.523
1129	37'-10	122.46	16.8	53.136		Sprinkler,	37'-5	Pe 0.361
146	37'-0			73.020		2PO(18'-8½)	157'-0	Pv
CM	4.3100	236.21	5.19	120		0.012863	10'-0	Pf 0.129
146	37'-0			73.020				Pe
126	37'-0			73.149			10'-0	Pv
Route 6								
BL	2.7050	8.39	0.47	120		0.000259	9'-0	Pf 0.002
1127	37'-10	122.13	16.8	52.847		Sprinkler		Pe
1131	37'-10			52.849			9'-0	Pv
BL	2.7050	130.52	7.29	120		0.041494	9'-0	Pf 0.373
1131	37'-10	122.13	16.8	52.849		Sprinkler		Pe
1133	37'-10			53.223			9'-0	Pv
BL	2.7050	253.08	14.13	120		0.141262	124'-3	Pf 20.198
1133	37'-10	122.56	16.8	53.223		Sprinkler,	18'-8½	Pe
148	37'-10			73.421		2E(9'-4½)	143'-0	Pv
BL	2.7050	144.81	8.08	120		0.050287	26'-9	Pf 3.227
148	37'-10			73.421			37'-5	Pe 0.361
150	37'-0			77.009		2PO(18'-8½)	64'-2	Pv
CM	4.3100	253.08	5.57	120		0.014614	8'-0	Pf 0.117
150	37'-0	108.27		77.009		Flow (q) from Route 11		Pe
100	37'-0			77.126			8'-0	Pv
Route 7								
UG	6.2800	250.00	2.59	140		0.001718	19'-10	Pf 0.161
54	1'-0	250.00		115.568		Hydrant,	74'-1	Pe 3.902
11	-8'-0			119.631		E(22'-1), GV(4'-8½), T(47'-3½)	93'-10½	Pv
UG	8.3900	701.29	4.07	140		0.002825	61'-1½	Pf 0.173
11	-8'-0	451.29		119.631		Flow (q) from Route 10		Pe
12	-8'-0			119.803			61'-1½	Pv
UG	8.3900	701.29	4.07	140		0.002825	635'-9	Pf 1.882
12	-8'-0			119.803			30'-6½	Pe
13	-8'-0			121.685		E(30'-6½)	666'-3½	Pv
UG	8.3900	701.29	4.07	140		0.002825	119'-3	Pf 0.337
13	-8'-0			121.685				Pe
14	-8'-0			122.022			119'-3	Pv
UG	8.3900	701.29	4.07	140		0.002825	519'-3½	Pf 1.553
14	-8'-0			122.022			30'-6½	Pe
15	-8'-0			123.575		E(30'-6½)	549'-10	Pv
UG	8.3900	701.29	4.07	140		0.002825	91'-11½	Pf 0.260
15	-8'-0			123.575				Pe
16	-8'-0			123.835			91'-11½	Pv
UG	8.3900	701.29	4.07	140		0.002825	214'-9	Pf 0.607
16	-8'-0			123.835				Pe
17	-8'-0			124.442			214'-9	Pv
UG	8.3900	701.29	4.07	140		0.002825	337'-8	Pf 1.208
17	-8'-0			124.442			89'-11	Pe
7	-8'-0			125.650		E(30'-6½), T(59'-4½)	427'-7	Pv
Route 8								
BL	3.3340	116.34	4.28	120		0.012118	315'-3	Pf 5.419
140	37'-8½			77.152		PO(22'-6)	131'-11	Pe -0.000
116	37'-8½			82.571		3PO(22'-6), 4E(10'-6)	447'-2	Pv
Route 9								



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 01 (16.8K)

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Fittings	Eq. Length	Summary
Upstream						Total Length	
BL	3.3340	119.22	4.38	120	0.012678	315'-3	Pf 5.669
142	38'-0			77.178	PO(22'-6)	131'-11	Pe -0.000
118	38'-0			82.847	3PO(22'-6), 4E(10'-6)	447'-2	Pv
Route 10							
UG	8.3900	451.29	2.62	140	0.001250	153'-8	Pf 0.192
10	-8'-0	1010.31		119.439	Flow (q) from Route 1		Pe
11	-8'-0			119.631		153'-8	Pv
Route 11							
CM	4.3100	108.27	2.38	120	0.003038	7'-6	Pf 0.023
152	37'-0	108.27		76.986	Flow (q) from Route 17		Pe
150	37'-0			77.009		7'-6	Pv
Route 12							
RN	2.7050	63.54	3.55	120	0.010955	295'-7	Pf 4.058
130	37'-0			74.639	PO(18'-8½)	74'-10½	Pe -0.000
104	37'-0			78.697	3PO(18'-8½)	370'-5½	Pv
Route 13							
RN	2.7050	66.71	3.72	120	0.011988	295'-7	Pf 4.441
132	37'-0			75.495	PO(18'-8½)	74'-10½	Pe -0.000
106	37'-0			79.936	3PO(18'-8½)	370'-5½	Pv
Route 14							
RN	2.7050	72.45	4.04	120	0.013967	295'-7	Pf 5.174
134	37'-0			76.198	PO(18'-8½)	74'-10½	Pe -0.000
108	37'-0			81.372	3PO(18'-8½)	370'-5½	Pv
Route 15							
RN	2.7050	74.03	4.13	120	0.014535	295'-7	Pf 5.385
138	37'-5			76.977	PO(18'-8½)	74'-10½	Pe 0.000
114	37'-5			82.362	3PO(18'-8½)	370'-5½	Pv
Route 16							
RN	2.7050	74.95	4.18	120	0.014871	295'-7	Pf 5.509
136	37'-2			76.684	PO(18'-8½)	74'-10½	Pe 0.000
112	37'-2			82.193	3PO(18'-8½)	370'-5½	Pv
Route 17							
BL	2.7050	108.27	6.04	120	0.029367	34'-3	Pf 3.204
148	37'-10			73.421	T(18'-8½)	74'-10½	Pe 0.361
152	37'-0			76.986	T(18'-8½), 2PO(18'-8½)	109'-1½	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

C Value Multiplier

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$$

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

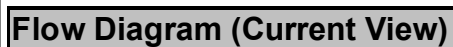


Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 01 (16.8K)

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream					Fittings	Total Length	

Pipe Type Legend	Units Legend	Fittings Legend
AO Arm-Over BL Branch Line CM Cross Main DN Drain DR Drop DY Dynamic FM Feed Main FR Feed Riser MS Miscellaneous OR Outrigger RN Riser Nipple SP Sprig ST Stand Pipe UG Underground	Diameter Inch Elevation Foot Flow gpm Discharge gpm Velocity fps Pressure psi Length Foot Friction Loss psi/Foot HWC Hazen-Williams Constant Pt Total pressure at a point in a pipe Pn Normal pressure at a point in a pipe Pf Pressure loss due to friction between points Pe Pressure due to elevation difference between indicated points Pv Velocity pressure at a point in a pipe	ALV Alarm Valve AngV Angle Valve b Bushing BalV Ball Valve BFP Backflow Preventer BV Butterfly Valve C Cross Flow Turn 90° cplg Coupling Cr Cross Run CV Check Valve DelV Deluge Valve DPV Dry Pipe Valve E 90° Elbow EE 45° Elbow Ee1 11¼° Elbow Ee2 22½° Elbow f Flow Device fd Flex Drop FDC Fire Department Connection fE 90° FireLock(TM) Elbow fEE 45° FireLock(TM) Elbow flg Flange FN Floating Node fT FireLock(TM) Tee g Gauge GloV Globe Valve GV Gate Valve Ho Hose Hose Hose HV Hose Valve Hyd Hydrant LtE Long Turn Elbow mecT Mechanical Tee Noz Nozzle P1 Pump In P2 Pump Out PIV Post Indicating Valve PO Pipe Outlet PrV Pressure Relief Valve PRV Pressure Reducing Valve red Reducer/Adapter S Supply sCV Swing Check Valve SFx Seismic Flex Spr Sprinkler St Strainer T Tee Flow Turn 90° Tr Tee Run U Union WirF Wirsbo WMV Water Meter Valve Z Cap



Report Description: Remote Area 01 (16.8K)





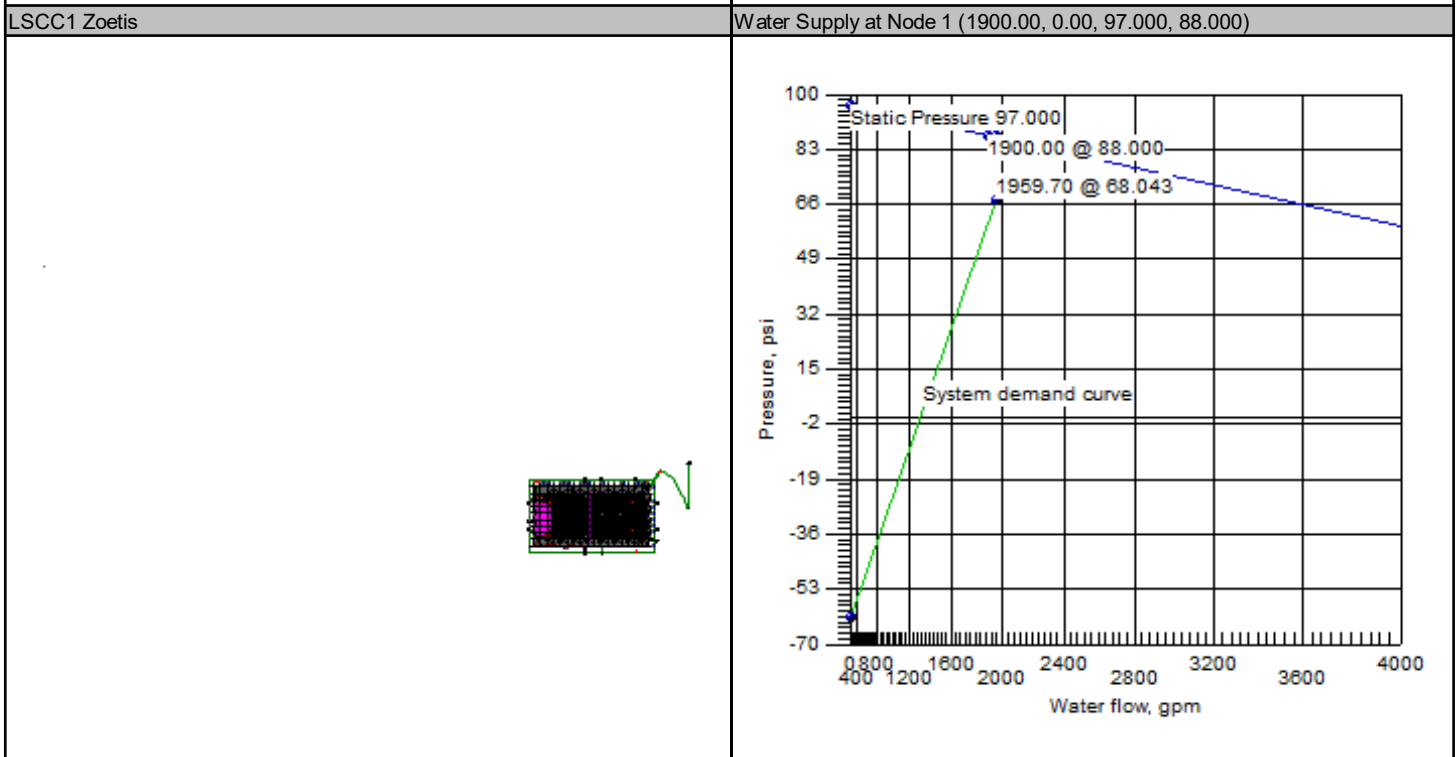
Hydraulic Overview

Job Number: 212189000
Report Description: Remote Area 01

Job		
Job Number 212189000	Design Engineer Jay Colbert	
Job Name: Lee's Summit Commerce Center	Phone 913.242.0057	FAX
Address 1 1120 NW Main St	State Certification/License Number	
Address 2	AHJ City of Lee's Summit	
Address 3 Lee's Summit, MO 64086	Job Site/Building Building A	

System	
Pressure 40.000	Area of Application NA
Most Demanding Sprinkler Data 22.4 K-Factor 141.67 at 40.000	Hose Streams 250.00
Coverage Per Sprinkler 100ft ²	Number Of Sprinklers Calculated 12 0
System Pressure Demand 68.043	System Flow Demand 1959.70
Total Demand 1959.70 @ 68.043	Pressure Result +19.427 (22.2%)

Supplies						Check Point Gauges			
Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)	Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)
1	Water Supply	1900.00		97.000	88.000	Pump Inlet	51.070	274.23	1959.70
4	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									





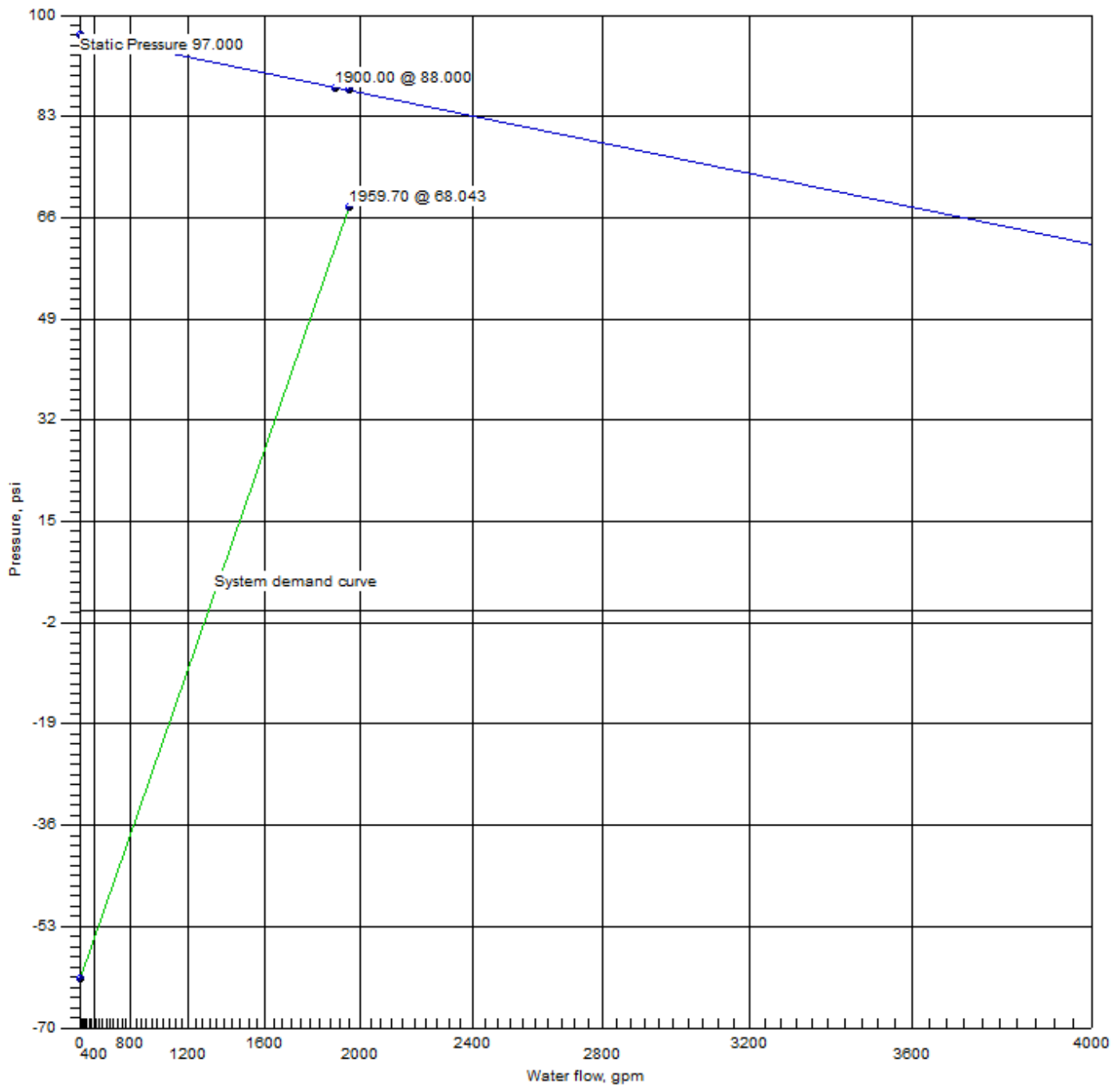
Hydraulic Summary

Job Number: 212189000
Report Description: Remote Area 01

Job											
Job Number 212189000				Design Engineer Jay Colbert							
Job Name: Lee's Summit Commerce Center				State Certification/License Number							
Address 1 1120 NW Main St				AHJ City of Lee's Summit							
Address 2				Job Site/Building Building A							
Address 3 Lee's Summit, MO 64086				Drawing Name LSCC1 Zoetis							
System				Remote Area(s)							
Most Demanding Sprinkler Data 22.4 K-Factor 141.67 at 40.000				Occupancy ESFR			Job Suffix				
Hose Allowance At Source 0.00				Pressure 40.000			Area of Application NA				
Additional Hose Supplies Node Hydrant At Node 54				Flow(gpm) 250.00			Number Of Sprinklers Calculated 12				
				Number Of Nozzles Calculated 0			Coverage Per Sprinkler 100ft ²				
				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 68.032 Right: 68.031							
Total Hose Streams 250.00											
System Flow Demand 1959.70			Total Water Required (Including Hose Allowance) 1959.70								
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 18.14 between nodes 138 and 140											
Maximum Velocity Under Ground 11.37 between nodes 224 and 7											
Volume capacity of Wet Pipes 34293.96gal			Volume capacity of Dry Pipes								
Supplies											
Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@	Flow (gpm)	Available (psi)	@	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply		97.000	88.000		1900.00	87.470		1959.70	68.043	19.427
4	Pump		84.000	60.000		2000.00	131.213		1959.70	111.786	19.427
Pumps: Static = Churn (Pressure @ Zero Flow)											
Contractor											
Contractor Number 21		Contact Name Jay Colbert					Contact Title				
Name of Contractor: F.E. Moran Fire Protection Inc.		Phone 913.242.0057					Extension				
Address 1 16815 College Blvd.		FAX									
Address 2		E-mail jay.colbert@femoran.com									
Address 3 Lenexa, KS 66219		Web-Site femoranfp.com									



Water Supply at Node 1



Hydraulic Graph

Water Supply at Node 1

Static: Pressure

97.000

Residual: Pressure

88.000 @ 1900.00

Available Pressure at System Demand

87.470 @ 1959.70

Required Pressure at System Demand

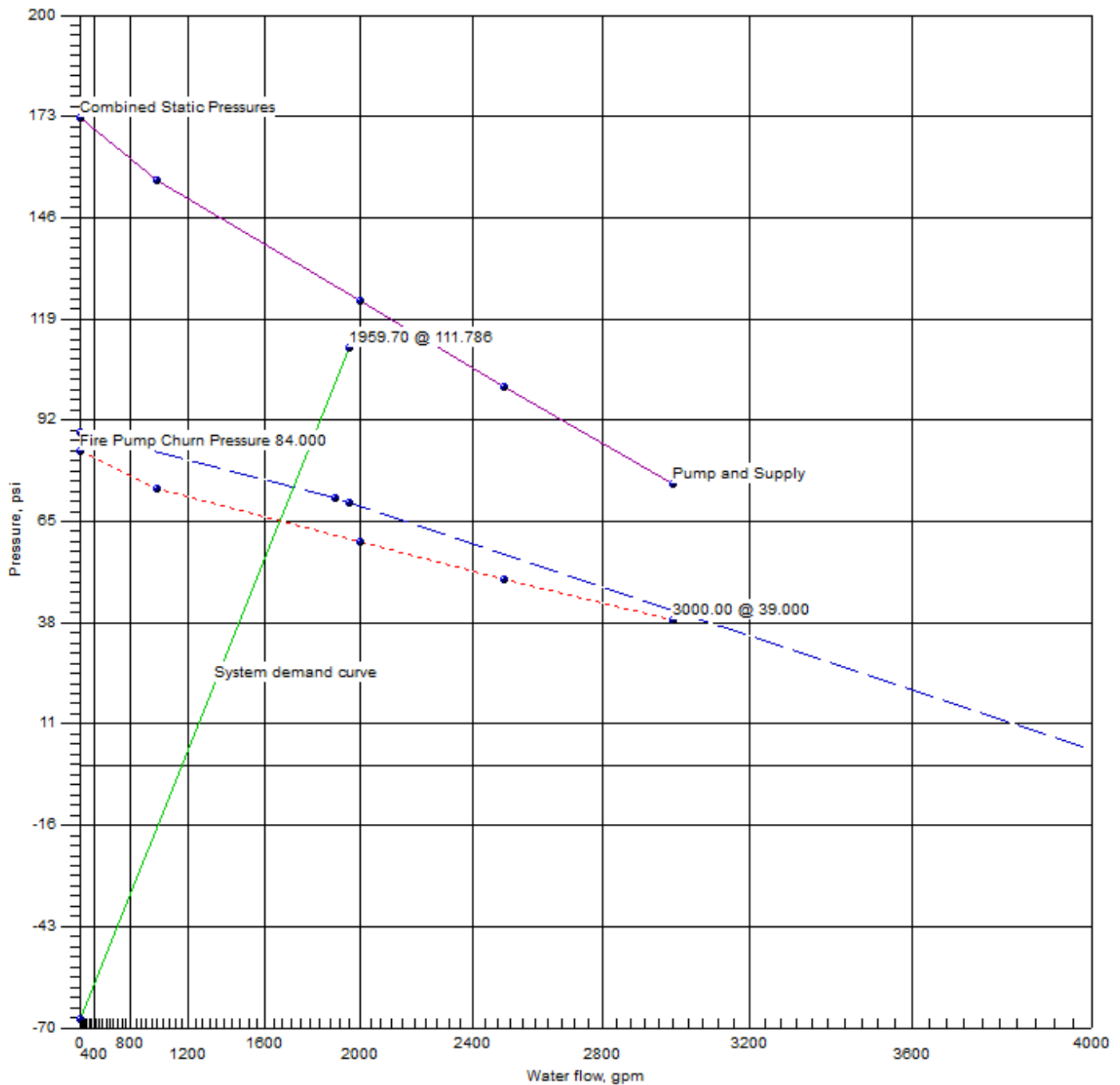
68.043 @ 1959.70

Required Pressure at System Demand (Including Hose Allowance at Source)

68.043 @ 1959.70



Pump at Node 4



Hydraulic Graph
Pump at Node 4

Static + Churn Pressure
173.256
Fire Pump Churn Pressure
84.000

Fire Pump Rating
60.000 @ 2000.00

Residual Pressure
60.716 @ 1959.70
Available Pressure at System Demand
131.213 @ 1959.70
Required Pressure at System Demand
111.786 @ 1959.70



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: Remote Area 01

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Hydrant	54	250.00	250.00	250	99.807		
⇒ Sprinkler	1135	141.67	141.67	22.4	40.000		
Sprinkler	1137	141.67	141.67	22.4	40.000		
Sprinkler	1139	141.96	141.67	22.4	40.162		
Sprinkler	1141	141.94	141.67	22.4	40.152		
Sprinkler	1143	142.39	141.67	22.4	40.409		
Sprinkler	1145	142.66	141.67	22.4	40.560		
Sprinkler	1147	142.39	141.67	22.4	40.409		
Sprinkler	1149	142.68	141.67	22.4	40.574		
Sprinkler	1151	142.93	141.67	22.4	40.715		
Sprinkler	1153	142.95	141.67	22.4	40.724		
Sprinkler	1155	143.35	141.67	22.4	40.953		
Sprinkler	1157	143.11	141.67	22.4	40.817		

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: Remote Area 01

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	68.043	1959.70
54	1'-0	Hyd(-1.000)	99.807	250.00
1135	38'-10	Spr(-40.000)	40.000	141.67
1137	38'-10	Spr(-40.000)	40.000	141.67
1139	38'-10	Spr(-40.162)	40.162	141.96
1141	38'-10	Spr(-40.152)	40.152	141.94
1143	38'-6½	Spr(-40.409)	40.409	142.39
1145	38'-6½	Spr(-40.560)	40.560	142.66
1147	38'-6½	Spr(-40.409)	40.409	142.39
1149	38'-6½	Spr(-40.574)	40.574	142.68
1151	39'-1	Spr(-40.715)	40.715	142.93
1153	39'-1	Spr(-40.724)	40.724	142.95
1155	39'-1	Spr(-40.953)	40.953	143.35
1157	39'-1	Spr(-40.817)	40.817	143.11
2	1'-9	T(65'-4½)	51.557	
3	1'-9	P1, Pump Inlet	51.070	
4	1'-9	P2(-60.886)	111.786	
5	1'-9		111.786	
6	6'-8½		107.218	
7	-8'-0	T(59'-4½)	111.583	
8	-8'-0	T(59'-4½)	109.196	
9	-8'-0	T(47'-3½)	108.352	
10	-8'-0	T(59'-4½)	103.592	
11	-8'-0	T(47'-3½)	103.870	
12	-8'-0	T(59'-4½)	104.092	
13	-8'-0	T(47'-3½)	106.503	
14	-8'-0	T(59'-4½)	106.935	
15	-8'-0	T(47'-3½)	108.925	
16	-8'-0	T(59'-4½)	109.258	
17	-8'-0	T(59'-4½)	110.036	
52	1'-0	Hyd	1.000	
55	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
100	37'-0	PO(18'-8½)	59.800	
102	37'-0	PO(18'-8½)	59.888	
104	37'-0	PO(18'-8½)	60.073	
106	37'-0	PO(18'-8½)	60.391	
108	37'-0	PO(18'-8½)	60.881	
110	37'-0		61.199	
112	37'-2	PO(18'-8½)	61.192	
114	37'-5	PO(18'-8½)	61.219	
116	37'-8½	PO(22'-6)	61.294	
118	38'-0	PO(22'-6)	61.511	
120	38'-3	PO(22'-6)	61.907	
122	1'-8½	PO(37'-8½)	96.593	
124	1'-0		97.799	
126	37'-0	PO(18'-8½)	51.329	
128	37'-0	PO(18'-8½)	51.242	
130	37'-0	PO(18'-8½)	51.057	
132	37'-0	PO(18'-8½)	50.739	
134	37'-0	PO(18'-8½)	50.249	
136	37'-2	PO(18'-8½)	49.473	
138	37'-5	PO(18'-8½)	48.376	
140	37'-8½	PO(22'-6)	46.954	
142	38'-0	PO(22'-6)	46.247	
144	38'-3	PO(22'-6)	45.978	
146	37'-0	PO(18'-8½)	51.354	
148	37'-10	T(18'-8½)	58.869	
150	37'-0	PO(18'-8½)	59.780	
152	37'-0	PO(18'-8½)	59.776	
224	1'-0		109.538	
309	-8'-0	E(35'-1)	65.533	



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 01

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
BL	3.3340	2.55	0.09	120		0.000010	9'-0	Pf 0.000
1135	38'-10	141.67	22.4	40.000		Sprinkler		Pe
1137	38'-10			40.000			9'-0	Pv
BL	3.3340	144.22	5.30	120		0.018031	9'-0	Pf 0.162
1137	38'-10	141.67	22.4	40.000		Sprinkler		Pe
1139	38'-10			40.162			9'-0	Pv
BL	3.3340	286.18	10.52	120		0.064061	240'-8	Pf 20.988
1139	38'-10	141.96	22.4	40.162		Sprinkler,	86'-11½	Pe 0.361
118	38'-0			61.511		4E(10'-6), 2PO(22'-6)	327'-7½	Pv
CM	6.3570	1392.66	14.08	120		0.051633	10'-0	Pf 0.517
118	38'-0	1106.48		61.511		Flow (q) from Route 2		Pe -0.120
120	38'-3			61.907			10'-0	Pv
CM	6.3570	1709.70	17.28	120		0.075460	71'-0½	Pf 18.833
120	38'-3	317.04		61.907		Flow (q) from Route 5	178'-6½	Pe 15.853
122	1'-8½			96.593		5E(17'-7), 2f(-0.000), CV(40'-3), BV(12'-7), PO(37'-8½)	249'-7	Pv
CM	8.2490	1709.70	10.26	120		0.021217	1'-6	Pf 0.904
122	1'-8½			96.593			41'-1½	Pe 0.303
124	1'-0			97.799		PO(41'-1½)	42'-7½	Pv
UG	8.3900	1709.70	9.92	140		0.014689	38'-9½	Pf 1.890
124	1'-0			97.799			89'-11	Pe 3.902
10	-8'-0			103.592		E(30'-6½), T(59'-4½)	128'-8½	Pv
UG	8.3900	1157.81	6.72	140		0.007142	635'-11½	Pf 4.760
10	-8'-0			103.592			30'-6½	Pe
9	-8'-0			108.352		E(30'-6½)	666'-6	Pv
UG	8.3900	1157.81	6.72	140		0.007142	118'-2	Pf 0.844
9	-8'-0			108.352				Pe
8	-8'-0			109.196			118'-2	Pv
UG	8.3900	1157.81	6.72	140		0.007142	275'-0	Pf 2.388
8	-8'-0			109.196			59'-4½	Pe
7	-8'-0			111.583		T(59'-4½)	334'-4½	Pv
UG	8.3900	1959.70	11.37	140		0.018907	67'-8	Pf 1.857
7	-8'-0	801.89		111.583		Flow (q) from Route 7	30'-6½	Pe -3.902
224	1'-0			109.538		E(30'-6½)	98'-2½	Pv
FR	8.2490	1959.70	11.76	120		0.027310	5'-8½	Pf 0.156
224	1'-0			109.538				Pe -2.476
6	6'-8½			107.218			5'-8½	Pv
DY	10.3700	1959.70	7.44	120		0.008961	13'-10½	Pf 2.416
6	6'-8½			107.218			255'-9	Pe 2.151
5	1'-9			111.786		4E(26'-0), T(48'-5½), BV(21'-3½), Tr(17'-0), CV(65'-0)	269'-8	Pv
DY	7.9810	1959.70	12.57	120		0.032076	0'-0	Pf 0.000
5	1'-9			111.786				Pe 0.000
4	1'-9			111.786			0'-0	Pv
Pump								
4		1959.70	7.40	111.786		Rating: 60.000 @ 2000.00		
3		Q=1959.70		51.070		Fire Pump Churn Pressure: 84.000		
DY	10.4000	1959.70	7.40	140		0.006644	0'-0	Pf 0.487
3	1'-9			51.070			73'-4	Pe 0.000
2	1'-9			51.557		GV(7'-11½), T(65'-4½)	73'-4	Pv
UG	10.4000	1959.70	7.40	140		0.006644	696'-3½	Pf 9.749
2	1'-9			51.557			175'-4½	Pe 4.227
309	-8'-0			65.533		4E(35'-1), 2EE(17'-6½), BFP(-3.948)	871'-8	Pv
UG	12.4600	1959.70	5.16	140		0.002755	360'-2½	Pf 0.993
309	-8'-0			65.533				Pe 1.517
1	-11'-6			68.043		Water Supply	360'-2½	Pv
		0.00				Hose Allowance At Source		
1		1959.70						
Route 2								
BL	3.3340	139.12	5.11	120		0.016868	9'-0	Pf 0.152
1135	38'-10	141.67	22.4	40.000		Sprinkler		Pe
1141	38'-10			40.152			9'-0	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 01

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
BL	3.3340	281.06	10.33	120		0.061955	47'-7"	Pf 5.734
1141	38'-10"	141.94	22.4	40.152		Sprinkler,	44'-11½"	Pe 0.361
142	38'-0"			46.247		2PO(22'-6")	92'-6½"	Pv
CM	4.3100	536.35	11.79	120		0.058645	10'-0"	Pf 0.587
142	38'-0"	255.30		46.247		Flow (q) from Route 6		Pe 0.120
140	37'-8½"			46.954			10'-0"	Pv
CM	4.3100	824.86	18.14	120		0.130032	10'-0"	Pf 1.301
140	37'-8½"	288.51		46.954		Flow (q) from Route 4		Pe 0.120
138	37'-5"			48.376			10'-0"	Pv
CM	4.3100	706.43	15.53	120		0.097616	10'-0"	Pf 0.977
138	37'-5"			48.376				Pe 0.120
136	37'-2"			49.473			10'-0"	Pv
CM	4.3100	593.71	13.06	120		0.070773	10'-0½"	Pf 0.710
136	37'-2"			49.473				Pe 0.067
134	37'-0"			50.249			10'-0½"	Pv
CM	4.3100	486.78	10.70	120		0.049013	10'-0"	Pf 0.490
134	37'-0"			50.249				Pe
132	37'-0"			50.739			10'-0"	Pv
CM	4.3100	385.29	8.47	120		0.031802	10'-0"	Pf 0.318
132	37'-0"			50.739				Pe
130	37'-0"			51.057			10'-0"	Pv
CM	4.3100	287.47	6.32	120		0.018499	10'-0"	Pf 0.185
130	37'-0"			51.057				Pe
128	37'-0"			51.242			10'-0"	Pv
CM	4.3100	191.84	4.22	120		0.008754	10'-0"	Pf 0.088
128	37'-0"			51.242				Pe
126	37'-0"			51.329			10'-0"	Pv
CM	4.3100	97.27	2.14	120		0.002492	10'-0"	Pf 0.025
126	37'-0"			51.329				Pe
146	37'-0"			51.354			10'-0"	Pv
RN	2.7050	97.27	5.43	120		0.024085	270'-10"	Pf 7.876
146	37'-0"			51.354		PO(18'-8½")	56'-2"	Pe -0.361
148	37'-10"			58.869		PO(18'-8½"), 2E(9'-4½")	327'-0"	Pv
BL	2.7050	55.65	3.11	120		0.008574	26'-9"	Pf 0.550
148	37'-10"			58.869			37'-5"	Pe 0.361
150	37'-0"			59.780		2PO(18'-8½")	64'-2"	Pv
CM	4.3100	97.27	2.14	120		0.002492	8'-0"	Pf 0.020
150	37'-0"	41.61		59.780		Flow (q) from Route 9		Pe
100	37'-0"			59.800			8'-0"	Pv
CM	4.3100	191.84	4.22	120		0.008754	10'-0"	Pf 0.088
100	37'-0"	94.58		59.800		Flow (q) from Route 11		Pe
102	37'-0"			59.888			10'-0"	Pv
CM	4.3100	287.47	6.32	120		0.018499	10'-0"	Pf 0.185
102	37'-0"	95.63		59.888		Flow (q) from Route 10		Pe -0.000
104	37'-0"			60.073			10'-0"	Pv
CM	4.3100	385.29	8.47	120		0.031802	10'-0"	Pf 0.318
104	37'-0"	97.82		60.073		Flow (q) from Route 12		Pe
106	37'-0"			60.391			10'-0"	Pv
CM	4.3100	486.78	10.70	120		0.049013	10'-0"	Pf 0.490
106	37'-0"	101.49		60.391		Flow (q) from Route 13		Pe
108	37'-0"			60.881			10'-0"	Pv
CM	4.3100	593.71	13.06	120		0.070773	4'-6"	Pf 0.318
108	37'-0"	106.94		60.881		Flow (q) from Route 14		Pe
110	37'-0"			61.199			4'-6"	Pv
CM	6.3570	593.71	6.00	120		0.010664	5'-6½"	Pf 0.059
110	37'-0"			61.199				Pe -0.066
112	37'-2"			61.192			5'-6½"	Pv
CM	6.3570	706.43	7.14	120		0.014709	10'-0"	Pf 0.147
112	37'-2"	112.71		61.192		Flow (q) from Route 16		Pe -0.120
114	37'-5"			61.219			10'-0"	Pv
CM	6.3570	824.86	8.34	120		0.019594	10'-0"	Pf 0.196
114	37'-5"	118.43		61.219		Flow (q) from Route 15		Pe -0.121
116	37'-8½"			61.294			10'-0"	Pv
CM	6.3570	1106.48	11.18	120		0.033737	10'-0"	Pf 0.337
116	37'-8½"	281.62		61.294		Flow (q) from Route 3		Pe -0.120
118	38'-0"			61.511			10'-0"	Pv

Route 3



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 01

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
BL	3.3340	138.96	5.11	120		0.016833	9'-0"	Pf 0.151
1143	38'-6½"	142.39	22.4	40.409		Sprinkler		Pe
1145	38'-6½"			40.560			9'-0"	Pv
BL	3.3340	281.62	10.35	120		0.062184	240'-8"	Pf 20.373
1145	38'-6½"	142.66	22.4	40.560		Sprinkler,	86'-11½"	Pe 0.361
116	37'-8½"			61.294		4E(10'-6), 2PO(22'-6)	327'-7½"	Pv
Route 4								
BL	3.3340	3.43	0.13	120		0.000018	9'-0"	Pf 0.000
1143	38'-6½"	142.39	22.4	40.409		Sprinkler		Pe
1147	38'-6½"			40.409			9'-0"	Pv
BL	3.3340	145.82	5.36	120		0.018403	9'-0"	Pf 0.166
1147	38'-6½"	142.39	22.4	40.409		Sprinkler		Pe
1149	38'-6½"			40.574			9'-0"	Pv
BL	3.3340	288.51	10.60	120		0.065029	47'-7"	Pf 6.019
1149	38'-6½"	142.68	22.4	40.574		Sprinkler,	44'-11½"	Pe 0.361
140	37'-8½"			46.954		2PO(22'-6)	92'-6½"	Pv
Route 5								
BL	3.3340	30.75	1.13	120		0.001033	9'-0"	Pf 0.009
1151	39'-1"	142.93	22.4	40.715		Sprinkler		Pe
1153	39'-1"			40.724			9'-0"	Pv
BL	3.3340	173.69	6.38	120		0.025433	9'-0"	Pf 0.229
1153	39'-1"	142.95	22.4	40.724		Sprinkler		Pe
1155	39'-1"			40.953			9'-0"	Pv
BL	3.3340	317.04	11.65	120		0.077424	221'-0"	Pf 20.593
1155	39'-1"	143.35	22.4	40.953		Sprinkler,	44'-11½"	Pe 0.361
120	38'-3"			61.907		2PO(22'-6)	265'-11½"	Pv
Route 6								
BL	3.3340	112.19	4.12	120		0.011329	9'-0"	Pf 0.102
1151	39'-1"	142.93	22.4	40.715		Sprinkler		Pe
1157	39'-1"			40.817			9'-0"	Pv
BL	3.3340	255.30	9.38	120		0.051861	47'-7"	Pf 4.800
1157	39'-1"	143.11	22.4	40.817		Sprinkler,	44'-11½"	Pe 0.361
144	38'-3"			45.978		2PO(22'-6)	92'-6½"	Pv
CM	4.3100	255.30	5.61	120		0.014852	10'-0"	Pf 0.149
144	38'-3"			45.978				Pe 0.120
142	38'-0"			46.247			10'-0"	Pv
Route 7								
UG	6.2800	250.00	2.59	140		0.001718	19'-10"	Pf 0.161
54	1'-0"	250.00		99.807		Hydrant,	74'-1"	Pe 3.902
11	-8'-0"			103.870		E(22'-1), GV(4'-8½), T(47'-3½)	93'-10½"	Pv
UG	8.3900	801.89	4.65	140		0.003620	61'-1½"	Pf 0.221
11	-8'-0"	551.89		103.870		Flow (q) from Route 8		Pe
12	-8'-0"			104.092			61'-1½"	Pv
UG	8.3900	801.89	4.65	140		0.003620	635'-9"	Pf 2.412
12	-8'-0"			104.092			30'-6½"	Pe
13	-8'-0"			106.503		E(30'-6½)	666'-3½"	Pv
UG	8.3900	801.89	4.65	140		0.003620	119'-3"	Pf 0.432
13	-8'-0"			106.503				Pe
14	-8'-0"			106.935			119'-3"	Pv
UG	8.3900	801.89	4.65	140		0.003620	519'-3½"	Pf 1.990
14	-8'-0"			106.935			30'-6½"	Pe
15	-8'-0"			108.925		E(30'-6½)	549'-10"	Pv
UG	8.3900	801.89	4.65	140		0.003620	91'-11½"	Pf 0.333
15	-8'-0"			108.925				Pe
16	-8'-0"			109.258			91'-11½"	Pv
UG	8.3900	801.89	4.65	140		0.003620	214'-9"	Pf 0.777
16	-8'-0"			109.258				Pe
17	-8'-0"			110.036			214'-9"	Pv
UG	8.3900	801.89	4.65	140		0.003620	337'-8"	Pf 1.548
17	-8'-0"			110.036			89'-11"	Pe
7	-8'-0"			111.583		E(30'-6½), T(59'-4½)	427'-7"	Pv
Route 8								
UG	8.3900	551.89	3.20	140		0.001813	153'-8"	Pf 0.279
10	-8'-0"	1157.81		103.592		Flow (q) from Route 1		Pe
11	-8'-0"			103.870			153'-8"	Pv
Route 9								



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 01

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
CM	4.3100	41.61	0.92	120		0.000518	7'-6"	Pf 0.004
152	37'-0"	41.61		59.776		Flow (q) from Route 17		Pe
150	37'-0"			59.780			7'-6"	Pv
Route 10								
RN	2.7050	95.63	5.34	120		0.023338	295'-7"	Pf 8.646
128	37'-0"			51.242		PO(18'-8½")	74'-10½"	Pe
102	37'-0"			59.888		3PO(18'-8½")	370'-5½"	Pv
Route 11								
RN	2.7050	94.58	5.28	120		0.022866	295'-7"	Pf 8.471
126	37'-0"			51.329		PO(18'-8½")	74'-10½"	Pe
100	37'-0"			59.800		3PO(18'-8½")	370'-5½"	Pv
Route 12								
RN	2.7050	97.82	5.46	120		0.024337	295'-7"	Pf 9.016
130	37'-0"			51.057		PO(18'-8½")	74'-10½"	Pe -0.000
104	37'-0"			60.073		3PO(18'-8½")	370'-5½"	Pv
Route 13								
RN	2.7050	101.49	5.67	120		0.026054	295'-7"	Pf 9.652
132	37'-0"			50.739		PO(18'-8½")	74'-10½"	Pe -0.000
106	37'-0"			60.391		3PO(18'-8½")	370'-5½"	Pv
Route 14								
RN	2.7050	106.94	5.97	120		0.028700	295'-7"	Pf 10.632
134	37'-0"			50.249		PO(18'-8½")	74'-10½"	Pe -0.000
108	37'-0"			60.881		3PO(18'-8½")	370'-5½"	Pv
Route 15								
RN	2.7050	118.43	6.61	120		0.034667	295'-7"	Pf 12.843
138	37'-5"			48.376		PO(18'-8½")	74'-10½"	Pe 0.000
114	37'-5"			61.219		3PO(18'-8½")	370'-5½"	Pv
Route 16								
RN	2.7050	112.71	6.29	120		0.031634	295'-7"	Pf 11.719
136	37'-2"			49.473		PO(18'-8½")	74'-10½"	Pe 0.000
112	37'-2"			61.192		3PO(18'-8½")	370'-5½"	Pv
Route 17								
BL	2.7050	41.61	2.32	120		0.005007	34'-3"	Pf 0.546
148	37'-10"			58.869		T(18'-8½")	74'-10½"	Pe 0.361
152	37'-0"			59.776		T(18'-8½"), 2PO(18'-8½")	109'-1½"	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

C Value Multiplier

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$$

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

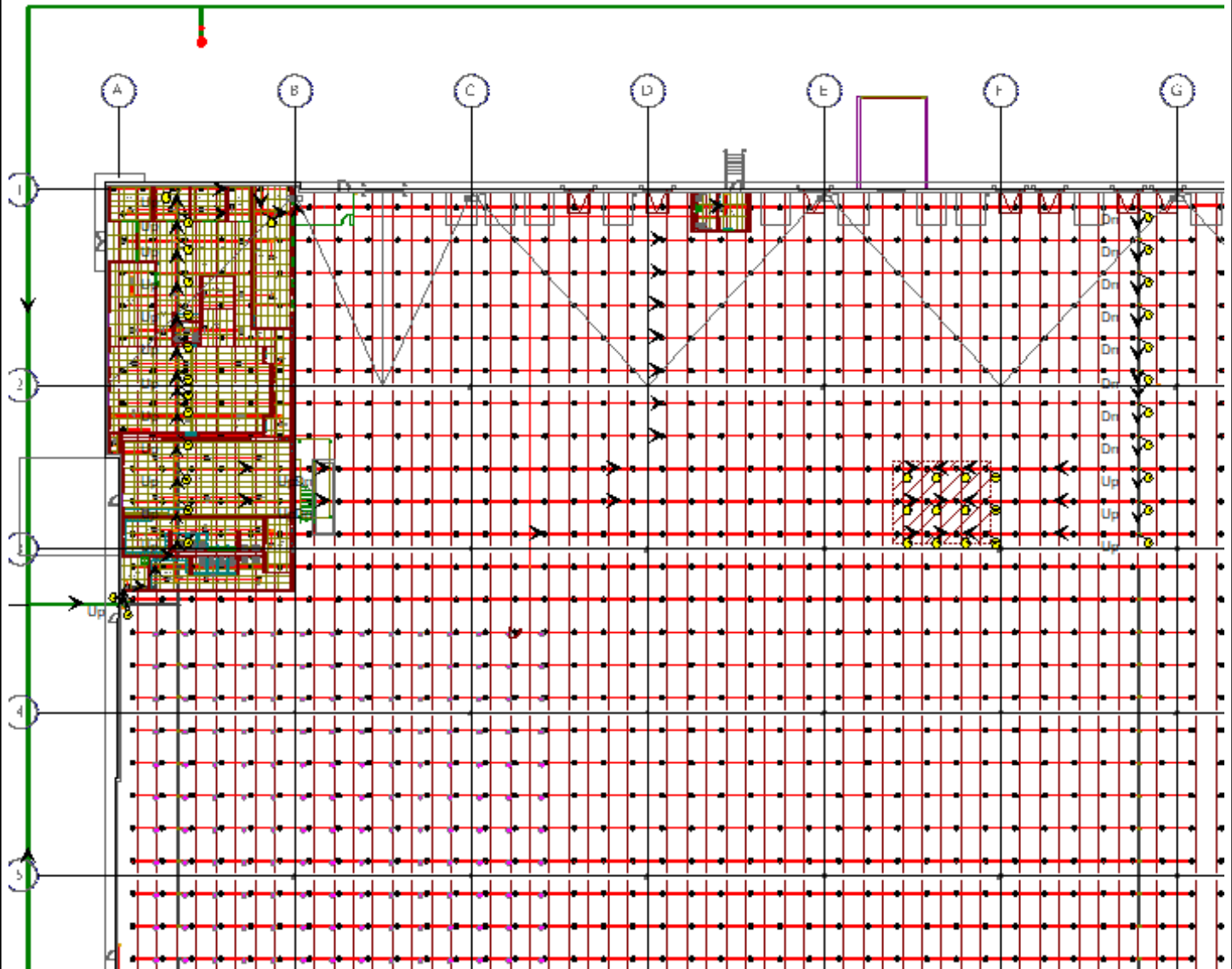


Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 01

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss		Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

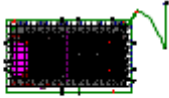
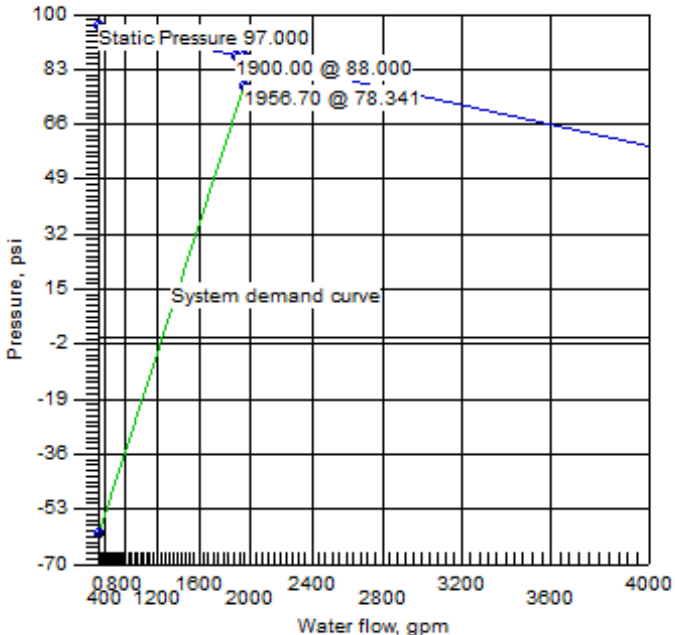
Pipe Type Legend	Units Legend		Fittings Legend	
AO Arm-Over	Diameter	Inch	ALV Alarm Valve	
BL Branch Line	Elevation	Foot	AngV Angle Valve	
CM Cross Main	Flow	gpm	b Bushing	
DN Drain	Discharge	gpm	BaIV Ball Valve	
DR Drop	Velocity	fps	BFP Backflow Preventer	
DY Dynamic	Pressure	psi	BV Butterfly Valve	
FM Feed Main	Length	Foot	C Cross Flow Turn 90°	
FR Feed Riser	Friction Loss	psi/Foot	cplg Coupling	
MS Miscellaneous	HWC	Hazen-Williams Constant	Cr Cross Run	
OR Outrigger	Pt	Total pressure at a point in a pipe	CV Check Valve	
RN Riser Nipple	Pn	Normal pressure at a point in a pipe	DeIV Deluge Valve	
SP Sprig	Pf	Pressure loss due to friction between points	DPV Dry Pipe Valve	
ST Stand Pipe	Pe	Pressure due to elevation difference between indicated points	E 90° Elbow	
UG Underground	Pv	Velocity pressure at a point in a pipe	EE 45° Elbow	
			Ee1 11¼° Elbow	
			Ee2 22½° Elbow	
			f Flow Device	
			fd Flex Drop	
			FDC Fire Department Connection	
			fE 90° FireLock(TM) Elbow	
			fEE 45° FireLock(TM) Elbow	
			flg Flange	
			FN Floating Node	
			fT FireLock(TM) Tee	
			g Gauge	
			GloV Globe Valve	
			GV Gate Valve	
			Ho Hose	
			Hose Hose	
			HV Hose Valve	
			Hyd Hydrant	
			LtE Long Turn Elbow	
			mecT Mechanical Tee	
			Noz Nozzle	
			P1 Pump In	
			P2 Pump Out	
			PIV Post Indicating Valve	
			PO Pipe Outlet	
			PrV Pressure Relief Valve	
			PRV Pressure Reducing Valve	
			red Reducer/Adapter	
			S Supply	
			sCV Swing Check Valve	
			SFx Seismic Flex	
			Spr Sprinkler	
			St Strainer	
			T Tee Flow Turn 90°	
			Tr Tee Run	
			U Union	
			WirF Wirsbo	
			WMV Water Meter Valve	
			Z Cap	





Hydraulic Overview

Job Number: 212189000
Report Description: Remote Area 02

Job									
Job Number 212189000					Design Engineer Jay Colbert				
Job Name: Lee's Summit Commerce Center					Phone 913.242.0057			FAX	
Address 1 1120 NW Main St					State Certification/License Number				
Address 2					AHJ City of Lee's Summit				
Address 3 Lee's Summit, MO 64086					Job Site/Building Building A				
System									
Pressure 40.000					Area of Application NA				
Most Demanding Sprinkler Data 22.4 K-Factor 141.67 at 40.000					Hose Streams 250.00				
Coverage Per Sprinkler 100ft ²					Number Of Sprinklers Calculated 12			0	
System Pressure Demand 78.341					System Flow Demand 1956.70				
Total Demand 1956.70 @ 78.341					Pressure Result +9.156 (10.5%)				
Supplies					Check Point Gauges				
<u>Node</u>	<u>Name</u>	<u>Flow(gpm)</u>	<u>Hose Flow(gpm)</u>	<u>Static(psi)</u>	<u>Residual(psi)</u>	<u>Identifier</u>	<u>Pressure(psi)</u>	<u>K-Factor(K)</u>	<u>Flow(gpm)</u>
1	Water Supply	1900.00		97.000	88.000	Pump Inlet	61.392	249.73	1956.70
4	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									
LSCC1 Zoetis					Water Supply at Node 1 (1900.00, 0.00, 97.000, 88.000)				
									



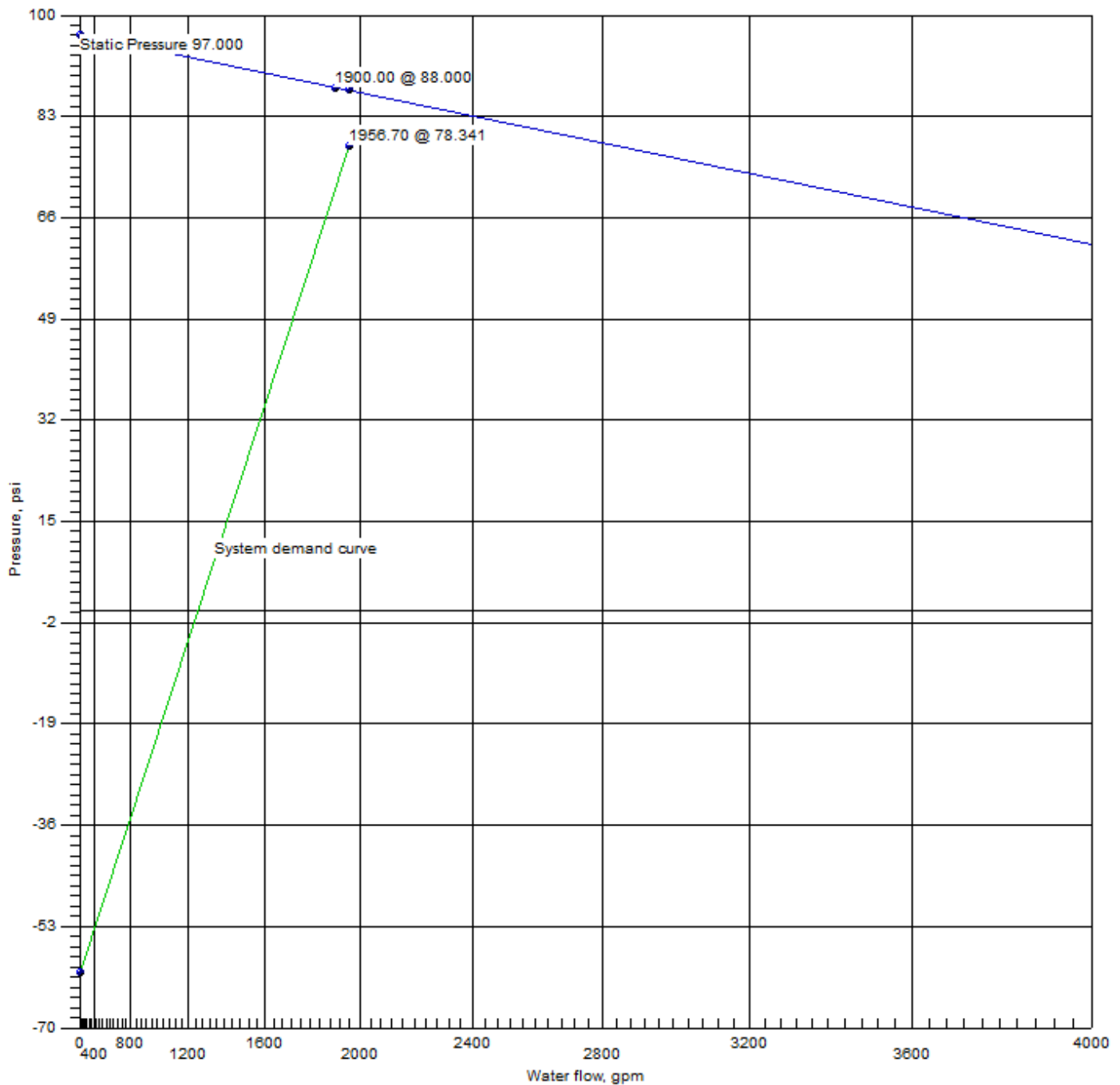
Hydraulic Summary

Job Number: 212189000
Report Description: Remote Area 02

Job											
Job Number 212189000					Design Engineer Jay Colbert						
Job Name: Lee's Summit Commerce Center					State Certification/License Number						
Address 1 1120 NW Main St					AHJ City of Lee's Summit						
Address 2					Job Site/Building Building A						
Address 3 Lee's Summit, MO 64086					Drawing Name LSCC1 Zoetis						
System					Remote Area(s)						
Most Demanding Sprinkler Data 22.4 K-Factor 141.67 at 40.000					Occupancy ESFR			Job Suffix			
Hose Allowance At Source 0.00					Pressure 40.000			Area of Application NA			
Additional Hose Supplies Node Hydrant At Node 54					Flow(gpm) 250.00		Number Of Sprinklers Calculated 12		Number Of Nozzles Calculated 0		
							Coverage Per Sprinkler 100ft ²				
					AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 78.298 Right: 78.291						
Total Hose Streams 250.00											
System Flow Demand 1956.70				Total Water Required (Including Hose Allowance) 1956.70							
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 18.85 between nodes 232 and 230											
Maximum Velocity Under Ground 11.36 between nodes 224 and 7											
Volume capacity of Wet Pipes 34293.96gal				Volume capacity of Dry Pipes							
Supplies											
Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@	Flow (gpm)	Available (psi)	@	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply		97.000	88.000		1900.00	87.497		1956.70	78.341	9.156
4	Pump		84.000	60.000		2000.00	131.317		1956.70	122.161	9.156
Pumps: Static = Churn (Pressure @ Zero Flow)											
Contractor											
Contractor Number 21		Contact Name Jay Colbert					Contact Title				
Name of Contractor: F.E. Moran Fire Protection Inc.						Phone 913.242.0057			Extension		
Address 1 16815 College Blvd.						FAX					
Address 2						E-mail jay.colbert@femoran.com					
Address 3 Lenexa, KS 66219						Web-Site femoranfp.com					



Water Supply at Node 1



Hydraulic Graph

Water Supply at Node 1

Static: Pressure

97.000

Residual: Pressure

88.000 @ 1900.00

Available Pressure at System Demand

87.497 @ 1956.70

Required Pressure at System Demand

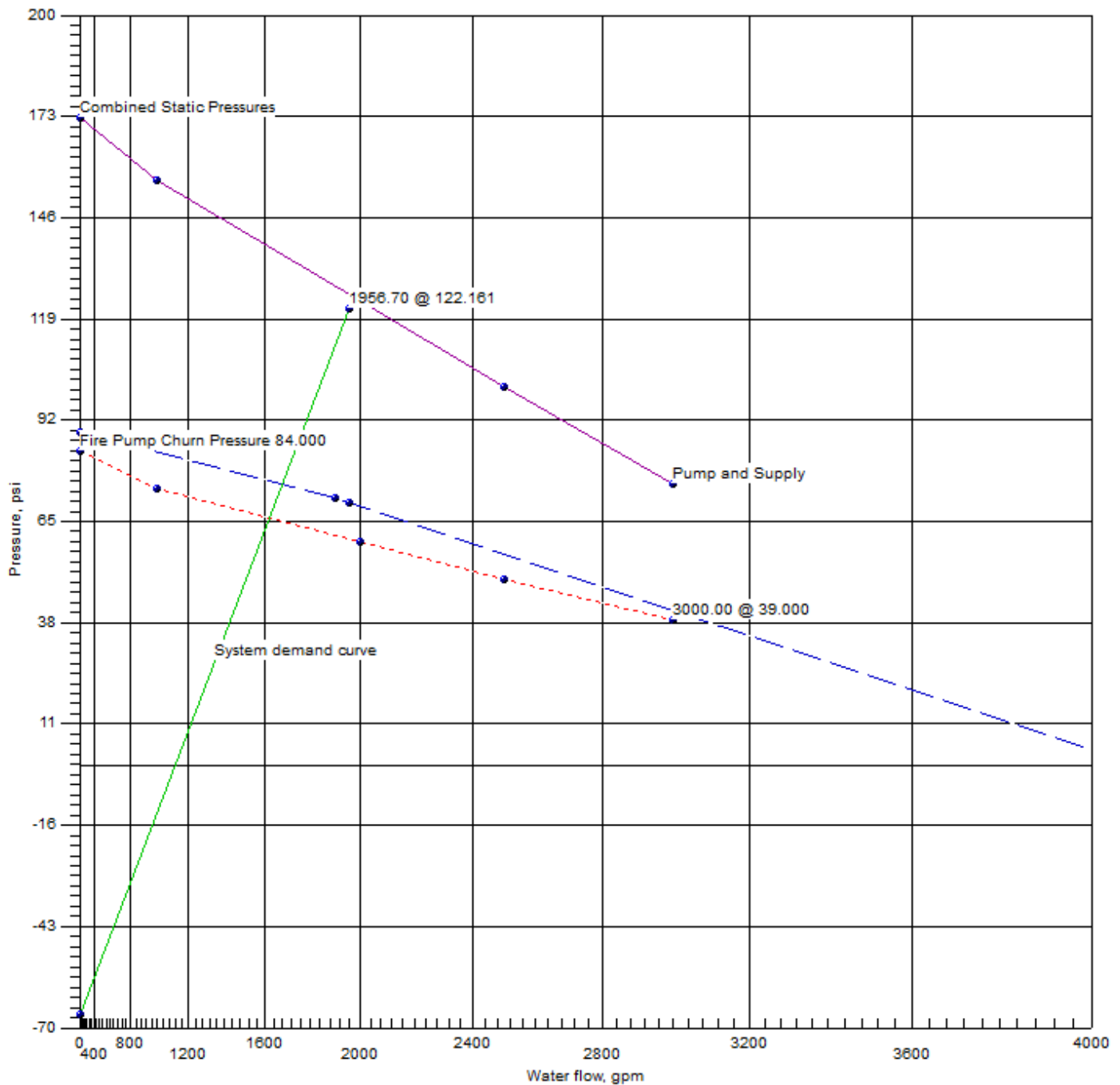
78.341 @ 1956.70

Required Pressure at System Demand (Including Hose Allowance at Source)

78.341 @ 1956.70



Pump at Node 4



Hydraulic Graph
Pump at Node 4

Static + Churn Pressure
173.256
Fire Pump Churn Pressure
84.000

Fire Pump Rating
60.000 @ 2000.00

Residual: Pressure
60.769 @ 1956.70
Available Pressure at System Demand
131.317 @ 1956.70
Required Pressure at System Demand
122.161 @ 1956.70



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: Remote Area 02

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Hydrant	54	250.00	250.00	250	110.217		
⇒ Sprinkler	2111	141.67	141.67	22.4	40.000		
Sprinkler	2113	142.43	141.67	22.4	40.432		
Sprinkler	2115	141.67	141.67	22.4	40.000		
Sprinkler	2117	142.44	141.67	22.4	40.438		
Sprinkler	2119	141.70	141.67	22.4	40.017		
Sprinkler	2121	142.46	141.67	22.4	40.446		
Sprinkler	2123	141.70	141.67	22.4	40.017		
Sprinkler	2125	142.48	141.67	22.4	40.457		
Sprinkler	2127	142.15	141.67	22.4	40.273		
Sprinkler	2129	142.90	141.67	22.4	40.696		
Sprinkler	2131	142.15	141.67	22.4	40.273		
Sprinkler	2133	142.95	141.67	22.4	40.724		

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: Remote Area 02

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	78.341	1956.70
54	1'-0	Hyd(-1.000)	110.217	250.00
2111	41'-8	Spr(-40.000)	40.000	141.67
2113	41'-8	Spr(-40.432)	40.432	142.43
2115	41'-8	Spr(-40.000)	40.000	141.67
2117	41'-8	Spr(-40.438)	40.438	142.44
2119	41'-10½	Spr(-40.017)	40.017	141.70
2121	41'-10½	Spr(-40.446)	40.446	142.46
2123	41'-10½	Spr(-40.017)	40.017	141.70
2125	41'-10½	Spr(-40.457)	40.457	142.48
2127	41'-10½	Spr(-40.273)	40.273	142.15
2129	41'-10½	Spr(-40.696)	40.696	142.90
2131	41'-10½	Spr(-40.273)	40.273	142.15
2133	41'-10½	Spr(-40.724)	40.724	142.95
2	1'-9	T(65'-4½)	61.878	
3	1'-9	P1, Pump Inlet	61.392	
4	1'-9	P2(-60.886)	122.161	
5	1'-9		122.161	
6	6'-8½		117.600	
7	-8'-0	T(59'-4½)	121.971	
8	-8'-0	T(59'-4½)	119.590	
9	-8'-0	T(47'-3½)	118.748	
10	-8'-0	T(59'-4½)	114.002	
11	-8'-0	T(47'-3½)	114.280	
12	-8'-0	T(59'-4½)	114.500	
13	-8'-0	T(47'-3½)	116.905	
14	-8'-0	T(59'-4½)	117.336	
15	-8'-0	T(47'-3½)	119.320	
16	-8'-0	T(59'-4½)	119.652	
17	-8'-0	T(59'-4½)	120.427	
52	1'-0	Hyd	1.000	
55	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
124	1'-0		108.216	
200	40'-9	PO(18'-8½)	76.490	
202	40'-11½	PO(18'-8½)	76.427	
204	40'-11½	PO(18'-8½)	76.528	
206	40'-8	PO(18'-8½)	76.856	
208	40'-5	PO(18'-8½)	77.230	
210	40'-1½	PO(18'-8½)	77.654	
212	39'-10	PO(18'-8½)	78.128	
214	39'-7	PO(18'-8½)	78.656	
216	39'-3½	PO(18'-8½)	79.239	
218	39'-0	PO(18'-8½)	79.883	
220	38'-9½	T(37'-8½)	82.706	
222	1'-8½	PO(41'-1½)	107.913	
224	1'-0		119.921	
226	40'-10	PO(18'-8½)	65.205	
228	41'-0½	PO(18'-8½)	65.296	
230	41'-0½	PO(18'-8½)	65.954	
232	40'-9	PO(18'-8½)	67.471	
234	38'-5½	PO(18'-8½)	82.778	
236	38'-9	PO(18'-8½)	82.662	
238	40'-6	PO(18'-8½)	68.703	
240	40'-2½	PO(18'-8½)	69.691	
242	39'-11	PO(18'-8½)	70.471	
244	39'-8	PO(18'-8½)	71.074	
246	39'-4½	PO(18'-8½)	71.525	
248	39'-1	PO(18'-8½)	71.850	
250	38'-10	PO(18'-8½)	72.076	
252	38'-6½	PO(18'-8½)	72.226	
309	-8'-0	E(35'-1)	75.834	



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 02

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
BL	2.7050	141.15	7.88	120		0.047964	9'-0	Pf 0.432
2111	41'-8	141.67	22.4	40.000		Sprinkler		Pe
2113	41'-8			40.432			9'-0	Pv
BL	2.7050	283.58	15.83	120		0.174365	167'-1	Pf 35.661
2113	41'-8	142.43	22.4	40.432		Sprinkler,	37'-5	Pe 0.397
200	40'-9			76.490		2PO(18'-8½)	204'-6	Pv
CM	6.3570	283.58	2.87	120		0.002718	10'-0	Pf 0.027
200	40'-9			76.490				Pe -0.090
202	40'-11½			76.427			10'-0	Pv
CM	6.3570	566.83	5.73	120		0.009788	9'-11½	Pf 0.097
202	40'-11½	283.25		76.427		Flow (q) from Route 3		Pe 0.004
204	40'-11½			76.528			9'-11½	Pv
CM	6.3570	849.44	8.59	120		0.020688	10'-0	Pf 0.207
204	40'-11½	282.61		76.528		Flow (q) from Route 5		Pe 0.120
206	40'-8			76.856			10'-0	Pv
CM	6.3570	949.19	9.59	120		0.025405	10'-0	Pf 0.254
206	40'-8	99.74		76.856		Flow (q) from Route 2		Pe 0.120
208	40'-5			77.230			10'-0	Pv
CM	6.3570	1043.88	10.55	120		0.030291	10'-0	Pf 0.303
208	40'-5	94.69		77.230		Flow (q) from Route 10		Pe 0.120
210	40'-1½			77.654			10'-0	Pv
CM	6.3570	1135.11	11.47	120		0.035370	10'-0	Pf 0.354
210	40'-1½	91.23		77.654		Flow (q) from Route 11		Pe 0.120
212	39'-10			78.128			10'-0	Pv
CM	6.3570	1224.42	12.38	120		0.040690	10'-0	Pf 0.407
212	39'-10	89.31		78.128		Flow (q) from Route 12		Pe 0.120
214	39'-7			78.656			10'-0	Pv
CM	6.3570	1313.25	13.27	120		0.046319	10'-0	Pf 0.463
214	39'-7	88.83		78.656		Flow (q) from Route 13		Pe 0.120
216	39'-3½			79.239			10'-0	Pv
CM	6.3570	1402.92	14.18	120		0.052339	10'-0	Pf 0.524
216	39'-3½	89.67		79.239		Flow (q) from Route 14		Pe 0.120
218	39'-0			79.883			10'-0	Pv
CM	6.3570	1494.59	15.11	120		0.058841	8'-6	Pf 2.720
218	39'-0	91.67		79.883		Flow (q) from Route 15	37'-8½	Pe 0.102
220	38'-9½			82.706		T(37'-8½)	46'-3	Pv
CM	6.3570	1706.70	17.25	120		0.075215	51'-0	Pf 9.132
220	38'-9½	212.11		82.706		Flow (q) from Route 9	70'-5	Pe 16.075
222	1'-8½			107.913		E(17'-7), 2f(-0.000), CV(40'-3), BV(12'-7)	121'-5	Pv
DY	8.2490	1706.70	10.25	120		0.021148	0'-0	Pf 0.000
222	1'-8½			107.913				Pe 0.303
124	1'-0			108.216			0'-0	Pv
UG	8.3900	1706.70	9.90	140		0.014641	38'-9½	Pf 1.884
124	1'-0			108.216			89'-11	Pe 3.902
10	-8'-0			114.002		E(30'-6½), T(59'-4½)	128'-8½	Pv
UG	8.3900	1156.02	6.71	140		0.007121	635'-11½	Pf 4.746
10	-8'-0			114.002			30'-6½	Pe
9	-8'-0			118.748		E(30'-6½)	666'-6	Pv
UG	8.3900	1156.02	6.71	140		0.007121	118'-2	Pf 0.841
9	-8'-0			118.748				Pe
8	-8'-0			119.590			118'-2	Pv
UG	8.3900	1156.02	6.71	140		0.007121	275'-0	Pf 2.381
8	-8'-0			119.590			59'-4½	Pe
7	-8'-0			121.971		T(59'-4½)	334'-4½	Pv
UG	8.3900	1956.70	11.36	140		0.018854	67'-8	Pf 1.852
7	-8'-0	800.68		121.971		Flow (q) from Route 7	30'-6½	Pe -3.902
224	1'-0			119.921		E(30'-6½)	98'-2½	Pv
FR	8.2490	1956.70	11.75	120		0.027233	5'-8½	Pf 0.156
224	1'-0			119.921				Pe -2.476
6	6'-8½			117.600			5'-8½	Pv
DY	10.3700	1956.70	7.43	120		0.008936	13'-10½	Pf 2.410
6	6'-8½			117.600			255'-9	Pe 2.151
5	1'-9			122.161		4E(26'-0), T(48'-5½), BV(21'-3½), Tr(17'-0), CV(65'-0)	269'-8	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 02

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
DY	7.9810	1956.70	12.55	120		0.031985	0'-0	Pf 0.000
5	1'-9			122.161				Pe 0.000
4	1'-9			122.161			0'-0	Pv
Pump								
4		1956.70		122.161		Rating: 60.000 @ 2000.00		
3		Q=1956.70	7.39	61.392		Fire Pump Churn Pressure: 84.000		
DY	10.4000	1956.70	7.39	140		0.006625	0'-0	Pf 0.486
3	1'-9			61.392			73'-4	Pe 0.000
2	1'-9			61.878		GV(7'-11½), T(65'-4½)	73'-4	Pv
UG	10.4000	1956.70	7.39	140		0.006625	696'-3½	Pf 9.729
2	1'-9			61.878			175'-4½	Pe 4.227
309	-8'-0			75.834		4E(35'-1), 2EE(17'-6½), BFP(-3.948)	871'-8	Pv
UG	12.4600	1956.70	5.15	140		0.002748	360'-2½	Pf 0.990
309	-8'-0			75.834				Pe 1.517
1	-11'-6			78.341		Water Supply	360'-2½	Pv
		0.00				Hose Allowance At Source		
1		1956.70						
Route 2								
BL	2.7050	0.52	0.03	120		0.000002	9'-0	Pf 0.000
2111	41'-8	141.67	22.4	40.000		Sprinkler		Pe
2115	41'-8			40.000			9'-0	Pv
BL	2.7050	142.19	7.94	120		0.048618	9'-0	Pf 0.438
2115	41'-8	141.67	22.4	40.000		Sprinkler		Pe
2117	41'-8			40.438			9'-0	Pv
BL	2.7050	284.63	15.89	120		0.175559	101'-7	Pf 24.406
2117	41'-8	142.44	22.4	40.438		Sprinkler,	37'-5	Pe 0.361
226	40'-10			65.205		2PO(18'-8½)	139'-0	Pv
CM	4.3100	284.63	6.26	120		0.018162	10'-0	Pf 0.182
226	40'-10			65.205				Pe -0.090
228	41'-0½			65.296			10'-0	Pv
CM	4.3100	569.72	12.53	120		0.065572	9'-11½	Pf 0.653
228	41'-0½	285.09		65.296		Flow (q) from Route 4		Pe 0.004
230	41'-0½			65.954			9'-11½	Pv
CM	4.3100	857.25	18.85	120		0.139637	10'-0	Pf 1.397
230	41'-0½	287.54		65.954		Flow (q) from Route 6		Pe 0.120
232	40'-9			67.471			10'-0	Pv
RN	2.7050	99.74	5.57	120		0.025230	295'-8	Pf 9.349
232	40'-9			67.471		PO(18'-8½)	74'-10½	Pe 0.036
206	40'-8			76.856		3PO(18'-8½)	370'-6½	Pv
Route 3								
BL	2.7050	140.79	7.86	120		0.047737	9'-0	Pf 0.430
2119	41'-10½	141.70	22.4	40.017		Sprinkler		Pe
2121	41'-10½			40.446			9'-0	Pv
BL	2.7050	283.25	15.81	120		0.173983	167'-1	Pf 35.583
2121	41'-10½	142.46	22.4	40.446		Sprinkler,	37'-5	Pe 0.398
202	40'-11½			76.427		2PO(18'-8½)	204'-6	Pv
Route 4								
BL	2.7050	0.91	0.05	120		0.000004	9'-0	Pf 0.000
2119	41'-10½	141.70	22.4	40.017		Sprinkler		Pe
2123	41'-10½			40.017			9'-0	Pv
BL	2.7050	142.61	7.96	120		0.048885	9'-0	Pf 0.440
2123	41'-10½	141.70	22.4	40.017		Sprinkler		Pe
2125	41'-10½			40.457			9'-0	Pv
BL	2.7050	285.09	15.92	120		0.176077	101'-7	Pf 24.478
2125	41'-10½	142.48	22.4	40.457		Sprinkler,	37'-5	Pe 0.362
228	41'-0½			65.296		2PO(18'-8½)	139'-0	Pv
Route 5								
BL	2.7050	139.72	7.80	120		0.047065	9'-0	Pf 0.424
2127	41'-10½	142.15	22.4	40.273		Sprinkler		Pe
2129	41'-10½			40.696			9'-0	Pv
BL	2.7050	282.61	15.78	120		0.173262	167'-1	Pf 35.435
2129	41'-10½	142.90	22.4	40.696		Sprinkler,	37'-5	Pe 0.397
204	40'-11½			76.528		2PO(18'-8½)	204'-6	Pv
Route 6								



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 02

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
BL	2.7050	2.44	0.14	120		0.000026	9'-0"	Pf 0.000
2127	41'-10½"	142.15	22.4	40.273		Sprinkler		Pe
2131	41'-10½"			40.273			9'-0"	Pv
BL	2.7050	144.59	8.07	120		0.050147	9'-0"	Pf 0.451
2131	41'-10½"	142.15	22.4	40.273		Sprinkler		Pe
2133	41'-10½"			40.724			9'-0"	Pv
BL	2.7050	287.54	16.05	120		0.178887	101'-7"	Pf 24.869
2133	41'-10½"	142.95	22.4	40.724		Sprinkler,	37'-5"	Pe 0.361
230	41'-0½"			65.954		2PO(18'-8½")	139'-0"	Pv
Route 7								
UG	6.2800	250.00	2.59	140		0.001718	19'-10"	Pf 0.161
54	1'-0"	250.00		110.217		Hydrant,	74'-1"	Pe 3.902
11	-8'-0"			114.280		E(22'-1), GV(4'-8½"), T(47'-3½")	93'-10½"	Pv
UG	8.3900	800.68	4.65	140		0.003610	61'-1½"	Pf 0.221
11	-8'-0"	550.68		114.280		Flow (q) from Route 8		Pe
12	-8'-0"			114.500			61'-1½"	Pv
UG	8.3900	800.68	4.65	140		0.003610	635'-9"	Pf 2.405
12	-8'-0"			114.500			30'-6½"	Pe
13	-8'-0"			116.905		E(30'-6½")	666'-3½"	Pv
UG	8.3900	800.68	4.65	140		0.003610	119'-3"	Pf 0.430
13	-8'-0"			116.905				Pe
14	-8'-0"			117.336			119'-3"	Pv
UG	8.3900	800.68	4.65	140		0.003610	519'-3½"	Pf 1.985
14	-8'-0"			117.336			30'-6½"	Pe
15	-8'-0"			119.320		E(30'-6½")	549'-10"	Pv
UG	8.3900	800.68	4.65	140		0.003610	91'-11½"	Pf 0.332
15	-8'-0"			119.320				Pe
16	-8'-0"			119.652			91'-11½"	Pv
UG	8.3900	800.68	4.65	140		0.003610	214'-9"	Pf 0.775
16	-8'-0"			119.652				Pe
17	-8'-0"			120.427			214'-9"	Pv
UG	8.3900	800.68	4.65	140		0.003610	337'-8"	Pf 1.543
17	-8'-0"			120.427			89'-11"	Pe
7	-8'-0"			121.971		E(30'-6½"), T(59'-4½")	427'-7"	Pv
Route 8								
UG	8.3900	550.68	3.20	140		0.001806	153'-8"	Pf 0.278
10	-8'-0"	1156.02		114.002		Flow (q) from Route 1		Pe
11	-8'-0"			114.280			153'-8"	Pv
Route 9								
CM	6.3570	105.63	1.07	120		0.000437	10'-0"	Pf 0.004
234	38'-5½"	105.63		82.778		Flow (q) from Route 17		Pe -0.120
236	38'-9"			82.662			10'-0"	Pv
CM	6.3570	212.11	2.14	120		0.001588	1'-6"	Pf 0.062
236	38'-9"	106.48		82.662		Flow (q) from Route 16	37'-8½"	Pe -0.018
220	38'-9½"			82.706		T(37'-8½")	39'-2½"	Pv
Route 10								
CM	4.3100	757.51	16.66	120		0.111076	10'-0"	Pf 1.111
232	40'-9"	99.74		67.471		Flow (q) from Route 2		Pe 0.120
238	40'-6"			68.703			10'-0"	Pv
RN	2.7050	94.69	5.29	120		0.022917	295'-8"	Pf 8.492
238	40'-6"			68.703		PO(18'-8½")	74'-10½"	Pe 0.036
208	40'-5"			77.230		3PO(18'-8½")	370'-6½"	Pv
Route 11								
CM	4.3100	662.82	14.58	120		0.086763	10'-0"	Pf 0.868
238	40'-6"	94.69		68.703		Flow (q) from Route 10		Pe 0.120
240	40'-2½"			69.691			10'-0"	Pv
RN	2.7050	91.23	5.09	120		0.021393	295'-8"	Pf 7.927
240	40'-2½"			69.691		PO(18'-8½")	74'-10½"	Pe 0.036
210	40'-1½"			77.654		3PO(18'-8½")	370'-6½"	Pv
Route 12								
CM	4.3100	571.59	12.57	120		0.065972	10'-0"	Pf 0.660
240	40'-2½"	91.23		69.691		Flow (q) from Route 11		Pe 0.120
242	39'-11"			70.471			10'-0"	Pv
RN	2.7050	89.31	4.99	120		0.020566	295'-8"	Pf 7.621
242	39'-11"			70.471		PO(18'-8½")	74'-10½"	Pe 0.036
212	39'-10"			78.128		3PO(18'-8½")	370'-6½"	Pv
Route 13								



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 02

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream					Fittings	Total Length	
CM	4.3100	482.28	10.61	120	0.048179	10'-0	Pf 0.482
242	39'-11	89.31		70.471	Flow (q) from Route 12		Pe 0.120
244	39'-8			71.074		10'-0	Pv
RN	2.7050	88.83	4.96	120	0.020364	295'-8	Pf 7.546
244	39'-8			71.074	PO(18'-8½)	74'-10½	Pe 0.036
214	39'-7			78.656	3PO(18'-8½)	370'-6½	Pv
Route 14							
CM	4.3100	393.45	8.65	120	0.033059	10'-0	Pf 0.331
244	39'-8	88.83		71.074	Flow (q) from Route 13		Pe 0.120
246	39'-4½			71.525		10'-0	Pv
RN	2.7050	89.67	5.01	120	0.020722	295'-8	Pf 7.678
246	39'-4½			71.525	PO(18'-8½)	74'-10½	Pe 0.036
216	39'-3½			79.239	3PO(18'-8½)	370'-6½	Pv
Route 15							
CM	4.3100	303.77	6.68	120	0.020487	10'-0	Pf 0.205
246	39'-4½	89.67		71.525	Flow (q) from Route 14		Pe 0.120
248	39'-1			71.850		10'-0	Pv
RN	2.7050	91.67	5.12	120	0.021582	295'-8	Pf 7.997
248	39'-1			71.850	PO(18'-8½)	74'-10½	Pe 0.036
218	39'-0			79.883	3PO(18'-8½)	370'-6½	Pv
Route 16							
CM	4.3100	212.11	4.66	120	0.010541	10'-0	Pf 0.105
248	39'-1	91.67		71.850	Flow (q) from Route 15		Pe 0.120
250	38'-10			72.076		10'-0	Pv
RN	2.7050	106.48	5.94	120	0.028471	295'-8	Pf 10.550
250	38'-10			72.076	PO(18'-8½)	74'-10½	Pe 0.036
236	38'-9			82.662	3PO(18'-8½)	370'-6½	Pv
Route 17							
CM	4.3100	105.63	2.32	120	0.002902	10'-0	Pf 0.029
250	38'-10	106.48		72.076	Flow (q) from Route 16		Pe 0.120
252	38'-6½			72.226		10'-0	Pv
RN	2.7050	105.63	5.90	120	0.028056	295'-8	Pf 10.516
252	38'-6½			72.226	PO(18'-8½)	79'-2	Pe 0.036
234	38'-5½			82.778	3PO(18'-8½), Tr(4'-3½)	374'-10	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

C Value Multiplier

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$$

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

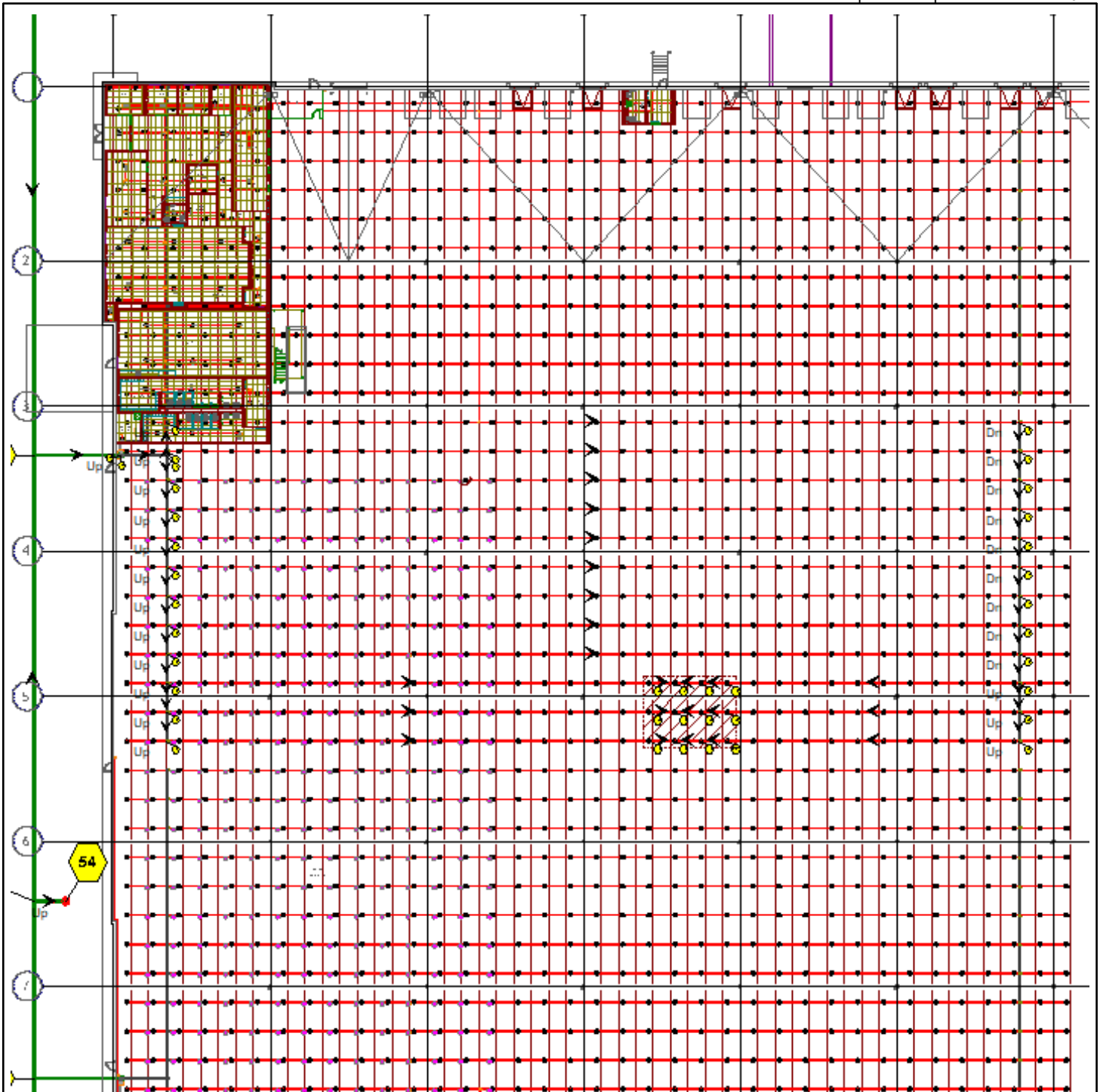


Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 02

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss		Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend	Units Legend		Fittings Legend	
AO Arm-Over	Diameter	Inch	ALV Alarm Valve	
BL Branch Line	Elevation	Foot	AngV Angle Valve	
CM Cross Main	Flow	gpm	b Bushing	
DN Drain	Discharge	gpm	BaIV Ball Valve	
DR Drop	Velocity	fps	BFP Backflow Preventer	
DY Dynamic	Pressure	psi	BV Butterfly Valve	
FM Feed Main	Length	Foot	C Cross Flow Turn 90°	
FR Feed Riser	Friction Loss	psi/Foot	cplg Coupling	
MS Miscellaneous	HWC	Hazen-Williams Constant	Cr Cross Run	
OR Outrigger	Pt	Total pressure at a point in a pipe	CV Check Valve	
RN Riser Nipple	Pn	Normal pressure at a point in a pipe	DeIV Deluge Valve	
SP Sprig	Pf	Pressure loss due to friction between points	DPV Dry Pipe Valve	
ST Stand Pipe	Pe	Pressure due to elevation difference between indicated points	E 90° Elbow	
UG Underground	Pv	Velocity pressure at a point in a pipe	EE 45° Elbow	
			Ee1 11¼° Elbow	
			Ee2 22½° Elbow	
			f Flow Device	
			fd Flex Drop	
			FDC Fire Department Connection	
			fE 90° FireLock(TM) Elbow	
			fEE 45° FireLock(TM) Elbow	
			flg Flange	
			FN Floating Node	
			fT FireLock(TM) Tee	
			g Gauge	
			GloV Globe Valve	
			GV Gate Valve	
			Ho Hose	
			Hose Hose	
			HV Hose Valve	
			Hyd Hydrant	
			LtE Long Turn Elbow	
			mecT Mechanical Tee	
			Noz Nozzle	
			P1 Pump In	
			P2 Pump Out	
			PIV Post Indicating Valve	
			PO Pipe Outlet	
			PrV Pressure Relief Valve	
			PRV Pressure Reducing Valve	
			red Reducer/Adapter	
			S Supply	
			sCV Swing Check Valve	
			SFx Seismic Flex	
			Spr Sprinkler	
			St Strainer	
			T Tee Flow Turn 90°	
			Tr Tee Run	
			U Union	
			WirF Wirsbo	
			WMV Water Meter Valve	
			Z Cap	





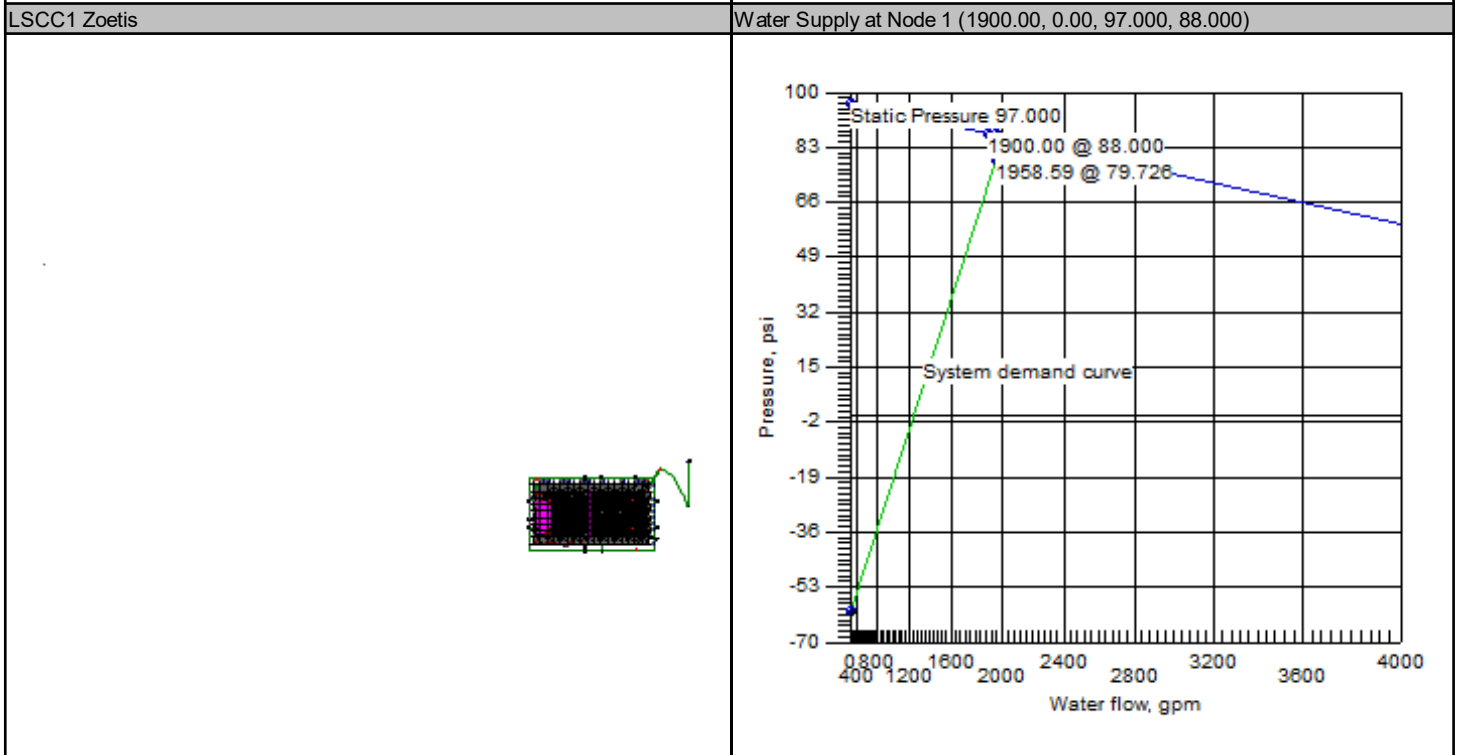
Hydraulic Overview

Job Number: 212189000
Report Description: Remote Area 03

Job		
Job Number 212189000	Design Engineer Jay Colbert	
Job Name: Lee's Summit Commerce Center	Phone 913.242.0057	FAX
Address 1 1120 NW Main St	State Certification/License Number	
Address 2	AHJ City of Lee's Summit	
Address 3 Lee's Summit, MO 64086	Job Site/Building Building A	

System	
Pressure 40.000	Area of Application NA
Most Demanding Sprinkler Data 22.4 K-Factor 141.67 at 40.000	Hose Streams 250.00
Coverage Per Sprinkler 100ft ²	Number Of Sprinklers Calculated 12 0
System Pressure Demand 79.726	System Flow Demand 1958.59
Total Demand 1958.59 @ 79.726	Pressure Result +7.754 (8.9%)

Supplies						Check Point Gauges			
Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)	Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)
1	Water Supply	1900.00		97.000	88.000	Pump Inlet	62.762	247.23	1958.59
4	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									





Report Description: Remote Area 03

Job Number 212189000	Design Engineer Jay Colbert
Job Name: Lee's Summit Commerce Center	State Certification/License Number
Address 1 1120 NW Main St	AHJ City of Lee's Summit
Address 2	Job Site/Building Building A
Address 3 Lee's Summit, MO 64086	Drawing Name LSCC1 Zoetis

Most Demanding Sprinkler Data 22.4 K-Factor 141.67 at 40.000		Occupancy ESFR		Job Suffix	
Hose Allowance At Source 0.00		Pressure 40.000		Area of Application NA	
Additional Hose Supplies Node Flow(gpm) Hydrant At Node 54 250.00		Number Of Sprinklers Calculated Number Of Nozzles Calculated 12 0		Coverage Per Sprinkler 100ft²	
		AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 79.689 Right: 79.671			
Total Hose Streams 250.00					
System Flow Demand 1958.59	Total Water Required (Including Hose Allowance) 1958.59				
Maximum Pressure Unbalance In Loops 0.000					
Maximum Velocity Above Ground 18.86 between nodes 332 and 330					
Maximum Velocity Under Ground 11.37 between nodes 224 and 7					
Volume capacity of Wet Pipes 34293.96gal	Volume capacity of Dry Pipes				

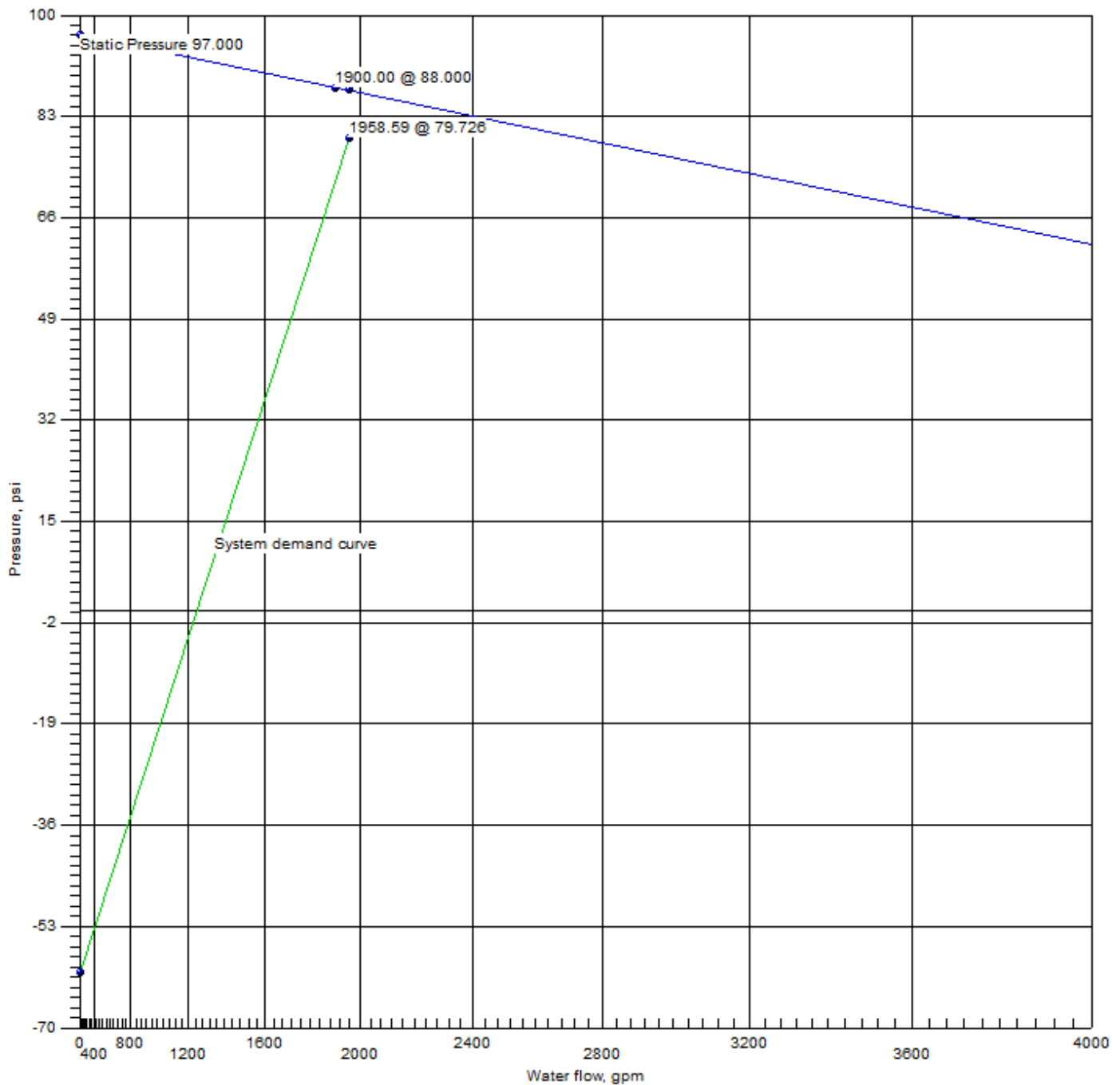
Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi) @	Flow (gpm)	Available (psi) @	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply		97.000	88.000	1900.00	87.480	1958.59	79.726	7.754
4	Pump		84.000	60.000	2000.00	131.251	1958.59	123.498	7.754

Pumps: Static = Churn (Pressure @ Zero Flow)

	Contractor Number 21	Contact Name Jay Colbert	Contact Title
Name of Contractor: F.E. Moran Fire Protection Inc.		Phone 913.242.0057	Extension
Address 1 16815 College Blvd.		FAX	
Address 2		E-mail jay.colbert@femoran.com	
Address 3 Lenexa, KS 66219		Web-Site femoranfp.com	



Water Supply at Node 1



Hydraulic Graph

Water Supply at Node 1

Static: Pressure

97.000

Residual: Pressure

88.000 @ 1900.00

Available Pressure at System Demand

87.480 @ 1958.59

Required Pressure at System Demand

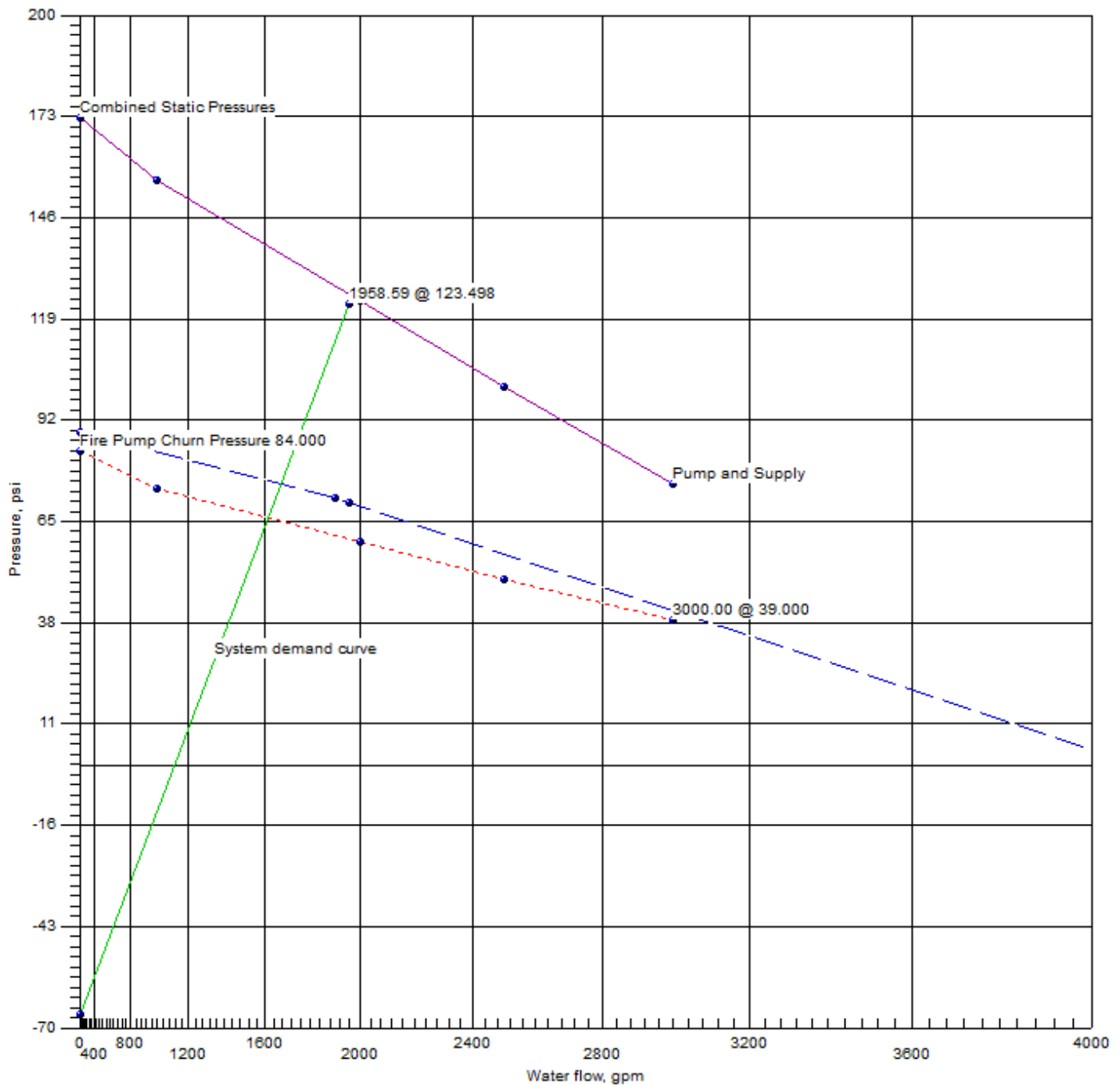
79.726 @ 1958.59

Required Pressure at System Demand (Including Hose Allowance at Source)

79.726 @ 1958.59



Pump at Node 4



Hydraulic Graph
Pump at Node 4

Static + Churn Pressure
173.256
Fire Pump Churn Pressure
84.000

Fire Pump Rating
60.000 @ 2000.00

Residual: Pressure
60.736 @ 1958.59
Available Pressure at System Demand
131.251 @ 1958.59
Required Pressure at System Demand
123.498 @ 1958.59



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: Remote Area 03

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Hydrant	54	250.00	250.00	250	110.975		
Sprinkler	3111	141.67	141.67	22.4	40.000		
⇒ Sprinkler	3113	141.67	141.67	22.4	40.000		
Sprinkler	3115	142.44	141.67	22.4	40.433		
Sprinkler	3117	142.44	141.67	22.4	40.436		
Sprinkler	3119	141.89	141.67	22.4	40.124		
Sprinkler	3121	141.89	141.67	22.4	40.124		
Sprinkler	3123	142.65	141.67	22.4	40.556		
Sprinkler	3125	142.67	141.67	22.4	40.564		
Sprinkler	3127	142.43	141.67	22.4	40.432		
Sprinkler	3129	143.18	141.67	22.4	40.858		
Sprinkler	3131	142.43	141.67	22.4	40.432		
Sprinkler	3133	143.23	141.67	22.4	40.884		

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: Remote Area 03

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	79.726	1958.59
54	1'-0	Hyd(-1.000)	110.975	250.00
3111	41'-5½	Spr(-40.000)	40.000	141.67
3113	41'-5½	Spr(-40.000)	40.000	141.67
3115	41'-5½	Spr(-40.433)	40.433	142.44
3117	41'-5½	Spr(-40.436)	40.436	142.44
3119	41'-3	Spr(-40.124)	40.124	141.89
3121	41'-3	Spr(-40.124)	40.124	141.89
3123	41'-3	Spr(-40.556)	40.556	142.65
3125	41'-3	Spr(-40.564)	40.564	142.67
3127	41'-0½	Spr(-40.432)	40.432	142.43
3129	41'-0½	Spr(-40.858)	40.858	143.18
3131	41'-0½	Spr(-40.432)	40.432	142.43
3133	41'-0½	Spr(-40.884)	40.884	143.23
2	1'-9	T(65'-4½)	63.249	
3	1'-9	P1, Pump Inlet	62.762	
4	1'-9	P2(-60.886)	123.498	
5	1'-9		123.498	
6	6'-8½		118.933	
7	-8'-0	T(59'-4½)	123.300	
8	-8'-0	T(59'-4½)	121.129	
9	-8'-0	T(47'-3½)	120.362	
10	-8'-0	T(59'-4½)	116.036	
11	-8'-0	T(47'-3½)	115.038	
12	-8'-0	T(59'-4½)	114.792	
13	-8'-0	T(47'-3½)	117.531	
14	-8'-0	T(59'-4½)	118.021	
15	-8'-0	T(47'-3½)	120.282	
16	-8'-0	T(59'-4½)	120.660	
17	-8'-0	T(59'-4½)	121.542	
52	1'-0	Hyd	1.000	
55	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
224	1'-0		121.253	
300	40'-6½	PO(18'-8½)	76.559	
302	40'-4	PO(18'-8½)	76.677	
304	40'-1½	PO(18'-8½)	76.865	
306	39'-11	PO(18'-8½)	77.163	
308	39'-8½	PO(18'-8½)	77.509	
309	-8'-0	E(35'-1)	77.217	
310	39'-6	PO(18'-8½)	77.904	
312	39'-3½	PO(18'-8½)	78.350	
314	39'-1	PO(18'-8½)	78.850	
316	38'-10½	PO(18'-8½)	79.408	
318	38'-8	PO(18'-8½)	80.026	
320	38'-5½	PO(18'-8½)	80.710	
322	38'-4	T(37'-8½)	83.698	
324	1'-8½	PO(41'-1½)	108.699	
326	40'-7½	PO(18'-8½)	65.157	
328	40'-5	PO(18'-8½)	65.428	
330	40'-2½	PO(18'-8½)	66.174	
332	40'-0	PO(18'-8½)	67.662	
334	39'-9½	PO(18'-8½)	68.862	
336	39'-7	PO(18'-8½)	69.818	
338	39'-4½	PO(18'-8½)	70.564	
340	39'-2	PO(18'-8½)	71.131	
342	38'-11½	PO(18'-8½)	71.546	
344	38'-9	PO(18'-8½)	71.836	
346	38'-6½	PO(18'-8½)	72.027	
348	38'-4	PO(18'-8½)	72.149	
350	38'-3	PO(18'-8½)	83.712	
428	1'-0		109.002	



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 03

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
BL	2.7050	141.44	7.90	120		0.048146	9'-0"	Pf 0.433
3113	41'-5½"	141.67	22.4	40.000		Sprinkler		Pe
3115	41'-5½"			40.433			9'-0"	Pv
BL	2.7050	283.88	15.85	120		0.174697	167'-1"	Pf 35.729
3115	41'-5½"	142.44	22.4	40.433		Sprinkler,	37'-5"	Pe 0.397
300	40'-6½"			76.559		2PO(18'-8½")	204'-6"	Pv
CM	6.3570	283.88	2.87	120		0.002723	10'-0"	Pf 0.027
300	40'-6½"			76.559				Pe 0.090
302	40'-4"			76.677			10'-0"	Pv
CM	6.3570	567.73	5.74	120		0.009817	10'-0"	Pf 0.098
302	40'-4"	283.85		76.677		Flow (q) from Route 3		Pe 0.090
304	40'-1½"			76.865			10'-0"	Pv
CM	6.3570	851.09	8.60	120		0.020762	10'-0"	Pf 0.208
304	40'-1½"	283.36		76.865		Flow (q) from Route 5		Pe 0.090
306	39'-11"			77.163			10'-0"	Pv
CM	6.3570	951.50	9.62	120		0.025520	10'-0"	Pf 0.255
306	39'-11"	100.41		77.163		Flow (q) from Route 2		Pe 0.090
308	39'-8½"			77.509			10'-0"	Pv
CM	6.3570	1046.91	10.58	120		0.030454	10'-0"	Pf 0.305
308	39'-8½"	95.40		77.509		Flow (q) from Route 10		Pe 0.090
310	39'-6"			77.904			10'-0"	Pv
CM	6.3570	1138.90	11.51	120		0.035589	10'-0"	Pf 0.356
310	39'-6"	92.00		77.904		Flow (q) from Route 11		Pe 0.090
312	39'-3½"			78.350			10'-0"	Pv
CM	6.3570	1229.03	12.42	120		0.040974	10'-0"	Pf 0.410
312	39'-3½"	90.13		78.350		Flow (q) from Route 12		Pe 0.090
314	39'-1"			78.850			10'-0"	Pv
CM	6.3570	1318.74	13.33	120		0.046677	10'-0"	Pf 0.467
314	39'-1"	89.71		78.850		Flow (q) from Route 13		Pe 0.090
316	38'-10½"			79.408			10'-0"	Pv
CM	6.3570	1409.33	14.25	120		0.052782	10'-0"	Pf 0.528
316	38'-10½"	90.60		79.408		Flow (q) from Route 14		Pe 0.090
318	38'-8"			80.026			10'-0"	Pv
CM	6.3570	1501.96	15.18	120		0.059379	10'-0"	Pf 0.594
318	38'-8"	92.63		80.026		Flow (q) from Route 15		Pe 0.090
320	38'-5½"			80.710			10'-0"	Pv
CM	6.3570	1597.59	16.15	120		0.066562	6'-4"	Pf 2.931
320	38'-5½"	95.62		80.710		Flow (q) from Route 16	37'-8½"	Pe 0.057
322	38'-4"			83.698		T(37'-8½")	44'-0½"	Pv
CM	6.3570	1708.59	17.27	120		0.075369	50'-6½"	Pf 9.117
322	38'-4"	111.00		83.698		Flow (q) from Route 17	70'-5"	Pe 15.884
324	1'-8½"			108.699		E(17'-7), 2f(-0.000), CV(40'-3), BV(12'-7)	120'-11½"	Pv
DY	8.2490	1708.59	10.26	120		0.021191	0'-0"	Pf 0.000
324	1'-8½"			108.699				Pe 0.303
428	1'-0"			109.002			0'-0"	Pv
UG	8.3900	1708.59	9.92	140		0.014671	38'-9½"	Pf 1.888
428	1'-0"			109.002			89'-11"	Pe 3.902
12	-8'-0"			114.792		E(30'-6½"), T(59'-4½")	128'-8½"	Pv
UG	8.3900	849.61	4.93	140		0.004028	61'-1½"	Pf 0.246
12	-8'-0"			114.792				Pe
11	-8'-0"			115.038			61'-1½"	Pv
UG	8.3900	1099.61	6.38	140		0.006492	153'-8"	Pf 0.998
11	-8'-0"	250.00		115.038		Flow (q) from Route 7		Pe
10	-8'-0"			116.036			153'-8"	Pv
UG	8.3900	1099.61	6.38	140		0.006492	635'-11½"	Pf 4.327
10	-8'-0"			116.036			30'-6½"	Pe
9	-8'-0"			120.362		E(30'-6½")	666'-6"	Pv
UG	8.3900	1099.61	6.38	140		0.006492	118'-2"	Pf 0.767
9	-8'-0"			120.362				Pe
8	-8'-0"			121.129			118'-2"	Pv
UG	8.3900	1099.61	6.38	140		0.006492	275'-0"	Pf 2.171
8	-8'-0"			121.129			59'-4½"	Pe
7	-8'-0"			123.300		T(59'-4½")	334'-4½"	Pv
UG	8.3900	1958.59	11.37	140		0.018888	67'-8"	Pf 1.855
7	-8'-0"	858.98		123.300		Flow (q) from Route 8	30'-6½"	Pe -3.902
224	1'-0"			121.253		E(30'-6½")	98'-2½"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 03

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
FR	8.2490	1958.59	11.76	120		0.027282	5'-8½"	Pf 0.156
224	1'-0"			121.253				Pe -2.476
6	6'-8½"			118.933			5'-8½"	Pv
DY	10.3700	1958.59	7.44	120		0.008952	13'-10½"	Pf 2.414
6	6'-8½"			118.933			255'-9"	Pe 2.151
5	1'-9"			123.498		4E(26'-0"), T(48'-5½"), BV(21'-3½"), Tr(17'-0"), CV(65'-0")	269'-8"	Pv
DY	7.9810	1958.59	12.56	120		0.032043	0'-0"	Pf 0.000
5	1'-9"			123.498				Pe 0.000
4	1'-9"			123.498			0'-0"	Pv
Pump		Velocity						
4		1958.59		123.498		Rating: 60.000 @ 2000.00		
3		Q=1958.59	7.40	62.762		Fire Pump Churn Pressure: 84.000		
DY	10.4000	1958.59	7.40	140		0.006637	0'-0"	Pf 0.487
3	1'-9"			62.762			73'-4"	Pe 0.000
2	1'-9"			63.249		GV(7'-11½"), T(65'-4½")	73'-4"	Pv
UG	10.4000	1958.59	7.40	140		0.006637	696'-3½"	Pf 9.742
2	1'-9"			63.249			175'-4½"	Pe 4.227
309	-8'-0"			77.217		4E(35'-1"), 2EE(17'-6½"), BFP(-3.948)	871'-8"	Pv
UG	12.4600	1958.59	5.15	140		0.002752	360'-2½"	Pf 0.992
309	-8'-0"			77.217				Pe 1.517
1	-11'-6"			79.726		Water Supply	360'-2½"	Pv
		0.00				Hose Allowance At Source		
1		1958.59						
Route 2								
BL	2.7050	0.23	0.01	120		0.000000	9'-0"	Pf 0.000
3113	41'-5½"	141.67	22.4	40.000		Sprinkler	9'-0"	Pe
3111	41'-5½"			40.000				Pv
BL	2.7050	141.90	7.92	120		0.048436	9'-0"	Pf 0.436
3111	41'-5½"	141.67	22.4	40.000		Sprinkler	9'-0"	Pe
3117	41'-5½"			40.436			9'-0"	Pv
BL	2.7050	284.34	15.87	120		0.175226	101'-7"	Pf 24.360
3117	41'-5½"	142.44	22.4	40.436		Sprinkler,	37'-5"	Pe 0.361
326	40'-7½"			65.157		2PO(18'-8½")	139'-0"	Pv
CM	4.3100	284.34	6.25	120		0.018128	10'-0"	Pf 0.181
326	40'-7½"			65.157				Pe 0.090
328	40'-5"			65.428			10'-0"	Pv
CM	4.3100	569.58	12.53	120		0.065544	10'-0"	Pf 0.656
328	40'-5"	285.24		65.428		Flow (q) from Route 4		Pe 0.090
330	40'-2½"			66.174			10'-0"	Pv
CM	4.3100	857.50	18.86	120		0.139711	10'-0"	Pf 1.397
330	40'-2½"	287.91		66.174		Flow (q) from Route 6		Pe 0.090
332	40'-0"			67.662			10'-0"	Pv
RN	2.7050	100.41	5.61	120		0.025544	295'-8"	Pf 9.465
332	40'-0"			67.662		PO(18'-8½")	74'-10½"	Pe 0.036
306	39'-11"			77.163		3PO(18'-8½")	370'-6½"	Pv
Route 3								
BL	2.7050	141.20	7.88	120		0.047995	9'-0"	Pf 0.432
3121	41'-3"	141.89	22.4	40.124		Sprinkler	9'-0"	Pe
3123	41'-3"			40.556				Pv
BL	2.7050	283.85	15.85	120		0.174671	167'-1"	Pf 35.723
3123	41'-3"	142.65	22.4	40.556		Sprinkler,	37'-5"	Pe 0.397
302	40'-4"			76.677		2PO(18'-8½")	204'-6"	Pv
Route 4								
BL	2.7050	0.69	0.04	120		0.000003	9'-0"	Pf 0.000
3121	41'-3"	141.89	22.4	40.124		Sprinkler	9'-0"	Pe
3119	41'-3"			40.124				Pv
BL	2.7050	142.58	7.96	120		0.048865	9'-0"	Pf 0.440
3119	41'-3"	141.89	22.4	40.124		Sprinkler	9'-0"	Pe
3125	41'-3"			40.564			9'-0"	Pv
BL	2.7050	285.24	15.92	120		0.176259	101'-7"	Pf 24.503
3125	41'-3"	142.67	22.4	40.564		Sprinkler,	37'-5"	Pe 0.361
328	40'-5"			65.428		2PO(18'-8½")	139'-0"	Pv
Route 5								



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 03

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
BL	2.7050	140.18	7.83	120		0.047356	9'-0	Pf 0.426
3127	41'-0½	142.43	22.4	40.432		Sprinkler		Pe
3129	41'-0½			40.858			9'-0	Pv
BL	2.7050	283.36	15.82	120		0.174115	167'-1	Pf 35.610
3129	41'-0½	143.18	22.4	40.858		Sprinkler,	37'-5	Pe 0.397
304	40'-1½			76.865		2PO(18'-8½)	204'-6	Pv
Route 6								
BL	2.7050	2.25	0.13	120		0.000023	9'-0	Pf 0.000
3127	41'-0½	142.43	22.4	40.432		Sprinkler		Pe
3131	41'-0½			40.432			9'-0	Pv
BL	2.7050	144.69	8.08	120		0.050209	9'-0	Pf 0.452
3131	41'-0½	142.43	22.4	40.432		Sprinkler		Pe
3133	41'-0½			40.884			9'-0	Pv
BL	2.7050	287.91	16.07	120		0.179321	101'-7	Pf 24.929
3133	41'-0½	143.23	22.4	40.884		Sprinkler,	37'-5	Pe 0.361
330	40'-2½			66.174		2PO(18'-8½)	139'-0	Pv
Route 7								
UG	6.2800	250.00	2.59	140		0.001718	19'-10	Pf 0.161
54	1'-0	250.00		110.975		Hydrant,	74'-1	Pe 3.902
11	-8'-0			115.038		E(22'-1), GV(4'-8½), T(47'-3½)	93'-10½	Pv
Route 8								
UG	8.3900	858.98	4.98	140		0.004111	119'-3	Pf 0.490
13	-8'-0	858.98		117.531		Flow (q) from Route 9		Pe
14	-8'-0			118.021			119'-3	Pv
UG	8.3900	858.98	4.98	140		0.004111	519'-3½	Pf 2.260
14	-8'-0			118.021			30'-6½	Pe
15	-8'-0			120.282		E(30'-6½)	549'-10	Pv
UG	8.3900	858.98	4.98	140		0.004111	91'-11½	Pf 0.378
15	-8'-0			120.282				Pe
16	-8'-0			120.660			91'-11½	Pv
UG	8.3900	858.98	4.98	140		0.004111	214'-9	Pf 0.883
16	-8'-0			120.660				Pe
17	-8'-0			121.542			214'-9	Pv
UG	8.3900	858.98	4.98	140		0.004111	337'-8	Pf 1.758
17	-8'-0			121.542			89'-11	Pe
7	-8'-0			123.300		E(30'-6½), T(59'-4½)	427'-7	Pv
Route 9								
UG	8.3900	858.98	4.98	140		0.004111	635'-9	Pf 2.739
12	-8'-0	849.61		114.792		Flow (q) from Route 1	30'-6½	Pe
13	-8'-0			117.531		E(30'-6½)	666'-3½	Pv
Route 10								
CM	4.3100	757.09	16.65	120		0.110960	10'-0	Pf 1.110
332	40'-0	100.41		67.662		Flow (q) from Route 2		Pe 0.090
334	39'-9½			68.862			10'-0	Pv
RN	2.7050	95.40	5.33	120		0.023238	295'-8	Pf 8.611
334	39'-9½			68.862		PO(18'-8½)	74'-10½	Pe 0.036
308	39'-8½			77.509		3PO(18'-8½)	370'-6½	Pv
Route 11								
CM	4.3100	661.68	14.55	120		0.086487	10'-0	Pf 0.865
334	39'-9½	95.40		68.862		Flow (q) from Route 10		Pe 0.090
336	39'-7			69.818			10'-0	Pv
RN	2.7050	92.00	5.14	120		0.021725	295'-8	Pf 8.050
336	39'-7			69.818		PO(18'-8½)	74'-10½	Pe 0.036
310	39'-6			77.904		3PO(18'-8½)	370'-6½	Pv
Route 12								
CM	4.3100	569.69	12.53	120		0.065565	10'-0	Pf 0.656
336	39'-7	92.00		69.818		Flow (q) from Route 11		Pe 0.090
338	39'-4½			70.564			10'-0	Pv
RN	2.7050	90.13	5.03	120		0.020916	295'-8	Pf 7.750
338	39'-4½			70.564		PO(18'-8½)	74'-10½	Pe 0.036
312	39'-3½			78.350		3PO(18'-8½)	370'-6½	Pv
Route 13								
CM	4.3100	479.56	10.55	120		0.047677	10'-0	Pf 0.477
338	39'-4½	90.13		70.564		Flow (q) from Route 12		Pe 0.090
340	39'-2			71.131			10'-0	Pv
RN	2.7050	89.71	5.01	120		0.020735	295'-8	Pf 7.683
340	39'-2			71.131		PO(18'-8½)	74'-10½	Pe 0.036
314	39'-1			78.850		3PO(18'-8½)	370'-6½	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 03

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Fittings	Eq. Length	Summary
Upstream				Pn		Total Length	
Route 14							
CM	4.3100	389.85	8.57	120	0.032502	10'-0	Pf 0.325
340	39'-2	89.71		71.131	Flow (q) from Route 13		Pe 0.090
342	38'-11½			71.546		10'-0	Pv
RN	2.7050	90.60	5.06	120	0.021118	295'-8	Pf 7.825
342	38'-11½			71.546	PO(18'-8½)	74'-10½	Pe 0.036
316	38'-10½			79.408	3PO(18'-8½)	370'-6½	Pv
Route 15							
CM	4.3100	299.26	6.58	120	0.019927	10'-0	Pf 0.199
342	38'-11½	90.60		71.546	Flow (q) from Route 14		Pe 0.090
344	38'-9			71.836		10'-0	Pv
RN	2.7050	92.63	5.17	120	0.022005	295'-8	Pf 8.154
344	38'-9			71.836	PO(18'-8½)	74'-10½	Pe 0.036
318	38'-8			80.026	3PO(18'-8½)	370'-6½	Pv
Route 16							
CM	4.3100	206.62	4.54	120	0.010042	10'-0	Pf 0.100
344	38'-9	92.63		71.836	Flow (q) from Route 15		Pe 0.090
346	38'-6½			72.027		10'-0	Pv
RN	2.7050	95.62	5.34	120	0.023337	295'-8	Pf 8.647
346	38'-6½			72.027	PO(18'-8½)	74'-10½	Pe 0.036
320	38'-5½			80.710	3PO(18'-8½)	370'-6½	Pv
Route 17							
CM	4.3100	111.00	2.44	120	0.003181	10'-0	Pf 0.032
346	38'-6½	95.62		72.027	Flow (q) from Route 16		Pe 0.090
348	38'-4			72.149		10'-0	Pv
RN	2.7050	111.00	6.20	120	0.030750	295'-8	Pf 11.526
348	38'-4			72.149	PO(18'-8½)	79'-2	Pe 0.036
350	38'-3			83.712	3PO(18'-8½), Tr(4'-3½)	374'-10	Pv
CM	6.3570	111.00	1.12	120	0.000479	3'-8½	Pf 0.020
350	38'-3			83.712		37'-8½	Pe -0.033
322	38'-4			83.698	T(37'-8½)	41'-5	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)	C Value Multiplier				
$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$	Value Of C	100	130	140	150
	Multiplying Factor	0.713	1.16	1.33	1.51

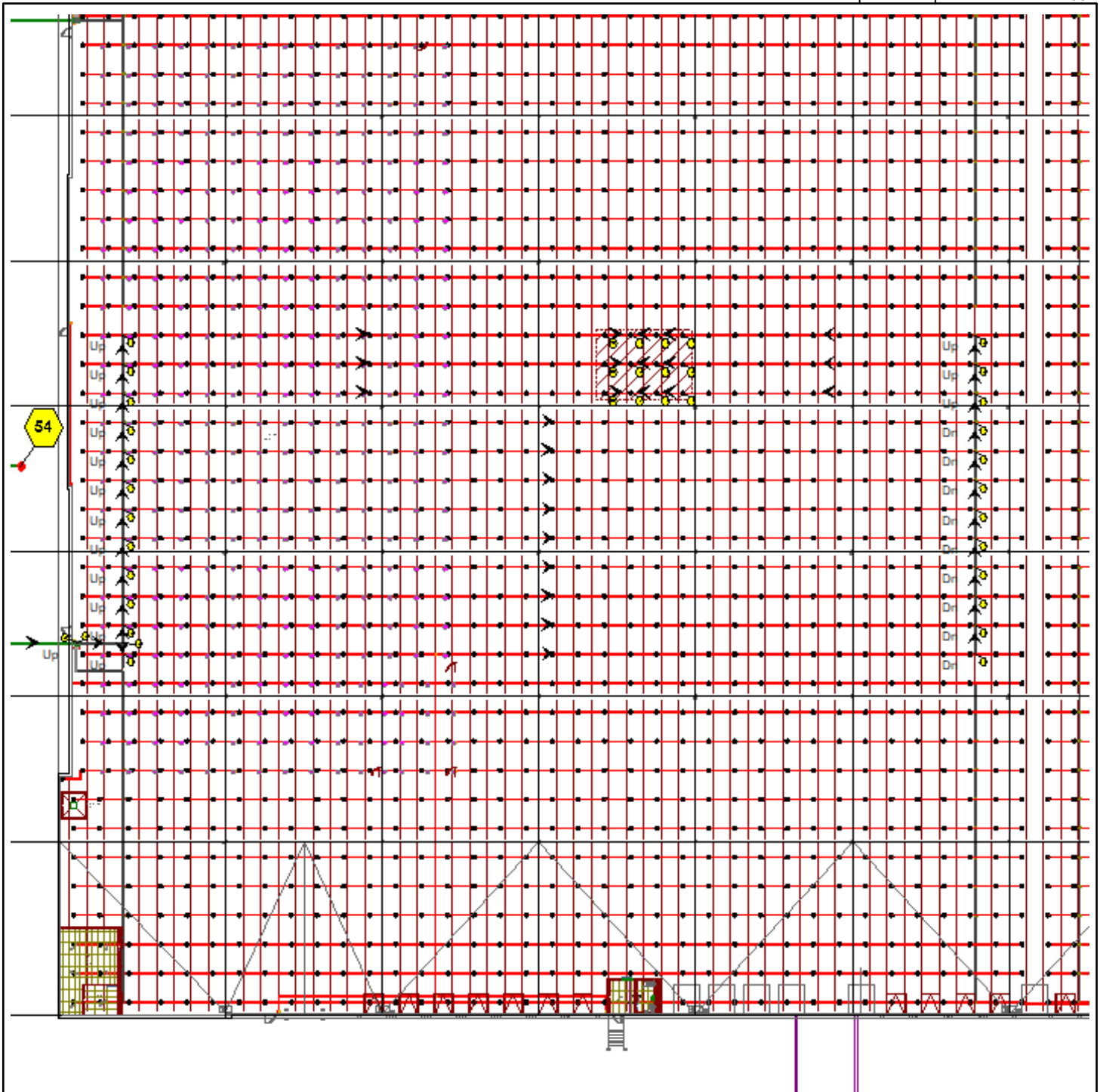


Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 03

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss		Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend	Units Legend		Fittings Legend	
AO Arm-Over	Diameter	Inch	ALV Alarm Valve	
BL Branch Line	Elevation	Foot	AngV Angle Valve	
CM Cross Main	Flow	gpm	b Bushing	
DN Drain	Discharge	gpm	BaIV Ball Valve	
DR Drop	Velocity	fps	BFP Backflow Preventer	
DY Dynamic	Pressure	psi	BV Butterfly Valve	
FM Feed Main	Length	Foot	C Cross Flow Turn 90°	
FR Feed Riser	Friction Loss	psi/Foot	cplg Coupling	
MS Miscellaneous	HWC	Hazen-Williams Constant	Cr Cross Run	
OR Outrigger	Pt	Total pressure at a point in a pipe	CV Check Valve	
RN Riser Nipple	Pn	Normal pressure at a point in a pipe	DeIV Deluge Valve	
SP Sprig	Pf	Pressure loss due to friction between points	DPV Dry Pipe Valve	
ST Stand Pipe	Pe	Pressure due to elevation difference between indicated points	E 90° Elbow	
UG Underground	Pv	Velocity pressure at a point in a pipe	EE 45° Elbow	
			Ee1 11¼° Elbow	
			Ee2 22½° Elbow	
			f Flow Device	
			fd Flex Drop	
			FDC Fire Department Connection	
			fE 90° FireLock(TM) Elbow	
			fEE 45° FireLock(TM) Elbow	
			flg Flange	
			FN Floating Node	
			fT FireLock(TM) Tee	
			g Gauge	
			GloV Globe Valve	
			GV Gate Valve	
			Ho Hose	
			Hose Hose	
			HV Hose Valve	
			Hyd Hydrant	
			LtE Long Turn Elbow	
			mecT Mechanical Tee	
			Noz Nozzle	
			P1 Pump In	
			P2 Pump Out	
			PIV Post Indicating Valve	
			PO Pipe Outlet	
			PrV Pressure Relief Valve	
			PRV Pressure Reducing Valve	
			red Reducer/Adapter	
			S Supply	
			sCV Swing Check Valve	
			SFx Seismic Flex	
			Spr Sprinkler	
			St Strainer	
			T Tee Flow Turn 90°	
			Tr Tee Run	
			U Union	
			WirF Wirsbo	
			WMV Water Meter Valve	
			Z Cap	





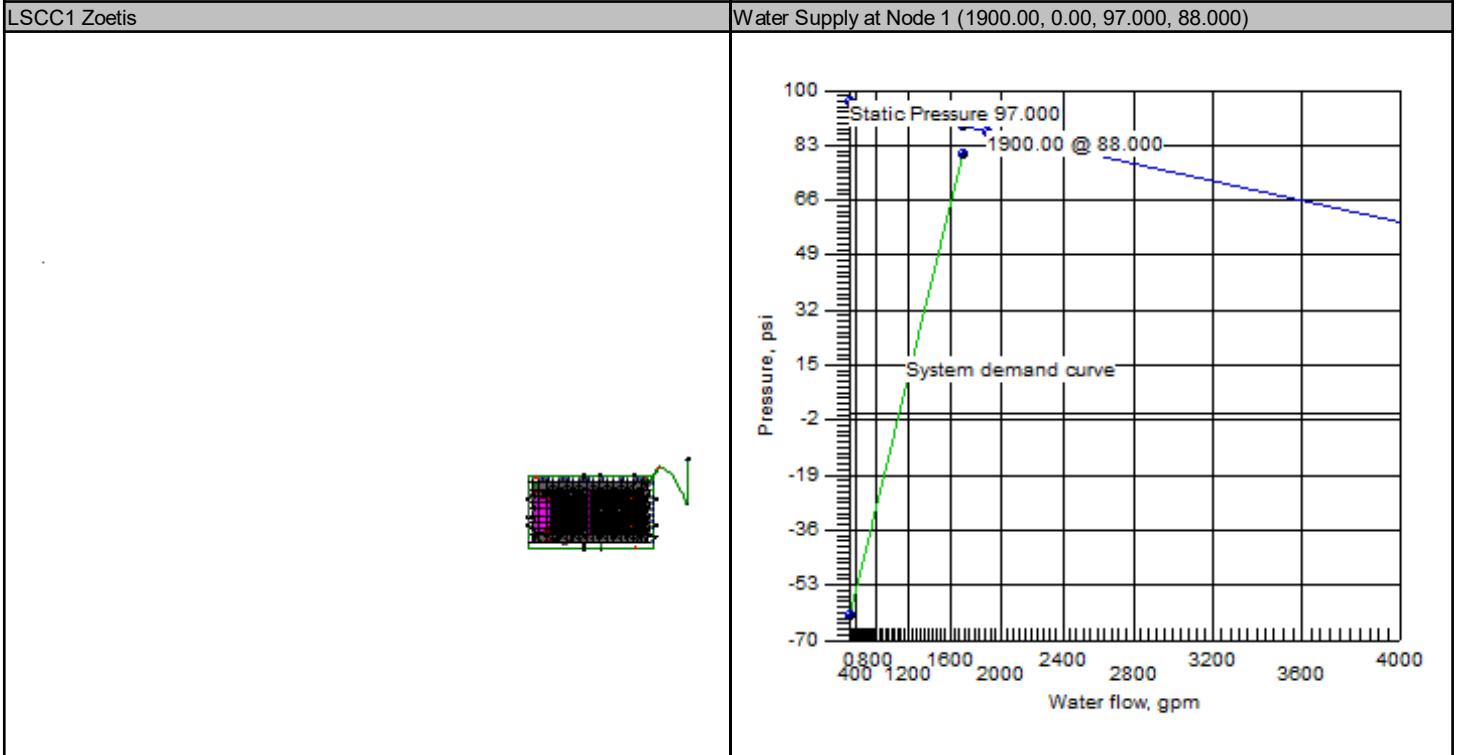
Hydraulic Overview

Job Number: 212189000
Report Description: Remote Area 04

Job		
Job Number 212189000	Design Engineer Jay Colbert	
Job Name: Lee's Summit Commerce Center	Phone 913.242.0057	FAX
Address 1 1120 NW Main St	State Certification/License Number	
Address 2	AHJ City of Lee's Summit	
Address 3 Lee's Summit, MO 64086	Job Site/Building Building A	

System	
Pressure 52.000	Area of Application NA
Most Demanding Sprinkler Data 16.8 K-Factor 121.15 at 52.000	Hose Streams 250.00
Coverage Per Sprinkler 100ft ²	Number Of Sprinklers Calculated 12 0
System Pressure Demand 80.726	System Flow Demand 1708.55
Total Demand 1708.55 @ 80.726	Pressure Result +8.879 (9.9%)

Supplies						Check Point Gauges			
Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)	Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)
1	Water Supply	1900.00		97.000	88.000	Pump Inlet	65.678	210.82	1708.55
4	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									





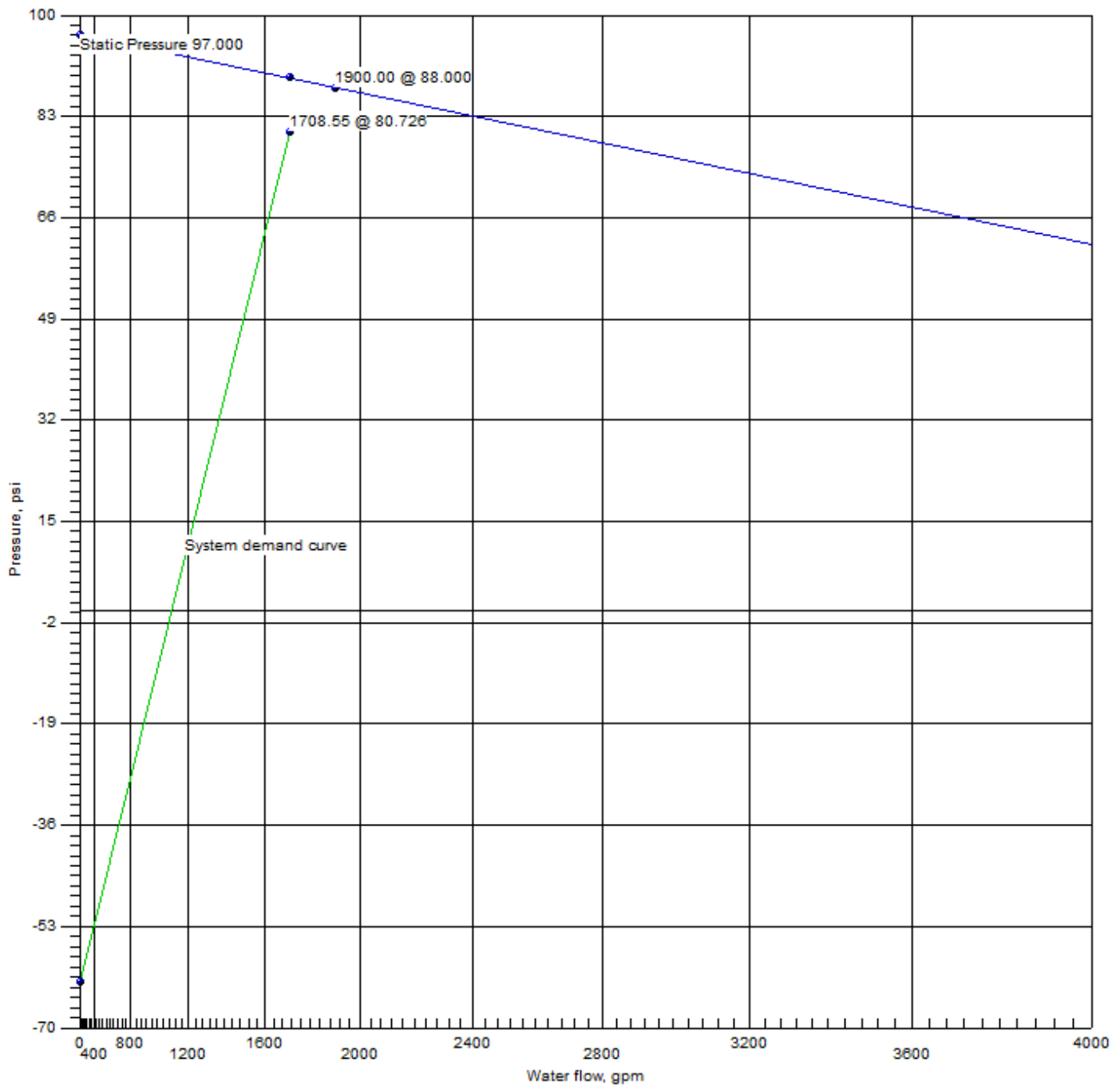
Hydraulic Summary

Job Number: 212189000
Report Description: Remote Area 04

Job											
Job Number 212189000				Design Engineer Jay Colbert							
Job Name: Lee's Summit Commerce Center				State Certification/License Number							
Address 1 1120 NW Main St				AHJ City of Lee's Summit							
Address 2				Job Site/Building Building A							
Address 3 Lee's Summit, MO 64086				Drawing Name LSCC1 Zoetis							
System				Remote Area(s)							
Most Demanding Sprinkler Data 16.8 K-Factor 121.15 at 52.000				Occupancy ESFR			Job Suffix				
Hose Allowance At Source 0.00				Pressure 52.000			Area of Application NA				
Additional Hose Supplies Node Hydrant At Node 54				Flow(gpm) 250.00			Number Of Sprinklers Calculated 12				
				Number Of Nozzles Calculated 0			Coverage Per Sprinkler 100ft ²				
				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 80.663 Right: 80.721							
Total Hose Streams 250.00											
System Flow Demand 1708.55			Total Water Required (Including Hose Allowance) 1708.55								
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 29.49 between nodes 422 and 420											
Maximum Velocity Under Ground 9.92 between nodes 224 and 7											
Volume capacity of Wet Pipes 34293.96gal			Volume capacity of Dry Pipes								
Supplies											
Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@	Flow (gpm)	Available (psi)	@	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply		97.000	88.000		1900.00	89.605		1708.55	80.726	8.879
4	Pump		84.000	60.000		2000.00	139.454		1708.55	130.575	8.879
Pumps: Static = Churn (Pressure @ Zero Flow)											
Contractor											
Contractor Number 21		Contact Name Jay Colbert					Contact Title				
Name of Contractor: F.E. Moran Fire Protection Inc.		Phone 913.242.0057					Extension				
Address 1 16815 College Blvd.		FAX									
Address 2		E-mail jay.colbert@femoran.com									
Address 3 Lenexa, KS 66219		Web-Site femoranfp.com									



Water Supply at Node 1



Hydraulic Graph

Water Supply at Node 1

Static: Pressure

97.000

Residual: Pressure

88.000 @ 1900.00

Available Pressure at System Demand

89.605 @ 1708.55

Required Pressure at System Demand

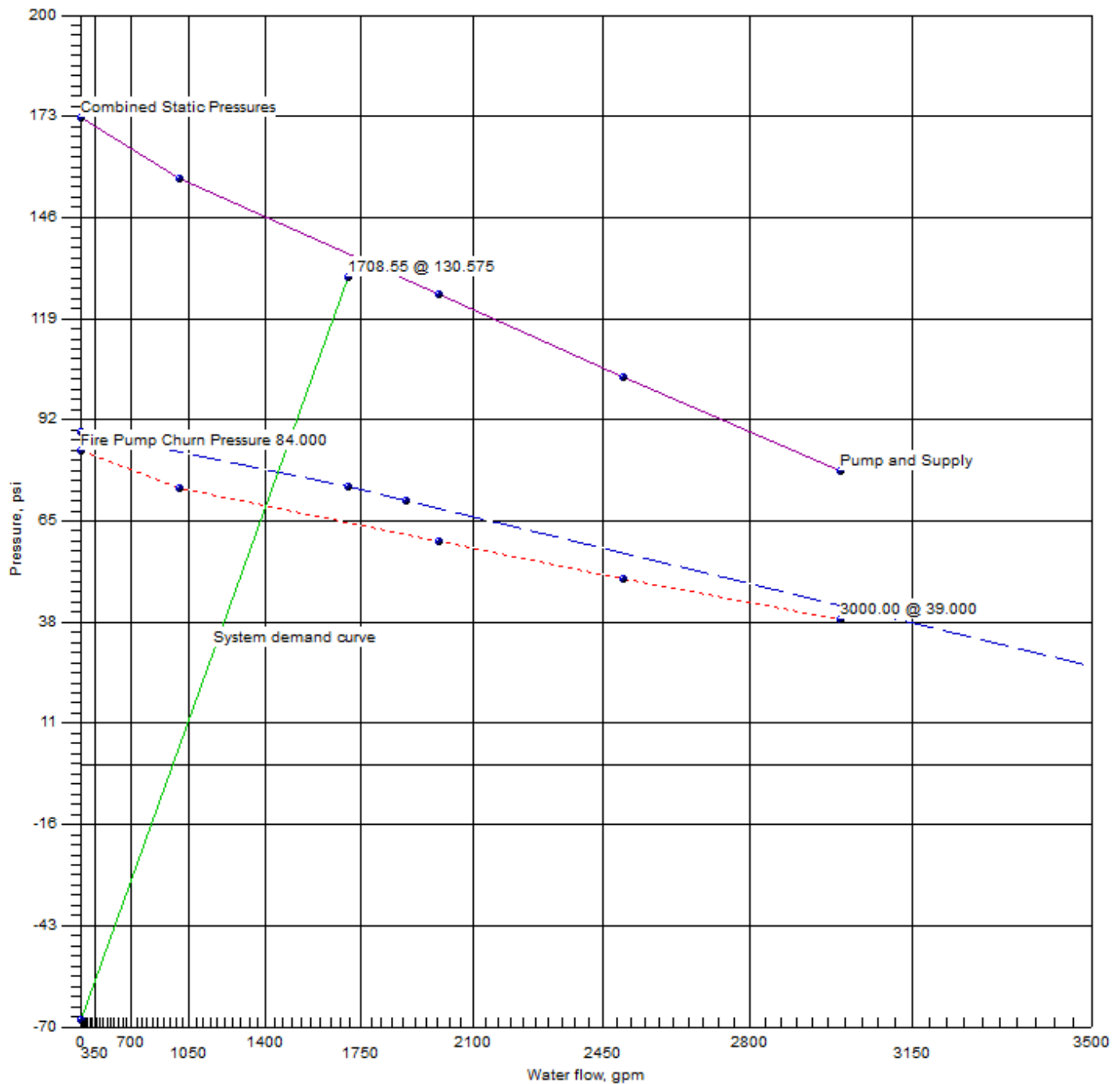
80.726 @ 1708.55

Required Pressure at System Demand (Including Hose Allowance at Source)

80.726 @ 1708.55



Pump at Node 4



Hydraulic Graph
Pump at Node 4

Static + Churn Pressure
173.256
Fire Pump Churn Pressure
84.000

Fire Pump Rating
60.000 @ 2000.00

Static Pressure
173.256

Residual Pressure
64.897 @ 1708.55

Available Pressure at System Demand
139.454 @ 1708.55

Required Pressure at System Demand
130.575 @ 1708.55



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: Remote Area 04

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Hydrant	54	250.00	250.00	250	120.878		
⇒ Sprinkler	4111	121.15	121.15	16.8	52.000		
Sprinkler	4113	121.51	121.15	16.8	52.314		
Sprinkler	4115	121.15	121.15	16.8	52.000		
Sprinkler	4117	121.54	121.15	16.8	52.337		
Sprinkler	4119	121.26	121.15	16.8	52.097		
Sprinkler	4121	121.62	121.15	16.8	52.411		
Sprinkler	4123	121.26	121.15	16.8	52.097		
Sprinkler	4125	121.65	121.15	16.8	52.434		
Sprinkler	4127	121.66	121.15	16.8	52.445		
Sprinkler	4129	122.03	121.15	16.8	52.761		
Sprinkler	4131	121.66	121.15	16.8	52.445		
Sprinkler	4133	122.06	121.15	16.8	52.786		

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: Remote Area 04

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	80.726	1708.55
54	1'-0	Hyd(-1.000)	120.878	250.00
4111	37'-10	Spr(-52.000)	52.000	121.15
4113	37'-10	Spr(-52.314)	52.314	121.51
4115	37'-10	Spr(-52.000)	52.000	121.15
4117	37'-10	Spr(-52.337)	52.337	121.54
4119	37'-10	Spr(-52.097)	52.097	121.26
4121	37'-10	Spr(-52.411)	52.411	121.62
4123	37'-10	Spr(-52.097)	52.097	121.26
4125	37'-10	Spr(-52.434)	52.434	121.65
4127	37'-10	Spr(-52.445)	52.445	121.66
4129	37'-10	Spr(-52.761)	52.761	122.03
4131	37'-10	Spr(-52.445)	52.445	121.66
4133	37'-10	Spr(-52.786)	52.786	122.06
2	1'-9	T(65'-4½)	66.056	
3	1'-9	P1, Pump Inlet	65.678	
4	1'-9	P2(-60.886)	130.575	
5	1'-9		130.575	
6	6'-8½		126.549	
7	-8'-0	T(59'-4½)	131.365	
8	-8'-0	T(59'-4½)	129.677	
9	-8'-0	T(47'-3½)	129.081	
10	-8'-0	T(59'-4½)	125.717	
11	-8'-0	T(47'-3½)	124.941	
12	-8'-0	T(59'-4½)	124.765	
13	-8'-0	T(47'-3½)	126.890	
14	-8'-0	T(59'-4½)	127.270	
15	-8'-0	T(47'-3½)	129.023	
16	-8'-0	T(59'-4½)	129.317	
17	-8'-0	T(59'-4½)	130.001	
52	1'-0	Hyd	1.000	
55	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
224	1'-0		128.904	
309	-8'-0	E(35'-1)	78.439	
400	37'-0	PO(18'-8½)	76.611	
402	37'-0	PO(18'-8½)	76.744	
404	37'-0	PO(18'-8½)	77.223	
406	37'-0	PO(18'-8½)	78.240	
408	37'-0	PO(18'-8½)	79.400	
410	37'-0	PO(18'-8½)	80.721	
412	37'-1	PO(18'-8½)	82.187	
414	37'-3½	PO(18'-8½)	83.821	
416	37'-6	PO(18'-8½)	85.719	
418	37'-8½	PO(18'-8½)	87.941	
420	37'-11	PO(18'-8½)	90.560	
422	37'-11½		90.716	
424	38'-1½	PO(18'-8½)	91.087	
426	1'-8½	PO(37'-8½)	118.478	
428	1'-0		119.454	
430	37'-0	PO(18'-8½)	73.588	
432	37'-0	PO(18'-8½)	73.725	
434	37'-0	PO(18'-8½)	74.222	
436	37'-0	PO(18'-8½)	75.276	
438	37'-0	PO(18'-8½)	76.193	
440	37'-0	PO(18'-8½)	76.976	
442	37'-1	PO(18'-8½)	77.584	
444	37'-3½	PO(18'-8½)	78.005	
446	37'-6	PO(18'-8½)	78.290	
448	37'-8½	PO(18'-8½)	78.442	
450	37'-11	PO(18'-8½)	78.476	
452	38'-1½	PO(18'-8½)	78.422	



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 04

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
BL	2.7050	118.83	6.63	120		0.034881	9'-0	Pf 0.314
4111	37'-10	121.15	16.8	52.000		Sprinkler		Pe
4113	37'-10			52.314			9'-0	Pv
BL	2.7050	240.34	13.42	120		0.128387	149'-0	Pf 23.936
4113	37'-10	121.51	16.8	52.314		Sprinkler,	37'-5	Pe 0.361
400	37'-0			76.611		2PO(18'-8½)	186'-5	Pv
CM	4.3100	240.34	5.29	120		0.013282	10'-0	Pf 0.133
400	37'-0			76.611				Pe
402	37'-0			76.744			10'-0	Pv
CM	4.3100	480.87	10.57	120		0.047918	10'-0	Pf 0.479
402	37'-0	240.53		76.744		Flow (q) from Route 3		Pe
404	37'-0			77.223			10'-0	Pv
CM	4.3100	722.11	15.88	120		0.101662	10'-0	Pf 1.017
404	37'-0	241.23		77.223		Flow (q) from Route 5		Pe
406	37'-0			78.240			10'-0	Pv
CM	4.3100	775.71	17.06	120		0.116063	10'-0	Pf 1.161
406	37'-0	53.61		78.240		Flow (q) from Route 17		Pe
408	37'-0			79.400			10'-0	Pv
CM	4.3100	831.66	18.29	120		0.132023	10'-0	Pf 1.320
408	37'-0	55.95		79.400		Flow (q) from Route 16		Pe
410	37'-0			80.721			10'-0	Pv
CM	4.3100	892.50	19.63	120		0.150443	10'-0	Pf 1.507
410	37'-0	60.84		80.721		Flow (q) from Route 15		Pe -0.041
412	37'-1			82.187			10'-0	Pv
CM	4.3100	960.51	21.12	120		0.172337	10'-0	Pf 1.724
412	37'-1	68.01		82.187		Flow (q) from Route 14		Pe -0.090
414	37'-3½			83.821			10'-0	Pv
CM	4.3100	1037.69	22.82	120		0.198826	10'-0	Pf 1.989
414	37'-3½	77.18		83.821		Flow (q) from Route 13		Pe -0.090
416	37'-6			85.719			10'-0	Pv
CM	4.3100	1125.79	24.76	120		0.231177	10'-0	Pf 2.312
416	37'-6	88.10		85.719		Flow (q) from Route 10		Pe -0.090
418	37'-8½			87.941			10'-0	Pv
CM	4.3100	1226.41	26.97	120		0.270847	10'-0	Pf 2.709
418	37'-8½	100.62		87.941		Flow (q) from Route 12		Pe -0.090
420	37'-11			90.560			10'-0	Pv
CM	4.3100	1341.00	29.49	120		0.319517	0'-6	Pf 0.160
420	37'-11	114.60		90.560		Flow (q) from Route 11		Pe -0.005
422	37'-11½			90.716			0'-6	Pv
CM	6.3570	1341.00	13.56	120		0.048146	9'-6	Pf 0.457
422	37'-11½			90.716				Pe -0.086
424	38'-1½			91.087			9'-6	Pv
CM	6.3570	1458.55	14.74	120		0.056243	62'-9½	Pf 11.594
424	38'-1½	117.55		91.087		Flow (q) from Route 2	143'-4	Pe 15.797
426	1'-8½			118.478		3E(17'-7), 2f(-0.000), CV(40'-3), BV(12'-7), PO(37'-8½)	206'-1½	Pv
CM	8.2490	1458.55	8.76	120		0.015814	1'-6	Pf 0.674
426	1'-8½			118.478			41'-1½	Pe 0.303
428	1'-0			119.454		PO(41'-1½)	42'-7½	Pv
UG	8.3900	1458.55	8.46	140		0.010948	38'-9½	Pf 1.409
428	1'-0			119.454			89'-11	Pe 3.902
12	-8'-0			124.765		E(30'-6½), T(59'-4½)	128'-8½	Pv
UG	8.3900	709.74	4.12	140		0.002888	61'-1½	Pf 0.176
12	-8'-0			124.765				Pe
11	-8'-0			124.941			61'-1½	Pv
UG	8.3900	959.74	5.57	140		0.005047	153'-8	Pf 0.776
11	-8'-0	250.00		124.941		Flow (q) from Route 7		Pe
10	-8'-0			125.717			153'-8	Pv
UG	8.3900	959.74	5.57	140		0.005047	635'-11½	Pf 3.364
10	-8'-0			125.717			30'-6½	Pe
9	-8'-0			129.081		E(30'-6½)	666'-6	Pv
UG	8.3900	959.74	5.57	140		0.005047	118'-2	Pf 0.596
9	-8'-0			129.081				Pe
8	-8'-0			129.677			118'-2	Pv
UG	8.3900	959.74	5.57	140		0.005047	275'-0	Pf 1.688
8	-8'-0			129.677			59'-4½	Pe
7	-8'-0			131.365		T(59'-4½)	334'-4½	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 04

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
UG	8.3900	1708.55	9.92	140		0.014670	67'-8"	Pf 1.441
7	-8'-0"	748.81		131.365		Flow (q) from Route 8	30'-6½"	Pe -3.902
224	1'-0"			128.904		E(30'-6½")	98'-2½"	Pv
FR	8.2490	1708.55	10.26	120		0.021191	5'-8½"	Pf 0.121
224	1'-0"			128.904			5'-8½"	Pe -2.476
6	6'-8½"			126.549				Pv
DY	10.3700	1708.55	6.49	120		0.006953	13'-10½"	Pf 1.875
6	6'-8½"			126.549			255'-9"	Pe 2.151
5	1'-9"			130.575		4E(26'-0"), T(48'-5½"), BV(21'-3½"), Tr(17'-0"), CV(65'-0")	269'-8"	Pv
DY	7.9810	1708.55	10.96	120		0.024888	0'-0"	Pf 0.000
5	1'-9"			130.575				Pe 0.000
4	1'-9"			130.575			0'-0"	Pv
Pump		Velocity						
4		1708.55		130.575		Rating: 60.000 @ 2000.00		
3		Q=1708.55	6.45	65.678		Fire Pump Churn Pressure: 84.000		
DY	10.4000	1708.55	6.45	140		0.005155	0'-0"	Pf 0.378
3	1'-9"			65.678			73'-4"	Pe 0.000
2	1'-9"			66.056		GV(7'-11½"), T(65'-4½")	73'-4"	Pv
UG	10.4000	1708.55	6.45	140		0.005155	696'-3½"	Pf 8.156
2	1'-9"			66.056			175'-4½"	Pe 4.227
309	-8'-0"			78.439		4E(35'-1), 2EE(17'-6½"), BFP(-3.948)	871'-8"	Pv
UG	12.4600	1708.55	4.50	140		0.002138	360'-2½"	Pf 0.770
309	-8'-0"			78.439				Pe 1.517
1	-11'-6"			80.726		Water Supply	360'-2½"	Pv
		0.00				Hose Allowance At Source		
1		1708.55						
Route 2								
BL	2.7050	2.32	0.13	120		0.000024	9'-0"	Pf 0.000
4111	37'-10"	121.15	16.8	52.000		Sprinkler		Pe
4115	37'-10"			52.000			9'-0"	Pv
BL	2.7050	123.47	6.89	120		0.037442	9'-0"	Pf 0.337
4115	37'-10"	121.15	16.8	52.000		Sprinkler		Pe
4117	37'-10"			52.337			9'-0"	Pv
BL	2.7050	245.01	13.68	120		0.133037	119'-7"	Pf 20.889
4117	37'-10"	121.54	16.8	52.337		Sprinkler,	37'-5"	Pe 0.361
430	37'-0"			73.588		2PO(18'-8½")	157'-0"	Pv
CM	4.3100	245.01	5.39	120		0.013763	10'-0"	Pf 0.138
430	37'-0"			73.588				Pe
432	37'-0"			73.725			10'-0"	Pv
CM	4.3100	490.27	10.78	120		0.049665	10'-0"	Pf 0.497
432	37'-0"	245.26		73.725		Flow (q) from Route 4		Pe
434	37'-0"			74.222			10'-0"	Pv
CM	4.3100	736.45	16.19	120		0.105429	10'-0"	Pf 1.054
434	37'-0"	246.18		74.222		Flow (q) from Route 6		Pe
436	37'-0"			75.276			10'-0"	Pv
CM	4.3100	682.84	15.02	120		0.091673	10'-0"	Pf 0.917
436	37'-0"			75.276				Pe
438	37'-0"			76.193			10'-0"	Pv
CM	4.3100	626.89	13.79	120		0.078263	10'-0"	Pf 0.783
438	37'-0"			76.193				Pe
440	37'-0"			76.976			10'-0"	Pv
CM	4.3100	566.05	12.45	120		0.064794	10'-0"	Pf 0.649
440	37'-0"			76.976				Pe -0.041
442	37'-1"			77.584			10'-0"	Pv
CM	4.3100	498.04	10.95	120		0.051132	10'-0"	Pf 0.511
442	37'-1"			77.584				Pe -0.090
444	37'-3½"			78.005			10'-0"	Pv
CM	4.3100	420.87	9.26	120		0.037447	10'-0"	Pf 0.375
444	37'-3½"			78.005				Pe -0.090
446	37'-6"			78.290			10'-0"	Pv
CM	4.3100	332.76	7.32	120		0.024249	10'-0"	Pf 0.243
446	37'-6"			78.290				Pe -0.090
448	37'-8½"			78.442			10'-0"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 04

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
CM	4.3100	232.14	5.10	120		0.012457	10'-0	Pf 0.125
448	37'-8½			78.442				Pe -0.090
450	37'-11			78.476			10'-0	Pv
CM	4.3100	117.55	2.58	120		0.003537	10'-0	Pf 0.035
450	37'-11			78.476				Pe -0.090
452	38'-1½			78.422			10'-0	Pv
RN	2.7050	117.55	6.56	120		0.034190	295'-7	Pf 12.666
452	38'-1½			78.422		PO(18'-8½)	74'-10½	Pe -0.000
424	38'-1½			91.087		3PO(18'-8½)	370'-5½	Pv
Route 3								
BL	2.7050	118.91	6.64	120		0.034926	9'-0	Pf 0.314
4119	37'-10	121.26	16.8	52.097		Sprinkler		Pe
4121	37'-10			52.411			9'-0	Pv
BL	2.7050	240.53	13.43	120		0.128580	149'-0	Pf 23.972
4121	37'-10	121.62	16.8	52.411		Sprinkler,	37'-5	Pe 0.361
402	37'-0			76.744		2PO(18'-8½)	186'-5	Pv
Route 4								
BL	2.7050	2.35	0.13	120		0.000025	9'-0	Pf 0.000
4119	37'-10	121.26	16.8	52.097		Sprinkler		Pe
4123	37'-10			52.097			9'-0	Pv
BL	2.7050	123.61	6.90	120		0.037523	9'-0	Pf 0.338
4123	37'-10	121.26	16.8	52.097		Sprinkler		Pe
4125	37'-10			52.434			9'-0	Pv
BL	2.7050	245.26	13.69	120		0.133294	119'-7	Pf 20.930
4125	37'-10	121.65	16.8	52.434		Sprinkler,	37'-5	Pe 0.361
432	37'-0			73.725		2PO(18'-8½)	157'-0	Pv
Route 5								
BL	2.7050	119.20	6.65	120		0.035086	9'-0	Pf 0.316
4127	37'-10	121.66	16.8	52.445		Sprinkler		Pe
4129	37'-10			52.761			9'-0	Pv
BL	2.7050	241.23	13.47	120		0.129273	149'-0	Pf 24.101
4129	37'-10	122.03	16.8	52.761		Sprinkler,	37'-5	Pe 0.361
404	37'-0			77.223		2PO(18'-8½)	186'-5	Pv
Route 6								
BL	2.7050	2.46	0.14	120		0.000027	9'-0	Pf 0.000
4127	37'-10	121.66	16.8	52.445		Sprinkler		Pe
4131	37'-10			52.445			9'-0	Pv
BL	2.7050	124.12	6.93	120		0.037812	9'-0	Pf 0.340
4131	37'-10	121.66	16.8	52.445		Sprinkler		Pe
4133	37'-10			52.786			9'-0	Pv
BL	2.7050	246.18	13.74	120		0.134221	119'-7	Pf 21.075
4133	37'-10	122.06	16.8	52.786		Sprinkler,	37'-5	Pe 0.361
434	37'-0			74.222		2PO(18'-8½)	157'-0	Pv
Route 7								
UG	6.2800	250.00	2.59	140		0.001718	19'-10	Pf 0.161
54	1'-0	250.00		120.878		Hydrant,	74'-1	Pe 3.902
11	-8'-0			124.941		E(22'-1), GV(4'-8½), T(47'-3½)	93'-10½	Pv
Route 8								
UG	8.3900	748.81	4.35	140		0.003189	119'-3	Pf 0.380
13	-8'-0	748.81		126.890		Flow (q) from Route 9		Pe
14	-8'-0			127.270			119'-3	Pv
UG	8.3900	748.81	4.35	140		0.003189	519'-3½	Pf 1.754
14	-8'-0			127.270			30'-6½	Pe
15	-8'-0			129.023		E(30'-6½)	549'-10	Pv
UG	8.3900	748.81	4.35	140		0.003189	91'-11½	Pf 0.293
15	-8'-0			129.023				Pe
16	-8'-0			129.317			91'-11½	Pv
UG	8.3900	748.81	4.35	140		0.003189	214'-9	Pf 0.685
16	-8'-0			129.317				Pe
17	-8'-0			130.001			214'-9	Pv
UG	8.3900	748.81	4.35	140		0.003189	337'-8	Pf 1.364
17	-8'-0			130.001			89'-11	Pe
7	-8'-0			131.365		E(30'-6½), T(59'-4½)	427'-7	Pv
Route 9								
UG	8.3900	748.81	4.35	140		0.003189	635'-9	Pf 2.125
12	-8'-0	709.74		124.765		Flow (q) from Route 1	30'-6½	Pe
13	-8'-0			126.890		E(30'-6½)	666'-3½	Pv
Route 10								



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 04

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Fittings	Eq. Length	Summary
Upstream						Total Length	
RN	2.7050	88.10	4.92	120	0.020055	295'-7	Pf 7.429
446	37'-6			78.290	PO(18'-8½)	74'-10½	Pe -0.000
416	37'-6			85.719	3PO(18'-8½)	370'-5½	Pv
Route 11							
RN	2.7050	114.60	6.40	120	0.032618	295'-7	Pf 12.084
450	37'-11			78.476	PO(18'-8½)	74'-10½	Pe -0.000
420	37'-11			90.560	3PO(18'-8½)	370'-5½	Pv
Route 12							
RN	2.7050	100.62	5.62	120	0.025642	295'-7	Pf 9.499
448	37'-8½			78.442	PO(18'-8½)	74'-10½	Pe -0.000
418	37'-8½			87.941	3PO(18'-8½)	370'-5½	Pv
Route 13							
RN	2.7050	77.18	4.31	120	0.015698	295'-7	Pf 5.815
444	37'-3½			78.005	PO(18'-8½)	74'-10½	Pe -0.000
414	37'-3½			83.821	3PO(18'-8½)	370'-5½	Pv
Route 14							
RN	2.7050	68.01	3.80	120	0.012425	295'-7	Pf 4.603
442	37'-1			77.584	PO(18'-8½)	74'-10½	Pe -0.000
412	37'-1			82.187	3PO(18'-8½)	370'-5½	Pv
Route 15							
RN	2.7050	60.84	3.40	120	0.010109	295'-7	Pf 3.745
440	37'-0			76.976	PO(18'-8½)	74'-10½	Pe
410	37'-0			80.721	3PO(18'-8½)	370'-5½	Pv
Route 16							
RN	2.7050	55.95	3.12	120	0.008658	295'-7	Pf 3.207
438	37'-0			76.193	PO(18'-8½)	74'-10½	Pe
408	37'-0			79.400	3PO(18'-8½)	370'-5½	Pv
Route 17							
RN	2.7050	53.61	2.99	120	0.007999	295'-7	Pf 2.963
436	37'-0			75.276	PO(18'-8½)	74'-10½	Pe
406	37'-0			78.240	3PO(18'-8½)	370'-5½	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

C Value Multiplier

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$$

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 04

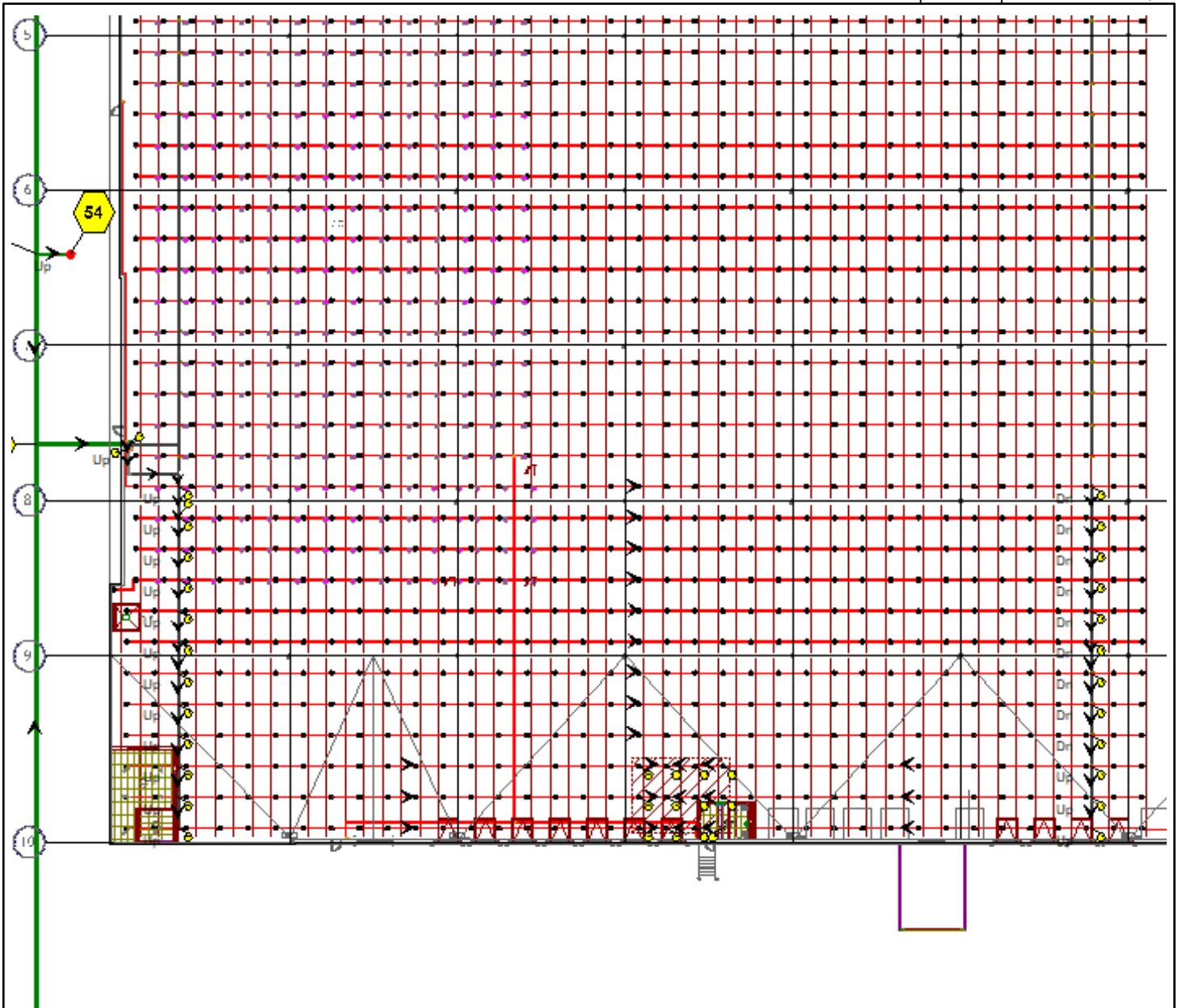
Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss		Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend	Units Legend		Fittings Legend	
AO Arm-Over	Diameter	Inch	ALV Alarm Valve	
BL Branch Line	Elevation	Foot	AngV Angle Valve	
CM Cross Main	Flow	gpm	b Bushing	
DN Drain	Discharge	gpm	BaIV Ball Valve	
DR Drop	Velocity	fps	BFP Backflow Preventer	
DY Dynamic	Pressure	psi	BV Butterfly Valve	
FM Feed Main	Length	Foot	C Cross Flow Turn 90°	
FR Feed Riser	Friction Loss	psi/Foot	cplg Coupling	
MS Miscellaneous	HWC	Hazen-Williams Constant	Cr Cross Run	
OR Outrigger	Pt	Total pressure at a point in a pipe	CV Check Valve	
RN Riser Nipple	Pn	Normal pressure at a point in a pipe	DeIV Deluge Valve	
SP Sprig	Pf	Pressure loss due to friction between points	DPV Dry Pipe Valve	
ST Stand Pipe	Pe	Pressure due to elevation difference between indicated points	E 90° Elbow	
UG Underground	Pv	Velocity pressure at a point in a pipe	EE 45° Elbow	
			Ee1 11¼° Elbow	
			Ee2 22½° Elbow	
			f Flow Device	
			fd Flex Drop	
			FDC Fire Department Connection	
			fE 90° FireLock(TM) Elbow	
			fEE 45° FireLock(TM) Elbow	
			flg Flange	
			FN Floating Node	
			fT FireLock(TM) Tee	
			g Gauge	
			GloV Globe Valve	
			GV Gate Valve	
			Ho Hose	
			Hose Hose	
			HV Hose Valve	
			Hyd Hydrant	
			LtE Long Turn Elbow	
			mecT Mechanical Tee	
			Noz Nozzle	
			P1 Pump In	
			P2 Pump Out	
			PIV Post Indicating Valve	
			PO Pipe Outlet	
			PrV Pressure Relief Valve	
			PRV Pressure Reducing Valve	
			red Reducer/Adapter	
			S Supply	
			sCV Swing Check Valve	
			SFx Seismic Flex	
			Spr Sprinkler	
			St Strainer	
			T Tee Flow Turn 90°	
			Tr Tee Run	
			U Union	
			WirF Wirsbo	
			WMV Water Meter Valve	
			Z Cap	



Flow Diagram (Current View)

Job Number: 212189000
Report Description: Remote Area 04





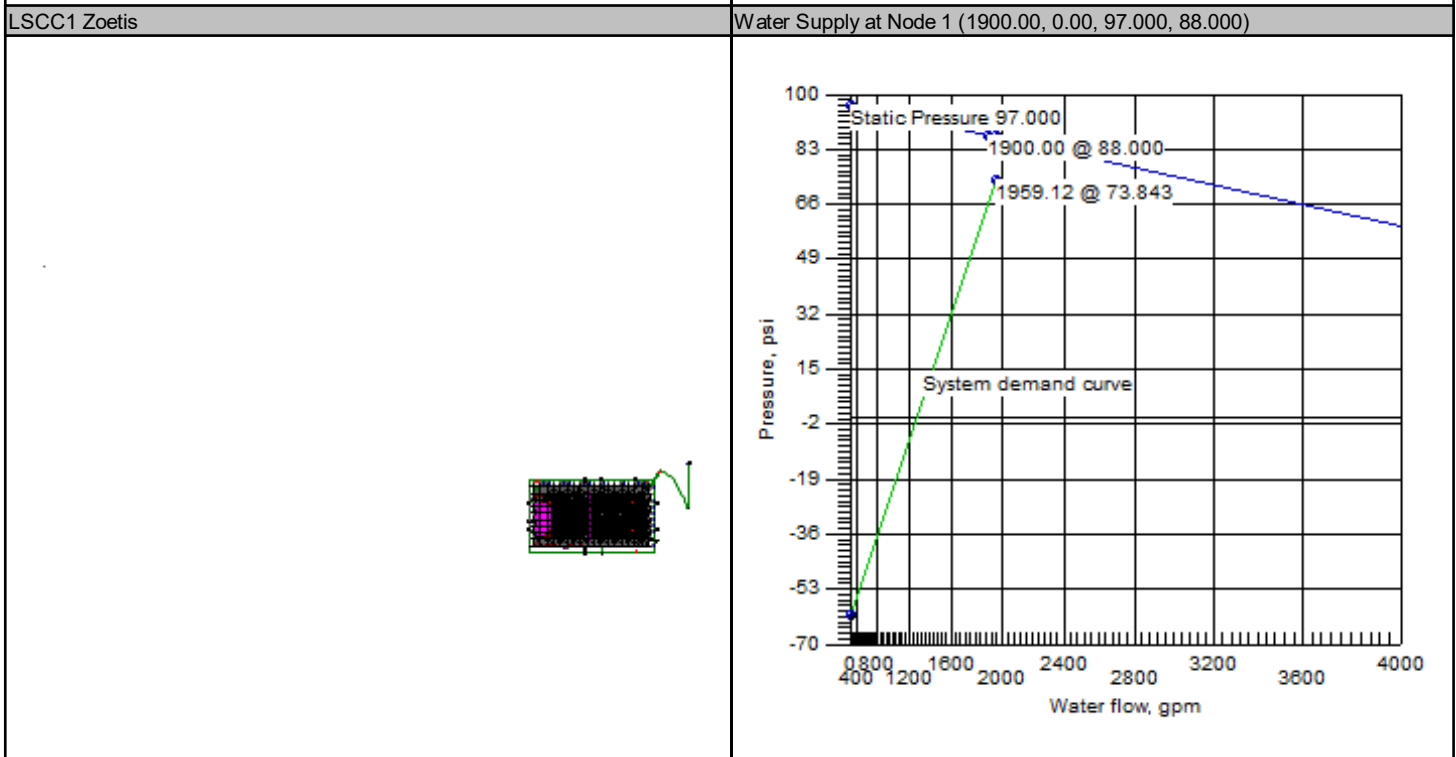
Hydraulic Overview

Job Number: 212189000
Report Description: Remote Area 05

Job		
Job Number 212189000	Design Engineer Jay Colbert	
Job Name: Lee's Summit Commerce Center	Phone 913.242.0057	FAX
Address 1 1120 NW Main St	State Certification/License Number	
Address 2	AHJ City of Lee's Summit	
Address 3 Lee's Summit, MO 64086	Job Site/Building Building A	

System	
Pressure 40.000	Area of Application NA
Most Demanding Sprinkler Data 22.4 K-Factor 141.67 at 40.000	Hose Streams 250.00
Coverage Per Sprinkler 100ft ²	Number Of Sprinklers Calculated 12 0
System Pressure Demand 73.843	System Flow Demand 1959.12
Total Demand 1959.12 @ 73.843	Pressure Result +13.633 (15.6%)

Supplies						Check Point Gauges			
Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)	Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)
1	Water Supply	1900.00		97.000	88.000	Pump Inlet	56.874	259.78	1959.12
4	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									





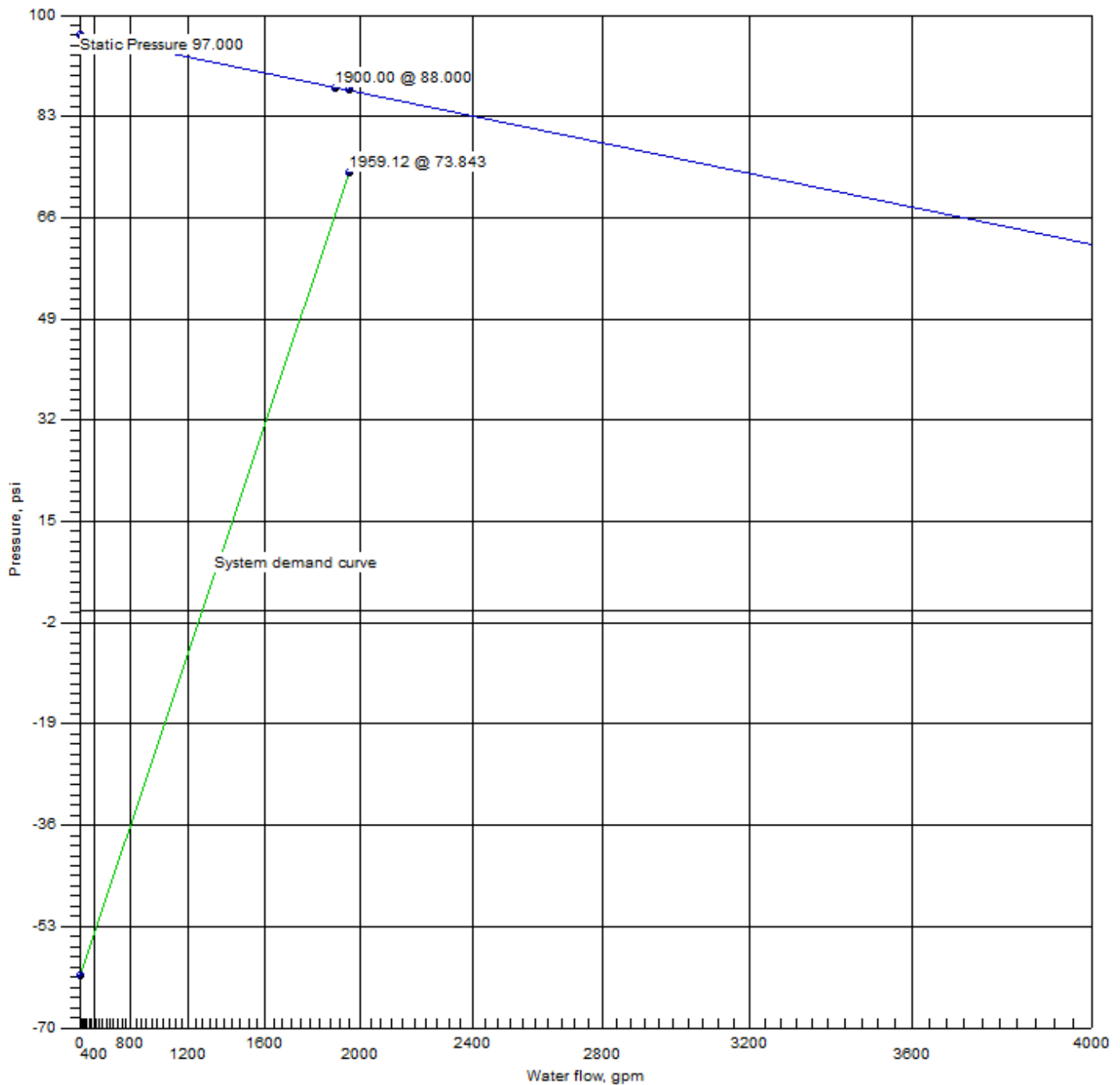
Hydraulic Summary

Job Number: 212189000
Report Description: Remote Area 05

Job											
Job Number 212189000				Design Engineer Jay Colbert							
Job Name: Lee's Summit Commerce Center				State Certification/License Number							
Address 1 1120 NW Main St				AHJ City of Lee's Summit							
Address 2				Job Site/Building Building A							
Address 3 Lee's Summit, MO 64086				Drawing Name LSCC1 Zoetis							
System				Remote Area(s)							
Most Demanding Sprinkler Data 22.4 K-Factor 141.67 at 40.000				Occupancy ESFR			Job Suffix				
Hose Allowance At Source 0.00				Pressure 40.000			Area of Application NA				
Additional Hose Supplies Node Hydrant At Node 52				Flow(gpm) 250.00			Number Of Sprinklers Calculated 12				
				Number Of Nozzles Calculated 0			Coverage Per Sprinkler 100ft ²				
				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 73.791 Right: 73.784							
Total Hose Streams 250.00											
System Flow Demand 1959.12			Total Water Required (Including Hose Allowance) 1959.12								
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 18.93 between nodes 540 and 538											
Maximum Velocity Under Ground 11.37 between nodes 224 and 7											
Volume capacity of Wet Pipes 34293.96gal			Volume capacity of Dry Pipes								
Supplies											
Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@	Flow (gpm)	Available (psi)	@	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply		97.000	88.000		1900.00	87.475		1959.12	73.843	13.633
4	Pump		84.000	60.000		2000.00	131.233		1959.12	117.601	13.633
Pumps: Static = Churn (Pressure @ Zero Flow)											
Contractor											
Contractor Number 21		Contact Name Jay Colbert					Contact Title				
Name of Contractor: F.E. Moran Fire Protection Inc.		Phone 913.242.0057					Extension				
Address 1 16815 College Blvd.		FAX									
Address 2		E-mail jay.colbert@femoran.com									
Address 3 Lenexa, KS 66219		Web-Site femoranfp.com									



Water Supply at Node 1



Hydraulic Graph

Water Supply at Node 1

Static: Pressure

97.000

Residual: Pressure

88.000 @ 1900.00

Available Pressure at System Demand

87.475 @ 1959.12

Required Pressure at System Demand

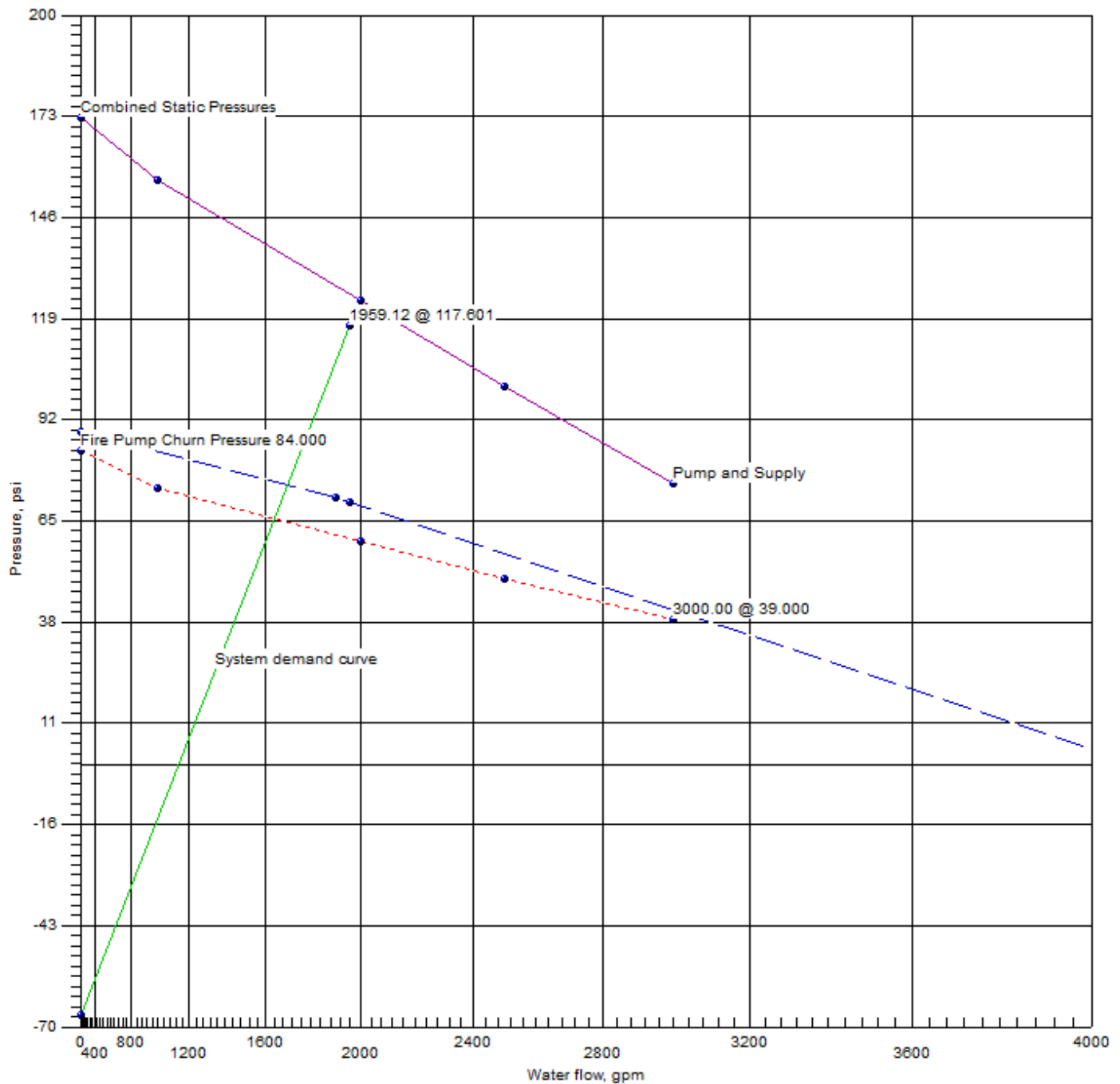
73.843 @ 1959.12

Required Pressure at System Demand (Including Hose Allowance at Source)

73.843 @ 1959.12



Pump at Node 4



Hydraulic Graph

Static + Churn Pressure

Fire Pump Rating

Pump at Node 4

173.256

60.000 @ 2000.00

Static: Pressure

Fire Pump Churn Pressure

173.256

84.000

Residual: Pressure

60.726 @ 1959.12

Available Pressure at System Demand

131.233 @ 1959.12

Required Pressure at System Demand

117.601 @ 1959.12



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: Remote Area 05

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Hydrant	52	250.00	250.00	250	109.521		
⇒ Sprinkler	5111	141.67	141.67	22.4	40.000		
Sprinkler	5113	142.43	141.67	22.4	40.428		
Sprinkler	5115	141.67	141.67	22.4	40.000		
Sprinkler	5117	142.45	141.67	22.4	40.441		
Sprinkler	5119	141.93	141.67	22.4	40.148		
Sprinkler	5121	142.68	141.67	22.4	40.574		
Sprinkler	5123	141.93	141.67	22.4	40.148		
Sprinkler	5125	142.72	141.67	22.4	40.593		
Sprinkler	5127	142.52	141.67	22.4	40.484		
Sprinkler	5129	143.26	141.67	22.4	40.904		
Sprinkler	5131	142.52	141.67	22.4	40.484		
Sprinkler	5133	143.33	141.67	22.4	40.943		

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: Remote Area 05

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	73.843	1959.12
52	1'-0	Hyd(-1.000)	109.521	250.00
5111	40'-6	Spr(-40.000)	40.000	141.67
5113	40'-6	Spr(-40.428)	40.428	142.43
5115	40'-6	Spr(-40.000)	40.000	141.67
5117	40'-6	Spr(-40.441)	40.441	142.45
5119	40'-2½	Spr(-40.148)	40.148	141.93
5121	40'-2½	Spr(-40.574)	40.574	142.68
5123	40'-2½	Spr(-40.148)	40.148	141.93
5125	40'-2½	Spr(-40.593)	40.593	142.72
5127	39'-11	Spr(-40.484)	40.484	142.52
5129	39'-11	Spr(-40.904)	40.904	143.26
5131	39'-11	Spr(-40.484)	40.484	142.52
5133	39'-11	Spr(-40.943)	40.943	143.33
2	1'-9	T(65'-4½)	57.361	
3	1'-9	P1, Pump Inlet	56.874	
4	1'-9	P2(-60.886)	117.601	
5	1'-9		117.601	
6	6'-8½		113.034	
7	-8'-0	T(59'-4½)	117.401	
8	-8'-0	T(59'-4½)	113.548	
9	-8'-0	T(47'-3½)	113.584	
10	-8'-0	T(59'-4½)	114.446	
11	-8'-0	T(47'-3½)	114.645	
12	-8'-0	T(59'-4½)	114.724	
13	-8'-0	T(47'-3½)	115.586	
14	-8'-0	T(59'-4½)	115.740	
15	-8'-0	T(47'-3½)	116.451	
16	-8'-0	T(59'-4½)	116.570	
17	-8'-0	T(59'-4½)	116.848	
54	1'-0	Hyd	1.000	
55	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
224	1'-0		115.355	
309	-8'-0	E(35'-1)	71.333	
500	39'-8	PO(18'-8½)	70.301	
502	39'-4½	PO(18'-8½)	70.448	
504	39'-1	PO(18'-8½)	70.666	
506	38'-10	PO(18'-8½)	70.993	
508	38'-6½	PO(18'-8½)	71.357	
510	38'-3	PO(18'-8½)	71.756	
512	38'-0	PO(18'-8½)	72.192	
514	37'-8½	PO(18'-8½)	72.663	
516	37'-5	PO(18'-8½)	73.168	
518	37'-2	PO(18'-8½)	73.708	
520	37'-0	PO(18'-8½)	74.232	
522	37'-0	PO(18'-8½)	74.726	
524	37'-0	PO(18'-8½)	75.261	
526	37'-0	PO(18'-8½)	75.842	
528	37'-0	PO(18'-8½)	76.474	
530	37'-0	PO(18'-8½)	77.164	
532	1'-8½	PO(37'-8½)	106.136	
534	39'-8	PO(18'-8½)	63.103	
536	39'-4½	PO(18'-8½)	63.406	
538	39'-1	PO(18'-8½)	64.186	
540	38'-10	PO(18'-8½)	65.714	
542	38'-6½	PO(18'-8½)	67.013	
544	38'-3	PO(18'-8½)	68.121	
546	37'-5	PO(18'-8½)	70.538	
548	37'-2	PO(18'-8½)	71.107	
550	38'-0	PO(18'-8½)	69.062	
552	37'-8½	PO(18'-8½)	69.861	



Node Analysis

Job Number: 212189000
Report Description: Remote Area 05

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
554	37'-0	PO(18'-8½)	72.096	
556	37'-0	PO(18'-8½)	72.155	
558	37'-0	PO(18'-8½)	71.792	
560	37'-0	PO(18'-8½)	71.979	
562	37'-0	PO(18'-8½)	71.527	
564	37'-0	PO(18'-8½)	72.173	
632	1'-0		107.342	



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 05

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
BL	2.7050	140.54	7.85	120		0.047583	9'-0	Pf 0.428
5111	40'-6	141.67	22.4	40.000		Sprinkler		Pe
5113	40'-6			40.428			9'-0	Pv
BL	2.7050	282.97	15.80	120		0.173668	105'-8	Pf 29.512
5113	40'-6	142.43	22.4	40.428		Sprinkler,	64'-3	Pe 0.361
500	39'-8			70.301		4fE(6'-8½), 2PO(18'-8½)	169'-11	Pv
CM	6.3570	282.97	2.86	120		0.002707	10'-0	Pf 0.027
500	39'-8			70.301				Pe 0.120
502	39'-4½			70.448			10'-0	Pv
CM	6.3570	565.95	5.72	120		0.009760	10'-0	Pf 0.098
502	39'-4½	282.98		70.448		Flow (q) from Route 3		Pe 0.120
504	39'-1			70.666			10'-0	Pv
CM	6.3570	848.35	8.58	120		0.020638	10'-0	Pf 0.206
504	39'-1	282.40		70.666		Flow (q) from Route 5		Pe 0.120
506	38'-10			70.993			10'-0	Pv
CM	6.3570	927.17	9.37	120		0.024325	10'-0	Pf 0.243
506	38'-10	78.82		70.993		Flow (q) from Route 14		Pe 0.120
508	38'-6½			71.357			10'-0	Pv
CM	6.3570	998.11	10.09	120		0.027880	10'-0	Pf 0.279
508	38'-6½	70.94		71.357		Flow (q) from Route 13		Pe 0.120
510	38'-3			71.756			10'-0	Pv
CM	6.3570	1066.12	10.78	120		0.031496	10'-0	Pf 0.315
510	38'-3	68.01		71.756		Flow (q) from Route 2		Pe 0.120
512	38'-0			72.192			10'-0	Pv
CM	6.3570	1128.85	11.41	120		0.035010	10'-0	Pf 0.350
512	38'-0	62.72		72.192		Flow (q) from Route 11		Pe 0.120
514	37'-8½			72.663			10'-0	Pv
CM	6.3570	1187.92	12.01	120		0.038474	10'-0	Pf 0.385
514	37'-8½	59.08		72.663		Flow (q) from Route 12		Pe 0.120
516	37'-5			73.168			10'-0	Pv
CM	6.3570	1245.01	12.59	120		0.041965	10'-0	Pf 0.420
516	37'-5	57.09		73.168		Flow (q) from Route 9		Pe 0.120
518	37'-2			73.708			10'-0	Pv
CM	6.3570	1301.76	13.16	120		0.045572	10'-0½	Pf 0.457
518	37'-2	56.75		73.708		Flow (q) from Route 10		Pe 0.067
520	37'-0			74.232			10'-0½	Pv
CM	6.3570	1359.72	13.74	120		0.049397	10'-0	Pf 0.494
520	37'-0	57.96		74.232		Flow (q) from Route 19		Pe
522	37'-0			74.726			10'-0	Pv
CM	6.3570	1420.28	14.36	120		0.053544	10'-0	Pf 0.535
522	37'-0	60.56		74.726		Flow (q) from Route 17		Pe
524	37'-0			75.261			10'-0	Pv
CM	6.3570	1484.63	15.01	120		0.058118	10'-0	Pf 0.581
524	37'-0	64.35		75.261		Flow (q) from Route 18		Pe 0.000
526	37'-0			75.842			10'-0	Pv
CM	6.3570	1553.75	15.71	120		0.063223	10'-0	Pf 0.632
526	37'-0	69.12		75.842		Flow (q) from Route 15		Pe
528	37'-0			76.474			10'-0	Pv
CM	6.3570	1628.40	16.46	120		0.068956	10'-0	Pf 0.690
528	37'-0	74.65		76.474		Flow (q) from Route 16		Pe
530	37'-0			77.164			10'-0	Pv
CM	6.3570	1709.12	17.28	120		0.075413	55'-6	Pf 13.667
530	37'-0	80.72		77.164		Flow (q) from Route 20	125'-9	Pe 15.304
532	1'-8½			106.136		2E(17'-7), 2f(-0.000), CV(40'-3), BV(12'-7), PO(37'-8½)	181'-3	Pv
CM	8.2490	1709.12	10.26	120		0.021203	1'-6	Pf 0.903
532	1'-8½			106.136			41'-1½	Pe 0.303
632	1'-0			107.342		PO(41'-1½)	42'-7½	Pv
UG	8.3900	1709.12	9.92	140		0.014679	67'-1½	Pf 2.305
632	1'-0			107.342			89'-11	Pe 3.902
8	-8'-0			113.548		E(30'-6½), T(59'-4½)	157'-0	Pv
UG	8.3900	1499.38	8.70	140		0.011522	275'-0	Pf 3.852
8	-8'-0			113.548			59'-4½	Pe
7	-8'-0			117.401		T(59'-4½)	334'-4½	Pv
UG	8.3900	1959.12	11.37	140		0.018897	67'-8	Pf 1.856
7	-8'-0	459.74		117.401		Flow (q) from Route 7	30'-6½	Pe -3.902
224	1'-0			115.355		E(30'-6½)	98'-2½	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 05

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
FR	8.2490	1959.12	11.76	120		0.027296	5'-8½"	Pf 0.156
224	1'-0"			115.355				Pe -2.476
6	6'-8½"			113.034			5'-8½"	Pv
DY	10.3700	1959.12	7.44	120		0.008956	13'-10½"	Pf 2.415
6	6'-8½"			113.034			255'-9"	Pe 2.151
5	1'-9"			117.601		4E(26'-0"), T(48'-5½"), BV(21'-3½"), Tr(17'-0"), CV(65'-0")	269'-8"	Pv
DY	7.9810	1959.12	12.56	120		0.032059	0'-0"	Pf 0.000
5	1'-9"			117.601				Pe 0.000
4	1'-9"			117.601			0'-0"	Pv
Pump		Velocity						
4		1959.12		117.601		Rating: 60.000 @ 2000.00		
3		Q=1959.12	7.40	56.874		Fire Pump Churn Pressure: 84.000		
DY	10.4000	1959.12	7.40	140		0.006640	0'-0"	Pf 0.487
3	1'-9"			56.874			73'-4"	Pe 0.000
2	1'-9"			57.361		GV(7'-11½"), T(65'-4½")	73'-4"	Pv
UG	10.4000	1959.12	7.40	140		0.006640	696'-3½"	Pf 9.745
2	1'-9"			57.361			175'-4½"	Pe 4.227
309	-8'-0"			71.333		4E(35'-1"), 2EE(17'-6½"), BFP(-3.948)	871'-8"	Pv
UG	12.4600	1959.12	5.15	140		0.002754	360'-2½"	Pf 0.992
309	-8'-0"			71.333				Pe 1.517
1	-11'-6"			73.843		Water Supply	360'-2½"	Pv
		0.00				Hose Allowance At Source		
1		1959.12						
Route 2								
BL	2.7050	1.13	0.06	120		0.000006	9'-0"	Pf 0.000
5111	40'-6"	141.67	22.4	40.000		Sprinkler	9'-0"	Pe
5115	40'-6"			40.000			9'-0"	Pv
BL	2.7050	142.80	7.97	120		0.049003	9'-0"	Pf 0.441
5115	40'-6"	141.67	22.4	40.000		Sprinkler	9'-0"	Pe
5117	40'-6"			40.441			9'-0"	Pv
BL	2.7050	285.24	15.92	120		0.176259	89'-1"	Pf 22.300
5117	40'-6"	142.45	22.4	40.441		Sprinkler,	37'-5"	Pe 0.361
534	39'-8"			63.103		2PO(18'-8½")	126'-6"	Pv
CM	4.3100	285.24	6.27	120		0.018235	10'-0"	Pf 0.182
534	39'-8"			63.103			10'-0"	Pe 0.120
536	39'-4½"			63.406			10'-0"	Pv
CM	4.3100	571.53	12.57	120		0.065959	10'-0"	Pf 0.660
536	39'-4½"	286.29		63.406		Flow (q) from Route 4	10'-0"	Pe 0.120
538	39'-1"			64.186			10'-0"	Pv
CM	4.3100	860.77	18.93	120		0.140699	10'-0"	Pf 1.408
538	39'-1"	289.24		64.186		Flow (q) from Route 6	10'-0"	Pe 0.120
540	38'-10"			65.714			10'-0"	Pv
CM	4.3100	781.95	17.20	120		0.117795	10'-0"	Pf 1.178
540	38'-10"			65.714			10'-0"	Pe 0.120
542	38'-6½"			67.013			10'-0"	Pv
CM	4.3100	711.01	15.64	120		0.098790	10'-0"	Pf 0.988
542	38'-6½"			67.013			10'-0"	Pe 0.120
544	38'-3"			68.121			10'-0"	Pv
RN	2.7050	68.01	3.80	120		0.012424	217'-9"	Pf 3.635
544	38'-3"			68.121		PO(18'-8½")	74'-10½"	Pe -0.000
510	38'-3"			71.756		3PO(18'-8½")	292'-7½"	Pv
Route 3								
BL	2.7050	140.29	7.83	120		0.047426	9'-0"	Pf 0.427
5119	40'-2½"	141.93	22.4	40.148		Sprinkler	9'-0"	Pe
5121	40'-2½"			40.574			9'-0"	Pv
BL	2.7050	282.98	15.80	120		0.173676	105'-8"	Pf 29.513
5121	40'-2½"	142.68	22.4	40.574		Sprinkler,	64'-3"	Pe 0.361
502	39'-4½"			70.448		4FE(6'-8½"), 2PO(18'-8½")	169'-11"	Pv
Route 4								
BL	2.7050	1.64	0.09	120		0.000013	9'-0"	Pf 0.000
5119	40'-2½"	141.93	22.4	40.148		Sprinkler	9'-0"	Pe
5123	40'-2½"			40.148			9'-0"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 05

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
BL	2.7050	143.57	8.02	120		0.049495	9'-0	Pf 0.445
5123	40'-2½	141.93	22.4	40.148		Sprinkler		Pe
5125	40'-2½			40.593			9'-0	Pv
BL	2.7050	286.29	15.98	120		0.177451	89'-1	Pf 22.451
5125	40'-2½	142.72	22.4	40.593		Sprinkler,	37'-5	Pe 0.361
536	39'-4½			63.406		2PO(18'-8½)	126'-6	Pv
Route 5								
BL	2.7050	139.14	7.77	120		0.046706	9'-0	Pf 0.420
5127	39'-11	142.52	22.4	40.484		Sprinkler		Pe
5129	39'-11			40.904			9'-0	Pv
BL	2.7050	282.40	15.77	120		0.173020	105'-8	Pf 29.402
5129	39'-11	143.26	22.4	40.904		Sprinkler,	64'-3	Pe 0.361
504	39'-1			70.666		4fE(6'-8½), 2PO(18'-8½)	169'-11	Pv
Route 6								
BL	2.7050	3.39	0.19	120		0.000048	9'-0	Pf 0.000
5127	39'-11	142.52	22.4	40.484		Sprinkler		Pe
5131	39'-11			40.484			9'-0	Pv
BL	2.7050	145.91	8.15	120		0.050998	9'-0	Pf 0.459
5131	39'-11	142.52	22.4	40.484		Sprinkler		Pe
5133	39'-11			40.943			9'-0	Pv
BL	2.7050	289.24	16.15	120		0.180854	89'-1	Pf 22.882
5133	39'-11	143.33	22.4	40.943		Sprinkler,	37'-5	Pe 0.361
538	39'-1			64.186		2PO(18'-8½)	126'-6	Pv
Route 7								
UG	6.2800	250.00	2.59	140		0.001718	20'-0	Pf 0.162
52	1'-0	250.00		109.521		Hydrant,	74'-1	Pe 3.902
9	-8'-0			113.584		E(22'-1), GV(4'-8½), T(47'-3½)	94'-1	Pv
UG	8.3900	459.74	2.67	140		0.001293	635'-11½	Pf 0.862
9	-8'-0	209.74		113.584		Flow (q) from Route 8	30'-6½	Pe
10	-8'-0			114.446		E(30'-6½)	666'-6	Pv
UG	8.3900	459.74	2.67	140		0.001293	153'-8	Pf 0.199
10	-8'-0			114.446				Pe
11	-8'-0			114.645			153'-8	Pv
UG	8.3900	459.74	2.67	140		0.001293	61'-1½	Pf 0.079
11	-8'-0			114.645				Pe
12	-8'-0			114.724			61'-1½	Pv
UG	8.3900	459.74	2.67	140		0.001293	635'-9	Pf 0.862
12	-8'-0			114.724			30'-6½	Pe
13	-8'-0			115.586		E(30'-6½)	666'-3½	Pv
UG	8.3900	459.74	2.67	140		0.001293	119'-3	Pf 0.154
13	-8'-0			115.586				Pe
14	-8'-0			115.740			119'-3	Pv
UG	8.3900	459.74	2.67	140		0.001293	519'-3½	Pf 0.711
14	-8'-0			115.740			30'-6½	Pe
15	-8'-0			116.451		E(30'-6½)	549'-10	Pv
UG	8.3900	459.74	2.67	140		0.001293	91'-11½	Pf 0.119
15	-8'-0			116.451				Pe
16	-8'-0			116.570			91'-11½	Pv
UG	8.3900	459.74	2.67	140		0.001293	214'-9	Pf 0.278
16	-8'-0			116.570				Pe
17	-8'-0			116.848			214'-9	Pv
UG	8.3900	459.74	2.67	140		0.001293	337'-8	Pf 0.553
17	-8'-0			116.848			89'-11	Pe
7	-8'-0			117.401		E(30'-6½), T(59'-4½)	427'-7	Pv
Route 8								
UG	8.3900	209.74	1.22	140		0.000303	118'-2	Pf 0.036
8	-8'-0	1499.38		113.548		Flow (q) from Route 1		Pe
9	-8'-0			113.584			118'-2	Pv
Route 9								
RN	2.7050	57.09	3.19	120		0.008988	217'-9	Pf 2.630
546	37'-5	521.20		70.538		PO(18'-8½), Flow (q) from Route	74'-10½	Pe -0.000
516	37'-5			73.168		24	292'-7½	Pv
						3PO(18'-8½)		
Route 10								
CM	4.3100	464.11	10.21	120		0.044873	10'-0	Pf 0.449
546	37'-5	521.20		70.538		Flow (q) from Route 24		Pe 0.120
548	37'-2			71.107			10'-0	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 05

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
RN	2.7050	56.75	3.17	120		0.008889	217'-9"	Pf 2.601
548	37'-2			71.107		PO(18'-8½)	74'-10½"	Pe -0.000
518	37'-2			73.708		3PO(18'-8½)	292'-7½"	Pv
Route 11								
RN	2.7050	62.72	3.50	120		0.010696	217'-9"	Pf 3.130
550	38'-0	643.00		69.062		PO(18'-8½), Flow (q) from Route	74'-10½"	Pe -0.000
512	38'-0			72.192		25	292'-7½"	Pv
						3PO(18'-8½)		
Route 12								
CM	4.3100	580.27	12.76	120		0.067837	10'-0"	Pf 0.679
550	38'-0	643.00		69.062		Flow (q) from Route 25	10'-0"	Pe 0.120
552	37'-8½			69.861				Pv
RN	2.7050	59.08	3.30	120		0.009574	217'-9"	Pf 2.802
552	37'-8½			69.861		PO(18'-8½)	74'-10½"	Pe -0.000
514	37'-8½			72.663		3PO(18'-8½)	292'-7½"	Pv
Route 13								
RN	2.7050	70.94	3.96	120		0.013433	221'-9"	Pf 4.345
542	38'-6½			67.013		PO(18'-8½)	101'-8½"	Pe -0.000
508	38'-6½			71.357		3PO(18'-8½), 4fE(6'-8½)	323'-5½"	Pv
Route 14								
RN	2.7050	78.82	4.40	120		0.016324	221'-9"	Pf 5.280
540	38'-10			65.714		PO(18'-8½)	101'-8½"	Pe -0.000
506	38'-10			70.993		3PO(18'-8½), 4fE(6'-8½)	323'-5½"	Pv
Route 15								
RN	2.7050	69.12	3.86	120		0.012802	217'-9"	Pf 3.746
554	37'-0	224.48		72.096		PO(18'-8½), Flow (q) from Route	74'-10½"	Pe
526	37'-0			75.842		21	292'-7½"	Pv
						3PO(18'-8½)		
Route 16								
CM	4.3100	155.36	3.42	120		0.005926	10'-0"	Pf 0.059
554	37'-0	224.48		72.096		Flow (q) from Route 21	10'-0"	Pe
556	37'-0			72.155				Pv
RN	2.7050	74.65	4.17	120		0.014760	217'-9"	Pf 4.319
556	37'-0			72.155		PO(18'-8½)	74'-10½"	Pe
528	37'-0			76.474		3PO(18'-8½)	292'-7½"	Pv
Route 17								
RN	2.7050	60.56	3.38	120		0.010024	217'-9"	Pf 2.933
558	37'-0	349.39		71.792		PO(18'-8½), Flow (q) from Route	74'-10½"	Pe -0.000
522	37'-0			74.726		22	292'-7½"	Pv
						3PO(18'-8½)		
Route 18								
CM	4.3100	288.84	6.35	120		0.018662	10'-0"	Pf 0.187
558	37'-0	349.39		71.792		Flow (q) from Route 22	10'-0"	Pe
560	37'-0			71.979				Pv
RN	2.7050	64.35	3.59	120		0.011216	217'-9"	Pf 3.282
560	37'-0			71.979		PO(18'-8½)	74'-10½"	Pe -0.000
524	37'-0			75.261		3PO(18'-8½)	292'-7½"	Pv
Route 19								
RN	2.7050	57.96	3.24	120		0.009243	217'-9"	Pf 2.705
562	37'-0	407.36		71.527		PO(18'-8½), Flow (q) from Route	74'-10½"	Pe -0.000
520	37'-0			74.232		23	292'-7½"	Pv
						3PO(18'-8½)		
Route 20								
CM	4.3100	80.72	1.77	120		0.001765	10'-0"	Pf 0.018
556	37'-0	74.65		72.155		Flow (q) from Route 16	10'-0"	Pe
564	37'-0			72.173				Pv
RN	2.7050	80.72	4.51	120		0.017056	217'-9"	Pf 4.991
564	37'-0			72.173		PO(18'-8½)	74'-10½"	Pe
530	37'-0			77.164		3PO(18'-8½)	292'-7½"	Pv
Route 21								
CM	4.3100	224.48	4.94	120		0.011707	10'-0"	Pf 0.117
560	37'-0	64.35		71.979		Flow (q) from Route 18	10'-0"	Pe
554	37'-0			72.096				Pv
Route 22								
CM	4.3100	349.39	7.68	120		0.026539	10'-0"	Pf 0.265
562	37'-0	407.36		71.527		Flow (q) from Route 23	10'-0"	Pe
558	37'-0			71.792				Pv
Route 23								



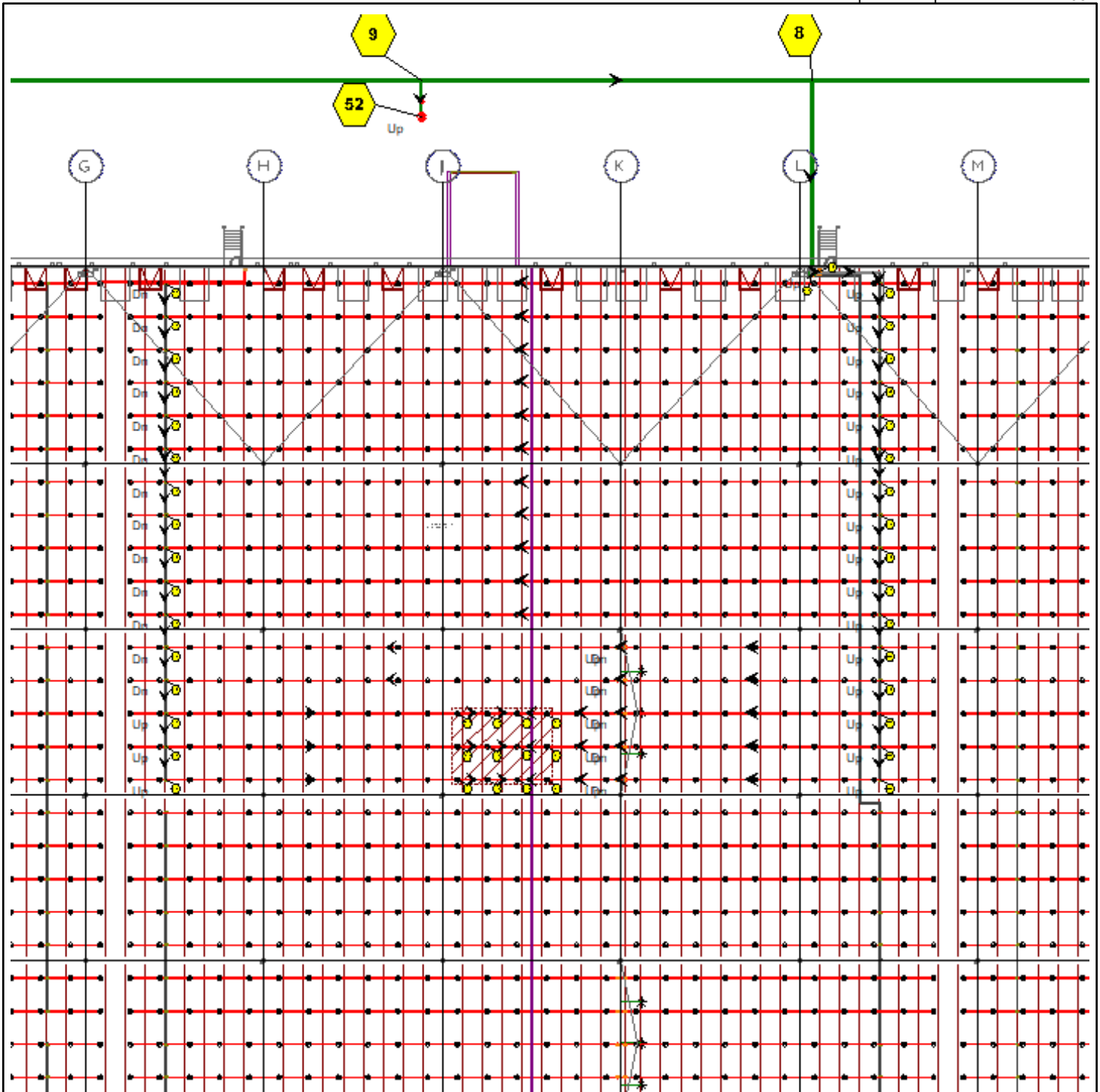
Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 05

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream					Fittings	Total Length	
CM	4.3100	407.36	8.96	120	0.035253	10'-0½	Pf 0.353
548	37'-2	56.75		71.107	Flow (q) from Route 10		Pe 0.066
562	37'-0			71.527		10'-0½	Pv
Route 24							
CM	4.3100	521.20	11.46	120	0.055616	10'-0	Pf 0.556
552	37'-8½	59.08		69.861	Flow (q) from Route 12		Pe 0.120
546	37'-5			70.538		10'-0	Pv
Route 25							
CM	4.3100	643.00	14.14	120	0.082023	10'-0	Pf 0.821
544	38'-3	68.01		68.121	Flow (q) from Route 2		Pe 0.120
550	38'-0			69.062		10'-0	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)	C Value Multiplier				
$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$	Value Of C	100	130	140	150
	Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type Legend	Units Legend	Fittings Legend
AO Arm-Over BL Branch Line CM Cross Main DN Drain DR Drop DY Dynamic FM Feed Main FR Feed Riser MS Miscellaneous OR Outtrigger RN Riser Nipple SP Sprig ST Stand Pipe UG Underground	Diameter Inch Elevation Foot Flow gpm Discharge gpm Velocity fps Pressure psi Length Foot Friction Loss psi/Foot HWC Hazen-Williams Constant Pt Total pressure at a point in a pipe Pn Normal pressure at a point in a pipe Pf Pressure loss due to friction between points Pe Pressure due to elevation difference between indicated points Pv Velocity pressure at a point in a pipe	ALV Alarm Valve AngV Angle Valve b Bushing BalV Ball Valve BFP Backflow Preventer BV Butterfly Valve C Cross Flow Turn 90° cplg Coupling Cr Cross Run CV Check Valve DelV Deluge Valve DPV Dry Pipe Valve E 90° Elbow EE 45° Elbow Ee1 11¼° Elbow Ee2 22½° Elbow f Flow Device fd Flex Drop FDC Fire Department Connection fE 90° FireLock(TM) Elbow fEE 45° FireLock(TM) Elbow flg Flange FN Floating Node fT FireLock(TM) Tee g Gauge GloV Globe Valve GV Gate Valve Ho Hose Hose Hose HV Hose Valve Hyd Hydrant LtE Long Turn Elbow mecT Mechanical Tee Noz Nozzle P1 Pump In P2 Pump Out PIV Post Indicating Valve PO Pipe Outlet PrV Pressure Relief Valve PRV Pressure Reducing Valve red Reducer/Adapter S Supply sCV Swing Check Valve SFx Seismic Flex Spr Sprinkler St Strainer T Tee Flow Turn 90° Tr Tee Run U Union WirF Wirsbo WMV Water Meter Valve Z Cap





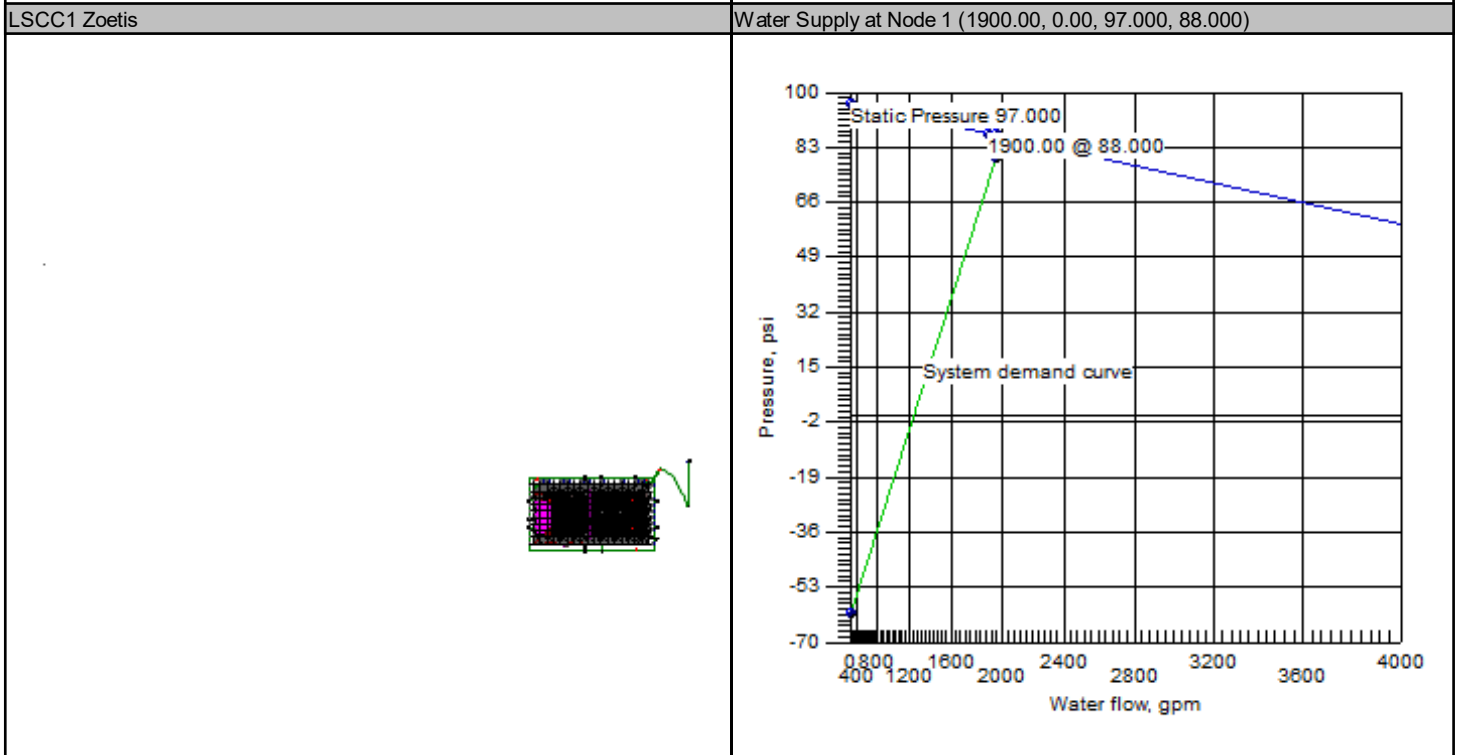
Hydraulic Overview

Job Number: 212189000
Report Description: Remote Area 06

Job		
Job Number 212189000	Design Engineer Jay Colbert	
Job Name: Lee's Summit Commerce Center	Phone 913.242.0057	FAX
Address 1 1120 NW Main St	State Certification/License Number	
Address 2	AHJ City of Lee's Summit	
Address 3 Lee's Summit, MO 64086	Job Site/Building Building A	

System	
Pressure 40.000	Area of Application NA
Most Demanding Sprinkler Data 22.4 K-Factor 141.67 at 40.000	Hose Streams 250.00
Coverage Per Sprinkler 100ft ²	Number Of Sprinklers Calculated 12 0
System Pressure Demand 80.319	System Flow Demand 1956.47
Total Demand 1956.47 @ 80.319	Pressure Result +7.179 (8.2%)

Supplies						Check Point Gauges			
<u>Node</u>	<u>Name</u>	<u>Flow(gpm)</u>	<u>Hose Flow(gpm)</u>	<u>Static(psi)</u>	<u>Residual(psi)</u>	<u>Identifier</u>	<u>Pressure(psi)</u>	<u>K-Factor(K)</u>	<u>Flow(gpm)</u>
1	Water Supply	1900.00		97.000	88.000	Pump Inlet	63.372	245.77	1956.47
4	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									





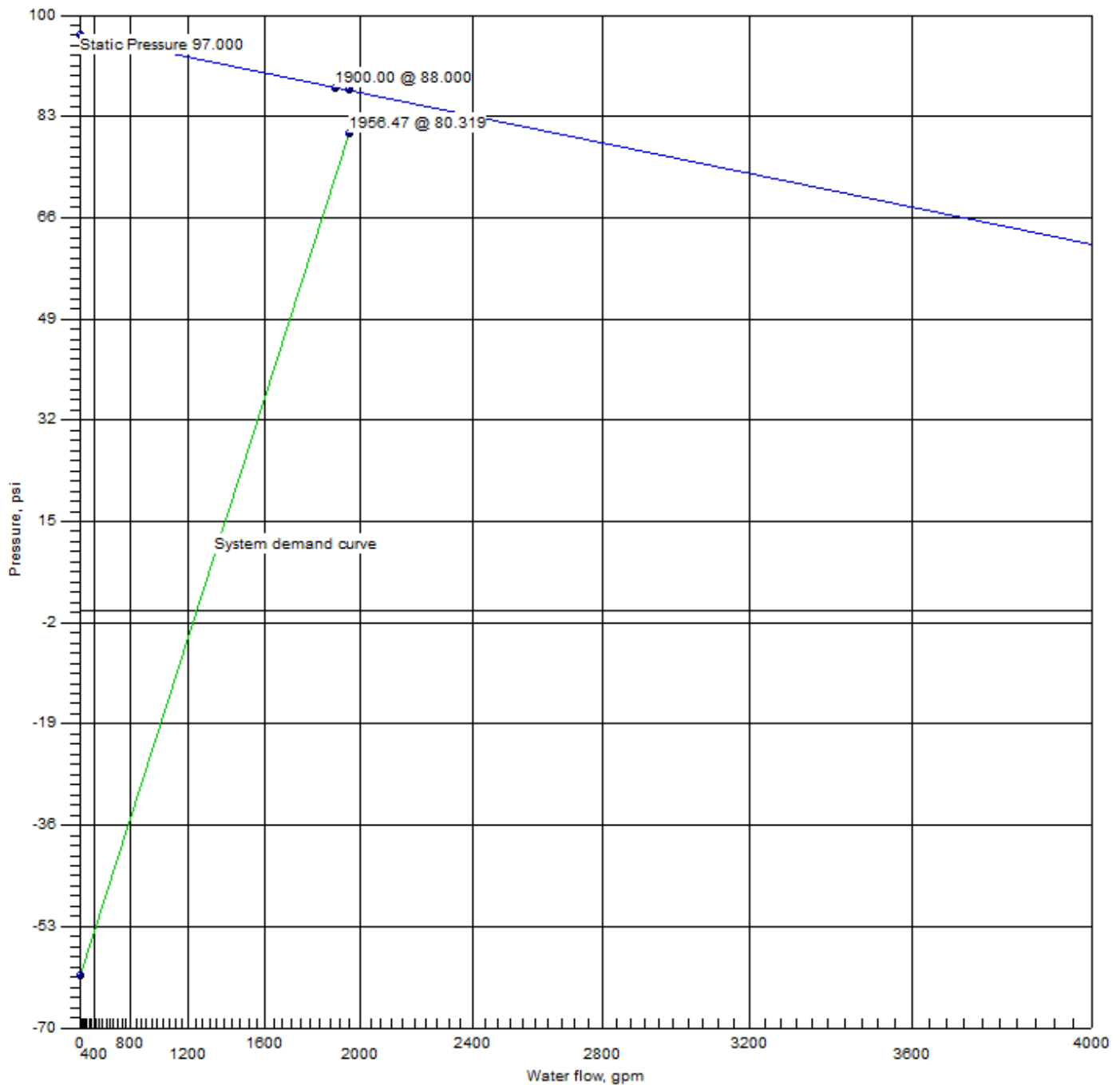
Hydraulic Summary

Job Number: 212189000
Report Description: Remote Area 06

Job											
Job Number 212189000					Design Engineer Jay Colbert						
Job Name: Lee's Summit Commerce Center					State Certification/License Number						
Address 1 1120 NW Main St					AHJ City of Lee's Summit						
Address 2					Job Site/Building Building A						
Address 3 Lee's Summit, MO 64086					Drawing Name LSCC1 Zoetis						
System					Remote Area(s)						
Most Demanding Sprinkler Data 22.4 K-Factor 141.67 at 40.000					Occupancy ESFR			Job Suffix			
Hose Allowance At Source 0.00					Pressure 40.000			Area of Application NA			
Additional Hose Supplies Node Hydrant At Node 52					Flow(gpm) 250.00		Number Of Sprinklers Calculated 12		Number Of Nozzles Calculated 0		
							Coverage Per Sprinkler 100ft ²				
					AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 80.280 Right: 80.241						
Total Hose Streams 250.00											
System Flow Demand 1956.47			Total Water Required (Including Hose Allowance) 1956.47								
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 19.00 between nodes 640 and 638											
Maximum Velocity Under Ground 11.35 between nodes 224 and 7											
Volume capacity of Wet Pipes 34293.96gal			Volume capacity of Dry Pipes								
Supplies											
Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@	Flow (gpm)	Available (psi)	@	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply		97.000	88.000		1900.00	87.499		1956.47	80.319	7.179
4	Pump		84.000	60.000		2000.00	131.324		1956.47	124.145	7.179
Pumps: Static = Churn (Pressure @ Zero Flow)											
Contractor											
Contractor Number 21		Contact Name Jay Colbert				Contact Title					
Name of Contractor: F.E. Moran Fire Protection Inc.				Phone 913.242.0057				Extension			
Address 1 16815 College Blvd.				FAX							
Address 2				E-mail jay.colbert@femoran.com							
Address 3 Lenexa, KS 66219				Web-Site femoranfp.com							



Water Supply at Node 1



Hydraulic Graph

Water Supply at Node 1

Static Pressure

97.000

Residual Pressure

88.000 @ 1900.00

Available Pressure at System Demand

87.499 @ 1956.47

Required Pressure at System Demand

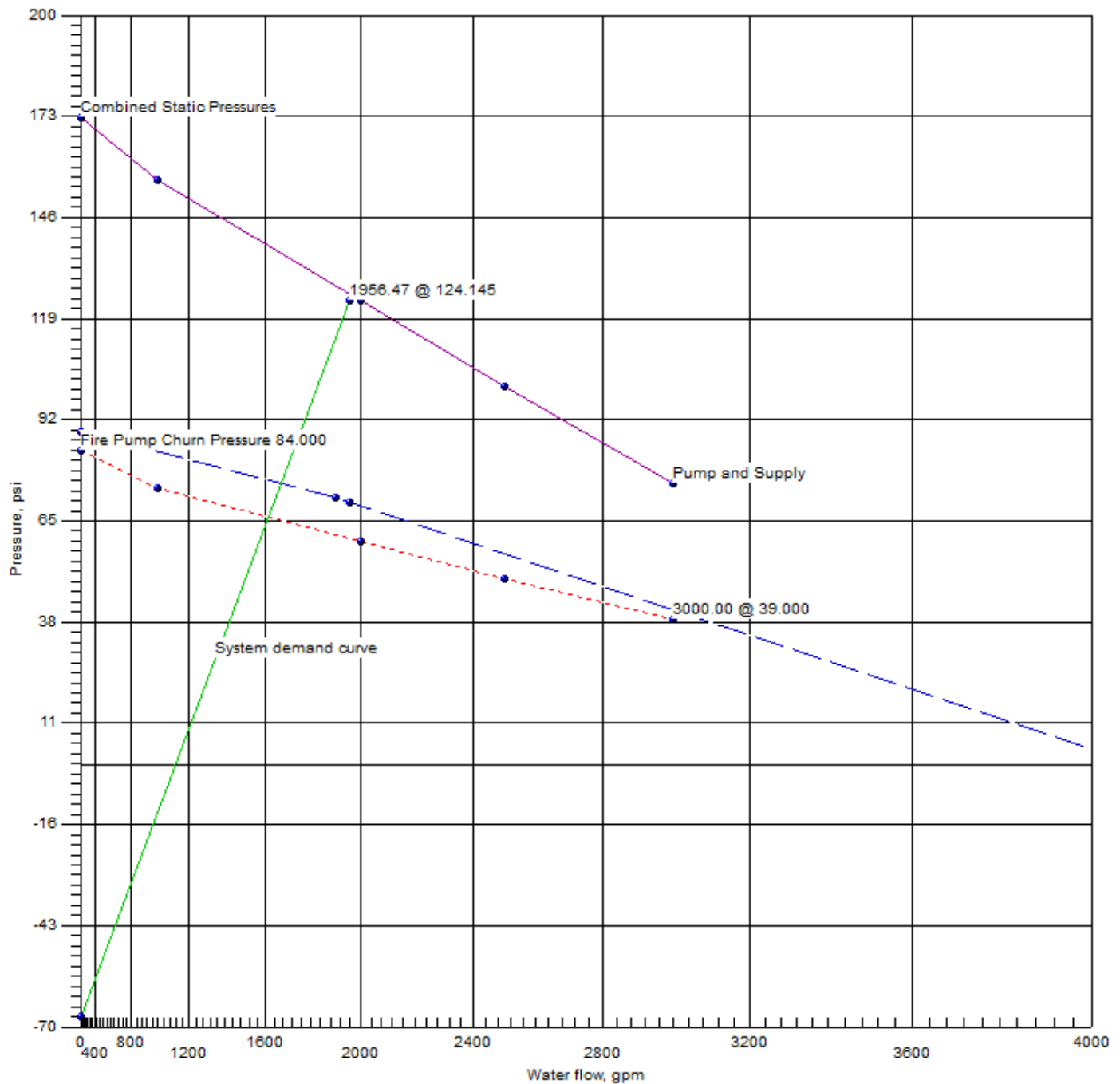
80.319 @ 1956.47

Required Pressure at System Demand (Including Hose Allowance at Source)

80.319 @ 1956.47



Pump at Node 4



Hydraulic Graph
Pump at Node 4

Static + Churn Pressure
173.256
Fire Pump Churn Pressure
84.000

Fire Pump Rating
60.000 @ 2000.00

Residual: Pressure
60.773 @ 1956.47
Available Pressure at System Demand
131.324 @ 1956.47
Required Pressure at System Demand
124.145 @ 1956.47



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: Remote Area 06

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Hydrant	52	250.00	250.00	250	116.086		
⇒ Sprinkler	6111	141.67	141.67	22.4	40.000		
Sprinkler	6113	142.41	141.67	22.4	40.420		
Sprinkler	6115	141.67	141.67	22.4	40.000		
Sprinkler	6117	142.46	141.67	22.4	40.449		
Sprinkler	6119	141.70	141.67	22.4	40.018		
Sprinkler	6121	142.44	141.67	22.4	40.436		
Sprinkler	6123	141.70	141.67	22.4	40.019		
Sprinkler	6125	142.50	141.67	22.4	40.471		
Sprinkler	6127	142.09	141.67	22.4	40.238		
Sprinkler	6129	142.81	141.67	22.4	40.648		
Sprinkler	6131	142.09	141.67	22.4	40.239		
Sprinkler	6133	142.91	141.67	22.4	40.705		

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: Remote Area 06

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	80.319	1956.47
52	1'-0	Hyd(-1.000)	116.086	250.00
6111	40'-0	Spr(-40.000)	40.000	141.67
6113	40'-0	Spr(-40.420)	40.420	142.41
6115	40'-0	Spr(-40.000)	40.000	141.67
6117	40'-0	Spr(-40.449)	40.449	142.46
6119	40'-2½	Spr(-40.018)	40.018	141.70
6121	40'-2½	Spr(-40.436)	40.436	142.44
6123	40'-2½	Spr(-40.019)	40.019	141.70
6125	40'-2½	Spr(-40.471)	40.471	142.50
6127	40'-5	Spr(-40.238)	40.238	142.09
6129	40'-5	Spr(-40.648)	40.648	142.81
6131	40'-5	Spr(-40.239)	40.239	142.09
6133	40'-5	Spr(-40.705)	40.705	142.91
2	1'-9	T(65'-4½)	63.858	
3	1'-9	P1, Pump Inlet	63.372	
4	1'-9	P2(-60.886)	124.145	
5	1'-9		124.145	
6	6'-8½		119.585	
7	-8'-0	T(59'-4½)	123.956	
8	-8'-0	T(59'-4½)	120.113	
9	-8'-0	T(47'-3½)	120.149	
10	-8'-0	T(59'-4½)	121.009	
11	-8'-0	T(47'-3½)	121.207	
12	-8'-0	T(59'-4½)	121.286	
13	-8'-0	T(47'-3½)	122.145	
14	-8'-0	T(59'-4½)	122.299	
15	-8'-0	T(47'-3½)	123.009	
16	-8'-0	T(59'-4½)	123.127	
17	-8'-0	T(59'-4½)	123.404	
54	1'-0	Hyd	1.000	
55	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
224	1'-0		121.905	
309	-8'-0	E(35'-1)	77.813	
600	39'-1	PO(18'-8½)	67.867	
602	39'-3½	PO(18'-8½)	67.803	
604	39'-6	PO(18'-8½)	67.810	
606	39'-8½	PO(18'-8½)	67.923	
608	39'-11	PO(18'-8½)	68.078	
610	40'-1½	PO(18'-8½)	68.272	
612	40'-4	PO(18'-8½)	68.504	
614	40'-6½	PO(18'-8½)	68.773	
616	40'-9	PO(18'-8½)	69.079	
618	40'-11½	PO(18'-8½)	69.424	
620	40'-11½	PO(18'-8½)	69.900	
622	40'-8	PO(18'-8½)	70.541	
624	40'-5	PO(18'-8½)	71.230	
626	40'-1½	PO(18'-8½)	71.974	
628	39'-10	PO(18'-8½)	72.779	
630	5'-4		110.505	
632	1'-0		113.913	
634	39'-2	PO(18'-8½)	60.112	
636	39'-4½	PO(18'-8½)	60.206	
638	39'-7	PO(18'-8½)	60.780	
640	39'-9½	PO(18'-8½)	62.106	
642	40'-0	PO(18'-8½)	63.179	
644	40'-2½	PO(18'-8½)	64.041	
646	40'-5	PO(18'-8½)	64.734	
648	40'-7½	PO(18'-8½)	65.283	
650	40'-10	PO(18'-8½)	65.707	
652	41'-0½	PO(18'-8½)	66.019	



Node Analysis

Job Number: 212189000
Report Description: Remote Area 06

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
654	41'-0½	PO(18'-8½)	66.326	
656	40'-2½	PO(18'-8½)	67.096	
658	39'-11	PO(18'-8½)	67.236	
660	40'-9	PO(18'-8½)	66.658	
662	40'-6	PO(18'-8½)	66.910	



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 06

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
BL	2.7050	139.16	7.77	120		0.046719	9'-0"	Pf 0.420
6111	40'-0"	141.67	22.4	40.000		Sprinkler		Pe
6113	40'-0"			40.420			9'-0"	Pv
BL	2.7050	281.57	15.72	120		0.172083	119'-9"	Pf 27.049
6113	40'-0"	142.41	22.4	40.420		Sprinkler,	37'-5"	Pe 0.397
600	39'-1"			67.867		2PO(18'-8½")	157'-2"	Pv
CM	6.3570	281.57	2.85	120		0.002683	10'-0"	Pf 0.027
600	39'-1"			67.867				Pe -0.090
602	39'-3½"			67.803			10'-0"	Pv
CM	6.3570	562.70	5.69	120		0.009657	10'-0"	Pf 0.097
602	39'-3½"	281.13		67.803		Flow (q) from Route 3		Pe -0.090
604	39'-6"			67.810			10'-0"	Pv
CM	6.3570	842.66	8.52	120		0.020383	10'-0"	Pf 0.204
604	39'-6"	279.97		67.810		Flow (q) from Route 5		Pe -0.090
606	39'-8½"			67.923			10'-0"	Pv
CM	6.3570	930.04	9.40	120		0.024465	10'-0"	Pf 0.245
606	39'-8½"	87.37		67.923		Flow (q) from Route 2		Pe -0.090
608	39'-11"			68.078			10'-0"	Pv
CM	6.3570	1009.61	10.21	120		0.028477	10'-0"	Pf 0.285
608	39'-11"	79.57		68.078		Flow (q) from Route 9		Pe -0.090
610	40'-1½"			68.272			10'-0"	Pv
CM	6.3570	1079.21	10.91	120		0.032215	10'-0"	Pf 0.322
610	40'-1½"	69.60		68.272		Flow (q) from Route 15		Pe -0.090
612	40'-4"			68.504			10'-0"	Pv
CM	6.3570	1144.57	11.57	120		0.035917	10'-0"	Pf 0.359
612	40'-4"	65.35		68.504		Flow (q) from Route 19		Pe -0.090
614	40'-6½"			68.773			10'-0"	Pv
CM	6.3570	1207.22	12.20	120		0.039639	10'-0"	Pf 0.396
614	40'-6½"	62.66		68.773		Flow (q) from Route 18		Pe -0.090
616	40'-9"			69.079			10'-0"	Pv
CM	6.3570	1268.72	12.82	120		0.043455	10'-0"	Pf 0.435
616	40'-9"	61.50		69.079		Flow (q) from Route 17		Pe -0.090
618	40'-11½"			69.424			10'-0"	Pv
CM	6.3570	1330.53	13.45	120		0.047453	9'-11½"	Pf 0.473
618	40'-11½"	61.81		69.424		Flow (q) from Route 16		Pe 0.004
620	40'-11½"			69.900			9'-11½"	Pv
CM	6.3570	1397.54	14.13	120		0.051969	10'-0"	Pf 0.520
620	40'-11½"	67.01		69.900		Flow (q) from Route 10		Pe 0.121
622	40'-8"			70.541			10'-0"	Pv
CM	6.3570	1467.65	14.84	120		0.056894	10'-0"	Pf 0.569
622	40'-8"	70.11		70.541		Flow (q) from Route 11		Pe 0.121
624	40'-5"			71.230			10'-0"	Pv
CM	6.3570	1541.97	15.59	120		0.062338	10'-0"	Pf 0.624
624	40'-5"	74.31		71.230		Flow (q) from Route 12		Pe 0.121
626	40'-1½"			71.974			10'-0"	Pv
CM	6.3570	1621.36	16.39	120		0.068406	10'-0"	Pf 0.684
626	40'-1½"	79.39		71.974		Flow (q) from Route 13		Pe 0.121
628	39'-10"			72.779			10'-0"	Pv
CM	6.3570	1706.47	17.25	120		0.075197	214'-7"	Pf 22.755
628	39'-10"	85.11		72.779		Flow (q) from Route 14	88'-0"	Pe 14.971
630	5'-4"			110.505		5E(17'-7")	302'-7½"	Pv
DY	8.2490	1706.47	10.24	120		0.021143	1'-1"	Pf 1.538
630	5'-4"			110.505			71'-7½"	Pe 1.870
632	1'-0"			113.913		2f(-0.000), CV(52'-10), BV(18'-9½")	72'-8½"	Pv
UG	8.3900	1706.47	9.90	140		0.014637	67'-1½"	Pf 2.298
632	1'-0"			113.913			89'-11"	Pe 3.902
8	-8'-0"			120.113		E(30'-6½"), T(59'-4½")	157'-0"	Pv
UG	8.3900	1497.35	8.69	140		0.011493	275'-0"	Pf 3.843
8	-8'-0"			120.113			59'-4½"	Pe
7	-8'-0"			123.956		T(59'-4½")	334'-4½"	Pv
UG	8.3900	1956.47	11.35	140		0.018850	67'-8"	Pf 1.851
7	-8'-0"	459.12		123.956		Flow (q) from Route 7	30'-6½"	Pe -3.902
224	1'-0"			121.905		E(30'-6½")	98'-2½"	Pv
FR	8.2490	1956.47	11.75	120		0.027227	5'-8½"	Pf 0.156
224	1'-0"			121.905				Pe -2.476
6	6'-8½"			119.585			5'-8½"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 06

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
DY	10.3700	1956.47	7.43	120		0.008934	13'-10½"	Pf 2.409
6	6'-8½"			119.585			255'-9"	Pe 2.151
5	1'-9"			124.145		4E(26'-0"), T(48'-5½"), BV(21'-3½"), Tr(17'-0"), CV(65'-0")	269'-8"	Pv
DY	7.9810	1956.47	12.55	120		0.031979	0'-0"	Pf 0.000
5	1'-9"			124.145				Pe 0.000
4	1'-9"			124.145			0'-0"	Pv
Pump		Velocity						
4		1956.47		124.145		Rating: 60.000 @ 2000.00		
3		Q=1956.47	7.39	63.372		Fire Pump Churn Pressure: 84.000		
DY	10.4000	1956.47	7.39	140		0.006623	0'-0"	Pf 0.486
3	1'-9"			63.372			73'-4"	Pe 0.000
2	1'-9"			63.858		GV(7'-11½"), T(65'-4½")	73'-4"	Pv
UG	10.4000	1956.47	7.39	140		0.006623	696'-3½"	Pf 9.728
2	1'-9"			63.858			175'-4½"	Pe 4.227
309	-8'-0"			77.813		4E(35'-1"), 2EE(17'-6½"), BFP(-3.948)	871'-8"	Pv
UG	12.4600	1956.47	5.15	140		0.002747	360'-2½"	Pf 0.990
309	-8'-0"			77.813				Pe 1.517
1	-11'-6"			80.319		Water Supply	360'-2½"	Pv
		0.00				Hose Allowance At Source		
1		1956.47						
Route 2								
BL	2.7050	2.51	0.14	120		0.000028	9'-0"	Pf 0.000
6111	40'-0"	141.67	22.4	40.000		Sprinkler		Pe
6115	40'-0"			40.000			9'-0"	Pv
BL	2.7050	144.18	8.05	120		0.049886	9'-0"	Pf 0.449
6115	40'-0"	141.67	22.4	40.000		Sprinkler		Pe
6117	40'-0"			40.449			9'-0"	Pv
BL	2.7050	286.64	16.00	120		0.177863	71'-1"	Pf 19.302
6117	40'-0"	142.46	22.4	40.449		Sprinkler,	37'-5"	Pe 0.361
634	39'-2"			60.112		2PO(18'-8½")	108'-6"	Pv
CM	4.3100	286.64	6.30	120		0.018401	10'-0"	Pf 0.184
634	39'-2"			60.112				Pe -0.090
636	39'-4½"			60.206			10'-0"	Pv
CM	4.3100	573.87	12.62	120		0.066459	10'-0"	Pf 0.665
636	39'-4½"	287.22		60.206		Flow (q) from Route 4		Pe -0.090
638	39'-7"			60.780			10'-0"	Pv
CM	4.3100	863.81	19.00	120		0.141619	10'-0"	Pf 1.416
638	39'-7"	289.94		60.780		Flow (q) from Route 6		Pe -0.090
640	39'-9½"			62.106			10'-0"	Pv
RN	2.7050	87.37	4.88	120		0.019749	217'-10"	Pf 5.781
640	39'-9½"			62.106		PO(18'-8½")	74'-10½"	Pe 0.036
606	39'-8½"			67.923		3PO(18'-8½")	292'-8½"	Pv
Route 3								
BL	2.7050	138.68	7.74	120		0.046425	9'-0"	Pf 0.418
6119	40'-2½"	141.70	22.4	40.018		Sprinkler		Pe
6121	40'-2½"			40.436			9'-0"	Pv
BL	2.7050	281.13	15.69	120		0.171579	119'-9"	Pf 26.970
6121	40'-2½"	142.44	22.4	40.436		Sprinkler,	37'-5"	Pe 0.397
602	39'-3½"			67.803		2PO(18'-8½")	157'-2"	Pv
Route 4								
BL	2.7050	3.02	0.17	120		0.000039	9'-0"	Pf 0.000
6119	40'-2½"	141.70	22.4	40.018		Sprinkler		Pe
6123	40'-2½"			40.019			9'-0"	Pv
BL	2.7050	144.72	8.08	120		0.050232	9'-0"	Pf 0.452
6123	40'-2½"	141.70	22.4	40.019		Sprinkler		Pe
6125	40'-2½"			40.471			9'-0"	Pv
BL	2.7050	287.22	16.04	120		0.178527	71'-1"	Pf 19.374
6125	40'-2½"	142.50	22.4	40.471		Sprinkler,	37'-5"	Pe 0.361
636	39'-4½"			60.206		2PO(18'-8½")	108'-6"	Pv
Route 5								
BL	2.7050	137.16	7.66	120		0.045482	9'-0"	Pf 0.409
6127	40'-5"	142.09	22.4	40.238		Sprinkler		Pe
6129	40'-5"			40.648			9'-0"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 06

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
BL	2.7050	279.97	15.63	120		0.170274	119'-9"	Pf 26.765
6129	40'-5"	142.81	22.4	40.648		Sprinkler,	37'-5"	Pe 0.397
604	39'-6"			67.810		2PO(18'-8½")	157'-2"	Pv
Route 6								
BL	2.7050	4.94	0.28	120		0.000097	9'-0"	Pf 0.001
6127	40'-5"	142.09	22.4	40.238		Sprinkler	9'-0"	Pe
6131	40'-5"			40.239			9'-0"	Pv
BL	2.7050	147.03	8.21	120		0.051724	9'-0"	Pf 0.466
6131	40'-5"	142.09	22.4	40.239		Sprinkler	9'-0"	Pe
6133	40'-5"			40.705			9'-0"	Pv
BL	2.7050	289.94	16.19	120		0.181665	71'-1"	Pf 19.714
6133	40'-5"	142.91	22.4	40.705		Sprinkler,	37'-5"	Pe 0.361
638	39'-7"			60.780		2PO(18'-8½")	108'-6"	Pv
Route 7								
UG	6.2800	250.00	2.59	140		0.001718	20'-0"	Pf 0.162
52	1'-0"	250.00		116.086		Hydrant,	74'-1"	Pe 3.902
9	-8'-0"			120.149		E(22'-1), GV(4'-8½"), T(47'-3½")	94'-1"	Pv
UG	8.3900	459.12	2.66	140		0.001290	635'-11½"	Pf 0.860
9	-8'-0"	209.12		120.149		Flow (q) from Route 8	30'-6½"	Pe
10	-8'-0"			121.009		E(30'-6½")	666'-6"	Pv
UG	8.3900	459.12	2.66	140		0.001290	153'-8"	Pf 0.198
10	-8'-0"			121.009			153'-8"	Pe
11	-8'-0"			121.207			153'-8"	Pv
UG	8.3900	459.12	2.66	140		0.001290	61'-1½"	Pf 0.079
11	-8'-0"			121.207			61'-1½"	Pe
12	-8'-0"			121.286			61'-1½"	Pv
UG	8.3900	459.12	2.66	140		0.001290	635'-9"	Pf 0.860
12	-8'-0"			121.286			30'-6½"	Pe
13	-8'-0"			122.145		E(30'-6½")	666'-3½"	Pv
UG	8.3900	459.12	2.66	140		0.001290	119'-3"	Pf 0.154
13	-8'-0"			122.145			119'-3"	Pe
14	-8'-0"			122.299			119'-3"	Pv
UG	8.3900	459.12	2.66	140		0.001290	519'-3½"	Pf 0.709
14	-8'-0"			122.299			30'-6½"	Pe
15	-8'-0"			123.009		E(30'-6½")	549'-10"	Pv
UG	8.3900	459.12	2.66	140		0.001290	91'-11½"	Pf 0.119
15	-8'-0"			123.009			91'-11½"	Pe
16	-8'-0"			123.127			91'-11½"	Pv
UG	8.3900	459.12	2.66	140		0.001290	214'-9"	Pf 0.277
16	-8'-0"			123.127			214'-9"	Pe
17	-8'-0"			123.404			214'-9"	Pv
UG	8.3900	459.12	2.66	140		0.001290	337'-8"	Pf 0.552
17	-8'-0"			123.404			89'-11"	Pe
7	-8'-0"			123.956		E(30'-6½"), T(59'-4½")	427'-7"	Pv
Route 8								
UG	8.3900	209.12	1.21	140		0.000301	118'-2"	Pf 0.036
8	-8'-0"	1497.35		120.113		Flow (q) from Route 1	118'-2"	Pe
9	-8'-0"			120.149			118'-2"	Pv
Route 9								
CM	4.3100	776.44	17.07	120		0.116264	10'-0"	Pf 1.163
640	39'-9½"	87.37		62.106		Flow (q) from Route 2	10'-0"	Pe -0.090
642	40'-0"			63.179			10'-0"	Pv
RN	2.7050	79.57	4.44	120		0.016612	217'-10"	Pf 4.863
642	40'-0"			63.179		PO(18'-8½")	74'-10½"	Pe 0.036
608	39'-11"			68.078		3PO(18'-8½")	292'-8½"	Pv
Route 10								
CM	4.3100	696.86	15.32	120		0.095185	10'-0"	Pf 0.952
642	40'-0"	79.57		63.179		Flow (q) from Route 9	10'-0"	Pe -0.090
644	40'-2½"			64.041			10'-0"	Pv
CM	4.3100	627.26	13.79	120		0.078347	10'-0"	Pf 0.784
644	40'-2½"			64.041			10'-0"	Pe -0.090
646	40'-5"			64.734			10'-0"	Pv
CM	4.3100	561.91	12.36	120		0.063918	10'-0"	Pf 0.639
646	40'-5"			64.734			10'-0"	Pe -0.090
648	40'-7½"			65.283			10'-0"	Pv
CM	4.3100	499.25	10.98	120		0.051361	10'-0"	Pf 0.514
648	40'-7½"			65.283			10'-0"	Pe -0.090
650	40'-10"			65.707			10'-0"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 06

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
CM	4.3100	437.75	9.63	120		0.040274	10'-0"	Pf 0.403
650	40'-10"			65.707				Pe -0.090
652	41'-0½"			66.019			10'-0"	Pv
CM	4.3100	375.94	8.27	120		0.030389	9'-11½"	Pf 0.303
652	41'-0½"			66.019				Pe 0.004
654	41'-0½"			66.326			9'-11½"	Pv
RN	2.7050	67.01	3.74	120		0.012088	217'-10"	Pf 3.538
654	41'-0½"			66.326		PO(18'-8½")	74'-10½"	Pe 0.036
620	40'-11½"			69.900		3PO(18'-8½")	292'-8½"	Pv
Route 11								
CM	4.3100	308.93	6.79	120		0.021134	10'-0"	Pf 0.211
654	41'-0½"	67.01		66.326		Flow (q) from Route 10		Pe 0.121
660	40'-9"			66.658			10'-0"	Pv
RN	2.7050	70.11	3.91	120		0.013142	217'-10"	Pf 3.847
660	40'-9"			66.658		PO(18'-8½")	74'-10½"	Pe 0.036
622	40'-8"			70.541		3PO(18'-8½")	292'-8½"	Pv
Route 12								
CM	4.3100	238.82	5.25	120		0.013128	10'-0"	Pf 0.131
660	40'-9"	70.11		66.658		Flow (q) from Route 11		Pe 0.121
662	40'-6"			66.910			10'-0"	Pv
RN	2.7050	74.31	4.15	120		0.014638	217'-10"	Pf 4.285
662	40'-6"			66.910		PO(18'-8½")	74'-10½"	Pe 0.036
624	40'-5"			71.230		3PO(18'-8½")	292'-8½"	Pv
Route 13								
CM	4.3100	164.51	3.62	120		0.006587	10'-0"	Pf 0.066
662	40'-6"	74.31		66.910		Flow (q) from Route 12		Pe 0.121
656	40'-2½"			67.096			10'-0"	Pv
RN	2.7050	79.39	4.43	120		0.016543	217'-10"	Pf 4.842
656	40'-2½"			67.096		PO(18'-8½")	74'-10½"	Pe 0.036
626	40'-1½"			71.974		3PO(18'-8½")	292'-8½"	Pv
Route 14								
CM	4.3100	85.11	1.87	120		0.001946	10'-0"	Pf 0.019
656	40'-2½"	79.39		67.096		Flow (q) from Route 13		Pe 0.121
658	39'-11"			67.236			10'-0"	Pv
RN	2.7050	85.11	4.75	120		0.018814	217'-10"	Pf 5.507
658	39'-11"			67.236		PO(18'-8½")	74'-10½"	Pe 0.036
628	39'-10"			72.779		3PO(18'-8½")	292'-8½"	Pv
Route 15								
RN	2.7050	69.60	3.89	120		0.012967	221'-10"	Pf 4.195
644	40'-2½"			64.041		PO(18'-8½")	101'-8½"	Pe 0.036
610	40'-1½"			68.272		3PO(18'-8½"), 4fE(6'-8½")	323'-6½"	Pv
Route 16								
RN	2.7050	61.81	3.45	120		0.010411	221'-10"	Pf 3.368
652	41'-0½"			66.019		PO(18'-8½")	101'-8½"	Pe 0.036
618	40'-11½"			69.424		3PO(18'-8½"), 4fE(6'-8½")	323'-6½"	Pv
Route 17								
RN	2.7050	61.50	3.43	120		0.010313	221'-10"	Pf 3.337
650	40'-10"			65.707		PO(18'-8½")	101'-8½"	Pe 0.036
616	40'-9"			69.079		3PO(18'-8½"), 4fE(6'-8½")	323'-6½"	Pv
Route 18								
RN	2.7050	62.66	3.50	120		0.010675	221'-10"	Pf 3.454
648	40'-7½"			65.283		PO(18'-8½")	101'-8½"	Pe 0.036
614	40'-6½"			68.773		3PO(18'-8½"), 4fE(6'-8½")	323'-6½"	Pv
Route 19								
RN	2.7050	65.35	3.65	120		0.011541	221'-10"	Pf 3.734
646	40'-5"			64.734		PO(18'-8½")	101'-8½"	Pe 0.036
612	40'-4"			68.504		3PO(18'-8½"), 4fE(6'-8½")	323'-6½"	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)		C Value Multiplier				
$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$		Value Of C	100	130	140	150
		Multiplying Factor	0.713	1.16	1.33	1.51

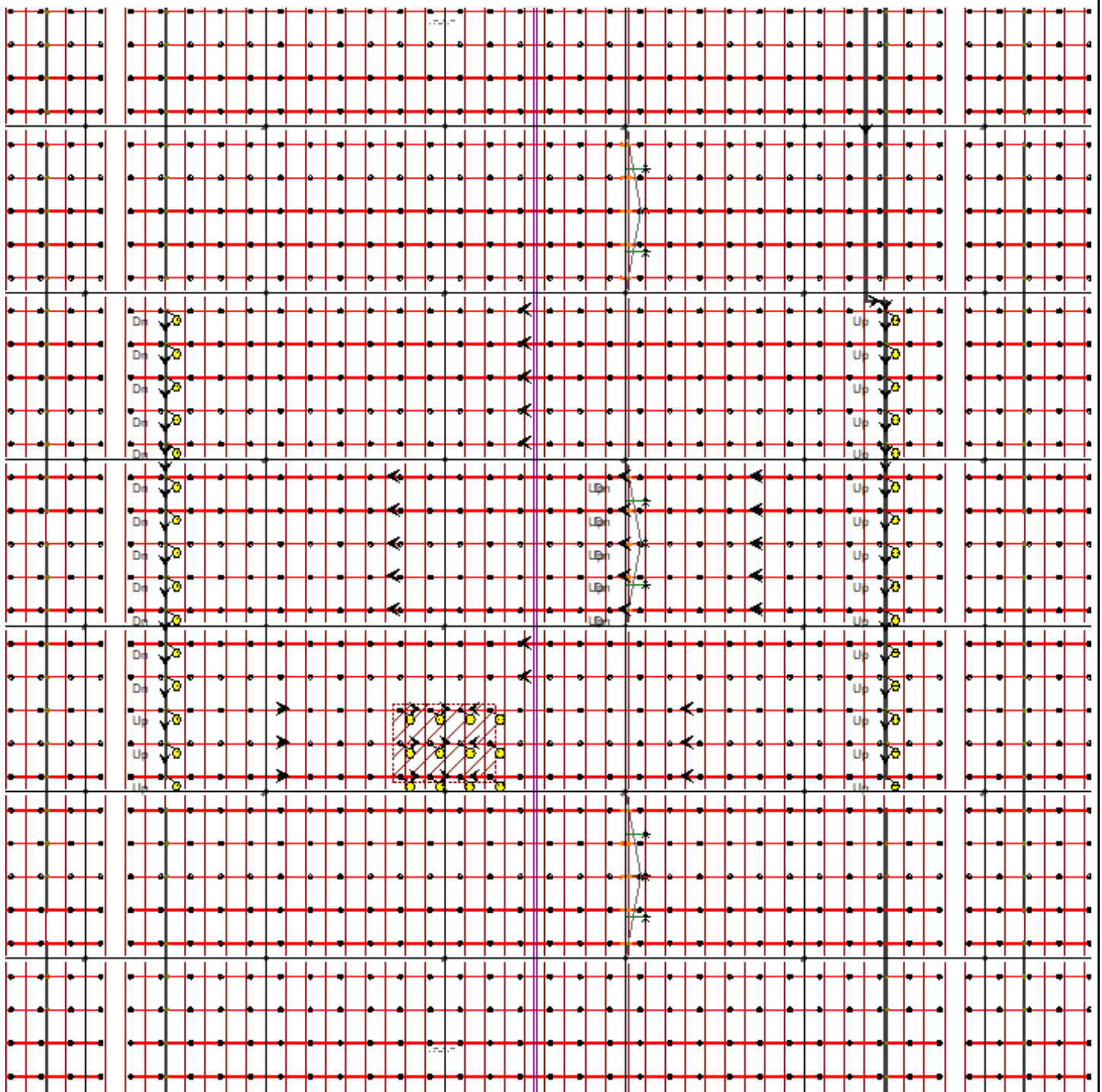


Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 06

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss		Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend	Units Legend		Fittings Legend	
AO Arm-Over	Diameter	Inch	ALV Alarm Valve	
BL Branch Line	Elevation	Foot	AngV Angle Valve	
CM Cross Main	Flow	gpm	b Bushing	
DN Drain	Discharge	gpm	BaIV Ball Valve	
DR Drop	Velocity	fps	BFP Backflow Preventer	
DY Dynamic	Pressure	psi	BV Butterfly Valve	
FM Feed Main	Length	Foot	C Cross Flow Turn 90°	
FR Feed Riser	Friction Loss	psi/Foot	cplg Coupling	
MS Miscellaneous	HWC	Hazen-Williams Constant	Cr Cross Run	
OR Outrigger	Pt	Total pressure at a point in a pipe	CV Check Valve	
RN Riser Nipple	Pn	Normal pressure at a point in a pipe	DeIV Deluge Valve	
SP Sprig	Pf	Pressure loss due to friction between points	DPV Dry Pipe Valve	
ST Stand Pipe	Pe	Pressure due to elevation difference between indicated points	E 90° Elbow	
UG Underground	Pv	Velocity pressure at a point in a pipe	EE 45° Elbow	
			Ee1 11¼° Elbow	
			Ee2 22½° Elbow	
			f Flow Device	
			fd Flex Drop	
			FDC Fire Department Connection	
			fE 90° FireLock(TM) Elbow	
			fEE 45° FireLock(TM) Elbow	
			flg Flange	
			FN Floating Node	
			fT FireLock(TM) Tee	
			g Gauge	
			GloV Globe Valve	
			GV Gate Valve	
			Ho Hose	
			Hose Hose	
			HV Hose Valve	
			Hyd Hydrant	
			LtE Long Turn Elbow	
			mecT Mechanical Tee	
			Noz Nozzle	
			P1 Pump In	
			P2 Pump Out	
			PIV Post Indicating Valve	
			PO Pipe Outlet	
			PrV Pressure Relief Valve	
			PRV Pressure Reducing Valve	
			red Reducer/Adapter	
			S Supply	
			sCV Swing Check Valve	
			SFx Seismic Flex	
			Spr Sprinkler	
			St Strainer	
			T Tee Flow Turn 90°	
			Tr Tee Run	
			U Union	
			WirF Wirsbo	
			WMV Water Meter Valve	
			Z Cap	





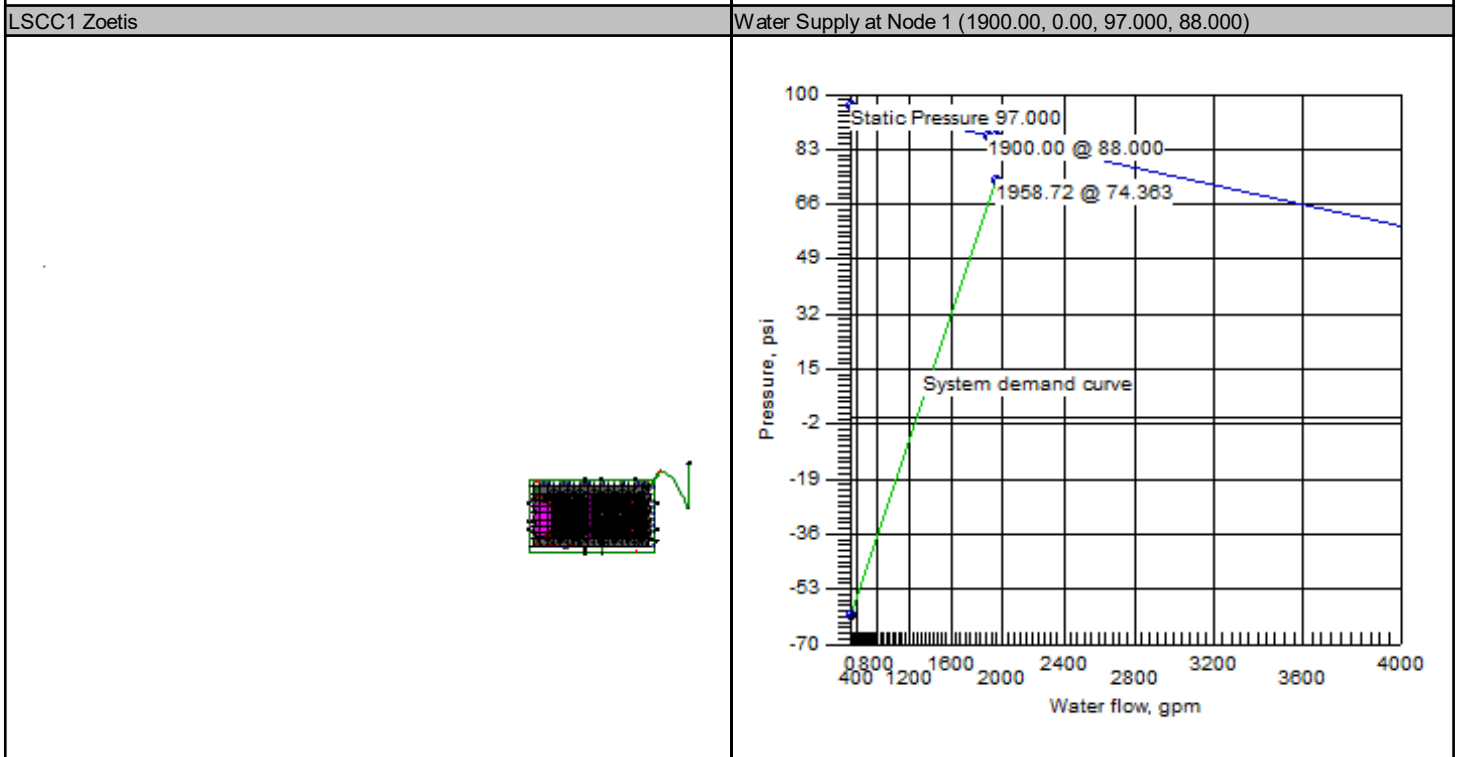
Hydraulic Overview

Job Number: 212189000
Report Description: Remote Area 07

Job		
Job Number 212189000	Design Engineer Jay Colbert	
Job Name: Lee's Summit Commerce Center	Phone 913.242.0057	FAX
Address 1 1120 NW Main St	State Certification/License Number	
Address 2	AHJ City of Lee's Summit	
Address 3 Lee's Summit, MO 64086	Job Site/Building Building A	

System	
Pressure 40.000	Area of Application NA
Most Demanding Sprinkler Data 22.4 K-Factor 141.67 at 40.000	Hose Streams 250.00
Coverage Per Sprinkler 100ft ²	Number Of Sprinklers Calculated 12 0
System Pressure Demand 74.363	System Flow Demand 1958.72
Total Demand 1958.72 @ 74.363	Pressure Result +13.116 (15.0%)

Supplies						Check Point Gauges			
<u>Node</u>	<u>Name</u>	<u>Flow(gpm)</u>	<u>Hose Flow(gpm)</u>	<u>Static(psi)</u>	<u>Residual(psi)</u>	<u>Identifier</u>	<u>Pressure(psi)</u>	<u>K-Factor(K)</u>	<u>Flow(gpm)</u>
1	Water Supply	1900.00		97.000	88.000	Pump Inlet	57.398	258.54	1958.72
4	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									





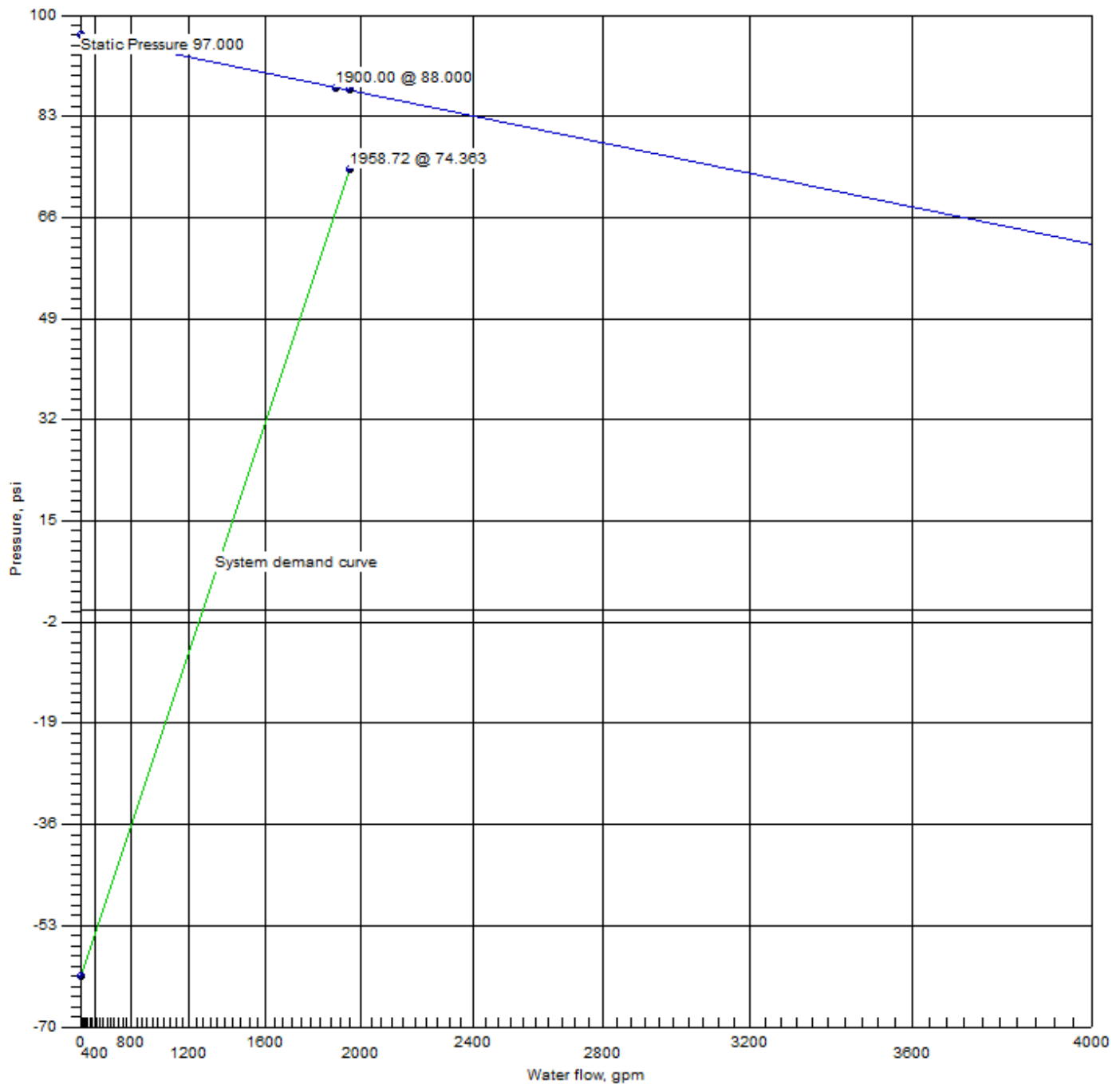
Hydraulic Summary

Job Number: 212189000
Report Description: Remote Area 07

Job											
Job Number 212189000				Design Engineer Jay Colbert							
Job Name: Lee's Summit Commerce Center				State Certification/License Number							
Address 1 1120 NW Main St				AHJ City of Lee's Summit							
Address 2				Job Site/Building Building A							
Address 3 Lee's Summit, MO 64086				Drawing Name LSCC1 Zoetis							
System				Remote Area(s)							
Most Demanding Sprinkler Data 22.4 K-Factor 141.67 at 40.000				Occupancy ESFR			Job Suffix				
Hose Allowance At Source 0.00				Pressure 40.000			Area of Application NA				
Additional Hose Supplies Node Hydrant At Node 55				Flow(gpm) 250.00		Number Of Sprinklers Calculated 12		Number Of Nozzles Calculated 0		Coverage Per Sprinkler 100ft ²	
				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 74.312 Right: 74.304							
Total Hose Streams 250.00											
System Flow Demand 1958.72		Total Water Required (Including Hose Allowance) 1958.72									
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 18.92 between nodes 740 and 738											
Maximum Velocity Under Ground 11.37 between nodes 224 and 7											
Volume capacity of Wet Pipes 34293.96gal		Volume capacity of Dry Pipes									
Supplies											
Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@	Flow (gpm)	Available (psi)	@	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply		97.000	88.000		1900.00	87.479		1958.72	74.363	13.116
4	Pump		84.000	60.000		2000.00	131.247		1958.72	118.131	13.116
Pumps: Static = Churn (Pressure @ Zero Flow)											
Contractor											
Contractor Number 21		Contact Name Jay Colbert				Contact Title					
Name of Contractor: F.E. Moran Fire Protection Inc.				Phone 913.242.0057				Extension			
Address 1 16815 College Blvd.				FAX							
Address 2				E-mail jay.colbert@femoran.com							
Address 3 Lenexa, KS 66219				Web-Site femoranfp.com							



Water Supply at Node 1



Hydraulic Graph

Water Supply at Node 1

Static: Pressure

97.000

Residual: Pressure

88.000 @ 1900.00

Available Pressure at System Demand

87.479 @ 1958.72

Required Pressure at System Demand

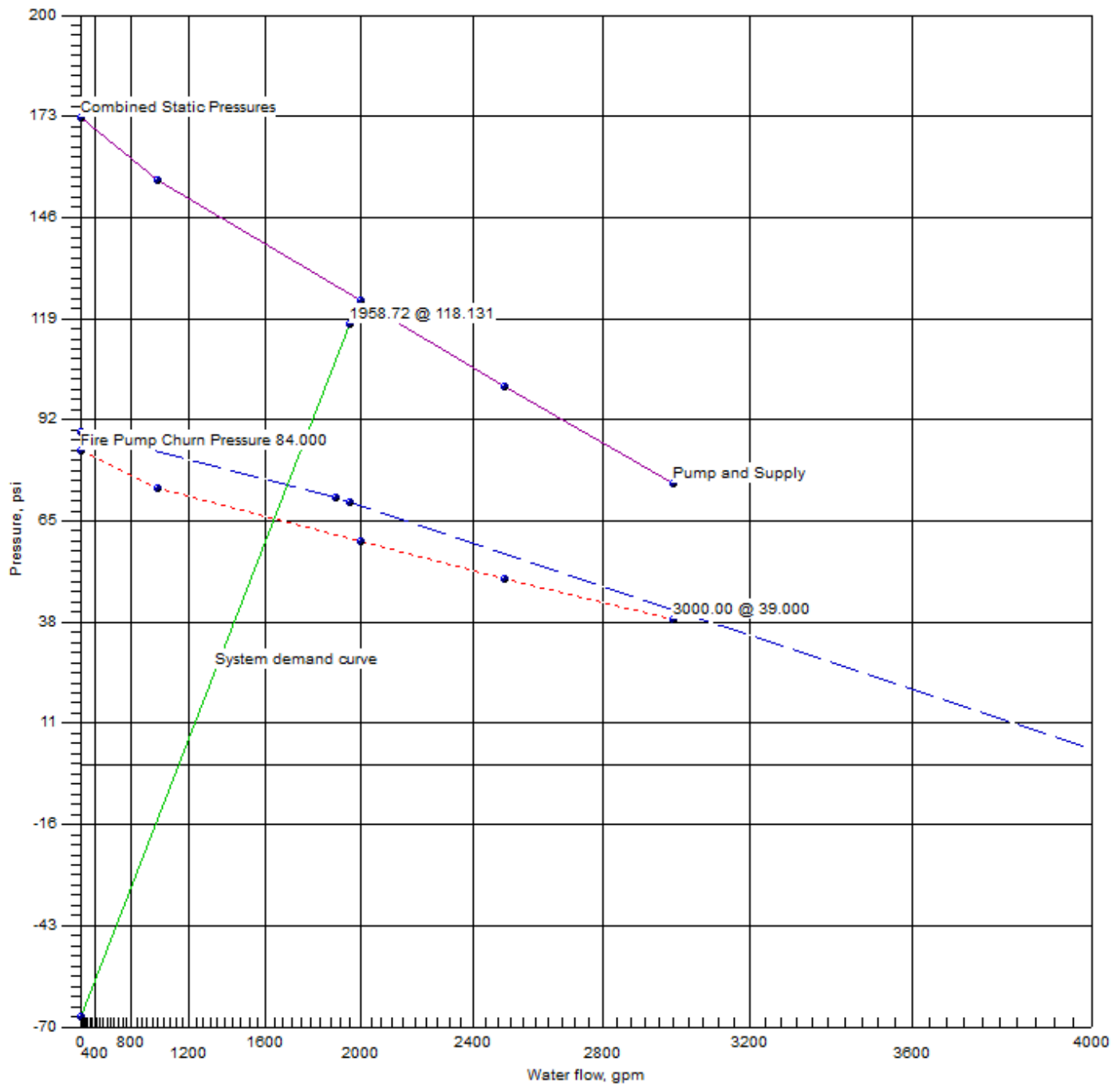
74.363 @ 1958.72

Required Pressure at System Demand (Including Hose Allowance at Source)

74.363 @ 1958.72



Pump at Node 4



Hydraulic Graph
Pump at Node 4

Static + Churn Pressure
173.256
Fire Pump Churn Pressure
84.000

Fire Pump Rating
60.000 @ 2000.00

Residual: Pressure
60.733 @ 1958.72
Available Pressure at System Demand
131.247 @ 1958.72
Required Pressure at System Demand
118.131 @ 1958.72



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: Remote Area 07

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Hydrant	55	250.00	250.00	250	105.726		
⇒ Sprinkler	7111	141.67	141.67	22.4	40.000		
Sprinkler	7113	142.43	141.67	22.4	40.428		
Sprinkler	7115	141.67	141.67	22.4	40.000		
Sprinkler	7117	142.45	141.67	22.4	40.441		
Sprinkler	7119	141.90	141.67	22.4	40.129		
Sprinkler	7121	142.65	141.67	22.4	40.555		
Sprinkler	7123	141.90	141.67	22.4	40.129		
Sprinkler	7125	142.68	141.67	22.4	40.574		
Sprinkler	7127	142.46	141.67	22.4	40.446		
Sprinkler	7129	143.20	141.67	22.4	40.866		
Sprinkler	7131	142.46	141.67	22.4	40.446		
Sprinkler	7133	143.26	141.67	22.4	40.905		

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: Remote Area 07

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	74.363	1958.72
55	1'-0	Hyd(-1.000)	105.726	250.00
7111	39'-9½	Spr(-40.000)	40.000	141.67
7113	39'-9½	Spr(-40.428)	40.428	142.43
7115	39'-9½	Spr(-40.000)	40.000	141.67
7117	39'-9½	Spr(-40.441)	40.441	142.45
7119	39'-7	Spr(-40.129)	40.129	141.90
7121	39'-7	Spr(-40.555)	40.555	142.65
7123	39'-7	Spr(-40.129)	40.129	141.90
7125	39'-7	Spr(-40.574)	40.574	142.68
7127	39'-4½	Spr(-40.446)	40.446	142.46
7129	39'-4½	Spr(-40.866)	40.866	143.20
7131	39'-4½	Spr(-40.446)	40.446	142.46
7133	39'-4½	Spr(-40.905)	40.905	143.26
2	1'-9	T(65'-4½)	57.885	
3	1'-9	P1, Pump Inlet	57.398	
4	1'-9	P2(-60.886)	118.131	
5	1'-9		118.131	
6	6'-8½		113.566	
7	-8'-0	T(59'-4½)	117.933	
8	-8'-0	T(59'-4½)	116.571	
9	-8'-0	T(47'-3½)	116.090	
10	-8'-0	T(59'-4½)	113.376	
11	-8'-0	T(47'-3½)	112.751	
12	-8'-0	T(59'-4½)	112.502	
13	-8'-0	T(47'-3½)	109.789	
14	-8'-0	T(59'-4½)	109.533	
15	-8'-0	T(47'-3½)	113.130	
16	-8'-0	T(59'-4½)	113.731	
17	-8'-0	T(59'-4½)	115.136	
52	1'-0	Hyd	1.000	
54	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
224	1'-0		115.886	
309	-8'-0	E(35'-1)	71.854	
700	38'-11½	PO(18'-8½)	70.299	
702	38'-9	PO(18'-8½)	70.416	
704	38'-6½	PO(18'-8½)	70.604	
706	38'-4	PO(18'-8½)	70.901	
708	38'-1½	PO(18'-8½)	71.234	
710	37'-11	PO(18'-8½)	71.604	
712	37'-8½	PO(18'-8½)	72.009	
714	37'-6	PO(18'-8½)	72.449	
716	37'-3½	PO(18'-8½)	72.924	
718	37'-1	PO(18'-8½)	73.434	
720	37'-0	PO(18'-8½)	73.931	
722	37'-0	PO(18'-8½)	74.425	
724	37'-0	PO(18'-8½)	74.960	
726	37'-0	PO(18'-8½)	75.541	
728	37'-0	PO(18'-8½)	76.173	
730	37'-0	PO(18'-8½)	76.862	
732	1'-2½		103.257	
734	38'-11½	PO(18'-8½)	63.104	
736	38'-9	PO(18'-8½)	63.377	
738	38'-6½	PO(18'-8½)	64.127	
740	38'-4	PO(18'-8½)	65.624	
742	38'-1½	PO(18'-8½)	66.892	
744	37'-11	PO(18'-8½)	67.970	
746	37'-0	PO(18'-8½)	71.228	
748	37'-0	PO(18'-8½)	71.493	
750	37'-0	PO(18'-8½)	71.679	
752	37'-0	PO(18'-8½)	71.797	



Node Analysis

Job Number: 212189000
Report Description: Remote Area 07

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
754	37'-0	PO(18'-8½)	71.856	
756	37'-0	PO(18'-8½)	71.873	
758	37'-8½	PO(18'-8½)	68.880	
760	37'-6	PO(18'-8½)	69.649	
762	37'-3½	PO(18'-8½)	70.295	
764	37'-1	PO(18'-8½)	70.834	



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 07

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
BL	2.7050	140.53	7.85	120		0.047577	9'-0	Pf 0.428
7111	39'-9½	141.67	22.4	40.000		Sprinkler		Pe
7113	39'-9½			40.428			9'-0	Pv
BL	2.7050	282.96	15.80	120		0.173657	105'-8	Pf 29.510
7113	39'-9½	142.43	22.4	40.428		Sprinkler,	64'-3	Pe 0.361
700	38'-11½			70.299		4fE(6'-8½), 2PO(18'-8½)	169'-11	Pv
CM	6.3570	282.96	2.86	120		0.002707	10'-0	Pf 0.027
700	38'-11½			70.299				Pe 0.090
702	38'-9			70.416			10'-0	Pv
CM	6.3570	565.87	5.72	120		0.009758	10'-0	Pf 0.098
702	38'-9	282.91		70.416		Flow (q) from Route 3		Pe 0.090
704	38'-6½			70.604			10'-0	Pv
CM	6.3570	848.15	8.57	120		0.020629	10'-0	Pf 0.206
704	38'-6½	282.27		70.604		Flow (q) from Route 5		Pe 0.090
706	38'-4			70.901			10'-0	Pv
CM	6.3570	926.95	9.37	120		0.024315	10'-0	Pf 0.243
706	38'-4	78.80		70.901		Flow (q) from Route 9		Pe 0.090
708	38'-1½			71.234			10'-0	Pv
CM	6.3570	997.87	10.09	120		0.027868	10'-0	Pf 0.279
708	38'-1½	70.92		71.234		Flow (q) from Route 16		Pe 0.090
710	37'-11			71.604			10'-0	Pv
CM	6.3570	1065.87	10.77	120		0.031482	10'-0	Pf 0.315
710	37'-11	67.99		71.604		Flow (q) from Route 2		Pe 0.090
712	37'-8½			72.009			10'-0	Pv
CM	6.3570	1128.58	11.41	120		0.034994	10'-0	Pf 0.350
712	37'-8½	62.71		72.009		Flow (q) from Route 17		Pe 0.090
714	37'-6			72.449			10'-0	Pv
CM	6.3570	1187.64	12.01	120		0.038457	10'-0	Pf 0.385
714	37'-6	59.06		72.449		Flow (q) from Route 18		Pe 0.090
716	37'-3½			72.924			10'-0	Pv
CM	6.3570	1244.72	12.58	120		0.041947	10'-0	Pf 0.420
716	37'-3½	57.08		72.924		Flow (q) from Route 19		Pe 0.090
718	37'-1			73.434			10'-0	Pv
CM	6.3570	1301.46	13.16	120		0.045552	10'-0	Pf 0.456
718	37'-1	56.74		73.434		Flow (q) from Route 20		Pe 0.041
720	37'-0			73.931			10'-0	Pv
CM	6.3570	1359.40	13.74	120		0.049375	10'-0	Pf 0.494
720	37'-0	57.95		73.931		Flow (q) from Route 10		Pe
722	37'-0			74.425			10'-0	Pv
CM	6.3570	1419.95	14.35	120		0.053520	10'-0	Pf 0.535
722	37'-0	60.54		74.425		Flow (q) from Route 11		Pe
724	37'-0			74.960			10'-0	Pv
CM	6.3570	1484.29	15.00	120		0.058093	10'-0	Pf 0.581
724	37'-0	64.34		74.960		Flow (q) from Route 12		Pe
726	37'-0			75.541			10'-0	Pv
CM	6.3570	1553.39	15.70	120		0.063195	10'-0	Pf 0.632
726	37'-0	69.10		75.541		Flow (q) from Route 13		Pe
728	37'-0			76.173			10'-0	Pv
CM	6.3570	1628.02	16.46	120		0.068926	10'-0	Pf 0.689
728	37'-0	74.63		76.173		Flow (q) from Route 14		Pe
730	37'-0			76.862			10'-0	Pv
CM	6.3570	1708.72	17.27	120		0.075380	56'-3½	Pf 10.878
730	37'-0	80.70		76.862		Flow (q) from Route 15	88'-0	Pe 15.517
732	1'-2½			103.257		2E(17'-7), 2f(-0.000), CV(40'-3), BV(12'-7)	144'-4	Pv
UG	8.3900	1708.72	9.92	140		0.014673	65'-8½	Pf 2.283
732	1'-2½			103.257			89'-11	Pe 3.992
14	-8'-0			109.533		E(30'-6½), T(59'-4½)	155'-7½	Pv
UG	8.3900	1104.15	6.41	140		0.006542	519'-3½	Pf 3.597
14	-8'-0			109.533			30'-6½	Pe
15	-8'-0			113.130		E(30'-6½)	549'-10	Pv
UG	8.3900	1104.15	6.41	140		0.006542	91'-11½	Pf 0.601
15	-8'-0			113.130				Pe
16	-8'-0			113.731			91'-11½	Pv
UG	8.3900	1104.15	6.41	140		0.006542	214'-9	Pf 1.405
16	-8'-0			113.731				Pe
17	-8'-0			115.136			214'-9	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 07

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
UG	8.3900	1104.15	6.41	140		0.006542	337'-8"	Pf 2.797
17	-8'-0"			115.136			89'-11"	Pe
7	-8'-0"			117.933		E(30'-6½"), T(59'-4½")	427'-7"	Pv
UG	8.3900	1958.72	11.37	140		0.018890	67'-8"	Pf 1.855
7	-8'-0"	854.56		117.933		Flow (q) from Route 7	30'-6½"	Pe -3.902
224	1'-0"			115.886		E(30'-6½")	98'-2½"	Pv
FR	8.2490	1958.72	11.76	120		0.027285	5'-8½"	Pf 0.156
224	1'-0"			115.886				Pe -2.476
6	6'-8½"			113.566			5'-8½"	Pv
DY	10.3700	1958.72	7.44	120		0.008953	13'-10½"	Pf 2.414
6	6'-8½"			113.566			255'-9"	Pe 2.151
5	1'-9"			118.131		4E(26'-0"), T(48'-5½"), BV(21'-3½"), Tr(17'-0"), CV(65'-0")	269'-8"	Pv
DY	7.9810	1958.72	12.56	120		0.032047	0'-0"	Pf 0.000
5	1'-9"			118.131				Pe 0.000
4	1'-9"			118.131			0'-0"	Pv
Pump								
4		1958.72	Velocity	118.131		Rating: 60.000 @ 2000.00		
3		Q=1958.72	7.40	57.398		Fire Pump Churn Pressure: 84.000		
DY	10.4000	1958.72	7.40	140		0.006637	0'-0"	Pf 0.487
3	1'-9"			57.398			73'-4"	Pe 0.000
2	1'-9"			57.885		GV(7'-11½"), T(65'-4½")	73'-4"	Pv
UG	10.4000	1958.72	7.40	140		0.006637	696'-3½"	Pf 9.742
2	1'-9"			57.885			175'-4½"	Pe 4.227
309	-8'-0"			71.854		4E(35'-1"), 2EE(17'-6½"), BFP(-3.948)	871'-8"	Pv
UG	12.4600	1958.72	5.15	140		0.002753	360'-2½"	Pf 0.992
309	-8'-0"			71.854				Pe 1.517
1	-11'-6"			74.363		Water Supply	360'-2½"	Pv
		0.00				Hose Allowance At Source		
1		1958.72						
Route 2								
BL	2.7050	1.14	0.06	120		0.000006	9'-0"	Pf 0.000
7111	39'-9½"	141.67	22.4	40.000		Sprinkler	9'-0"	Pe
7115	39'-9½"			40.000				Pv
BL	2.7050	142.81	7.97	120		0.049009	9'-0"	Pf 0.441
7115	39'-9½"	141.67	22.4	40.000		Sprinkler	9'-0"	Pe
7117	39'-9½"			40.441			9'-0"	Pv
BL	2.7050	285.25	15.93	120		0.176271	89'-1"	Pf 22.302
7117	39'-9½"	142.45	22.4	40.441		Sprinkler,	37'-5"	Pe 0.361
734	38'-11½"			63.104		2PO(18'-8½")	126'-6"	Pv
CM	4.3100	285.25	6.27	120		0.018236	10'-0"	Pf 0.182
734	38'-11½"			63.104				Pe 0.090
736	38'-9"			63.377			10'-0"	Pv
CM	4.3100	571.47	12.57	120		0.065947	10'-0"	Pf 0.660
736	38'-9"	286.22		63.377		Flow (q) from Route 4		Pe 0.090
738	38'-6½"			64.127			10'-0"	Pv
CM	4.3100	860.57	18.92	120		0.140639	10'-0"	Pf 1.407
738	38'-6½"	289.10		64.127		Flow (q) from Route 6		Pe 0.090
740	38'-4"			65.624			10'-0"	Pv
CM	4.3100	781.77	17.19	120		0.117746	10'-0"	Pf 1.178
740	38'-4"			65.624				Pe 0.090
742	38'-1½"			66.892			10'-0"	Pv
CM	4.3100	710.85	15.63	120		0.098749	10'-0"	Pf 0.988
742	38'-1½"			66.892				Pe 0.090
744	37'-11"			67.970			10'-0"	Pv
RN	2.7050	67.99	3.80	120		0.012418	217'-9"	Pf 3.634
744	37'-11"			67.970		PO(18'-8½")	74'-10½"	Pe -0.000
710	37'-11"			71.604		3PO(18'-8½")	292'-7½"	Pv
Route 3								
BL	2.7050	140.26	7.83	120		0.047405	9'-0"	Pf 0.427
7119	39'-7"	141.90	22.4	40.129		Sprinkler		Pe
7121	39'-7"			40.555			9'-0"	Pv
BL	2.7050	282.91	15.79	120		0.173599	105'-8"	Pf 29.500
7121	39'-7"	142.65	22.4	40.555		Sprinkler,	64'-3"	Pe 0.361
702	38'-9"			70.416		4fE(6'-8½"), 2PO(18'-8½")	169'-11"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 07

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 4								
BL	2.7050	1.64	0.09	120		0.000013	9'-0	Pf 0.000
7119	39'-7	141.90	22.4	40.129		Sprinkler		Pe
7123	39'-7			40.129			9'-0	Pv
BL	2.7050	143.54	8.01	120		0.049474	9'-0	Pf 0.445
7123	39'-7	141.90	22.4	40.129		Sprinkler		Pe
7125	39'-7			40.574			9'-0	Pv
BL	2.7050	286.22	15.98	120		0.177375	89'-1	Pf 22.441
7125	39'-7	142.68	22.4	40.574		Sprinkler,	37'-5	Pe 0.361
736	38'-9			63.377		2PO(18'-8½)	126'-6	Pv
Route 5								
BL	2.7050	139.08	7.76	120		0.046670	9'-0	Pf 0.420
7127	39'-4½	142.46	22.4	40.446		Sprinkler		Pe
7129	39'-4½			40.866			9'-0	Pv
BL	2.7050	282.27	15.76	120		0.172879	105'-8	Pf 29.378
7129	39'-4½	143.20	22.4	40.866		Sprinkler,	64'-3	Pe 0.361
704	38'-6½			70.604		4fE(6'-8½), 2PO(18'-8½)	169'-11	Pv
Route 6								
BL	2.7050	3.38	0.19	120		0.000048	9'-0	Pf 0.000
7127	39'-4½	142.46	22.4	40.446		Sprinkler		Pe
7131	39'-4½			40.446			9'-0	Pv
BL	2.7050	145.84	8.14	120		0.050950	9'-0	Pf 0.459
7131	39'-4½	142.46	22.4	40.446		Sprinkler		Pe
7133	39'-4½			40.905			9'-0	Pv
BL	2.7050	289.10	16.14	120		0.180690	89'-1	Pf 22.861
7133	39'-4½	143.26	22.4	40.905		Sprinkler,	37'-5	Pe 0.361
738	38'-6½			64.127		2PO(18'-8½)	126'-6	Pv
Route 7								
UG	6.2800	250.00	2.59	140		0.001718	19'-9	Pf 0.161
55	1'-0	250.00		105.726		Hydrant,	74'-1	Pe 3.902
13	-8'-0			109.789		E(22'-1), GV(4'-8½), T(47'-3½)	93'-10	Pv
UG	8.3900	854.56	4.96	140		0.004072	635'-9	Pf 2.713
13	-8'-0	604.56		109.789		Flow (q) from Route 8	30'-6½	Pe
12	-8'-0			112.502		E(30'-6½)	666'-3½	Pv
UG	8.3900	854.56	4.96	140		0.004072	61'-1½	Pf 0.249
12	-8'-0			112.502				Pe
11	-8'-0			112.751			61'-1½	Pv
UG	8.3900	854.56	4.96	140		0.004072	153'-8	Pf 0.626
11	-8'-0			112.751				Pe
10	-8'-0			113.376			153'-8	Pv
UG	8.3900	854.56	4.96	140		0.004072	635'-11½	Pf 2.714
10	-8'-0			113.376			30'-6½	Pe
9	-8'-0			116.090		E(30'-6½)	666'-6	Pv
UG	8.3900	854.56	4.96	140		0.004072	118'-2	Pf 0.481
9	-8'-0			116.090				Pe
8	-8'-0			116.571			118'-2	Pv
UG	8.3900	854.56	4.96	140		0.004072	275'-0	Pf 1.362
8	-8'-0			116.571			59'-4½	Pe
7	-8'-0			117.933		T(59'-4½)	334'-4½	Pv
Route 8								
UG	8.3900	604.56	3.51	140		0.002147	119'-3	Pf 0.256
14	-8'-0	1104.15		109.533		Flow (q) from Route 1		Pe
13	-8'-0			109.789			119'-3	Pv
Route 9								
RN	2.7050	78.80	4.40	120		0.016316	221'-9	Pf 5.277
740	38'-4			65.624		PO(18'-8½)	101'-8½	Pe -0.000
706	38'-4			70.901		3PO(18'-8½), 4fE(6'-8½)	323'-5½	Pv
Route 10								
RN	2.7050	57.95	3.24	120		0.009239	217'-9	Pf 2.703
746	37'-0	407.26		71.228		PO(18'-8½), Flow (q) from Route	74'-10½	Pe
720	37'-0			73.931		21	292'-7½	Pv
						3PO(18'-8½)		
Route 11								
CM	4.3100	349.31	7.68	120		0.026528	10'-0	Pf 0.265
746	37'-0	407.26		71.228		Flow (q) from Route 21		Pe
748	37'-0			71.493			10'-0	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 07

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
RN	2.7050	60.54	3.38	120		0.010019	217'-9"	Pf 2.932
748	37'-0"			71.493		PO(18'-8½")	74'-10½"	Pe
722	37'-0"			74.425		3PO(18'-8½")	292'-7½"	Pv
Route 12								
CM	4.3100	288.77	6.35	120		0.018654	10'-0"	Pf 0.187
748	37'-0"	60.54		71.493		Flow (q) from Route 11	10'-0"	Pe
750	37'-0"			71.679			10'-0"	Pv
RN	2.7050	64.34	3.59	120		0.011211	217'-9"	Pf 3.281
750	37'-0"			71.679		PO(18'-8½")	74'-10½"	Pe
724	37'-0"			74.960		3PO(18'-8½")	292'-7½"	Pv
Route 13								
CM	4.3100	224.43	4.94	120		0.011702	10'-0"	Pf 0.117
750	37'-0"	64.34		71.679		Flow (q) from Route 12	10'-0"	Pe
752	37'-0"			71.797			10'-0"	Pv
RN	2.7050	69.10	3.86	120		0.012796	217'-9"	Pf 3.744
752	37'-0"			71.797		PO(18'-8½")	74'-10½"	Pe
726	37'-0"			75.541		3PO(18'-8½")	292'-7½"	Pv
Route 14								
CM	4.3100	155.33	3.42	120		0.005923	10'-0"	Pf 0.059
752	37'-0"	69.10		71.797		Flow (q) from Route 13	10'-0"	Pe
754	37'-0"			71.856			10'-0"	Pv
RN	2.7050	74.63	4.17	120		0.014753	217'-9"	Pf 4.317
754	37'-0"			71.856		PO(18'-8½")	74'-10½"	Pe
728	37'-0"			76.173		3PO(18'-8½")	292'-7½"	Pv
Route 15								
CM	4.3100	80.70	1.77	120		0.001764	10'-0"	Pf 0.018
754	37'-0"	74.63		71.856		Flow (q) from Route 14	10'-0"	Pe
756	37'-0"			71.873			10'-0"	Pv
RN	2.7050	80.70	4.51	120		0.017049	217'-9"	Pf 4.989
756	37'-0"			71.873		PO(18'-8½")	74'-10½"	Pe
730	37'-0"			76.862		3PO(18'-8½")	292'-7½"	Pv
Route 16								
RN	2.7050	70.92	3.96	120		0.013427	221'-9"	Pf 4.343
742	38'-1½"			66.892		PO(18'-8½")	101'-8½"	Pe -0.000
708	38'-1½"			71.234		3PO(18'-8½"), 4fE(6'-8½")	323'-5½"	Pv
Route 17								
CM	4.3100	642.85	14.14	120		0.081989	10'-0"	Pf 0.820
744	37'-11"	67.99		67.970		Flow (q) from Route 2	10'-0"	Pe 0.090
758	37'-8½"			68.880			10'-0"	Pv
RN	2.7050	62.71	3.50	120		0.010692	217'-9"	Pf 3.129
758	37'-8½"			68.880		PO(18'-8½")	74'-10½"	Pe -0.000
712	37'-8½"			72.009		3PO(18'-8½")	292'-7½"	Pv
Route 18								
CM	4.3100	580.14	12.76	120		0.067809	10'-0"	Pf 0.678
758	37'-8½"	62.71		68.880		Flow (q) from Route 17	10'-0"	Pe 0.090
760	37'-6"			69.649			10'-0"	Pv
RN	2.7050	59.06	3.30	120		0.009570	217'-9"	Pf 2.800
760	37'-6"			69.649		PO(18'-8½")	74'-10½"	Pe -0.000
714	37'-6"			72.449		3PO(18'-8½")	292'-7½"	Pv
Route 19								
CM	4.3100	521.08	11.46	120		0.055593	10'-0"	Pf 0.556
760	37'-6"	59.06		69.649		Flow (q) from Route 18	10'-0"	Pe 0.090
762	37'-3½"			70.295			10'-0"	Pv
RN	2.7050	57.08	3.19	120		0.008985	217'-9"	Pf 2.629
762	37'-3½"			70.295		PO(18'-8½")	74'-10½"	Pe -0.000
716	37'-3½"			72.924		3PO(18'-8½")	292'-7½"	Pv
Route 20								
CM	4.3100	464.00	10.20	120		0.044855	10'-0"	Pf 0.449
762	37'-3½"	57.08		70.295		Flow (q) from Route 19	10'-0"	Pe 0.090
764	37'-1"			70.834			10'-0"	Pv
RN	2.7050	56.74	3.17	120		0.008885	217'-9"	Pf 2.600
764	37'-1"			70.834		PO(18'-8½")	74'-10½"	Pe -0.000
718	37'-1"			73.434		3PO(18'-8½")	292'-7½"	Pv
Route 21								
CM	4.3100	407.26	8.96	120		0.035238	10'-0"	Pf 0.353
764	37'-1"	56.74		70.834		Flow (q) from Route 20	10'-0"	Pe 0.041
746	37'-0"			71.228			10'-0"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 07

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss		Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

C Value Multiplier

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$$

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type Legend

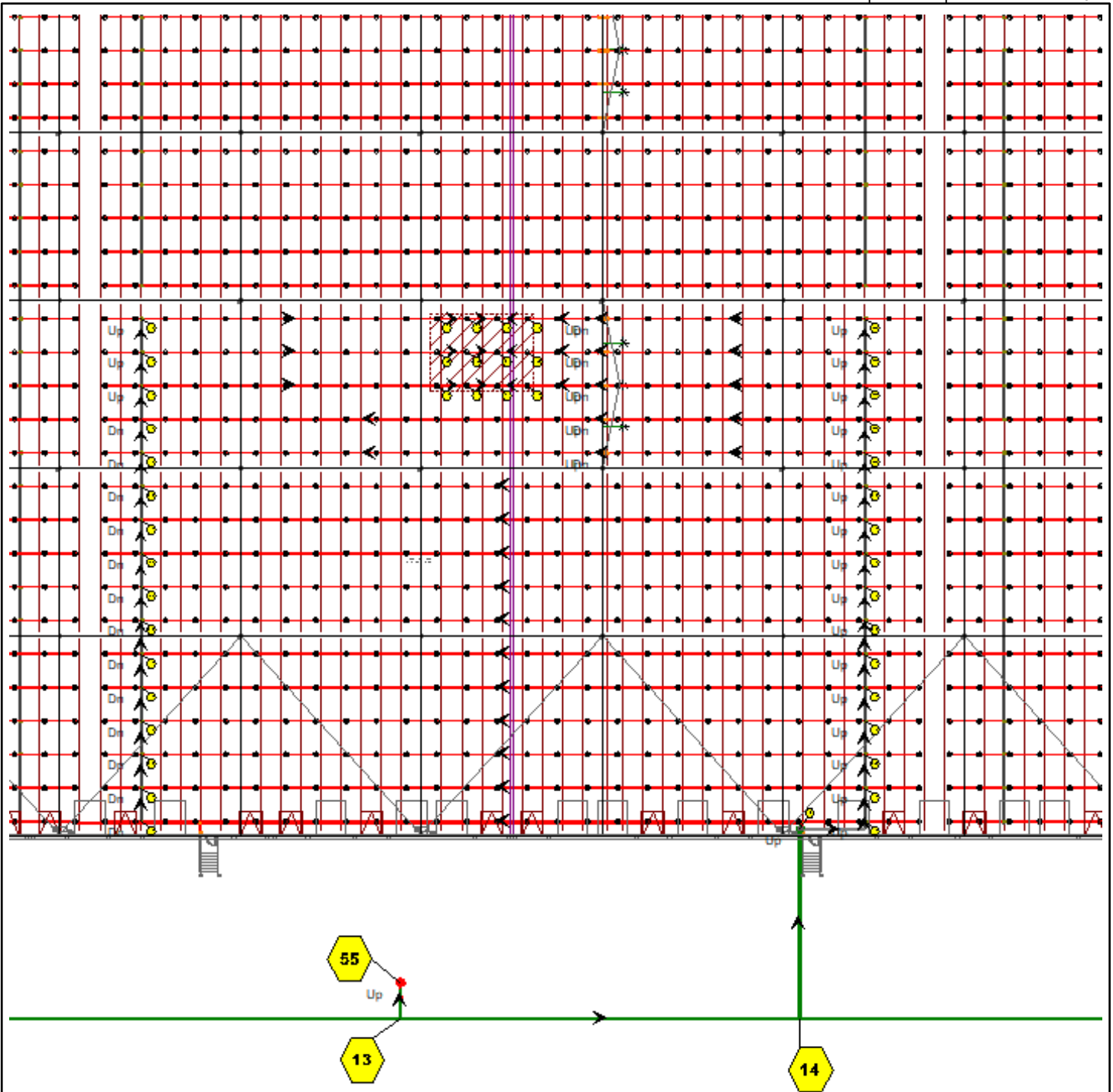
AO Arm-Over
BL Branch Line
CM Cross Main
DN Drain
DR Drop
DY Dynamic
FM Feed Main
FR Feed Riser
MS Miscellaneous
OR Outrigger
RN Riser Nipple
SP Sprig
ST Stand Pipe
UG Underground

Units Legend

Diameter Inch
Elevation Foot
Flow gpm
Discharge gpm
Velocity fps
Pressure psi
Length Foot
Friction Loss psi/Foot
HWC Hazen-Williams Constant
Pt Total pressure at a point in a pipe
Pn Normal pressure at a point in a pipe
Pf Pressure loss due to friction between points
Pe Pressure due to elevation difference between indicated points
Pv Velocity pressure at a point in a pipe

Fittings Legend

ALV Alarm Valve
AngV Angle Valve
b Bushing
BaV Ball Valve
BFP Backflow Preventer
BV Butterfly Valve
C Cross Flow Turn 90°
cplg Coupling
Cr Cross Run
CV Check Valve
DeV Deluge Valve
DPV Dry Pipe Valve
E 90° Elbow
EE 45° Elbow
Ee1 11¼° Elbow
Ee2 22½° Elbow
f Flow Device
fd Flex Drop
FDC Fire Department Connection
fE 90° FireLock(TM) Elbow
fEE 45° FireLock(TM) Elbow
flg Flange
FN Floating Node
fT FireLock(TM) Tee
g Gauge
GloV Globe Valve
GV Gate Valve
Ho Hose
Hose Hose
HV Hose Valve
Hyd Hydrant
LtE Long Turn Elbow
mecT Mechanical Tee
Noz Nozzle
P1 Pump In
P2 Pump Out
PIV Post Indicating Valve
PO Pipe Outlet
PrV Pressure Relief Valve
PRV Pressure Reducing Valve
red Reducer/Adapter
S Supply
sCV Swing Check Valve
SFx Seismic Flex
Spr Sprinkler
St Strainer
T Tee Flow Turn 90°
Tr Tee Run
U Union
WirF Wirsbo
WMV Water Meter Valve
Z Cap





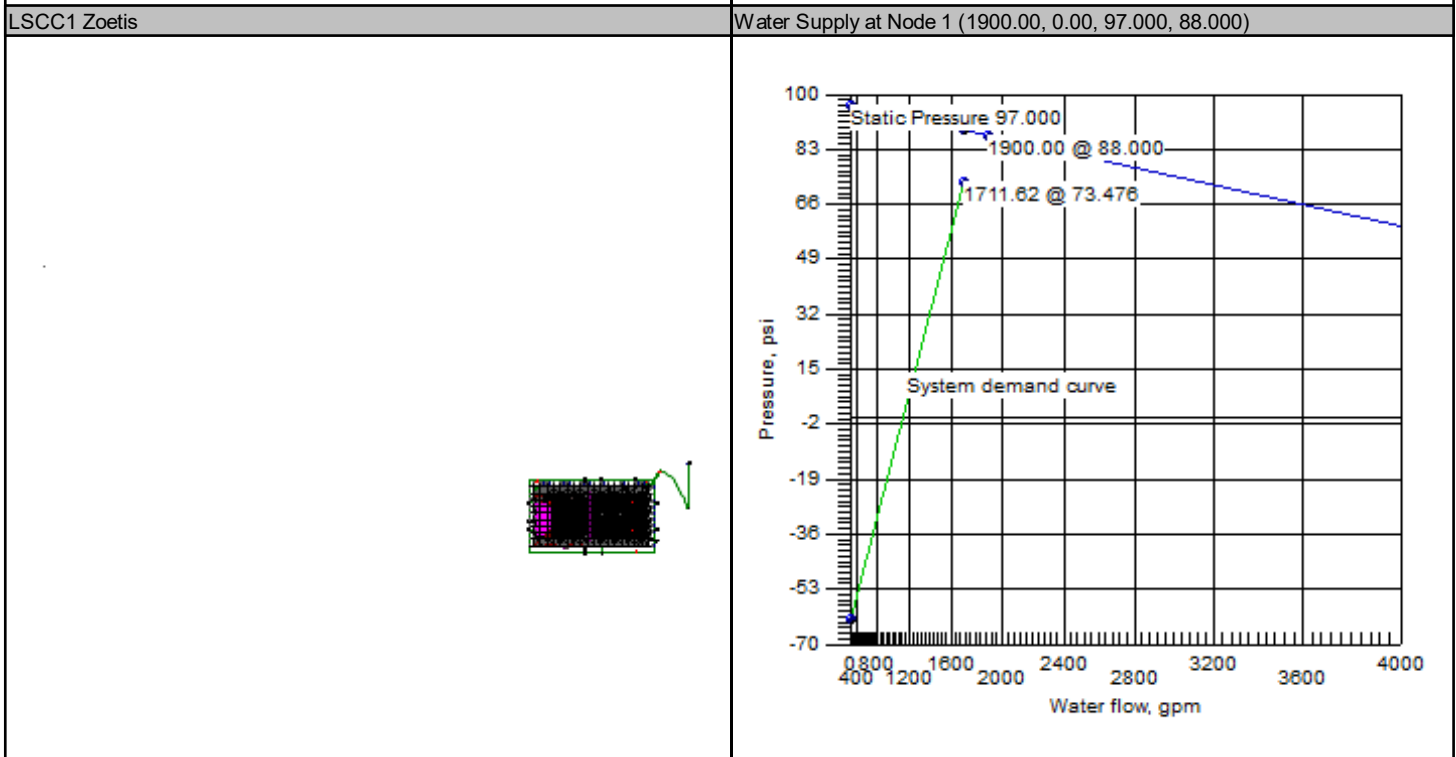
Hydraulic Overview

Job Number: 212189000
Report Description: Remote Area 08 (16.8K)

Job		
Job Number 212189000	Design Engineer Jay Colbert	
Job Name: Lee's Summit Commerce Center	Phone 913.242.0057	FAX
Address 1 1120 NW Main St	State Certification/License Number	
Address 2	AHJ City of Lee's Summit	
Address 3 Lee's Summit, MO 64086	Job Site/Building Building A	

System	
Pressure 52.000	Area of Application NA
Most Demanding Sprinkler Data 16.8 K-Factor 121.15 at 52.000	Hose Streams 250.00
Coverage Per Sprinkler 100ft ²	Number Of Sprinklers Calculated 12 0
System Pressure Demand 73.476	System Flow Demand 1711.62
Total Demand 1711.62 @ 73.476	Pressure Result +16.104 (18.0%)

Supplies						Check Point Gauges			
Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)	Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)
1	Water Supply	1900.00		97.000	88.000	Pump Inlet	58.403	223.97	1711.62
4	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									





Job Number: 212189000

Report Description: Remote Area 08 (16.8K)

Job Number 212189000	Design Engineer Jay Colbert
Job Name: Lee's Summit Commerce Center	State Certification/License Number
Address 1 1120 NW Main St	AHJ City of Lee's Summit
Address 2	Job Site/Building Building A
Address 3 Lee's Summit, MO 64086	Drawing Name LSCC1 Zoetis

Remote Area(s)

Most Demanding Sprinkler Data 16.8 K-Factor 121.15 at 52.000		Occupancy ESFR	Job Suffix
Hose Allowance At Source 0.00		Pressure 52.000	Area of Application NA
Additional Hose Supplies <u>Node</u> <u>Flow(gpm)</u> Hydrant At Node 52 250.00		Number Of Sprinklers Calculated Number Of Nozzles Calculated 12 0	Coverage Per Sprinkler 100ft²
		AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 73.461 Right: 73.426	
Total Hose Streams 250.00			
System Flow Demand 1711.62	Total Water Required (Including Hose Allowance) 1711.62		
Maximum Pressure Unbalance In Loops 0.000			
Maximum Velocity Above Ground 21.78 between nodes 824 and 822			
Maximum Velocity Under Ground 9.93 between nodes 224 and 7			
Volume capacity of Wet Pipes 34293.96gal	Volume capacity of Dry Pipes		

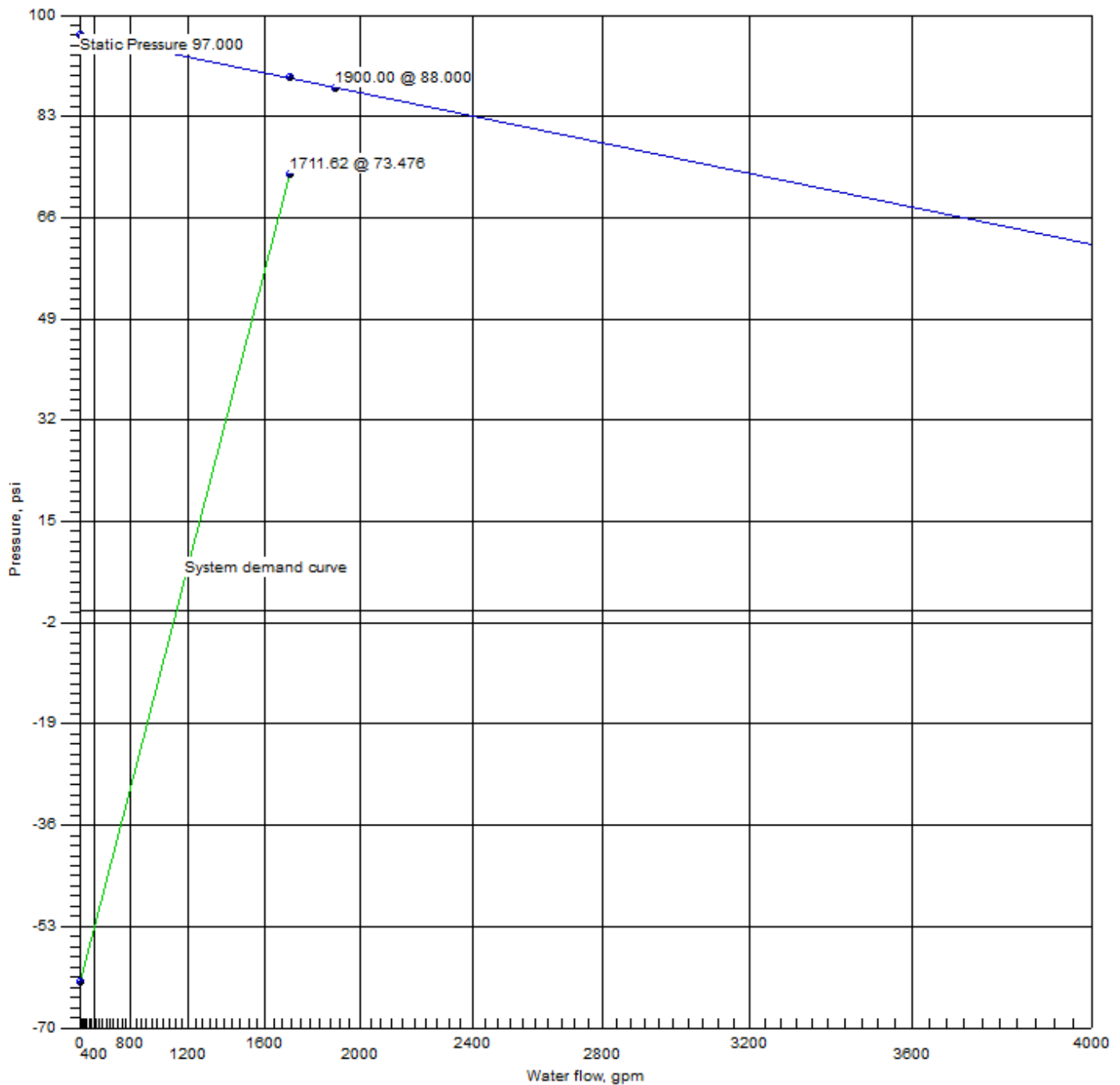
Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi) @	Flow (gpm)	Available (psi) @	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply		97.000	88.000	1900.00	89.581	1711.62	73.476	16.104
4	Pump		84.000	60.000	2000.00	139.356	1711.62	123.252	16.104

Pumps: Static = Churn (Pressure @ Zero Flow)

	Contractor Number 21	Contact Name Jay Colbert	Contact Title
Name of Contractor: F.E. Moran Fire Protection Inc.		Phone 913.242.0057	Extension
Address 1 16815 College Blvd.		FAX	
Address 2		E-mail jay.colbert@femoran.com	
Address 3 Lenexa, KS 66219		Web-Site femoranfp.com	



Water Supply at Node 1



Hydraulic Graph

Water Supply at Node 1

Static: Pressure

97.000

Residual: Pressure

88.000 @ 1900.00

Available Pressure at System Demand

89.581 @ 1711.62

Required Pressure at System Demand

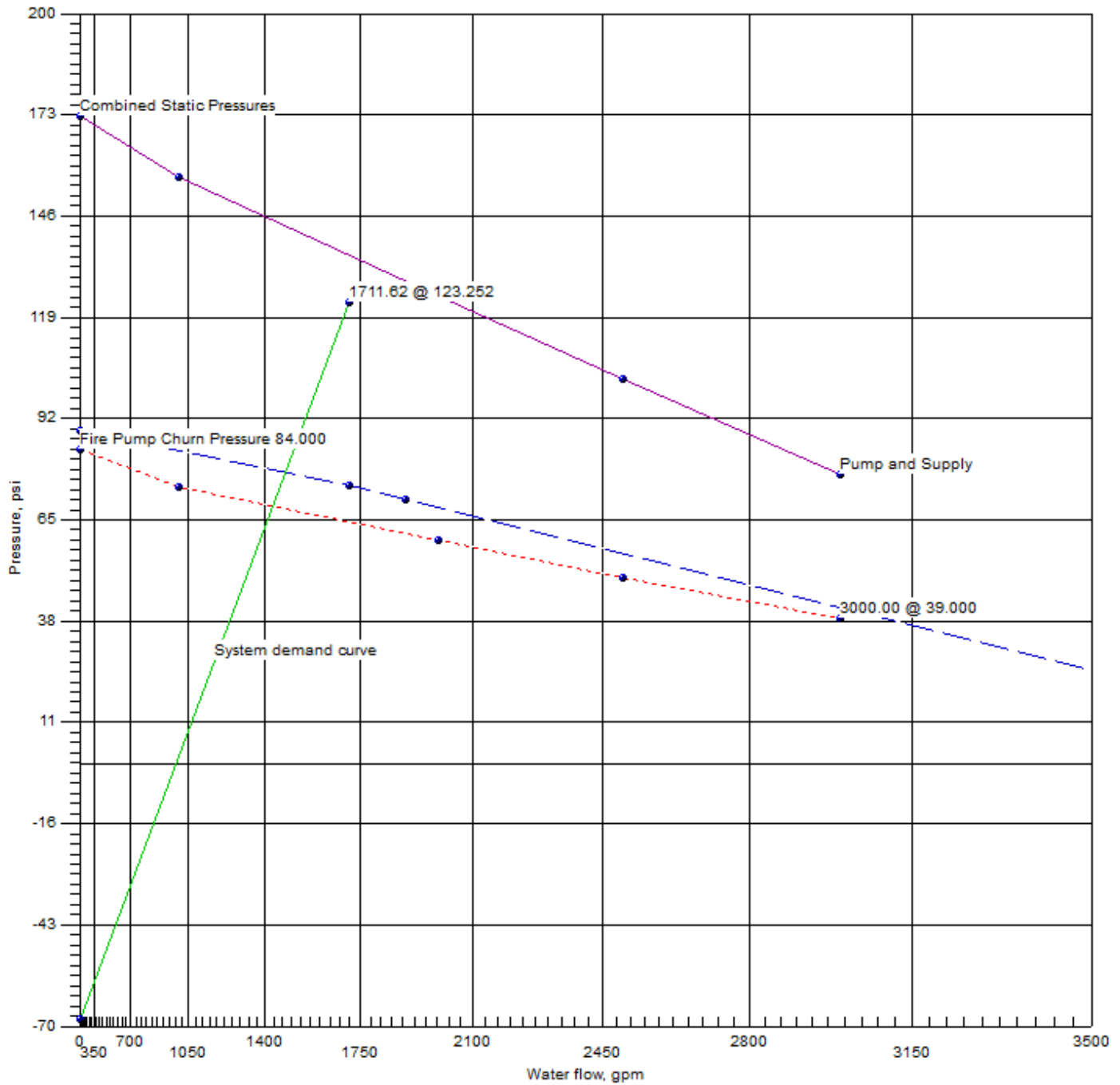
73.476 @ 1711.62

Required Pressure at System Demand (Including Hose Allowance at Source)

73.476 @ 1711.62



Pump at Node 4



Hydraulic Graph
Pump at Node 4

Static + Churn Pressure
173.256
Fire Pump Churn Pressure
84.000

Fire Pump Rating
60.000 @ 2000.00

Residual: Pressure
64.849 @ 1711.62
Available Pressure at System Demand
139.356 @ 1711.62
Required Pressure at System Demand
123.252 @ 1711.62



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: Remote Area 08 (16.8K)

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Hydrant	52	250.00	250.00	250	119.025		
⇒ Sprinkler	8111	121.15	121.15	16.8	52.000		
Sprinkler	8113	121.52	121.15	16.8	52.324		
Sprinkler	8115	121.15	121.15	16.8	52.000		
Sprinkler	8117	121.53	121.15	16.8	52.326		
Sprinkler	8119	121.55	121.15	16.8	52.350		
Sprinkler	8121	121.93	121.15	16.8	52.676		
Sprinkler	8123	121.55	121.15	16.8	52.350		
Sprinkler	8125	121.93	121.15	16.8	52.679		
Sprinkler	8127	122.13	121.15	16.8	52.851		
Sprinkler	8129	122.14	121.15	16.8	52.853		
Sprinkler	8131	122.57	121.15	16.8	53.225		
Sprinkler	8133	122.47	121.15	16.8	53.141		

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: Remote Area 08 (16.8K)

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	73.476	1711.62
52	1'-0	Hyd(-1.000)	119.025	250.00
8111	37'-10	Spr(-52.000)	52.000	121.15
8113	37'-10	Spr(-52.324)	52.324	121.52
8115	37'-10	Spr(-52.000)	52.000	121.15
8117	37'-10	Spr(-52.326)	52.326	121.53
8119	37'-10	Spr(-52.350)	52.350	121.55
8121	37'-10	Spr(-52.676)	52.676	121.93
8123	37'-10	Spr(-52.350)	52.350	121.55
8125	37'-10	Spr(-52.679)	52.679	121.93
8127	37'-10	Spr(-52.851)	52.851	122.13
8129	37'-10	Spr(-52.853)	52.853	122.14
8131	37'-10	Spr(-53.225)	53.225	122.57
8133	37'-10	Spr(-53.141)	53.141	122.47
2	1'-9	T(65'-4½)	58.782	
3	1'-9	P1, Pump Inlet	58.403	
4	1'-9	P2(-60.886)	123.252	
5	1'-9		123.252	
6	6'-8½		119.220	
7	-8'-0	T(59'-4½)	124.031	
8	-8'-0	T(59'-4½)	123.335	
9	-8'-0	T(47'-3½)	123.089	
10	-8'-0	T(59'-4½)	122.583	
11	-8'-0	T(47'-3½)	122.466	
12	-8'-0	T(59'-4½)	122.420	
13	-8'-0	T(47'-3½)	121.914	
14	-8'-0	T(59'-4½)	121.824	
15	-8'-0	T(47'-3½)	121.406	
16	-8'-0	T(59'-4½)	121.336	
17	-8'-0	T(59'-4½)	121.173	
54	1'-0	Hyd	1.000	
55	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
224	1'-0		121.574	
309	-8'-0	E(35'-1)	71.186	
800	38'-3	PO(18'-8½)	84.625	
802	1'-8½	PO(37'-8½)	114.571	
804	1'-0		115.550	
806	38'-3	PO(18'-8½)	75.540	
808	38'-0	PO(18'-8½)	75.635	
810	37'-8½	PO(18'-8½)	75.666	
812	37'-5	PO(18'-8½)	75.602	
814	37'-5	PO(18'-8½)	83.678	
816	37'-8½	PO(18'-8½)	83.935	
818	38'-0	PO(18'-8½)	84.249	
820	37'-0	PO(18'-8½)	81.036	
822	37'-0	PO(18'-8½)	82.569	
824	37'-0		83.389	
826	37'-2	PO(18'-8½)	83.475	
828	37'-10	T(18'-8½)	74.415	
830	37'-0	PO(18'-8½)	78.072	
832	37'-0	PO(18'-8½)	78.188	
834	37'-0	PO(18'-8½)	78.695	
836	37'-0	PO(18'-8½)	79.755	
838	37'-0	PO(18'-8½)	78.049	
840	37'-0	PO(18'-8½)	73.561	
842	37'-0	PO(18'-8½)	72.542	
844	37'-0	PO(18'-8½)	72.065	
846	37'-0	PO(18'-8½)	71.936	
848	37'-0	PO(18'-8½)	75.017	
850	37'-0	PO(18'-8½)	74.381	
852	37'-2	PO(18'-8½)	75.413	



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 08 (16.8K)

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
BL	2.7050	120.94	6.75	120		0.036035	9'-0	Pf 0.324
8111	37'-10	121.15	16.8	52.000		Sprinkler		Pe
8113	37'-10			52.324			9'-0	Pv
BL	2.7050	242.46	13.54	120		0.130492	158'-0	Pf 25.503
8113	37'-10	121.52	16.8	52.324		Sprinkler,	37'-5	Pe 0.361
832	37'-0			78.188		2PO(18'-8½)	195'-5	Pv
CM	4.3100	495.35	10.89	120		0.050621	10'-0	Pf 0.506
832	37'-0	252.89		78.188		Flow (q) from Route 5		Pe
834	37'-0			78.695			10'-0	Pv
CM	4.3100	738.60	16.24	120		0.106000	10'-0	Pf 1.060
834	37'-0	243.25		78.695		Flow (q) from Route 3		Pe
836	37'-0			79.755			10'-0	Pv
CM	4.3100	818.45	18.00	120		0.128170	10'-0	Pf 1.282
836	37'-0	79.85		79.755		Flow (q) from Route 2		Pe
820	37'-0			81.036			10'-0	Pv
CM	4.3100	901.46	19.82	120		0.153251	10'-0	Pf 1.533
820	37'-0	83.01		81.036		Flow (q) from Route 12		Pe
822	37'-0			82.569			10'-0	Pv
CM	4.3100	990.35	21.78	120		0.182371	4'-6	Pf 0.821
822	37'-0	88.88		82.569		Flow (q) from Route 13		Pe
824	37'-0			83.389			4'-6	Pv
CM	6.3570	990.35	10.01	120		0.027480	5'-6½	Pf 0.152
824	37'-0			83.389				Pe -0.067
826	37'-2			83.475			5'-6½	Pv
CM	6.3570	1082.43	10.94	120		0.032393	10'-0	Pf 0.324
826	37'-2	92.08		83.475		Flow (q) from Route 14		Pe -0.120
814	37'-5			83.678			10'-0	Pv
CM	6.3570	1174.60	11.87	120		0.037680	10'-0	Pf 0.377
814	37'-5	92.17		83.678		Flow (q) from Route 15		Pe -0.120
816	37'-8½			83.935			10'-0	Pv
CM	6.3570	1267.95	12.82	120		0.043407	10'-0	Pf 0.434
816	37'-8½	93.35		83.935		Flow (q) from Route 16		Pe -0.120
818	38'-0			84.249			10'-0	Pv
CM	6.3570	1363.39	13.78	120		0.049644	10'-0	Pf 0.497
818	38'-0	95.44		84.249		Flow (q) from Route 17		Pe -0.120
800	38'-3			84.625			10'-0	Pv
CM	6.3570	1461.62	14.77	120		0.056462	71'-1	Pf 14.093
800	38'-3	98.23		84.625		Flow (q) from Route 18	178'-6½	Pe 15.852
802	1'-8½			114.571		5E(17'-7), 2f(-0.000), CV(40'-3), BV(12'-7), PO(37'-8½)	249'-7½	Pv
CM	8.2490	1461.62	8.77	120		0.015875	1'-6	Pf 0.676
802	1'-8½			114.571			41'-1½	Pe 0.303
804	1'-0			115.550		PO(41'-1½)	42'-7½	Pv
UG	8.3900	1461.62	8.48	140		0.010991	66'-8½	Pf 1.722
804	1'-0			115.550			89'-11	Pe 3.902
17	-8'-0			121.173		E(30'-6½), T(59'-4½)	156'-7½	Pv
UG	8.3900	1116.96	6.48	140		0.006683	337'-8	Pf 2.857
17	-8'-0			121.173			89'-11	Pe
7	-8'-0			124.031		E(30'-6½), T(59'-4½)	427'-7	Pv
UG	8.3900	1711.62	9.93	140		0.014719	67'-8	Pf 1.445
7	-8'-0	594.66		124.031		Flow (q) from Route 7	30'-6½	Pe -3.902
224	1'-0			121.574		E(30'-6½)	98'-2½	Pv
FR	8.2490	1711.62	10.28	120		0.021261	5'-8½	Pf 0.121
224	1'-0			121.574				Pe -2.476
6	6'-8½			119.220			5'-8½	Pv
DY	10.3700	1711.62	6.50	120		0.006976	13'-10½	Pf 1.881
6	6'-8½			119.220			255'-9	Pe 2.151
5	1'-9			123.252		4E(26'-0), T(48'-5½), BV(21'-3½), Tr(17'-0), CV(65'-0)	269'-8	Pv
DY	7.9810	1711.62	10.98	120		0.024971	0'-0	Pf 0.000
5	1'-9			123.252				Pe 0.000
4	1'-9			123.252			0'-0	Pv
Pump								
4		1711.62		123.252		Rating: 60.000 @ 2000.00		
3		Q=1711.62	6.46	58.403		Fire Pump Churn Pressure: 84.00		
						0		



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 08 (16.8K)

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
DY	10.4000	1711.62	6.46	140		0.005172	0'-0"	Pf 0.379
3	1'-9"			58.403			73'-4"	Pe 0.000
2	1'-9"			58.782		GV(7'-11½"), T(65'-4½")	73'-4"	Pv
UG	10.4000	1711.62	6.46	140		0.005172	696'-3½"	Pf 8.177
2	1'-9"			58.782			175'-4½"	Pe 4.227
309	-8'-0"			71.186		4E(35'-1), 2EE(17'-6½"), BFP(-3.9 48)	871'-8"	Pv
UG	12.4600	1711.62	4.50	140		0.002145	360'-2½"	Pf 0.773
309	-8'-0"			71.186				Pe 1.517
1	-11'-6"			73.476		Water Supply	360'-2½"	Pv
		0.00				Hose Allowance At Source		
1		1711.62						
Route 2								
BL	2.7050	0.21	0.01	120		0.000000	9'-0"	Pf 0.000
8111	37'-10"	121.15	16.8	52.000		Sprinkler		Pe
8115	37'-10"			52.000			9'-0"	Pv
BL	2.7050	121.36	6.78	120		0.036267	9'-0"	Pf 0.326
8115	37'-10"	121.15	16.8	52.000		Sprinkler		Pe
8117	37'-10"			52.326			9'-0"	Pv
BL	2.7050	242.88	13.56	120		0.130913	110'-7"	Pf 19.378
8117	37'-10"	121.53	16.8	52.326		Sprinkler,	37'-5"	Pe 0.361
844	37'-0"			72.065		2PO(18'-8½")	148'-0"	Pv
CM	4.3100	479.30	10.54	120		0.047629	10'-0"	Pf 0.476
844	37'-0"	236.42		72.065		Flow (q) from Route 6		Pe
842	37'-0"			72.542			10'-0"	Pv
CM	4.3100	723.02	15.90	120		0.101901	10'-0"	Pf 1.019
842	37'-0"	243.72		72.542		Flow (q) from Route 4		Pe
840	37'-0"			73.561			10'-0"	Pv
RN	2.7050	79.85	4.46	120		0.016720	295'-7"	Pf 6.194
840	37'-0"			73.561		PO(18'-8½")	74'-10½"	Pe -0.000
836	37'-0"			79.755		3PO(18'-8½")	370'-5½"	Pv
Route 3								
BL	2.7050	121.32	6.77	120		0.036247	9'-0"	Pf 0.326
8119	37'-10"	121.55	16.8	52.350		Sprinkler		Pe
8121	37'-10"			52.676			9'-0"	Pv
BL	2.7050	243.25	13.58	120		0.131281	158'-0"	Pf 25.657
8121	37'-10"	121.93	16.8	52.676		Sprinkler,	37'-5"	Pe 0.361
834	37'-0"			78.695		2PO(18'-8½")	195'-5"	Pv
Route 4								
BL	2.7050	0.23	0.01	120		0.000000	9'-0"	Pf 0.000
8119	37'-10"	121.55	16.8	52.350		Sprinkler		Pe
8123	37'-10"			52.350			9'-0"	Pv
BL	2.7050	121.79	6.80	120		0.036506	9'-0"	Pf 0.329
8123	37'-10"	121.55	16.8	52.350		Sprinkler		Pe
8125	37'-10"			52.679			9'-0"	Pv
BL	2.7050	243.72	13.61	120		0.131751	110'-7"	Pf 19.502
8125	37'-10"	121.93	16.8	52.679		Sprinkler,	37'-5"	Pe 0.361
842	37'-0"			72.542		2PO(18'-8½")	148'-0"	Pv
Route 5								
BL	2.7050	8.18	0.46	120		0.000247	9'-0"	Pf 0.002
8127	37'-10"	122.13	16.8	52.851		Sprinkler		Pe
8129	37'-10"			52.853			9'-0"	Pv
BL	2.7050	130.32	7.28	120		0.041378	9'-0"	Pf 0.372
8129	37'-10"	122.14	16.8	52.853		Sprinkler		Pe
8131	37'-10"			53.225			9'-0"	Pv
BL	2.7050	252.89	14.12	120		0.141062	131'-6"	Pf 21.190
8131	37'-10"	122.57	16.8	53.225		Sprinkler,	18'-8½"	Pe
828	37'-10"			74.415		2E(9'-4½")	150'-2½"	Pv
BL	2.7050	144.32	8.06	120		0.049975	28'-6"	Pf 3.295
828	37'-10"			74.415			37'-5"	Pe 0.361
830	37'-0"			78.072		2PO(18'-8½")	65'-11"	Pv
CM	4.3100	252.89	5.56	120		0.014594	8'-0"	Pf 0.117
830	37'-0"	108.57		78.072		Flow (q) from Route 10		Pe
832	37'-0"			78.188			8'-0"	Pv
Route 6								



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 08 (16.8K)

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream						Total Length	
BL	2.7050	113.95	6.36	120	0.032278	9'-0	Pf 0.291
8127	37'-10	122.13	16.8	52.851	Sprinkler		Pe
8133	37'-10			53.141		9'-0	Pv
BL	2.7050	236.42	13.20	120	0.124539	110'-7	Pf 18.434
8133	37'-10	122.47	16.8	53.141	Sprinkler,	37'-5	Pe 0.361
846	37'-0			71.936	2PO(18'-8½)	148'-0	Pv
CM	4.3100	236.42	5.20	120	0.012884	10'-0	Pf 0.129
846	37'-0			71.936			Pe
844	37'-0			72.065		10'-0	Pv
Route 7							
UG	6.2800	250.00	2.59	140	0.001718	20'-0	Pf 0.162
52	1'-0	250.00		119.025	Hydrant,	74'-1	Pe 3.902
9	-8'-0			123.089	E(22'-1), GV(4'-8½), T(47'-3½)	94'-1	Pv
UG	8.3900	594.66	3.45	140	0.002082	118'-2	Pf 0.246
9	-8'-0	344.66		123.089	Flow (q) from Route 8		Pe
8	-8'-0			123.335		118'-2	Pv
UG	8.3900	594.66	3.45	140	0.002082	275'-0	Pf 0.696
8	-8'-0			123.335		59'-4½	Pe
7	-8'-0			124.031	T(59'-4½)	334'-4½	Pv
Route 8							
UG	8.3900	344.66	2.00	140	0.000759	119'-3	Pf 0.090
14	-8'-0	344.66		121.824	Flow (q) from Route 9		Pe
13	-8'-0			121.914		119'-3	Pv
UG	8.3900	344.66	2.00	140	0.000759	635'-9	Pf 0.506
13	-8'-0			121.914		30'-6½	Pe
12	-8'-0			122.420	E(30'-6½)	666'-3½	Pv
UG	8.3900	344.66	2.00	140	0.000759	61'-1½	Pf 0.046
12	-8'-0			122.420			Pe
11	-8'-0			122.466		61'-1½	Pv
UG	8.3900	344.66	2.00	140	0.000759	153'-8	Pf 0.117
11	-8'-0			122.466			Pe
10	-8'-0			122.583		153'-8	Pv
UG	8.3900	344.66	2.00	140	0.000759	635'-11½	Pf 0.506
10	-8'-0			122.583		30'-6½	Pe
9	-8'-0			123.089	E(30'-6½)	666'-6	Pv
Route 9							
UG	8.3900	344.66	2.00	140	0.000759	214'-9	Pf 0.163
17	-8'-0	1116.96		121.173	Flow (q) from Route 1		Pe
16	-8'-0			121.336		214'-9	Pv
UG	8.3900	344.66	2.00	140	0.000759	91'-11½	Pf 0.070
16	-8'-0			121.336			Pe
15	-8'-0			121.406		91'-11½	Pv
UG	8.3900	344.66	2.00	140	0.000759	519'-3½	Pf 0.417
15	-8'-0			121.406		30'-6½	Pe
14	-8'-0			121.824	E(30'-6½)	549'-10	Pv
Route 10							
CM	4.3100	108.57	2.39	120	0.003053	7'-6	Pf 0.023
838	37'-0	108.57		78.049	Flow (q) from Route 11		Pe
830	37'-0			78.072		7'-6	Pv
Route 11							
BL	2.7050	108.57	6.06	120	0.029514	36'-0	Pf 3.272
828	37'-10			74.415	T(18'-8½)	74'-10½	Pe 0.361
838	37'-0			78.049	T(18'-8½), 2PO(18'-8½)	110'-10½	Pv
Route 12							
CM	4.3100	643.17	14.14	120	0.082063	10'-0	Pf 0.821
840	37'-0	79.85		73.561	Flow (q) from Route 2		Pe
850	37'-0			74.381		10'-0	Pv
RN	2.7050	83.01	4.63	120	0.017965	295'-7	Pf 6.655
850	37'-0			74.381	PO(18'-8½)	74'-10½	Pe -0.000
820	37'-0			81.036	3PO(18'-8½)	370'-5½	Pv
Route 13							
CM	4.3100	560.16	12.32	120	0.063551	10'-0	Pf 0.636
850	37'-0	83.01		74.381	Flow (q) from Route 12		Pe
848	37'-0			75.017		10'-0	Pv
RN	2.7050	88.88	4.96	120	0.020386	295'-7	Pf 7.552
848	37'-0			75.017	PO(18'-8½)	74'-10½	Pe -0.000
822	37'-0			82.569	3PO(18'-8½)	370'-5½	Pv
Route 14							



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 08 (16.8K)

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Fittings	Eq. Length	Summary
Upstream						Total Length	
RN	2.7050	92.08	5.14	120	0.021762	295'-7"	Pf 8.062
852	37'-2"	471.27		75.413	PO(18'-8½"), Flow (q) from Route	74'-10½"	Pe -0.000
826	37'-2"			83.475	19	370'-5½"	Pv
					3PO(18'-8½")		
Route 15							
CM	4.3100	379.19	8.34	120	0.030877	10'-0"	Pf 0.309
852	37'-2"	471.27		75.413	Flow (q) from Route 19		Pe -0.120
812	37'-5"			75.602		10'-0"	Pv
RN	2.7050	92.17	5.15	120	0.021803	295'-7"	Pf 8.077
812	37'-5"			75.602	PO(18'-8½")	74'-10½"	Pe -0.000
814	37'-5"			83.678	3PO(18'-8½")	370'-5½"	Pv
Route 16							
CM	4.3100	287.02	6.31	120	0.018445	10'-0"	Pf 0.185
812	37'-5"	92.17		75.602	Flow (q) from Route 15		Pe -0.120
810	37'-8½"			75.666		10'-0"	Pv
RN	2.7050	93.35	5.21	120	0.022322	295'-7"	Pf 8.269
810	37'-8½"			75.666	PO(18'-8½")	74'-10½"	Pe -0.000
816	37'-8½"			83.935	3PO(18'-8½")	370'-5½"	Pv
Route 17							
CM	4.3100	193.67	4.26	120	0.008908	10'-0"	Pf 0.089
810	37'-8½"	93.35		75.666	Flow (q) from Route 16		Pe -0.120
808	38'-0"			75.635		10'-0"	Pv
RN	2.7050	95.44	5.33	120	0.023254	295'-7"	Pf 8.614
808	38'-0"			75.635	PO(18'-8½")	74'-10½"	Pe -0.000
818	38'-0"			84.249	3PO(18'-8½")	370'-5½"	Pv
Route 18							
CM	4.3100	98.23	2.16	120	0.002537	10'-0"	Pf 0.025
808	38'-0"	95.44		75.635	Flow (q) from Route 17		Pe -0.120
806	38'-3"			75.540		10'-0"	Pv
RN	2.7050	98.23	5.48	120	0.024526	295'-7"	Pf 9.086
806	38'-3"			75.540	PO(18'-8½")	74'-10½"	Pe -0.000
800	38'-3"			84.625	3PO(18'-8½")	370'-5½"	Pv
Route 19							
CM	4.3100	471.27	10.36	120	0.046164	10'-0½"	Pf 0.463
848	37'-0"	88.88		75.017	Flow (q) from Route 13		Pe -0.066
852	37'-2"			75.413		10'-0½"	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

C Value Multiplier

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$$

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51



Hydraulic Analysis

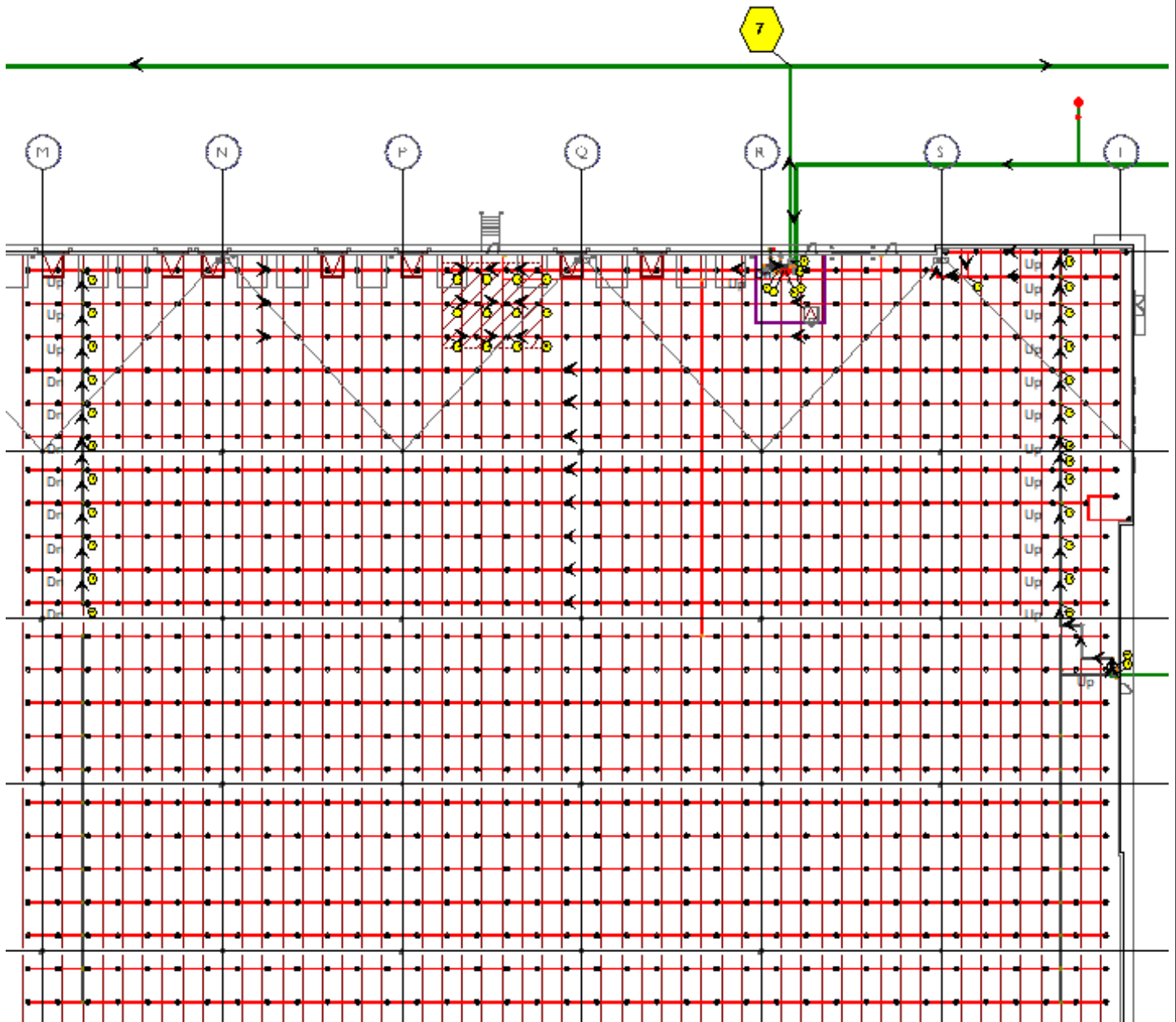
Job Number: 212189000
Report Description: Remote Area 08 (16.8K)

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream						Total Length	

Pipe Type Legend	
AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend	
Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend	
ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BaIV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DeIV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PrV	Pressure Relief Valve
PRV	Pressure Reducing Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
SFx	Seismic Flex
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap





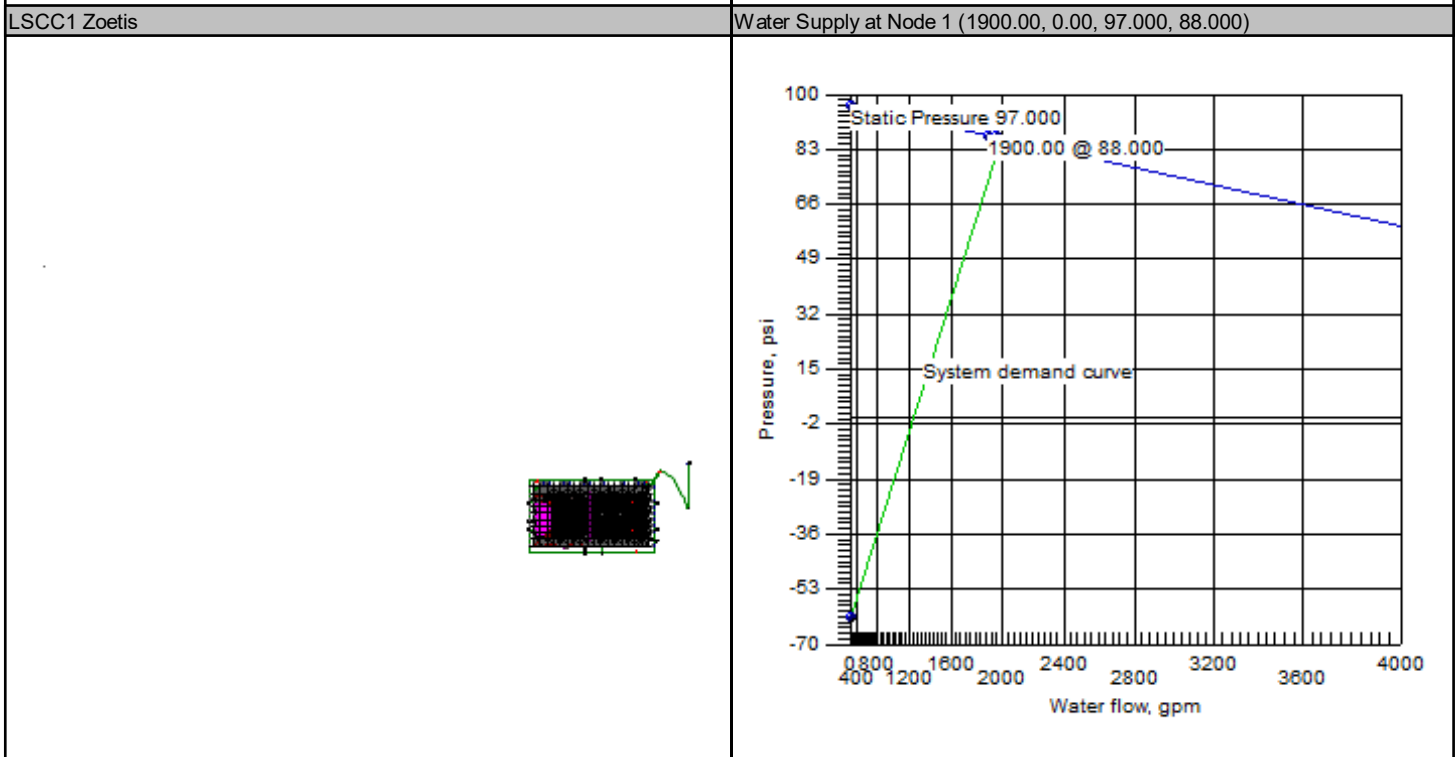
Hydraulic Overview

Job Number: 212189000
Report Description: Remote Area 08

Job		
Job Number 212189000	Design Engineer Jay Colbert	
Job Name: Lee's Summit Commerce Center	Phone 913.242.0057	FAX
Address 1 1120 NW Main St	State Certification/License Number	
Address 2	AHJ City of Lee's Summit	
Address 3 Lee's Summit, MO 64086	Job Site/Building Building A	

System	
Pressure 40.000	Area of Application NA
Most Demanding Sprinkler Data 22.4 K-Factor 141.67 at 40.000	Hose Streams 250.00
Coverage Per Sprinkler 100ft ²	Number Of Sprinklers Calculated 12 0
System Pressure Demand 81.616	System Flow Demand 1956.80
Total Demand 1956.80 @ 81.616	Pressure Result +5.880 (6.7%)

Supplies						Check Point Gauges			
Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)	Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)
1	Water Supply	1900.00		97.000	88.000	Pump Inlet	64.666	243.34	1956.80
4	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									





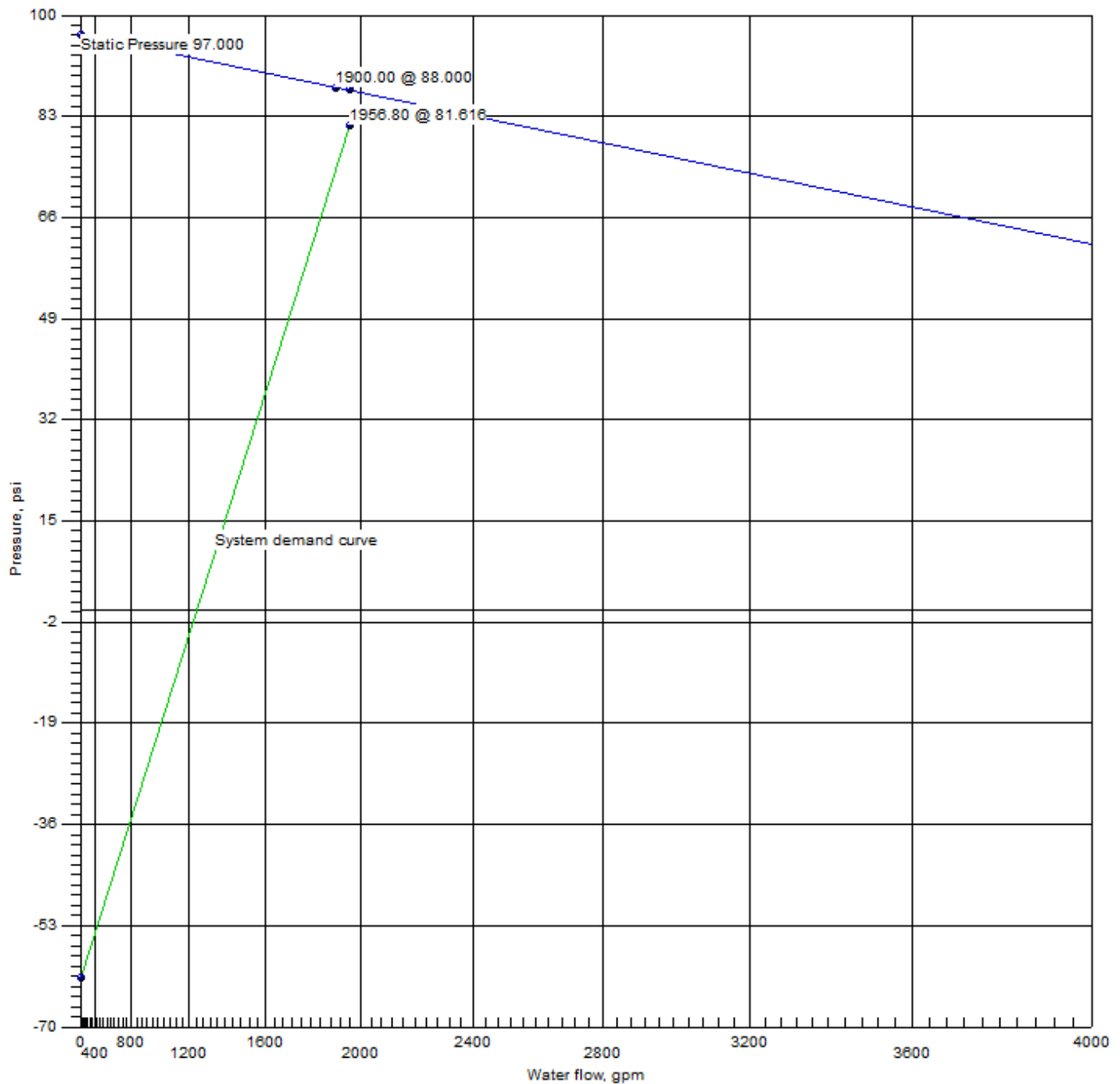
Hydraulic Summary

Job Number: 212189000
Report Description: Remote Area 08

Job											
Job Number 212189000				Design Engineer Jay Colbert							
Job Name: Lee's Summit Commerce Center				State Certification/License Number							
Address 1 1120 NW Main St				AHJ City of Lee's Summit							
Address 2				Job Site/Building Building A							
Address 3 Lee's Summit, MO 64086				Drawing Name LSCC1 Zoetis							
System				Remote Area(s)							
Most Demanding Sprinkler Data 22.4 K-Factor 141.67 at 40.000				Occupancy ESFR			Job Suffix				
Hose Allowance At Source 0.00				Pressure 40.000			Area of Application NA				
Additional Hose Supplies Node Hydrant At Node 52				Flow(gpm) 250.00			Number Of Sprinklers Calculated 12				
				Number Of Nozzles Calculated 0			Coverage Per Sprinkler 100ft ²				
				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 81.578 Right: 81.564							
Total Hose Streams 250.00											
System Flow Demand 1956.80			Total Water Required (Including Hose Allowance) 1956.80								
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 18.98 between nodes 812 and 810											
Maximum Velocity Under Ground 11.36 between nodes 224 and 7											
Volume capacity of Wet Pipes 34293.96gal			Volume capacity of Dry Pipes								
Supplies											
Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@	Flow (gpm)	Available (psi)	@	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply		97.000	88.000		1900.00	87.496		1956.80	81.616	5.880
4	Pump		84.000	60.000		2000.00	131.313		1956.80	125.433	5.880
Pumps: Static = Churn (Pressure @ Zero Flow)											
Contractor											
Contractor Number 21		Contact Name Jay Colbert					Contact Title				
Name of Contractor: F.E. Moran Fire Protection Inc.		Phone 913.242.0057					Extension				
Address 1 16815 College Blvd.		FAX									
Address 2		E-mail jay.colbert@femoran.com									
Address 3 Lenexa, KS 66219		Web-Site femoranfp.com									



Water Supply at Node 1



Hydraulic Graph

Water Supply at Node 1

Static: Pressure

97.000

Residual: Pressure

88.000 @ 1900.00

Available Pressure at System Demand

87.496 @ 1956.80

Required Pressure at System Demand

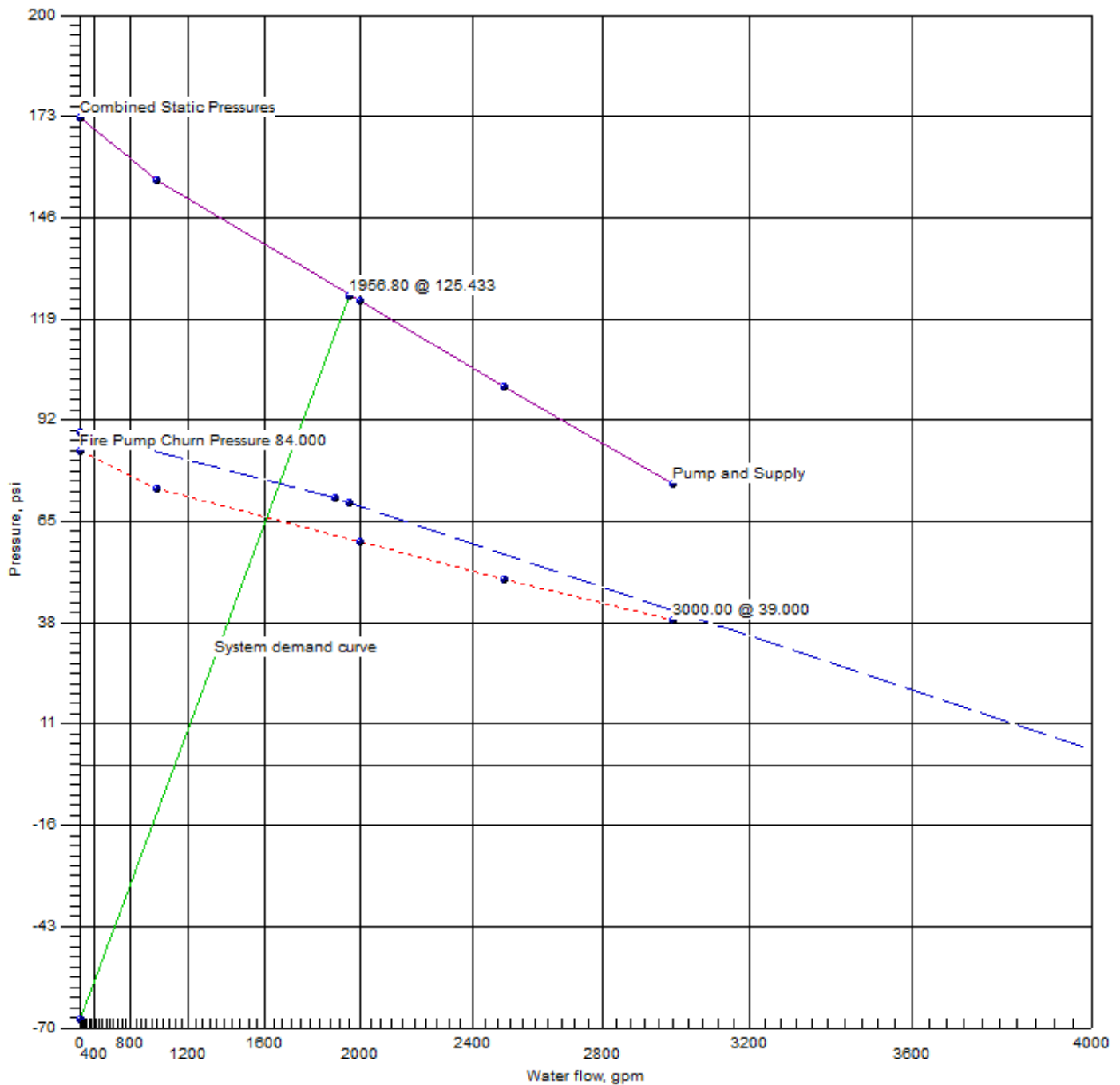
81.616 @ 1956.80

Required Pressure at System Demand (Including Hose Allowance at Source)

81.616 @ 1956.80



Pump at Node 4



Hydraulic Graph
Pump at Node 4

Static + Churn Pressure
173.256
Fire Pump Churn Pressure
84.000

Fire Pump Rating
60.000 @ 2000.00

Residual Pressure
60.767 @ 1956.80
Available Pressure at System Demand
131.313 @ 1956.80
Required Pressure at System Demand
125.433 @ 1956.80



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: Remote Area 08

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Hydrant	52	250.00	250.00	250	120.039		
⇒ Sprinkler	8135	141.67	141.67	22.4	40.000		
Sprinkler	8137	142.43	141.67	22.4	40.429		
Sprinkler	8139	141.67	141.67	22.4	40.000		
Sprinkler	8141	142.45	141.67	22.4	40.441		
Sprinkler	8143	141.72	141.67	22.4	40.027		
Sprinkler	8145	142.46	141.67	22.4	40.446		
Sprinkler	8147	141.72	141.67	22.4	40.027		
Sprinkler	8149	142.51	141.67	22.4	40.478		
Sprinkler	8151	142.16	141.67	22.4	40.276		
Sprinkler	8153	142.87	141.67	22.4	40.682		
Sprinkler	8155	142.16	141.67	22.4	40.277		
Sprinkler	8157	142.99	141.67	22.4	40.747		

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: Remote Area 08

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	81.616	1956.80
52	1'-0	Hyd(-1.000)	120.039	250.00
8135	39'-1	Spr(-40.000)	40.000	141.67
8137	39'-1	Spr(-40.429)	40.429	142.43
8139	39'-1	Spr(-40.000)	40.000	141.67
8141	39'-1	Spr(-40.441)	40.441	142.45
8143	38'-10	Spr(-40.027)	40.027	141.72
8145	38'-10	Spr(-40.446)	40.446	142.46
8147	38'-10	Spr(-40.027)	40.027	141.72
8149	38'-10	Spr(-40.478)	40.478	142.51
8151	38'-6½	Spr(-40.276)	40.276	142.16
8153	38'-6½	Spr(-40.682)	40.682	142.87
8155	38'-6½	Spr(-40.277)	40.277	142.16
8157	38'-6½	Spr(-40.747)	40.747	142.99
2	1'-9	T(65'-4½)	65.151	
3	1'-9	P1, Pump Inlet	64.666	
4	1'-9	P2(-60.886)	125.433	
5	1'-9		125.433	
6	6'-8½		120.872	
7	-8'-0	T(59'-4½)	125.242	
8	-8'-0	T(59'-4½)	124.400	
9	-8'-0	T(47'-3½)	124.103	
10	-8'-0	T(59'-4½)	123.408	
11	-8'-0	T(47'-3½)	123.247	
12	-8'-0	T(59'-4½)	123.184	
13	-8'-0	T(47'-3½)	122.489	
14	-8'-0	T(59'-4½)	122.365	
15	-8'-0	T(47'-3½)	121.792	
16	-8'-0	T(59'-4½)	121.696	
17	-8'-0	T(59'-4½)	121.472	
54	1'-0	Hyd	1.000	
55	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
224	1'-0		123.192	
309	-8'-0	E(35'-1)	79.108	
800	38'-3	PO(18'-8½)	79.444	
802	1'-8½	PO(37'-8½)	114.073	
804	1'-0		115.276	
806	38'-3	PO(18'-8½)	62.120	
808	38'-0	PO(18'-8½)	62.423	
810	37'-8½	PO(18'-8½)	63.204	
812	37'-5	PO(18'-8½)	64.739	
814	37'-5	PO(18'-8½)	78.696	
816	37'-8½	PO(18'-8½)	78.788	
818	38'-0	PO(18'-8½)	79.026	
820	37'-0	PO(18'-8½)	77.779	
822	37'-0	PO(18'-8½)	78.312	
824	37'-0		78.659	
826	37'-2	PO(18'-8½)	78.656	
828	37'-10	T(18'-8½)	76.141	
830	37'-0	PO(18'-8½)	77.115	
832	37'-0	PO(18'-8½)	77.137	
834	37'-0	PO(18'-8½)	77.232	
836	37'-0	PO(18'-8½)	77.434	
838	37'-0	PO(18'-8½)	77.111	
840	37'-0	PO(18'-8½)	67.637	
842	37'-0	PO(18'-8½)	67.838	
844	37'-0	PO(18'-8½)	67.934	
846	37'-0	PO(18'-8½)	67.961	
848	37'-0	PO(18'-8½)	66.758	
850	37'-0	PO(18'-8½)	67.291	
852	37'-2	PO(18'-8½)	65.921	



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 08

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
BL	2.7050	140.64	7.85	120		0.047641	9'-0	Pf 0.429
8135	39'-1	141.67	22.4	40.000		Sprinkler		Pe
8137	39'-1			40.429			9'-0	Pv
BL	2.7050	283.06	15.80	120		0.173775	185'-0	Pf 38.654
8137	39'-1	142.43	22.4	40.429		Sprinkler,	37'-5	Pe 0.361
800	38'-3			79.444		2PO(18'-8½)	222'-5	Pv
CM	6.3570	1706.80	17.25	120		0.075223	71'-1	Pf 18.776
800	38'-3	1423.73		79.444		Flow (q) from Route 2	178'-6½	Pe 15.852
802	1'-8½			114.073		5E(17'-7), 2f(-0.000), CV(40'-3), BV(12'-7), PO(37'-8½)	249'-7½	Pv
CM	8.2490	1706.80	10.25	120		0.021150	1'-6	Pf 0.901
802	1'-8½			114.073			41'-1½	Pe 0.303
804	1'-0			115.276		PO(41'-1½)	42'-7½	Pv
UG	8.3900	1706.80	9.90	140		0.014643	66'-8½	Pf 2.294
804	1'-0			115.276			89'-11	Pe 3.902
17	-8'-0			121.472		E(30'-6½), T(59'-4½)	156'-7½	Pv
UG	8.3900	1297.62	7.53	140		0.008819	337'-8	Pf 3.771
17	-8'-0			121.472			89'-11	Pe
7	-8'-0			125.242		E(30'-6½), T(59'-4½)	427'-7	Pv
UG	8.3900	1956.80	11.36	140		0.018856	67'-8	Pf 1.852
7	-8'-0	659.18		125.242		Flow (q) from Route 7	30'-6½	Pe -3.902
224	1'-0			123.192		E(30'-6½)	98'-2½	Pv
FR	8.2490	1956.80	11.75	120		0.027236	5'-8½	Pf 0.156
224	1'-0			123.192				Pe -2.476
6	6'-8½			120.872			5'-8½	Pv
DY	10.3700	1956.80	7.43	120		0.008937	13'-10½	Pf 2.410
6	6'-8½			120.872			255'-9	Pe 2.151
5	1'-9			125.433		4E(26'-0), T(48'-5½), BV(21'-3½) , Tr(17'-0), CV(65'-0)	269'-8	Pv
DY	7.9810	1956.80	12.55	120		0.031989	0'-0	Pf 0.000
5	1'-9			125.433				Pe 0.000
4	1'-9			125.433			0'-0	Pv
Pump								
4		1956.80		125.433		Rating: 60.000 @ 2000.00		
3		Q=1956.80	7.39	64.666		Fire Pump Churn Pressure: 84.00 0		
DY	10.4000	1956.80	7.39	140		0.006625	0'-0	Pf 0.486
3	1'-9			64.666			73'-4	Pe 0.000
2	1'-9			65.151		GV(7'-11½), T(65'-4½)	73'-4	Pv
UG	10.4000	1956.80	7.39	140		0.006625	696'-3½	Pf 9.730
2	1'-9			65.151			175'-4½	Pe 4.227
309	-8'-0			79.108		4E(35'-1), 2EE(17'-6½), BFP(-3.9 48)	871'-8	Pv
UG	12.4600	1956.80	5.15	140		0.002748	360'-2½	Pf 0.990
309	-8'-0			79.108				Pe 1.517
1	-11'-6			81.616		Water Supply	360'-2½	Pv
		0.00				Hose Allowance At Source		
1		1956.80						
Route 2								
BL	2.7050	1.03	0.06	120		0.000005	9'-0	Pf 0.000
8135	39'-1	141.67	22.4	40.000		Sprinkler		Pe
8139	39'-1			40.000			9'-0	Pv
BL	2.7050	142.70	7.97	120		0.048944	9'-0	Pf 0.440
8139	39'-1	141.67	22.4	40.000		Sprinkler		Pe
8141	39'-1			40.441			9'-0	Pv
BL	2.7050	285.15	15.92	120		0.176152	83'-7	Pf 21.318
8141	39'-1	142.45	22.4	40.441		Sprinkler,	37'-5	Pe 0.361
806	38'-3			62.120		2PO(18'-8½)	121'-0	Pv
CM	4.3100	285.15	6.27	120		0.018224	10'-0	Pf 0.182
806	38'-3			62.120				Pe 0.120
808	38'-0			62.423			10'-0	Pv
CM	4.3100	572.21	12.58	120		0.066105	10'-0	Pf 0.661
808	38'-0	287.06		62.423		Flow (q) from Route 4		Pe 0.120
810	37'-8½			63.204			10'-0	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 08

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
CM	4.3100	862.95	18.98	120		0.141357	10'-0	Pf 1.414
810	37'-8½	290.73		63.204		Flow (q) from Route 6		Pe 0.120
812	37'-5			64.739			10'-0	Pv
RN	2.7050	123.88	6.92	120		0.037676	295'-7	Pf 13.957
812	37'-5			64.739		PO(18'-8½)	74'-10½	Pe -0.000
814	37'-5			78.696		3PO(18'-8½)	370'-5½	Pv
CM	6.3570	862.95	8.72	120		0.021300	10'-0	Pf 0.213
814	37'-5	739.06		78.696		Flow (q) from Route 10		Pe -0.120
816	37'-8½			78.788			10'-0	Pv
CM	6.3570	1142.39	11.55	120		0.035791	10'-0	Pf 0.358
816	37'-8½	279.45		78.788		Flow (q) from Route 5		Pe -0.120
818	38'-0			79.026			10'-0	Pv
CM	6.3570	1423.73	14.39	120		0.053785	10'-0	Pf 0.538
818	38'-0	281.34		79.026		Flow (q) from Route 3		Pe -0.120
800	38'-3			79.444			10'-0	Pv
Route 3								
BL	2.7050	138.88	7.75	120		0.046549	9'-0	Pf 0.419
8143	38'-10	141.72	22.4	40.027		Sprinkler		Pe
8145	38'-10			40.446			9'-0	Pv
BL	2.7050	281.34	15.71	120		0.171823	185'-0	Pf 38.220
8145	38'-10	142.46	22.4	40.446		Sprinkler,	37'-5	Pe 0.361
818	38'-0			79.026		2PO(18'-8½)	222'-5	Pv
Route 4								
BL	2.7050	2.83	0.16	120		0.000035	9'-0	Pf 0.000
8143	38'-10	141.72	22.4	40.027		Sprinkler		Pe
8147	38'-10			40.027			9'-0	Pv
BL	2.7050	144.55	8.07	120		0.050122	9'-0	Pf 0.451
8147	38'-10	141.72	22.4	40.027		Sprinkler		Pe
8149	38'-10			40.478			9'-0	Pv
BL	2.7050	287.06	16.03	120		0.178344	83'-7	Pf 21.583
8149	38'-10	142.51	22.4	40.478		Sprinkler,	37'-5	Pe 0.361
808	38'-0			62.423		2PO(18'-8½)	121'-0	Pv
Route 5								
BL	2.7050	136.57	7.62	120		0.045127	9'-0	Pf 0.406
8151	38'-6½	142.16	22.4	40.276		Sprinkler		Pe
8153	38'-6½			40.682			9'-0	Pv
BL	2.7050	279.45	15.60	120		0.169690	185'-0	Pf 37.745
8153	38'-6½	142.87	22.4	40.682		Sprinkler,	37'-5	Pe 0.361
816	37'-8½			78.788		2PO(18'-8½)	222'-5	Pv
Route 6								
BL	2.7050	5.58	0.31	120		0.000122	9'-0	Pf 0.001
8151	38'-6½	142.16	22.4	40.276		Sprinkler		Pe
8155	38'-6½			40.277			9'-0	Pv
BL	2.7050	147.74	8.25	120		0.052190	9'-0	Pf 0.470
8155	38'-6½	142.16	22.4	40.277		Sprinkler		Pe
8157	38'-6½			40.747			9'-0	Pv
BL	2.7050	290.73	16.23	120		0.182581	83'-7	Pf 22.096
8157	38'-6½	142.99	22.4	40.747		Sprinkler,	37'-5	Pe 0.361
810	37'-8½			63.204		2PO(18'-8½)	121'-0	Pv
Route 7								
UG	6.2800	250.00	2.59	140		0.001718	20'-0	Pf 0.162
52	1'-0	250.00		120.039		Hydrant,	74'-1	Pe 3.902
9	-8'-0			124.103		E(22'-1), GV(4'-8½), T(47'-3½)	94'-1	Pv
UG	8.3900	659.18	3.83	140		0.002519	118'-2	Pf 0.298
9	-8'-0	409.18		124.103		Flow (q) from Route 8		Pe
8	-8'-0			124.400			118'-2	Pv
UG	8.3900	659.18	3.83	140		0.002519	275'-0	Pf 0.842
8	-8'-0			124.400			59'-4½	Pe
7	-8'-0			125.242		T(59'-4½)	334'-4½	Pv
Route 8								
UG	8.3900	409.18	2.37	140		0.001043	119'-3	Pf 0.124
14	-8'-0	409.18		122.365		Flow (q) from Route 9		Pe
13	-8'-0			122.489			119'-3	Pv
UG	8.3900	409.18	2.37	140		0.001043	635'-9	Pf 0.695
13	-8'-0			122.489			30'-6½	Pe
12	-8'-0			123.184		E(30'-6½)	666'-3½	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 08

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
UG	8.3900	409.18	2.37	140		0.001043	61'-1½"	Pf 0.064
12	-8'-0"			123.184				Pe
11	-8'-0"			123.247			61'-1½"	Pv
UG	8.3900	409.18	2.37	140		0.001043	153'-8"	Pf 0.160
11	-8'-0"			123.247				Pe
10	-8'-0"			123.408			153'-8"	Pv
UG	8.3900	409.18	2.37	140		0.001043	635'-11½"	Pf 0.695
10	-8'-0"			123.408			30'-6½"	Pe
9	-8'-0"			124.103		E(30'-6½")	666'-6"	Pv
Route 9								
UG	8.3900	409.18	2.37	140		0.001043	214'-9"	Pf 0.224
17	-8'-0"	1297.62		121.472		Flow (q) from Route 1		Pe
16	-8'-0"			121.696			214'-9"	Pv
UG	8.3900	409.18	2.37	140		0.001043	91'-11½"	Pf 0.096
16	-8'-0"			121.696				Pe
15	-8'-0"			121.792			91'-11½"	Pv
UG	8.3900	409.18	2.37	140		0.001043	519'-3½"	Pf 0.573
15	-8'-0"			121.792			30'-6½"	Pe
14	-8'-0"			122.365		E(30'-6½")	549'-10"	Pv
Route 10								
CM	4.3100	509.31	11.20	120		0.053293	10'-0"	Pf 0.533
820	37'-0"	403.16 + 106.15		77.779		Flow (q) from Route 11 and 19		Pe
822	37'-0"			78.312			10'-0"	Pv
CM	4.3100	621.16	13.66	120		0.076945	4'-6"	Pf 0.346
822	37'-0"	111.85		78.312		Flow (q) from Route 18		Pe
824	37'-0"			78.659			4'-6"	Pv
CM	6.3570	621.16	6.28	120		0.011594	5'-6½"	Pf 0.064
824	37'-0"			78.659				Pe -0.067
826	37'-2"			78.656			5'-6½"	Pv
CM	6.3570	739.06	7.47	120		0.015991	10'-0"	Pf 0.160
826	37'-2"	117.90		78.656		Flow (q) from Route 20		Pe -0.120
814	37'-5"			78.696			10'-0"	Pv
Route 11								
BL	2.7050	58.17	3.25	120		0.009304	28'-6"	Pf 0.613
828	37'-10"	101.92		76.141		Flow (q) from Route 16	37'-5"	Pe 0.361
830	37'-0"			77.115		2PO(18'-8½")	65'-11"	Pv
CM	4.3100	101.92	2.24	120		0.002717	8'-0"	Pf 0.022
830	37'-0"	43.76		77.115		Flow (q) from Route 12		Pe
832	37'-0"			77.137			8'-0"	Pv
CM	4.3100	200.84	4.42	120		0.009528	10'-0"	Pf 0.095
832	37'-0"	98.91		77.137		Flow (q) from Route 17		Pe
834	37'-0"			77.232			10'-0"	Pv
CM	4.3100	300.85	6.62	120		0.020123	10'-0"	Pf 0.201
834	37'-0"	100.01		77.232		Flow (q) from Route 15		Pe
836	37'-0"			77.434			10'-0"	Pv
CM	4.3100	403.16	8.87	120		0.034584	10'-0"	Pf 0.346
836	37'-0"	102.31		77.434		Flow (q) from Route 14		Pe
820	37'-0"			77.779			10'-0"	Pv
Route 12								
CM	4.3100	43.76	0.96	120		0.000568	7'-6"	Pf 0.004
838	37'-0"	43.76		77.111		Flow (q) from Route 13		Pe
830	37'-0"			77.115			7'-6"	Pv
Route 13								
BL	2.7050	43.76	2.44	120		0.005495	36'-0"	Pf 0.609
828	37'-10"	101.92		76.141		T(18'-8½"), Flow (q) from Route 16	74'-10½"	Pe 0.361
838	37'-0"			77.111		T(18'-8½"), 2PO(18'-8½")	110'-10½"	Pv
Route 14								
RN	2.7050	102.31	5.71	120		0.026444	295'-7"	Pf 9.796
840	37'-0"	403.16		67.637		PO(18'-8½"), Flow (q) from Route 21	74'-10½"	Pe -0.000
836	37'-0"			77.434		3PO(18'-8½")	370'-5½"	Pv
Route 15								
CM	4.3100	300.85	6.62	120		0.020123	10'-0"	Pf 0.201
840	37'-0"	403.16		67.637		Flow (q) from Route 21		Pe
842	37'-0"			67.838			10'-0"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 08

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Fittings	Eq. Length	Summary
Upstream						Total Length	
RN	2.7050	100.01	5.58	120	0.025358	295'-7"	Pf 9.394
842	37'-0"			67.838	PO(18'-8½")	74'-10½"	Pe -0.000
834	37'-0"			77.232	3PO(18'-8½")	370'-5½"	Pv
Route 16							
CM	4.3100	200.84	4.42	120	0.009528	10'-0"	Pf 0.095
842	37'-0"	100.01		67.838	Flow (q) from Route 15	10'-0"	Pe
844	37'-0"			67.934		10'-0"	Pv
CM	4.3100	101.92	2.24	120	0.002717	10'-0"	Pf 0.027
844	37'-0"			67.934		10'-0"	Pe
846	37'-0"			67.961		10'-0"	Pv
RN	2.7050	101.92	5.69	120	0.026261	269'-1"	Pf 8.541
846	37'-0"			67.961	PO(18'-8½")	56'-2"	Pe -0.361
828	37'-10"			76.141	PO(18'-8½"), 2E(9'-4½")	325'-3"	Pv
Route 17							
RN	2.7050	98.91	5.52	120	0.024844	295'-7"	Pf 9.203
844	37'-0"			67.934	PO(18'-8½")	74'-10½"	Pe -0.000
832	37'-0"			77.137	3PO(18'-8½")	370'-5½"	Pv
Route 18							
RN	2.7050	111.85	6.24	120	0.031189	295'-7"	Pf 11.554
848	37'-0"	621.16		66.758	PO(18'-8½"), Flow (q) from Route 22	74'-10½"	Pe -0.000
822	37'-0"			78.312	22	370'-5½"	Pv
					3PO(18'-8½")		
Route 19							
CM	4.3100	509.31	11.20	120	0.053293	10'-0"	Pf 0.533
848	37'-0"	621.16		66.758	Flow (q) from Route 22	10'-0"	Pe
850	37'-0"			67.291		10'-0"	Pv
RN	2.7050	106.15	5.93	120	0.028312	295'-7"	Pf 10.488
850	37'-0"			67.291	PO(18'-8½")	74'-10½"	Pe -0.000
820	37'-0"			77.779	3PO(18'-8½")	370'-5½"	Pv
Route 20							
CM	4.3100	739.06	16.25	120	0.106123	10'-0"	Pf 1.062
812	37'-5"	123.88		64.739	Flow (q) from Route 2	10'-0"	Pe 0.120
852	37'-2"			65.921		10'-0"	Pv
RN	2.7050	117.90	6.58	120	0.034379	295'-7"	Pf 12.736
852	37'-2"			65.921	PO(18'-8½")	74'-10½"	Pe -0.000
826	37'-2"			78.656	3PO(18'-8½")	370'-5½"	Pv
Route 21							
CM	4.3100	403.16	8.87	120	0.034584	10'-0"	Pf 0.346
850	37'-0"	106.15		67.291	Flow (q) from Route 19	10'-0"	Pe
840	37'-0"			67.637		10'-0"	Pv
Route 22							
CM	4.3100	621.16	13.66	120	0.076945	10'-0½"	Pf 0.771
852	37'-2"	117.90		65.921	Flow (q) from Route 20	10'-0½"	Pe 0.066
848	37'-0"			66.758		10'-0½"	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

C Value Multiplier

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$$

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

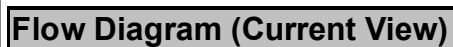


Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 08

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss		Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend	Units Legend		Fittings Legend	
AO Arm-Over	Diameter	Inch	ALV Alarm Valve	
BL Branch Line	Elevation	Foot	AngV Angle Valve	
CM Cross Main	Flow	gpm	b Bushing	
DN Drain	Discharge	gpm	BaIV Ball Valve	
DR Drop	Velocity	fps	BFP Backflow Preventer	
DY Dynamic	Pressure	psi	BV Butterfly Valve	
FM Feed Main	Length	Foot	C Cross Flow Turn 90°	
FR Feed Riser	Friction Loss	psi/Foot	cplg Coupling	
MS Miscellaneous	HWC	Hazen-Williams Constant	Cr Cross Run	
OR Outrigger	Pt	Total pressure at a point in a pipe	CV Check Valve	
RN Riser Nipple	Pn	Normal pressure at a point in a pipe	DeIV Deluge Valve	
SP Sprig	Pf	Pressure loss due to friction between points	DPV Dry Pipe Valve	
ST Stand Pipe	Pe	Pressure due to elevation difference between indicated points	E 90° Elbow	
UG Underground	Pv	Velocity pressure at a point in a pipe	EE 45° Elbow	
			Ee1 11¼° Elbow	
			Ee2 22½° Elbow	
			f Flow Device	
			fd Flex Drop	
			FDC Fire Department Connection	
			fE 90° FireLock(TM) Elbow	
			fEE 45° FireLock(TM) Elbow	
			flg Flange	
			FN Floating Node	
			fT FireLock(TM) Tee	
			g Gauge	
			GloV Globe Valve	
			GV Gate Valve	
			Ho Hose	
			Hose Hose	
			HV Hose Valve	
			Hyd Hydrant	
			LtE Long Turn Elbow	
			mecT Mechanical Tee	
			Noz Nozzle	
			P1 Pump In	
			P2 Pump Out	
			PIV Post Indicating Valve	
			PO Pipe Outlet	
			PrV Pressure Relief Valve	
			PRV Pressure Reducing Valve	
			red Reducer/Adapter	
			S Supply	
			sCV Swing Check Valve	
			SFx Seismic Flex	
			Spr Sprinkler	
			St Strainer	
			T Tee Flow Turn 90°	
			Tr Tee Run	
			U Union	
			WirF Wirsbo	
			WMV Water Meter Valve	
			Z Cap	





Hydraulic Overview

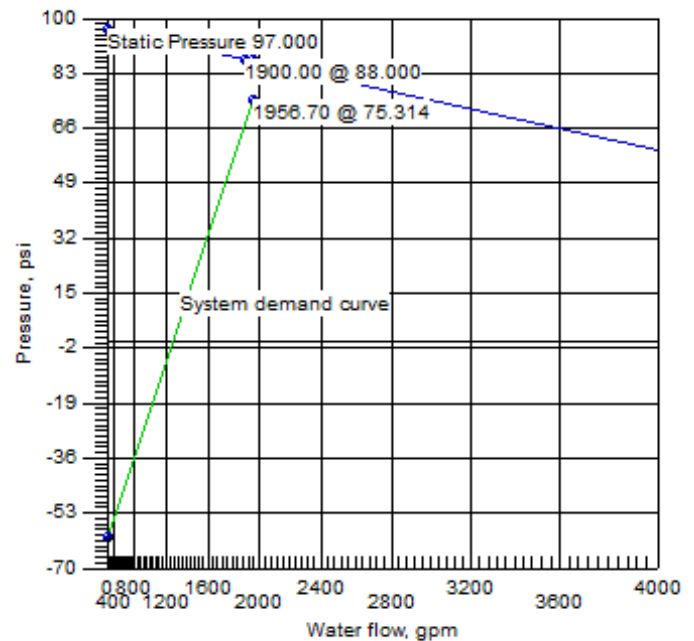
Job Number: 212189000
Report Description: Remote Area 09

Job		
Job Number 212189000	Design Engineer Jay Colbert	
Job Name: Lee's Summit Commerce Center	Phone 913.242.0057	FAX
Address 1 1120 NW Main St	State Certification/License Number	
Address 2	AHJ City of Lee's Summit	
Address 3 Lee's Summit, MO 64086	Job Site/Building Building A	

System	
Pressure 40.000	Area of Application NA
Most Demanding Sprinkler Data 22.4 K-Factor 141.67 at 40.000	Hose Streams 250.00
Coverage Per Sprinkler 100ft ²	Number Of Sprinklers Calculated 12 0
System Pressure Demand 75.314	System Flow Demand 1956.70
Total Demand 1956.70 @ 75.314	Pressure Result +12.183 (13.9%)

Supplies						Check Point Gauges			
Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)	Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)
1	Water Supply	1900.00		97.000	88.000	Pump Inlet	58.365	256.12	1956.70
4	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									

LSCC1 Zoetis	Water Supply at Node 1 (1900.00, 0.00, 97.000, 88.000)
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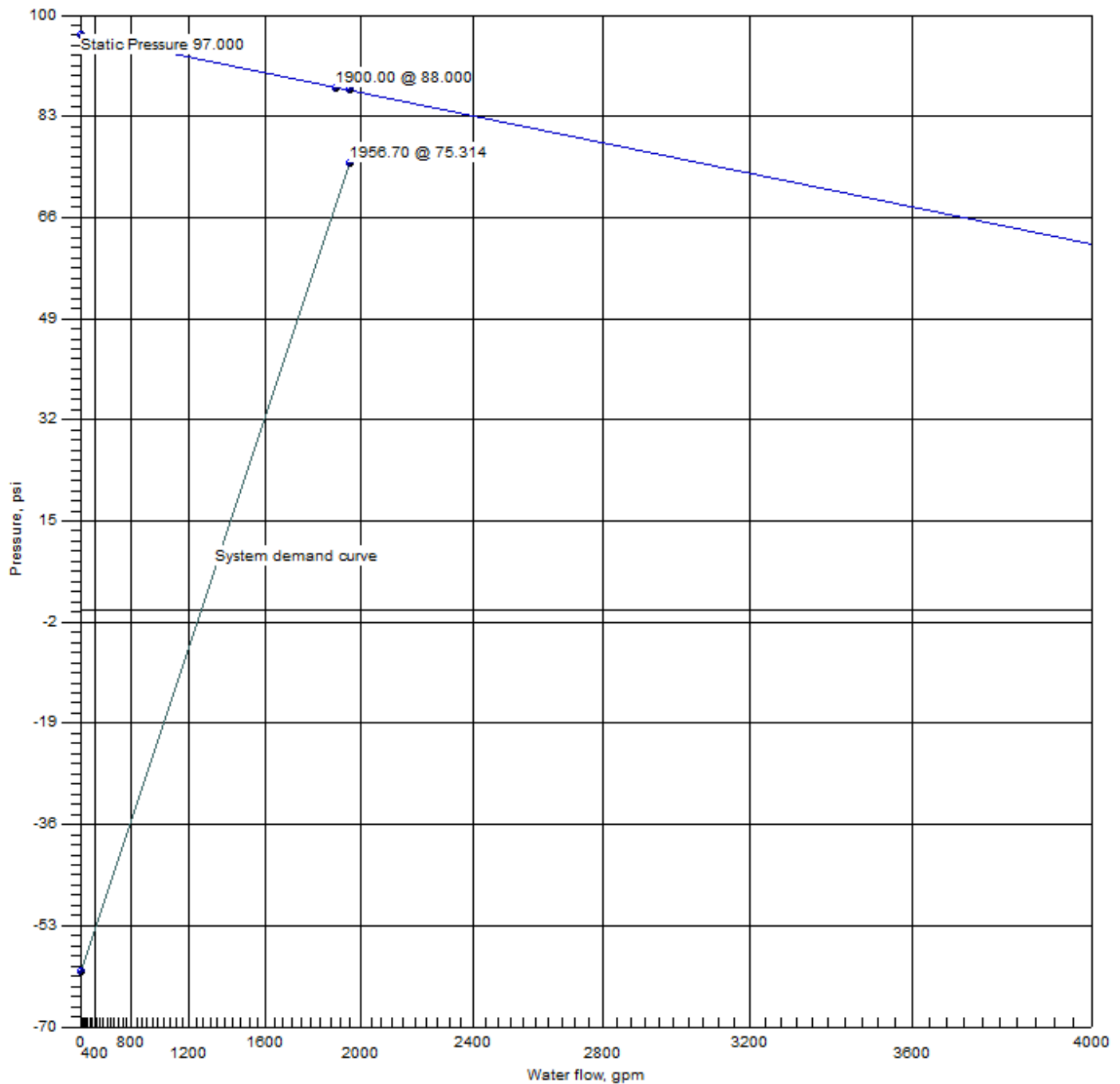
Hydraulic Summary

Job Number: 212189000
Report Description: Remote Area 09

Job									
Job Number 212189000				Design Engineer Jay Colbert					
Job Name: Lee's Summit Commerce Center				State Certification/License Number					
Address 1 1120 NW Main St				AHJ City of Lee's Summit					
Address 2				Job Site/Building Building A					
Address 3 Lee's Summit, MO 64086				Drawing Name LSCC1 Zoetis					
System				Remote Area(s)					
Most Demanding Sprinkler Data 22.4 K-Factor 141.67 at 40.000				Occupancy ESFR			Job Suffix		
Hose Allowance At Source 0.00				Pressure 40.000			Area of Application NA		
Additional Hose Supplies Node Hydrant At Node 56				Flow(gpm) 250.00			Number Of Sprinklers Calculated 12		
				Number Of Nozzles Calculated 0			Coverage Per Sprinkler 100ft ²		
				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 75.265 Right: 75.270					
Total Hose Streams 250.00									
System Flow Demand 1956.70			Total Water Required (Including Hose Allowance) 1956.70						
Maximum Pressure Unbalance In Loops 0.000									
Maximum Velocity Above Ground 18.85 between nodes 930 and 928									
Maximum Velocity Under Ground 11.36 between nodes 224 and 7									
Volume capacity of Wet Pipes 34293.96gal			Volume capacity of Dry Pipes						
Supplies									
Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@ Flow (gpm)	Available (psi)	@ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply		97.000	88.000	1900.00	87.497	1956.70	75.314	12.183
4	Pump		84.000	60.000	2000.00	131.317	1956.70	119.134	12.183
Pumps: Static = Churn (Pressure @ Zero Flow)									
Contractor									
Contractor Number 21		Contact Name Jay Colbert				Contact Title			
Name of Contractor: F.E. Moran Fire Protection Inc.		Phone 913.242.0057				Extension			
Address 1 16815 College Blvd.		FAX							
Address 2		E-mail jay.colbert@femoran.com							
Address 3 Lenexa, KS 66219		Web-Site femoranfp.com							



Water Supply at Node 1



Hydraulic Graph

Water Supply at Node 1

Static: Pressure

97.000

Residual: Pressure

88.000 @ 1900.00

Available Pressure at System Demand

87.497 @ 1956.70

Required Pressure at System Demand

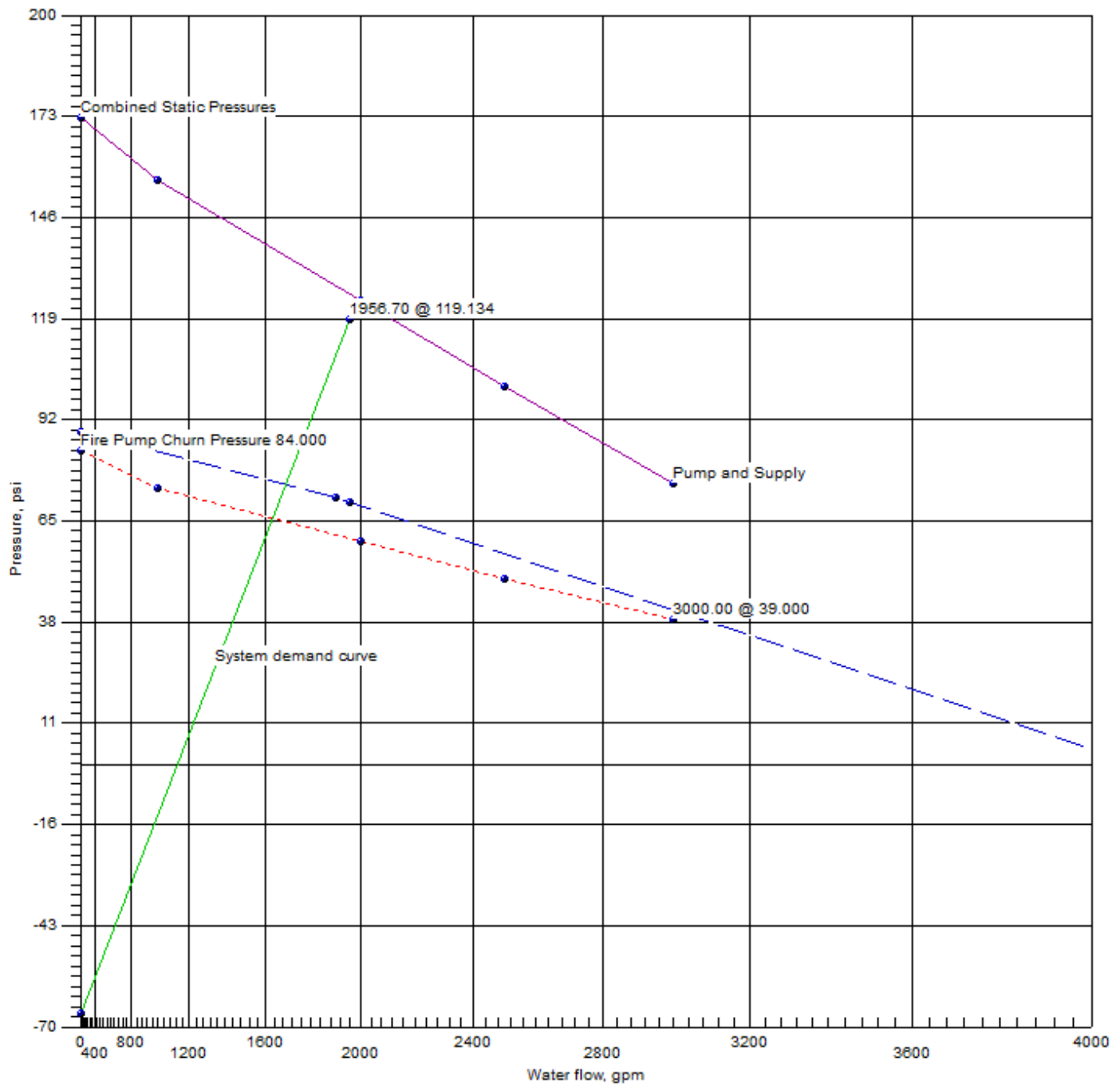
75.314 @ 1956.70

Required Pressure at System Demand (Including Hose Allowance at Source)

75.314 @ 1956.70



Pump at Node 4



Hydraulic Graph
Pump at Node 4

Static + Churn Pressure
173.256
Fire Pump Churn Pressure
84.000

Fire Pump Rating
60.000 @ 2000.00

Residual: Pressure
60.769 @ 1956.70
Available Pressure at System Demand
131.317 @ 1956.70
Required Pressure at System Demand
119.134 @ 1956.70



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: Remote Area 09

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Hydrant	56	250.00	250.00	250	110.462		
Sprinkler	9111	141.67	141.67	22.4	40.000		
⇒ Sprinkler	9113	141.67	141.67	22.4	40.000		
Sprinkler	9115	142.43	141.67	22.4	40.432		
Sprinkler	9117	142.44	141.67	22.4	40.438		
Sprinkler	9119	141.70	141.67	22.4	40.017		
Sprinkler	9121	142.46	141.67	22.4	40.446		
Sprinkler	9123	141.70	141.67	22.4	40.017		
Sprinkler	9125	142.48	141.67	22.4	40.457		
Sprinkler	9127	142.15	141.67	22.4	40.272		
Sprinkler	9129	142.90	141.67	22.4	40.696		
Sprinkler	9131	142.15	141.67	22.4	40.273		
Sprinkler	9133	142.95	141.67	22.4	40.724		

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: Remote Area 09

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	75.314	1956.70
56	1'-0	Hyd(-1.000)	110.462	250.00
9111	41'-8	Spr(-40.000)	40.000	141.67
9113	41'-8	Spr(-40.000)	40.000	141.67
9115	41'-8	Spr(-40.432)	40.432	142.43
9117	41'-8	Spr(-40.438)	40.438	142.44
9119	41'-10½	Spr(-40.017)	40.017	141.70
9121	41'-10½	Spr(-40.446)	40.446	142.46
9123	41'-10½	Spr(-40.017)	40.017	141.70
9125	41'-10½	Spr(-40.457)	40.457	142.48
9127	41'-10½	Spr(-40.272)	40.272	142.15
9129	41'-10½	Spr(-40.696)	40.696	142.90
9131	41'-10½	Spr(-40.273)	40.273	142.15
9133	41'-10½	Spr(-40.724)	40.724	142.95
2	1'-9	T(65'-4½)	58.851	
3	1'-9	P1, Pump Inlet	58.365	
4	1'-9	P2(-60.886)	119.134	
5	1'-9		119.134	
6	6'-8½		114.574	
7	-8'-0	T(59'-4½)	118.944	
8	-8'-0	T(59'-4½)	118.395	
9	-8'-0	T(47'-3½)	118.201	
10	-8'-0	T(59'-4½)	117.107	
11	-8'-0	T(47'-3½)	116.854	
12	-8'-0	T(59'-4½)	116.754	
13	-8'-0	T(47'-3½)	115.660	
14	-8'-0	T(59'-4½)	115.464	
15	-8'-0	T(47'-3½)	114.561	
16	-8'-0	T(59'-4½)	114.516	
17	-8'-0	T(59'-4½)	114.410	
52	1'-0	Hyd	1.000	
54	1'-0	Hyd	1.000	
55	1'-0	Hyd	1.000	
224	1'-0		116.894	
309	-8'-0	E(35'-1)	72.807	
804	1'-0		108.215	
900	40'-9	PO(18'-8½)	76.490	
902	40'-11½	PO(18'-8½)	76.427	
904	40'-11½	PO(18'-8½)	76.529	
906	40'-8	PO(18'-8½)	76.856	
908	40'-5	PO(18'-8½)	77.231	
910	40'-1½	PO(18'-8½)	77.654	
912	39'-10	PO(18'-8½)	78.128	
914	39'-7	PO(18'-8½)	78.656	
916	39'-3½	PO(18'-8½)	79.240	
918	39'-0	PO(18'-8½)	79.884	
920	38'-9½	T(37'-8½)	82.705	
922	1'-8½	PO(41'-1½)	107.912	
924	40'-10	PO(18'-8½)	65.205	
926	41'-0½	PO(18'-8½)	65.296	
928	41'-0½	PO(18'-8½)	65.954	
930	40'-9	PO(18'-8½)	67.471	
932	38'-5½	PO(18'-8½)	82.777	
934	38'-9	PO(18'-8½)	82.661	
936	40'-6	PO(18'-8½)	68.703	
938	40'-2½	PO(18'-8½)	69.691	
940	39'-11	PO(18'-8½)	70.472	
942	39'-8	PO(18'-8½)	71.074	
944	39'-4½	PO(18'-8½)	71.525	
946	39'-1	PO(18'-8½)	71.850	
948	38'-10	PO(18'-8½)	72.076	
950	38'-6½	PO(18'-8½)	72.226	



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 09

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
BL	2.7050	141.15	7.88	120		0.047964	9'-0	Pf 0.432
9113	41'-8	141.67	22.4	40.000		Sprinkler		Pe
9115	41'-8			40.432			9'-0	Pv
BL	2.7050	283.58	15.83	120		0.174365	167'-1	Pf 35.661
9115	41'-8	142.43	22.4	40.432		Sprinkler,	37'-5	Pe 0.397
900	40'-9			76.490		2PO(18'-8½)	204'-6	Pv
CM	6.3570	283.58	2.87	120		0.002718	10'-0	Pf 0.027
900	40'-9			76.490				Pe -0.090
902	40'-11½			76.427			10'-0	Pv
CM	6.3570	566.83	5.73	120		0.009788	9'-11½	Pf 0.097
902	40'-11½	283.25		76.427		Flow (q) from Route 3		Pe 0.004
904	40'-11½			76.529			9'-11½	Pv
CM	6.3570	849.45	8.59	120		0.020688	10'-0	Pf 0.207
904	40'-11½	282.61		76.529		Flow (q) from Route 5		Pe 0.120
906	40'-8			76.856			10'-0	Pv
CM	6.3570	949.19	9.59	120		0.025405	10'-0	Pf 0.254
906	40'-8	99.74		76.856		Flow (q) from Route 2		Pe 0.120
908	40'-5			77.231			10'-0	Pv
CM	6.3570	1043.88	10.55	120		0.030291	10'-0	Pf 0.303
908	40'-5	94.69		77.231		Flow (q) from Route 10		Pe 0.120
910	40'-1½			77.654			10'-0	Pv
CM	6.3570	1135.11	11.47	120		0.035370	10'-0	Pf 0.354
910	40'-1½	91.23		77.654		Flow (q) from Route 11		Pe 0.120
912	39'-10			78.128			10'-0	Pv
CM	6.3570	1224.42	12.38	120		0.040690	10'-0	Pf 0.407
912	39'-10	89.31		78.128		Flow (q) from Route 12		Pe 0.120
914	39'-7			78.656			10'-0	Pv
CM	6.3570	1313.26	13.28	120		0.046319	10'-0	Pf 0.463
914	39'-7	88.84		78.656		Flow (q) from Route 13		Pe 0.120
916	39'-3½			79.240			10'-0	Pv
CM	6.3570	1402.93	14.18	120		0.052340	10'-0	Pf 0.524
916	39'-3½	89.68		79.240		Flow (q) from Route 14		Pe 0.120
918	39'-0			79.884			10'-0	Pv
CM	6.3570	1494.60	15.11	120		0.058842	8'-6	Pf 2.719
918	39'-0	91.67		79.884		Flow (q) from Route 15	37'-8½	Pe 0.102
920	38'-9½			82.705		T(37'-8½)	46'-2½	Pv
CM	6.3570	1706.70	17.25	120		0.075215	51'-0	Pf 9.132
920	38'-9½	212.09		82.705		Flow (q) from Route 9	70'-5	Pe 16.076
922	1'-8½			107.912		E(17'-7), 2f(-0.000), CV(40'-3), BV(12'-7)	121'-5	Pv
DY	8.2490	1706.70	10.25	120		0.021148	0'-0	Pf 0.000
922	1'-8½			107.912				Pe 0.303
804	1'-0			108.215			0'-0	Pv
UG	8.3900	1706.70	9.90	140		0.014641	66'-8½	Pf 2.293
804	1'-0			108.215			89'-11	Pe 3.902
17	-8'-0			114.410		E(30'-6½), T(59'-4½)	156'-7½	Pv
UG	8.3900	1433.64	8.32	140		0.010605	337'-8	Pf 4.534
17	-8'-0			114.410			89'-11	Pe
7	-8'-0			118.944		E(30'-6½), T(59'-4½)	427'-7	Pv
UG	8.3900	1956.70	11.36	140		0.018854	67'-8	Pf 1.852
7	-8'-0	523.06		118.944		Flow (q) from Route 7	30'-6½	Pe -3.902
224	1'-0			116.894		E(30'-6½)	98'-2½	Pv
FR	8.2490	1956.70	11.75	120		0.027233	5'-8½	Pf 0.156
224	1'-0			116.894				Pe -2.476
6	6'-8½			114.574			5'-8½	Pv
DY	10.3700	1956.70	7.43	120		0.008936	13'-10½	Pf 2.410
6	6'-8½			114.574			255'-9	Pe 2.151
5	1'-9			119.134		4E(26'-0), T(48'-5½), BV(21'-3½), Tr(17'-0), CV(65'-0)	269'-8	Pv
DY	7.9810	1956.70	12.55	120		0.031985	0'-0	Pf 0.000
5	1'-9			119.134				Pe 0.000
4	1'-9			119.134			0'-0	Pv
Pump								
4		1956.70		119.134		Rating: 60.000 @ 2000.00		
3		Q=1956.70	7.39	58.365		Fire Pump Churn Pressure: 84.00		
						0		



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 09

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
DY	10.4000	1956.70	7.39	140		0.006625	0'-0	Pf 0.486
3	1'-9			58.365			73'-4	Pe 0.000
2	1'-9			58.851		GV(7'-11½), T(65'-4½)	73'-4	Pv
UG	10.4000	1956.70	7.39	140		0.006625	696'-3½	Pf 9.729
2	1'-9			58.851			175'-4½	Pe 4.227
309	-8'-0			72.807		4E(35'-1), 2EE(17'-6½), BFP(-3.9 48)	871'-8	Pv
UG	12.4600	1956.70	5.15	140		0.002748	360'-2½	Pf 0.990
309	-8'-0			72.807			360'-2½	Pe 1.517
1	-11'-6			75.314		Water Supply		Pv
		0.00				Hose Allowance At Source		
1		1956.70						
Route 2								
BL	2.7050	0.52	0.03	120		0.000002	9'-0	Pf 0.000
9113	41'-8	141.67	22.4	40.000		Sprinkler	9'-0	Pe
9111	41'-8			40.000				Pv
BL	2.7050	142.19	7.94	120		0.048618	9'-0	Pf 0.438
9111	41'-8	141.67	22.4	40.000		Sprinkler	9'-0	Pe
9117	41'-8			40.438				Pv
BL	2.7050	284.63	15.89	120		0.175558	101'-7	Pf 24.406
9117	41'-8	142.44	22.4	40.438		Sprinkler,	37'-5	Pe 0.361
924	40'-10			65.205		2PO(18'-8½)	139'-0	Pv
CM	4.3100	284.63	6.26	120		0.018162	10'-0	Pf 0.182
924	40'-10			65.205			10'-0	Pe -0.090
926	41'-0½			65.296				Pv
CM	4.3100	569.72	12.53	120		0.065572	9'-11½	Pf 0.653
926	41'-0½	285.09		65.296		Flow (q) from Route 4	9'-11½	Pe 0.005
928	41'-0½			65.954				Pv
CM	4.3100	857.25	18.85	120		0.139637	10'-0	Pf 1.397
928	41'-0½	287.53		65.954		Flow (q) from Route 6	10'-0	Pe 0.120
930	40'-9			67.471				Pv
RN	2.7050	99.74	5.57	120		0.025231	295'-8	Pf 9.349
930	40'-9			67.471		PO(18'-8½)	74'-10½	Pe 0.036
906	40'-8			76.856		3PO(18'-8½)	370'-6½	Pv
Route 3								
BL	2.7050	140.79	7.86	120		0.047737	9'-0	Pf 0.430
9119	41'-10½	141.70	22.4	40.017		Sprinkler	9'-0	Pe
9121	41'-10½			40.446				Pv
BL	2.7050	283.25	15.81	120		0.173984	167'-1	Pf 35.583
9121	41'-10½	142.46	22.4	40.446		Sprinkler,	37'-5	Pe 0.398
902	40'-11½			76.427		2PO(18'-8½)	204'-6	Pv
Route 4								
BL	2.7050	0.91	0.05	120		0.000004	9'-0	Pf 0.000
9119	41'-10½	141.70	22.4	40.017		Sprinkler	9'-0	Pe
9123	41'-10½			40.017				Pv
BL	2.7050	142.61	7.96	120		0.048884	9'-0	Pf 0.440
9123	41'-10½	141.70	22.4	40.017		Sprinkler	9'-0	Pe
9125	41'-10½			40.457				Pv
BL	2.7050	285.09	15.92	120		0.176077	101'-7	Pf 24.478
9125	41'-10½	142.48	22.4	40.457		Sprinkler,	37'-5	Pe 0.361
926	41'-0½			65.296		2PO(18'-8½)	139'-0	Pv
Route 5								
BL	2.7050	139.72	7.80	120		0.047066	9'-0	Pf 0.424
9127	41'-10½	142.15	22.4	40.272		Sprinkler	9'-0	Pe
9129	41'-10½			40.696				Pv
BL	2.7050	282.61	15.78	120		0.173263	167'-1	Pf 35.435
9129	41'-10½	142.90	22.4	40.696		Sprinkler,	37'-5	Pe 0.397
904	40'-11½			76.529		2PO(18'-8½)	204'-6	Pv
Route 6								
BL	2.7050	2.44	0.14	120		0.000026	9'-0	Pf 0.000
9127	41'-10½	142.15	22.4	40.272		Sprinkler	9'-0	Pe
9131	41'-10½			40.273				Pv
BL	2.7050	144.59	8.07	120		0.050147	9'-0	Pf 0.451
9131	41'-10½	142.15	22.4	40.273		Sprinkler	9'-0	Pe
9133	41'-10½			40.724				Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 09

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
BL	2.7050	287.53	16.05	120		0.178885	101'-7	Pf 24.869
9133	41'-10½	142.95	22.4	40.724		Sprinkler,	37'-5	Pe 0.361
928	41'-0½			65.954		2PO(18'-8½)	139'-0	Pv
Route 7								
UG	6.2800	250.00	2.59	140		0.001718	40'-9	Pf 0.197
56	1'-0	250.00		110.462		Hydrant,	74'-1	Pe 3.902
15	-8'-0			114.561		E(22'-1), GV(4'-8½), T(47'-3½)	114'-10	Pv
UG	8.3900	523.06	3.04	140		0.001642	519'-3½	Pf 0.903
15	-8'-0	273.06		114.561		Flow (q) from Route 8	30'-6½	Pe
14	-8'-0			115.464		E(30'-6½)	549'-10	Pv
UG	8.3900	523.06	3.04	140		0.001642	119'-3	Pf 0.196
14	-8'-0			115.464				Pe
13	-8'-0			115.660			119'-3	Pv
UG	8.3900	523.06	3.04	140		0.001642	635'-9	Pf 1.094
13	-8'-0			115.660			30'-6½	Pe
12	-8'-0			116.754		E(30'-6½)	666'-3½	Pv
UG	8.3900	523.06	3.04	140		0.001642	61'-1½	Pf 0.100
12	-8'-0			116.754				Pe
11	-8'-0			116.854			61'-1½	Pv
UG	8.3900	523.06	3.04	140		0.001642	153'-8	Pf 0.252
11	-8'-0			116.854				Pe
10	-8'-0			117.107			153'-8	Pv
UG	8.3900	523.06	3.04	140		0.001642	635'-11½	Pf 1.094
10	-8'-0			117.107			30'-6½	Pe
9	-8'-0			118.201		E(30'-6½)	666'-6	Pv
UG	8.3900	523.06	3.04	140		0.001642	118'-2	Pf 0.194
9	-8'-0			118.201				Pe
8	-8'-0			118.395			118'-2	Pv
UG	8.3900	523.06	3.04	140		0.001642	275'-0	Pf 0.549
8	-8'-0			118.395			59'-4½	Pe
7	-8'-0			118.944		T(59'-4½)	334'-4½	Pv
Route 8								
UG	8.3900	273.06	1.58	140		0.000493	214'-9	Pf 0.106
17	-8'-0	1433.64		114.410		Flow (q) from Route 1		Pe
16	-8'-0			114.516			214'-9	Pv
UG	8.3900	273.06	1.58	140		0.000493	91'-11½	Pf 0.045
16	-8'-0			114.516				Pe
15	-8'-0			114.561			91'-11½	Pv
Route 9								
CM	6.3570	105.63	1.07	120		0.000437	10'-0	Pf 0.004
932	38'-5½	105.63		82.777		Flow (q) from Route 17		Pe -0.120
934	38'-9			82.661			10'-0	Pv
CM	6.3570	212.09	2.14	120		0.001588	1'-6	Pf 0.062
934	38'-9	106.47		82.661		Flow (q) from Route 16	37'-8½	Pe -0.018
920	38'-9½			82.705		T(37'-8½)	39'-3	Pv
Route 10								
CM	4.3100	757.51	16.66	120		0.111075	10'-0	Pf 1.111
930	40'-9	99.74		67.471		Flow (q) from Route 2		Pe 0.120
936	40'-6			68.703			10'-0	Pv
RN	2.7050	94.69	5.29	120		0.022918	295'-8	Pf 8.492
936	40'-6			68.703		PO(18'-8½)	74'-10½	Pe 0.036
908	40'-5			77.231		3PO(18'-8½)	370'-6½	Pv
Route 11								
CM	4.3100	662.82	14.58	120		0.086762	10'-0	Pf 0.868
936	40'-6	94.69		68.703		Flow (q) from Route 10		Pe 0.120
938	40'-2½			69.691			10'-0	Pv
RN	2.7050	91.23	5.09	120		0.021393	295'-8	Pf 7.927
938	40'-2½			69.691		PO(18'-8½)	74'-10½	Pe 0.036
910	40'-1½			77.654		3PO(18'-8½)	370'-6½	Pv
Route 12								
CM	4.3100	571.59	12.57	120		0.065970	10'-0	Pf 0.660
938	40'-2½	91.23		69.691		Flow (q) from Route 11		Pe 0.120
940	39'-11			70.472			10'-0	Pv
RN	2.7050	89.31	4.99	120		0.020567	295'-8	Pf 7.621
940	39'-11			70.472		PO(18'-8½)	74'-10½	Pe 0.036
912	39'-10			78.128		3PO(18'-8½)	370'-6½	Pv
Route 13								



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 09

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream					Fittings	Total Length	
CM	4.3100	482.27	10.61	120	0.048177	10'-0	Pf 0.482
940	39'-11	89.31		70.472	Flow (q) from Route 12		Pe 0.120
942	39'-8			71.074		10'-0	Pv
RN	2.7050	88.84	4.96	120	0.020365	295'-8	Pf 7.546
942	39'-8			71.074	PO(18'-8½)	74'-10½	Pe 0.036
914	39'-7			78.656	3PO(18'-8½)	370'-6½	Pv
Route 14							
CM	4.3100	393.44	8.65	120	0.033058	10'-0	Pf 0.331
942	39'-8	88.84		71.074	Flow (q) from Route 13		Pe 0.120
944	39'-4½			71.525		10'-0	Pv
RN	2.7050	89.68	5.01	120	0.020723	295'-8	Pf 7.679
944	39'-4½			71.525	PO(18'-8½)	74'-10½	Pe 0.036
916	39'-3½			79.240	3PO(18'-8½)	370'-6½	Pv
Route 15							
CM	4.3100	303.76	6.68	120	0.020485	10'-0	Pf 0.205
944	39'-4½	89.68		71.525	Flow (q) from Route 14		Pe 0.120
946	39'-1			71.850		10'-0	Pv
RN	2.7050	91.67	5.12	120	0.021583	295'-8	Pf 7.997
946	39'-1			71.850	PO(18'-8½)	74'-10½	Pe 0.036
918	39'-0			79.884	3PO(18'-8½)	370'-6½	Pv
Route 16							
CM	4.3100	212.09	4.66	120	0.010540	10'-0	Pf 0.105
946	39'-1	91.67		71.850	Flow (q) from Route 15		Pe 0.120
948	38'-10			72.076		10'-0	Pv
RN	2.7050	106.47	5.94	120	0.028468	295'-8	Pf 10.549
948	38'-10			72.076	PO(18'-8½)	74'-10½	Pe 0.036
934	38'-9			82.661	3PO(18'-8½)	370'-6½	Pv
Route 17							
CM	4.3100	105.63	2.32	120	0.002902	10'-0	Pf 0.029
948	38'-10	106.47		72.076	Flow (q) from Route 16		Pe 0.120
950	38'-6½			72.226		10'-0	Pv
RN	2.7050	105.63	5.90	120	0.028053	295'-8	Pf 10.515
950	38'-6½			72.226	PO(18'-8½)	79'-2	Pe 0.036
932	38'-5½			82.777	3PO(18'-8½), Tr(4'-3½)	374'-10	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

C Value Multiplier

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$$

Value Of C	100	130	140	150
Multipling Factor	0.713	1.16	1.33	1.51

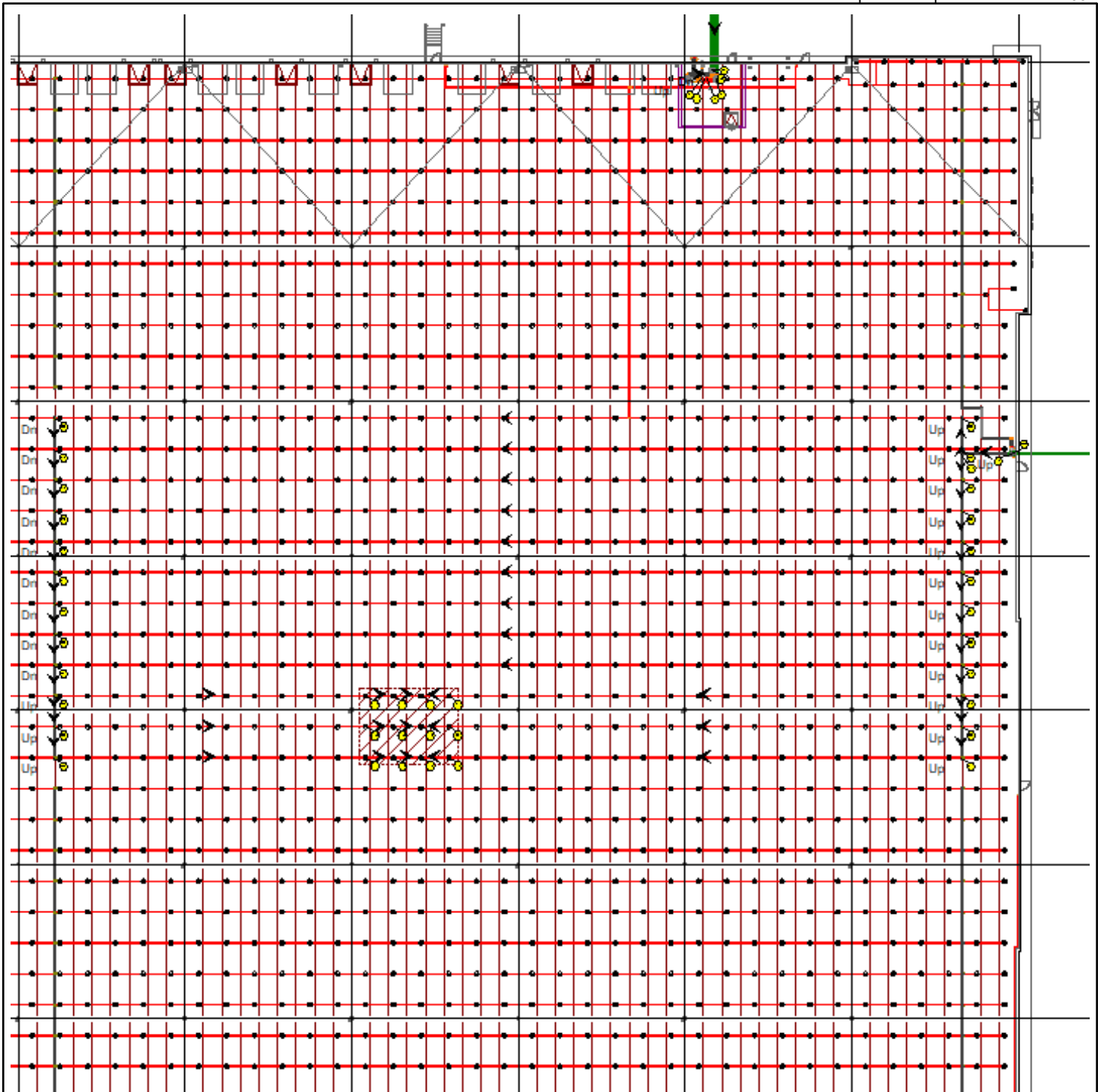


Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 09

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss		Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend	Units Legend		Fittings Legend	
AO Arm-Over	Diameter	Inch	ALV Alarm Valve	
BL Branch Line	Elevation	Foot	AngV Angle Valve	
CM Cross Main	Flow	gpm	b Bushing	
DN Drain	Discharge	gpm	BaIV Ball Valve	
DR Drop	Velocity	fps	BFP Backflow Preventer	
DY Dynamic	Pressure	psi	BV Butterfly Valve	
FM Feed Main	Length	Foot	C Cross Flow Turn 90°	
FR Feed Riser	Friction Loss	psi/Foot	cplg Coupling	
MS Miscellaneous	HWC	Hazen-Williams Constant	Cr Cross Run	
OR Outrigger	Pt	Total pressure at a point in a pipe	CV Check Valve	
RN Riser Nipple	Pn	Normal pressure at a point in a pipe	DeIV Deluge Valve	
SP Sprig	Pf	Pressure loss due to friction between points	DPV Dry Pipe Valve	
ST Stand Pipe	Pe	Pressure due to elevation difference between indicated points	E 90° Elbow	
UG Underground	Pv	Velocity pressure at a point in a pipe	EE 45° Elbow	
			Ee1 11¼° Elbow	
			Ee2 22½° Elbow	
			f Flow Device	
			fd Flex Drop	
			FDC Fire Department Connection	
			fE 90° FireLock(TM) Elbow	
			fEE 45° FireLock(TM) Elbow	
			flg Flange	
			FN Floating Node	
			fT FireLock(TM) Tee	
			g Gauge	
			GloV Globe Valve	
			GV Gate Valve	
			Ho Hose	
			Hose Hose	
			HV Hose Valve	
			Hyd Hydrant	
			LtE Long Turn Elbow	
			mecT Mechanical Tee	
			Noz Nozzle	
			P1 Pump In	
			P2 Pump Out	
			PIV Post Indicating Valve	
			PO Pipe Outlet	
			PrV Pressure Relief Valve	
			PRV Pressure Reducing Valve	
			red Reducer/Adapter	
			S Supply	
			sCV Swing Check Valve	
			SFx Seismic Flex	
			Spr Sprinkler	
			St Strainer	
			T Tee Flow Turn 90°	
			Tr Tee Run	
			U Union	
			WirF Wirsbo	
			WMV Water Meter Valve	
			Z Cap	





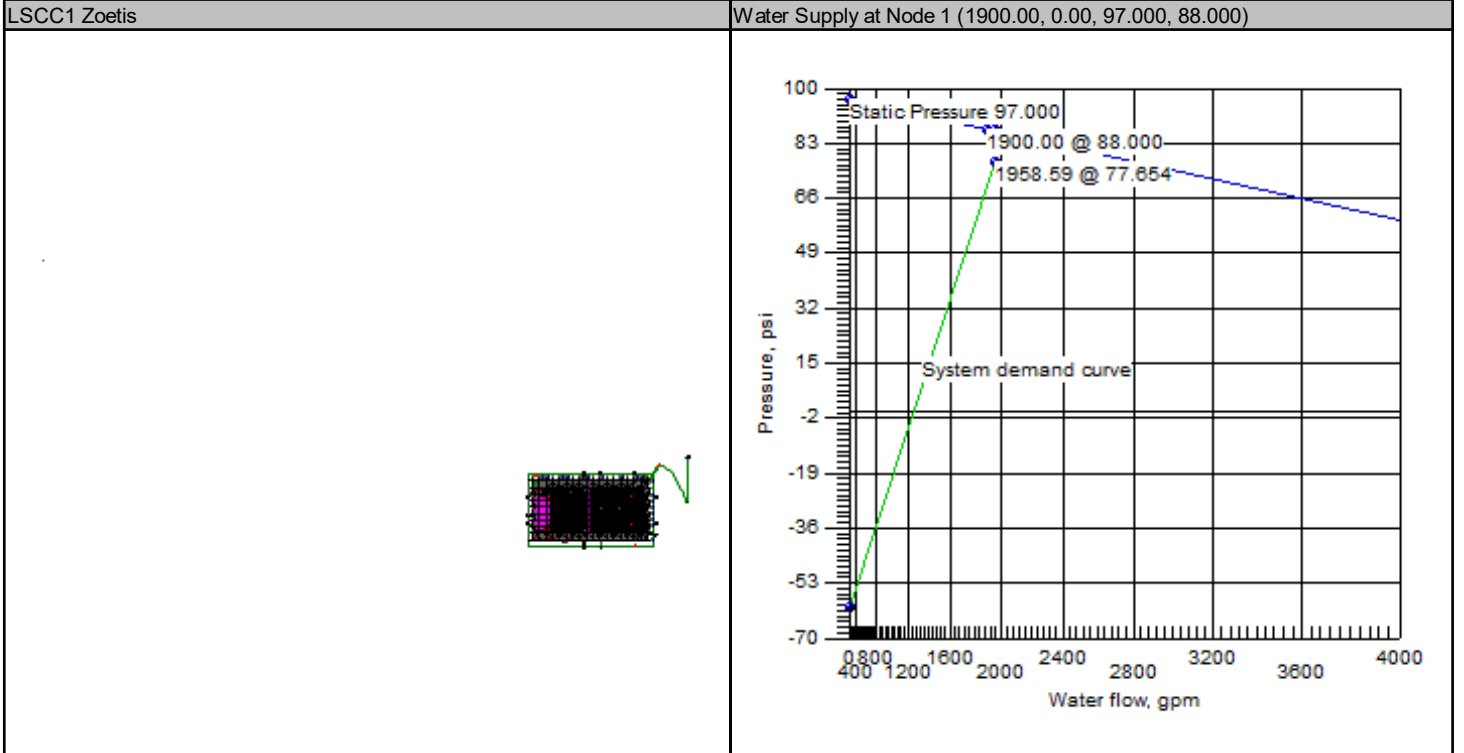
Hydraulic Overview

Job Number: 212189000
Report Description: Remote Area 10

Job		
Job Number 212189000	Design Engineer Jay Colbert	
Job Name: Lee's Summit Commerce Center	Phone 913.242.0057	FAX
Address 1 1120 NW Main St	State Certification/License Number	
Address 2	AHJ City of Lee's Summit	
Address 3 Lee's Summit, MO 64086	Job Site/Building Building A	

System	
Pressure 40.000	Area of Application NA
Most Demanding Sprinkler Data 22.4 K-Factor 141.67 at 40.000	Hose Streams 250.00
Coverage Per Sprinkler 100ft ²	Number Of Sprinklers Calculated 12 0
System Pressure Demand 77.654	System Flow Demand 1958.59
Total Demand 1958.59 @ 77.654	Pressure Result +9.826 (11.2%)

Supplies						Check Point Gauges			
Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)	Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)
1	Water Supply	1900.00		97.000	88.000	Pump Inlet	60.690	251.41	1958.59
4	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									





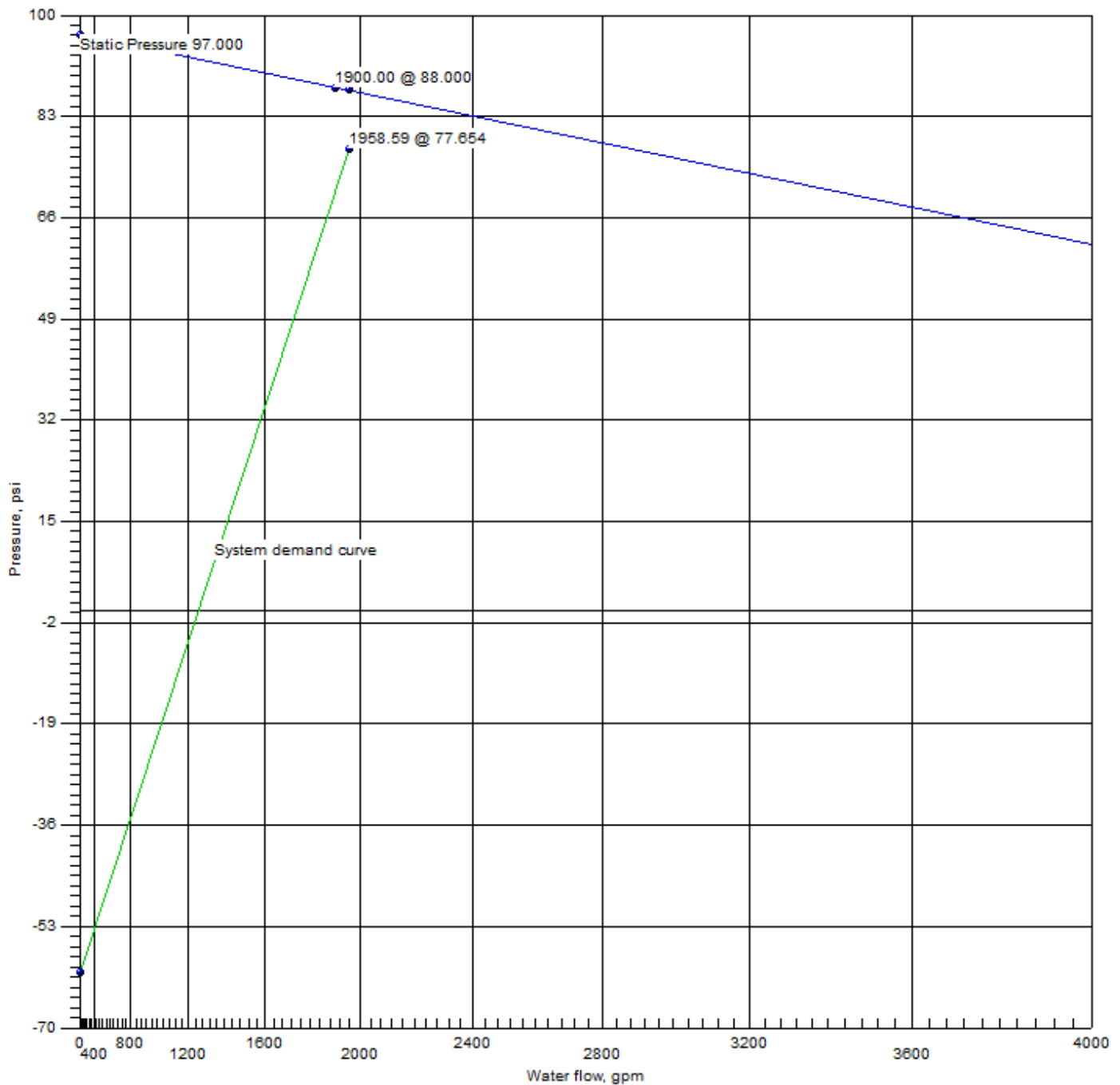
Hydraulic Summary

Job Number: 212189000
Report Description: Remote Area 10

Job											
Job Number 212189000				Design Engineer Jay Colbert							
Job Name: Lee's Summit Commerce Center				State Certification/License Number							
Address 1 1120 NW Main St				AHJ City of Lee's Summit							
Address 2				Job Site/Building Building A							
Address 3 Lee's Summit, MO 64086				Drawing Name LSCC1 Zoetis							
System				Remote Area(s)							
Most Demanding Sprinkler Data 22.4 K-Factor 141.67 at 40.000				Occupancy ESFR			Job Suffix				
Hose Allowance At Source 0.00				Pressure 40.000			Area of Application NA				
Additional Hose Supplies Node Hydrant At Node 56				Flow(gpm) 250.00			Number Of Sprinklers Calculated 12				
				Number Of Nozzles Calculated 0			Coverage Per Sprinkler 100ft ²				
				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 77.599 Right: 77.616							
Total Hose Streams 250.00											
System Flow Demand 1958.59			Total Water Required (Including Hose Allowance) 1958.59								
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 18.86 between nodes 1034 and 1032											
Maximum Velocity Under Ground 11.37 between nodes 224 and 7											
Volume capacity of Wet Pipes 34293.96gal			Volume capacity of Dry Pipes								
Supplies											
Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@	Flow (gpm)	Available (psi)	@	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply		97.000	88.000		1900.00	87.480		1958.59	77.654	9.826
4	Pump		84.000	60.000		2000.00	131.251		1958.59	121.426	9.826
Pumps: Static = Churn (Pressure @ Zero Flow)											
Contractor											
Contractor Number 21		Contact Name Jay Colbert					Contact Title				
Name of Contractor: F.E. Moran Fire Protection Inc.		Phone 913.242.0057					Extension				
Address 1 16815 College Blvd.		FAX									
Address 2		E-mail jay.colbert@femoran.com									
Address 3 Lenexa, KS 66219		Web-Site femoranfp.com									



Water Supply at Node 1



Hydraulic Graph

Water Supply at Node 1

Static: Pressure

97.000

Residual: Pressure

88.000 @ 1900.00

Available Pressure at System Demand

87.480 @ 1958.59

Required Pressure at System Demand

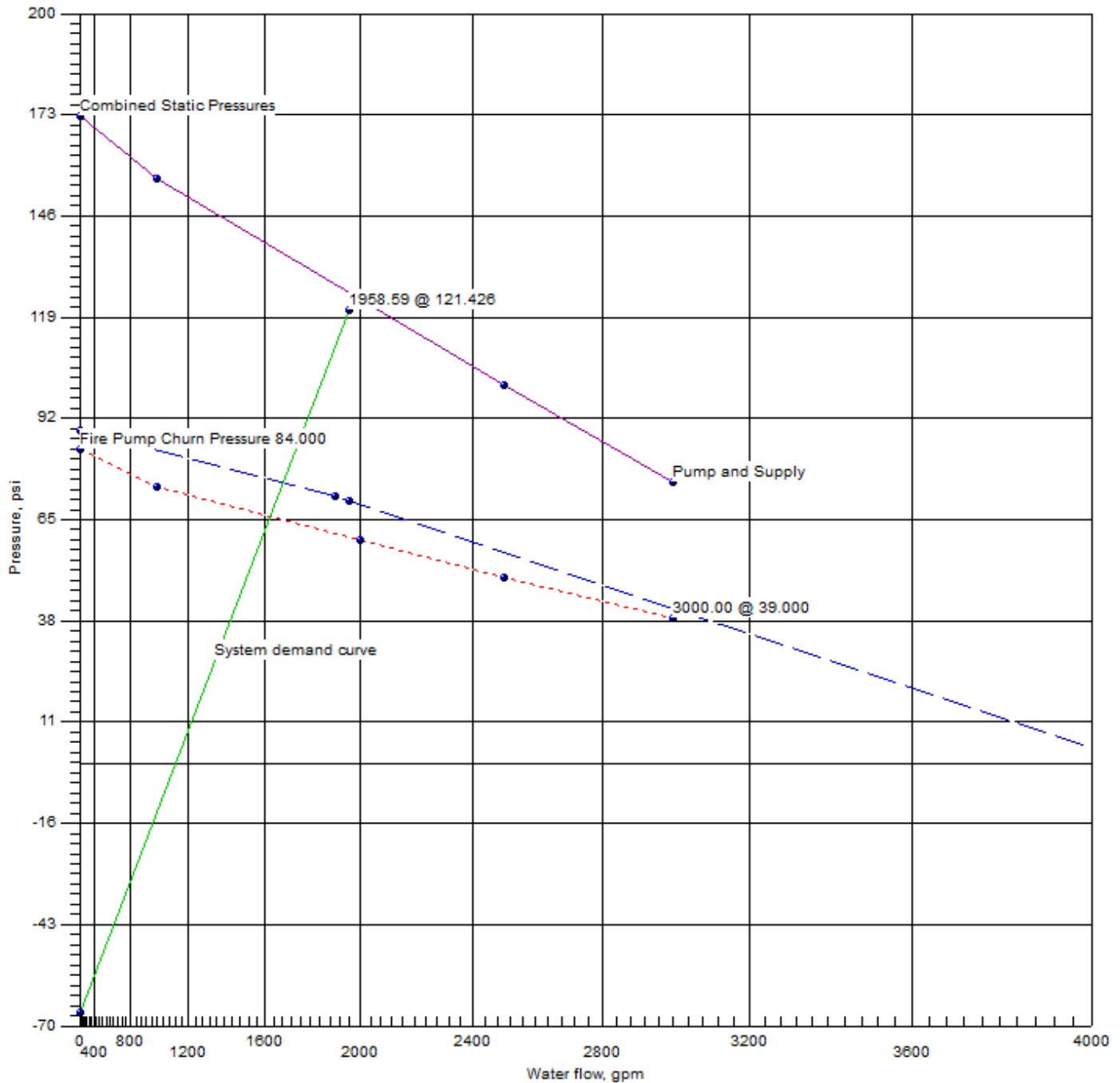
77.654 @ 1958.59

Required Pressure at System Demand (Including Hose Allowance at Source)

77.654 @ 1958.59



Pump at Node 4



Hydraulic Graph
Pump at Node 4

Static + Churn Pressure
173.256
Fire Pump Churn Pressure
84.000

Fire Pump Rating
60.000 @ 2000.00

Residual: Pressure
60.736 @ 1958.59
Available Pressure at System Demand
131.251 @ 1958.59
Required Pressure at System Demand
121.426 @ 1958.59



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: Remote Area 10

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Hydrant	56	250.00	250.00	250	111.182		
Sprinkler	10111	141.67	141.67	22.4	40.000		
⇒ Sprinkler	10113	141.67	141.67	22.4	40.000		
Sprinkler	10115	142.44	141.67	22.4	40.433		
Sprinkler	10117	142.44	141.67	22.4	40.436		
Sprinkler	10119	141.89	141.67	22.4	40.124		
Sprinkler	10121	141.89	141.67	22.4	40.124		
Sprinkler	10123	142.65	141.67	22.4	40.556		
Sprinkler	10125	142.67	141.67	22.4	40.564		
Sprinkler	10127	142.43	141.67	22.4	40.432		
Sprinkler	10129	143.18	141.67	22.4	40.858		
Sprinkler	10131	142.43	141.67	22.4	40.432		
Sprinkler	10133	143.23	141.67	22.4	40.884		

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: Remote Area 10

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	77.654	1958.59
56	1'-0	Hyd(-1.000)	111.182	250.00
10111	41'-5½	Spr(-40.000)	40.000	141.67
10113	41'-5½	Spr(-40.000)	40.000	141.67
10115	41'-5½	Spr(-40.433)	40.433	142.44
10117	41'-5½	Spr(-40.436)	40.436	142.44
10119	41'-3	Spr(-40.124)	40.124	141.89
10121	41'-3	Spr(-40.124)	40.124	141.89
10123	41'-3	Spr(-40.556)	40.556	142.65
10125	41'-3	Spr(-40.564)	40.564	142.67
10127	41'-0½	Spr(-40.432)	40.432	142.43
10129	41'-0½	Spr(-40.858)	40.858	143.18
10131	41'-0½	Spr(-40.432)	40.432	142.43
10133	41'-0½	Spr(-40.884)	40.884	143.23
2	1'-9	T(65'-4½)	61.177	
3	1'-9	P1, Pump Inlet	60.690	
4	1'-9	P2(-60.886)	121.426	
5	1'-9		121.426	
6	6'-8½		116.861	
7	-8'-0	T(59'-4½)	121.228	
8	-8'-0	T(59'-4½)	120.483	
9	-8'-0	T(47'-3½)	120.220	
10	-8'-0	T(59'-4½)	118.735	
11	-8'-0	T(47'-3½)	118.392	
12	-8'-0	T(59'-4½)	118.256	
13	-8'-0	T(47'-3½)	116.772	
14	-8'-0	T(59'-4½)	116.506	
15	-8'-0	T(47'-3½)	115.281	
16	-8'-0	T(59'-4½)	115.202	
17	-8'-0	T(59'-4½)	117.217	
52	1'-0	Hyd	1.000	
54	1'-0	Hyd	1.000	
55	1'-0	Hyd	1.000	
224	1'-0		119.181	
309	-8'-0	E(35'-1)	75.145	
1000	40'-6½	PO(18'-8½)	76.559	
1002	40'-4	PO(18'-8½)	76.677	
1004	40'-1½	PO(18'-8½)	76.865	
1006	39'-11	PO(18'-8½)	77.163	
1008	39'-8½	PO(18'-8½)	77.509	
1010	39'-6	PO(18'-8½)	77.904	
1012	39'-3½	PO(18'-8½)	78.350	
1014	39'-1	PO(18'-8½)	78.850	
1016	38'-10½	PO(18'-8½)	79.408	
1018	38'-8	PO(18'-8½)	80.026	
1020	38'-5½	PO(18'-8½)	80.710	
1022	38'-3	PO(18'-8½)	83.712	
1024	1'-8½	PO(41'-1½)	108.700	
1026	1'-0		109.002	
1028	40'-7½	PO(18'-8½)	65.157	
1030	40'-5	PO(18'-8½)	65.428	
1032	40'-2½	PO(18'-8½)	66.174	
1034	40'-0	PO(18'-8½)	67.662	
1036	39'-9½	PO(18'-8½)	68.862	
1038	39'-7	PO(18'-8½)	69.818	
1040	39'-4½	PO(18'-8½)	70.564	
1042	39'-2	PO(18'-8½)	71.131	
1044	38'-11½	PO(18'-8½)	71.546	
1046	38'-9	PO(18'-8½)	71.836	
1048	38'-6½	PO(18'-8½)	72.027	
1050	38'-4	PO(18'-8½)	72.149	
6858	38'-4	T(37'-8½)	83.698	



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 10

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
BL	2.7050	141.44	7.90	120		0.048146	9'-0	Pf 0.433
10113	41'-5½	141.67	22.4	40.000		Sprinkler		Pe
10115	41'-5½			40.433			9'-0	Pv
BL	2.7050	283.88	15.85	120		0.174696	167'-1	Pf 35.729
10115	41'-5½	142.44	22.4	40.433		Sprinkler,	37'-5	Pe 0.397
1000	40'-6½			76.559		2PO(18'-8½)	204'-6	Pv
CM	6.3570	283.88	2.87	120		0.002723	10'-0	Pf 0.027
1000	40'-6½			76.559				Pe 0.090
1002	40'-4			76.677			10'-0	Pv
CM	6.3570	567.73	5.74	120		0.009817	10'-0	Pf 0.098
1002	40'-4	283.85		76.677		Flow (q) from Route 3		Pe 0.090
1004	40'-1½			76.865			10'-0	Pv
CM	6.3570	851.09	8.60	120		0.020762	10'-0	Pf 0.208
1004	40'-1½	283.36		76.865		Flow (q) from Route 5		Pe 0.090
1006	39'-11			77.163			10'-0	Pv
CM	6.3570	951.50	9.62	120		0.025520	10'-0	Pf 0.255
1006	39'-11	100.41		77.163		Flow (q) from Route 2		Pe 0.090
1008	39'-8½			77.509			10'-0	Pv
CM	6.3570	1046.91	10.58	120		0.030454	10'-0	Pf 0.305
1008	39'-8½	95.40		77.509		Flow (q) from Route 10		Pe 0.090
1010	39'-6			77.904			10'-0	Pv
CM	6.3570	1138.90	11.51	120		0.035589	10'-0	Pf 0.356
1010	39'-6	92.00		77.904		Flow (q) from Route 11		Pe 0.090
1012	39'-3½			78.350			10'-0	Pv
CM	6.3570	1229.03	12.42	120		0.040974	10'-0	Pf 0.410
1012	39'-3½	90.13		78.350		Flow (q) from Route 12		Pe 0.090
1014	39'-1			78.850			10'-0	Pv
CM	6.3570	1318.73	13.33	120		0.046677	10'-0	Pf 0.467
1014	39'-1	89.71		78.850		Flow (q) from Route 13		Pe 0.090
1016	38'-10½			79.408			10'-0	Pv
CM	6.3570	1409.33	14.25	120		0.052782	10'-0	Pf 0.528
1016	38'-10½	90.60		79.408		Flow (q) from Route 14		Pe 0.090
1018	38'-8			80.026			10'-0	Pv
CM	6.3570	1501.96	15.18	120		0.059379	10'-0	Pf 0.594
1018	38'-8	92.63		80.026		Flow (q) from Route 15		Pe 0.090
1020	38'-5½			80.710			10'-0	Pv
CM	6.3570	1597.59	16.15	120		0.066562	6'-4	Pf 2.931
1020	38'-5½	95.62		80.710		Flow (q) from Route 16	37'-8½	Pe 0.057
6858	38'-4			83.698		T(37'-8½)	44'-0½	Pv
CM	6.3570	1708.59	17.27	120		0.075369	50'-6½	Pf 9.117
6858	38'-4	111.00		83.698		Flow (q) from Route 9	70'-5	Pe 15.884
1024	1'-8½			108.700		E(17'-7), 2f(-0.000), CV(40'-3), BV(12'-7)	120'-11½	Pv
DY	8.2490	1708.59	10.26	120		0.021191	0'-0	Pf 0.000
1024	1'-8½			108.700				Pe 0.303
1026	1'-0			109.002			0'-0	Pv
UG	8.3900	1708.59	9.92	140		0.014671	66'-8½	Pf 2.298
1026	1'-0			109.002			89'-11	Pe 3.902
16	-8'-0			115.202		E(30'-6½), T(59'-4½)	156'-7½	Pv
UG	8.3900	1341.71	7.79	140		0.009381	214'-9	Pf 2.015
16	-8'-0			115.202				Pe
17	-8'-0			117.217			214'-9	Pv
UG	8.3900	1341.71	7.79	140		0.009381	337'-8	Pf 4.011
17	-8'-0			117.217			89'-11	Pe
7	-8'-0			121.228		E(30'-6½), T(59'-4½)	427'-7	Pv
UG	8.3900	1958.59	11.37	140		0.018888	67'-8	Pf 1.855
7	-8'-0	616.88		121.228		Flow (q) from Route 7	30'-6½	Pe -3.902
224	1'-0			119.181		E(30'-6½)	98'-2½	Pv
FR	8.2490	1958.59	11.76	120		0.027282	5'-8½	Pf 0.156
224	1'-0			119.181				Pe -2.476
6	6'-8½			116.861			5'-8½	Pv
DY	10.3700	1958.59	7.44	120		0.008952	13'-10½	Pf 2.414
6	6'-8½			116.861			255'-9	Pe 2.151
5	1'-9			121.426		4E(26'-0), T(48'-5½), BV(21'-3½), Tr(17'-0), CV(65'-0)	269'-8	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 10

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
DY	7.9810	1958.59	12.56	120		0.032043	0'-0	Pf 0.000
5	1'-9			121.426				Pe 0.000
4	1'-9			121.426			0'-0	Pv
Pump								
4		1958.59		121.426		Rating: 60.000 @ 2000.00		
3		Q=1958.59	7.40	60.690		Fire Pump Churn Pressure: 84.00		
						0		
DY	10.4000	1958.59	7.40	140		0.006637	0'-0	Pf 0.487
3	1'-9			60.690			73'-4	Pe 0.000
2	1'-9			61.177		GV(7'-11½), T(65'-4½)	73'-4	Pv
UG	10.4000	1958.59	7.40	140		0.006637	696'-3½	Pf 9.742
2	1'-9			61.177			175'-4½	Pe 4.227
309	-8'-0			75.145		4E(35'-1), 2EE(17'-6½), BFP(-3.9	871'-8	Pv
						48)		
UG	12.4600	1958.59	5.15	140		0.002752	360'-2½	Pf 0.992
309	-8'-0			75.145				Pe 1.517
1	-11'-6			77.654		Water Supply	360'-2½	Pv
		0.00				Hose Allowance At Source		
1		1958.59						
Route 2								
BL	2.7050	0.23	0.01	120		0.000000	9'-0	Pf 0.000
10113	41'-5½	141.67	22.4	40.000		Sprinkler		Pe
10111	41'-5½			40.000			9'-0	Pv
BL	2.7050	141.90	7.92	120		0.048436	9'-0	Pf 0.436
10111	41'-5½	141.67	22.4	40.000		Sprinkler		Pe
10117	41'-5½			40.436			9'-0	Pv
BL	2.7050	284.34	15.87	120		0.175226	101'-7	Pf 24.360
10117	41'-5½	142.44	22.4	40.436		Sprinkler,	37'-5	Pe 0.361
1028	40'-7½			65.157		2PO(18'-8½)	139'-0	Pv
CM	4.3100	284.34	6.25	120		0.018128	10'-0	Pf 0.181
1028	40'-7½			65.157				Pe 0.090
1030	40'-5			65.428			10'-0	Pv
CM	4.3100	569.58	12.53	120		0.065544	10'-0	Pf 0.656
1030	40'-5	285.24		65.428		Flow (q) from Route 4		Pe 0.090
1032	40'-2½			66.174			10'-0	Pv
CM	4.3100	857.50	18.86	120		0.139711	10'-0	Pf 1.397
1032	40'-2½	287.91		66.174		Flow (q) from Route 6		Pe 0.090
1034	40'-0			67.662			10'-0	Pv
RN	2.7050	100.41	5.61	120		0.025544	295'-8	Pf 9.465
1034	40'-0			67.662		PO(18'-8½)	74'-10½	Pe 0.036
1006	39'-11			77.163		3PO(18'-8½)	370'-6½	Pv
Route 3								
BL	2.7050	141.20	7.88	120		0.047995	9'-0	Pf 0.432
10121	41'-3	141.89	22.4	40.124		Sprinkler		Pe
10123	41'-3			40.556			9'-0	Pv
BL	2.7050	283.85	15.85	120		0.174670	167'-1	Pf 35.723
10123	41'-3	142.65	22.4	40.556		Sprinkler,	37'-5	Pe 0.397
1002	40'-4			76.677		2PO(18'-8½)	204'-6	Pv
Route 4								
BL	2.7050	0.69	0.04	120		0.000003	9'-0	Pf 0.000
10121	41'-3	141.89	22.4	40.124		Sprinkler		Pe
10119	41'-3			40.124			9'-0	Pv
BL	2.7050	142.58	7.96	120		0.048865	9'-0	Pf 0.440
10119	41'-3	141.89	22.4	40.124		Sprinkler		Pe
10125	41'-3			40.564			9'-0	Pv
BL	2.7050	285.24	15.92	120		0.176259	101'-7	Pf 24.503
10125	41'-3	142.67	22.4	40.564		Sprinkler,	37'-5	Pe 0.361
1030	40'-5			65.428		2PO(18'-8½)	139'-0	Pv
Route 5								
BL	2.7050	140.18	7.83	120		0.047356	9'-0	Pf 0.426
10127	41'-0½	142.43	22.4	40.432		Sprinkler		Pe
10129	41'-0½			40.858			9'-0	Pv
BL	2.7050	283.36	15.82	120		0.174115	167'-1	Pf 35.610
10129	41'-0½	143.18	22.4	40.858		Sprinkler,	37'-5	Pe 0.397
1004	40'-1½			76.865		2PO(18'-8½)	204'-6	Pv
Route 6								



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 10

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
BL	2.7050	2.25	0.13	120		0.000023	9'-0	Pf 0.000
10127	41'-0½	142.43	22.4	40.432		Sprinkler		Pe
10131	41'-0½			40.432			9'-0	Pv
BL	2.7050	144.69	8.08	120		0.050209	9'-0	Pf 0.452
10131	41'-0½	142.43	22.4	40.432		Sprinkler		Pe
10133	41'-0½			40.884			9'-0	Pv
BL	2.7050	287.91	16.07	120		0.179321	101'-7	Pf 24.929
10133	41'-0½	143.23	22.4	40.884		Sprinkler,	37'-5	Pe 0.361
1032	40'-2½			66.174		2PO(18'-8½)	139'-0	Pv
Route 7								
UG	6.2800	250.00	2.59	140		0.001718	40'-9	Pf 0.197
56	1'-0	250.00		111.182		Hydrant,	74'-1	Pe 3.902
15	-8'-0			115.281		E(22'-1), GV(4'-8½), T(47'-3½)	114'-10	Pv
UG	8.3900	616.88	3.58	140		0.002228	519'-3½	Pf 1.225
15	-8'-0	366.88		115.281		Flow (q) from Route 8	30'-6½	Pe
14	-8'-0			116.506		E(30'-6½)	549'-10	Pv
UG	8.3900	616.88	3.58	140		0.002228	119'-3	Pf 0.266
14	-8'-0			116.506				Pe
13	-8'-0			116.772			119'-3	Pv
UG	8.3900	616.88	3.58	140		0.002228	635'-9	Pf 1.485
13	-8'-0			116.772			30'-6½	Pe
12	-8'-0			118.256		E(30'-6½)	666'-3½	Pv
UG	8.3900	616.88	3.58	140		0.002228	61'-1½	Pf 0.136
12	-8'-0			118.256				Pe
11	-8'-0			118.392			61'-1½	Pv
UG	8.3900	616.88	3.58	140		0.002228	153'-8	Pf 0.342
11	-8'-0			118.392				Pe
10	-8'-0			118.735			153'-8	Pv
UG	8.3900	616.88	3.58	140		0.002228	635'-11½	Pf 1.485
10	-8'-0			118.735			30'-6½	Pe
9	-8'-0			120.220		E(30'-6½)	666'-6	Pv
UG	8.3900	616.88	3.58	140		0.002228	118'-2	Pf 0.263
9	-8'-0			120.220				Pe
8	-8'-0			120.483			118'-2	Pv
UG	8.3900	616.88	3.58	140		0.002228	275'-0	Pf 0.745
8	-8'-0			120.483			59'-4½	Pe
7	-8'-0			121.228		T(59'-4½)	334'-4½	Pv
Route 8								
UG	8.3900	366.88	2.13	140		0.000852	91'-11½	Pf 0.078
16	-8'-0	1341.71		115.202		Flow (q) from Route 1		Pe
15	-8'-0			115.281			91'-11½	Pv
Route 9								
CM	6.3570	111.00	1.12	120		0.000479	3'-8	Pf 0.020
1022	38'-3	111.00		83.712		Flow (q) from Route 17	37'-8½	Pe -0.033
6858	38'-4			83.698		T(37'-8½)	41'-5	Pv
Route 10								
CM	4.3100	757.09	16.65	120		0.110960	10'-0	Pf 1.110
1034	40'-0	100.41		67.662		Flow (q) from Route 2		Pe 0.090
1036	39'-9½			68.862			10'-0	Pv
RN	2.7050	95.40	5.33	120		0.023238	295'-8	Pf 8.611
1036	39'-9½			68.862		PO(18'-8½)	74'-10½	Pe 0.036
1008	39'-8½			77.509		3PO(18'-8½)	370'-6½	Pv
Route 11								
CM	4.3100	661.68	14.55	120		0.086487	10'-0	Pf 0.865
1036	39'-9½	95.40		68.862		Flow (q) from Route 10		Pe 0.090
1038	39'-7			69.818			10'-0	Pv
RN	2.7050	92.00	5.14	120		0.021725	295'-8	Pf 8.050
1038	39'-7			69.818		PO(18'-8½)	74'-10½	Pe 0.036
1010	39'-6			77.904		3PO(18'-8½)	370'-6½	Pv
Route 12								
CM	4.3100	569.69	12.53	120		0.065566	10'-0	Pf 0.656
1038	39'-7	92.00		69.818		Flow (q) from Route 11		Pe 0.090
1040	39'-4½			70.564			10'-0	Pv
RN	2.7050	90.13	5.03	120		0.020916	295'-8	Pf 7.750
1040	39'-4½			70.564		PO(18'-8½)	74'-10½	Pe 0.036
1012	39'-3½			78.350		3PO(18'-8½)	370'-6½	Pv
Route 13								



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 10

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream						Total Length	
CM	4.3100	479.56	10.55	120	0.047677	10'-0	Pf 0.477
1040	39'-4½	90.13		70.564	Flow (q) from Route 12		Pe 0.090
1042	39'-2			71.131		10'-0	Pv
RN	2.7050	89.71	5.01	120	0.020735	295'-8	Pf 7.683
1042	39'-2			71.131	PO(18'-8½)	74'-10½	Pe 0.036
1014	39'-1			78.850	3PO(18'-8½)	370'-6½	Pv
Route 14							
CM	4.3100	389.85	8.57	120	0.032503	10'-0	Pf 0.325
1042	39'-2	89.71		71.131	Flow (q) from Route 13		Pe 0.090
1044	38'-11½			71.546		10'-0	Pv
RN	2.7050	90.60	5.06	120	0.021118	295'-8	Pf 7.825
1044	38'-11½			71.546	PO(18'-8½)	74'-10½	Pe 0.036
1016	38'-10½			79.408	3PO(18'-8½)	370'-6½	Pv
Route 15							
CM	4.3100	299.26	6.58	120	0.019927	10'-0	Pf 0.199
1044	38'-11½	90.60		71.546	Flow (q) from Route 14		Pe 0.090
1046	38'-9			71.836		10'-0	Pv
RN	2.7050	92.63	5.17	120	0.022005	295'-8	Pf 8.154
1046	38'-9			71.836	PO(18'-8½)	74'-10½	Pe 0.036
1018	38'-8			80.026	3PO(18'-8½)	370'-6½	Pv
Route 16							
CM	4.3100	206.63	4.54	120	0.010042	10'-0	Pf 0.100
1046	38'-9	92.63		71.836	Flow (q) from Route 15		Pe 0.090
1048	38'-6½			72.027		10'-0	Pv
RN	2.7050	95.62	5.34	120	0.023337	295'-8	Pf 8.647
1048	38'-6½			72.027	PO(18'-8½)	74'-10½	Pe 0.036
1020	38'-5½			80.710	3PO(18'-8½)	370'-6½	Pv
Route 17							
CM	4.3100	111.00	2.44	120	0.003181	10'-0	Pf 0.032
1048	38'-6½	95.62		72.027	Flow (q) from Route 16		Pe 0.090
1050	38'-4			72.149		10'-0	Pv
RN	2.7050	111.00	6.20	120	0.030751	295'-8	Pf 11.527
1050	38'-4			72.149	PO(18'-8½)	79'-2	Pe 0.036
1022	38'-3			83.712	3PO(18'-8½), Tr(4'-3½)	374'-10	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

C Value Multiplier

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$$

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

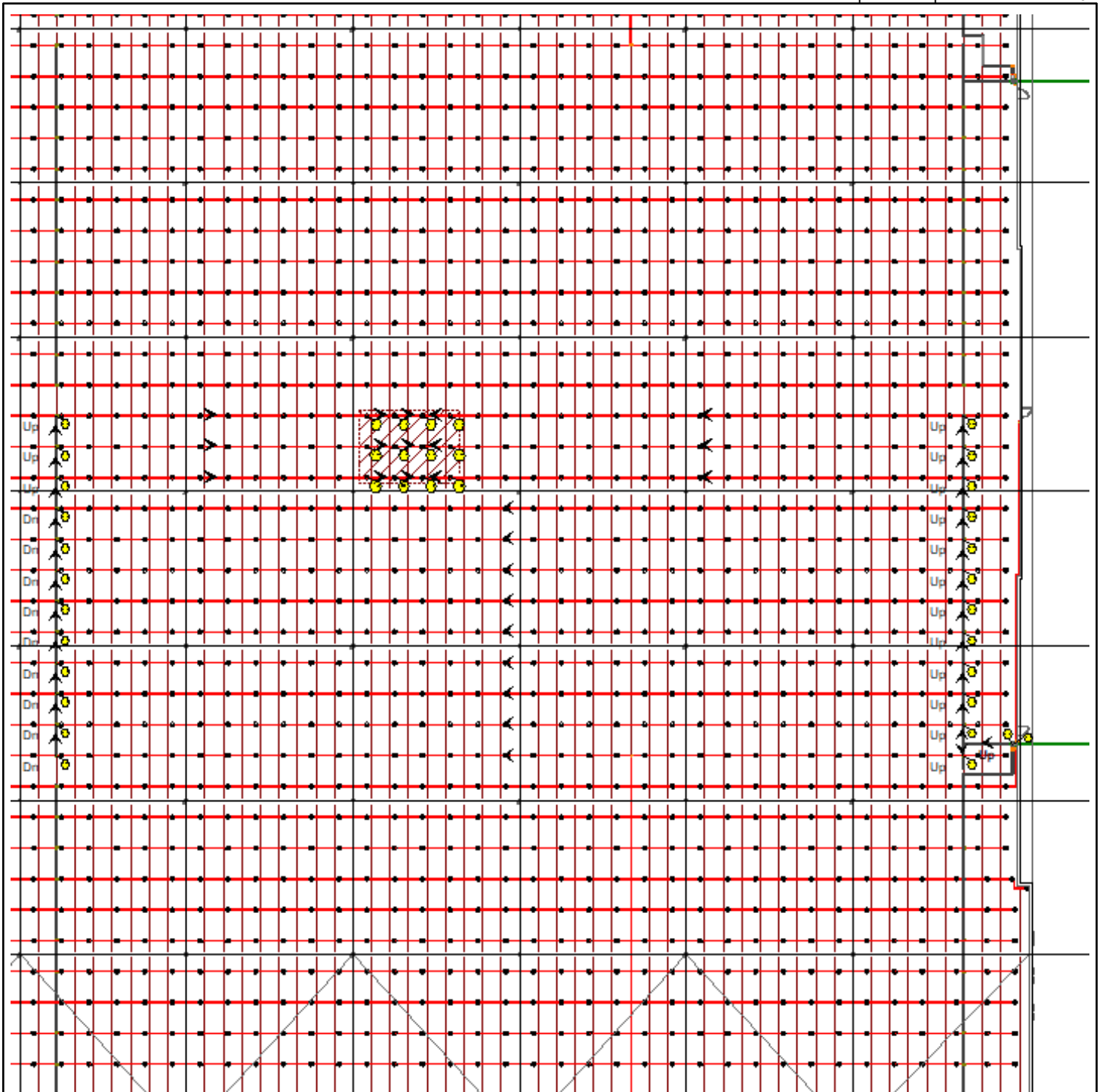


Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 10

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss		Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend	Units Legend		Fittings Legend	
AO Arm-Over	Diameter	Inch	ALV Alarm Valve	
BL Branch Line	Elevation	Foot	AngV Angle Valve	
CM Cross Main	Flow	gpm	b Bushing	
DN Drain	Discharge	gpm	BaIV Ball Valve	
DR Drop	Velocity	fps	BFP Backflow Preventer	
DY Dynamic	Pressure	psi	BV Butterfly Valve	
FM Feed Main	Length	Foot	C Cross Flow Turn 90°	
FR Feed Riser	Friction Loss	psi/Foot	cplg Coupling	
MS Miscellaneous	HWC	Hazen-Williams Constant	Cr Cross Run	
OR Outrigger	Pt	Total pressure at a point in a pipe	CV Check Valve	
RN Riser Nipple	Pn	Normal pressure at a point in a pipe	DeIV Deluge Valve	
SP Sprig	Pf	Pressure loss due to friction between points	DPV Dry Pipe Valve	
ST Stand Pipe	Pe	Pressure due to elevation difference between indicated points	E 90° Elbow	
UG Underground	Pv	Velocity pressure at a point in a pipe	EE 45° Elbow	
			Ee1 11¼° Elbow	
			Ee2 22½° Elbow	
			f Flow Device	
			fd Flex Drop	
			FDC Fire Department Connection	
			fE 90° FireLock(TM) Elbow	
			fEE 45° FireLock(TM) Elbow	
			flg Flange	
			FN Floating Node	
			fT FireLock(TM) Tee	
			g Gauge	
			GloV Globe Valve	
			GV Gate Valve	
			Ho Hose	
			Hose Hose	
			HV Hose Valve	
			Hyd Hydrant	
			LtE Long Turn Elbow	
			mecT Mechanical Tee	
			Noz Nozzle	
			P1 Pump In	
			P2 Pump Out	
			PIV Post Indicating Valve	
			PO Pipe Outlet	
			PrV Pressure Relief Valve	
			PRV Pressure Reducing Valve	
			red Reducer/Adapter	
			S Supply	
			sCV Swing Check Valve	
			SFx Seismic Flex	
			Spr Sprinkler	
			St Strainer	
			T Tee Flow Turn 90°	
			Tr Tee Run	
			U Union	
			WirF Wirsbo	
			WMV Water Meter Valve	
			Z Cap	





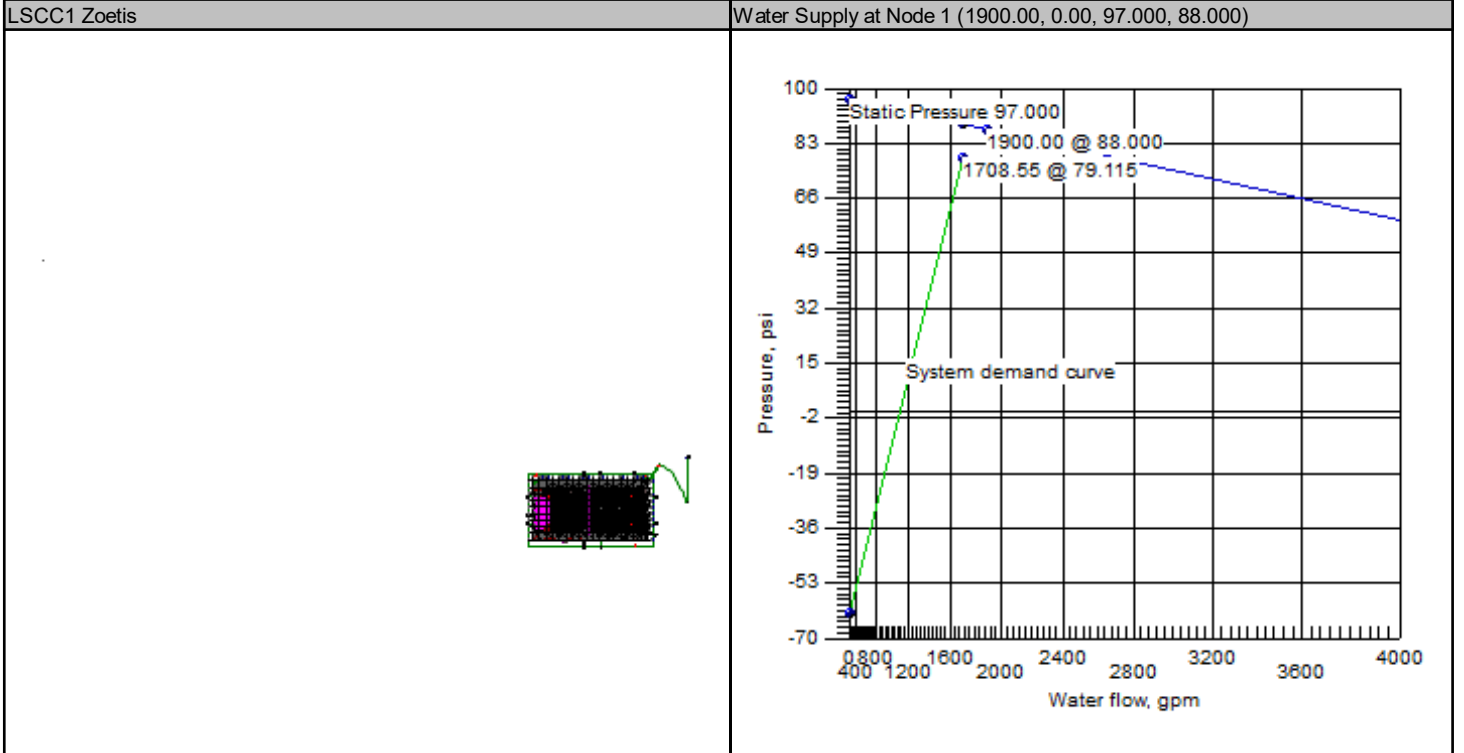
Hydraulic Overview

Job Number: 212189000
Report Description: Remote Area 11

Job		
Job Number 212189000	Design Engineer Jay Colbert	
Job Name: Lee's Summit Commerce Center	Phone 913.242.0057	FAX
Address 1 1120 NW Main St	State Certification/License Number	
Address 2	AHJ City of Lee's Summit	
Address 3 Lee's Summit, MO 64086	Job Site/Building Building A	

System	
Pressure 52.000	Area of Application NA
Most Demanding Sprinkler Data 16.8 K-Factor 121.15 at 52.000	Hose Streams 250.00
Coverage Per Sprinkler 100ft ²	Number Of Sprinklers Calculated 12 0
System Pressure Demand 79.115	System Flow Demand 1708.55
Total Demand 1708.55 @ 79.115	Pressure Result +10.490 (11.7%)

Supplies						Check Point Gauges			
Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)	Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)
1	Water Supply	1900.00		97.000	88.000	Pump Inlet	64.067	213.46	1708.55
4	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									





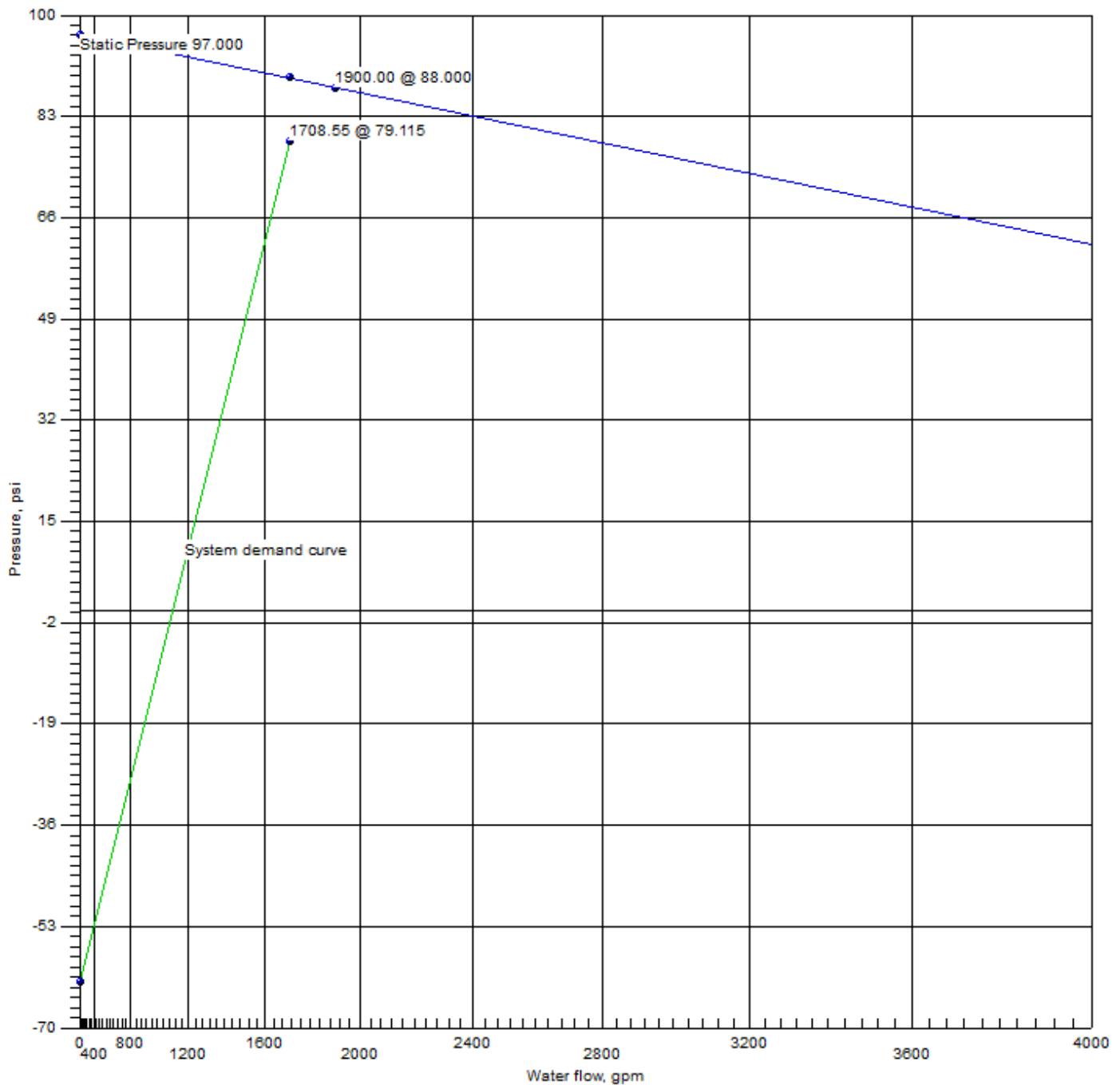
Hydraulic Summary

Job Number: 212189000
Report Description: Remote Area 11

Job											
Job Number 212189000					Design Engineer Jay Colbert						
Job Name: Lee's Summit Commerce Center					State Certification/License Number						
Address 1 1120 NW Main St					AHJ City of Lee's Summit						
Address 2					Job Site/Building Building A						
Address 3 Lee's Summit, MO 64086					Drawing Name LSCC1 Zoetis						
System					Remote Area(s)						
Most Demanding Sprinkler Data 16.8 K-Factor 121.15 at 52.000					Occupancy ESFR			Job Suffix			
Hose Allowance At Source 0.00					Pressure 52.000			Area of Application NA			
Additional Hose Supplies Node Hydrant At Node 56					Flow(gpm) 250.00		Number Of Sprinklers Calculated 12		Number Of Nozzles Calculated 0		
							Coverage Per Sprinkler 100ft ²				
					AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 79.111 Right: 79.052						
Total Hose Streams 250.00											
System Flow Demand 1708.55			Total Water Required (Including Hose Allowance) 1708.55								
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 29.49 between nodes 1122 and 1120											
Maximum Velocity Under Ground 9.92 between nodes 224 and 7											
Volume capacity of Wet Pipes 34293.96gal			Volume capacity of Dry Pipes								
Supplies											
Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@	Flow (gpm)	Available (psi)	@	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply		97.000	88.000		1900.00	89.605		1708.55	79.115	10.490
4	Pump		84.000	60.000		2000.00	139.454		1708.55	128.964	10.490
Pumps: Static = Churn (Pressure @ Zero Flow)											
Contractor											
Contractor Number 21		Contact Name Jay Colbert					Contact Title				
Name of Contractor: F.E. Moran Fire Protection Inc.					Phone 913.242.0057			Extension			
Address 1 16815 College Blvd.					FAX						
Address 2					E-mail jay.colbert@femoran.com						
Address 3 Lenexa, KS 66219					Web-Site femoranfp.com						



Water Supply at Node 1



Hydraulic Graph

Water Supply at Node 1

Static: Pressure

97.000

Residual: Pressure

88.000 @ 1900.00

Available Pressure at System Demand

89.605 @ 1708.55

Required Pressure at System Demand

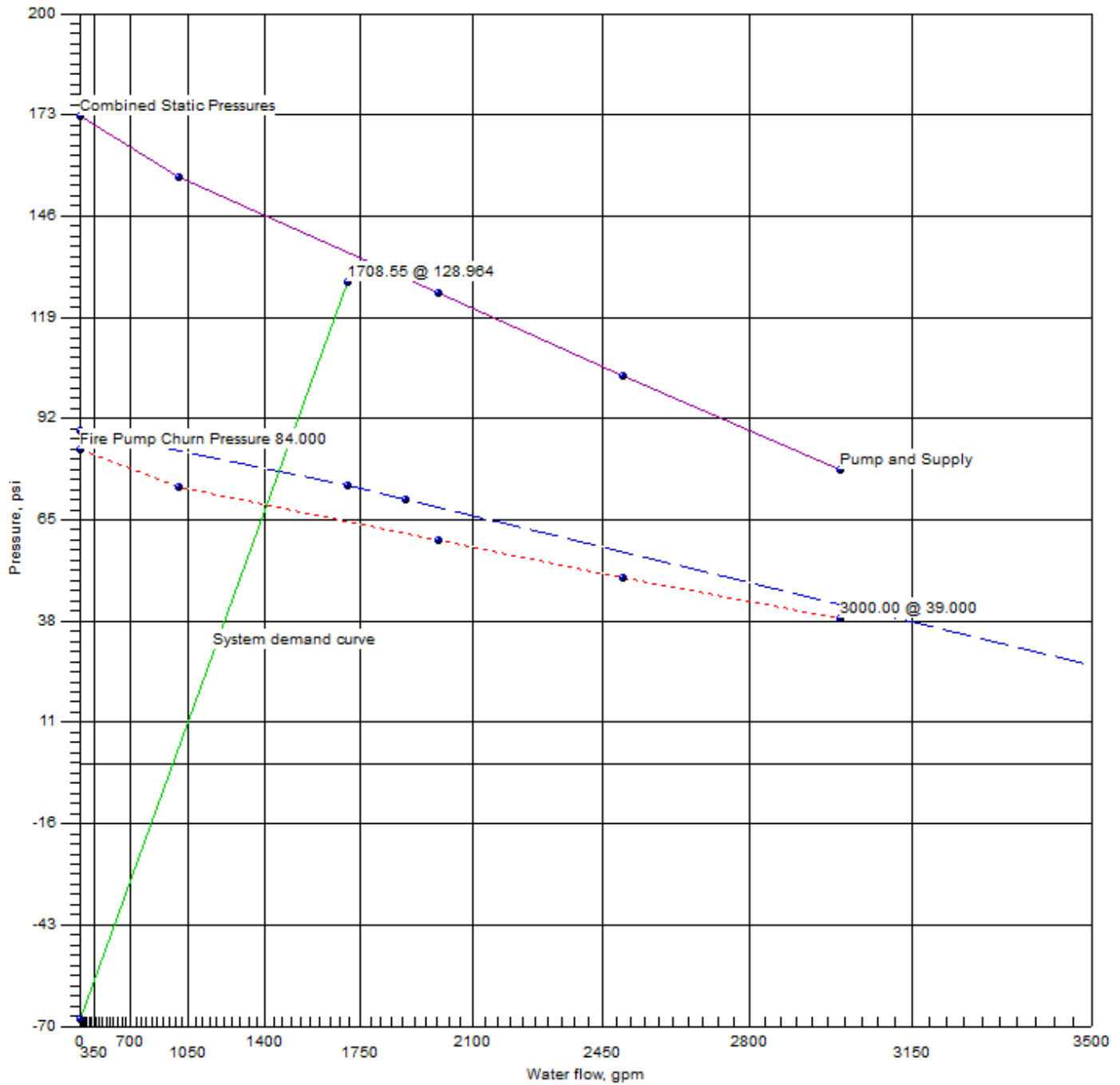
79.115 @ 1708.55

Required Pressure at System Demand (Including Hose Allowance at Source)

79.115 @ 1708.55



Pump at Node 4



Hydraulic Graph
Pump at Node 4

Static + Churn Pressure
173.256
Fire Pump Churn Pressure
84.000

Fire Pump Rating
60.000 @ 2000.00

Residual Pressure
64.897 @ 1708.55

Available Pressure at System Demand
139.454 @ 1708.55

Required Pressure at System Demand
128.964 @ 1708.55



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: Remote Area 11

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Hydrant	56	250.00	250.00	250	121.029		
⇒ Sprinkler	11111	121.15	121.15	16.8	52.000		
Sprinkler	11113	121.51	121.15	16.8	52.314		
Sprinkler	11115	121.15	121.15	16.8	52.000		
Sprinkler	11117	121.54	121.15	16.8	52.337		
Sprinkler	11119	121.26	121.15	16.8	52.097		
Sprinkler	11121	121.62	121.15	16.8	52.411		
Sprinkler	11123	121.26	121.15	16.8	52.097		
Sprinkler	11125	121.65	121.15	16.8	52.435		
Sprinkler	11127	121.66	121.15	16.8	52.445		
Sprinkler	11129	122.03	121.15	16.8	52.761		
Sprinkler	11131	121.66	121.15	16.8	52.445		
Sprinkler	11133	122.06	121.15	16.8	52.786		

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: Remote Area 11

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	79.115	1708.55
56	1'-0	Hyd(-1.000)	121.029	250.00
11111	37'-10	Spr(-52.000)	52.000	121.15
11113	37'-10	Spr(-52.314)	52.314	121.51
11115	37'-10	Spr(-52.000)	52.000	121.15
11117	37'-10	Spr(-52.337)	52.337	121.54
11119	37'-10	Spr(-52.097)	52.097	121.26
11121	37'-10	Spr(-52.411)	52.411	121.62
11123	37'-10	Spr(-52.097)	52.097	121.26
11125	37'-10	Spr(-52.435)	52.435	121.65
11127	37'-10	Spr(-52.445)	52.445	121.66
11129	37'-10	Spr(-52.761)	52.761	122.03
11131	37'-10	Spr(-52.445)	52.445	121.66
11133	37'-10	Spr(-52.786)	52.786	122.06
2	1'-9	T(65'-4½)	64.445	
3	1'-9	P1, Pump Inlet	64.067	
4	1'-9	P2(-60.886)	128.964	
5	1'-9		128.964	
6	6'-8½		124.938	
7	-8'-0	T(59'-4½)	129.754	
8	-8'-0	T(59'-4½)	129.175	
9	-8'-0	T(47'-3½)	128.970	
10	-8'-0	T(59'-4½)	127.815	
11	-8'-0	T(47'-3½)	127.548	
12	-8'-0	T(59'-4½)	127.443	
13	-8'-0	T(47'-3½)	126.288	
14	-8'-0	T(59'-4½)	126.081	
15	-8'-0	T(47'-3½)	125.128	
16	-8'-0	T(59'-4½)	125.078	
17	-8'-0	T(59'-4½)	126.641	
52	1'-0	Hyd	1.000	
54	1'-0	Hyd	1.000	
55	1'-0	Hyd	1.000	
224	1'-0		127.293	
309	-8'-0	E(35'-1)	76.828	
1026	1'-0		119.461	
1100	37'-0	PO(18'-8½)	76.618	
1102	37'-0	PO(18'-8½)	76.751	
1104	37'-0	PO(18'-8½)	77.230	
1106	37'-0	PO(18'-8½)	78.246	
1108	37'-0	PO(18'-8½)	79.407	
1110	37'-0	PO(18'-8½)	80.727	
1112	37'-1	PO(18'-8½)	82.193	
1114	37'-3½	PO(18'-8½)	83.826	
1116	37'-6	PO(18'-8½)	85.725	
1118	37'-8½	PO(18'-8½)	87.947	
1120	37'-11	PO(18'-8½)	90.565	
1122	37'-11		90.729	
1124	38'-1½	PO(18'-8½)	91.099	
1126	1'-8½	PO(37'-8½)	118.485	
1128	37'-0	PO(18'-8½)	73.591	
1130	37'-0	PO(18'-8½)	73.729	
1132	37'-0	PO(18'-8½)	74.226	
1134	37'-0	PO(18'-8½)	75.280	
1136	37'-0	PO(18'-8½)	76.197	
1138	37'-0	PO(18'-8½)	76.980	
1140	37'-1	PO(18'-8½)	77.588	
1142	37'-3½	PO(18'-8½)	78.009	
1144	37'-6	PO(18'-8½)	78.294	
1146	37'-8½	PO(18'-8½)	78.446	
1148	37'-11	PO(18'-8½)	78.481	
1150	38'-1½	PO(18'-8½)	78.426	



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 11

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
BL	2.7050	118.81	6.63	120		0.034869	9'-0	Pf 0.314
11111	37'-10	121.15	16.8	52.000		Sprinkler		Pe
11113	37'-10			52.314			9'-0	Pv
BL	2.7050	240.32	13.42	120		0.128366	149'-1	Pf 23.943
11113	37'-10	121.51	16.8	52.314		Sprinkler,	37'-5	Pe 0.361
1100	37'-0			76.618		2PO(18'-8½)	186'-6	Pv
CM	4.3100	240.32	5.28	120		0.013280	10'-0	Pf 0.133
1100	37'-0			76.618				Pe
1102	37'-0			76.751			10'-0	Pv
CM	4.3100	480.83	10.57	120		0.047910	10'-0	Pf 0.479
1102	37'-0	240.51		76.751		Flow (q) from Route 3		Pe
1104	37'-0			77.230			10'-0	Pv
CM	4.3100	722.04	15.88	120		0.101645	10'-0	Pf 1.016
1104	37'-0	241.21		77.230		Flow (q) from Route 5		Pe
1106	37'-0			78.246			10'-0	Pv
CM	4.3100	775.66	17.06	120		0.116050	10'-0	Pf 1.160
1106	37'-0	53.62		78.246		Flow (q) from Route 2		Pe
1108	37'-0			79.407			10'-0	Pv
CM	4.3100	831.63	18.29	120		0.132013	10'-0	Pf 1.320
1108	37'-0	55.96		79.407		Flow (q) from Route 9		Pe
1110	37'-0			80.727			10'-0	Pv
CM	4.3100	892.47	19.63	120		0.150435	10'-0	Pf 1.507
1110	37'-0	60.85		80.727		Flow (q) from Route 10		Pe -0.041
1112	37'-1			82.193			10'-0	Pv
CM	4.3100	960.49	21.12	120		0.172331	10'-0	Pf 1.724
1112	37'-1	68.02		82.193		Flow (q) from Route 13		Pe -0.090
1114	37'-3½			83.826			10'-0	Pv
CM	4.3100	1037.67	22.82	120		0.198820	10'-0	Pf 1.989
1114	37'-3½	77.18		83.826		Flow (q) from Route 12		Pe -0.090
1116	37'-6			85.725			10'-0	Pv
CM	4.3100	1125.77	24.76	120		0.231171	10'-0	Pf 2.312
1116	37'-6	88.10		85.725		Flow (q) from Route 16		Pe -0.090
1118	37'-8½			87.947			10'-0	Pv
CM	4.3100	1226.39	26.97	120		0.270839	10'-0	Pf 2.709
1118	37'-8½	100.62		87.947		Flow (q) from Route 15		Pe -0.090
1120	37'-11			90.565			10'-0	Pv
CM	4.3100	1340.98	29.49	120		0.319507	0'-6½	Pf 0.168
1120	37'-11	114.59		90.565		Flow (q) from Route 14		Pe -0.004
1122	37'-11			90.729			0'-6½	Pv
CM	6.3570	1340.98	13.56	120		0.048144	9'-5½	Pf 0.456
1122	37'-11			90.729				Pe -0.086
1124	38'-1½			91.099			9'-5½	Pv
CM	6.3570	1458.55	14.74	120		0.056243	62'-8½	Pf 11.589
1124	38'-1½	117.57		91.099		Flow (q) from Route 11	143'-4	Pe 15.797
1126	1'-8½			118.485		3E(17'-7), 2f(-0.000), CV(40'-3), BV(12'-7), PO(37'-8½)	206'-0½	Pv
CM	8.2490	1458.55	8.76	120		0.015814	1'-6	Pf 0.674
1126	1'-8½			118.485			41'-1½	Pe 0.303
1026	1'-0			119.461		PO(41'-1½)	42'-7½	Pv
UG	8.3900	1458.55	8.46	140		0.010948	66'-8½	Pf 1.715
1026	1'-0			119.461			89'-11	Pe 3.902
16	-8'-0			125.078		E(30'-6½), T(59'-4½)	156'-7½	Pv
UG	8.3900	1169.97	6.79	140		0.007281	214'-9	Pf 1.564
16	-8'-0			125.078				Pe
17	-8'-0			126.641			214'-9	Pv
UG	8.3900	1169.97	6.79	140		0.007281	337'-8	Pf 3.113
17	-8'-0			126.641			89'-11	Pe
7	-8'-0			129.754		E(30'-6½), T(59'-4½)	427'-7	Pv
UG	8.3900	1708.55	9.92	140		0.014670	67'-8	Pf 1.441
7	-8'-0	538.58		129.754		Flow (q) from Route 7	30'-6½	Pe -3.902
224	1'-0			127.293		E(30'-6½)	98'-2½	Pv
FR	8.2490	1708.55	10.26	120		0.021191	5'-8½	Pf 0.121
224	1'-0			127.293				Pe -2.476
6	6'-8½			124.938			5'-8½	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 11

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
DY	10.3700	1708.55	6.49	120		0.006953	13'-10½"	Pf 1.875
6	6'-8½"			124.938			255'-9"	Pe 2.151
5	1'-9"			128.964		4E(26'-0"), T(48'-5½"), BV(21'-3½"), Tr(17'-0"), CV(65'-0")	269'-8"	Pv
DY	7.9810	1708.55	10.96	120		0.024888	0'-0"	Pf 0.000
5	1'-9"			128.964				Pe 0.000
4	1'-9"			128.964			0'-0"	Pv
Pump		Velocity						
4		1708.55		128.964		Rating: 60.000 @ 2000.00		
3		Q=1708.55	6.45	64.067		Fire Pump Churn Pressure: 84.000		
DY	10.4000	1708.55	6.45	140		0.005155	0'-0"	Pf 0.378
3	1'-9"			64.067			73'-4"	Pe 0.000
2	1'-9"			64.445		GV(7'-11½"), T(65'-4½")	73'-4"	Pv
UG	10.4000	1708.55	6.45	140		0.005155	696'-3½"	Pf 8.156
2	1'-9"			64.445			175'-4½"	Pe 4.227
309	-8'-0"			76.828		4E(35'-1"), 2EE(17'-6½"), BFP(-3.948)	871'-8"	Pv
UG	12.4600	1708.55	4.50	140		0.002138	360'-2½"	Pf 0.770
309	-8'-0"			76.828				Pe 1.517
1	-11'-6"			79.115		Water Supply	360'-2½"	Pv
		0.00				Hose Allowance At Source		
1		1708.55						
Route 2								
BL	2.7050	2.34	0.13	120		0.000024	9'-0"	Pf 0.000
11111	37'-10"	121.15	16.8	52.000		Sprinkler		Pe
11115	37'-10"			52.000			9'-0"	Pv
BL	2.7050	123.49	6.89	120		0.037455	9'-0"	Pf 0.337
11115	37'-10"	121.15	16.8	52.000		Sprinkler		Pe
11117	37'-10"			52.337			9'-0"	Pv
BL	2.7050	245.03	13.68	120		0.133059	119'-7"	Pf 20.893
11117	37'-10"	121.54	16.8	52.337		Sprinkler,	37'-5"	Pe 0.361
1128	37'-0"			73.591		2PO(18'-8½")	157'-0"	Pv
CM	4.3100	245.03	5.39	120		0.013766	10'-0"	Pf 0.138
1128	37'-0"			73.591				Pe
1130	37'-0"			73.729			10'-0"	Pv
CM	4.3100	490.31	10.78	120		0.049673	10'-0"	Pf 0.497
1130	37'-0"	245.28		73.729		Flow (q) from Route 4		Pe
1132	37'-0"			74.226			10'-0"	Pv
CM	4.3100	736.51	16.20	120		0.105447	10'-0"	Pf 1.054
1132	37'-0"	246.20		74.226		Flow (q) from Route 6		Pe
1134	37'-0"			75.280			10'-0"	Pv
RN	2.7050	53.62	2.99	120		0.008004	295'-8"	Pf 2.966
1134	37'-0"			75.280		PO(18'-8½")	74'-10½"	Pe
1106	37'-0"			78.246		3PO(18'-8½")	370'-6½"	Pv
Route 3								
BL	2.7050	118.89	6.64	120		0.034914	9'-0"	Pf 0.314
11119	37'-10"	121.26	16.8	52.097		Sprinkler		Pe
11121	37'-10"			52.411			9'-0"	Pv
BL	2.7050	240.51	13.43	120		0.128558	149'-1"	Pf 23.979
11121	37'-10"	121.62	16.8	52.411		Sprinkler,	37'-5"	Pe 0.361
1102	37'-0"			76.751		2PO(18'-8½")	186'-6"	Pv
Route 4								
BL	2.7050	2.37	0.13	120		0.000025	9'-0"	Pf 0.000
11119	37'-10"	121.26	16.8	52.097		Sprinkler		Pe
11123	37'-10"			52.097			9'-0"	Pv
BL	2.7050	123.63	6.90	120		0.037535	9'-0"	Pf 0.338
11123	37'-10"	121.26	16.8	52.097		Sprinkler		Pe
11125	37'-10"			52.435			9'-0"	Pv
BL	2.7050	245.28	13.69	120		0.133316	119'-7"	Pf 20.933
11125	37'-10"	121.65	16.8	52.435		Sprinkler,	37'-5"	Pe 0.361
1130	37'-0"			73.729		2PO(18'-8½")	157'-0"	Pv
Route 5								
BL	2.7050	119.18	6.65	120		0.035074	9'-0"	Pf 0.316
11127	37'-10"	121.66	16.8	52.445		Sprinkler		Pe
11129	37'-10"			52.761			9'-0"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 11

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
BL	2.7050	241.21	13.47	120		0.129251	149'-1	Pf 24.108
11129	37'-10	122.03	16.8	52.761		Sprinkler,	37'-5	Pe 0.361
1104	37'-0			77.230		2PO(18'-8½)	186'-6	Pv
Route 6								
BL	2.7050	2.48	0.14	120		0.000027	9'-0	Pf 0.000
11127	37'-10	121.66	16.8	52.445		Sprinkler		Pe
11131	37'-10			52.445			9'-0	Pv
BL	2.7050	124.15	6.93	120		0.037825	9'-0	Pf 0.340
11131	37'-10	121.66	16.8	52.445		Sprinkler		Pe
11133	37'-10			52.786			9'-0	Pv
BL	2.7050	246.20	13.75	120		0.134244	119'-7	Pf 21.079
11133	37'-10	122.06	16.8	52.786		Sprinkler,	37'-5	Pe 0.361
1132	37'-0			74.226		2PO(18'-8½)	157'-0	Pv
Route 7								
UG	6.2800	250.00	2.59	140		0.001718	40'-9	Pf 0.197
56	1'-0	250.00		121.029		Hydrant,	74'-1	Pe 3.902
15	-8'-0			125.128		E(22'-1), GV(4'-8½), T(47'-3½)	114'-10	Pv
UG	8.3900	538.58	3.13	140		0.001733	519'-3½	Pf 0.953
15	-8'-0	288.58		125.128		Flow (q) from Route 8	30'-6½	Pe
14	-8'-0			126.081		E(30'-6½)	549'-10	Pv
UG	8.3900	538.58	3.13	140		0.001733	119'-3	Pf 0.207
14	-8'-0			126.081				Pe
13	-8'-0			126.288			119'-3	Pv
UG	8.3900	538.58	3.13	140		0.001733	635'-9	Pf 1.155
13	-8'-0			126.288			30'-6½	Pe
12	-8'-0			127.443		E(30'-6½)	666'-3½	Pv
UG	8.3900	538.58	3.13	140		0.001733	61'-1½	Pf 0.106
12	-8'-0			127.443				Pe
11	-8'-0			127.548			61'-1½	Pv
UG	8.3900	538.58	3.13	140		0.001733	153'-8	Pf 0.266
11	-8'-0			127.548				Pe
10	-8'-0			127.815			153'-8	Pv
UG	8.3900	538.58	3.13	140		0.001733	635'-11½	Pf 1.155
10	-8'-0			127.815			30'-6½	Pe
9	-8'-0			128.970		E(30'-6½)	666'-6	Pv
UG	8.3900	538.58	3.13	140		0.001733	118'-2	Pf 0.205
9	-8'-0			128.970				Pe
8	-8'-0			129.175			118'-2	Pv
UG	8.3900	538.58	3.13	140		0.001733	275'-0	Pf 0.580
8	-8'-0			129.175			59'-4½	Pe
7	-8'-0			129.754		T(59'-4½)	334'-4½	Pv
Route 8								
UG	8.3900	288.58	1.67	140		0.000546	91'-11½	Pf 0.050
16	-8'-0	1169.97		125.078		Flow (q) from Route 1		Pe
15	-8'-0			125.128			91'-11½	Pv
Route 9								
CM	4.3100	682.89	15.02	120		0.091685	10'-0	Pf 0.917
1134	37'-0	53.62		75.280		Flow (q) from Route 2		Pe
1136	37'-0			76.197			10'-0	Pv
RN	2.7050	55.96	3.12	120		0.008662	295'-8	Pf 3.210
1136	37'-0			76.197		PO(18'-8½)	74'-10½	Pe
1108	37'-0			79.407		3PO(18'-8½)	370'-6½	Pv
Route 10								
CM	4.3100	626.93	13.79	120		0.078271	10'-0	Pf 0.783
1136	37'-0	55.96		76.197		Flow (q) from Route 9		Pe
1138	37'-0			76.980			10'-0	Pv
RN	2.7050	60.85	3.40	120		0.010112	295'-8	Pf 3.747
1138	37'-0			76.980		PO(18'-8½)	74'-10½	Pe
1110	37'-0			80.727		3PO(18'-8½)	370'-6½	Pv
Route 11								
CM	4.3100	566.08	12.45	120		0.064800	10'-0	Pf 0.649
1138	37'-0	60.85		76.980		Flow (q) from Route 10		Pe -0.041
1140	37'-1			77.588			10'-0	Pv
CM	4.3100	498.06	10.95	120		0.051135	10'-0	Pf 0.511
1140	37'-1			77.588				Pe -0.090
1142	37'-3½			78.009			10'-0	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Remote Area 11

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream						Total Length	
CM	4.3100	420.88	9.26	120	0.037449	10'-0"	Pf 0.375
1142	37'-3½"			78.009			Pe -0.090
1144	37'-6"			78.294		10'-0"	Pv
CM	4.3100	332.78	7.32	120	0.024251	10'-0"	Pf 0.243
1144	37'-6"			78.294			Pe -0.090
1146	37'-8½"			78.446		10'-0"	Pv
CM	4.3100	232.16	5.11	120	0.012458	10'-0"	Pf 0.125
1146	37'-8½"			78.446			Pe -0.090
1148	37'-11"			78.481		10'-0"	Pv
CM	4.3100	117.57	2.59	120	0.003538	10'-0"	Pf 0.035
1148	37'-11"			78.481			Pe -0.090
1150	38'-1½"			78.426		10'-0"	Pv
RN	2.7050	117.57	6.56	120	0.034203	295'-8"	Pf 12.674
1150	38'-1½"			78.426	PO(18'-8½")	74'-10½"	Pe -0.000
1124	38'-1½"			91.099	3PO(18'-8½")	370'-6½"	Pv
Route 12							
RN	2.7050	77.18	4.31	120	0.015699	295'-8"	Pf 5.817
1142	37'-3½"			78.009	PO(18'-8½")	74'-10½"	Pe -0.000
1114	37'-3½"			83.826	3PO(18'-8½")	370'-6½"	Pv
Route 13							
RN	2.7050	68.02	3.80	120	0.012428	295'-8"	Pf 4.605
1140	37'-1"			77.588	PO(18'-8½")	74'-10½"	Pe -0.000
1112	37'-1"			82.193	3PO(18'-8½")	370'-6½"	Pv
Route 14							
RN	2.7050	114.59	6.40	120	0.032615	295'-8"	Pf 12.085
1148	37'-11"			78.481	PO(18'-8½")	74'-10½"	Pe -0.000
1120	37'-11"			90.565	3PO(18'-8½")	370'-6½"	Pv
Route 15							
RN	2.7050	100.62	5.62	120	0.025641	295'-8"	Pf 9.501
1146	37'-8½"			78.446	PO(18'-8½")	74'-10½"	Pe -0.000
1118	37'-8½"			87.947	3PO(18'-8½")	370'-6½"	Pv
Route 16							
RN	2.7050	88.10	4.92	120	0.020055	295'-8"	Pf 7.431
1144	37'-6"			78.294	PO(18'-8½")	74'-10½"	Pe -0.000
1116	37'-6"			85.725	3PO(18'-8½")	370'-6½"	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

C Value Multiplier

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$$

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51



Hydraulic Analysis

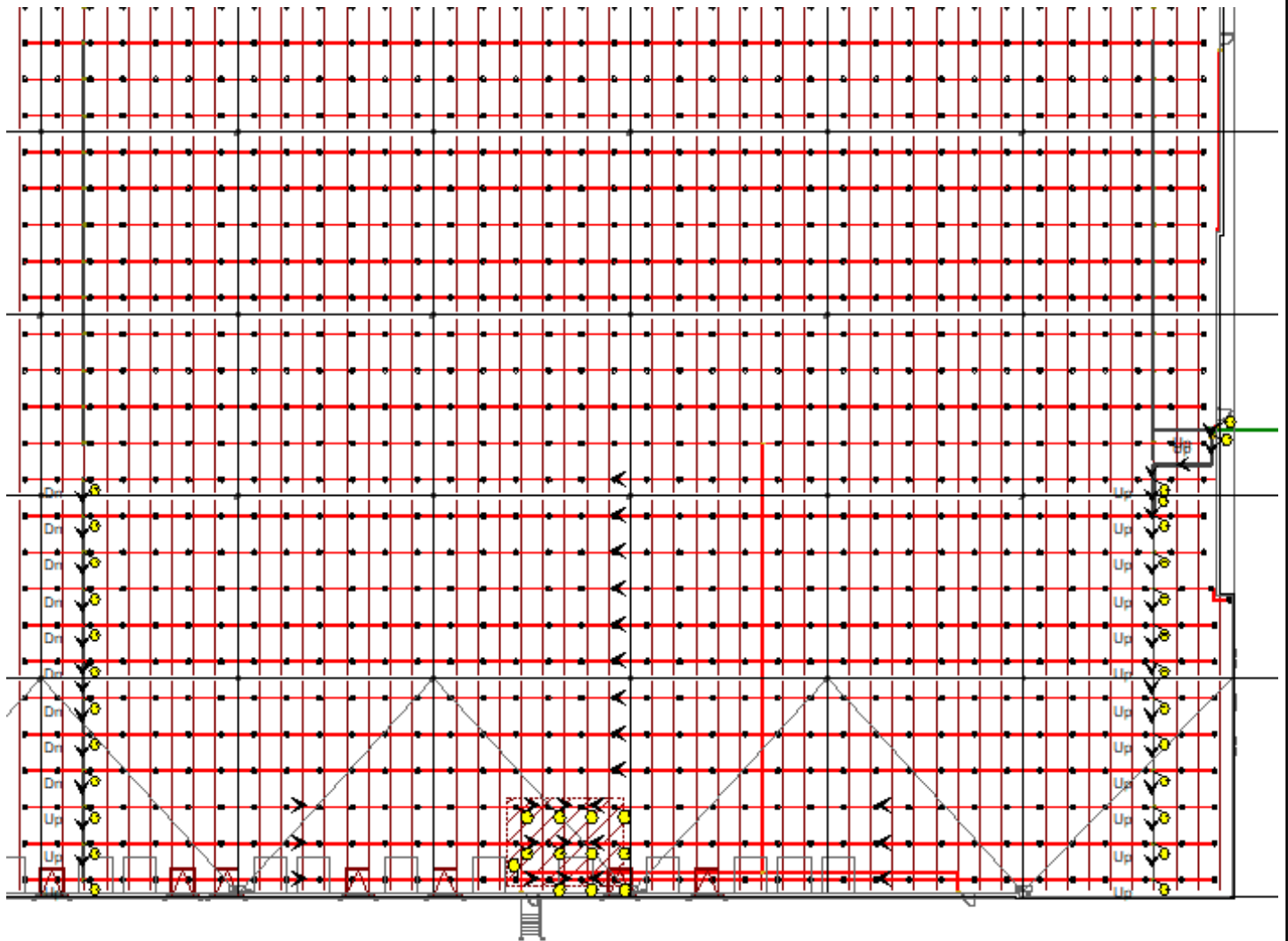
Job Number: 212189000
Report Description: Remote Area 11

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss		Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend	
AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend	
Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend	
ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BaIV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DeIV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PrV	Pressure Relief Valve
PRV	Pressure Reducing Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
SFx	Seismic Flex
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap





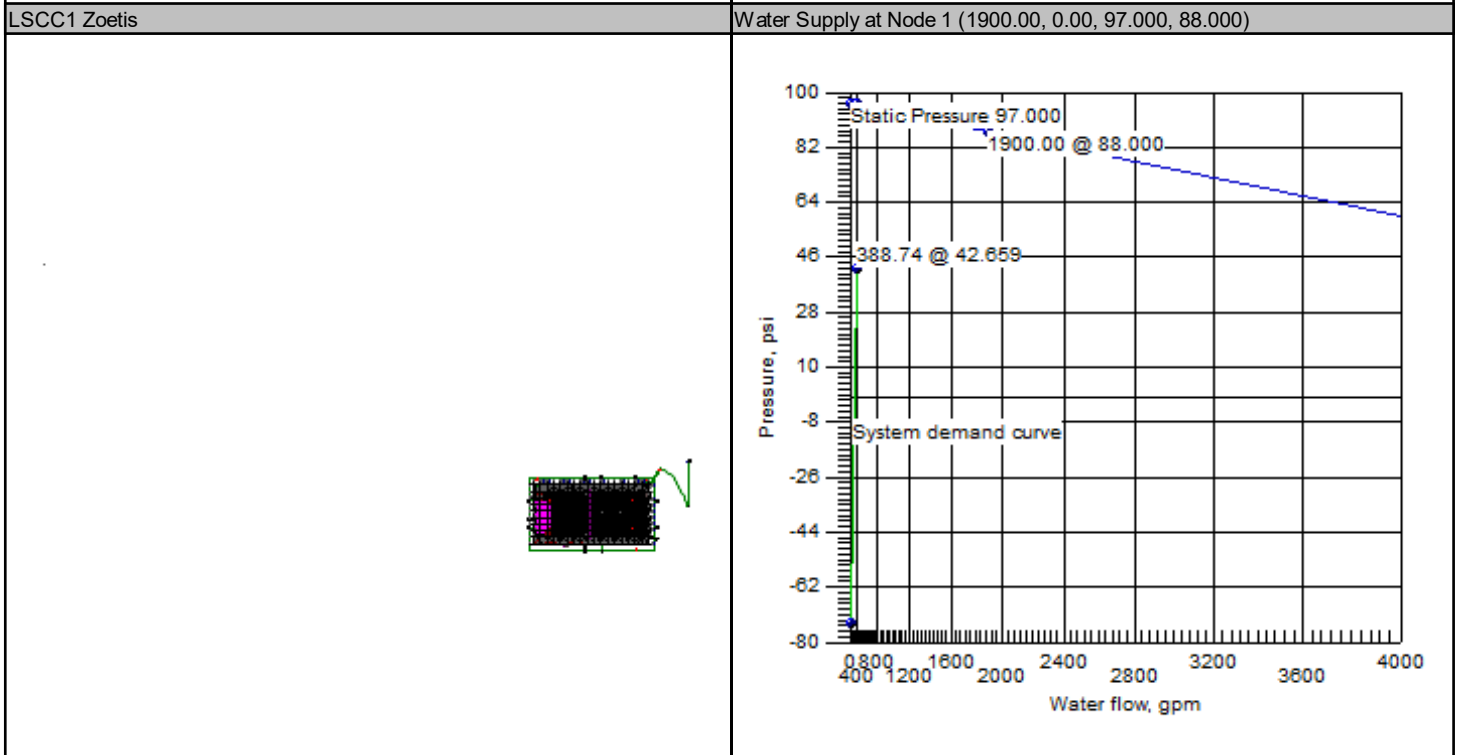
Hydraulic Overview

Job Number: 212189000
Report Description: Office Remote Area

Job		
Job Number 212189000	Design Engineer Jay Colbert	
Job Name: Lee's Summit Commerce Center	Phone 913.242.0057	FAX
Address 1 1120 NW Main St	State Certification/License Number	
Address 2	AHJ City of Lee's Summit	
Address 3 Lee's Summit, MO 64086	Job Site/Building Building A	

System	
Density 0.10gpm/ft²	Area of Application 1500ft² (Actual 965ft²)
Most Demanding Sprinkler Data 5.6 K-Factor 39.99 at 51.000	Hose Streams 100.00
Coverage Per Sprinkler 400ft²	Number Of Sprinklers Calculated 7 0
System Pressure Demand 42.659	System Flow Demand 388.74
Total Demand 388.74 @ 42.659	Pressure Result +53.863 (55.8%)

Supplies						Check Point Gauges			
Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)	Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)
1	Water Supply	1900.00		97.000	88.000	Pump Inlet	32.293	68.41	388.74
4	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									





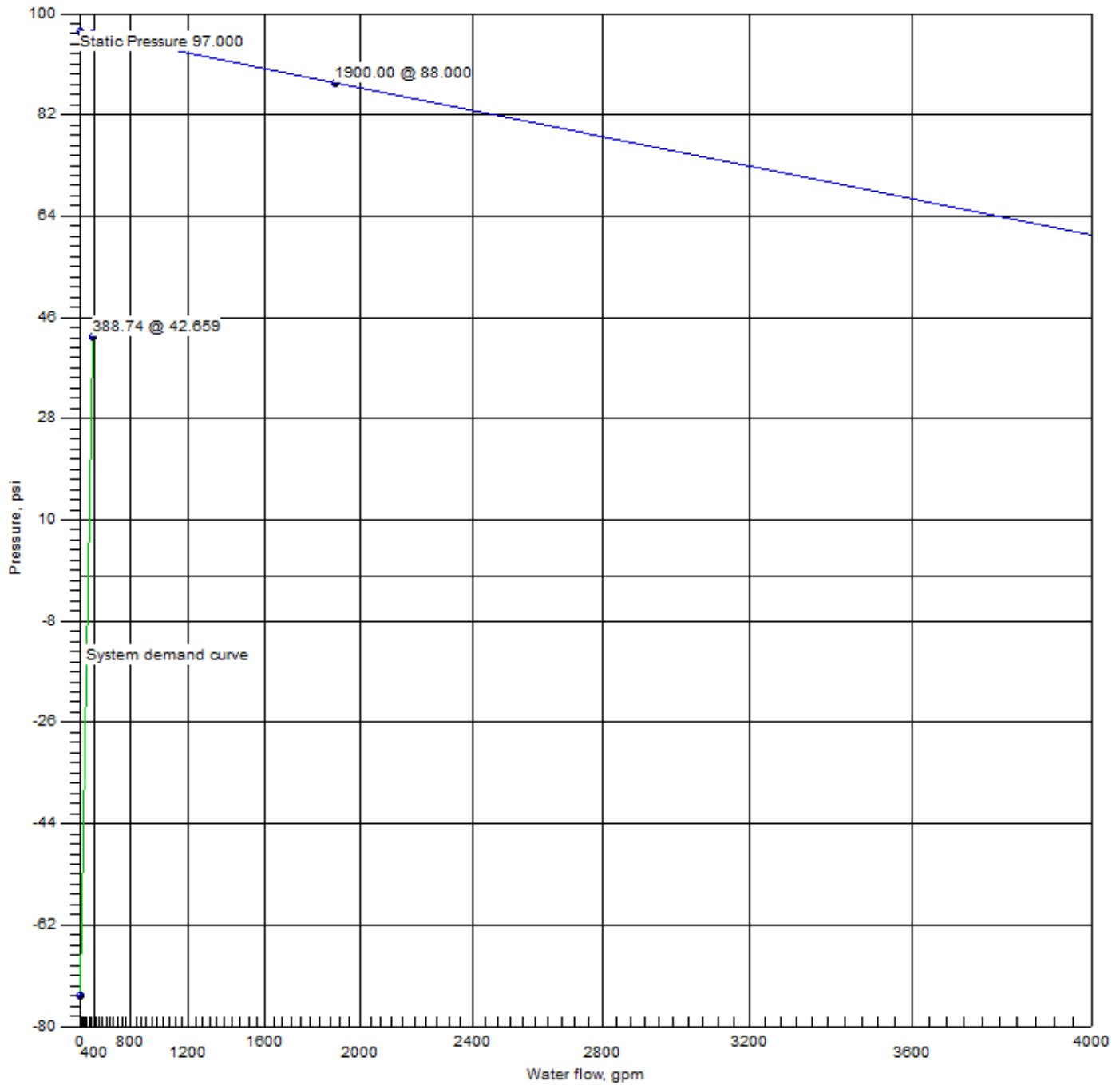
Hydraulic Summary

Job Number: 212189000
Report Description: Office Remote Area

Job											
Job Number 212189000				Design Engineer Jay Colbert							
Job Name: Lee's Summit Commerce Center				State Certification/License Number							
Address 1 1120 NW Main St				AHJ City of Lee's Summit							
Address 2				Job Site/Building Building A							
Address 3 Lee's Summit, MO 64086				Drawing Name LSCC1 Zoetis							
System				Remote Area(s)							
Most Demanding Sprinkler Data 5.6 K-Factor 39.99 at 51.000				Occupancy Light Hazard			Job Suffix				
Hose Allowance At Source 0.00				Density 0.10gpm/ft ²			Area of Application 1500ft ² (Actual 965ft ²)				
Additional Hose Supplies Node Hydrant At Node 54				Flow(gpm) 100.00			Number Of Sprinklers Calculated 7				
				Number Of Nozzles Calculated 0			Coverage Per Sprinkler 400ft ²				
				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area							
Total Hose Streams 100.00											
System Flow Demand 388.74			Total Water Required (Including Hose Allowance) 388.74								
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 16.62 between nodes 107 and 105											
Maximum Velocity Under Ground 2.26 between nodes 224 and 7											
Volume capacity of Wet Pipes 34293.96gal			Volume capacity of Dry Pipes								
Supplies											
Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@	Flow (gpm)	Available (psi)	@	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply		97.000	88.000		1900.00	96.522		388.74	42.659	53.863
4	Pump		84.000	60.000		2000.00	168.414		388.74	114.552	53.863
Pumps: Static = Churn (Pressure @ Zero Flow)											
Contractor											
Contractor Number 21		Contact Name Jay Colbert					Contact Title				
Name of Contractor: F.E. Moran Fire Protection Inc.		Phone 913.242.0057					Extension				
Address 1 16815 College Blvd.		FAX									
Address 2		E-mail jay.colbert@femoran.com									
Address 3 Lenexa, KS 66219		Web-Site femoranfp.com									



Water Supply at Node 1



Hydraulic Graph

Water Supply at Node 1

Static: Pressure

97.000

Residual: Pressure

88.000 @ 1900.00

Available Pressure at System Demand

96.522 @ 388.74

Required Pressure at System Demand

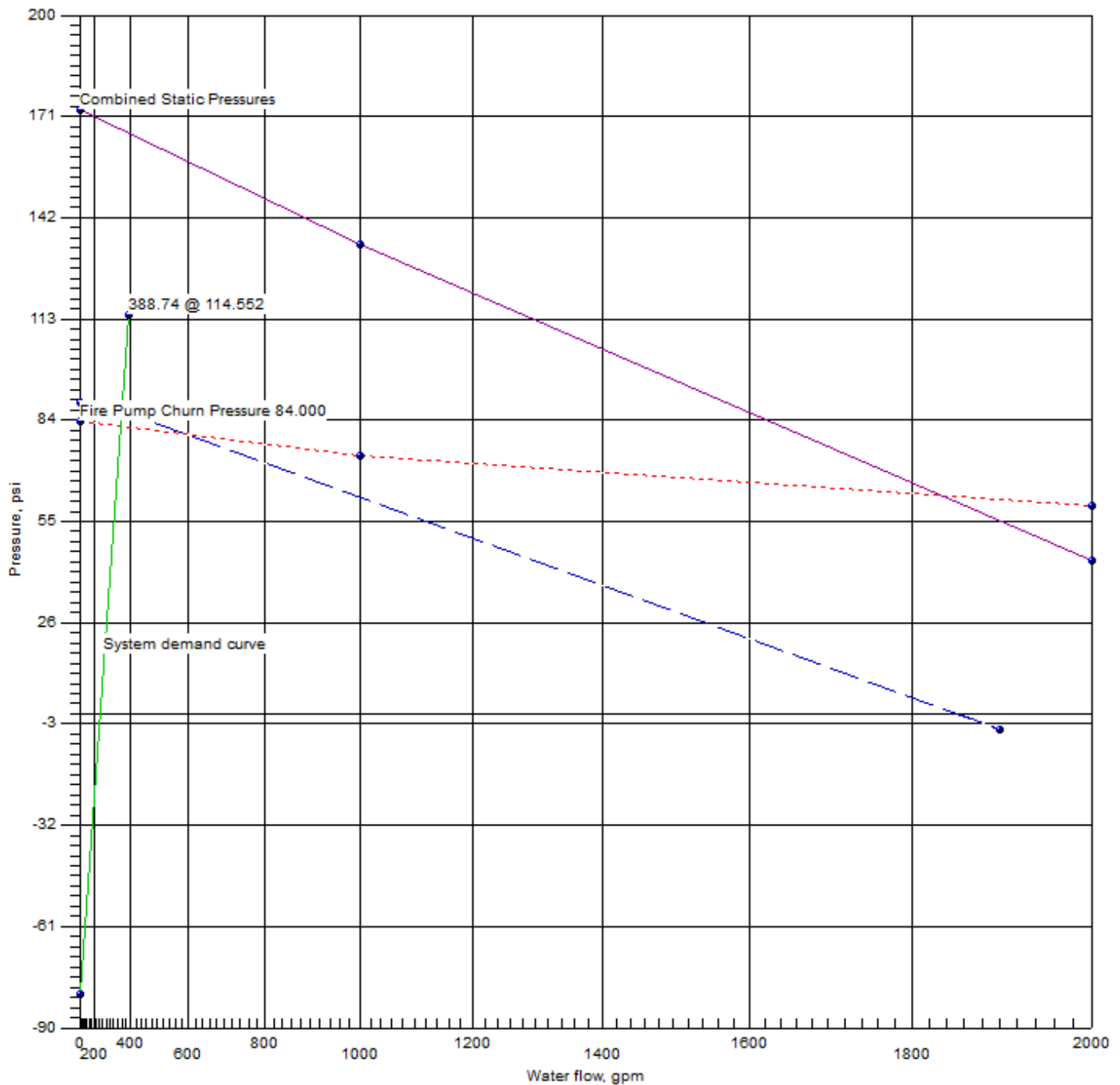
42.659 @ 388.74

Required Pressure at System Demand (Including Hose Allowance at Source)

42.659 @ 388.74



Pump at Node 4



Hydraulic Graph

Static + Churn Pressure

Fire Pump Rating

Pump at Node 4

173.256

60.000 @ 2000.00

Static: Pressure

Fire Pump Churn Pressure

173.256

84.000

Residual: Pressure

82.259 @ 388.74

Available Pressure at System Demand

168.414 @ 388.74

Required Pressure at System Demand

114.552 @ 388.74



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: Office Remote Area

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Hydrant	54	100.00	100.00	250	114.233		
⇒ Sprinkler	1611	39.99	39.99	5.6	51.000		
Sprinkler	1613	40.41	39.99	5.6	52.065		
Sprinkler	1615	41.12	39.99	5.6	53.909		
Sprinkler	1617	41.56	39.99	5.6	55.080		
Sprinkler	1619	41.77	39.99	5.6	55.624		
Sprinkler	1621	41.83	39.99	5.6	55.788		
Sprinkler	1623	42.07	39.99	5.6	56.442		

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: Office Remote Area

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	42.659	388.74
54	1'-0	Hyd(-0.160)	114.233	100.00
1611	9'-8	Spr(-51.000), fd(30'-8½)	51.000	39.99
1613	9'-8	Spr(-52.065), fd(30'-8½)	52.065	40.41
1615	9'-8	Spr(-53.909), fd(30'-8½)	53.909	41.12
1617	9'-8	Spr(-55.080), fd(30'-8½)	55.080	41.56
1619	9'-8	Spr(-55.624), fd(30'-8½)	55.624	41.77
1621	9'-8	Spr(-55.788), fd(30'-8½)	55.788	41.83
1623	9'-8	Spr(-56.442), fd(30'-8½)	56.442	42.07
2	1'-9	T(65'-4½)	32.317	
3	1'-9	P1, Pump Inlet	32.293	
4	1'-9	P2(-60.886)	114.552	
5	1'-9		114.552	
6	6'-8½		112.279	
7	-8'-0	T(59'-4½)	118.556	
8	-8'-0	T(59'-4½)	118.438	
9	-8'-0	T(47'-3½)	118.396	
10	-8'-0	T(59'-4½)	118.159	
11	-8'-0	T(47'-3½)	118.164	
12	-8'-0	T(59'-4½)	118.175	
13	-8'-0	T(47'-3½)	118.298	
14	-8'-0	T(59'-4½)	118.320	
15	-8'-0	T(47'-3½)	118.421	
16	-8'-0	T(59'-4½)	118.438	
17	-8'-0	T(59'-4½)	118.478	
52	1'-0	Hyd	1.000	
55	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
100	37'-0	PO(18'-8½)	97.206	
101	10'-8	PO(6'-2½)	68.534	
102	37'-0	PO(18'-8½)	97.347	
103	10'-8	PO(5'-0)	68.701	
104	37'-0	PO(18'-8½)	97.473	
105	10'-8	PO(5'-0)	71.103	
106	37'-0	PO(18'-8½)	97.589	
107	10'-8	PO(11'-3½)	77.651	
108	37'-0	PO(18'-8½)	97.698	
109	37'-0	PO(18'-8½)	97.014	
110	37'-0		97.750	
111	10'-8	PO(5'-0)	72.627	
112	37'-2	PO(18'-8½)	97.693	
113	10'-8	PO(5'-0)	73.336	
114	37'-5	PO(18'-8½)	97.592	
115	10'-8	PO(11'-3½)	76.656	
116	37'-8½	PO(22'-6)	97.491	
117	10'-8	PO(6'-2½)	73.853	
118	38'-0	PO(22'-6)	97.393	
119	10'-8	PO(5'-0)	74.400	
120	38'-3	PO(22'-6)	97.297	
122	1'-8½	PO(37'-8½)	113.851	
124	1'-0		114.187	
126	37'-0	PO(18'-8½)	97.612	
128	37'-0	PO(18'-8½)	97.617	
130	37'-0	PO(18'-8½)	97.626	
132	37'-0	PO(18'-8½)	97.638	
134	37'-0	PO(18'-8½)	97.652	
136	37'-2	PO(18'-8½)	97.598	
138	37'-5	PO(18'-8½)	97.487	
140	37'-8½	PO(22'-6)	97.374	
142	38'-0	PO(22'-6)	97.257	
144	38'-3	PO(22'-6)	97.138	
146	37'-0	PO(18'-8½)	97.610	



Node Analysis

Job Number: 212189000
Report Description: Office Remote Area

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
148	37'-10	T(18'-8½)	96.731	
150	37'-0	PO(18'-8½)	97.078	
152	37'-0	PO(18'-8½)	97.015	
224	1'-0		114.748	
309	-8'-0	E(35'-1)	41.092	



Hydraulic Analysis

Job Number: 212189000
Report Description: Office Remote Area

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
BL	1.0970	39.99	13.58	120		0.377135	4'-6"	Pf 17.968
1611	9'-8"	39.99	5.6	51.000		Sprinkler,	43'-1½"	Pe -0.434
101	10'-8"			68.534		2PO(6'-2½"), fd(30'-8½")	47'-7½"	Pv
BL	1.7280	39.99	5.47	120		0.041254	4'-0½"	Pf 0.166
101	10'-8"			68.534				Pe
103	10'-8"			68.701			4'-0½"	Pv
BL	1.7280	80.40	11.00	120		0.150153	16'-0"	Pf 2.402
103	10'-8"	40.41		68.701		Flow (q) from Route 2		Pe
105	10'-8"			71.103			16'-0"	Pv
BL	1.7280	121.52	16.62	120		0.322396	9'-0"	Pf 6.548
105	10'-8"	41.12		71.103		Flow (q) from Route 3	11'-3½"	Pe
107	10'-8"			77.651		PO(11'-3½")	20'-3½"	Pv
BL	2.7050	288.74	16.12	120		0.180277	126'-7½"	Pf 30.780
107	10'-8"	167.23		77.651		Flow (q) from Route 4	44'-1½"	Pe -11.416
109	37'-0"			97.014		T(18'-8½"), fE(6'-8½"), PO(18'-8½")	170'-9"	Pv
CM	4.3100	274.22	6.03	120		0.016953	3'-9"	Pf 0.064
109	37'-0"			97.014				Pe
150	37'-0"			97.078			3'-9"	Pv
CM	4.3100	266.40	5.86	120		0.016069	8'-0"	Pf 0.129
150	37'-0"			97.078				Pe
100	37'-0"			97.206			8'-0"	Pv
CM	4.3100	248.11	5.46	120		0.014088	10'-0"	Pf 0.141
100	37'-0"			97.206				Pe
102	37'-0"			97.347			10'-0"	Pv
CM	4.3100	233.44	5.13	120		0.012585	10'-0"	Pf 0.126
102	37'-0"			97.347				Pe -0.000
104	37'-0"			97.473			10'-0"	Pv
CM	4.3100	222.65	4.90	120		0.011531	10'-0"	Pf 0.115
104	37'-0"			97.473				Pe
106	37'-0"			97.589			10'-0"	Pv
CM	4.3100	216.78	4.77	120		0.010975	10'-0"	Pf 0.110
106	37'-0"			97.589				Pe
108	37'-0"			97.698			10'-0"	Pv
CM	4.3100	222.42	4.89	120		0.011509	4'-6"	Pf 0.052
108	37'-0"	5.64		97.698		Flow (q) from Route 20		Pe
110	37'-0"			97.750			4'-6"	Pv
CM	6.3570	222.42	2.25	120		0.001734	5'-6½"	Pf 0.010
110	37'-0"			97.750				Pe -0.066
112	37'-2"			97.693			5'-6½"	Pv
CM	6.3570	230.78	2.33	120		0.001857	10'-0"	Pf 0.019
112	37'-2"	8.35		97.693		Flow (q) from Route 21		Pe -0.120
114	37'-5"			97.592			10'-0"	Pv
CM	6.3570	239.55	2.42	120		0.001989	10'-0"	Pf 0.020
114	37'-5"	8.77		97.592		Flow (q) from Route 13		Pe -0.121
116	37'-8½"			97.491			10'-0"	Pv
CM	6.3570	254.18	2.57	120		0.002220	10'-0"	Pf 0.022
116	37'-8½"	14.63		97.491		Flow (q) from Route 11		Pe -0.120
118	38'-0"			97.393			10'-0"	Pv
CM	6.3570	270.02	2.73	120		0.002483	10'-0"	Pf 0.025
118	38'-0"	15.84		97.393		Flow (q) from Route 10		Pe -0.120
120	38'-3"			97.297			10'-0"	Pv
CM	6.3570	288.74	2.92	120		0.002810	71'-0½"	Pf 0.701
120	38'-3"	18.72		97.297		Flow (q) from Route 9	178'-6½"	Pe 15.853
122	1'-8½"			113.851		5E(17'-7"), 2f(-0.000), CV(40'-3"), BV(12'-7"), PO(37'-8½")	249'-7"	Pv
CM	8.2490	288.74	1.73	120		0.000790	1'-6"	Pf 0.034
122	1'-8½"			113.851			41'-1½"	Pe 0.303
124	1'-0"			114.187		PO(41'-1½")	42'-7½"	Pv
UG	8.3900	288.74	1.68	140		0.000547	38'-9½"	Pf 0.070
124	1'-0"			114.187			89'-11"	Pe 3.902
10	-8'-0"			118.159		E(30'-6½"), T(59'-4½")	128'-8½"	Pv
UG	8.3900	228.46	1.33	140		0.000355	635'-11½"	Pf 0.236
10	-8'-0"			118.159			30'-6½"	Pe
9	-8'-0"			118.396		E(30'-6½")	666'-6"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Office Remote Area

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
UG	8.3900	228.46	1.33	140		0.000355	118'-2"	Pf 0.042
9	-8'-0			118.396				Pe
8	-8'-0			118.438			118'-2"	Pv
UG	8.3900	228.46	1.33	140		0.000355	275'-0"	Pf 0.119
8	-8'-0			118.438			59'-4½"	Pe
7	-8'-0			118.556		T(59'-4½")	334'-4½"	Pv
UG	8.3900	388.74	2.26	140		0.000948	67'-8"	Pf 0.093
7	-8'-0	160.28		118.556		Flow (q) from Route 8	30'-6½"	Pe -3.902
224	1'-0			114.748		E(30'-6½")	98'-2½"	Pv
FR	8.2490	388.74	2.33	120		0.001370	5'-8½"	Pf 0.008
224	1'-0			114.748				Pe -2.476
6	6'-8½"			112.279			5'-8½"	Pv
DY	10.3700	388.74	1.48	120		0.000449	13'-10½"	Pf 0.121
6	6'-8½"			112.279			255'-9"	Pe 2.151
5	1'-9			114.552		4E(26'-0), T(48'-5½), BV(21'-3½), Tr(17'-0), CV(65'-0)	269'-8"	Pv
DY	7.9810	388.74	2.49	120		0.001609	0'-0"	Pf 0.000
5	1'-9			114.552				Pe 0.000
4	1'-9			114.552			0'-0"	Pv
Pump		Velocity						
4		388.74		114.552		Rating: 60.000 @ 2000.00		
3		Q=388.74	1.47	32.293		Fire Pump Churn Pressure: 84.000		
DY	10.4000	388.74	1.47	140		0.000333	0'-0"	Pf 0.024
3	1'-9			32.293			73'-4"	Pe 0.000
2	1'-9			32.317		GV(7'-11½), T(65'-4½)	73'-4"	Pv
UG	10.4000	388.74	1.47	140		0.000333	696'-3½"	Pf 4.548
2	1'-9			32.317			175'-4½"	Pe 4.227
309	-8'-0			41.092		4E(35'-1), 2EE(17'-6½), BFP(-3.948)	871'-8"	Pv
UG	12.4600	388.74	1.02	140		0.000138	360'-2½"	Pf 0.050
309	-8'-0			41.092				Pe 1.517
1	-11'-6			42.659		Water Supply	360'-2½"	Pv
		0.00				Hose Allowance At Source		
1		388.74						
Route 2								
DY	1.0490	40.41	15.00	120		0.478004	0'-0"	Pf 17.069
1613	9'-8	40.41	5.6	52.065		Sprinkler,	35'-8½"	Pe -0.434
103	10'-8			68.701		PO(5'-0), fd(30'-8½)	35'-8½"	Pv
Route 3								
DY	1.0490	41.12	15.26	120		0.493644	0'-0"	Pf 17.627
1615	9'-8	41.12	5.6	53.909		Sprinkler,	35'-8½"	Pe -0.434
105	10'-8			71.103		PO(5'-0), fd(30'-8½)	35'-8½"	Pv
Route 4								
DY	1.0490	41.56	15.43	120		0.503547	0'-0"	Pf 17.981
1617	9'-8	41.56	5.6	55.080		Sprinkler,	35'-8½"	Pe -0.434
111	10'-8			72.627		PO(5'-0), fd(30'-8½)	35'-8½"	Pv
BL	1.7280	41.56	5.69	120		0.044297	16'-0"	Pf 0.709
111	10'-8			72.627				Pe
113	10'-8			73.336			16'-0"	Pv
BL	1.7280	83.33	11.40	120		0.160421	9'-5"	Pf 3.320
113	10'-8	41.77		73.336		Flow (q) from Route 5	11'-3½"	Pe
115	10'-8			76.656		PO(11'-3½)	20'-8½"	Pv
BL	2.7050	167.23	9.34	120		0.065631	15'-2"	Pf 0.995
115	10'-8	83.90		76.656		Flow (q) from Route 6		Pe
107	10'-8			77.651			15'-2"	Pv
Route 5								
DY	1.0490	41.77	15.50	120		0.508150	0'-0"	Pf 18.145
1619	9'-8	41.77	5.6	55.624		Sprinkler,	35'-8½"	Pe -0.434
113	10'-8			73.336		PO(5'-0), fd(30'-8½)	35'-8½"	Pv
Route 6								
BL	1.0970	41.83	14.20	120		0.409777	2'-0"	Pf 18.498
1621	9'-8	41.83	5.6	55.788		Sprinkler,	43'-1½"	Pe -0.434
117	10'-8			73.853		2PO(6'-2½), fd(30'-8½)	45'-1½"	Pv
BL	1.7280	41.83	5.72	120		0.044825	12'-2½"	Pf 0.547
117	10'-8			73.853				Pe
119	10'-8			74.400			12'-2½"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Office Remote Area

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
BL	1.7280	83.90	11.48	120		0.162466	2'-7"	Pf 2.256
119	10'-8"	42.07		74.400		Flow (q) from Route 7	11'-3½"	Pe
115	10'-8"			76.656		PO(11'-3½")	13'-10½"	Pv
Route 7								
DY	1.0490	42.07	15.62	120		0.515057	0'-0"	Pf 18.392
1623	9'-8"	42.07	5.6	56.442		Sprinkler,	35'-8½"	Pe -0.434
119	10'-8"			74.400		PO(5'-0"), fd(30'-8½")	35'-8½"	Pv
Route 8								
UG	6.2800	100.00	1.04	140		0.000315	19'-10"	Pf 0.030
54	1'-0"	100.00		114.233		Hydrant,	74'-1"	Pe 3.902
11	-8'-0"			118.164		E(22'-1"), GV(4'-8½"), T(47'-3½")	93'-10½"	Pv
UG	8.3900	160.28	0.93	140		0.000184	61'-1½"	Pf 0.011
11	-8'-0"	60.28		118.164		Flow (q) from Route 12		Pe
12	-8'-0"			118.175			61'-1½"	Pv
UG	8.3900	160.28	0.93	140		0.000184	635'-9"	Pf 0.123
12	-8'-0"			118.175			30'-6½"	Pe
13	-8'-0"			118.298		E(30'-6½")	666'-3½"	Pv
UG	8.3900	160.28	0.93	140		0.000184	119'-3"	Pf 0.022
13	-8'-0"			118.298				Pe
14	-8'-0"			118.320			119'-3"	Pv
UG	8.3900	160.28	0.93	140		0.000184	519'-3½"	Pf 0.101
14	-8'-0"			118.320			30'-6½"	Pe
15	-8'-0"			118.421		E(30'-6½")	549'-10"	Pv
UG	8.3900	160.28	0.93	140		0.000184	91'-11½"	Pf 0.017
15	-8'-0"			118.421				Pe
16	-8'-0"			118.438			91'-11½"	Pv
UG	8.3900	160.28	0.93	140		0.000184	214'-9"	Pf 0.040
16	-8'-0"			118.438				Pe
17	-8'-0"			118.478			214'-9"	Pv
UG	8.3900	160.28	0.93	140		0.000184	337'-8"	Pf 0.079
17	-8'-0"			118.478			89'-11"	Pe
7	-8'-0"			118.556		E(30'-6½"), T(59'-4½")	427'-7"	Pv
Route 9								
CM	4.3100	18.72	0.41	120		0.000118	10'-0"	Pf 0.001
142	38'-0"			97.257				Pe -0.120
144	38'-3"			97.138			10'-0"	Pv
BL	3.3340	18.72	0.69	120		0.000413	295'-7"	Pf 0.159
144	38'-3"			97.138		PO(22'-6)	89'-11½"	Pe -0.000
120	38'-3"			97.297		3PO(22'-6)	385'-6½"	Pv
Route 10								
CM	4.3100	49.19	1.08	120		0.000706	10'-0"	Pf 0.007
138	37'-5"			97.487				Pe -0.120
140	37'-8½"			97.374			10'-0"	Pv
CM	4.3100	34.56	0.76	120		0.000367	10'-0"	Pf 0.004
140	37'-8½"			97.374				Pe -0.120
142	38'-0"			97.257			10'-0"	Pv
BL	3.3340	15.84	0.58	120		0.000303	315'-3"	Pf 0.135
142	38'-0"			97.257		PO(22'-6)	131'-11"	Pe -0.000
118	38'-0"			97.393		3PO(22'-6), 4E(10'-6)	447'-2"	Pv
Route 11								
BL	3.3340	14.63	0.54	120		0.000262	315'-3"	Pf 0.117
140	37'-8½"			97.374		PO(22'-6)	131'-11"	Pe -0.000
116	37'-8½"			97.491		3PO(22'-6), 4E(10'-6)	447'-2"	Pv
Route 12								
UG	8.3900	60.28	0.35	140		0.000030	153'-8"	Pf 0.005
10	-8'-0"	228.46		118.159		Flow (q) from Route 1		Pe
11	-8'-0"			118.164			153'-8"	Pv
Route 13								
BL	2.7050	22.34	1.25	120		0.001584	270'-10"	Pf 0.518
148	37'-10"	14.52 + 7.82		96.731		Flow (q) from Route 14 and 15	56'-2"	Pe 0.361
146	37'-0"			97.610		2E(9'-4½"), 2PO(18'-8½")	327'-0"	Pv
CM	4.3100	22.34	0.49	120		0.000164	10'-0"	Pf 0.002
146	37'-0"			97.610				Pe
126	37'-0"			97.612			10'-0"	Pv
CM	4.3100	40.63	0.89	120		0.000496	10'-0"	Pf 0.005
126	37'-0"	18.30		97.612		Flow (q) from Route 17		Pe
128	37'-0"			97.617			10'-0"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Office Remote Area

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	
CM	4.3100	55.31	1.22	120		0.000877	10'-0	Pf 0.009
128	37'-0	14.67		97.617		Flow (q) from Route 16		Pe
130	37'-0			97.626			10'-0	Pv
CM	4.3100	66.09	1.45	120		0.001219	10'-0	Pf 0.012
130	37'-0	10.79		97.626		Flow (q) from Route 18		Pe
132	37'-0			97.638			10'-0	Pv
CM	4.3100	71.96	1.58	120		0.001427	10'-0	Pf 0.014
132	37'-0	5.87		97.638		Flow (q) from Route 19		Pe
134	37'-0			97.652			10'-0	Pv
CM	4.3100	66.32	1.46	120		0.001227	10'-0½	Pf 0.012
134	37'-0			97.652				Pe -0.067
136	37'-2			97.598			10'-0½	Pv
CM	4.3100	57.96	1.27	120		0.000956	10'-0	Pf 0.010
136	37'-2			97.598				Pe -0.120
138	37'-5			97.487			10'-0	Pv
RN	2.7050	8.77	0.49	120		0.000281	295'-7	Pf 0.104
138	37'-5			97.487		PO(18'-8½)	74'-10½	Pe 0.000
114	37'-5			97.592		3PO(18'-8½)	370'-5½	Pv
Route 14								
CM	4.3100	14.52	0.32	120		0.000074	3'-9	Pf 0.000
109	37'-0	274.22		97.014		Flow (q) from Route 1		Pe
152	37'-0			97.015			3'-9	Pv
RN	2.7050	14.52	0.81	120		0.000714	34'-3	Pf 0.078
152	37'-0			97.015		PO(18'-8½)	74'-10½	Pe -0.361
148	37'-10			96.731		PO(18'-8½), 2T(18'-8½)	109'-1½	Pv
Route 15								
RN	2.7050	7.82	0.44	120		0.000227	26'-9	Pf 0.015
150	37'-0			97.078		PO(18'-8½)	37'-5	Pe -0.361
148	37'-10			96.731		PO(18'-8½)	64'-2	Pv
Route 16								
RN	2.7050	14.67	0.82	120		0.000728	295'-7	Pf 0.270
102	37'-0			97.347		PO(18'-8½)	74'-10½	Pe
128	37'-0			97.617		3PO(18'-8½)	370'-5½	Pv
Route 17								
RN	2.7050	18.30	1.02	120		0.001095	295'-7	Pf 0.406
100	37'-0			97.206		PO(18'-8½)	74'-10½	Pe
126	37'-0			97.612		3PO(18'-8½)	370'-5½	Pv
Route 18								
RN	2.7050	10.79	0.60	120		0.000412	295'-7	Pf 0.153
104	37'-0			97.473		PO(18'-8½)	74'-10½	Pe 0.000
130	37'-0			97.626		3PO(18'-8½)	370'-5½	Pv
Route 19								
RN	2.7050	5.87	0.33	120		0.000134	295'-7	Pf 0.049
106	37'-0			97.589		PO(18'-8½)	74'-10½	Pe 0.000
132	37'-0			97.638		3PO(18'-8½)	370'-5½	Pv
Route 20								
RN	2.7050	5.64	0.31	120		0.000124	295'-7	Pf 0.046
134	37'-0			97.652		PO(18'-8½)	74'-10½	Pe -0.000
108	37'-0			97.698		3PO(18'-8½)	370'-5½	Pv
Route 21								
RN	2.7050	8.35	0.47	120		0.000257	295'-7	Pf 0.095
136	37'-2			97.598		PO(18'-8½)	74'-10½	Pe 0.000
112	37'-2			97.693		3PO(18'-8½)	370'-5½	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

C Value Multiplier

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$$

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51



Hydraulic Analysis

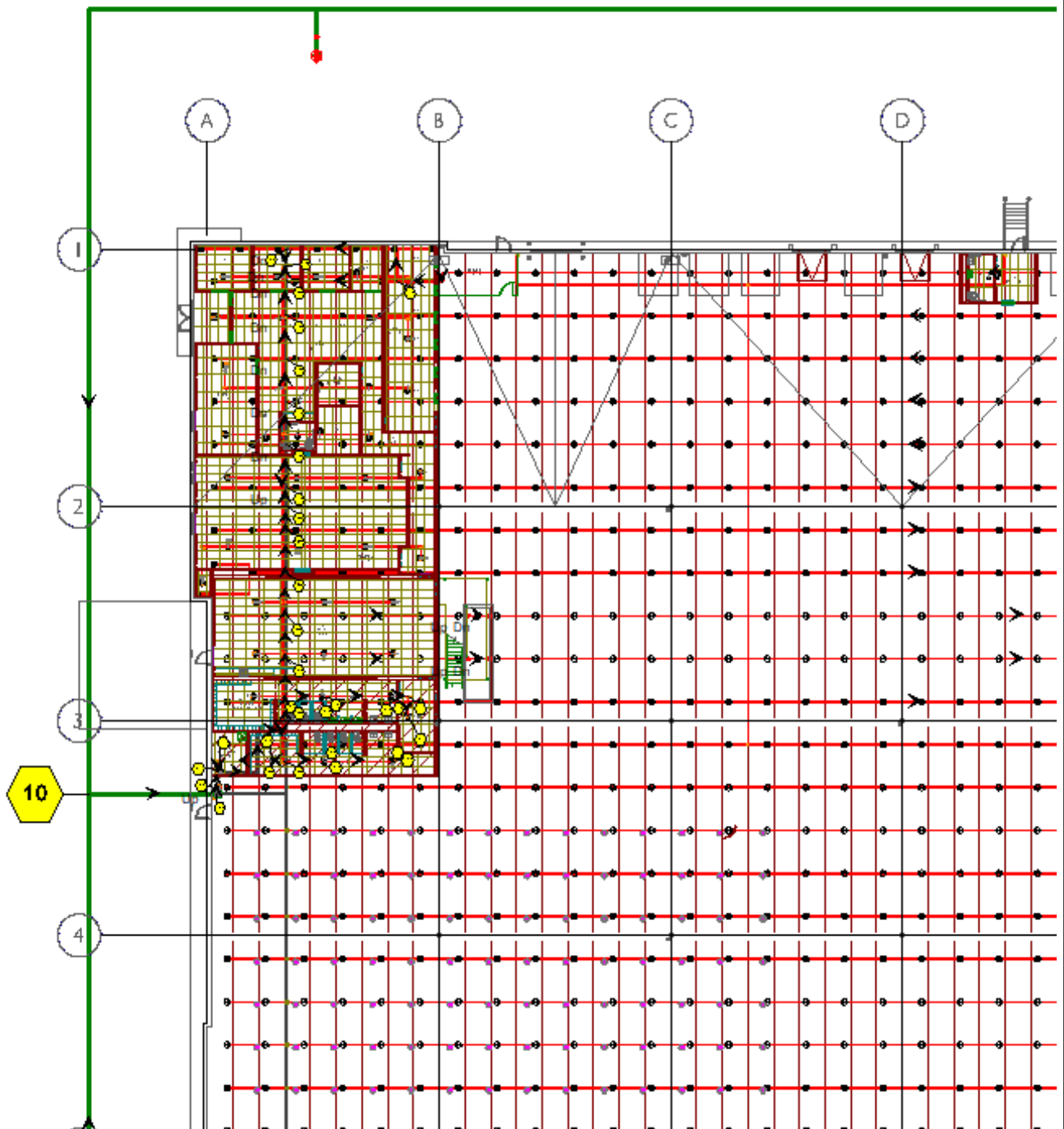
Job Number: 212189000
Report Description: Office Remote Area

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss		Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend	
AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend	
Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend	
ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BaV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DeV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PrV	Pressure Relief Valve
PRV	Pressure Reducing Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
SFx	Seismic Flex
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap





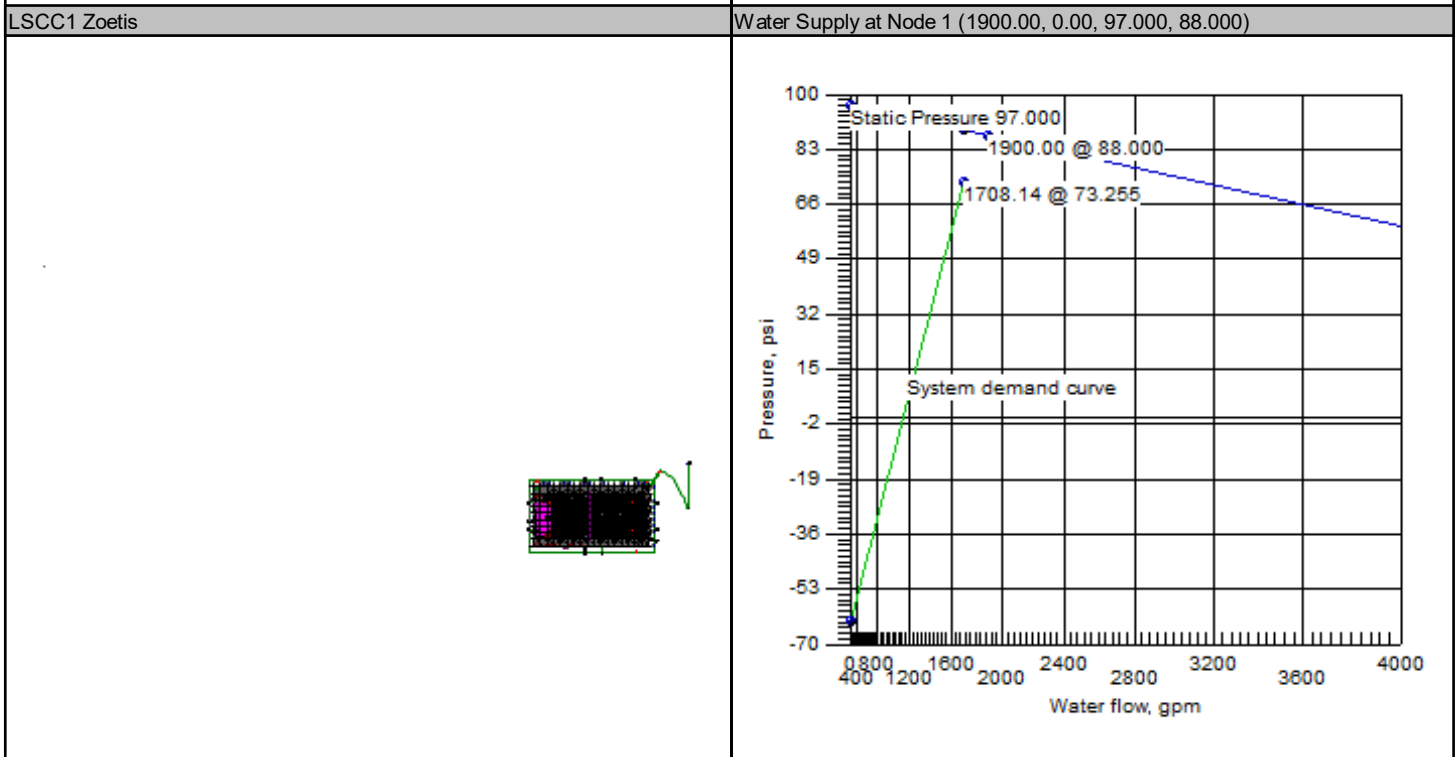
Hydraulic Overview

Job Number: 212189000
Report Description: Cooler Remote Area

Job		
Job Number 212189000	Design Engineer Jay Colbert	
Job Name: Lee's Summit Commerce Center	Phone 913.242.0057	FAX
Address 1 1120 NW Main St	State Certification/License Number	
Address 2	AHJ City of Lee's Summit	
Address 3 Lee's Summit, MO 64086	Job Site/Building Building A	

System	
Pressure 52.000	Area of Application NA
Most Demanding Sprinkler Data 16.8 K-Factor 121.15 at 52.000	Hose Streams 250.00
Coverage Per Sprinkler 90ft ²	Number Of Sprinklers Calculated 12 0
System Pressure Demand 73.255	System Flow Demand 1708.14
Total Demand 1708.14 @ 73.255	Pressure Result +16.353 (18.2%)

Supplies						Check Point Gauges			
Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)	Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)
1	Water Supply	1900.00		97.000	88.000	Pump Inlet	58.210	223.88	1708.14
4	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									





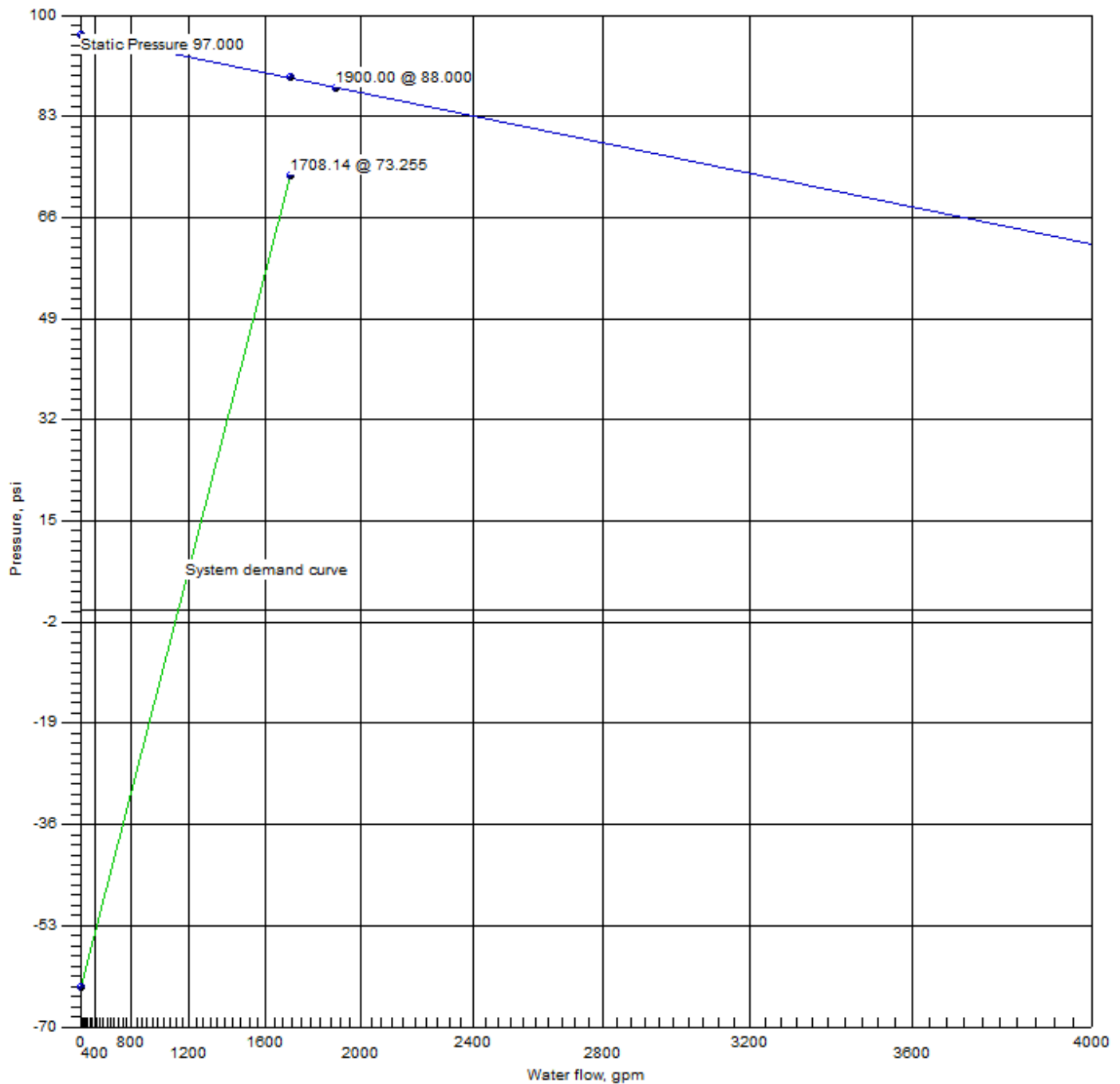
Hydraulic Summary

Job Number: 212189000
Report Description: Cooler Remote Area

Job											
Job Number 212189000				Design Engineer Jay Colbert							
Job Name: Lee's Summit Commerce Center				State Certification/License Number							
Address 1 1120 NW Main St				AHJ City of Lee's Summit							
Address 2				Job Site/Building Building A							
Address 3 Lee's Summit, MO 64086				Drawing Name LSCC1 Zoetis							
System				Remote Area(s)							
Most Demanding Sprinkler Data 16.8 K-Factor 121.15 at 52.000				Occupancy ESFR			Job Suffix				
Hose Allowance At Source 0.00				Pressure 52.000			Area of Application NA				
Additional Hose Supplies Node Hydrant At Node 54				Flow(gpm) 250.00		Number Of Sprinklers Calculated 12		Number Of Nozzles Calculated 0		Coverage Per Sprinkler 90ft ²	
				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Right: 72.538							
Total Hose Streams 250.00											
System Flow Demand 1708.14		Total Water Required (Including Hose Allowance) 1708.14									
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 19.25 between nodes 349 and 3633											
Maximum Velocity Under Ground 9.91 between nodes 224 and 7											
Volume capacity of Wet Pipes 34293.96gal		Volume capacity of Dry Pipes									
Supplies											
Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@	Flow (gpm)	Available (psi)	@	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply		97.000	88.000		1900.00	89.609		1708.14	73.255	16.353
4	Pump		84.000	60.000		2000.00	139.467		1708.14	123.114	16.353
Pumps: Static = Churn (Pressure @ Zero Flow)											
Contractor											
Contractor Number 21		Contact Name Jay Colbert				Contact Title					
Name of Contractor: F.E. Moran Fire Protection Inc.				Phone 913.242.0057				Extension			
Address 1 16815 College Blvd.				FAX							
Address 2				E-mail jay.colbert@femoran.com							
Address 3 Lenexa, KS 66219				Web-Site femoranfp.com							



Water Supply at Node 1



Hydraulic Graph

Water Supply at Node 1

Static: Pressure

97.000

Residual: Pressure

88.000 @ 1900.00

Available Pressure at System Demand

89.609 @ 1708.14

Required Pressure at System Demand

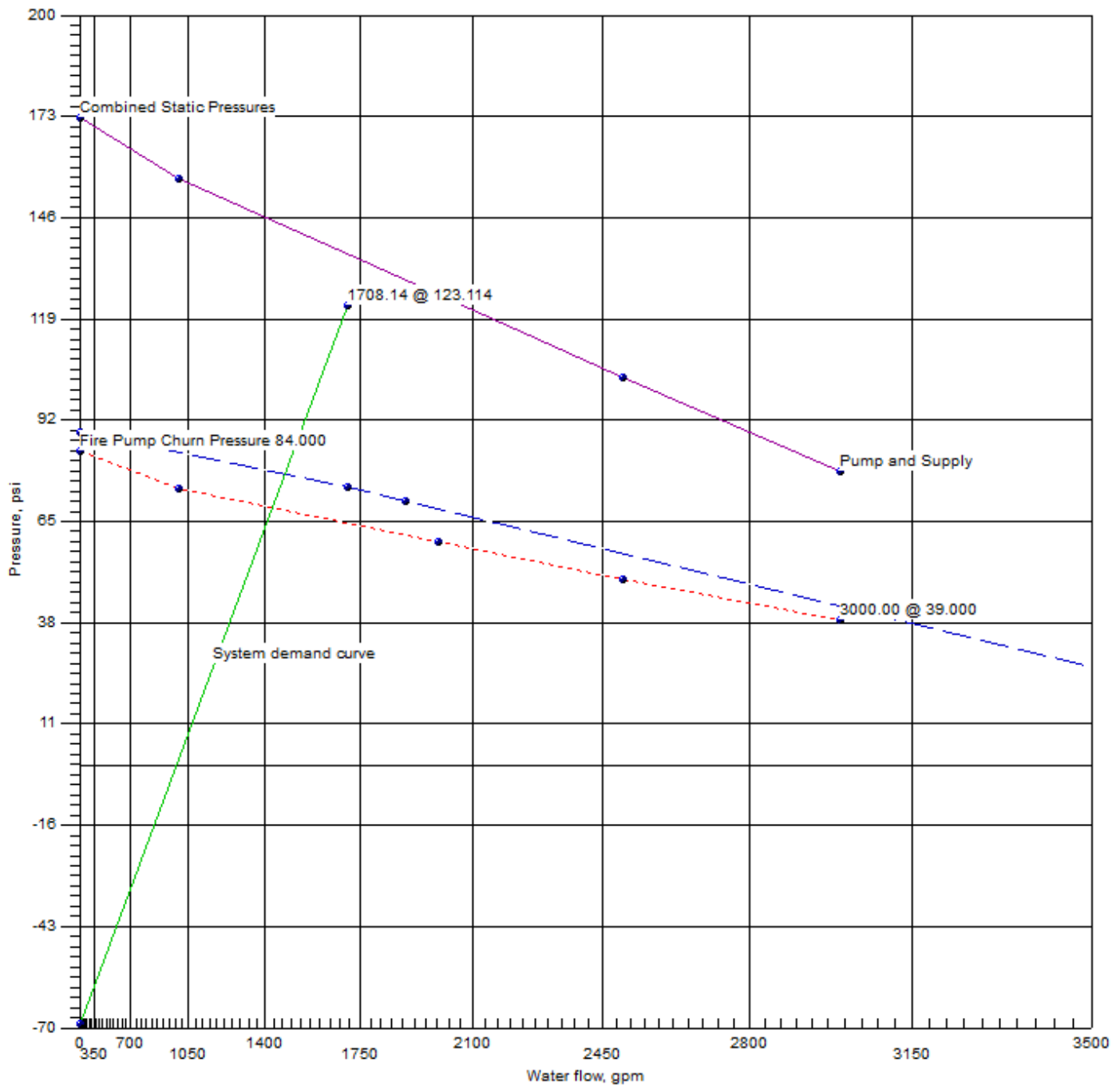
73.255 @ 1708.14

Required Pressure at System Demand (Including Hose Allowance at Source)

73.255 @ 1708.14



Pump at Node 4



Hydraulic Graph
Pump at Node 4

Static + Churn Pressure
173.256
Fire Pump Churn Pressure
84.000

Fire Pump Rating
60.000 @ 2000.00

Static: Pressure
173.256

Residual: Pressure
64.904 @ 1708.14

Available Pressure at System Demand
139.467 @ 1708.14

Required Pressure at System Demand
123.114 @ 1708.14



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: Cooler Remote Area

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Hydrant	54	250.00	250.00	250	113.422		
⇒ Sprinkler	3611	121.15	121.15	16.8	52.000		
Sprinkler	3613	121.21	121.15	16.8	52.056		
Sprinkler	3615	121.26	121.15	16.8	52.094		
Sprinkler	3617	121.28	121.15	16.8	52.112		
Sprinkler	3619	121.32	121.15	16.8	52.150		
Sprinkler	3621	121.39	121.15	16.8	52.206		
Sprinkler	3623	121.47	121.15	16.8	52.281		
Sprinkler	3625	121.54	121.15	16.8	52.336		
Sprinkler	3627	121.61	121.15	16.8	52.396		
Sprinkler	3629	121.83	121.15	16.8	52.590		
Sprinkler	3631	121.94	121.15	16.8	52.684		
Sprinkler	3633	122.15	121.15	16.8	52.868		

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: Cooler Remote Area

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	73.255	1708.14
54	1'-0	Hyd(-1.000)	113.422	250.00
3611	35'-11	Spr(-52.000)	52.000	121.15
3613	35'-11	Spr(-52.056)	52.056	121.21
3615	35'-8½	Spr(-52.094)	52.094	121.26
3617	35'-11	Spr(-52.112)	52.112	121.28
3619	35'-8½	Spr(-52.150)	52.150	121.32
3621	35'-8½	Spr(-52.206)	52.206	121.39
3623	35'-6	Spr(-52.281)	52.281	121.47
3625	35'-6	Spr(-52.336)	52.336	121.54
3627	35'-6	Spr(-52.396)	52.396	121.61
3629	35'-11	Spr(-52.590)	52.590	121.83
3631	35'-8½	Spr(-52.684)	52.684	121.94
3633	35'-6	Spr(-52.868)	52.868	122.15
2	1'-9	T(65'-4½)	58.588	
3	1'-9	P1, Pump Inlet	58.210	
4	1'-9	P2(-60.886)	123.114	
5	1'-9		123.114	
6	6'-8½		119.089	
7	-8'-0	T(59'-4½)	123.906	
8	-8'-0	T(59'-4½)	122.219	
9	-8'-0	T(47'-3½)	121.623	
10	-8'-0	T(59'-4½)	118.260	
11	-8'-0	T(47'-3½)	117.485	
12	-8'-0	T(59'-4½)	117.308	
13	-8'-0	T(47'-3½)	119.432	
14	-8'-0	T(59'-4½)	119.812	
15	-8'-0	T(47'-3½)	121.565	
16	-8'-0	T(59'-4½)	121.858	
17	-8'-0	T(59'-4½)	122.543	
52	1'-0	Hyd	1.000	
55	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
224	1'-0		121.444	
300	40'-6½	PO(18'-8½)	83.018	
301	36'-11	T(8'-11½), Tr(2'-7)	53.838	
302	40'-4	PO(18'-8½)	83.137	
303	41'-5½	PO(11'-3½)	59.241	
304	40'-1½	PO(18'-8½)	83.333	
305	41'-5½	PO(11'-3½)	59.307	
306	39'-11	PO(18'-8½)	83.645	
307	41'-5½	PO(11'-3½)	59.932	
308	39'-8½	PO(18'-8½)	83.988	
309	-8'-0	E(35'-1)	70.968	
310	39'-6	PO(18'-8½)	84.361	
311	36'-11	T(8'-11½), Tr(2'-7)	53.897	
312	39'-3½	PO(18'-8½)	84.765	
313	36'-8½	T(8'-11½), Tr(2'-7)	53.936	
314	39'-1	PO(18'-8½)	85.202	
315	41'-3	PO(11'-3½)	59.351	
316	38'-10½	PO(18'-8½)	85.674	
317	41'-3	PO(11'-3½)	59.417	
318	38'-8	PO(18'-8½)	86.183	
319	41'-3	PO(11'-3½)	60.042	
320	38'-5½	PO(18'-8½)	86.733	
321	36'-11	T(8'-11½), Tr(2'-7)	53.954	
322	38'-4	T(37'-8½)	89.012	
323	41'-5½	PO(11'-3½)	59.372	
324	1'-8½	PO(41'-1½)	111.696	
325	36'-8½	T(8'-11½), Tr(2'-7)	53.994	
326	40'-7½	PO(18'-8½)	78.320	
327	36'-8½	T(8'-11½), Tr(2'-7)	54.053	



Node Analysis

Job Number: 212189000
Report Description: Cooler Remote Area

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
328	40'-5	PO(18'-8½)	78.497	
329	41'-3	PO(11'-3½)	59.483	
330	40'-2½	PO(18'-8½)	78.902	
331	36'-6	T(8'-11½), Tr(2'-7)	54.131	
332	40'-0	PO(18'-8½)	79.660	
333	41'-0½	PO(11'-3½)	59.571	
334	39'-9½	PO(18'-8½)	80.290	
335	41'-0½	PO(11'-3½)	59.635	
336	39'-7	PO(18'-8½)	80.809	
337	41'-0½	PO(11'-3½)	60.258	
338	39'-4½	PO(18'-8½)	81.231	
339	36'-6	T(8'-11½), Tr(2'-7)	54.188	
340	39'-2	PO(18'-8½)	81.567	
341	36'-6	T(8'-11½), Tr(2'-7)	54.250	
342	38'-11½	PO(18'-8½)	81.829	
343	41'-0½	PO(11'-3½)	59.705	
344	38'-9	PO(18'-8½)	82.026	
345	36'-11	T(8'-11½), Tr(2'-7)	54.452	
346	38'-6½	PO(18'-8½)	82.172	
347	36'-8½	T(8'-11½), Tr(2'-7)	54.549	
348	38'-4	PO(18'-8½)	82.281	
349	36'-6	T(8'-11½), Tr(2'-7)	54.741	
350	38'-3	PO(18'-8½)	89.033	
428	1'-0		111.998	



Hydraulic Analysis

Job Number: 212189000
Report Description: Cooler Remote Area

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
DR	1.6100	121.15	19.09	100		0.633901	1'-0	Pf 2.271
3611	35'-11	121.15	16.8	52.000		Sprinkler,	2'-7	Pe -0.434
301	36'-11			53.838		Tr(2'-7)	3'-7	Pv
DR	1.7280	121.15	16.57	120		0.320583	4'-6½	Pf 7.378
301	36'-11			53.838			18'-5½	Pe -1.975
303	41'-5½			59.241		E(3'-7), cplg(3'-7), PO(11'-3½)	23'-0	Pv
BL	2.7050	51.22	2.86	120		0.007352	9'-0	Pf 0.066
303	41'-5½			59.241			9'-0	Pe
305	41'-5½			59.307			9'-0	Pv
BL	2.7050	172.43	9.63	120		0.069459	9'-0	Pf 0.625
305	41'-5½	121.21		59.307		Flow (q) from Route 2	9'-0	Pe
307	41'-5½			59.932			9'-0	Pv
BL	2.7050	294.26	16.43	120		0.186705	84'-1	Pf 22.688
307	41'-5½	121.83		59.932		Flow (q) from Route 10	37'-5	Pe 0.397
300	40'-6½			83.018		2PO(18'-8½)	121'-6	Pv
CM	6.3570	294.26	2.97	120		0.002911	10'-0	Pf 0.029
300	40'-6½			83.018			10'-0	Pe 0.090
302	40'-4			83.137			10'-0	Pv
CM	6.3570	588.59	5.95	120		0.010495	10'-0	Pf 0.105
302	40'-4	294.33		83.137		Flow (q) from Route 3	10'-0	Pe 0.090
304	40'-1½			83.333			10'-0	Pv
CM	6.3570	882.78	8.92	120		0.022215	10'-0	Pf 0.222
304	40'-1½	294.19		83.333		Flow (q) from Route 7	10'-0	Pe 0.090
306	39'-11			83.645			10'-0	Pv
CM	6.3570	945.38	9.56	120		0.025217	10'-0	Pf 0.252
306	39'-11	62.60		83.645		Flow (q) from Route 4	10'-0	Pe 0.090
308	39'-8½			83.988			10'-0	Pv
CM	6.3570	1005.47	10.16	120		0.028262	10'-0	Pf 0.283
308	39'-8½	60.09		83.988		Flow (q) from Route 16	10'-0	Pe 0.090
310	39'-6			84.361			10'-0	Pv
CM	6.3570	1064.26	10.76	120		0.031394	10'-0	Pf 0.314
310	39'-6	58.79		84.361		Flow (q) from Route 17	10'-0	Pe 0.090
312	39'-3½			84.765			10'-0	Pv
CM	6.3570	1122.89	11.35	120		0.034669	10'-0	Pf 0.347
312	39'-3½	58.63		84.765		Flow (q) from Route 18	10'-0	Pe 0.090
314	39'-1			85.202			10'-0	Pv
CM	6.3570	1182.42	11.95	120		0.038146	10'-0	Pf 0.382
314	39'-1	59.54		85.202		Flow (q) from Route 19	10'-0	Pe 0.090
316	38'-10½			85.674			10'-0	Pv
CM	6.3570	1243.81	12.57	120		0.041890	10'-0	Pf 0.419
316	38'-10½	61.39		85.674		Flow (q) from Route 20	10'-0	Pe 0.090
318	38'-8			86.183			10'-0	Pv
CM	6.3570	1307.87	13.22	120		0.045968	10'-0	Pf 0.460
318	38'-8	64.06		86.183		Flow (q) from Route 21	10'-0	Pe 0.090
320	38'-5½			86.733			10'-0	Pv
CM	6.3570	1375.25	13.90	120		0.050445	6'-4	Pf 2.221
320	38'-5½	67.38		86.733		Flow (q) from Route 22	37'-8½	Pe 0.057
322	38'-4			89.012		T(37'-8½)	44'-0½	Pv
CM	6.3570	1458.14	14.74	120		0.056214	50'-6½	Pf 6.800
322	38'-4	82.89		89.012		Flow (q) from Route 23	70'-5	Pe 15.884
324	1'-8½			111.696		E(17'-7), 2f(-0.000), CV(40'-3), BV(12'-7)	120'-11½	Pv
DY	8.2490	1458.14	8.75	120		0.015806	0'-0	Pf 0.000
324	1'-8½			111.696			0'-0	Pe 0.303
428	1'-0			111.998			0'-0	Pv
UG	8.3900	1458.14	8.46	140		0.010942	38'-9½	Pf 1.408
428	1'-0			111.998			89'-11	Pe 3.902
12	-8'-0			117.308		E(30'-6½), T(59'-4½)	128'-8½	Pv
UG	8.3900	709.52	4.12	140		0.002886	61'-1½	Pf 0.176
12	-8'-0			117.308			61'-1½	Pe
11	-8'-0			117.485			61'-1½	Pv
UG	8.3900	959.52	5.57	140		0.005045	153'-8	Pf 0.775
11	-8'-0	250.00		117.485		Flow (q) from Route 13	153'-8	Pe
10	-8'-0			118.260			153'-8	Pv
UG	8.3900	959.52	5.57	140		0.005045	635'-11½	Pf 3.363
10	-8'-0			118.260			30'-6½	Pe
9	-8'-0			121.623		E(30'-6½)	666'-6	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Cooler Remote Area

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
UG	8.3900	959.52	5.57	140		0.005045	118'-2"	Pf 0.596
9	-8'-0"			121.623				Pe
8	-8'-0"			122.219			118'-2"	Pv
UG	8.3900	959.52	5.57	140		0.005045	275'-0"	Pf 1.687
8	-8'-0"			122.219			59'-4½"	Pe
7	-8'-0"			123.906		T(59'-4½")	334'-4½"	Pv
UG	8.3900	1708.14	9.91	140		0.014664	67'-8"	Pf 1.440
7	-8'-0"	748.63		123.906		Flow (q) from Route 14	30'-6½"	Pe -3.902
224	1'-0"			121.444		E(30'-6½")	98'-2½"	Pv
FR	8.2490	1708.14	10.25	120		0.021181	5'-8½"	Pf 0.121
224	1'-0"			121.444				Pe -2.476
6	6'-8½"			119.089			5'-8½"	Pv
DY	10.3700	1708.14	6.49	120		0.006950	13'-10½"	Pf 1.874
6	6'-8½"			119.089			255'-9"	Pe 2.151
5	1'-9"			123.114		4E(26'-0"), T(48'-5½"), BV(21'-3½"), Tr(17'-0"), CV(65'-0")	269'-8"	Pv
DY	7.9810	1708.14	10.95	120		0.024877	0'-0"	Pf 0.000
5	1'-9"			123.114				Pe 0.000
4	1'-9"			123.114			0'-0"	Pv
Pump		Velocity						
4		1708.14		123.114		Rating: 60.000 @ 2000.00		
3		Q=1708.14	6.45	58.210		Fire Pump Churn Pressure: 84.000		
DY	10.4000	1708.14	6.45	140		0.005153	0'-0"	Pf 0.378
3	1'-9"			58.210			73'-4"	Pe 0.000
2	1'-9"			58.588		GV(7'-11½"), T(65'-4½")	73'-4"	Pv
UG	10.4000	1708.14	6.45	140		0.005153	696'-3½"	Pf 8.153
2	1'-9"			58.588			175'-4½"	Pe 4.227
309	-8'-0"			70.968		4E(35'-1), 2EE(17'-6½"), BFP(-3.948)	871'-8"	Pv
UG	12.4600	1708.14	4.49	140		0.002137	360'-2½"	Pf 0.770
309	-8'-0"			70.968				Pe 1.517
1	-11'-6"			73.255		Water Supply	360'-2½"	Pv
		0.00				Hose Allowance At Source		
1		1708.14						
Route 2								
DR	1.6100	121.21	19.10	100		0.634538	1'-0"	Pf 2.274
3613	35'-11"	121.21	16.8	52.056		Sprinkler,	2'-7"	Pe -0.434
311	36'-11"			53.897		Tr(2'-7")	3'-7"	Pv
DR	1.7280	121.21	16.58	120		0.320905	4'-6½"	Pf 7.385
311	36'-11"			53.897			18'-5½"	Pe -1.975
305	41'-5½"			59.307		E(3'-7"), cplg(3'-7"), PO(11'-3½")	23'-0"	Pv
Route 3								
DR	1.6100	121.26	19.11	100		0.634962	1'-0"	Pf 2.275
3615	35'-8½"	121.26	16.8	52.094		Sprinkler,	2'-7"	Pe -0.434
313	36'-8½"			53.936		Tr(2'-7")	3'-7"	Pv
DR	1.7280	121.26	16.59	120		0.321119	4'-6½"	Pf 7.390
313	36'-8½"			53.936			18'-5½"	Pe -1.975
315	41'-3"			59.351		E(3'-7"), cplg(3'-7"), PO(11'-3½")	23'-0"	Pv
BL	2.7050	51.07	2.85	120		0.007313	9'-0"	Pf 0.066
315	41'-3"			59.351				Pe
317	41'-3"			59.417			9'-0"	Pv
BL	2.7050	172.39	9.62	120		0.069430	9'-0"	Pf 0.625
317	41'-3"	121.32		59.417		Flow (q) from Route 5		Pe
319	41'-3"			60.042			9'-0"	Pv
BL	2.7050	294.33	16.43	120		0.186786	84'-1"	Pf 22.698
319	41'-3"	121.94		60.042		Flow (q) from Route 11	37'-5"	Pe 0.397
302	40'-4"			83.137		2PO(18'-8½")	121'-6"	Pv
Route 4								
DR	1.6100	121.28	19.11	100		0.635160	1'-0"	Pf 2.276
3617	35'-11"	121.28	16.8	52.112		Sprinkler,	2'-7"	Pe -0.434
321	36'-11"			53.954		Tr(2'-7")	3'-7"	Pv
DR	1.7280	121.28	16.59	120		0.321220	4'-6½"	Pf 7.392
321	36'-11"			53.954			18'-5½"	Pe -1.975
323	41'-5½"			59.372		E(3'-7"), cplg(3'-7"), PO(11'-3½")	23'-0"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: Cooler Remote Area

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
BL	2.7050	191.21	10.67	120		0.084096	183'-7"	Pf 18.587
323	41'-5½"	69.93		59.372		Flow (q) from Route 26	37'-5"	Pe 0.361
326	40'-7½"			78.320		2PO(18'-8½")	221'-0"	Pv
CM	4.3100	191.21	4.20	120		0.008700	10'-0"	Pf 0.087
326	40'-7½"			78.320				Pe 0.090
328	40'-5"			78.497			10'-0"	Pv
CM	4.3100	382.78	8.42	120		0.031420	10'-0"	Pf 0.314
328	40'-5"	191.57		78.497		Flow (q) from Route 6		Pe 0.090
330	40'-2½"			78.902			10'-0"	Pv
CM	4.3100	575.36	12.65	120		0.066779	10'-0"	Pf 0.668
330	40'-2½"	192.58		78.902		Flow (q) from Route 9		Pe 0.090
332	40'-0"			79.660			10'-0"	Pv
RN	2.7050	62.60	3.49	120		0.010657	295'-8"	Pf 3.949
332	40'-0"			79.660		PO(18'-8½")	74'-10½"	Pe 0.036
306	39'-11"			83.645		3PO(18'-8½")	370'-6½"	Pv
Route 5								
DR	1.6100	121.32	19.12	100		0.635595	1'-0"	Pf 2.278
3619	35'-8½"	121.32	16.8	52.150		Sprinkler,	2'-7"	Pe -0.434
325	36'-8½"			53.994		Tr(2'-7")	3'-7"	Pv
DR	1.7280	121.32	16.60	120		0.321440	4'-6½"	Pf 7.398
325	36'-8½"			53.994			18'-5½"	Pe -1.975
317	41'-3"			59.417		E(3'-7), cplg(3'-7), PO(11'-3½")	23'-0"	Pv
Route 6								
DR	1.6100	121.39	19.13	100		0.636229	1'-0"	Pf 2.280
3621	35'-8½"	121.39	16.8	52.206		Sprinkler,	2'-7"	Pe -0.434
327	36'-8½"			54.053		Tr(2'-7")	3'-7"	Pv
DR	1.7280	121.39	16.61	120		0.321760	4'-6½"	Pf 7.405
327	36'-8½"			54.053			18'-5½"	Pe -1.975
329	41'-3"			59.483		E(3'-7), cplg(3'-7), PO(11'-3½")	23'-0"	Pv
BL	2.7050	191.57	10.70	120		0.084396	183'-7"	Pf 18.653
329	41'-3"	70.19		59.483		Flow (q) from Route 25	37'-5"	Pe 0.361
328	40'-5"			78.497		2PO(18'-8½")	221'-0"	Pv
Route 7								
DR	1.6100	121.47	19.14	100		0.637073	1'-0"	Pf 2.283
3623	35'-6"	121.47	16.8	52.281		Sprinkler,	2'-7"	Pe -0.434
331	36'-6"			54.131		Tr(2'-7")	3'-7"	Pv
DR	1.7280	121.47	16.62	120		0.322187	4'-6½"	Pf 7.415
331	36'-6"			54.131			18'-5½"	Pe -1.975
333	41'-0½"			59.571		E(3'-7), cplg(3'-7), PO(11'-3½")	23'-0"	Pv
BL	2.7050	50.50	2.82	120		0.007162	9'-0"	Pf 0.064
333	41'-0½"			59.571			9'-0"	Pe
335	41'-0½"			59.635				Pv
BL	2.7050	172.03	9.60	120		0.069165	9'-0"	Pf 0.622
335	41'-0½"	121.54		59.635		Flow (q) from Route 8		Pe
337	41'-0½"			60.258			9'-0"	Pv
BL	2.7050	294.19	16.42	120		0.186618	84'-1"	Pf 22.678
337	41'-0½"	122.15		60.258		Flow (q) from Route 12	37'-5"	Pe 0.397
304	40'-1½"			83.333		2PO(18'-8½")	121'-6"	Pv
Route 8								
DR	1.6100	121.54	19.15	100		0.637694	1'-0"	Pf 2.285
3625	35'-6"	121.54	16.8	52.336		Sprinkler,	2'-7"	Pe -0.434
339	36'-6"			54.188		Tr(2'-7")	3'-7"	Pv
DR	1.7280	121.54	16.63	120		0.322501	4'-6½"	Pf 7.422
339	36'-6"			54.188			18'-5½"	Pe -1.975
335	41'-0½"			59.635		E(3'-7), cplg(3'-7), PO(11'-3½")	23'-0"	Pv
Route 9								
DR	1.6100	121.61	19.16	100		0.638367	1'-0"	Pf 2.287
3627	35'-6"	121.61	16.8	52.396		Sprinkler,	2'-7"	Pe -0.434
341	36'-6"			54.250		Tr(2'-7")	3'-7"	Pv
DR	1.7280	121.61	16.64	120		0.322841	4'-6½"	Pf 7.430
341	36'-6"			54.250			18'-5½"	Pe -1.975
343	41'-0½"			59.705		E(3'-7), cplg(3'-7), PO(11'-3½")	23'-0"	Pv
BL	2.7050	192.58	10.75	120		0.085221	183'-7"	Pf 18.835
343	41'-0½"	70.98		59.705		Flow (q) from Route 24	37'-5"	Pe 0.361
330	40'-2½"			78.902		2PO(18'-8½")	221'-0"	Pv
Route 10								



Hydraulic Analysis

Job Number: 212189000
Report Description: Cooler Remote Area

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
DR	1.6100	121.83	19.20	100		0.640552	1'-0	Pf 2.295
3629	35'-11	121.83	16.8	52.590		Sprinkler,	2'-7	Pe -0.434
345	36'-11			54.452		Tr(2'-7)	3'-7	Pv
DR	1.7280	121.83	16.67	120		0.323946	4'-6½	Pf 7.455
345	36'-11			54.452			18'-5½	Pe -1.975
307	41'-5½			59.932		E(3'-7), cplg(3'-7), PO(11'-3½)	23'-0	Pv
Route 11								
DR	1.6100	121.94	19.22	100		0.641606	1'-0	Pf 2.299
3631	35'-8½	121.94	16.8	52.684		Sprinkler,	2'-7	Pe -0.434
347	36'-8½			54.549		Tr(2'-7)	3'-7	Pv
DR	1.7280	121.94	16.68	120		0.324479	4'-6½	Pf 7.467
347	36'-8½			54.549			18'-5½	Pe -1.975
319	41'-3			60.042		E(3'-7), cplg(3'-7), PO(11'-3½)	23'-0	Pv
Route 12								
DR	1.6100	122.15	19.25	100		0.643680	1'-0	Pf 2.307
3633	35'-6	122.15	16.8	52.868		Sprinkler,	2'-7	Pe -0.434
349	36'-6			54.741		Tr(2'-7)	3'-7	Pv
DR	1.7280	122.15	16.71	120		0.325528	4'-6½	Pf 7.492
349	36'-6			54.741			18'-5½	Pe -1.975
337	41'-0½			60.258		E(3'-7), cplg(3'-7), PO(11'-3½)	23'-0	Pv
Route 13								
UG	6.2800	250.00	2.59	140		0.001718	19'-10	Pf 0.161
54	1'-0	250.00		113.422		Hydrant,	74'-1	Pe 3.902
11	-8'-0			117.485		E(22'-1), GV(4'-8½), T(47'-3½)	93'-10½	Pv
Route 14								
UG	8.3900	748.63	4.34	140		0.003188	119'-3	Pf 0.380
13	-8'-0	748.63		119.432		Flow (q) from Route 15		Pe
14	-8'-0			119.812			119'-3	Pv
UG	8.3900	748.63	4.34	140		0.003188	519'-3½	Pf 1.753
14	-8'-0			119.812			30'-6½	Pe
15	-8'-0			121.565		E(30'-6½)	549'-10	Pv
UG	8.3900	748.63	4.34	140		0.003188	91'-11½	Pf 0.293
15	-8'-0			121.565				Pe
16	-8'-0			121.858			91'-11½	Pv
UG	8.3900	748.63	4.34	140		0.003188	214'-9	Pf 0.685
16	-8'-0			121.858				Pe
17	-8'-0			122.543			214'-9	Pv
UG	8.3900	748.63	4.34	140		0.003188	337'-8	Pf 1.363
17	-8'-0			122.543			89'-11	Pe
7	-8'-0			123.906		E(30'-6½), T(59'-4½)	427'-7	Pv
Route 15								
UG	8.3900	748.63	4.34	140		0.003188	635'-9	Pf 2.124
12	-8'-0	709.52		117.308		Flow (q) from Route 1	30'-6½	Pe
13	-8'-0			119.432		E(30'-6½)	666'-3½	Pv
Route 16								
CM	4.3100	512.77	11.28	120		0.053963	10'-0	Pf 0.540
332	40'-0	62.60		79.660		Flow (q) from Route 4		Pe 0.090
334	39'-9½			80.290			10'-0	Pv
RN	2.7050	60.09	3.35	120		0.009881	295'-8	Pf 3.661
334	39'-9½			80.290		PO(18'-8½)	74'-10½	Pe 0.036
308	39'-8½			83.988		3PO(18'-8½)	370'-6½	Pv
Route 17								
CM	4.3100	452.67	9.95	120		0.042850	10'-0	Pf 0.429
334	39'-9½	60.09		80.290		Flow (q) from Route 16		Pe 0.090
336	39'-7			80.809			10'-0	Pv
RN	2.7050	58.79	3.28	120		0.009487	295'-8	Pf 3.515
336	39'-7			80.809		PO(18'-8½)	74'-10½	Pe 0.036
310	39'-6			84.361		3PO(18'-8½)	370'-6½	Pv
Route 18								
CM	4.3100	393.89	8.66	120		0.033127	10'-0	Pf 0.331
336	39'-7	58.79		80.809		Flow (q) from Route 17		Pe 0.090
338	39'-4½			81.231			10'-0	Pv
RN	2.7050	58.63	3.27	120		0.009441	295'-8	Pf 3.498
338	39'-4½			81.231		PO(18'-8½)	74'-10½	Pe 0.036
312	39'-3½			84.765		3PO(18'-8½)	370'-6½	Pv
Route 19								



Hydraulic Analysis

Job Number: 212189000
Report Description: Cooler Remote Area

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
CM	4.3100	335.26	7.37	120		0.024587	10'-0	Pf 0.246
338	39'-4½	58.63		81.231		Flow (q) from Route 18		Pe 0.090
340	39'-2			81.567			10'-0	Pv
RN	2.7050	59.54	3.32	120		0.009713	295'-8	Pf 3.599
340	39'-2			81.567		PO(18'-8½)	74'-10½	Pe 0.036
314	39'-1			85.202		3PO(18'-8½)	370'-6½	Pv
Route 20								
CM	4.3100	275.72	6.06	120		0.017125	10'-0	Pf 0.171
340	39'-2	59.54		81.567		Flow (q) from Route 19		Pe 0.090
342	38'-11½			81.829			10'-0	Pv
RN	2.7050	61.39	3.43	120		0.010280	295'-8	Pf 3.809
342	38'-11½			81.829		PO(18'-8½)	74'-10½	Pe 0.036
316	38'-10½			85.674		3PO(18'-8½)	370'-6½	Pv
Route 21								
CM	4.3100	214.33	4.71	120		0.010746	10'-0	Pf 0.107
342	38'-11½	61.39		81.829		Flow (q) from Route 20		Pe 0.090
344	38'-9			82.026			10'-0	Pv
RN	2.7050	64.06	3.58	120		0.011121	295'-8	Pf 4.121
344	38'-9			82.026		PO(18'-8½)	74'-10½	Pe 0.036
318	38'-8			86.183		3PO(18'-8½)	370'-6½	Pv
Route 22								
CM	4.3100	150.27	3.30	120		0.005572	10'-0	Pf 0.056
344	38'-9	64.06		82.026		Flow (q) from Route 21		Pe 0.090
346	38'-6½			82.172			10'-0	Pv
RN	2.7050	67.38	3.76	120		0.012211	295'-8	Pf 4.525
346	38'-6½			82.172		PO(18'-8½)	74'-10½	Pe 0.036
320	38'-5½			86.733		3PO(18'-8½)	370'-6½	Pv
Route 23								
CM	4.3100	82.89	1.82	120		0.001854	10'-0	Pf 0.019
346	38'-6½	67.38		82.172		Flow (q) from Route 22		Pe 0.090
348	38'-4			82.281			10'-0	Pv
RN	2.7050	82.89	4.63	120		0.017917	295'-8	Pf 6.716
348	38'-4			82.281		PO(18'-8½)	79'-2	Pe 0.036
350	38'-3			89.033		3PO(18'-8½), Tr(4'-3½)	374'-10	Pv
CM	6.3570	82.89	0.84	120		0.000279	3'-8½	Pf 0.012
350	38'-3			89.033			37'-8½	Pe -0.033
322	38'-4			89.012		T(37'-8½)	41'-5	Pv
Route 24								
BL	2.7050	70.98	3.96	120		0.013445	10'-0	Pf 0.134
333	41'-0½	50.50		59.571		Flow (q) from Route 7		Pe
343	41'-0½			59.705			10'-0	Pv
Route 25								
BL	2.7050	70.19	3.92	120		0.013170	10'-0	Pf 0.132
315	41'-3	51.07		59.351		Flow (q) from Route 3		Pe
329	41'-3			59.483			10'-0	Pv
Route 26								
BL	2.7050	69.93	3.90	120		0.013080	10'-0	Pf 0.131
303	41'-5½	51.22		59.241		Flow (q) from Route 1		Pe
323	41'-5½			59.372			10'-0	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

C Value Multiplier

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$$

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51



Hydraulic Analysis

Job Number: 212189000
Report Description: Cooler Remote Area

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss		Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend	Units Legend		Fittings Legend	
AO Arm-Over	Diameter	Inch	ALV Alarm Valve	
BL Branch Line	Elevation	Foot	AngV Angle Valve	
CM Cross Main	Flow	gpm	b Bushing	
DN Drain	Discharge	gpm	BaIV Ball Valve	
DR Drop	Velocity	fps	BFP Backflow Preventer	
DY Dynamic	Pressure	psi	BV Butterfly Valve	
FM Feed Main	Length	Foot	C Cross Flow Turn 90°	
FR Feed Riser	Friction Loss	psi/Foot	cplg Coupling	
MS Miscellaneous	HWC	Hazen-Williams Constant	Cr Cross Run	
OR Outrigger	Pt	Total pressure at a point in a pipe	CV Check Valve	
RN Riser Nipple	Pn	Normal pressure at a point in a pipe	DeIV Deluge Valve	
SP Sprig	Pf	Pressure loss due to friction between points	DPV Dry Pipe Valve	
ST Stand Pipe	Pe	Pressure due to elevation difference between indicated points	E 90° Elbow	
UG Underground	Pv	Velocity pressure at a point in a pipe	EE 45° Elbow	
			Ee1 11¼° Elbow	
			Ee2 22½° Elbow	
			f Flow Device	
			fd Flex Drop	
			FDC Fire Department Connection	
			fE 90° FireLock(TM) Elbow	
			fEE 45° FireLock(TM) Elbow	
			flg Flange	
			FN Floating Node	
			fT FireLock(TM) Tee	
			g Gauge	
			GloV Globe Valve	
			GV Gate Valve	
			Ho Hose	
			Hose Hose	
			HV Hose Valve	
			Hyd Hydrant	
			LtE Long Turn Elbow	
			mecT Mechanical Tee	
			Noz Nozzle	
			P1 Pump In	
			P2 Pump Out	
			PIV Post Indicating Valve	
			PO Pipe Outlet	
			PrV Pressure Relief Valve	
			PRV Pressure Reducing Valve	
			red Reducer/Adapter	
			S Supply	
			sCV Swing Check Valve	
			SFx Seismic Flex	
			Spr Sprinkler	
			St Strainer	
			T Tee Flow Turn 90°	
			Tr Tee Run	
			U Union	
			WirF Wirsbo	
			WMV Water Meter Valve	
			Z Cap	



Flow Diagram (Current View)

Job Number: 212189000
Report Description: Cooler Remote Area

