

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

1100 NW Main St
Lee's Summit, MO 64086

FEM Job # 212189000
Date: 02/22/2023

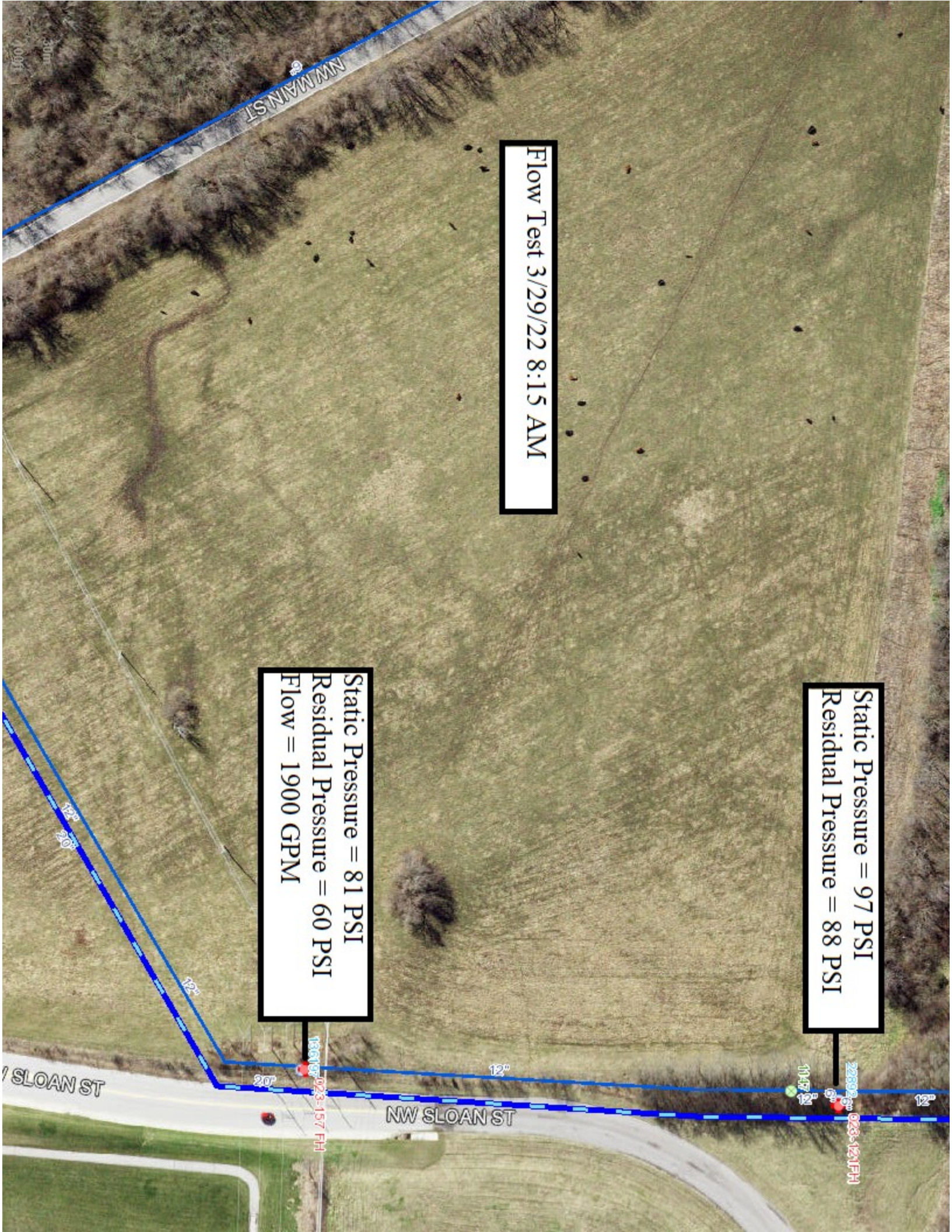
Jay Colbert



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



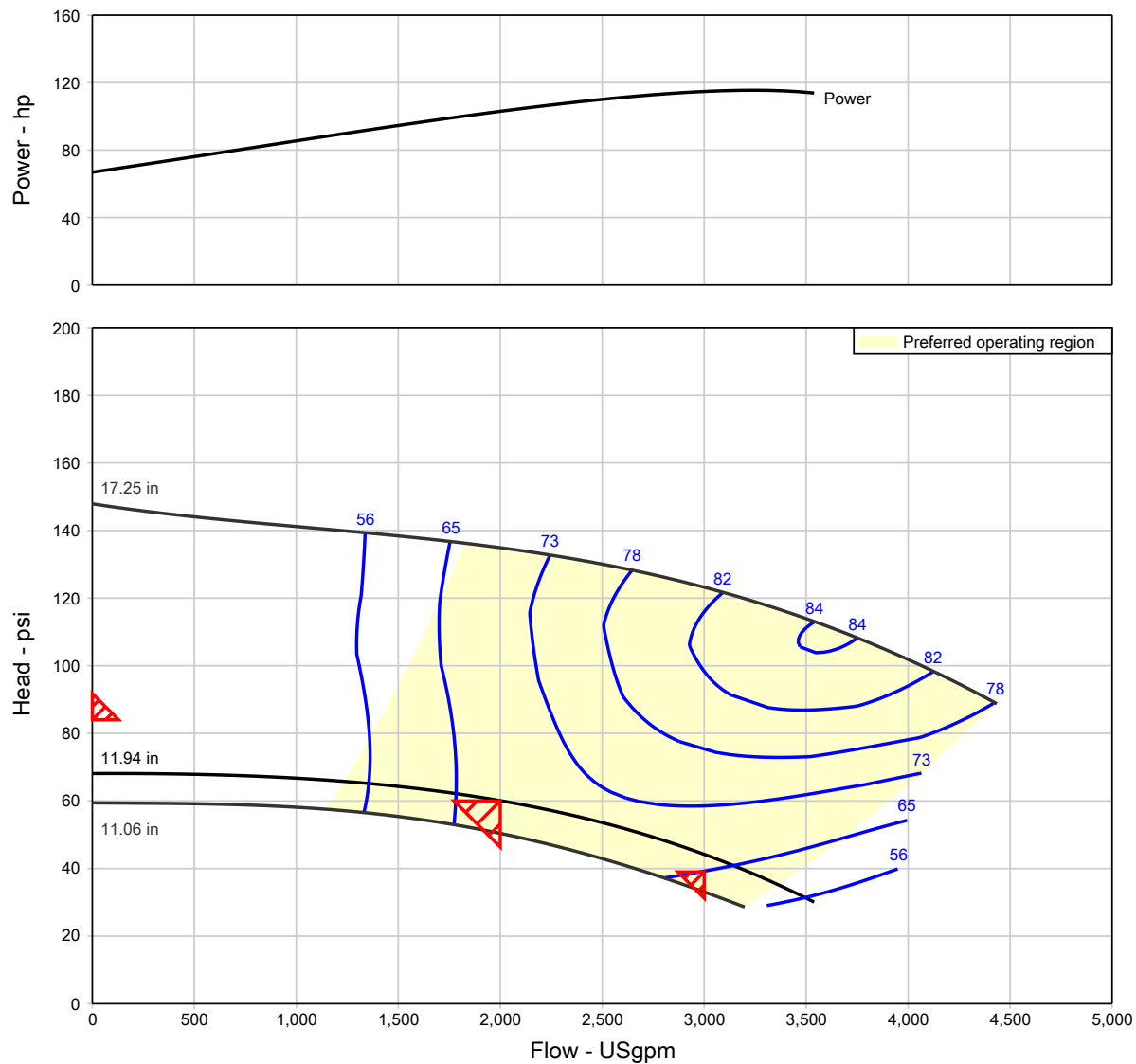


PENTAIR

Customer : FE Moran
Project name : Lees Summit

Pump Performance Curve

Encompass 2.0 - 22.0.0



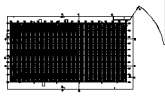
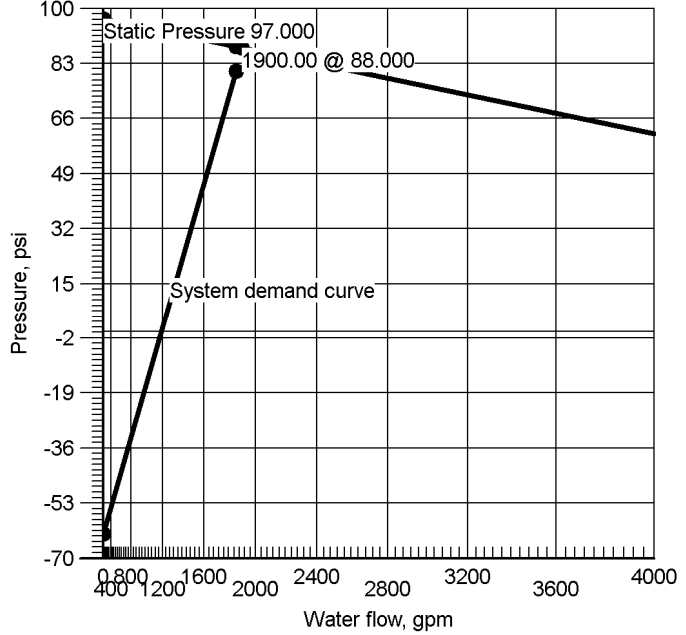
Item number	: 001	Size	: 8-481-17B
Service	:	Stages	: 1
Quantity	: 1	Driver type	: Motor
Quote number	: 220317TJ01	Frequency	: 60 Hz
Date last saved	: April 01, 2022 8:14 AM	Speed, rated	: 1770 rpm
Flow, rated	: 2,000.0 USgpm	Based on curve number	: 184-8X10X17B-1770
Differential head / pressure, rated	: 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: FP Overhead System 01A

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 28 K-Factor 177.09 at 40.000					Hose Streams 250.00				
Coverage Per Sprinkler 100 ft²					Number Of Sprinklers Calculated 9			0	
System Pressure Demand 80.705					System Flow Demand 1855.95				
Total Demand 1855.95 @ 80.705					Pressure Result +7.678 (8.7%)				
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 (461)	0.000	0	0.00
5	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)				
									



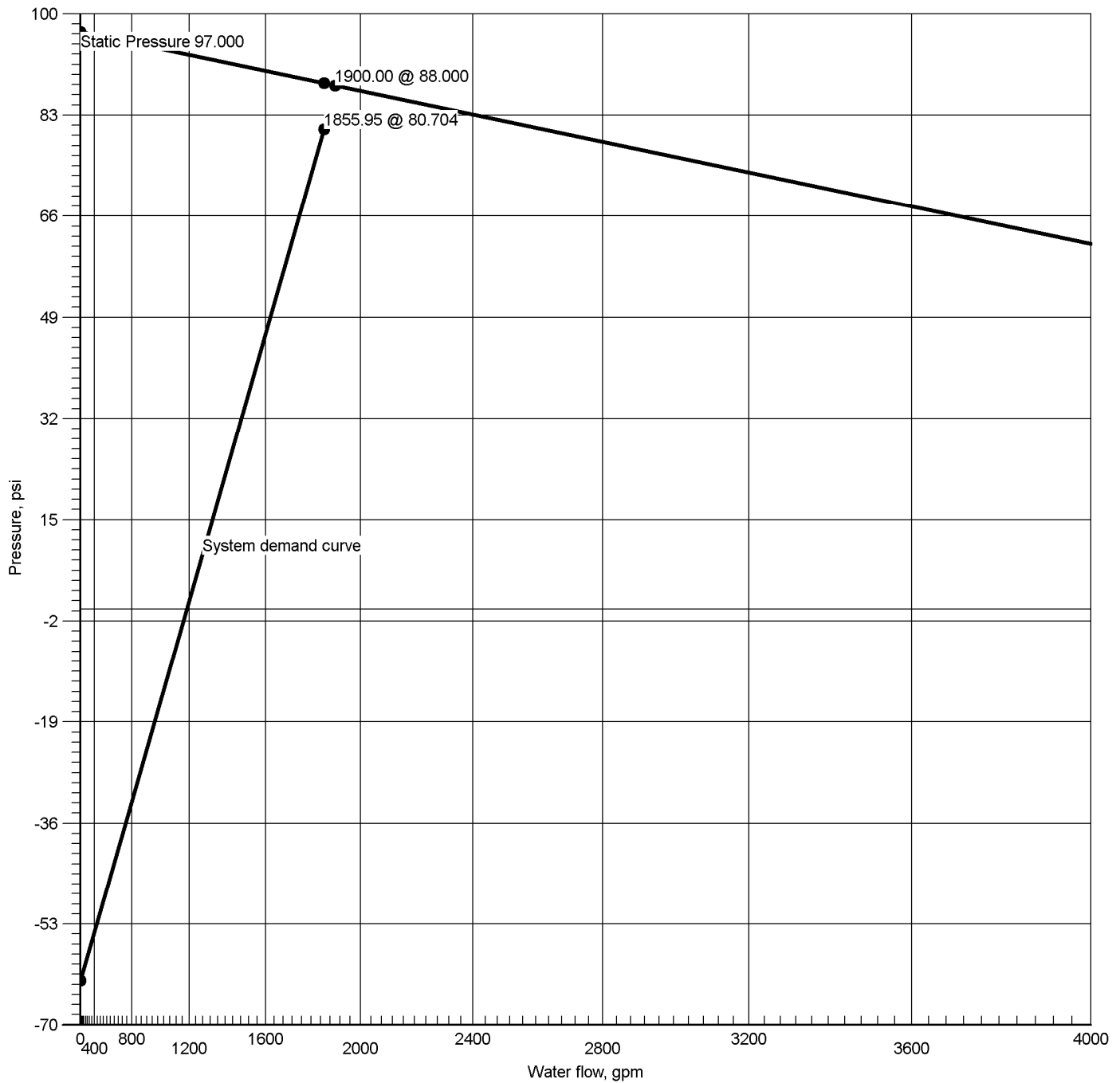
Hydraulic Summary

Job Number: 212189000
Report Description: FP Overhead System 01A

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 28 K-Factor 177.09 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 9				
				Number Of Nozzles Calculated 0			Coverage Per Sprinkler 100 ft²				
				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 80.660 Right: 80.672							
Total Hose Streams 250.00											
System Flow Demand 1855.95		Total Water Required (Including Hose Allowance) 1855.95									
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 24.08 between nodes 110 and 108											
Maximum Velocity Under Ground 12.85 between nodes 8 and 9											
Volume capacity of Wet Pipes 32135.48 gal		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	88.382		1855.95	80.704	7.678
5	Pump		84.000	60.000		2000.00	134.562		1855.95	126.884	7.678
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

88.382 @ 1855.95

Required Pressure at System Demand

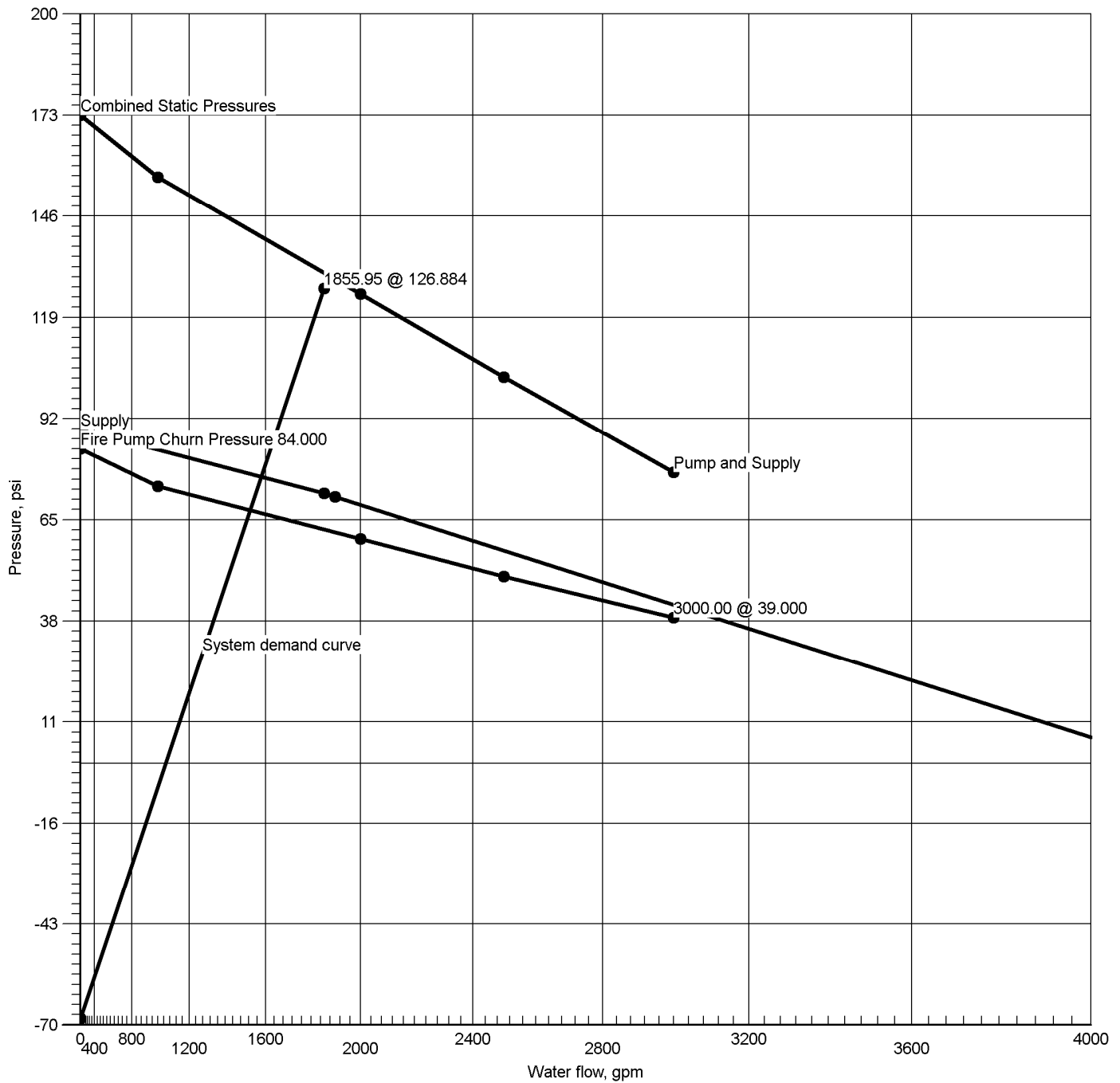
80.704 @ 1855.95

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

80.704 @ 1855.95



Pump at Node 5



Hydraulic Graph
Pump at Node 5

Static + Churn Pressure
173.256
Fire Pump Churn Pressure
84.000

Fire Pump Rating
60.000 @ 2000.00

Static Pressure
173.256

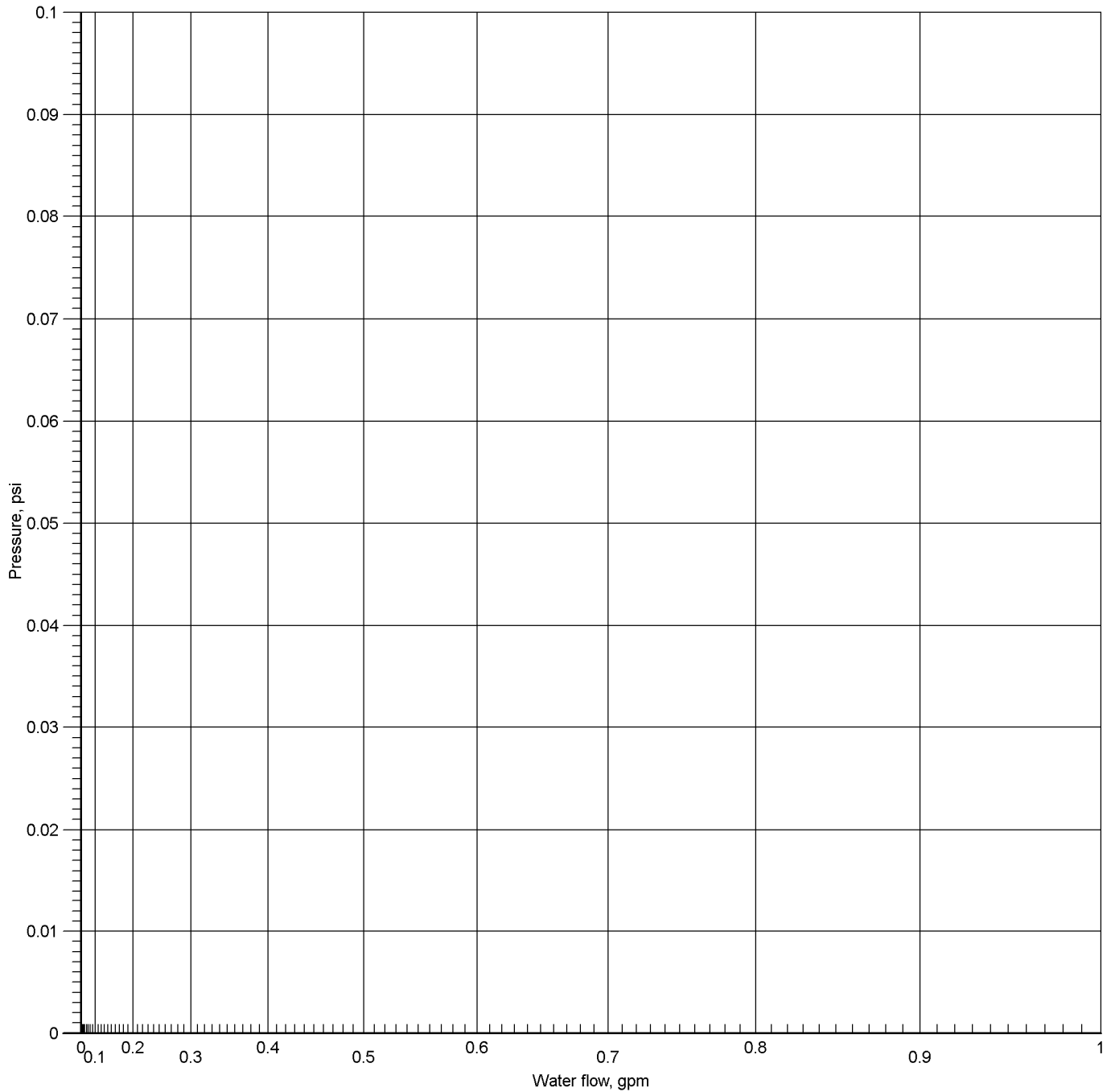
Residual Pressure
62.502 @ 1855.95

Available Pressure at System Demand
134.562 @ 1855.95

Required Pressure at System Demand
126.884 @ 1855.95



Pump Inlet at Node 461



Hydraulic Graph

Pump Inlet at Node 461

Static: Pressure

0.000

Residual: Pressure

N/A

Available Pressure at System Demand

N/A

Required Pressure at System Demand

0.000 @ 0.00

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

N/A



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: FP Overhead System 01A

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Hydrant	54	250.00	250.00	250	113.375			
Sprinkler	1111	177.51	177.09	28	40.193			
Sprinkler	1113	180.07	177.09	28	41.357			
⇒ Sprinkler	1115	177.09	177.09	28	40.000			
Sprinkler	1117	177.47	177.09	28	40.172			
Sprinkler	1119	177.88	177.09	28	40.358			
Sprinkler	1121	178.30	177.09	28	40.552			
Sprinkler	1123	178.26	177.09	28	40.531			
Sprinkler	1125	179.54	177.09	28	41.114			
Sprinkler	1127	179.84	177.09	28	41.251			

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: FP Overhead System 01A

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	80.704	1855.95
54	1'-0	Hyd(-1.000)	113.375	250.00
1111	37'-10	Spr(-40.193)	40.193	177.51
1113	37'-10	Spr(-41.357)	41.357	180.07
1115	37'-10	Spr(-40.000)	40.000	177.09
1117	37'-10	Spr(-40.172)	40.172	177.47
1119	37'-10	Spr(-40.358)	40.358	177.88
1121	37'-10	Spr(-40.552)	40.552	178.30
1123	37'-10	Spr(-40.531)	40.531	178.26
1125	37'-10	Spr(-41.114)	41.114	179.54
1127	37'-10	Spr(-41.251)	41.251	179.84
2	-8'-0	E(24'-7)	76.257	
4	1'-9	P1	64.382	
5	1'-9	P2(-62.502)	126.884	
6	1'-9		126.884	
7	6'-8½		122.548	
8	1'-0		124.883	
9	-8'-0	T(43'-10)	126.697	
10	-8'-0	T(43'-10)	123.907	
11	-8'-0	T(47'-3½)	122.874	
12	-8'-0	T(43'-10)	117.113	
13	-8'-0	T(47'-3½)	117.438	
14	-8'-0	T(43'-10)	117.708	
15	-8'-0	T(47'-3½)	120.623	
16	-8'-0	T(43'-10)	121.151	
17	-8'-0	T(47'-3½)	123.550	
18	-8'-0	T(43'-10)	123.957	
19	-8'-0	T(43'-10)	124.908	
51	1'-0	Hyd	1.000	
53	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
100	37'-0	PO(18'-8½)	71.408	
102	37'-0	PO(18'-8½)	72.028	
104	37'-0	PO(18'-8½)	73.320	
106	37'-0	PO(18'-8½)	74.876	
108	37'-0	PO(18'-8½)	76.730	
110	37'-0		77.718	
112	37'-2	PO(18'-8½)	77.835	
114	37'-5	PO(18'-8½)	78.104	
116	37'-8½	PO(18'-8½)	78.436	
118	38'-0	PO(18'-8½)	78.833	
120	38'-3	PO(18'-8½)	79.305	
122	1'-8½	PO(37'-8½)	110.241	
124	1'-0		111.348	
126	37'-10	T(18'-8½)	66.921	
128	37'-0	PO(18'-8½)	71.264	
130	37'-0	PO(18'-8½)	64.401	
132	37'-0	PO(18'-8½)	64.954	
134	37'-0	PO(18'-8½)	66.136	
136	37'-0	PO(18'-8½)	67.089	
138	37'-0	PO(18'-8½)	67.826	
140	37'-2	PO(18'-8½)	68.297	
142	37'-0	PO(18'-8½)	64.252	
144	38'-0	PO(18'-8½)	68.610	
146	38'-3	PO(18'-8½)	68.519	
148	37'-5	PO(18'-8½)	68.533	
150	37'-8½	PO(18'-8½)	68.625	
152	37'-0	PO(18'-8½)	71.236	



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 01A

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
BL	2.7050	91.24	5.09	120		0.021398	9'-0"	Pf 0.193
1115	37'-10"	177.09	28	40.000		Sprinkler		Pe
1111	37'-10"			40.193			9'-0"	Pv
BL	2.7050	268.76	15.00	120		0.157876	158'-0"	Pf 30.855
1111	37'-10"	177.51	28	40.193		Sprinkler,	37'-5"	Pe 0.361
100	37'-0"			71.408		2PO(18'-8½")	195'-5"	Pv
CM	4.3100	552.30	12.15	120		0.061911	10'-0"	Pf 0.619
100	37'-0"	283.54		71.408		Flow (q) from Route 6		Pe
102	37'-0"			72.028			10'-0"	Pv
CM	4.3100	822.28	18.08	120		0.129281	10'-0"	Pf 1.293
102	37'-0"	269.98		72.028		Flow (q) from Route 3		Pe -0.000
104	37'-0"			73.320			10'-0"	Pv
CM	4.3100	908.79	19.98	120		0.155564	10'-0"	Pf 1.556
104	37'-0"	86.52		73.320		Flow (q) from Route 15		Pe
106	37'-0"			74.876			10'-0"	Pv
CM	4.3100	999.16	21.97	120		0.185386	10'-0"	Pf 1.854
106	37'-0"	90.37		74.876		Flow (q) from Route 16		Pe
108	37'-0"			76.730			10'-0"	Pv
CM	4.3100	1095.13	24.08	120		0.219664	4'-6"	Pf 0.988
108	37'-0"	95.96		76.730		Flow (q) from Route 13		Pe
110	37'-0"			77.718			4'-6"	Pv
CM	6.3570	1095.13	11.07	120		0.033100	5'-6½"	Pf 0.183
110	37'-0"			77.718				Pe -0.066
112	37'-2"			77.835			5'-6½"	Pv
CM	6.3570	1195.97	12.09	120		0.038958	10'-0"	Pf 0.390
112	37'-2"	100.84		77.835		Flow (q) from Route 2		Pe -0.120
114	37'-5"			78.104			10'-0"	Pv
CM	6.3570	1296.37	13.10	120		0.045223	10'-0"	Pf 0.453
114	37'-5"	100.40		78.104		Flow (q) from Route 12		Pe -0.121
116	37'-8½"			78.436			10'-0"	Pv
CM	6.3570	1394.15	14.09	120		0.051736	10'-0"	Pf 0.517
116	37'-8½"	97.78		78.436		Flow (q) from Route 10		Pe -0.120
118	38'-0"			78.833			10'-0"	Pv
CM	6.3570	1498.85	15.15	120		0.059152	10'-0"	Pf 0.592
118	38'-0"	104.70		78.833		Flow (q) from Route 8		Pe -0.120
120	38'-3"			79.305			10'-0"	Pv
CM	6.3570	1605.95	16.23	120		0.067208	71'-0½"	Pf 15.083
120	38'-3"	107.10		79.305		Flow (q) from Route 9	153'-4½"	Pe 15.853
122	1'-8½"			110.241		5fE(12'-7"), 2f(-0.000), CV(40'-3"), BV(12'-7"), PO(37'-8½")	224'-5"	Pv
CM	8.2490	1605.95	9.64	120		0.018897	1'-6"	Pf 0.805
122	1'-8½"			110.241			41'-1½"	Pe 0.303
124	1'-0"			111.348		PO(41'-1½")	42'-7½"	Pv
UG	7.6800	1605.95	11.12	150		0.017712	38'-9½"	Pf 1.863
124	1'-0"			111.348			66'-4½"	Pe 3.902
12	-8'-0"			117.113		E(22'-6½"), T(43'-10")	105'-2"	Pv
UG	7.6800	1096.88	7.60	150		0.008749	635'-11½"	Pf 5.761
12	-8'-0"			117.113			22'-6½"	Pe
11	-8'-0"			122.874		E(22'-6½")	658'-6"	Pv
UG	7.6800	1096.88	7.60	150		0.008749	118'-2"	Pf 1.034
11	-8'-0"			122.874				Pe
10	-8'-0"			123.907			118'-2"	Pv
UG	7.6800	1096.88	7.60	150		0.008749	275'-0"	Pf 2.789
10	-8'-0"			123.907			43'-10"	Pe
9	-8'-0"			126.697		T(43'-10")	318'-9½"	Pv
UG	7.6800	1855.95	12.85	150		0.023148	67'-8"	Pf 2.088
9	-8'-0"	759.07		126.697		Flow (q) from Route 7	22'-6½"	Pe -3.902
8	1'-0"			124.883		E(22'-6½")	90'-2½"	Pv
FR	8.2490	1855.95	11.14	120		0.024696	5'-8½"	Pf 0.141
8	1'-0"			124.883				Pe -2.476
7	6'-8½"			122.548			5'-8½"	Pv
DY	10.3700	1855.95	7.05	120		0.008103	13'-10½"	Pf 2.185
7	6'-8½"			122.548			255'-9"	Pe 2.151
6	1'-9"			126.884		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: FP Overhead System 01A

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	1855.95	11.90	120		0.029006	0'-0	Pf 0.000
6	1'-9			126.884				Pe 0.000
5	1'-9			126.884			0'-0	Pv
Pump								
5		1855.95		126.884		Rating: 60.000 @ 2000.00		
4		Q=1855.95	8.54	64.382		Fire Pump Churn Pressure: 84.00		
						0		
UG	9.4200	1855.95	8.54	150		0.008562	305'-9½	Pf 7.648
4	1'-9			64.382			137'-6	Pe 4.227
2	-8'-0			76.257		GV(5'-7), T(45'-10), 3E(24'-7), EE(12'-3½), BFP(-3.852)	443'-3½	Pv
UG	11.2000	1855.95	6.04	150		0.003686	750'-9	Pf 2.930
2	-8'-0			76.257			44'-3	Pe 1.517
1	-11'-6			80.704		EE(14'-4½), E(29'-10½), S	795'-0	Pv
		0.00				Hose Allowance At Source		
1		1855.95						
Route 2								
BL	2.7050	85.84	4.79	120		0.019114	9'-0	Pf 0.172
1115	37'-10	177.09	28	40.000		Sprinkler		Pe
1117	37'-10			40.172			9'-0	Pv
BL	2.7050	263.31	14.70	120		0.152008	119'-7	Pf 23.868
1117	37'-10	177.47	28	40.172		Sprinkler,	37'-5	Pe 0.361
130	37'-0			64.401		2PO(18'-8½)	157'-0	Pv
CM	4.3100	519.21	11.42	120		0.055224	10'-0	Pf 0.552
130	37'-0	255.90		64.401		Flow (q) from Route 5		Pe
132	37'-0			64.954			10'-0	Pv
CM	4.3100	783.67	17.23	120		0.118276	10'-0	Pf 1.183
132	37'-0	264.46		64.954		Flow (q) from Route 4		Pe
134	37'-0			66.136			10'-0	Pv
CM	4.3100	697.15	15.33	120		0.095259	10'-0	Pf 0.953
134	37'-0			66.136				Pe
136	37'-0			67.089			10'-0	Pv
CM	4.3100	606.79	13.34	120		0.073682	10'-0	Pf 0.737
136	37'-0			67.089				Pe
138	37'-0			67.826			10'-0	Pv
CM	4.3100	510.82	11.23	120		0.053585	10'-0½	Pf 0.537
138	37'-0			67.826				Pe -0.067
140	37'-2			68.297			10'-0½	Pv
RN	2.7050	100.84	5.63	120		0.025747	295'-7	Pf 9.538
140	37'-2			68.297		PO(18'-8½)	74'-10½	Pe 0.000
112	37'-2			77.835		3PO(18'-8½)	370'-5½	Pv
Route 3								
BL	2.7050	91.67	5.12	120		0.021585	9'-0	Pf 0.194
1119	37'-10	177.88	28	40.358		Sprinkler		Pe
1121	37'-10			40.552			9'-0	Pv
BL	2.7050	269.98	15.07	120		0.159206	158'-0	Pf 31.115
1121	37'-10	178.30	28	40.552		Sprinkler,	37'-5	Pe 0.361
102	37'-0			72.028		2PO(18'-8½)	195'-5	Pv
Route 4								
BL	2.7050	86.20	4.81	120		0.019263	9'-0	Pf 0.173
1119	37'-10	177.88	28	40.358		Sprinkler		Pe
1123	37'-10			40.531			9'-0	Pv
BL	2.7050	264.46	14.76	120		0.153239	119'-7	Pf 24.062
1123	37'-10	178.26	28	40.531		Sprinkler,	37'-5	Pe 0.361
132	37'-0			64.954		2PO(18'-8½)	157'-0	Pv
Route 5								
BL	2.7050	76.06	4.25	120		0.015281	9'-0	Pf 0.138
1125	37'-10	179.54	28	41.114		Sprinkler		Pe
1127	37'-10			41.251			9'-0	Pv
BL	2.7050	255.90	14.29	120		0.144185	119'-7	Pf 22.640
1127	37'-10	179.84	28	41.251		Sprinkler,	37'-5	Pe 0.361
142	37'-0			64.252		2PO(18'-8½)	157'-0	Pv
CM	4.3100	255.90	5.63	120		0.014917	10'-0	Pf 0.149
142	37'-0			64.252				Pe
130	37'-0			64.401			10'-0	Pv
Route 6								



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 01A

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	103.48	5.78	120		0.027005	9'-0	Pf 0.243
1125	37'-10	179.54	28	41.114		Sprinkler		Pe
1113	37'-10			41.357			9'-0	Pv
BL	2.7050	283.54	15.83	120		0.174317	133'-3	Pf 25.564
1113	37'-10	180.07	28	41.357		Sprinkler,	13'-4½	Pe
126	37'-10			66.921		2fE(6'-8½)	146'-8	Pv
BL	2.7050	162.24	9.06	120		0.062054	26'-9	Pf 3.982
126	37'-10			66.921			37'-5	Pe 0.361
128	37'-0			71.264		2PO(18'-8½)	64'-2	Pv
CM	4.3100	283.54	6.24	120		0.018034	8'-0	Pf 0.144
128	37'-0	121.31		71.264		Flow (q) from Route 14		Pe
100	37'-0			71.408			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		113.375		Hydrant,	74'-1	Pe 3.902
13	-8'-0			117.438		E(22'-1), GV(4'-8½), T(47'-3½)	93'-10½	Pv
UG	7.6800	759.07	5.26	150		0.004428	61'-1½	Pf 0.271
13	-8'-0	509.07		117.438		Flow (q) from Route 11		Pe
14	-8'-0			117.708			61'-1½	Pv
UG	7.6800	759.07	5.26	150		0.004428	635'-9	Pf 2.915
14	-8'-0			117.708			22'-6½	Pe
15	-8'-0			120.623		E(22'-6½)	658'-3½	Pv
UG	7.6800	759.07	5.26	150		0.004428	119'-3	Pf 0.528
15	-8'-0			120.623				Pe
16	-8'-0			121.151			119'-3	Pv
UG	7.6800	759.07	5.26	150		0.004428	519'-3½	Pf 2.399
16	-8'-0			121.151			22'-6½	Pe
17	-8'-0			123.550		E(22'-6½)	541'-10	Pv
UG	7.6800	759.07	5.26	150		0.004428	91'-11½	Pf 0.407
17	-8'-0			123.550				Pe
18	-8'-0			123.957			91'-11½	Pv
UG	7.6800	759.07	5.26	150		0.004428	214'-9	Pf 0.951
18	-8'-0			123.957				Pe
19	-8'-0			124.908			214'-9	Pv
UG	7.6800	759.07	5.26	150		0.004428	337'-8	Pf 1.789
19	-8'-0			124.908			66'-4½	Pe
9	-8'-0			126.697		E(22'-6½), T(43'-10)	404'-0½	Pv
Route 8								
BL	2.7050	104.70	5.85	120		0.027597	295'-7	Pf 10.224
144	38'-0	211.80		68.610		PO(18'-8½), Flow (q) from Route 18	74'-10½	Pe -0.000
118	38'-0			78.833		3PO(18'-8½)	370'-5½	Pv
Route 9								
CM	4.3100	107.10	2.36	120		0.002978	10'-0	Pf 0.030
144	38'-0	211.80		68.610		Flow (q) from Route 18		Pe -0.120
146	38'-3			68.519			10'-0	Pv
BL	2.7050	107.10	5.98	120		0.028781	295'-7	Pf 10.786
146	38'-3			68.519		PO(18'-8½)	79'-2	Pe -0.000
120	38'-3			79.305		3PO(18'-8½), Tr(4'-3½)	374'-9	Pv
Route 10								
CM	4.3100	309.58	6.81	120		0.021216	10'-0	Pf 0.212
148	37'-5			68.533				Pe -0.120
150	37'-8½			68.625			10'-0	Pv
BL	2.7050	97.78	5.46	120		0.024321	301'-9	Pf 9.811
150	37'-8½			68.625		PO(18'-8½)	101'-8	Pe -0.000
116	37'-8½			78.436		3PO(18'-8½), 4fE(6'-8½)	403'-5	Pv
Route 11								
UG	7.6800	509.07	3.53	150		0.002114	153'-8	Pf 0.325
12	-8'-0	1096.88		117.113		Flow (q) from Route 1		Pe
13	-8'-0			117.438			153'-8	Pv
Route 12								
CM	4.3100	409.98	9.02	120		0.035675	10'-0	Pf 0.357
140	37'-2	100.84		68.297		Flow (q) from Route 2		Pe -0.120
148	37'-5			68.533			10'-0	Pv
RN	2.7050	100.40	5.61	120		0.025540	295'-7	Pf 9.571
148	37'-5			68.533		PO(18'-8½)	79'-2	Pe 0.000
114	37'-5			78.104		3PO(18'-8½), Tr(4'-3½)	374'-9	Pv
Route 13								



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 01A

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream					Fittings	Total Length	
RN	2.7050	95.96	5.36	120	0.023491	295'-7	Pf 8.904
138	37'-0			67.826	PO(18'-8½)	83'-5½	Pe -0.000
108	37'-0			76.730	3PO(18'-8½), 2Tr(4'-3½)	379'-0½	Pv
Route 14							
CM	4.3100	121.31	2.67	120	0.003749	7'-6	Pf 0.028
152	37'-0	121.31		71.236	Flow (q) from Route 17		Pe
128	37'-0			71.264		7'-6	Pv
Route 15							
RN	2.7050	86.52	4.83	120	0.019392	295'-7	Pf 7.184
134	37'-0			66.136	PO(18'-8½)	74'-10½	Pe -0.000
104	37'-0			73.320	3PO(18'-8½)	370'-5½	Pv
Route 16							
RN	2.7050	90.37	5.05	120	0.021020	295'-7	Pf 7.787
136	37'-0			67.089	PO(18'-8½)	74'-10½	Pe -0.000
106	37'-0			74.876	3PO(18'-8½)	370'-5½	Pv
Route 17							
BL	2.7050	121.31	6.77	120	0.036239	34'-3	Pf 3.954
126	37'-10			66.921	T(18'-8½)	74'-10½	Pe 0.361
152	37'-0			71.236	T(18'-8½), 2PO(18'-8½)	109'-1½	Pv
Route 18							
CM	4.3100	211.80	4.66	120	0.010512	10'-0	Pf 0.105
150	37'-8½	97.78		68.625	Flow (q) from Route 10		Pe -0.120
144	38'-0			68.610		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
Multipling Factor	0.713	1.16	1.33	1.51

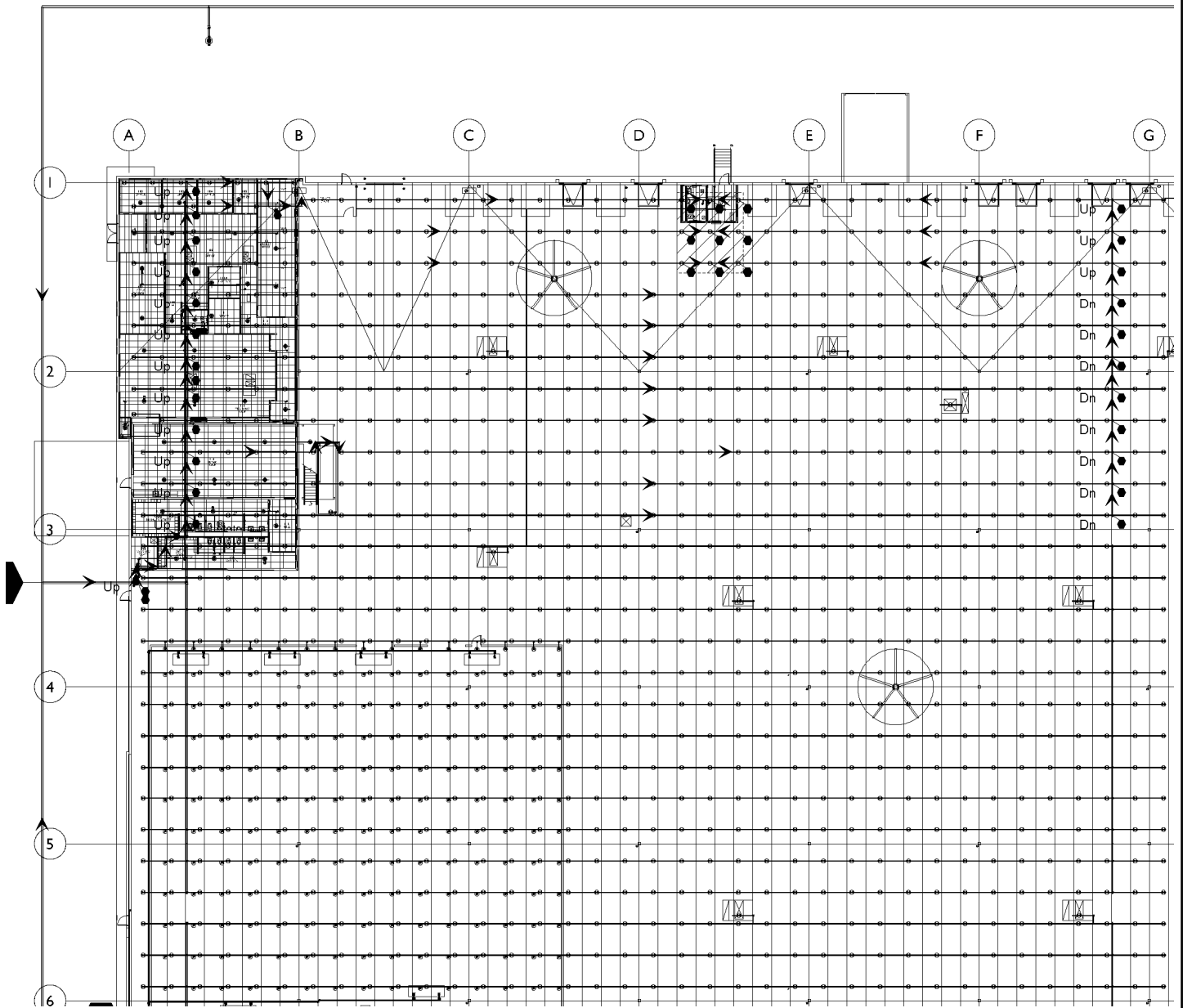


Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 01A

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

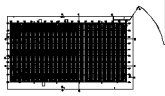
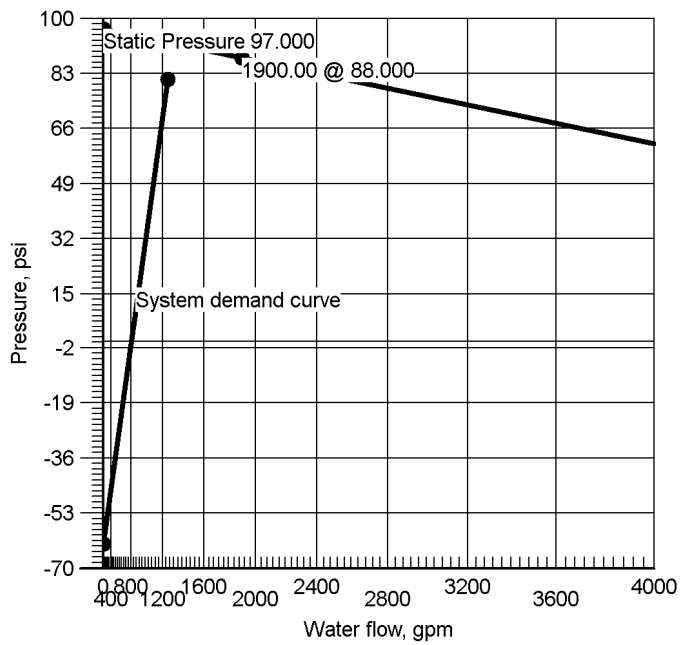
Pipe Type Legend	Units Legend	Fittings Legend
AO Arm-Over BL Branch Line CM Cross Main DN Drain DR Drop DY Dynamic FM Feed Main FR Feed Riser MS Miscellaneous OR Outrigger RN Riser Nipple SN Swing Nipple SP Sprig ST Stand Pipe UG Underground	Diameter Inch Elevation Foot Flow gpm Discharge gpm Velocity 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: FP Overhead System 01B

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 80.000					Area of Application NA				
Most Demanding Sprinkler Data 28 K-Factor 250.44 at 80.000					Hose Streams 250.00				
Coverage Per Sprinkler 100 ft²					Number Of Sprinklers Calculated 4			0	
System Pressure Demand 81.329					System Flow Demand 1255.99				
Total Demand 1255.99 @ 81.329					Pressure Result +11.486 (12.4%)				
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 (461)	0.000	0	0.00
5	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)				
									



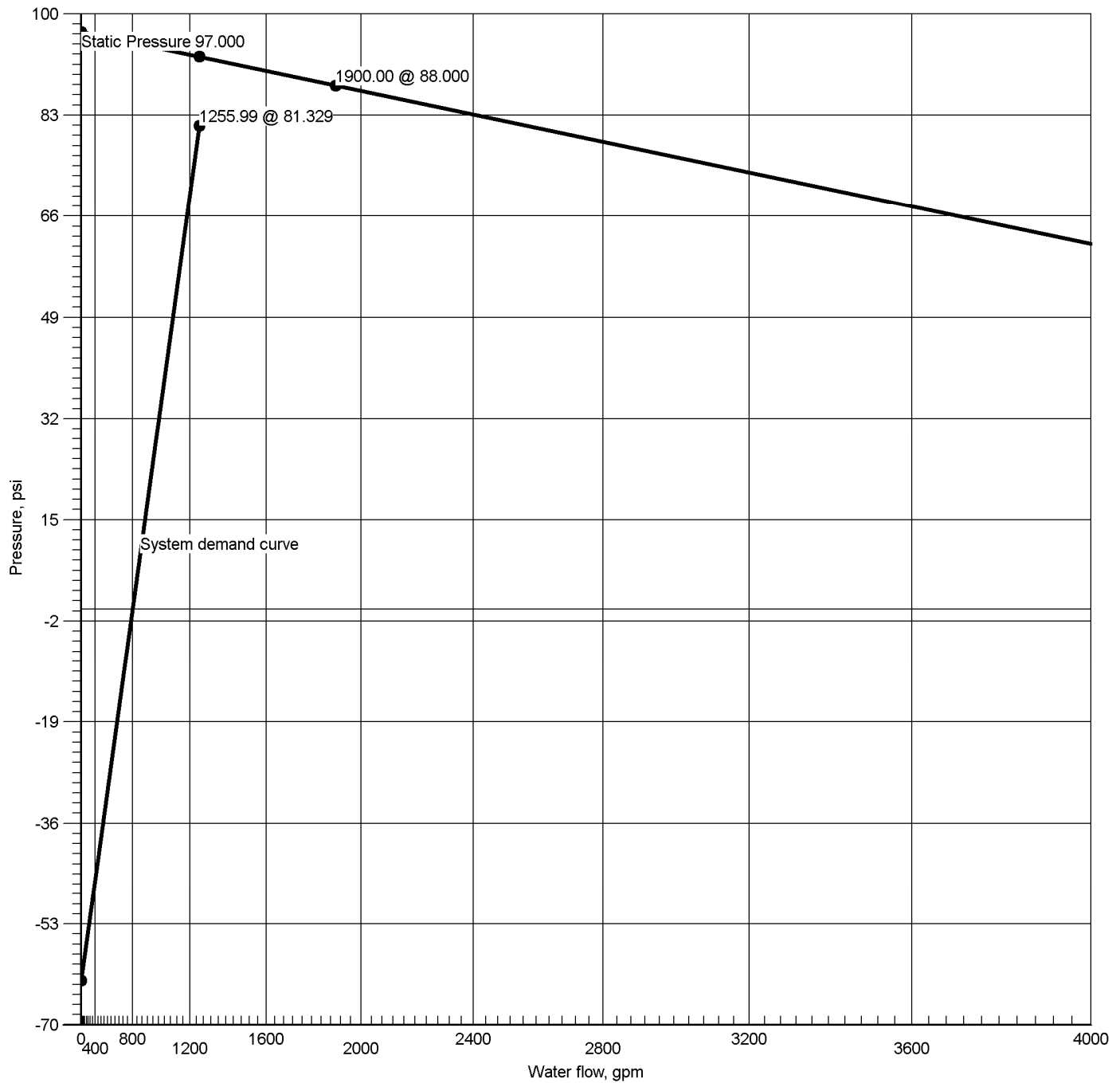
Hydraulic Summary

Job Number: 212189000
Report Description: FP Overhead System 01B

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 28 K-Factor 250.44 at 80.000				Occupancy ESFR			Job Suffix		
Hose Allowance At Source 0.00				Pressure 80.000			Area of Application NA		
Additional Hose Supplies Node Hydrant At Node 54				Number Of Sprinklers Calculated 4			Number Of Nozzles Calculated 0		Coverage Per Sprinkler 100 ft²
Flow(gpm) 250.00				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 81.288 Right: 81.288					
Total Hose Streams 250.00									
System Flow Demand 1255.99		Total Water Required (Including Hose Allowance) 1255.99							
Maximum Pressure Unbalance In Loops 0.000									
Maximum Velocity Above Ground 15.57 between nodes 110 and 108									
Maximum Velocity Under Ground 8.70 between nodes 8 and 9									
Volume capacity of Wet Pipes 32132.49 gal		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	92.815	1255.99	81.329	11.486
5	Pump		84.000	60.000	2000.00	151.492	1255.99	140.006	11.486
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

92.815 @ 1255.99

Required Pressure at System Demand

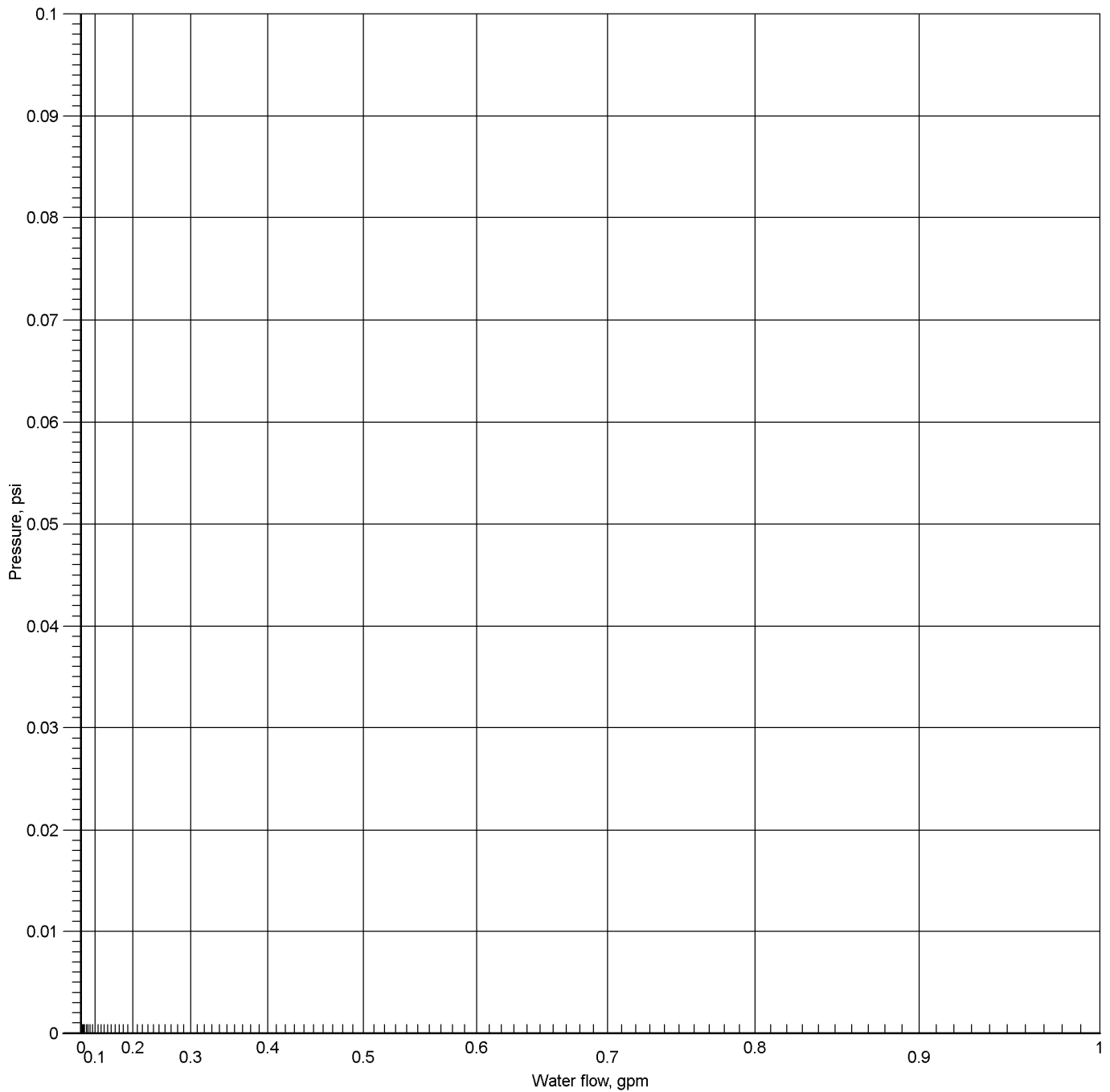
81.329 @ 1255.99

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

81.329 @ 1255.99



Pump Inlet at Node 461



Hydraulic Graph

Pump Inlet at Node 461

Static: Pressure

0.000

Residual: Pressure

N/A

Available Pressure at System Demand

N/A

Required Pressure at System Demand

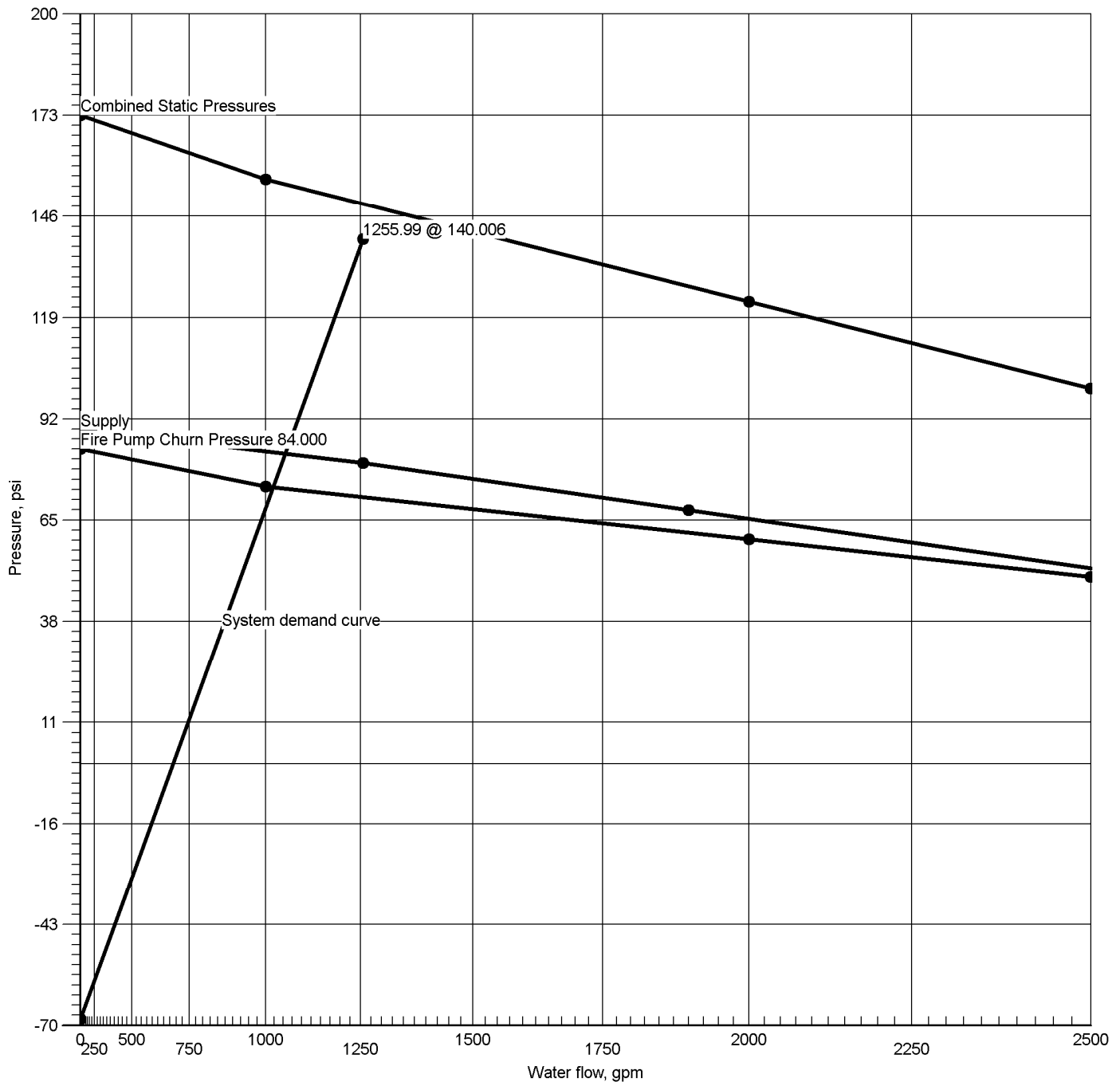
0.000 @ 0.00

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

N/A



Pump at Node 5



Hydraulic Graph	Static + Churn Pressure	Fire Pump Rating
Pump at Node 5	173.256	60.000 @ 2000.00
Static Pressure	173.256	Fire Pump Churn Pressure
	84.000	
Residual Pressure		
71.181 @ 1255.99		
Available Pressure at System Demand		
151.492 @ 1255.99		
Required Pressure at System Demand		
140.006 @ 1255.99		



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: FP Overhead System 01B

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Hydrant	54	250.00	250.00	250	133.495			
⇒ Sprinkler	1111	250.44	250.44	28	80.000			
Sprinkler	1113	252.55	250.44	28	81.354			
Sprinkler	1129	250.44	250.44	28	80.000			
Sprinkler	1131	252.56	250.44	28	81.358			

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: FP Overhead System 01B

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	81.329	1255.99
54	1'-0	Hyd(-1.000)	133.495	250.00
1111	37'-10	Spr(-80.000)	80.000	250.44
1113	37'-10	Spr(-81.354)	81.354	252.55
1129	37'-10	Spr(-80.000)	80.000	250.44
1131	37'-10	Spr(-81.358)	81.358	252.56
2	-8'-0	E(24'-7)	78.389	
4	1'-9	P1	68.824	
5	1'-9	P2(-71.181)	140.006	
6	1'-9		140.006	
7	6'-8½		136.794	
8	1'-0		139.201	
9	-8'-0	T(43'-10)	142.089	
10	-8'-0	T(43'-10)	140.742	
11	-8'-0	T(47'-3½)	140.243	
12	-8'-0	T(43'-10)	137.460	
13	-8'-0	T(47'-3½)	137.558	
14	-8'-0	T(43'-10)	137.690	
15	-8'-0	T(47'-3½)	139.117	
16	-8'-0	T(43'-10)	139.375	
17	-8'-0	T(47'-3½)	140.549	
18	-8'-0	T(43'-10)	140.748	
19	-8'-0	T(43'-10)	141.214	
51	1'-0	Hyd	1.000	
53	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
100	37'-0	PO(18'-8½)	106.366	
102	37'-0	PO(18'-8½)	106.911	
104	37'-0	PO(18'-8½)	107.543	
106	37'-0	PO(18'-8½)	108.273	
108	37'-0	PO(18'-8½)	109.117	
110	37'-0		109.558	
112	37'-2	PO(18'-8½)	109.574	
114	37'-5	PO(18'-8½)	109.624	
116	37'-8½	PO(18'-8½)	109.700	
118	38'-0	PO(18'-8½)	109.801	
120	38'-3	PO(18'-8½)	109.932	
122	1'-8½	PO(37'-8½)	132.133	
124	1'-0		132.775	
126	37'-10	T(18'-8½)	102.388	
128	37'-0	PO(18'-8½)	106.240	
130	37'-0	PO(18'-8½)	104.446	
132	37'-0	PO(18'-8½)	104.944	
134	37'-0	PO(18'-8½)	105.363	
136	37'-0	PO(18'-8½)	105.708	
138	37'-0	PO(18'-8½)	105.978	
140	37'-2	PO(18'-8½)	106.109	
142	37'-0	PO(18'-8½)	104.313	
144	38'-0	PO(18'-8½)	105.999	
146	38'-3	PO(18'-8½)	105.889	
148	37'-5	PO(18'-8½)	106.121	
150	37'-8½	PO(18'-8½)	106.080	
152	37'-0	PO(18'-8½)	106.215	



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 01B

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream						Total Length	
Route 1							
BL	2.7050	0.91	0.05	120	0.000004	9'-0	Pf 0.000
1111	37'-10	250.44	28	80.000	Sprinkler		Pe
1129	37'-10			80.000		9'-0	Pv
BL	2.7050	251.35	14.03	120	0.139484	149'-0	Pf 26.005
1129	37'-10	250.44	28	80.000	Sprinkler,	37'-5	Pe 0.361
100	37'-0			106.366	2PO(18'-8½)	186'-5	Pv
CM	4.3100	515.39	11.33	120	0.054474	10'-0	Pf 0.545
100	37'-0	264.03		106.366	Flow (q) from Route 4		Pe
102	37'-0			106.911		10'-0	Pv
CM	4.3100	558.34	12.28	120	0.063171	10'-0	Pf 0.632
102	37'-0	42.96		106.911	Flow (q) from Route 13		Pe -0.000
104	37'-0			107.543		10'-0	Pv
CM	4.3100	603.75	13.28	120	0.073001	10'-0	Pf 0.730
104	37'-0	45.40		107.543	Flow (q) from Route 14		Pe
106	37'-0			108.273		10'-0	Pv
CM	4.3100	653.33	14.37	120	0.084477	10'-0	Pf 0.845
106	37'-0	49.58		108.273	Flow (q) from Route 15		Pe
108	37'-0			109.117		10'-0	Pv
CM	4.3100	707.95	15.57	120	0.098007	4'-6	Pf 0.441
108	37'-0	54.63		109.117	Flow (q) from Route 11		Pe
110	37'-0			109.558		4'-6	Pv
CM	6.3570	707.95	7.16	120	0.014768	5'-6½	Pf 0.082
110	37'-0			109.558			Pe -0.066
112	37'-2			109.574		5'-6½	Pv
CM	6.3570	766.28	7.75	120	0.017098	10'-0	Pf 0.171
112	37'-2	58.33		109.574	Flow (q) from Route 2		Pe -0.120
114	37'-5			109.624		10'-0	Pv
CM	6.3570	824.60	8.34	120	0.019582	10'-0	Pf 0.196
114	37'-5	58.31		109.624	Flow (q) from Route 10		Pe -0.121
116	37'-8½			109.700		10'-0	Pv
CM	6.3570	881.64	8.91	120	0.022162	10'-0	Pf 0.222
116	37'-8½	57.04		109.700	Flow (q) from Route 8		Pe -0.120
118	38'-0			109.801		10'-0	Pv
CM	6.3570	942.98	9.53	120	0.025098	10'-0	Pf 0.251
118	38'-0	61.34		109.801	Flow (q) from Route 6		Pe -0.120
120	38'-3			109.932		10'-0	Pv
CM	6.3570	1005.99	10.17	120	0.028288	71'-0½	Pf 6.349
120	38'-3	63.01		109.932	Flow (q) from Route 7	153'-4½	Pe 15.853
122	1'-8½			132.133	5fE(12'-7), 2f(-0.000), CV(40'-3), BV(12'-7), PO(37'-8½)	224'-5	Pv
CM	8.2490	1005.99	6.04	120	0.007954	1'-6	Pf 0.339
122	1'-8½			132.133		41'-1½	Pe 0.303
124	1'-0			132.775	PO(41'-1½)	42'-7½	Pv
UG	7.6800	1005.99	6.97	150	0.007455	38'-9½	Pf 0.784
124	1'-0			132.775		66'-4½	Pe 3.902
12	-8'-0			137.460	E(22'-6½), T(43'-10)	105'-2	Pv
UG	7.6800	740.14	5.13	150	0.004226	635'-11½	Pf 2.783
12	-8'-0			137.460		22'-6½	Pe
11	-8'-0			140.243	E(22'-6½)	658'-6	Pv
UG	7.6800	740.14	5.13	150	0.004226	118'-2	Pf 0.499
11	-8'-0			140.243			Pe
10	-8'-0			140.742		118'-2	Pv
UG	7.6800	740.14	5.13	150	0.004226	275'-0	Pf 1.347
10	-8'-0			140.742		43'-10	Pe
9	-8'-0			142.089	T(43'-10)	318'-9½	Pv
UG	7.6800	1255.99	8.70	150	0.011240	67'-8	Pf 1.014
9	-8'-0	515.85		142.089	Flow (q) from Route 5	22'-6½	Pe -3.902
8	1'-0			139.201	E(22'-6½)	90'-2½	Pv
FR	8.2490	1255.99	7.54	120	0.011992	5'-8½	Pf 0.068
8	1'-0			139.201			Pe -2.476
7	6'-8½			136.794		5'-8½	Pv
DY	10.3700	1255.99	4.77	120	0.003935	13'-10½	Pf 1.061
7	6'-8½			136.794		255'-9	Pe 2.151
6	1'-9			140.006	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: FP Overhead System 01B

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream						Total Length	
DY	7.9810	1255.99	8.05	120	0.014085	0'-0	Pf 0.000
6	1'-9			140.006			Pe 0.000
5	1'-9			140.006		0'-0	Pv
Pump							
5		1255.99		140.006	Rating: 60.000 @ 2000.00		
4		Q=1255.99	5.78	68.824	Fire Pump Churn Pressure: 84.00		
					0		
UG	9.4200	1255.99	5.78	150	0.004158	305'-9½	Pf 5.338
4	1'-9			68.824		137'-6	Pe 4.227
2	-8'-0			78.389	GV(5'-7), T(45'-10), 3E(24'-7), EE(12'-3½), BFP(-3.494)	443'-3½	Pv
UG	11.2000	1255.99	4.09	150	0.001790	750'-9	Pf 1.423
2	-8'-0			78.389		44'-3	Pe 1.517
1	-11'-6			81.329	EE(14'-4½), E(29'-10½), S	795'-0	Pv
		0.00			Hose Allowance At Source		
1		1255.99					
Route 2							
BL	2.7050	249.53	13.93	120	0.137614	137'-7	Pf 24.085
1111	37'-10	250.44	28	80.000	Sprinkler,	37'-5	Pe 0.361
130	37'-0			104.446	2PO(18'-8½)	175'-0	Pv
CM	4.3100	490.60	10.79	120	0.049727	10'-0	Pf 0.497
130	37'-0	241.07		104.446	Flow (q) from Route 3		Pe
132	37'-0			104.944		10'-0	Pv
CM	4.3100	447.64	9.84	120	0.041973	10'-0	Pf 0.420
132	37'-0			104.944			Pe
134	37'-0			105.363		10'-0	Pv
CM	4.3100	402.24	8.85	120	0.034439	10'-0	Pf 0.344
134	37'-0			105.363			Pe
136	37'-0			105.708		10'-0	Pv
CM	4.3100	352.66	7.76	120	0.026999	10'-0	Pf 0.270
136	37'-0			105.708			Pe
138	37'-0			105.978		10'-0	Pv
CM	4.3100	298.03	6.55	120	0.019776	10'-0½	Pf 0.198
138	37'-0			105.978			Pe -0.067
140	37'-2			106.109		10'-0½	Pv
RN	2.7050	58.33	3.26	120	0.009351	295'-7	Pf 3.464
140	37'-2			106.109	PO(18'-8½)	74'-10½	Pe 0.000
112	37'-2			109.574	3PO(18'-8½)	370'-5½	Pv
Route 3							
BL	2.7050	241.07	13.46	120	0.129115	137'-7	Pf 22.598
1113	37'-10	252.55	28	81.354	Sprinkler,	37'-5	Pe 0.361
142	37'-0			104.313	2PO(18'-8½)	175'-0	Pv
CM	4.3100	241.07	5.30	120	0.013358	10'-0	Pf 0.134
142	37'-0			104.313			Pe
130	37'-0			104.446		10'-0	Pv
Route 4							
BL	2.7050	11.48	0.64	120	0.000462	9'-0	Pf 0.004
1113	37'-10	252.55	28	81.354	Sprinkler		Pe
1131	37'-10			81.358		9'-0	Pv
BL	2.7050	264.03	14.74	120	0.152779	124'-3	Pf 21.030
1131	37'-10	252.56	28	81.358	Sprinkler,	13'-4½	Pe
126	37'-10			102.388	2fE(6'-8½)	137'-8	Pv
BL	2.7050	151.07	8.43	120	0.054387	26'-9	Pf 3.490
126	37'-10			102.388		37'-5	Pe 0.361
128	37'-0			106.240	2PO(18'-8½)	64'-2	Pv
CM	4.3100	264.03	5.81	120	0.015806	8'-0	Pf 0.126
128	37'-0	112.96		106.240	Flow (q) from Route 12		Pe
100	37'-0			106.366		8'-0	Pv
Route 5							
UG	6.2800	250.00	2.59	140	0.001718	19'-10	Pf 0.161
54	1'-0	250.00		133.495	Hydrant,	74'-1	Pe 3.902
13	-8'-0			137.558	E(22'-1), GV(4'-8½), T(47'-3½)	93'-10½	Pv
UG	7.6800	515.85	3.57	150	0.002167	61'-1½	Pf 0.132
13	-8'-0	265.85		137.558	Flow (q) from Route 9		Pe
14	-8'-0			137.690		61'-1½	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 01B

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream						Total Length	
UG	7.6800	515.85	3.57	150	0.002167	635'-9"	Pf 1.426
14	-8'-0"			137.690		22'-6½"	Pe
15	-8'-0"			139.117	E(22'-6½")	658'-3½"	Pv
UG	7.6800	515.85	3.57	150	0.002167	119'-3"	Pf 0.258
15	-8'-0"			139.117			Pe
16	-8'-0"			139.375		119'-3"	Pv
UG	7.6800	515.85	3.57	150	0.002167	519'-3½"	Pf 1.174
16	-8'-0"			139.375		22'-6½"	Pe
17	-8'-0"			140.549	E(22'-6½")	541'-10"	Pv
UG	7.6800	515.85	3.57	150	0.002167	91'-11½"	Pf 0.199
17	-8'-0"			140.549			Pe
18	-8'-0"			140.748		91'-11½"	Pv
UG	7.6800	515.85	3.57	150	0.002167	214'-9"	Pf 0.465
18	-8'-0"			140.748			Pe
19	-8'-0"			141.214		214'-9"	Pv
UG	7.6800	515.85	3.57	150	0.002167	337'-8"	Pf 0.875
19	-8'-0"			141.214		66'-4½"	Pe
9	-8'-0"			142.089	E(22'-6½"), T(43'-10")	404'-0½"	Pv
Route 6							
BL	2.7050	61.34	3.42	120	0.010264	295'-7"	Pf 3.802
144	38'-0"	124.35		105.999	PO(18'-8½"), Flow (q) from Route 17	74'-10½"	Pe -0.000
118	38'-0"			109.801	3PO(18'-8½")	370'-5½"	Pv
Route 7							
CM	4.3100	63.01	1.39	120	0.001116	10'-0"	Pf 0.011
144	38'-0"	124.35		105.999	Flow (q) from Route 17		Pe -0.120
146	38'-3"			105.889		10'-0"	Pv
BL	2.7050	63.01	3.52	120	0.010787	295'-7"	Pf 4.042
146	38'-3"			105.889	PO(18'-8½")	79'-2"	Pe -0.000
120	38'-3"			109.932	3PO(18'-8½"), Tr(4'-3½")	374'-9"	Pv
Route 8							
CM	4.3100	181.39	3.99	120	0.007892	10'-0"	Pf 0.079
148	37'-5"			106.121			Pe -0.120
150	37'-8½"			106.080		10'-0"	Pv
BL	2.7050	57.04	3.18	120	0.008973	301'-9"	Pf 3.620
150	37'-8½"			106.080	PO(18'-8½")	101'-8"	Pe -0.000
116	37'-8½"			109.700	3PO(18'-8½"), 4fE(6'-8½")	403'-5"	Pv
Route 9							
UG	7.6800	265.85	1.84	150	0.000636	153'-8"	Pf 0.098
12	-8'-0"	740.14		137.460	Flow (q) from Route 1		Pe
13	-8'-0"			137.558		153'-8"	Pv
Route 10							
CM	4.3100	239.70	5.27	120	0.013217	10'-0"	Pf 0.132
140	37'-2"	58.33		106.109	Flow (q) from Route 2		Pe -0.120
148	37'-5"			106.121		10'-0"	Pv
RN	2.7050	58.31	3.26	120	0.009347	295'-7"	Pf 3.503
148	37'-5"			106.121	PO(18'-8½")	79'-2"	Pe 0.000
114	37'-5"			109.624	3PO(18'-8½"), Tr(4'-3½")	374'-9"	Pv
Route 11							
RN	2.7050	54.63	3.05	120	0.008283	295'-7"	Pf 3.140
138	37'-0"			105.978	PO(18'-8½")	83'-5½"	Pe -0.000
108	37'-0"			109.117	3PO(18'-8½"), 2Tr(4'-3½")	379'-0½"	Pv
Route 12							
CM	4.3100	112.96	2.48	120	0.003286	7'-6"	Pf 0.025
152	37'-0"	112.96		106.215	Flow (q) from Route 16		Pe
128	37'-0"			106.240		7'-6"	Pv
Route 13							
RN	2.7050	42.96	2.40	120	0.005311	295'-7"	Pf 1.967
132	37'-0"			104.944	PO(18'-8½")	74'-10½"	Pe
102	37'-0"			106.911	3PO(18'-8½")	370'-5½"	Pv
Route 14							
RN	2.7050	45.40	2.53	120	0.005883	295'-7"	Pf 2.179
134	37'-0"			105.363	PO(18'-8½")	74'-10½"	Pe -0.000
104	37'-0"			107.543	3PO(18'-8½")	370'-5½"	Pv
Route 15							
RN	2.7050	49.58	2.77	120	0.006924	295'-7"	Pf 2.565
136	37'-0"			105.708	PO(18'-8½")	74'-10½"	Pe -0.000
106	37'-0"			108.273	3PO(18'-8½")	370'-5½"	Pv



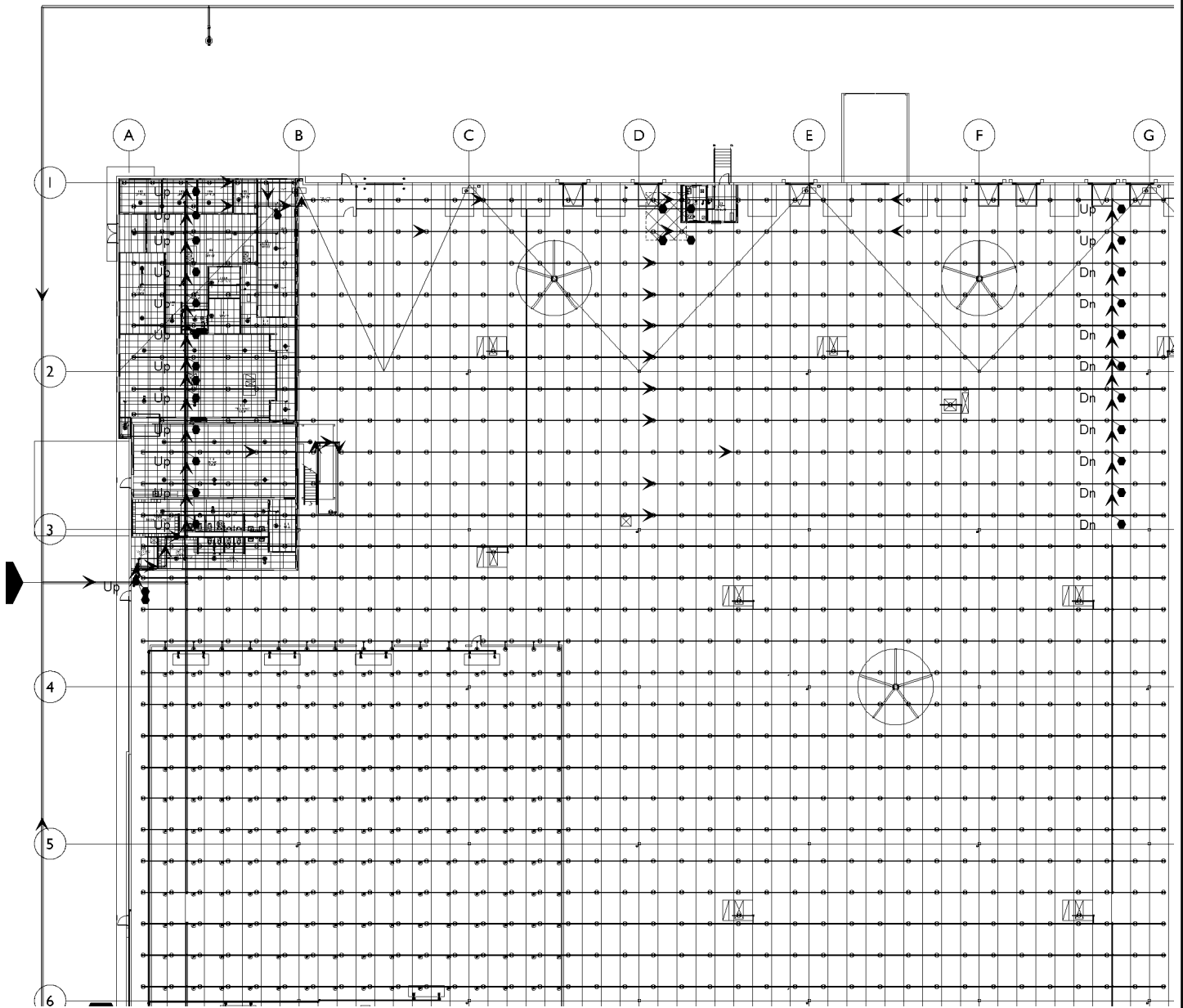
Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 01B

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream					Fittings	Total Length	
Route 16							
BL	2.7050	112.96	6.31	120	0.031762	34'-3	Pf 3.465
126	37'-10			102.388	T(18'-8½)	74'-10½	Pe 0.361
152	37'-0			106.215	T(18'-8½), 2PO(18'-8½)	109'-1½	Pv
Route 17							
CM	4.3100	124.35	2.73	120	0.003925	10'-0	Pf 0.039
150	37'-8½	57.04		106.080	Flow (q) from Route 8		Pe -0.120
144	38'-0			105.999		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
				Multiplying Factor	0.713	1.16	1.33

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 SN Swing 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 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





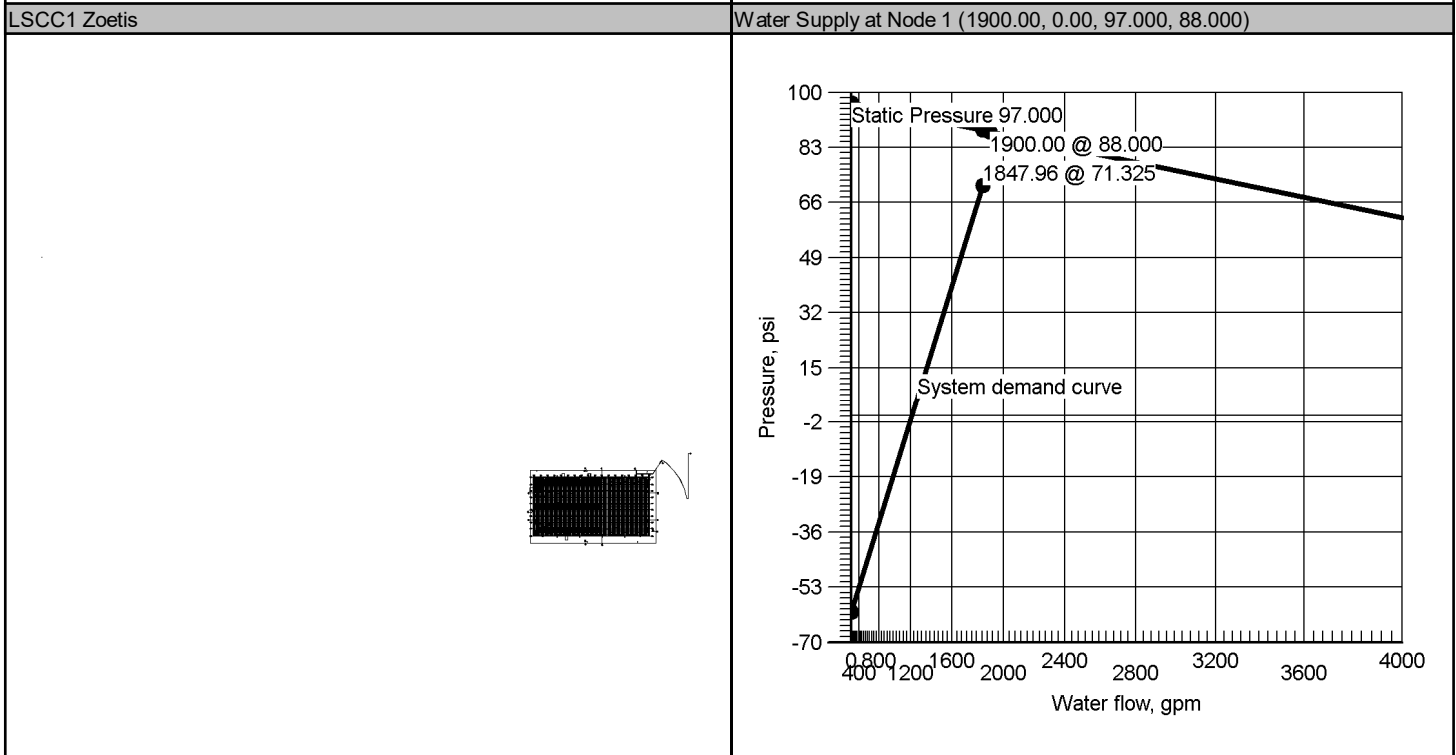
Hydraulic Overview

Job Number: 212189000
Report Description: FP Overhead System 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 28 K-Factor 177.09 at 40.000	Hose Streams 250.00
Coverage Per Sprinkler 100 ft²	Number Of Sprinklers Calculated 9 0
System Pressure Demand 71.325	System Flow Demand 1847.96
Total Demand 1847.96 @ 71.325	Pressure Result +17.126 (19.4%)

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 (461)	0.000	0	0.00
5	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									





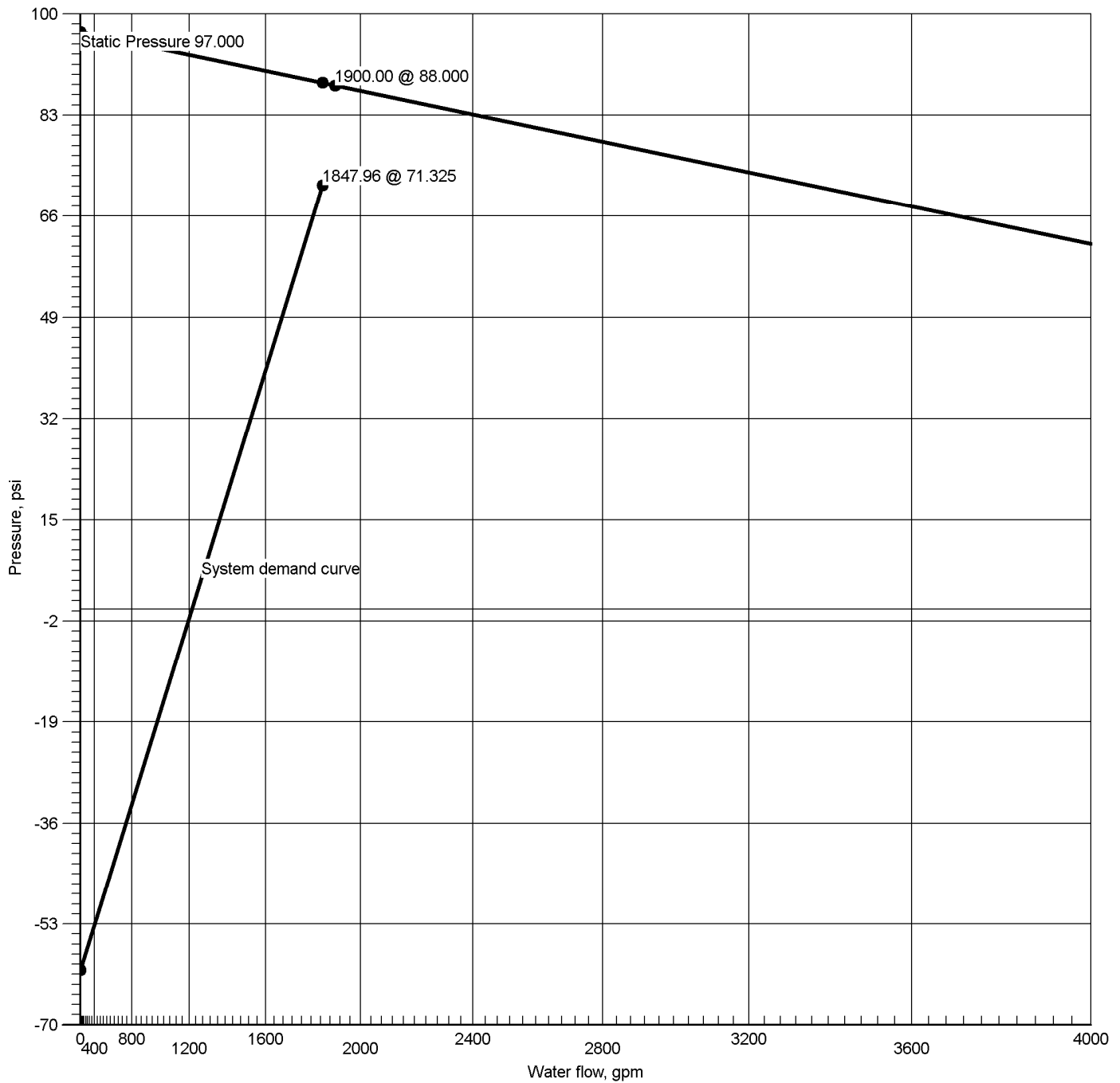
Hydraulic Summary

Job Number: 212189000
Report Description: FP Overhead System 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 28 K-Factor 177.09 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 9				
				Number Of Nozzles Calculated 0			Coverage Per Sprinkler 100 ft²				
				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 71.245 Right: 71.321							
Total Hose Streams 250.00											
System Flow Demand 1847.96			Total Water Required (Including Hose Allowance) 1847.96								
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 17.83 between nodes 232 and 230											
Maximum Velocity Under Ground 12.80 between nodes 8 and 9											
Volume capacity of Wet Pipes 32132.49 gal			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	88.451		1847.96	71.325	17.126
5	Pump		84.000	60.000		2000.00	134.826		1847.96	117.700	17.126
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

88.451 @ 1847.96

Required Pressure at System Demand

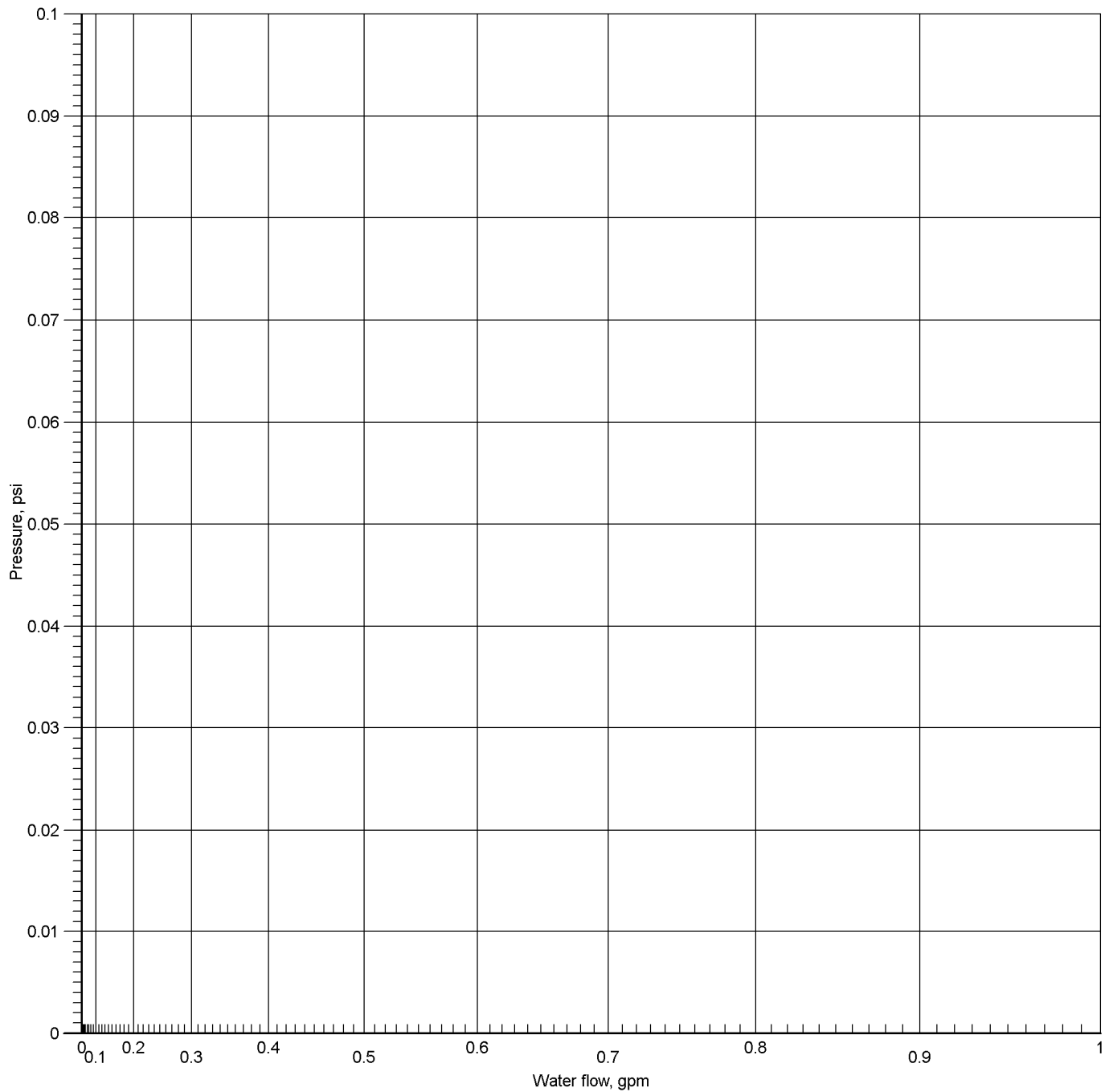
71.325 @ 1847.96

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

71.325 @ 1847.96



Pump Inlet at Node 461



Hydraulic Graph

Pump Inlet at Node 461

Static: Pressure

0.000

Residual: Pressure

N/A

Available Pressure at System Demand

N/A

Required Pressure at System Demand

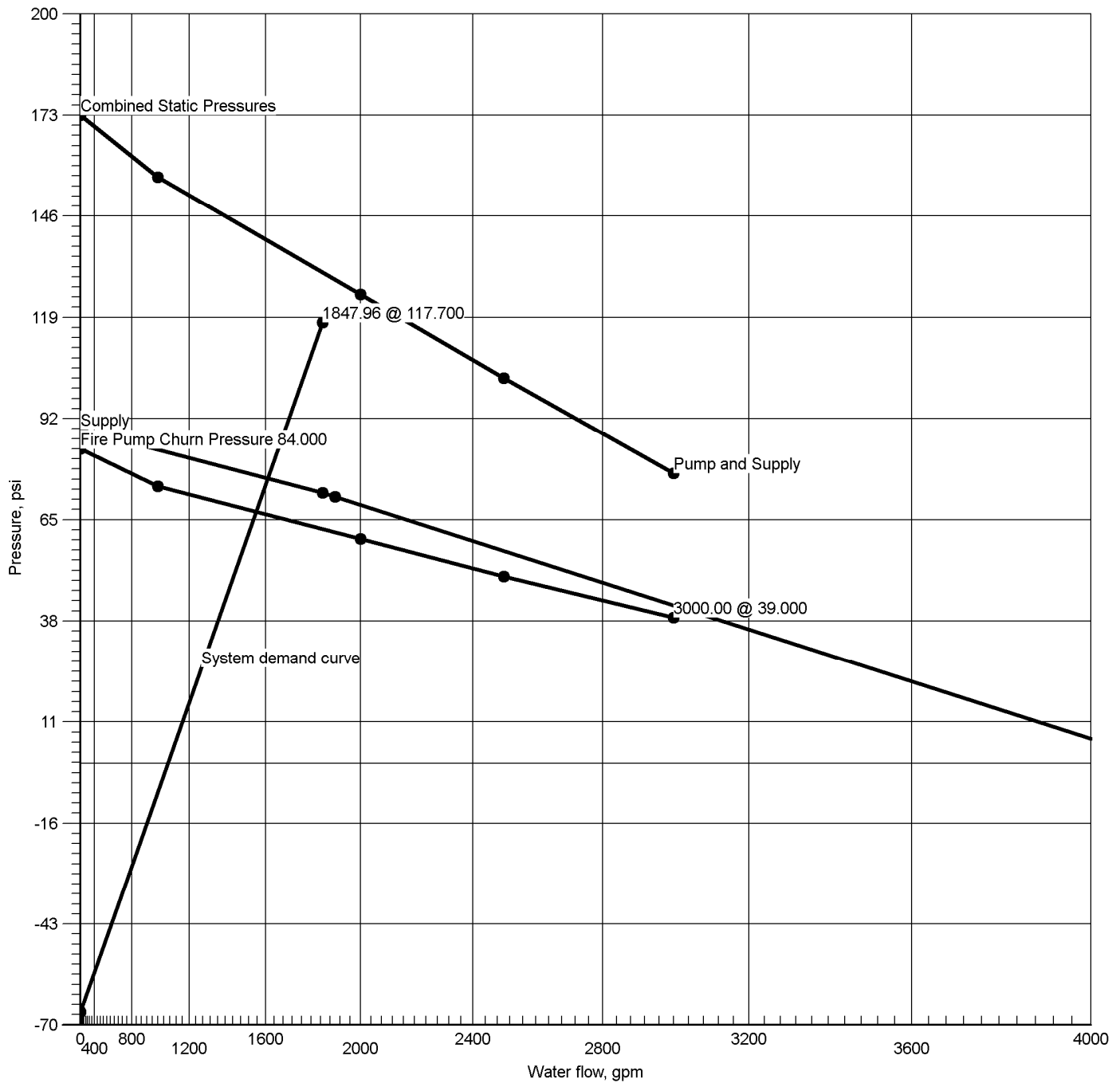
0.000 @ 0.00

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

N/A



Pump at Node 5



Hydraulic Graph
Pump at Node 5

Static + Churn Pressure
173.256
Fire Pump Churn Pressure
84.000

Fire Pump Rating
60.000 @ 2000.00

Static: Pressure
173.256

Residual: Pressure
62.636 @ 1847.96

Available Pressure at System Demand
134.826 @ 1847.96

Required Pressure at System Demand
117.700 @ 1847.96



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: FP Overhead System 02

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Hydrant	54	250.00	250.00	250	104.299			
⇒ Sprinkler	2111	177.09	177.09	28	40.000			
Sprinkler	2113	177.46	177.09	28	40.170			
Sprinkler	2115	177.52	177.09	28	40.195			
Sprinkler	2117	177.11	177.09	28	40.011			
Sprinkler	2119	177.48	177.09	28	40.179			
Sprinkler	2121	177.54	177.09	28	40.207			
Sprinkler	2123	177.65	177.09	28	40.253			
Sprinkler	2125	178.01	177.09	28	40.418			
Sprinkler	2127	178.09	177.09	28	40.456			

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: FP Overhead System 02

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	71.325	1847.96
54	1'-0	Hyd(-1.000)	104.299	250.00
2111	41'-8	Spr(-40.000)	40.000	177.09
2113	41'-8	Spr(-40.170)	40.170	177.46
2115	41'-8	Spr(-40.195)	40.195	177.52
2117	41'-10½	Spr(-40.011)	40.011	177.11
2119	41'-10½	Spr(-40.179)	40.179	177.48
2121	41'-10½	Spr(-40.207)	40.207	177.54
2123	41'-10½	Spr(-40.253)	40.253	177.65
2125	41'-10½	Spr(-40.418)	40.418	178.01
2127	41'-10½	Spr(-40.456)	40.456	178.09
2	-8'-0	E(24'-7)	66.901	
4	1'-9	P1	55.064	
5	1'-9	P2(-62.636)	117.700	
6	1'-9		117.700	
7	6'-8½		113.382	
8	1'-0		115.718	
9	-8'-0	T(43'-10)	117.548	
10	-8'-0	T(43'-10)	114.781	
11	-8'-0	T(47'-3½)	113.756	
12	-8'-0	T(43'-10)	108.041	
13	-8'-0	T(47'-3½)	108.362	
14	-8'-0	T(43'-10)	108.630	
15	-8'-0	T(47'-3½)	111.522	
16	-8'-0	T(43'-10)	112.046	
17	-8'-0	T(47'-3½)	114.426	
18	-8'-0	T(43'-10)	114.830	
19	-8'-0	T(43'-10)	115.773	
51	1'-0	Hyd	1.000	
53	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
124	1'-0		102.294	
200	40'-9	PO(18'-8½)	72.901	
202	40'-11½	PO(18'-8½)	72.835	
204	40'-11½	PO(18'-8½)	72.923	
206	40'-8	PO(18'-8½)	73.223	
208	40'-5	PO(18'-8½)	73.566	
210	40'-1½	PO(18'-8½)	73.952	
212	39'-10	PO(18'-8½)	74.384	
214	39'-7	PO(18'-8½)	74.863	
216	39'-3½	PO(18'-8½)	75.394	
218	39'-0	PO(18'-8½)	75.978	
220	38'-9½	FT(31'-5)	78.166	
222	1'-8½	PO(41'-1½)	101.991	
226	40'-10	PO(18'-8½)	62.585	
228	41'-0½	PO(18'-8½)	62.659	
230	41'-0½	PO(18'-8½)	63.253	
232	40'-9	PO(18'-8½)	64.634	
234	38'-5½	PO(18'-8½)	78.255	
236	38'-9	PO(18'-8½)	78.138	
238	40'-6	PO(18'-8½)	65.755	
240	40'-2½	PO(18'-8½)	66.656	
242	39'-11	PO(18'-8½)	67.367	
244	39'-8	PO(18'-8½)	67.918	
246	39'-4½	PO(18'-8½)	68.332	
248	39'-1	PO(18'-8½)	68.632	
252	38'-10	PO(18'-8½)	68.845	
260	38'-6½	PO(18'-8½)	68.990	



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 02

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream						Total Length	
Route 1							
BL	2.7050	85.31	4.76	120	0.018894	9'-0	Pf 0.170
2111	41'-8	177.09	28	40.000	Sprinkler	9'-0	Pe
2113	41'-8			40.170			Pv
BL	2.7050	262.77	14.67	120	0.151432	176'-1	Pf 32.334
2113	41'-8	177.46	28	40.170	Sprinkler,	37'-5	Pe 0.397
200	40'-9			72.901	2PO(18'-8½)	213'-6	Pv
CM	6.3570	262.77	2.66	120	0.002361	10'-0	Pf 0.024
200	40'-9			72.901		10'-0	Pe -0.090
202	40'-11½			72.835			Pv
CM	6.3570	525.21	5.31	120	0.008500	9'-11½	Pf 0.085
202	40'-11½	262.44		72.835	Flow (q) from Route 3	9'-11½	Pe 0.004
204	40'-11½			72.923			Pv
CM	6.3570	786.99	7.96	120	0.017962	10'-0	Pf 0.180
204	40'-11½	261.78		72.923	Flow (q) from Route 5	10'-0	Pe 0.120
206	40'-8			73.223			Pv
CM	6.3570	882.05	8.92	120	0.022181	10'-0	Pf 0.222
206	40'-8	95.06		73.223	Flow (q) from Route 2	10'-0	Pe 0.120
208	40'-5			73.566			Pv
CM	6.3570	972.33	9.83	120	0.026562	10'-0	Pf 0.266
208	40'-5	90.28		73.566	Flow (q) from Route 10	10'-0	Pe 0.120
210	40'-1½			73.952			Pv
CM	6.3570	1059.33	10.71	120	0.031126	10'-0	Pf 0.311
210	40'-1½	87.00		73.952	Flow (q) from Route 11	10'-0	Pe 0.120
212	39'-10			74.384			Pv
CM	6.3570	1144.50	11.57	120	0.035913	10'-0	Pf 0.359
212	39'-10	85.17		74.384	Flow (q) from Route 12	10'-0	Pe 0.120
214	39'-7			74.863			Pv
CM	6.3570	1229.20	12.43	120	0.040984	10'-0	Pf 0.410
214	39'-7	84.70		74.863	Flow (q) from Route 13	10'-0	Pe 0.120
216	39'-3½			75.394			Pv
CM	6.3570	1314.67	13.29	120	0.046411	10'-0	Pf 0.464
216	39'-3½	85.47		75.394	Flow (q) from Route 14	10'-0	Pe 0.120
218	39'-0			75.978			Pv
CM	6.3570	1400.92	14.16	120	0.052201	8'-6	Pf 2.085
218	39'-0	86.25		75.978	Flow (q) from Route 15	31'-5	Pe 0.102
220	38'-9½			78.166	fT(31'-5)	39'-11½	Pv
CM	6.3570	1597.96	16.15	120	0.066590	51'-0	Pf 7.750
220	38'-9½	197.04		78.166	Flow (q) from Route 9	65'-4½	Pe 16.075
222	1'-8½			101.991	fE(12'-7), 2f(-0.000), CV(40'-3), BV(12'-7)	116'-4½	Pv
DY	8.2490	1597.96	9.59	120	0.018723	0'-0	Pf 0.000
222	1'-8½			101.991		0'-0	Pe 0.303
124	1'-0			102.294			Pv
UG	7.6800	1597.96	11.07	150	0.017549	38'-9½	Pf 1.845
124	1'-0			102.294		66'-4½	Pe 3.902
12	-8'-0			108.041	E(22'-6½), T(43'-10)	105'-2	Pv
UG	7.6800	1092.13	7.56	150	0.008679	635'-11½	Pf 5.715
12	-8'-0			108.041		22'-6½	Pe
11	-8'-0			113.756	E(22'-6½)	658'-6	Pv
UG	7.6800	1092.13	7.56	150	0.008679	118'-2	Pf 1.025
11	-8'-0			113.756		118'-2	Pe
10	-8'-0			114.781			Pv
UG	7.6800	1092.13	7.56	150	0.008679	275'-0	Pf 2.767
10	-8'-0			114.781		43'-10	Pe
9	-8'-0			117.548	T(43'-10)	318'-9½	Pv
UG	7.6800	1847.96	12.80	150	0.022964	67'-8	Pf 2.071
9	-8'-0	755.83		117.548	Flow (q) from Route 7	22'-6½	Pe -3.902
8	1'-0			115.718	E(22'-6½)	90'-2½	Pv
FR	8.2490	1847.96	11.09	120	0.024500	5'-8½	Pf 0.140
8	1'-0			115.718		5'-8½	Pe -2.476
7	6'-8½			113.382			Pv
DY	10.3700	1847.96	7.02	120	0.008039	13'-10½	Pf 2.168
7	6'-8½			113.382		255'-9	Pe 2.151
6	1'-9			117.700	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: FP Overhead System 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	1847.96	11.85	120		0.028775	0'-0	Pf 0.000
6	1'-9			117.700				Pe 0.000
5	1'-9			117.700			0'-0	Pv
Pump								
5		1847.96		117.700		Rating: 60.000 @ 2000.00		
4		Q=1847.96	8.51	55.064		Fire Pump Churn Pressure: 84.00		
						0		
UG	9.4200	1847.96	8.51	150		0.008494	305'-9½	Pf 7.610
4	1'-9			55.064			137'-6	Pe 4.227
2	-8'-0			66.901		GV(5'-7), T(45'-10), 3E(24'-7), EE(12'-3½), BFP(-3.845)	443'-3½	Pv
UG	11.2000	1847.96	6.02	150		0.003656	750'-9	Pf 2.907
2	-8'-0			66.901			44'-3	Pe 1.517
1	-11'-6			71.325		EE(14'-4½), E(29'-10½), S	795'-0	Pv
		0.00				Hose Allowance At Source		
1		1847.96						
Route 2								
BL	2.7050	91.78	5.12	120		0.021631	9'-0	Pf 0.195
2111	41'-8	177.09	28	40.000		Sprinkler		Pe
2115	41'-8			40.195			9'-0	Pv
BL	2.7050	269.30	15.03	120		0.158464	101'-7	Pf 22.029
2115	41'-8	177.52	28	40.195		Sprinkler,	37'-5	Pe 0.361
226	40'-10			62.585		2PO(18'-8½)	139'-0	Pv
CM	4.3100	269.30	5.92	120		0.016394	10'-0	Pf 0.164
226	40'-10			62.585				Pe -0.090
228	41'-0½			62.659			10'-0	Pv
CM	4.3100	539.00	11.85	120		0.059182	9'-11½	Pf 0.590
228	41'-0½	269.70		62.659		Flow (q) from Route 4		Pe 0.004
230	41'-0½			63.253			9'-11½	Pv
CM	4.3100	810.97	17.83	120		0.126011	10'-0	Pf 1.261
230	41'-0½	271.97		63.253		Flow (q) from Route 6		Pe 0.120
232	40'-9			64.634			10'-0	Pv
RN	2.7050	95.06	5.31	120		0.023083	295'-8	Pf 8.553
232	40'-9			64.634		PO(18'-8½)	74'-10½	Pe 0.036
206	40'-8			73.223		3PO(18'-8½)	370'-6½	Pv
Route 3								
BL	2.7050	84.95	4.74	120		0.018749	9'-0	Pf 0.169
2117	41'-10½	177.11	28	40.011		Sprinkler		Pe
2119	41'-10½			40.179			9'-0	Pv
BL	2.7050	262.44	14.65	120		0.151075	176'-1	Pf 32.258
2119	41'-10½	177.48	28	40.179		Sprinkler,	37'-5	Pe 0.398
202	40'-11½			72.835		2PO(18'-8½)	213'-6	Pv
Route 4								
BL	2.7050	92.16	5.15	120		0.021797	9'-0	Pf 0.196
2117	41'-10½	177.11	28	40.011		Sprinkler		Pe
2121	41'-10½			40.207			9'-0	Pv
BL	2.7050	269.70	15.06	120		0.158905	101'-7	Pf 22.091
2121	41'-10½	177.54	28	40.207		Sprinkler,	37'-5	Pe 0.362
228	41'-0½			62.659		2PO(18'-8½)	139'-0	Pv
Route 5								
BL	2.7050	83.77	4.68	120		0.018269	9'-0	Pf 0.164
2123	41'-10½	177.65	28	40.253		Sprinkler		Pe
2125	41'-10½			40.418			9'-0	Pv
BL	2.7050	261.78	14.61	120		0.150377	176'-1	Pf 32.108
2125	41'-10½	178.01	28	40.418		Sprinkler,	37'-5	Pe 0.397
204	40'-11½			72.923		2PO(18'-8½)	213'-6	Pv
Route 6								
BL	2.7050	93.88	5.24	120		0.022554	9'-0	Pf 0.203
2123	41'-10½	177.65	28	40.253		Sprinkler		Pe
2127	41'-10½			40.456			9'-0	Pv
BL	2.7050	271.97	15.18	120		0.161386	101'-7	Pf 22.436
2127	41'-10½	178.09	28	40.456		Sprinkler,	37'-5	Pe 0.361
230	41'-0½			63.253		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		104.299		Hydrant,	74'-1	Pe 3.902
13	-8'-0			108.362		E(22'-1), GV(4'-8½), T(47'-3½)	93'-10½	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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	
UG	7.6800	755.83	5.23	150		0.004393	61'-1½"	Pf 0.268
13	-8'-0	505.83		108.362		Flow (q) from Route 8		Pe
14	-8'-0			108.630			61'-1½"	Pv
UG	7.6800	755.83	5.23	150		0.004393	635'-9"	Pf 2.892
14	-8'-0			108.630			22'-6½"	Pe
15	-8'-0			111.522		E(22'-6½")	658'-3½"	Pv
UG	7.6800	755.83	5.23	150		0.004393	119'-3"	Pf 0.524
15	-8'-0			111.522				Pe
16	-8'-0			112.046			119'-3"	Pv
UG	7.6800	755.83	5.23	150		0.004393	519'-3½"	Pf 2.380
16	-8'-0			112.046			22'-6½"	Pe
17	-8'-0			114.426		E(22'-6½")	541'-10"	Pv
UG	7.6800	755.83	5.23	150		0.004393	91'-11½"	Pf 0.404
17	-8'-0			114.426				Pe
18	-8'-0			114.830			91'-11½"	Pv
UG	7.6800	755.83	5.23	150		0.004393	214'-9"	Pf 0.943
18	-8'-0			114.830				Pe
19	-8'-0			115.773			214'-9"	Pv
UG	7.6800	755.83	5.23	150		0.004393	337'-8"	Pf 1.775
19	-8'-0			115.773			66'-4½"	Pe
9	-8'-0			117.548		E(22'-6½"), T(43'-10")	404'-0½"	Pv
Route 8								
UG	7.6800	505.83	3.50	150		0.002090	153'-8"	Pf 0.321
12	-8'-0	1092.13		108.041		Flow (q) from Route 1		Pe
13	-8'-0			108.362			153'-8"	Pv
Route 9								
CM	6.3570	97.83	0.99	120		0.000379	10'-0"	Pf 0.004
234	38'-5½"	97.83		78.255		Flow (q) from Route 17		Pe -0.120
236	38'-9"			78.138			10'-0"	Pv
CM	6.3570	197.04	1.99	120		0.001386	1'-6"	Pf 0.046
236	38'-9"	99.22		78.138		Flow (q) from Route 16	31'-5"	Pe -0.018
220	38'-9½"			78.166		fT(31'-5")	32'-11"	Pv
Route 10								
CM	4.3100	715.91	15.74	120		0.100055	10'-0"	Pf 1.001
232	40'-9"	95.06		64.634		Flow (q) from Route 2		Pe 0.120
238	40'-6"			65.755			10'-0"	Pv
RN	2.7050	90.28	5.04	120		0.020981	295'-8"	Pf 7.774
238	40'-6"			65.755		PO(18'-8½")	74'-10½"	Pe 0.036
208	40'-5"			73.566		3PO(18'-8½")	370'-6½"	Pv
Route 11								
CM	4.3100	625.63	13.76	120		0.077972	10'-0"	Pf 0.780
238	40'-6"	90.28		65.755		Flow (q) from Route 10		Pe 0.120
240	40'-2½"			66.656			10'-0"	Pv
RN	2.7050	87.00	4.86	120		0.019593	295'-8"	Pf 7.260
240	40'-2½"			66.656		PO(18'-8½")	74'-10½"	Pe 0.036
210	40'-1½"			73.952		3PO(18'-8½")	370'-6½"	Pv
Route 12								
CM	4.3100	538.63	11.84	120		0.059108	10'-0"	Pf 0.591
240	40'-2½"	87.00		66.656		Flow (q) from Route 11		Pe 0.120
242	39'-11"			67.367			10'-0"	Pv
RN	2.7050	85.17	4.75	120		0.018838	295'-8"	Pf 6.980
242	39'-11"			67.367		PO(18'-8½")	74'-10½"	Pe 0.036
212	39'-10"			74.384		3PO(18'-8½")	370'-6½"	Pv
Route 13								
CM	4.3100	453.46	9.97	120		0.042989	10'-0"	Pf 0.430
242	39'-11"	85.17		67.367		Flow (q) from Route 12		Pe 0.120
244	39'-8"			67.918			10'-0"	Pv
RN	2.7050	84.70	4.73	120		0.018646	295'-8"	Pf 6.909
244	39'-8"			67.918		PO(18'-8½")	74'-10½"	Pe 0.036
214	39'-7"			74.863		3PO(18'-8½")	370'-6½"	Pv
Route 14								
CM	4.3100	368.76	8.11	120		0.029325	10'-0"	Pf 0.293
244	39'-8"	84.70		67.918		Flow (q) from Route 13		Pe 0.120
246	39'-4½"			68.332			10'-0"	Pv
RN	2.7050	85.47	4.77	120		0.018961	295'-8"	Pf 7.026
246	39'-4½"			68.332		PO(18'-8½")	74'-10½"	Pe 0.036
216	39'-3½"			75.394		3PO(18'-8½")	370'-6½"	Pv
Route 15								



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 02

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	283.29	6.23	120	0.018005	10'-0	Pf 0.180
246	39'-4½	85.47		68.332	Flow (q) from Route 14		Pe 0.120
248	39'-1			68.632		10'-0	Pv
RN	2.7050	86.25	4.82	120	0.019282	295'-8	Pf 7.310
248	39'-1			68.632	PO(18'-8½)	83'-5½	Pe 0.036
218	39'-0			75.978	3PO(18'-8½), 2Tr(4'-3½)	379'-1½	Pv
Route 16							
CM	4.3100	197.04	4.33	120	0.009198	10'-0	Pf 0.092
248	39'-1	86.25		68.632	Flow (q) from Route 15		Pe 0.120
252	38'-10			68.845		10'-0	Pv
RN	2.7050	99.22	5.54	120	0.024984	295'-8	Pf 9.258
252	38'-10			68.845	PO(18'-8½)	74'-10½	Pe 0.036
236	38'-9			78.138	3PO(18'-8½)	370'-6½	Pv
Route 17							
CM	4.3100	97.83	2.15	120	0.002518	10'-0	Pf 0.025
252	38'-10	99.22		68.845	Flow (q) from Route 16		Pe 0.120
260	38'-6½			68.990		10'-0	Pv
RN	2.7050	97.83	5.46	120	0.024342	295'-8	Pf 9.229
260	38'-6½			68.990	PO(18'-8½)	83'-5½	Pe 0.036
234	38'-5½			78.255	3PO(18'-8½), 2Tr(4'-3½)	379'-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
Multipling Factor	0.713	1.16	1.33	1.51



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 02

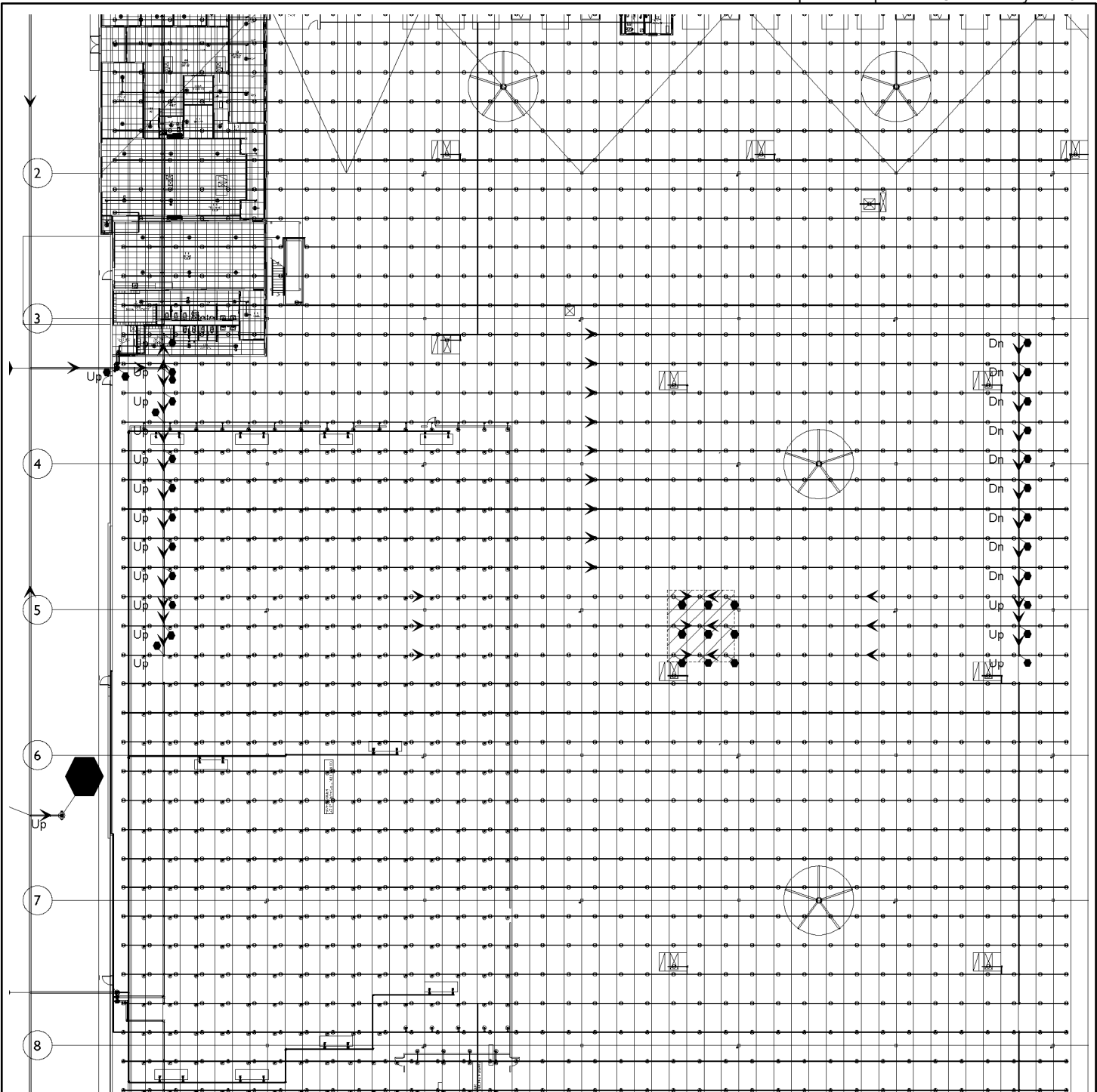
Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream					Fittings	Total Length	

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 SN Swing 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



Flow Diagram (Current View)

Job Number: 212189000
Report Description: FP Overhead System 02





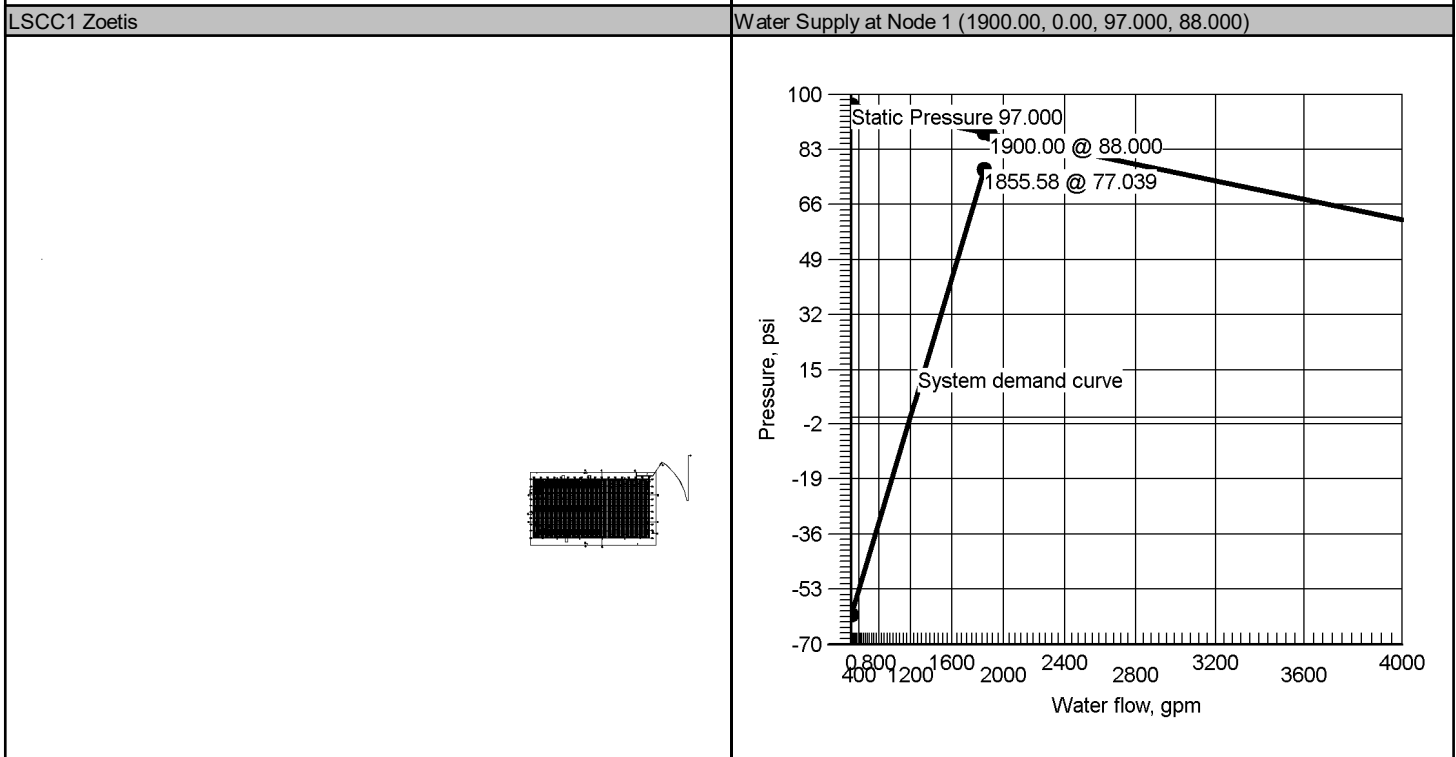
Hydraulic Overview

Job Number: 212189000
Report Description: FP Overhead System 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 28 K-Factor 177.09 at 40.000	Hose Streams 250.00
Coverage Per Sprinkler 100 ft²	Number Of Sprinklers Calculated 9 0
System Pressure Demand 77.039	System Flow Demand 1855.58
Total Demand 1855.58 @ 77.039	Pressure Result +11.346 (12.8%)

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 (461)	0.000	0	0.00
5	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									





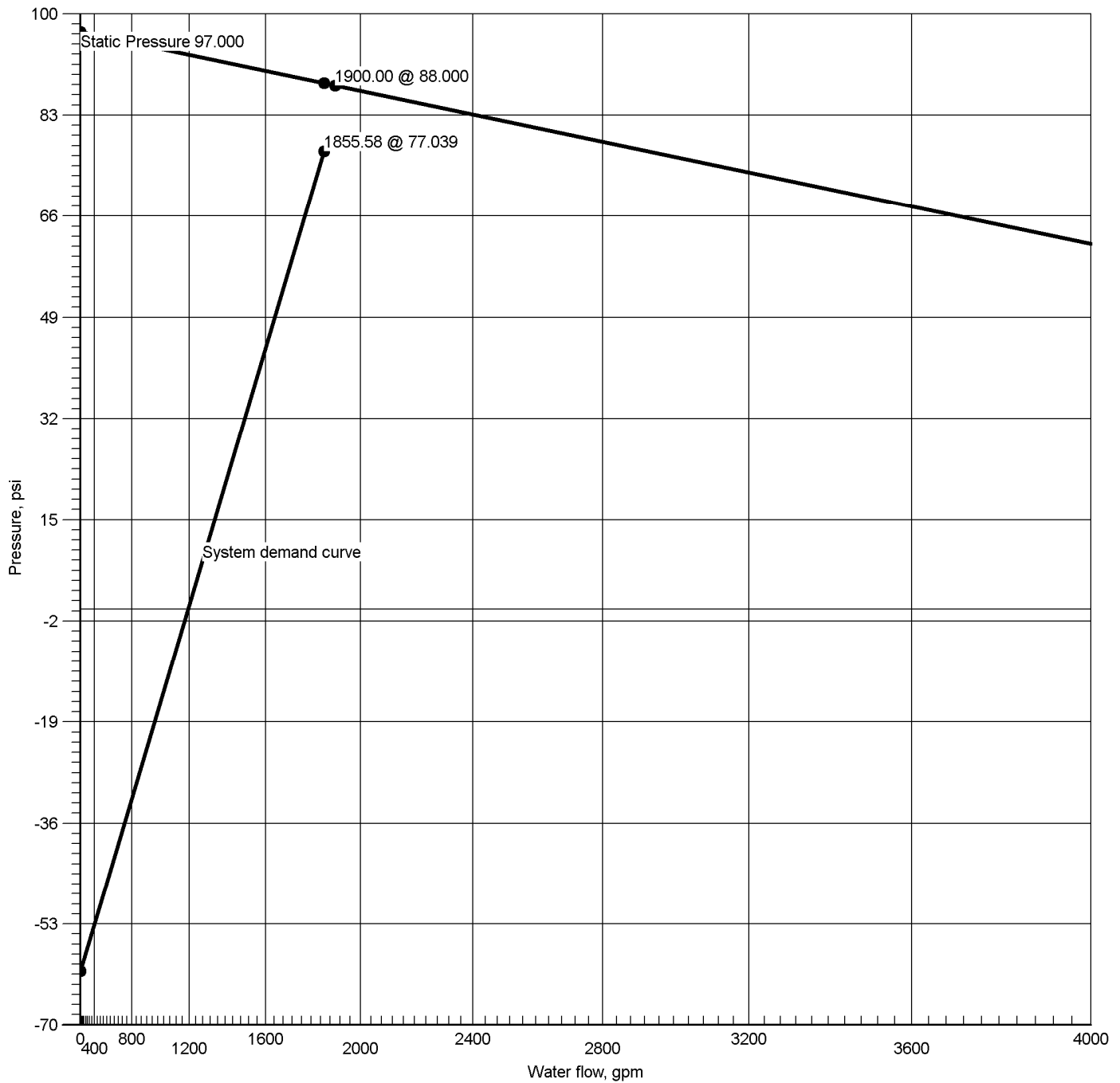
Hydraulic Summary

Job Number: 212189000
Report Description: FP Overhead System 03

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 28 K-Factor 177.09 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 9				
				Number Of Nozzles Calculated 0			Coverage Per Sprinkler 100 ft²				
				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 76.899 Right: 76.762							
Total Hose Streams 250.00											
System Flow Demand 1855.58			Total Water Required (Including Hose Allowance) 1855.58								
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 18.30 between nodes 332 and 330											
Maximum Velocity Under Ground 12.85 between nodes 8 and 9											
Volume capacity of Wet Pipes 32132.49 gal			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	88.385		1855.58	77.039	11.346
5	Pump		84.000	60.000		2000.00	134.574		1855.58	123.228	11.346
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

88.385 @ 1855.58

Required Pressure at System Demand

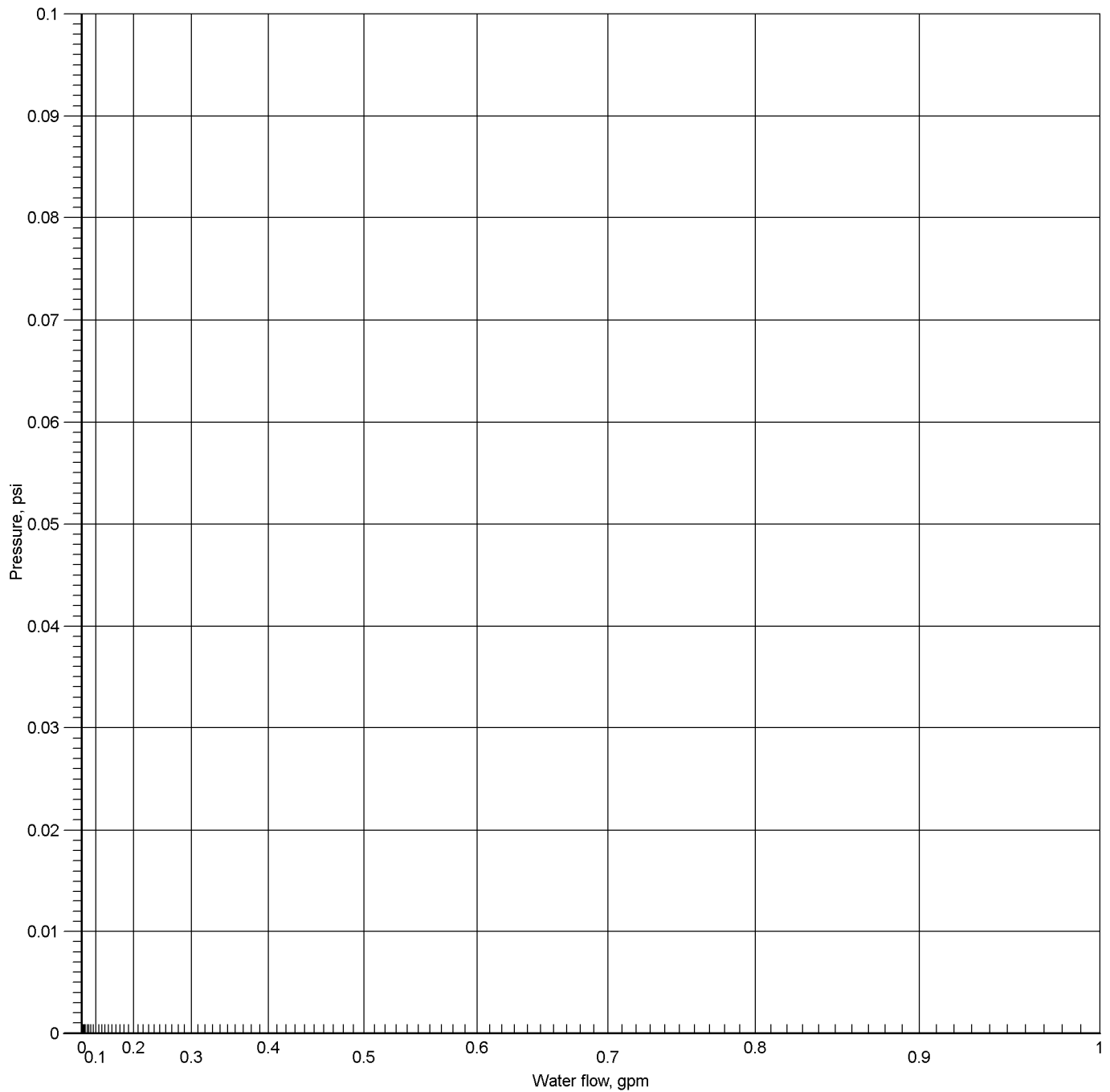
77.039 @ 1855.58

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

77.039 @ 1855.58



Pump Inlet at Node 461



Hydraulic Graph

Pump Inlet at Node 461

Static: Pressure

0.000

Residual: Pressure

N/A

Available Pressure at System Demand

N/A

Required Pressure at System Demand

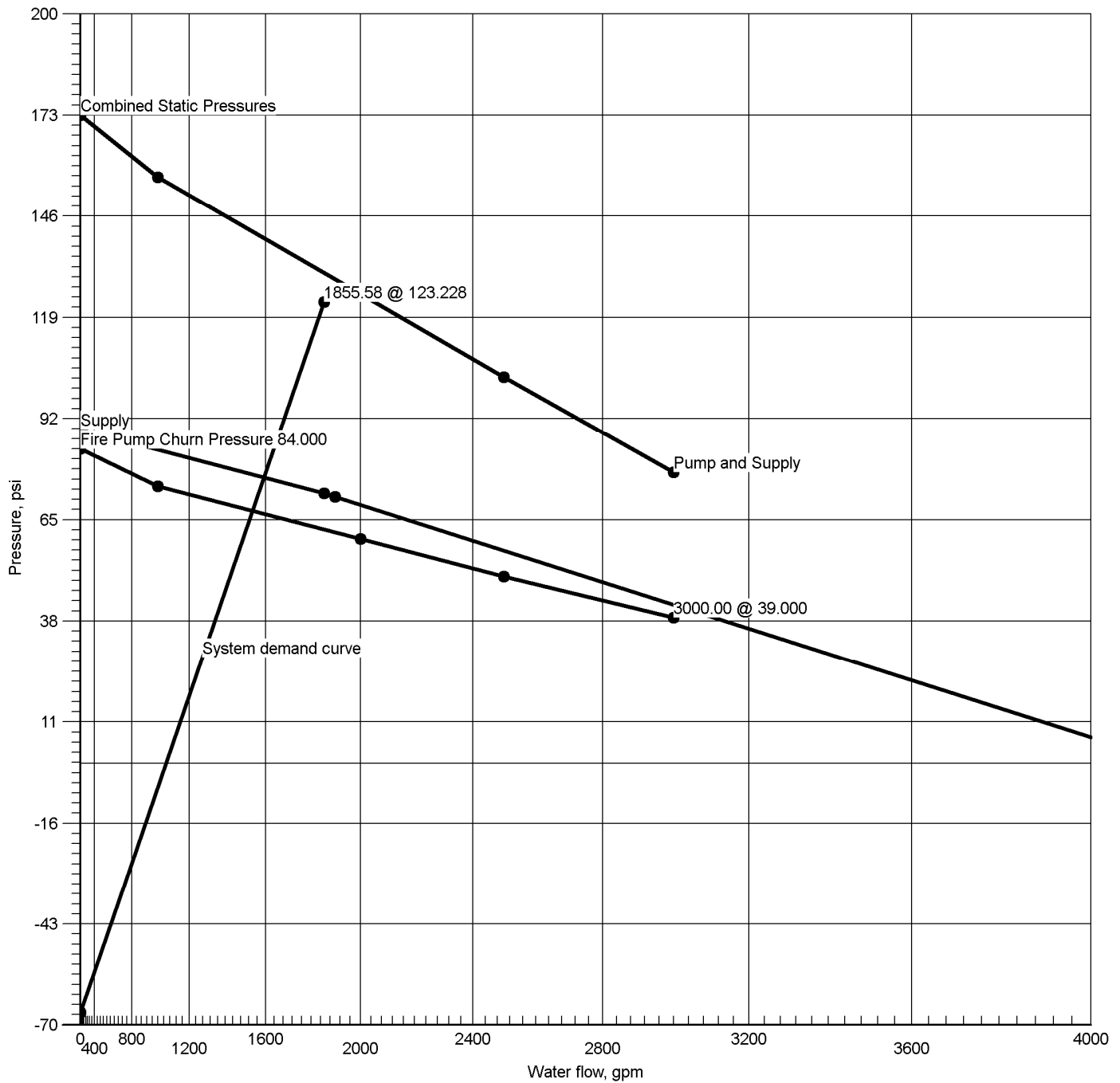
0.000 @ 0.00

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

N/A



Pump at Node 5



Hydraulic Graph

Static + Churn Pressure

Fire Pump Rating

Pump at Node 5

173.256

60.000 @ 2000.00

Static: Pressure

Fire Pump Churn Pressure

173.256

84.000

Residual: Pressure

62.508 @ 1855.58

Available Pressure at System Demand

134.574 @ 1855.58

Required Pressure at System Demand

123.228 @ 1855.58



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: FP Overhead System 03

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Hydrant	54	250.00	250.00	250	109.046			
⇒ Sprinkler	3111	177.09	177.09	28	40.000			
Sprinkler	3113	177.42	177.09	28	40.151			
Sprinkler	3115	177.56	177.09	28	40.216			
Sprinkler	3117	178.30	177.09	28	40.550			
Sprinkler	3119	178.63	177.09	28	40.700			
Sprinkler	3121	178.79	177.09	28	40.772			
Sprinkler	3123	178.99	177.09	28	40.864			
Sprinkler	3125	179.31	177.09	28	41.009			
Sprinkler	3127	179.49	177.09	28	41.094			

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: FP Overhead System 03

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	77.039	1855.58
54	1'-0	Hyd(-1.000)	109.046	250.00
3111	41'-5½	Spr(-40.000)	40.000	177.09
3113	41'-5½	Spr(-40.151)	40.151	177.42
3115	41'-5½	Spr(-40.216)	40.216	177.56
3117	41'-3	Spr(-40.550)	40.550	178.30
3119	41'-3	Spr(-40.700)	40.700	178.63
3121	41'-3	Spr(-40.772)	40.772	178.79
3123	41'-0½	Spr(-40.864)	40.864	178.99
3125	41'-0½	Spr(-41.009)	41.009	179.31
3127	41'-0½	Spr(-41.094)	41.094	179.49
2	-8'-0	E(24'-7)	72.593	
4	1'-9	P1	60.720	
5	1'-9	P2(-62.508)	123.228	
6	1'-9		123.228	
7	6'-8½		118.893	
8	1'-0		121.228	
9	-8'-0	T(43'-10)	123.042	
10	-8'-0	T(43'-10)	120.507	
11	-8'-0	T(47'-3½)	119.567	
12	-8'-0	T(43'-10)	114.331	
13	-8'-0	T(47'-3½)	113.109	
14	-8'-0	T(43'-10)	112.816	
15	-8'-0	T(47'-3½)	116.132	
16	-8'-0	T(43'-10)	116.733	
17	-8'-0	T(47'-3½)	119.462	
18	-8'-0	T(43'-10)	119.925	
19	-8'-0	T(43'-10)	121.007	
51	1'-0	Hyd	1.000	
53	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
300	40'-6½	PO(18'-8½)	73.622	
302	40'-4	PO(18'-8½)	73.735	
304	40'-1½	PO(18'-8½)	73.907	
306	39'-11	PO(18'-8½)	74.172	
308	39'-8½	PO(18'-8½)	74.479	
310	39'-6	PO(18'-8½)	74.831	
312	39'-3½	PO(18'-8½)	75.231	
314	39'-1	PO(18'-8½)	75.680	
316	38'-10½	PO(18'-8½)	76.181	
318	38'-8	PO(18'-8½)	76.738	
320	38'-5½	PO(18'-8½)	77.356	
322	38'-3½	FT(31'-5)	79.752	
324	1'-8½	PO(37'-8½)	105.945	
326	40'-7½	PO(18'-8½)	62.644	
328	40'-5	PO(18'-8½)	62.904	
330	40'-2½	PO(18'-8½)	63.613	
332	40'-0	PO(18'-8½)	65.026	
334	39'-9½	PO(18'-8½)	66.164	
336	39'-7	PO(18'-8½)	67.068	
338	39'-4½	PO(18'-8½)	67.774	
340	39'-2	PO(18'-8½)	68.310	
342	38'-11½	PO(18'-8½)	68.703	
344	38'-9	PO(18'-8½)	68.977	
346	38'-6½	PO(18'-8½)	69.159	
348	38'-4	PO(18'-8½)	69.278	
350	38'-3	PO(18'-8½)	79.757	
428	1'-0		107.053	



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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	80.04	4.47	120		0.016792	9'-0	Pf 0.151
3111	41'-5½	177.09	28	40.000		Sprinkler		Pe
3113	41'-5½			40.151			9'-0	Pv
BL	2.7050	257.46	14.37	120		0.145819	185'-1	Pf 33.073
3113	41'-5½	177.42	28	40.151		Sprinkler,	41'-8½	Pe 0.397
300	40'-6½			73.622		Tr(4'-3½), 2PO(18'-8½)	226'-9½	Pv
CM	6.3570	257.46	2.60	120		0.002273	10'-0	Pf 0.023
300	40'-6½			73.622				Pe 0.090
302	40'-4			73.735			10'-0	Pv
CM	6.3570	515.74	5.21	120		0.008219	10'-0	Pf 0.082
302	40'-4	258.28		73.735		Flow (q) from Route 3		Pe 0.090
304	40'-1½			73.907			10'-0	Pv
CM	6.3570	773.43	7.82	120		0.017394	10'-0	Pf 0.174
304	40'-1½	257.69		73.907		Flow (q) from Route 5		Pe 0.090
306	39'-11			74.172			10'-0	Pv
CM	6.3570	871.78	8.81	120		0.021705	10'-0	Pf 0.217
306	39'-11	98.35		74.172		Flow (q) from Route 2		Pe 0.090
308	39'-8½			74.479			10'-0	Pv
CM	6.3570	965.18	9.76	120		0.026203	10'-0	Pf 0.262
308	39'-8½	93.40		74.479		Flow (q) from Route 10		Pe 0.090
310	39'-6			74.831			10'-0	Pv
CM	6.3570	1055.17	10.67	120		0.030900	10'-0	Pf 0.309
310	39'-6	89.98		74.831		Flow (q) from Route 11		Pe 0.090
312	39'-3½			75.231			10'-0	Pv
CM	6.3570	1143.20	11.56	120		0.035838	10'-0	Pf 0.358
312	39'-3½	88.04		75.231		Flow (q) from Route 12		Pe 0.090
314	39'-1			75.680			10'-0	Pv
CM	6.3570	1230.68	12.44	120		0.041075	10'-0	Pf 0.411
314	39'-1	87.47		75.680		Flow (q) from Route 13		Pe 0.090
316	38'-10½			76.181			10'-0	Pv
CM	6.3570	1318.85	13.33	120		0.046685	10'-0	Pf 0.467
316	38'-10½	88.17		76.181		Flow (q) from Route 14		Pe 0.090
318	38'-8			76.738			10'-0	Pv
CM	6.3570	1408.81	14.24	120		0.052747	10'-0	Pf 0.528
318	38'-8	89.97		76.738		Flow (q) from Route 15		Pe 0.090
320	38'-5½			77.356			10'-0	Pv
CM	6.3570	1500.35	15.17	120		0.059261	7'-10	Pf 2.326
320	38'-5½	91.54		77.356		Flow (q) from Route 16	31'-5	Pe 0.071
322	38'-3½			79.752		fT(31'-5)	39'-3	Pv
CM	6.3570	1605.58	16.23	120		0.067179	50'-6½	Pf 10.323
322	38'-3½	105.23		79.752		Flow (q) from Route 17	103'-1	Pe 15.871
324	1'-8½			105.945		fE(12'-7), 2f(-0.000), CV(40'-3), BV(12'-7), PO(37'-8½)	153'-8	Pv
CM	8.2490	1605.58	9.64	120		0.018889	1'-6	Pf 0.805
324	1'-8½			105.945			41'-1½	Pe 0.303
428	1'-0			107.053		PO(41'-1½)	42'-7½	Pv
UG	7.6800	1605.58	11.12	150		0.017704	38'-9½	Pf 1.862
428	1'-0			107.053			66'-4½	Pe 3.902
14	-8'-0			112.816		E(22'-6½), T(43'-10)	105'-2	Pv
UG	7.6800	791.71	5.48	150		0.004786	61'-1½	Pf 0.292
14	-8'-0			112.816				Pe
13	-8'-0			113.109			61'-1½	Pv
UG	7.6800	1041.71	7.21	150		0.007952	153'-8	Pf 1.222
13	-8'-0	250.00		113.109		Flow (q) from Route 7		Pe
12	-8'-0			114.331			153'-8	Pv
UG	7.6800	1041.71	7.21	150		0.007952	635'-11½	Pf 5.237
12	-8'-0			114.331			22'-6½	Pe
11	-8'-0			119.567		E(22'-6½)	658'-6	Pv
UG	7.6800	1041.71	7.21	150		0.007952	118'-2	Pf 0.940
11	-8'-0			119.567				Pe
10	-8'-0			120.507			118'-2	Pv
UG	7.6800	1041.71	7.21	150		0.007952	275'-0	Pf 2.535
10	-8'-0			120.507			43'-10	Pe
9	-8'-0			123.042		T(43'-10)	318'-9½	Pv
UG	7.6800	1855.58	12.85	150		0.023139	67'-8	Pf 2.087
9	-8'-0	813.87		123.042		Flow (q) from Route 8	22'-6½	Pe -3.902
8	1'-0			121.228		E(22'-6½)	90'-2½	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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	1855.58	11.14	120		0.024687	5'-8½"	Pf 0.141
8	1'-0			121.228				Pe -2.476
7	6'-8½"			118.893			5'-8½"	Pv
DY	10.3700	1855.58	7.05	120		0.008100	13'-10½"	Pf 2.184
7	6'-8½"			118.893			255'-9"	Pe 2.151
6	1'-9			123.228		4E(26'-0), T(48'-5½"), BV(21'-3½"), Tr(17'-0), CV(65'-0)	269'-8"	Pv
DY	7.9810	1855.58	11.90	120		0.028995	0'-0	Pf 0.000
6	1'-9			123.228				Pe 0.000
5	1'-9			123.228			0'-0	Pv
Pump		Velocity						
5		1855.58		123.228		Rating: 60.000 @ 2000.00		
4		Q=1855.58	8.54	60.720		Fire Pump Churn Pressure: 84.000		
UG	9.4200	1855.58	8.54	150		0.008559	305'-9½"	Pf 7.646
4	1'-9			60.720			137'-6"	Pe 4.227
2	-8'-0			72.593		GV(5'-7), T(45'-10), 3E(24'-7), EE(12'-3½"), BFP(-3.852)	443'-3½"	Pv
UG	11.2000	1855.58	6.04	150		0.003684	750'-9"	Pf 2.929
2	-8'-0			72.593			44'-3"	Pe 1.517
1	-11'-6			77.039		EE(14'-4½"), E(29'-10½"), S	795'-0"	Pv
		0.00				Hose Allowance At Source		
1		1855.58						
Route 2								
BL	2.7050	97.05	5.42	120		0.023984	9'-0	Pf 0.216
3111	41'-5½"	177.09	28	40.000		Sprinkler		Pe
3115	41'-5½"			40.216			9'-0	Pv
BL	2.7050	274.61	15.33	120		0.164299	92'-7"	Pf 22.067
3115	41'-5½"	177.56	28	40.216		Sprinkler,	41'-8½"	Pe 0.361
326	40'-7½"			62.644		Tr(4'-3½"), 2PO(18'-8½")	134'-3½"	Pv
CM	4.3100	274.61	6.04	120		0.016997	10'-0	Pf 0.170
326	40'-7½"			62.644				Pe 0.090
328	40'-5			62.904			10'-0	Pv
CM	4.3100	552.06	12.14	120		0.061861	10'-0	Pf 0.619
328	40'-5	277.44		62.904		Flow (q) from Route 4		Pe 0.090
330	40'-2½"			63.613			10'-0	Pv
CM	4.3100	832.16	18.30	120		0.132168	10'-0	Pf 1.322
330	40'-2½"	280.10		63.613		Flow (q) from Route 6		Pe 0.090
332	40'-0			65.026			10'-0	Pv
RN	2.7050	98.35	5.49	120		0.024585	295'-8"	Pf 9.110
332	40'-0			65.026		PO(18'-8½")	74'-10½"	Pe 0.036
306	39'-11			74.172		3PO(18'-8½")	370'-6½"	Pv
Route 3								
BL	2.7050	79.65	4.45	120		0.016640	9'-0	Pf 0.150
3117	41'-3	178.30	28	40.550		Sprinkler		Pe
3119	41'-3			40.700			9'-0	Pv
BL	2.7050	258.28	14.42	120		0.146675	185'-1"	Pf 32.638
3119	41'-3	178.63	28	40.700		Sprinkler,	37'-5"	Pe 0.397
302	40'-4			73.735		2PO(18'-8½")	222'-6"	Pv
Route 4								
BL	2.7050	98.65	5.51	120		0.024723	9'-0	Pf 0.223
3117	41'-3	178.30	28	40.550		Sprinkler		Pe
3121	41'-3			40.772			9'-0	Pv
BL	2.7050	277.44	15.49	120		0.167444	92'-7"	Pf 21.771
3121	41'-3	178.79	28	40.772		Sprinkler,	37'-5"	Pe 0.361
328	40'-5			62.904		2PO(18'-8½")	130'-0"	Pv
Route 5								
BL	2.7050	78.38	4.38	120		0.016155	9'-0	Pf 0.145
3123	41'-0½"	178.99	28	40.864		Sprinkler		Pe
3125	41'-0½"			41.009			9'-0	Pv
BL	2.7050	257.69	14.39	120		0.146060	185'-1"	Pf 32.501
3125	41'-0½"	179.31	28	41.009		Sprinkler,	37'-5"	Pe 0.397
304	40'-1½"			73.907		2PO(18'-8½")	222'-6"	Pv
Route 6								
BL	2.7050	100.61	5.62	120		0.025636	9'-0	Pf 0.231
3123	41'-0½"	178.99	28	40.864		Sprinkler		Pe
3127	41'-0½"			41.094			9'-0	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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	
BL	2.7050	280.10	15.64	120		0.170422	92'-7"	Pf 22.158
3127	41'-0½"	179.49	28	41.094		Sprinkler,	37'-5"	Pe 0.361
330	40'-2½"			63.613		2PO(18'-8½")	130'-0"	Pv
Route 7								
UG	6.2800	250.00	2.59	140		0.001718	19'-10"	Pf 0.161
54	1'-0"	250.00		109.046		Hydrant,	74'-1"	Pe 3.902
13	-8'-0"			113.109		E(22'-1), GV(4'-8½"), T(47'-3½")	93'-10½"	Pv
Route 8								
UG	7.6800	813.87	5.64	150		0.005037	119'-3"	Pf 0.601
15	-8'-0"	813.87		116.132		Flow (q) from Route 9		Pe
16	-8'-0"			116.733			119'-3"	Pv
UG	7.6800	813.87	5.64	150		0.005037	519'-3½"	Pf 2.729
16	-8'-0"			116.733			22'-6½"	Pe
17	-8'-0"			119.462		E(22'-6½")	541'-10"	Pv
UG	7.6800	813.87	5.64	150		0.005037	91'-11½"	Pf 0.463
17	-8'-0"			119.462				Pe
18	-8'-0"			119.925			91'-11½"	Pv
UG	7.6800	813.87	5.64	150		0.005037	214'-9"	Pf 1.082
18	-8'-0"			119.925				Pe
19	-8'-0"			121.007			214'-9"	Pv
UG	7.6800	813.87	5.64	150		0.005037	337'-8"	Pf 2.035
19	-8'-0"			121.007			66'-4½"	Pe
9	-8'-0"			123.042		E(22'-6½"), T(43'-10")	404'-0½"	Pv
Route 9								
UG	7.6800	813.87	5.64	150		0.005037	635'-9"	Pf 3.316
14	-8'-0"	791.71		112.816		Flow (q) from Route 1	22'-6½"	Pe
15	-8'-0"			116.132		E(22'-6½")	658'-3½"	Pv
Route 10								
CM	4.3100	733.80	16.14	120		0.104729	10'-0"	Pf 1.048
332	40'-0"	98.35		65.026		Flow (q) from Route 2		Pe 0.090
334	39'-9½"			66.164			10'-0"	Pv
RN	2.7050	93.40	5.21	120		0.022344	295'-8"	Pf 8.279
334	39'-9½"			66.164		PO(18'-8½")	74'-10½"	Pe 0.036
308	39'-8½"			74.479		3PO(18'-8½")	370'-6½"	Pv
Route 11								
CM	4.3100	640.40	14.08	120		0.081411	10'-0"	Pf 0.814
334	39'-9½"	93.40		66.164		Flow (q) from Route 10		Pe 0.090
336	39'-7"			67.068			10'-0"	Pv
RN	2.7050	89.98	5.02	120		0.020854	295'-8"	Pf 7.727
336	39'-7"			67.068		PO(18'-8½")	74'-10½"	Pe 0.036
310	39'-6"			74.831		3PO(18'-8½")	370'-6½"	Pv
Route 12								
CM	4.3100	550.42	12.10	120		0.061522	10'-0"	Pf 0.615
336	39'-7"	89.98		67.068		Flow (q) from Route 11		Pe 0.090
338	39'-4½"			67.774			10'-0"	Pv
RN	2.7050	88.04	4.91	120		0.020027	295'-8"	Pf 7.421
338	39'-4½"			67.774		PO(18'-8½")	74'-10½"	Pe 0.036
312	39'-3½"			75.231		3PO(18'-8½")	370'-6½"	Pv
Route 13								
CM	4.3100	462.38	10.17	120		0.044565	10'-0"	Pf 0.446
338	39'-4½"	88.04		67.774		Flow (q) from Route 12		Pe 0.090
340	39'-2"			68.310			10'-0"	Pv
RN	2.7050	87.47	4.88	120		0.019791	295'-8"	Pf 7.333
340	39'-2"			68.310		PO(18'-8½")	74'-10½"	Pe 0.036
314	39'-1"			75.680		3PO(18'-8½")	370'-6½"	Pv
Route 14								
CM	4.3100	374.91	8.24	120		0.030235	10'-0"	Pf 0.302
340	39'-2"	87.47		68.310		Flow (q) from Route 13		Pe 0.090
342	38'-11½"			68.703			10'-0"	Pv
RN	2.7050	88.17	4.92	120		0.020084	295'-8"	Pf 7.442
342	38'-11½"			68.703		PO(18'-8½")	74'-10½"	Pe 0.036
316	38'-10½"			76.181		3PO(18'-8½")	370'-6½"	Pv
Route 15								
CM	4.3100	286.74	6.31	120		0.018411	10'-0"	Pf 0.184
342	38'-11½"	88.17		68.703		Flow (q) from Route 14		Pe 0.090
344	38'-9"			68.977			10'-0"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 03

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream					Fittings	Total Length	
RN	2.7050	89.97	5.02	120	0.020847	295'-8"	Pf 7.725
344	38'-9"			68.977	PO(18'-8½")	74'-10½"	Pe 0.036
318	38'-8"			76.738	3PO(18'-8½")	370'-6½"	Pv
Route 16							
CM	4.3100	196.77	4.33	120	0.009174	10'-0"	Pf 0.092
344	38'-9"	89.97		68.977	Flow (q) from Route 15		Pe 0.090
346	38'-6½"			69.159		10'-0"	Pv
RN	2.7050	91.54	5.11	120	0.021525	295'-8"	Pf 8.161
346	38'-6½"			69.159	PO(18'-8½")	83'-5½"	Pe 0.036
320	38'-5½"			77.356	3PO(18'-8½"), 2Tr(4'-3½")	379'-1½"	Pv
Route 17							
CM	4.3100	105.23	2.31	120	0.002882	10'-0"	Pf 0.029
346	38'-6½"	91.54		69.159	Flow (q) from Route 16		Pe 0.090
348	38'-4"			69.278		10'-0"	Pv
RN	2.7050	105.23	5.87	120	0.027860	295'-8"	Pf 10.443
348	38'-4"			69.278	PO(18'-8½")	79'-2"	Pe 0.036
350	38'-3"			79.757	3PO(18'-8½"), Tr(4'-3½")	374'-10"	Pv
CM	6.3570	105.23	1.06	120	0.000434	2'-2"	Pf 0.015
350	38'-3"			79.757		31'-5"	Pe -0.020
322	38'-3½"			79.752	fT(31'-5")	33'-7½"	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: FP Overhead System 03

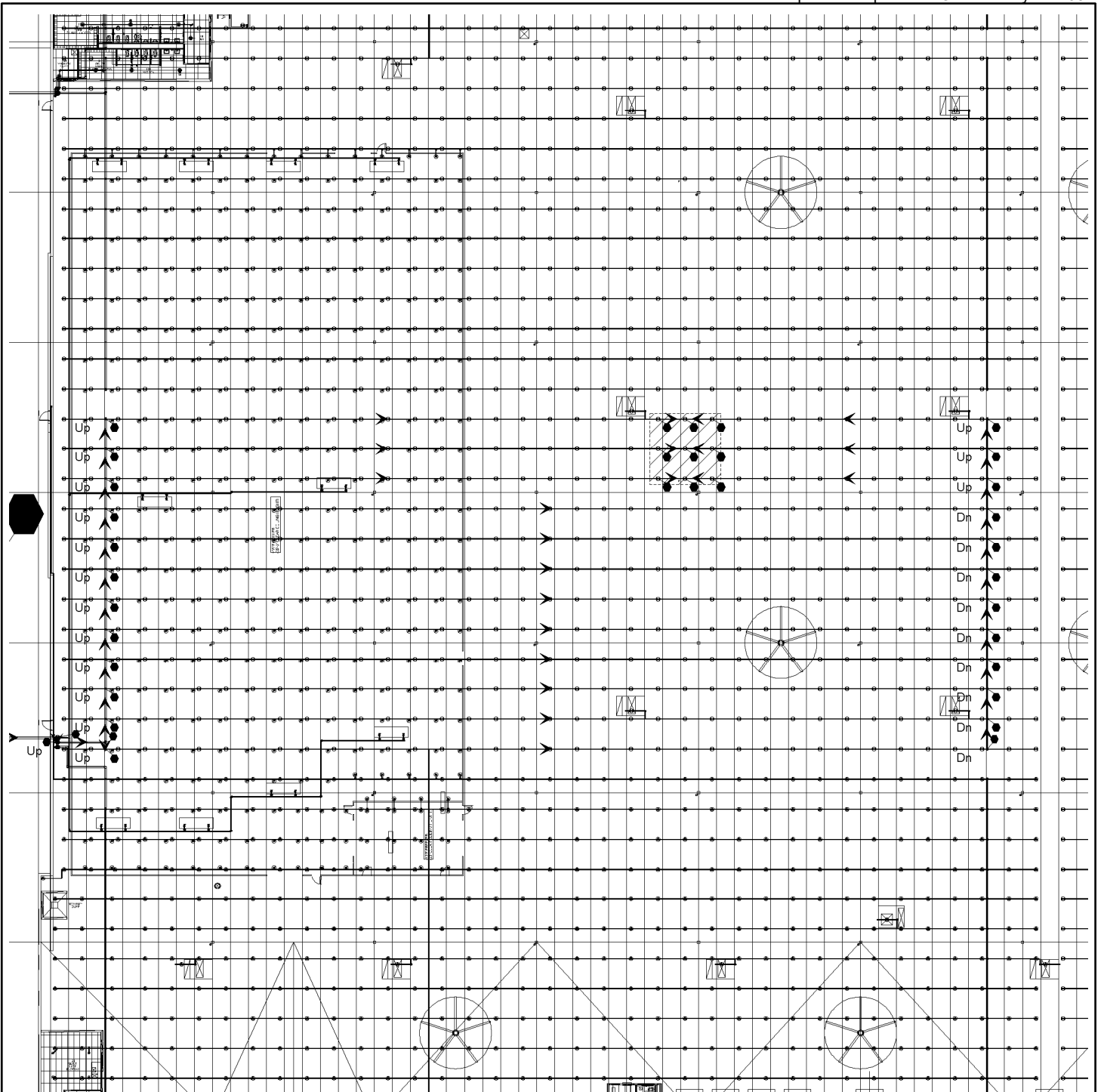
Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream					Fittings	Total Length	

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 SN Swing 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



Flow Diagram (Current View)

Job Number: 212189000
Report Description: FP Overhead System 03





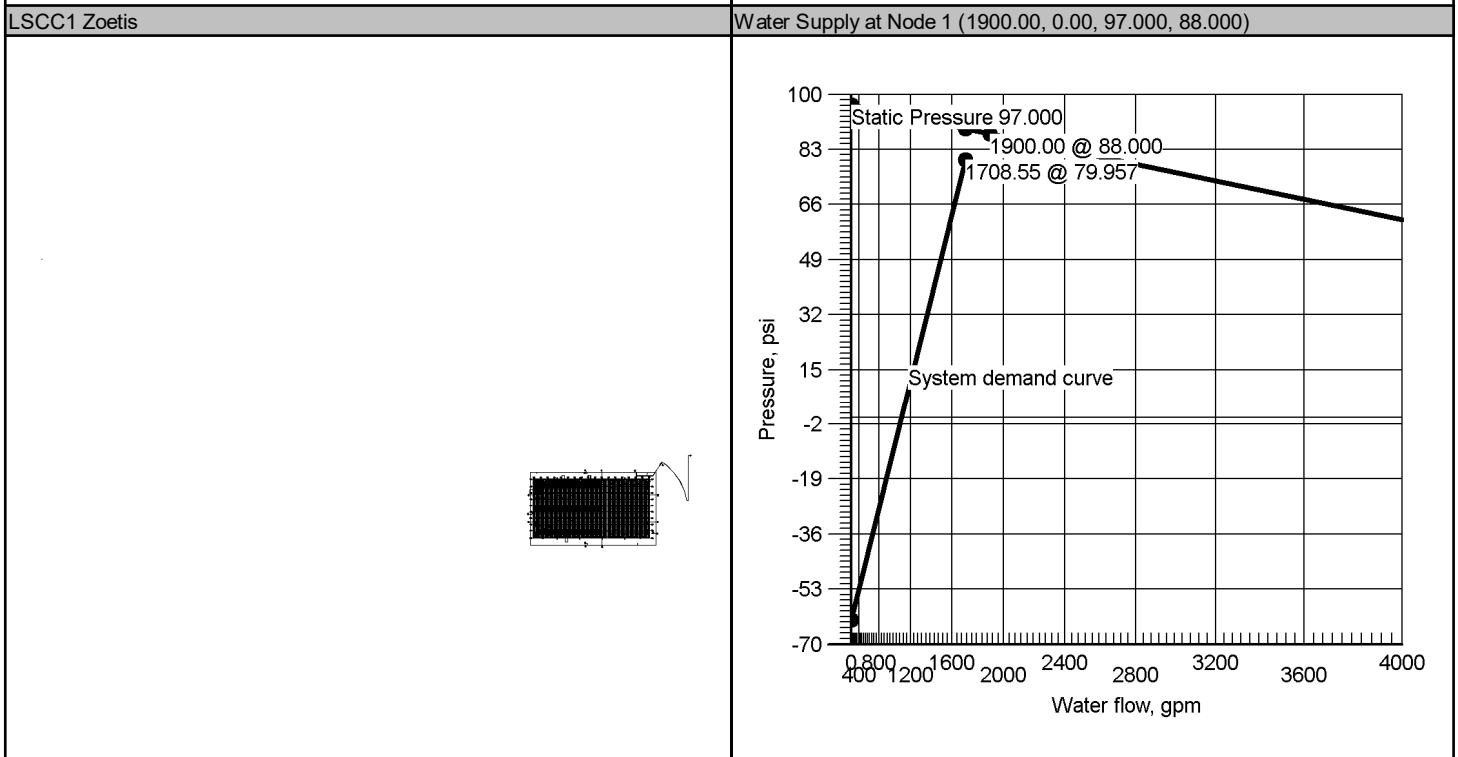
Hydraulic Overview

Job Number: 212189000
Report Description: FP Overhead System 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 100 ft²	Number Of Sprinklers Calculated 12 0
System Pressure Demand 79.957	System Flow Demand 1708.55
Total Demand 1708.55 @ 79.957	Pressure Result +9.649 (10.8%)

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 (461)	0.000	0	0.00
5	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									





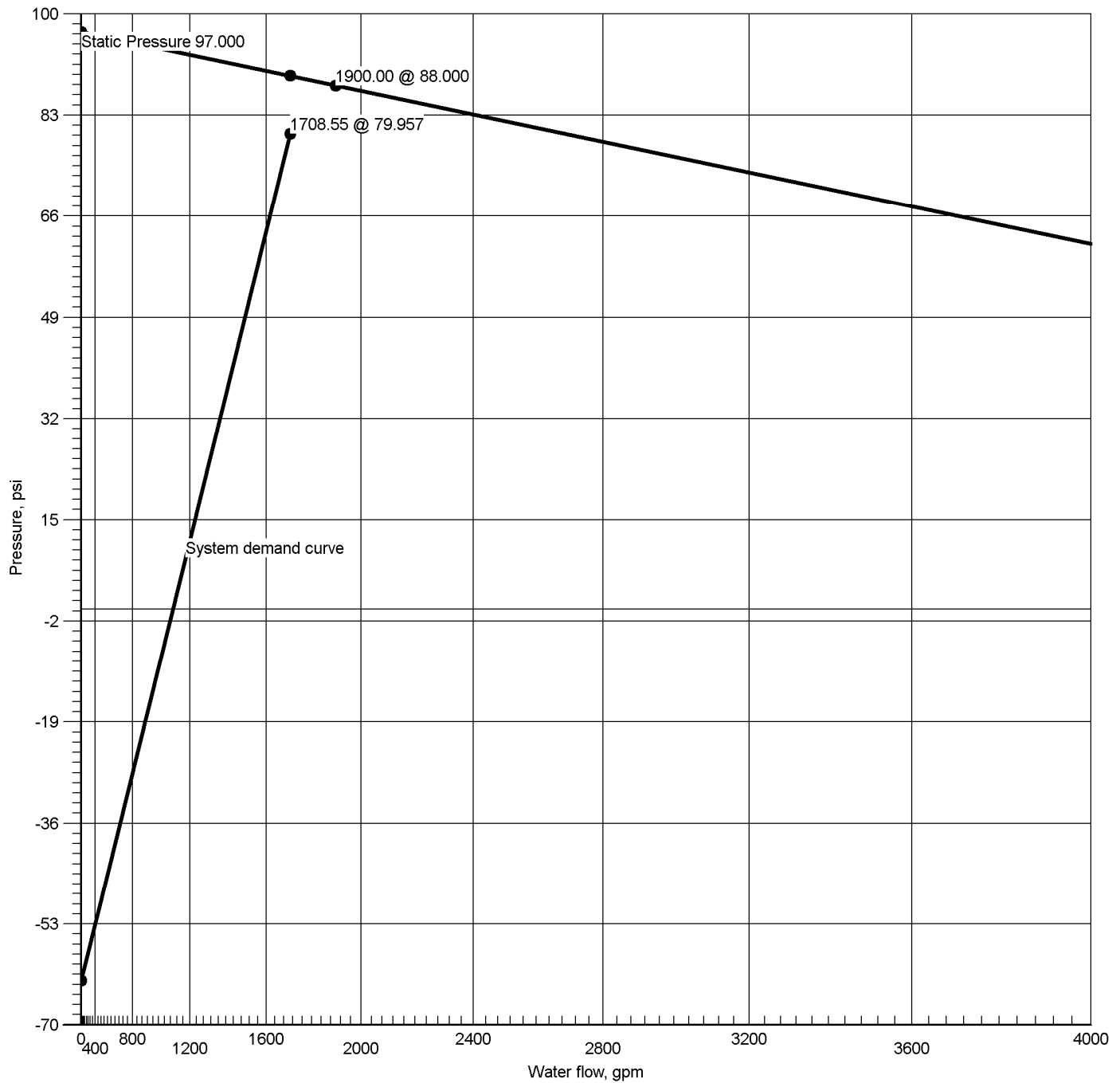
Job Number: 212189000

Report Description: FP Overhead System 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 NodeFlow(gpm) Hydrant At Node 54250.00					Number Of Sprinklers Calculated 12		Number Of Nozzles Calculated 0		Coverage Per Sprinkler 100 ft²		
					AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 79.895Right: 79.951						
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 11.83 between nodes 8 and 9											
Volume capacity of Wet Pipes 32132.49 gal			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	79.957	9.649
5	Pump		84.000	60.000		2000.00	139.325		1708.55	129.676	9.649
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

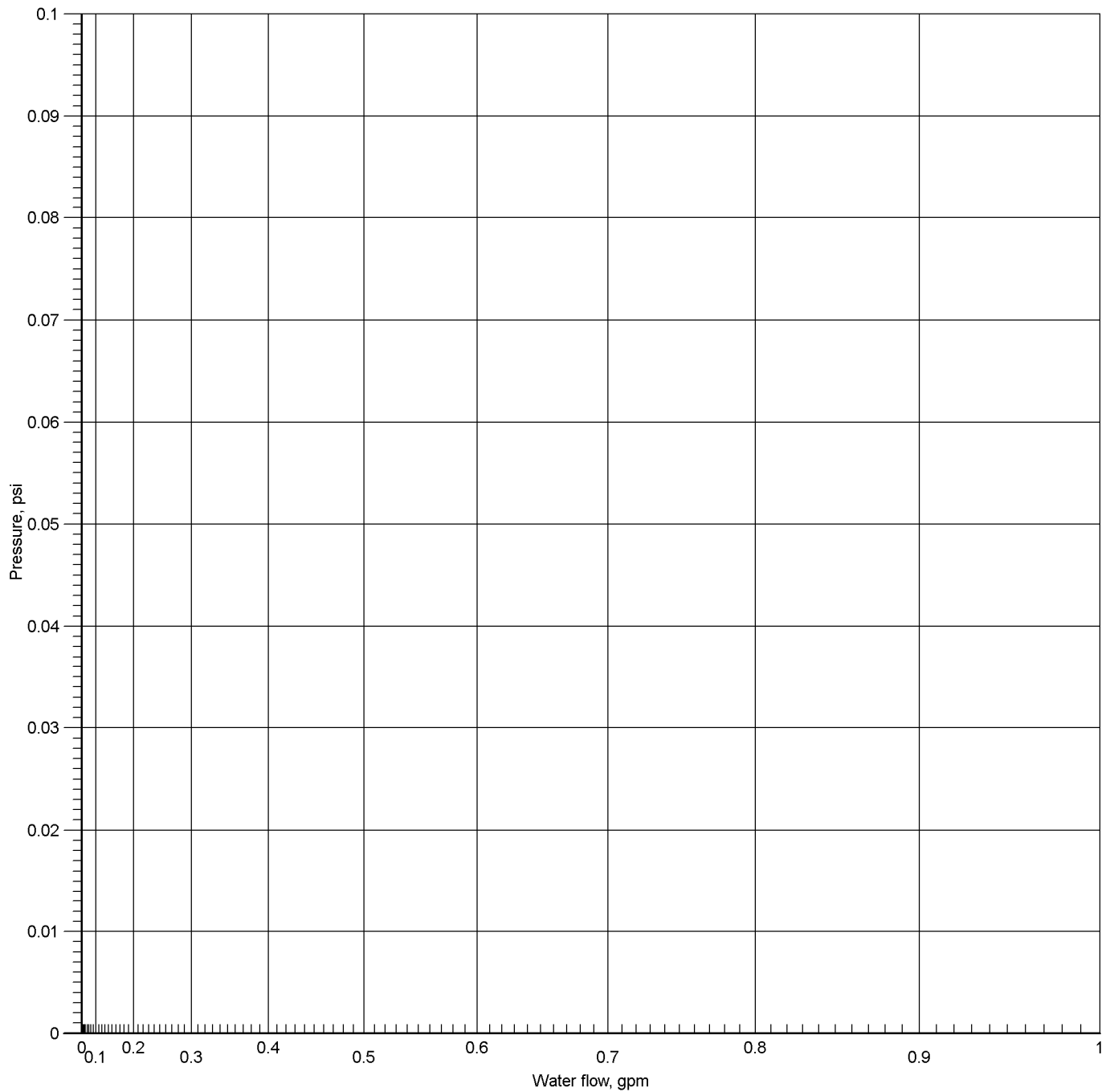
79.957 @ 1708.55

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

79.957 @ 1708.55



Pump Inlet at Node 461



Hydraulic Graph

Pump Inlet at Node 461

Static: Pressure

0.000

Residual: Pressure

N/A

Available Pressure at System Demand

N/A

Required Pressure at System Demand

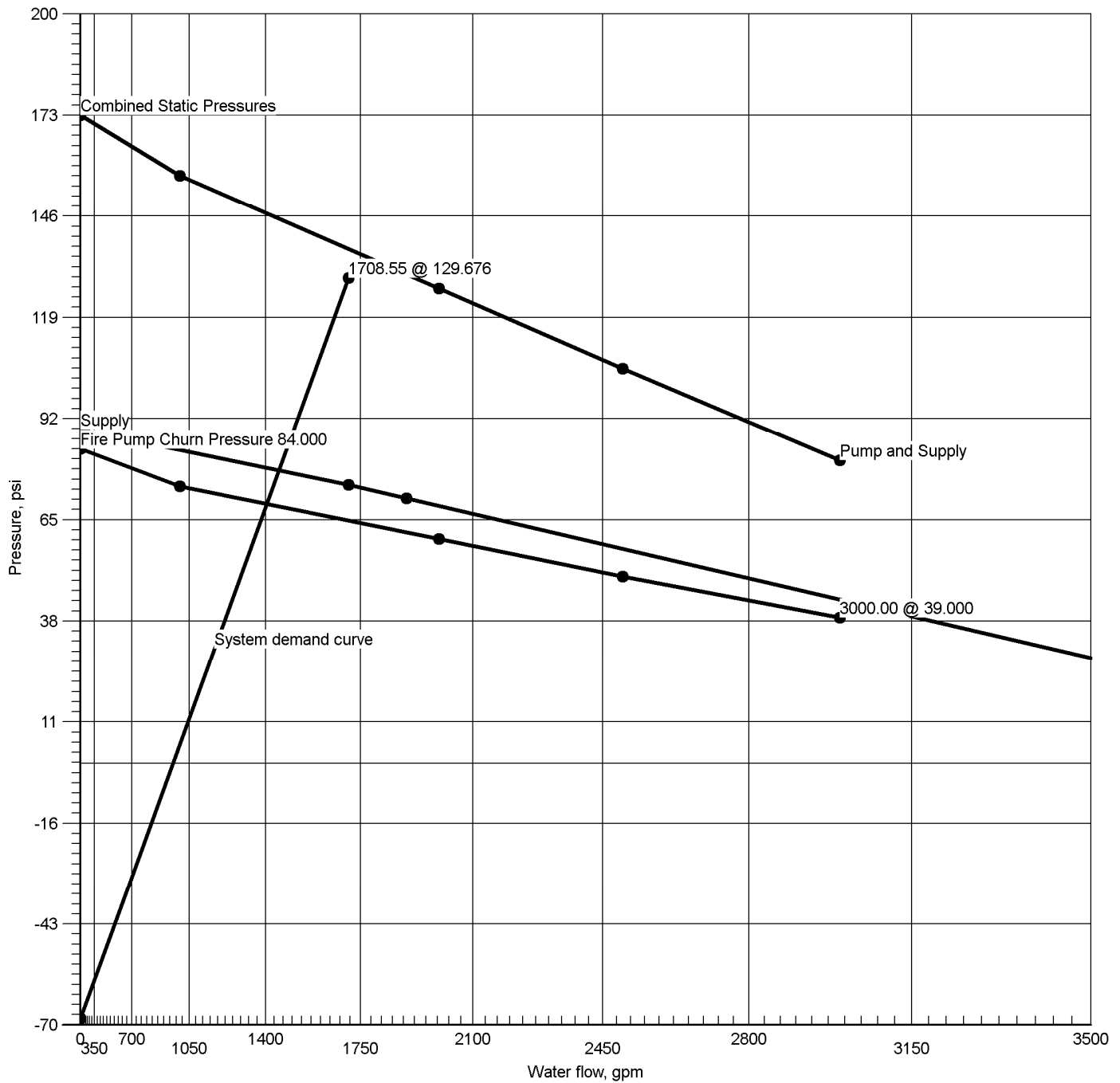
0.000 @ 0.00

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

N/A



Pump at Node 5



Hydraulic Graph
Pump at Node 5

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
139.325 @ 1708.55

Required Pressure at System Demand
129.676 @ 1708.55



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: FP Overhead System 04

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Hydrant	54	250.00	250.00	250	117.521			
⇒ 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	52.785			

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: FP Overhead System 04

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	79.957	1708.55
54	1'-0	Hyd(-1.000)	117.521	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(-52.785)	52.785	122.06
2	-8'-0	E(24'-7)	75.925	
4	1'-9	P1	64.779	
5	1'-9	P2(-64.897)	129.676	
6	1'-9		129.676	
7	6'-8½		125.650	
8	1'-0		128.005	
9	-8'-0	T(43'-10)	130.115	
10	-8'-0	T(43'-10)	127.938	
11	-8'-0	T(47'-3½)	127.131	
12	-8'-0	T(43'-10)	122.633	
13	-8'-0	T(47'-3½)	121.584	
14	-8'-0	T(43'-10)	121.345	
15	-8'-0	T(47'-3½)	124.189	
16	-8'-0	T(43'-10)	124.704	
17	-8'-0	T(47'-3½)	127.045	
18	-8'-0	T(43'-10)	127.442	
19	-8'-0	T(43'-10)	128.370	
51	1'-0	Hyd	1.000	
53	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
400	37'-0	PO(18'-8½)	76.622	
402	37'-0	PO(18'-8½)	76.754	
404	37'-0	PO(18'-8½)	77.234	
406	37'-0	PO(18'-8½)	78.251	
408	37'-0	PO(18'-8½)	79.413	
410	37'-0	PO(18'-8½)	80.734	
412	37'-1	PO(18'-8½)	82.200	
414	37'-3½	PO(18'-8½)	83.832	
416	37'-6	PO(18'-8½)	85.729	
418	37'-8½	PO(18'-8½)	87.949	
420	37'-11	PO(18'-8½)	90.568	
422	37'-11½		90.723	
424	38'-1½	PO(18'-8½)	91.095	
426	5'-3½		111.521	
428	1'-0		115.884	
430	37'-0	PO(18'-8½)	73.579	
432	37'-0	PO(18'-8½)	73.716	
434	37'-0	PO(18'-8½)	74.213	
436	37'-0	PO(18'-8½)	75.267	
438	37'-0	PO(18'-8½)	76.183	
440	37'-0	PO(18'-8½)	76.964	
442	37'-1	PO(18'-8½)	77.573	
444	37'-3½	PO(18'-8½)	77.995	
446	37'-6	PO(18'-8½)	78.280	
448	37'-8½	PO(18'-8½)	78.433	
450	37'-11	PO(18'-8½)	78.467	
452	38'-1½	PO(18'-8½)	78.413	



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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	118.88	6.64	120		0.034911	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	240.39	13.42	120		0.128441	149'-0	Pf 23.946
4113	37'-10	121.51	16.8	52.314		Sprinkler,	37'-5	Pe 0.361
400	37'-0			76.622		2PO(18'-8½)	186'-5	Pv
CM	4.3100	240.39	5.29	120		0.013288	10'-0	Pf 0.133
400	37'-0			76.622				Pe
402	37'-0			76.754			10'-0	Pv
CM	4.3100	480.98	10.58	120		0.047939	10'-0	Pf 0.479
402	37'-0	240.59		76.754		Flow (q) from Route 3		Pe
404	37'-0			77.234			10'-0	Pv
CM	4.3100	722.27	15.88	120		0.101705	10'-0	Pf 1.017
404	37'-0	241.29		77.234		Flow (q) from Route 5		Pe
406	37'-0			78.251			10'-0	Pv
CM	4.3100	776.08	17.07	120		0.116165	10'-0	Pf 1.162
406	37'-0	53.81		78.251		Flow (q) from Route 17		Pe
408	37'-0			79.413			10'-0	Pv
CM	4.3100	832.24	18.30	120		0.132193	10'-0	Pf 1.322
408	37'-0	56.16		79.413		Flow (q) from Route 16		Pe
410	37'-0			80.734			10'-0	Pv
CM	4.3100	892.18	19.62	120		0.150345	10'-0	Pf 1.506
410	37'-0	59.94		80.734		Flow (q) from Route 11		Pe -0.041
412	37'-1			82.200			10'-0	Pv
CM	4.3100	959.97	21.11	120		0.172156	10'-0	Pf 1.722
412	37'-1	67.78		82.200		Flow (q) from Route 10		Pe -0.090
414	37'-3½			83.832			10'-0	Pv
CM	4.3100	1037.29	22.81	120		0.198686	10'-0	Pf 1.987
414	37'-3½	77.33		83.832		Flow (q) from Route 15		Pe -0.090
416	37'-6			85.729			10'-0	Pv
CM	4.3100	1125.52	24.75	120		0.231074	10'-0	Pf 2.311
416	37'-6	88.22		85.729		Flow (q) from Route 12		Pe -0.090
418	37'-8½			87.949			10'-0	Pv
CM	4.3100	1226.24	26.97	120		0.270777	10'-0	Pf 2.708
418	37'-8½	100.72		87.949		Flow (q) from Route 14		Pe -0.090
420	37'-11			90.568			10'-0	Pv
CM	4.3100	1340.92	29.49	120		0.319480	0'-6	Pf 0.160
420	37'-11	114.68		90.568		Flow (q) from Route 13		Pe -0.005
422	37'-11½			90.723			0'-6	Pv
CM	6.3570	1340.92	13.55	120		0.048140	9'-6	Pf 0.457
422	37'-11½			90.723				Pe -0.086
424	38'-1½			91.095			9'-6	Pv
CM	6.3570	1458.55	14.74	120		0.056243	59'-9½	Pf 6.193
424	38'-1½	117.63		91.095		Flow (q) from Route 2	50'-3½	Pe 14.233
426	5'-3½			111.521		4fE(12'-7)	110'-1	Pv
DY	8.2490	1458.55	8.76	120		0.015814	4'-1	Pf 2.498
426	5'-3½			111.521			153'-10½	Pe 1.866
428	1'-0			115.884		2f(-0.000), CV(52'-10), BV(18'-9½), 2PO(41'-1½)	157'-11½	Pv
UG	7.6800	1458.55	10.10	150		0.014822	38'-9½	Pf 1.559
428	1'-0			115.884			66'-4½	Pe 3.902
14	-8'-0			121.345		E(22'-6½), T(43'-10)	105'-2	Pv
UG	7.6800	709.49	4.91	150		0.003908	61'-1½	Pf 0.239
14	-8'-0			121.345				Pe
13	-8'-0			121.584			61'-1½	Pv
UG	7.6800	959.49	6.65	150		0.006830	153'-8	Pf 1.050
13	-8'-0	250.00		121.584		Flow (q) from Route 7		Pe
12	-8'-0			122.633			153'-8	Pv
UG	7.6800	959.49	6.65	150		0.006830	635'-11½	Pf 4.498
12	-8'-0			122.633			22'-6½	Pe
11	-8'-0			127.131		E(22'-6½)	658'-6	Pv
UG	7.6800	959.49	6.65	150		0.006830	118'-2	Pf 0.807
11	-8'-0			127.131				Pe
10	-8'-0			127.938			118'-2	Pv
UG	7.6800	959.49	6.65	150		0.006830	275'-0	Pf 2.178
10	-8'-0			127.938			43'-10	Pe
9	-8'-0			130.115		T(43'-10)	318'-9½	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 04

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Fittings	Eq. Length	Summary
Upstream						Total Length	
UG	7.6800	1708.55	11.83	150	0.019862	67'-8"	Pf 1.792
9	-8'-0"	749.06		130.115	Flow (q) from Route 8	22'-6½"	Pe -3.902
8	1'-0"			128.005	E(22'-6½")	90'-2½"	Pv
FR	8.2490	1708.55	10.26	120	0.021191	5'-8½"	Pf 0.121
8	1'-0"			128.005			Pe -2.476
7	6'-8½"			125.650		5'-8½"	Pv
DY	10.3700	1708.55	6.49	120	0.006953	13'-10½"	Pf 1.875
7	6'-8½"			125.650		255'-9"	Pe 2.151
6	1'-9"			129.676	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
6	1'-9"			129.676			Pe 0.000
5	1'-9"			129.676		0'-0"	Pv
Pump		Velocity					
5		1708.55		129.676	Rating: 60.000 @ 2000.00		
4		Q=1708.55	7.87	64.779	Fire Pump Churn Pressure: 84.000		
UG	9.4200	1708.55	7.87	150	0.007347	305'-9½"	Pf 6.919
4	1'-9"			64.779		137'-6"	Pe 4.227
2	-8'-0"			75.925	GV(5'-7"), T(45'-10"), 3E(24'-7"), EE(12'-3½"), BFP(-3.663)	443'-3½"	Pv
UG	11.2000	1708.55	5.56	150	0.003163	750'-9"	Pf 2.514
2	-8'-0"			75.925		44'-3"	Pe 1.517
1	-11'-6"			79.957	EE(14'-4½"), E(29'-10½"), S	795'-0"	Pv
		0.00			Hose Allowance At Source		
1		1708.55					
Route 2							
BL	2.7050	2.27	0.13	120	0.000023	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	123.41	6.89	120	0.037412	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	244.95	13.68	120	0.132982	119'-7"	Pf 20.881
4117	37'-10"	121.54	16.8	52.337	Sprinkler,	37'-5"	Pe 0.361
430	37'-0"			73.579	2PO(18'-8½")	157'-0"	Pv
CM	4.3100	244.95	5.39	120	0.013758	10'-0"	Pf 0.138
430	37'-0"			73.579			Pe
432	37'-0"			73.716		10'-0"	Pv
CM	4.3100	490.16	10.78	120	0.049644	10'-0"	Pf 0.496
432	37'-0"	245.21		73.716	Flow (q) from Route 4		Pe
434	37'-0"			74.213		10'-0"	Pv
CM	4.3100	736.28	16.19	120	0.105385	10'-0"	Pf 1.054
434	37'-0"	246.13		74.213	Flow (q) from Route 6		Pe
436	37'-0"			75.267		10'-0"	Pv
CM	4.3100	682.47	15.01	120	0.091581	10'-0"	Pf 0.916
436	37'-0"			75.267			Pe
438	37'-0"			76.183		10'-0"	Pv
CM	4.3100	626.31	13.77	120	0.078129	10'-0"	Pf 0.781
438	37'-0"			76.183			Pe
440	37'-0"			76.964		10'-0"	Pv
CM	4.3100	566.37	12.45	120	0.064861	10'-0"	Pf 0.650
440	37'-0"			76.964			Pe -0.041
442	37'-1"			77.573		10'-0"	Pv
CM	4.3100	498.59	10.96	120	0.051235	10'-0"	Pf 0.512
442	37'-1"			77.573			Pe -0.090
444	37'-3½"			77.995		10'-0"	Pv
CM	4.3100	421.26	9.26	120	0.037511	10'-0"	Pf 0.375
444	37'-3½"			77.995			Pe -0.090
446	37'-6"			78.280		10'-0"	Pv
CM	4.3100	333.03	7.32	120	0.024286	10'-0"	Pf 0.243
446	37'-6"			78.280			Pe -0.090
448	37'-8½"			78.433		10'-0"	Pv
CM	4.3100	232.31	5.11	120	0.012474	10'-0"	Pf 0.125
448	37'-8½"			78.433			Pe -0.090
450	37'-11"			78.467		10'-0"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 04

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	117.63	2.59	120	0.003542	10'-0	Pf 0.035
450	37'-11			78.467			Pe -0.090
452	38'-1½			78.413		10'-0	Pv
RN	2.7050	117.63	6.57	120	0.034235	295'-7	Pf 12.683
452	38'-1½			78.413	PO(18'-8½)	74'-10½	Pe -0.000
424	38'-1½			91.095	3PO(18'-8½)	370'-5½	Pv
Route 3							
BL	2.7050	118.96	6.64	120	0.034955	9'-0	Pf 0.315
4119	37'-10	121.26	16.8	52.097	Sprinkler		Pe
4121	37'-10			52.411		9'-0	Pv
BL	2.7050	240.59	13.43	120	0.128634	149'-0	Pf 23.982
4121	37'-10	121.62	16.8	52.411	Sprinkler,	37'-5	Pe 0.361
402	37'-0			76.754	2PO(18'-8½)	186'-5	Pv
Route 4							
BL	2.7050	2.30	0.13	120	0.000024	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	123.55	6.90	120	0.037492	9'-0	Pf 0.337
4123	37'-10	121.26	16.8	52.097	Sprinkler		Pe
4125	37'-10			52.434		9'-0	Pv
BL	2.7050	245.21	13.69	120	0.133239	119'-7	Pf 20.921
4125	37'-10	121.65	16.8	52.434	Sprinkler,	37'-5	Pe 0.361
432	37'-0			73.716	2PO(18'-8½)	157'-0	Pv
Route 5							
BL	2.7050	119.26	6.66	120	0.035117	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	241.29	13.47	120	0.129329	149'-0	Pf 24.112
4129	37'-10	122.03	16.8	52.761	Sprinkler,	37'-5	Pe 0.361
404	37'-0			77.234	2PO(18'-8½)	186'-5	Pv
Route 6							
BL	2.7050	2.40	0.13	120	0.000026	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	124.07	6.93	120	0.037781	9'-0	Pf 0.340
4131	37'-10	121.66	16.8	52.445	Sprinkler		Pe
4133	37'-10			52.785		9'-0	Pv
BL	2.7050	246.13	13.74	120	0.134165	119'-7	Pf 21.066
4133	37'-10	122.06	16.8	52.785	Sprinkler,	37'-5	Pe 0.361
434	37'-0			74.213	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		117.521	Hydrant,	74'-1	Pe 3.902
13	-8'-0			121.584	E(22'-1), GV(4'-8½), T(47'-3½)	93'-10½	Pv
Route 8							
UG	7.6800	749.06	5.19	150	0.004320	119'-3	Pf 0.515
15	-8'-0	749.06		124.189	Flow (q) from Route 9		Pe
16	-8'-0			124.704		119'-3	Pv
UG	7.6800	749.06	5.19	150	0.004320	519'-3½	Pf 2.341
16	-8'-0			124.704		22'-6½	Pe
17	-8'-0			127.045	E(22'-6½)	541'-10	Pv
UG	7.6800	749.06	5.19	150	0.004320	91'-11½	Pf 0.397
17	-8'-0			127.045			Pe
18	-8'-0			127.442		91'-11½	Pv
UG	7.6800	749.06	5.19	150	0.004320	214'-9	Pf 0.928
18	-8'-0			127.442			Pe
19	-8'-0			128.370		214'-9	Pv
UG	7.6800	749.06	5.19	150	0.004320	337'-8	Pf 1.746
19	-8'-0			128.370		66'-4½	Pe
9	-8'-0			130.115	E(22'-6½), T(43'-10)	404'-0½	Pv
Route 9							
UG	7.6800	749.06	5.19	150	0.004320	635'-9	Pf 2.844
14	-8'-0	709.49		121.345	Flow (q) from Route 1	22'-6½	Pe
15	-8'-0			124.189	E(22'-6½)	658'-3½	Pv
Route 10							
RN	2.7050	67.78	3.78	120	0.012347	295'-7	Pf 4.627
442	37'-1			77.573	PO(18'-8½)	79'-2	Pe -0.000
412	37'-1			82.200	3PO(18'-8½), Tr(4'-3½)	374'-9	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 04

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Fittings	Eq. Length	Summary
Upstream						Total Length	
Route 11							
RN	2.7050	59.94	3.35	120	0.009836	295'-7	Pf 3.771
440	37'-0			76.964	PO(18'-8½)	87'-9	Pe
410	37'-0			80.734	3PO(18'-8½), 3Tr(4'-3½)	383'-4	Pv
Route 12							
RN	2.7050	88.22	4.93	120	0.020106	295'-7	Pf 7.449
446	37'-6			78.280	PO(18'-8½)	74'-10½	Pe -0.000
416	37'-6			85.729	3PO(18'-8½)	370'-5½	Pv
Route 13							
RN	2.7050	114.68	6.40	120	0.032664	295'-7	Pf 12.100
450	37'-11			78.467	PO(18'-8½)	74'-10½	Pe -0.000
420	37'-11			90.568	3PO(18'-8½)	370'-5½	Pv
Route 14							
RN	2.7050	100.72	5.62	120	0.025690	295'-7	Pf 9.517
448	37'-8½			78.433	PO(18'-8½)	74'-10½	Pe -0.000
418	37'-8½			87.949	3PO(18'-8½)	370'-5½	Pv
Route 15							
RN	2.7050	77.33	4.32	120	0.015755	295'-7	Pf 5.836
444	37'-3½			77.995	PO(18'-8½)	74'-10½	Pe -0.000
414	37'-3½			83.832	3PO(18'-8½)	370'-5½	Pv
Route 16							
RN	2.7050	56.16	3.14	120	0.008719	295'-7	Pf 3.230
438	37'-0			76.183	PO(18'-8½)	74'-10½	Pe
408	37'-0			79.413	3PO(18'-8½)	370'-5½	Pv
Route 17							
RN	2.7050	53.81	3.00	120	0.008055	295'-7	Pf 2.984
436	37'-0			75.267	PO(18'-8½)	74'-10½	Pe
406	37'-0			78.251	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



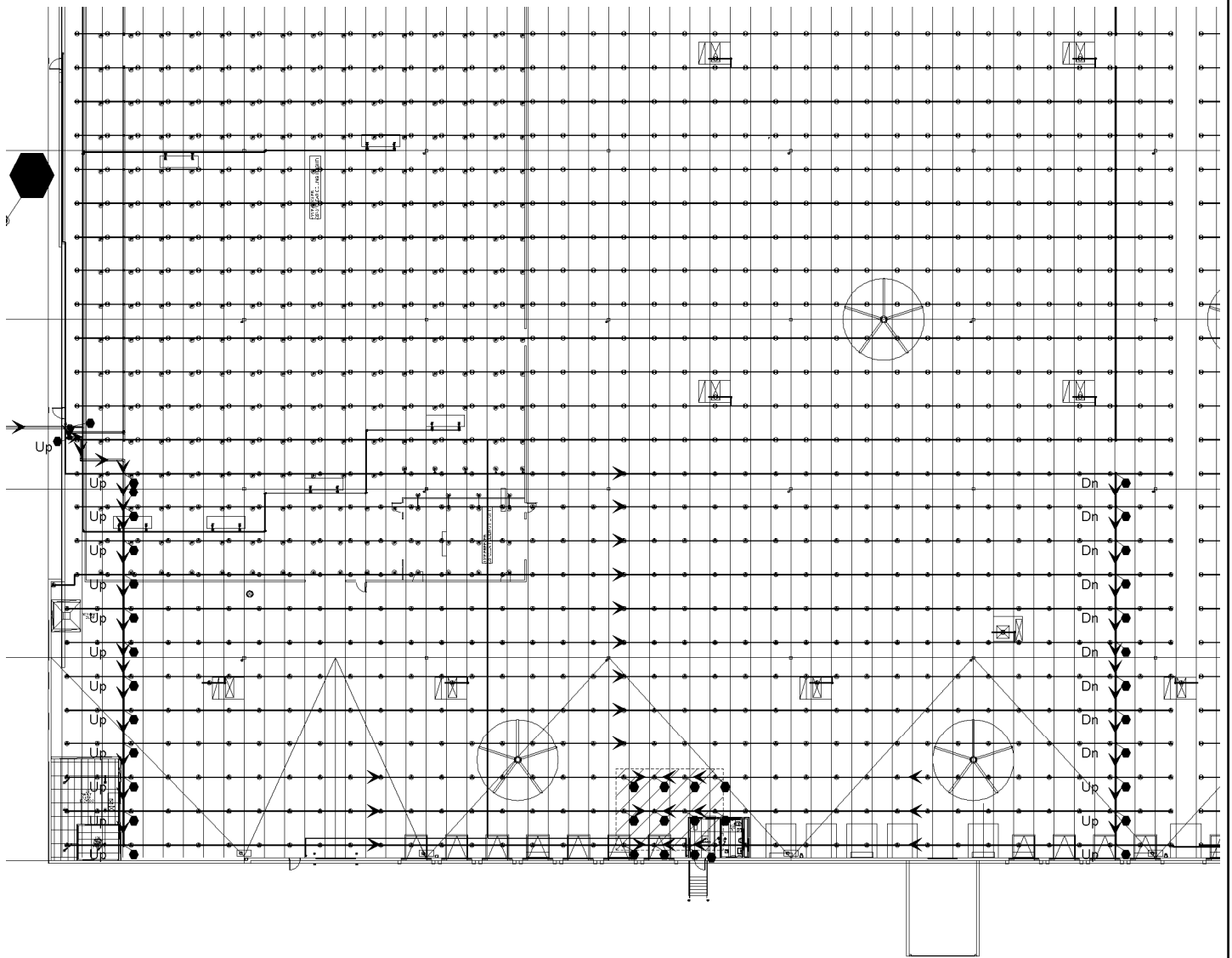
Hydraulic Analysis

Job Number: 212189000

Report Description: FP Overhead System 04

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 SN Swing 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

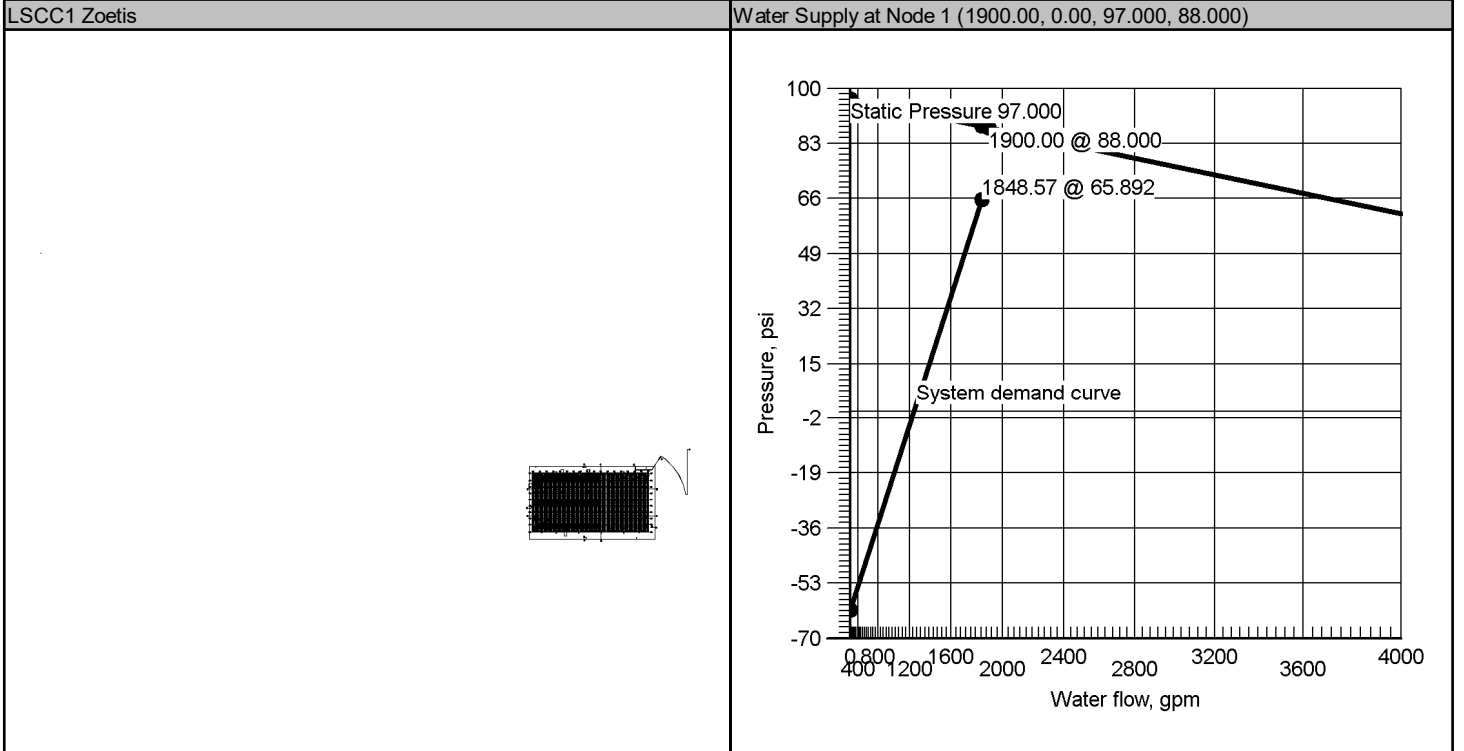
Job Number: 212189000
Report Description: FP Overhead System 05

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

System	
Pressure 40.000	Area of Application NA
Most Demanding Sprinkler Data 28 K-Factor 177.09 at 40.000	Hose Streams 250.00
Coverage Per Sprinkler 100 ft²	Number Of Sprinklers Calculated 9
System Pressure Demand 65.892	System Flow Demand 1848.57
Total Demand 1848.57 @ 65.892	Pressure Result +22.553 (25.5%)

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 (461)	0.000	0	0.00
5	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									

Pumps: Static = Churn (Pressure @ Zero Flow)





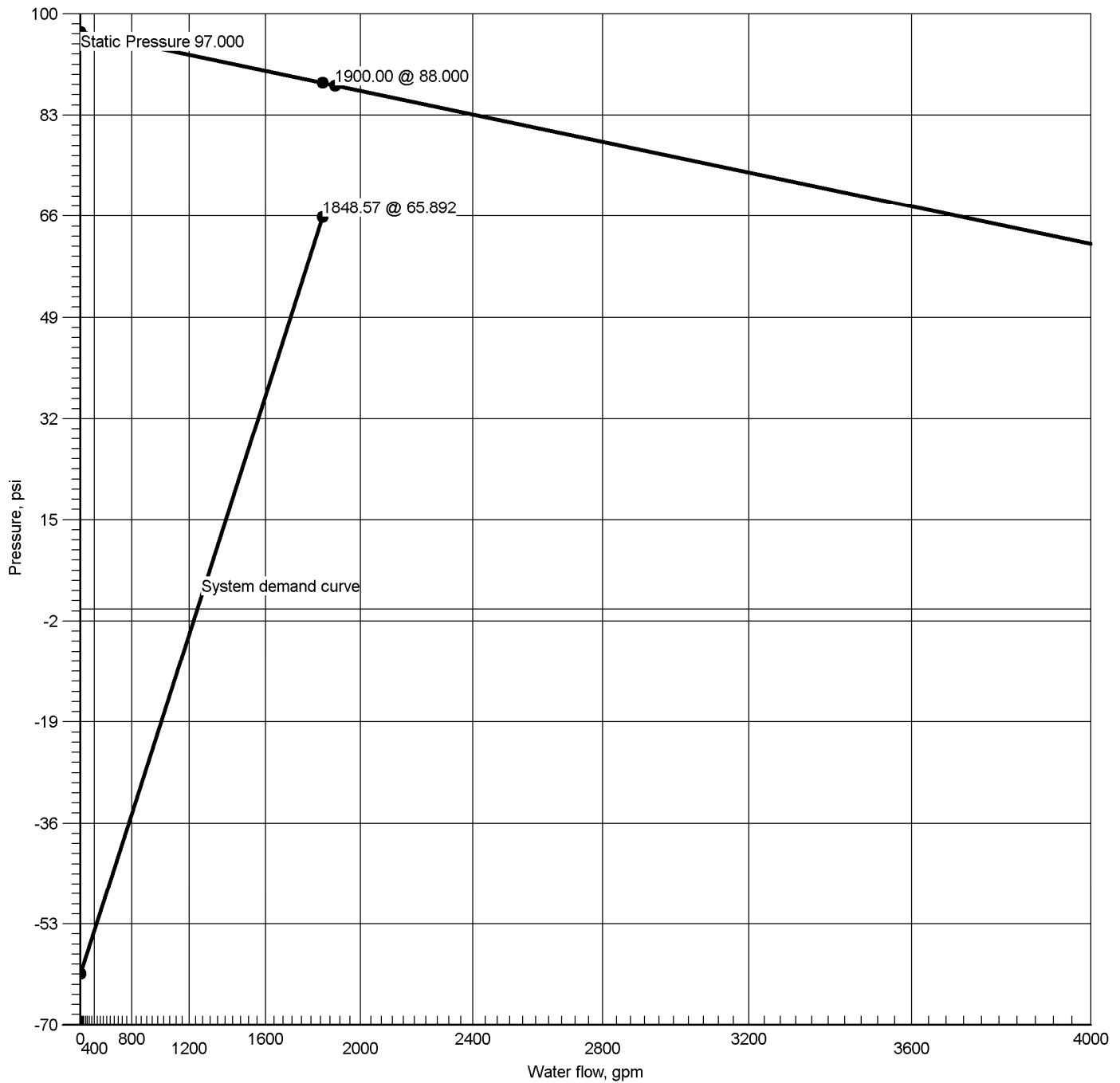
Hydraulic Summary

Job Number: 212189000
Report Description: FP Overhead System 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 28 K-Factor 177.09 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 9				
				Number Of Nozzles Calculated 0			Coverage Per Sprinkler 100 ft²				
				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 65.806 Right: 65.878							
Total Hose Streams 250.00											
System Flow Demand 1848.57		Total Water Required (Including Hose Allowance) 1848.57									
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 17.43 between nodes 540 and 538											
Maximum Velocity Under Ground 12.80 between nodes 8 and 9											
Volume capacity of Wet Pipes 32132.49 gal		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	88.445		1848.57	65.892	22.553
5	Pump		84.000	60.000		2000.00	134.806		1848.57	112.253	22.553
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

88.445 @ 1848.57

Required Pressure at System Demand

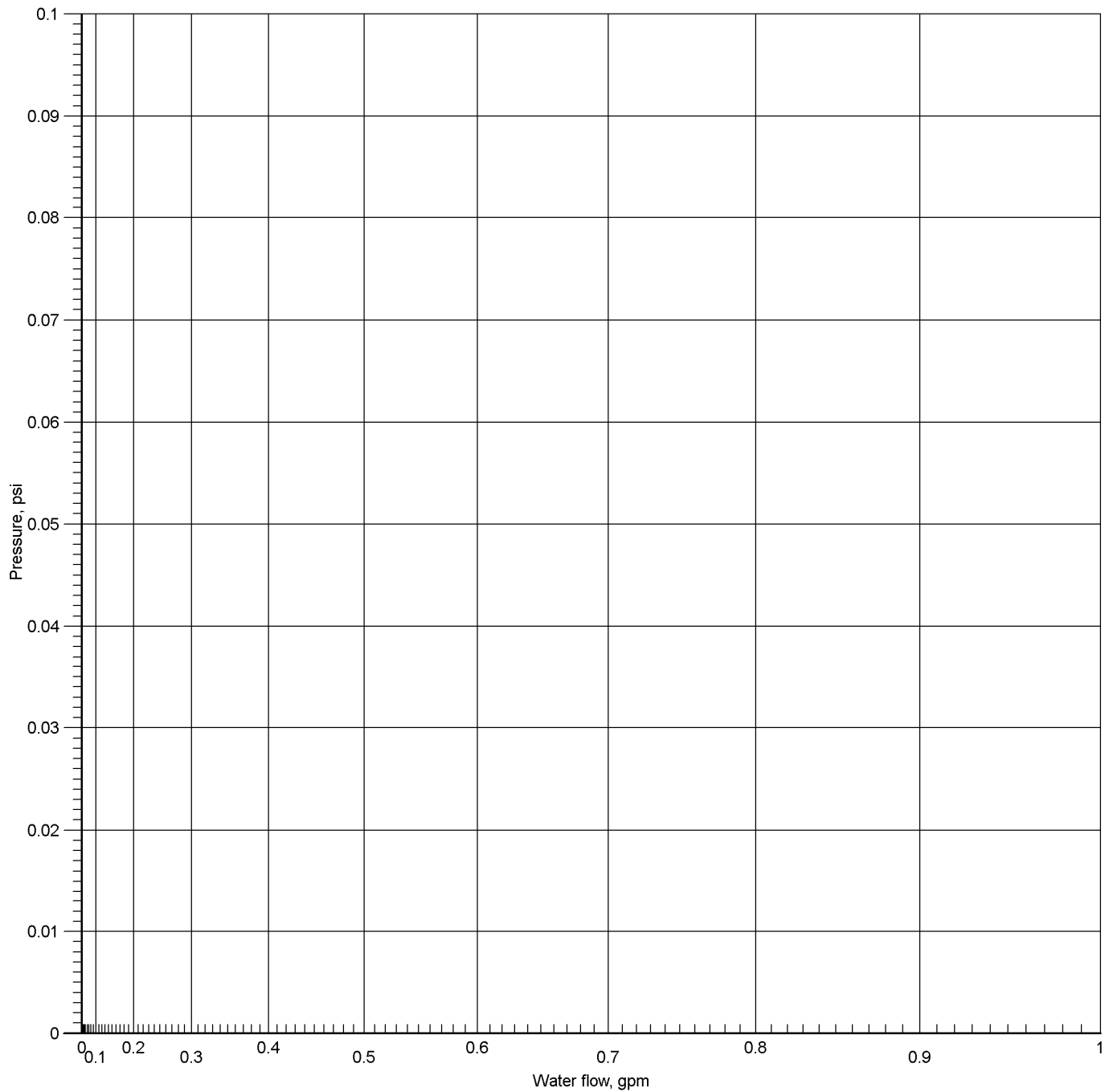
65.892 @ 1848.57

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

65.892 @ 1848.57



Pump Inlet at Node 461



Hydraulic Graph

Pump Inlet at Node 461

Static: Pressure

0.000

Residual: Pressure

N/A

Available Pressure at System Demand

N/A

Required Pressure at System Demand

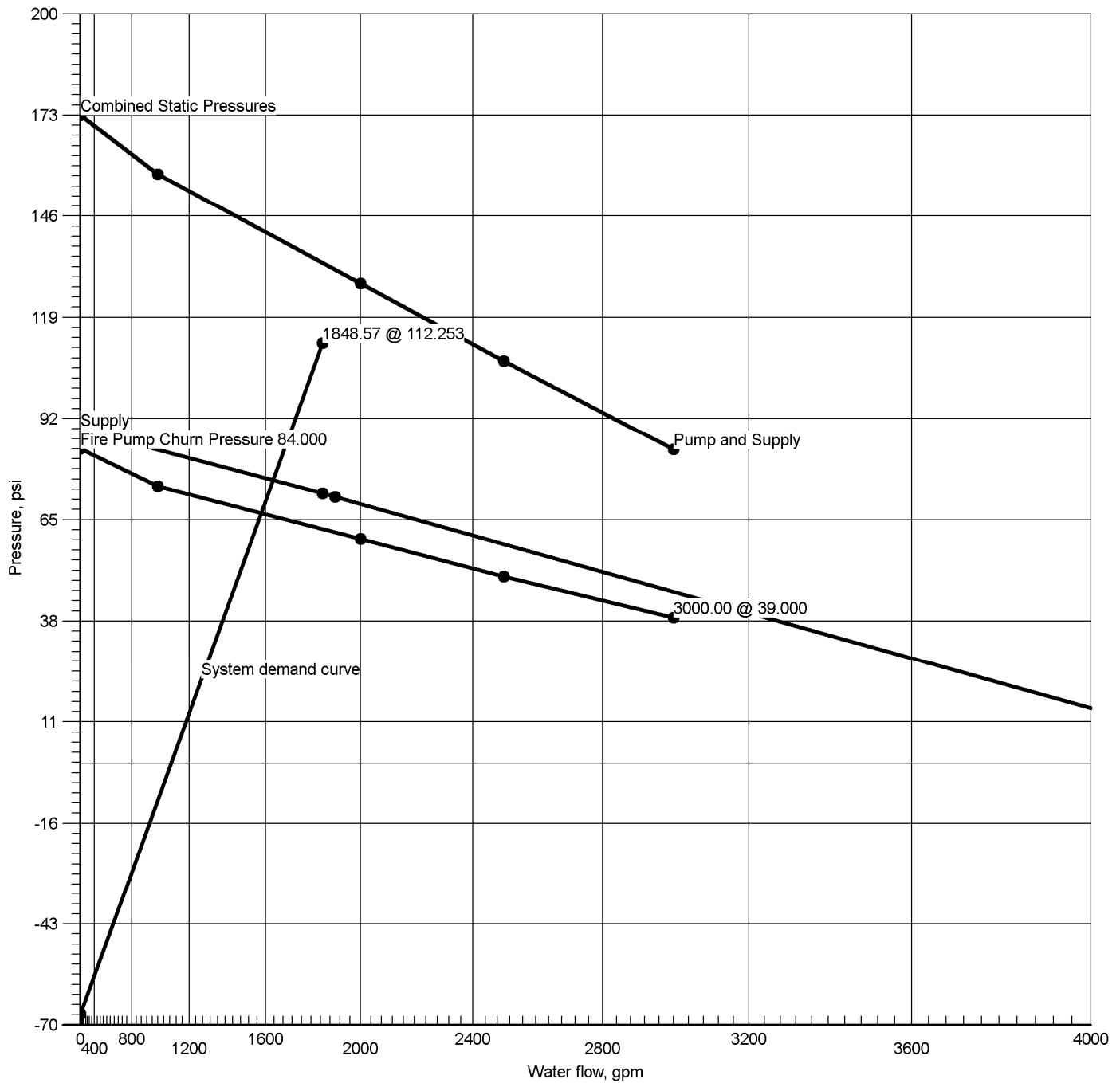
0.000 @ 0.00

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

N/A



Pump at Node 5



Hydraulic Graph

Static + Churn Pressure

Fire Pump Rating

Pump at Node 5

173.256

60.000 @ 2000.00

Static: Pressure

Fire Pump Churn Pressure

173.256

84.000

Residual: Pressure

62.626 @ 1848.57

Available Pressure at System Demand

134.806 @ 1848.57

Required Pressure at System Demand

112.253 @ 1848.57



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: FP Overhead System 05

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Hydrant	56	250.00	250.00	250	103.573			
⇒ Sprinkler	5111	177.09	177.09	28	40.000			
Sprinkler	5113	177.51	177.09	28	40.191			
Sprinkler	5115	177.47	177.09	28	40.174			
Sprinkler	5117	177.40	177.09	28	40.142			
Sprinkler	5119	177.82	177.09	28	40.332			
Sprinkler	5121	177.79	177.09	28	40.318			
Sprinkler	5123	177.56	177.09	28	40.214			
Sprinkler	5125	177.98	177.09	28	40.406			
Sprinkler	5127	177.94	177.09	28	40.388			

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: FP Overhead System 05

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	65.892	1848.57
56	1'-0	Hyd(-1.000)	103.573	250.00
5111	40'-6	Spr(-40.000)	40.000	177.09
5113	40'-6	Spr(-40.191)	40.191	177.51
5115	40'-6	Spr(-40.174)	40.174	177.47
5117	40'-2½	Spr(-40.142)	40.142	177.40
5119	40'-2½	Spr(-40.332)	40.332	177.82
5121	40'-2½	Spr(-40.318)	40.318	177.79
5123	39'-11	Spr(-40.214)	40.214	177.56
5125	39'-11	Spr(-40.406)	40.406	177.98
5127	39'-11	Spr(-40.388)	40.388	177.94
2	-8'-0	E(24'-7)	61.466	
4	1'-9	P1	49.627	
5	1'-9	P2(-62.626)	112.253	
6	1'-9		112.253	
7	6'-8½		107.933	
8	1'-0		110.269	
9	-8'-0	T(43'-10)	112.098	
10	-8'-0	T(43'-10)	107.600	
11	-8'-0	T(47'-3½)	107.636	
12	-8'-0	T(43'-10)	108.648	
13	-8'-0	T(47'-3½)	108.884	
14	-8'-0	T(43'-10)	108.978	
15	-8'-0	T(47'-3½)	109.990	
16	-8'-0	T(43'-10)	110.173	
17	-8'-0	T(47'-3½)	111.006	
18	-8'-0	T(43'-10)	111.147	
19	-8'-0	T(43'-10)	111.477	
51	1'-0	Hyd	1.000	
53	1'-0	Hyd	1.000	
54	1'-0	Hyd	1.000	
500	39'-8	PO(18'-8½)	67.306	
502	39'-4½	PO(18'-8½)	67.451	
504	39'-1	PO(18'-8½)	67.660	
506	38'-10	PO(18'-8½)	67.968	
508	38'-6½	PO(18'-8½)	68.308	
510	38'-3	PO(18'-8½)	68.680	
512	38'-0	PO(18'-8½)	69.083	
514	37'-8½	PO(18'-8½)	69.516	
516	37'-5	PO(18'-8½)	69.980	
518	37'-2	PO(18'-8½)	70.474	
520	37'-0	PO(18'-8½)	70.946	
522	37'-0	PO(18'-8½)	71.385	
524	37'-0	PO(18'-8½)	71.859	
526	37'-0	PO(18'-8½)	72.374	
528	37'-0	PO(18'-8½)	72.933	
530	37'-0	PO(18'-8½)	73.543	
532	1'-8½	PO(37'-8½)	100.253	
534	39'-8	PO(18'-8½)	61.193	
536	39'-4½	PO(18'-8½)	61.472	
538	39'-1	PO(18'-8½)	62.163	
540	38'-10	PO(18'-8½)	63.492	
542	38'-6½	PO(18'-8½)	64.625	
544	38'-3	PO(18'-8½)	65.596	
546	37'-5	PO(18'-8½)	67.733	
548	37'-2	PO(18'-8½)	68.242	
550	38'-0	PO(18'-8½)	66.424	
552	37'-8½	PO(18'-8½)	67.131	
554	37'-0	PO(18'-8½)	69.111	
556	37'-0	PO(18'-8½)	69.163	
558	37'-0	PO(18'-8½)	68.846	
560	37'-0	PO(18'-8½)	69.009	



Node Analysis

Job Number: 212189000
Report Description: FP Overhead System 05

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
562	37'-0	PO(18'-8½)	68.615	
564	37'-0	PO(18'-8½)	69.178	
632	1'-0		101.354	



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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	90.85	5.07	120		0.021225	9'-0"	Pf 0.191
5111	40'-6"	177.09	28	40.000		Sprinkler		Pe
5113	40'-6"			40.191			9'-0"	Pv
BL	2.7050	268.36	14.98	120		0.157439	105'-8"	Pf 26.754
5113	40'-6"	177.51	28	40.191		Sprinkler,	64'-3"	Pe 0.361
500	39'-8"			67.306		4fE(6'-8½"), 2PO(18'-8½")	169'-11"	Pv
CM	6.3570	268.36	2.71	120		0.002454	10'-0"	Pf 0.025
500	39'-8"			67.306				Pe 0.120
502	39'-4½"			67.451			10'-0"	Pv
CM	6.3570	536.73	5.43	120		0.008848	10'-0"	Pf 0.089
502	39'-4½"	268.38		67.451		Flow (q) from Route 3		Pe 0.120
504	39'-1"			67.660			10'-0"	Pv
CM	6.3570	805.84	8.15	120		0.018766	10'-0"	Pf 0.188
504	39'-1"	269.11		67.660		Flow (q) from Route 5		Pe 0.120
506	38'-10"			67.968			10'-0"	Pv
CM	6.3570	877.94	8.87	120		0.021990	10'-0"	Pf 0.220
506	38'-10"	72.10		67.968		Flow (q) from Route 14		Pe 0.120
508	38'-6½"			68.308			10'-0"	Pv
CM	6.3570	942.82	9.53	120		0.025090	10'-0"	Pf 0.251
508	38'-6½"	64.88		68.308		Flow (q) from Route 13		Pe 0.120
510	38'-3"			68.680			10'-0"	Pv
CM	6.3570	1005.04	10.16	120		0.028239	10'-0"	Pf 0.283
510	38'-3"	62.22		68.680		Flow (q) from Route 2		Pe 0.120
512	38'-0"			69.083			10'-0"	Pv
CM	6.3570	1062.46	10.74	120		0.031296	10'-0"	Pf 0.313
512	38'-0"	57.42		69.083		Flow (q) from Route 11		Pe 0.120
514	37'-8½"			69.516			10'-0"	Pv
CM	6.3570	1116.62	11.29	120		0.034311	10'-0"	Pf 0.343
514	37'-8½"	54.16		69.516		Flow (q) from Route 12		Pe 0.120
516	37'-5"			69.980			10'-0"	Pv
CM	6.3570	1169.05	11.82	120		0.037352	10'-0"	Pf 0.374
516	37'-5"	52.44		69.980		Flow (q) from Route 9		Pe 0.120
518	37'-2"			70.474			10'-0"	Pv
CM	6.3570	1221.30	12.35	120		0.040498	10'-0½"	Pf 0.406
518	37'-2"	52.24		70.474		Flow (q) from Route 10		Pe 0.067
520	37'-0"			70.946			10'-0½"	Pv
CM	6.3570	1274.37	12.88	120		0.043814	10'-0"	Pf 0.438
520	37'-0"	53.07		70.946		Flow (q) from Route 19		Pe
522	37'-0"			71.385			10'-0"	Pv
CM	6.3570	1330.38	13.45	120		0.047442	10'-0"	Pf 0.474
522	37'-0"	56.01		71.385		Flow (q) from Route 17		Pe
524	37'-0"			71.859			10'-0"	Pv
CM	6.3570	1390.00	14.05	120		0.051451	10'-0"	Pf 0.515
524	37'-0"	59.63		71.859		Flow (q) from Route 18		Pe 0.000
526	37'-0"			72.374			10'-0"	Pv
CM	6.3570	1454.14	14.70	120		0.055929	10'-0"	Pf 0.559
526	37'-0"	64.14		72.374		Flow (q) from Route 15		Pe
528	37'-0"			72.933			10'-0"	Pv
CM	6.3570	1523.50	15.40	120		0.060964	10'-0"	Pf 0.610
528	37'-0"	69.36		72.933		Flow (q) from Route 16		Pe
530	37'-0"			73.543			10'-0"	Pv
CM	6.3570	1598.57	16.16	120		0.066638	55'-6"	Pf 11.406
530	37'-0"	75.07		73.543		Flow (q) from Route 20	115'-8"	Pe 15.304
532	1'-8½"			100.253		2fE(12'-7"), 2f(-0.000), CV(40'-3"), BV(12'-7"), PO(37'-8½")	171'-2"	Pv
CM	8.2490	1598.57	9.60	120		0.018736	1'-6"	Pf 0.798
532	1'-8½"			100.253			41'-1½"	Pe 0.303
632	1'-0"			101.354		PO(41'-1½")	42'-7½"	Pv
UG	7.6800	1598.57	11.07	150		0.017562	67'-1½"	Pf 2.344
632	1'-0"			101.354			66'-4½"	Pe 3.902
10	-8'-0"			107.600		E(22'-6½"), T(43'-10")	133'-5½"	Pv
UG	7.6800	1420.15	9.84	150		0.014108	275'-0"	Pf 4.498
10	-8'-0"			107.600			43'-10"	Pe
9	-8'-0"			112.098		T(43'-10")	318'-9½"	Pv
UG	7.6800	1848.57	12.80	150		0.022978	67'-8"	Pf 2.073
9	-8'-0"	428.42		112.098		Flow (q) from Route 7	22'-6½"	Pe -3.902
8	1'-0"			110.269		E(22'-6½")	90'-2½"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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	1848.57	11.10	120		0.024515	5'-8½"	Pf 0.140
8	1'-0"			110.269				Pe -2.476
7	6'-8½"			107.933			5'-8½"	Pv
DY	10.3700	1848.57	7.02	120		0.008044	13'-10½"	Pf 2.169
7	6'-8½"			107.933			255'-9"	Pe 2.151
6	1'-9"			112.253		4E(26'-0"), T(48'-5½"), BV(21'-3½"), Tr(17'-0"), CV(65'-0")	269'-8"	Pv
DY	7.9810	1848.57	11.86	120		0.028793	0'-0"	Pf 0.000
6	1'-9"			112.253				Pe 0.000
5	1'-9"			112.253			0'-0"	Pv
Pump		Velocity						
5		1848.57		112.253		Rating: 60.000 @ 2000.00		
4		Q=1848.57	8.51	49.627		Fire Pump Churn Pressure: 84.000		
UG	9.4200	1848.57	8.51	150		0.008499	305'-9½"	Pf 7.613
4	1'-9"			49.627			137'-6"	Pe 4.227
2	-8'-0"			61.466		GV(5'-7"), T(45'-10"), 3E(24'-7"), EE(12'-3½"), BFP(-3.845)	443'-3½"	Pv
UG	11.2000	1848.57	6.02	150		0.003659	750'-9"	Pf 2.909
2	-8'-0"			61.466			44'-3"	Pe 1.517
1	-11'-6"			65.892		EE(14'-4½"), E(29'-10½"), S	795'-0"	Pv
		0.00				Hose Allowance At Source		
1		1848.57						
Route 2								
BL	2.7050	86.24	4.81	120		0.019279	9'-0"	Pf 0.174
5111	40'-6"	177.09	28	40.000		Sprinkler		Pe
5115	40'-6"			40.174			9'-0"	Pv
BL	2.7050	263.71	14.72	120		0.152438	98'-1"	Pf 20.658
5115	40'-6"	177.47	28	40.174		Sprinkler,	37'-5"	Pe 0.361
534	39'-8"			61.193		2PO(18'-8½")	135'-6"	Pv
CM	4.3100	263.71	5.80	120		0.015770	10'-0"	Pf 0.158
534	39'-8"			61.193				Pe 0.120
536	39'-4½"			61.472			10'-0"	Pv
CM	4.3100	528.35	11.62	120		0.057037	10'-0"	Pf 0.571
536	39'-4½"	264.64		61.472		Flow (q) from Route 4		Pe 0.120
538	39'-1"			62.163			10'-0"	Pv
CM	4.3100	792.73	17.43	120		0.120819	10'-0"	Pf 1.209
538	39'-1"	264.38		62.163		Flow (q) from Route 6		Pe 0.120
540	38'-10"			63.492			10'-0"	Pv
CM	4.3100	720.64	15.85	120		0.101280	10'-0"	Pf 1.013
540	38'-10"			63.492				Pe 0.120
542	38'-6½"			64.625			10'-0"	Pv
CM	4.3100	655.75	14.42	120		0.085058	10'-0"	Pf 0.851
542	38'-6½"			64.625				Pe 0.120
544	38'-3"			65.596			10'-0"	Pv
RN	2.7050	62.22	3.47	120		0.010538	217'-9"	Pf 3.084
544	38'-3"			65.596		PO(18'-8½")	74'-10½"	Pe -0.000
510	38'-3"			68.680		3PO(18'-8½")	292'-7½"	Pv
Route 3								
BL	2.7050	90.56	5.06	120		0.021101	9'-0"	Pf 0.190
5117	40'-2½"	177.40	28	40.142		Sprinkler		Pe
5119	40'-2½"			40.332			9'-0"	Pv
BL	2.7050	268.38	14.98	120		0.157462	105'-8"	Pf 26.758
5119	40'-2½"	177.82	28	40.332		Sprinkler,	64'-3"	Pe 0.361
502	39'-4½"			67.451		4fE(6'-8½"), 2PO(18'-8½")	169'-11"	Pv
Route 4								
BL	2.7050	86.85	4.85	120		0.019529	9'-0"	Pf 0.176
5117	40'-2½"	177.40	28	40.142		Sprinkler		Pe
5121	40'-2½"			40.318			9'-0"	Pv
BL	2.7050	264.64	14.77	120		0.153426	98'-1"	Pf 20.792
5121	40'-2½"	177.79	28	40.318		Sprinkler,	37'-5"	Pe 0.361
536	39'-4½"			61.472		2PO(18'-8½")	135'-6"	Pv
Route 5								
BL	2.7050	91.12	5.09	120		0.021345	9'-0"	Pf 0.192
5123	39'-11"	177.56	28	40.214		Sprinkler		Pe
5125	39'-11"			40.406			9'-0"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 05

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Fittings	Eq. Length	Summary
Upstream						Total Length	
BL	2.7050	269.11	15.02	120	0.158255	105'-8	Pf 26.893
5125	39'-11	177.98	28	40.406	Sprinkler,	64'-3	Pe 0.361
504	39'-1			67.660	4fE(6'-8½), 2PO(18'-8½)	169'-11	Pv
Route 6							
BL	2.7050	86.44	4.83	120	0.019360	9'-0	Pf 0.174
5123	39'-11	177.56	28	40.214	Sprinkler		Pe
5127	39'-11			40.388		9'-0	Pv
BL	2.7050	264.38	14.76	120	0.153155	98'-1	Pf 21.413
5127	39'-11	177.94	28	40.388	Sprinkler,	41'-8½	Pe 0.361
538	39'-1			62.163	Tr(4'-3½), 2PO(18'-8½)	139'-9½	Pv
Route 7							
UG	6.2800	250.00	2.59	140	0.001718	20'-0	Pf 0.162
56	1'-0	250.00		103.573	Hydrant,	74'-1	Pe 3.902
11	-8'-0			107.636	E(22'-1), GV(4'-8½), T(47'-3½)	94'-1	Pv
UG	7.6800	428.42	2.97	150	0.001537	635'-11½	Pf 1.012
11	-8'-0	178.42		107.636	Flow (q) from Route 8	22'-6½	Pe
12	-8'-0			108.648	E(22'-6½)	658'-6	Pv
UG	7.6800	428.42	2.97	150	0.001537	153'-8	Pf 0.236
12	-8'-0			108.648			Pe
13	-8'-0			108.884		153'-8	Pv
UG	7.6800	428.42	2.97	150	0.001537	61'-1½	Pf 0.094
13	-8'-0			108.884			Pe
14	-8'-0			108.978		61'-1½	Pv
UG	7.6800	428.42	2.97	150	0.001537	635'-9	Pf 1.012
14	-8'-0			108.978		22'-6½	Pe
15	-8'-0			109.990	E(22'-6½)	658'-3½	Pv
UG	7.6800	428.42	2.97	150	0.001537	119'-3	Pf 0.183
15	-8'-0			109.990			Pe
16	-8'-0			110.173		119'-3	Pv
UG	7.6800	428.42	2.97	150	0.001537	519'-3½	Pf 0.833
16	-8'-0			110.173		22'-6½	Pe
17	-8'-0			111.006	E(22'-6½)	541'-10	Pv
UG	7.6800	428.42	2.97	150	0.001537	91'-11½	Pf 0.141
17	-8'-0			111.006			Pe
18	-8'-0			111.147		91'-11½	Pv
UG	7.6800	428.42	2.97	150	0.001537	214'-9	Pf 0.330
18	-8'-0			111.147			Pe
19	-8'-0			111.477		214'-9	Pv
UG	7.6800	428.42	2.97	150	0.001537	337'-8	Pf 0.621
19	-8'-0			111.477		66'-4½	Pe
9	-8'-0			112.098	E(22'-6½), T(43'-10)	404'-0½	Pv
Route 8							
UG	7.6800	178.42	1.24	150	0.000304	118'-2	Pf 0.036
10	-8'-0	1420.15		107.600	Flow (q) from Route 1		Pe
11	-8'-0			107.636		118'-2	Pv
Route 9							
RN	2.7050	52.44	2.93	120	0.007680	217'-9	Pf 2.247
546	37'-5	481.95		67.733	PO(18'-8½), Flow (q) from Route	74'-10½	Pe -0.000
516	37'-5			69.980	24	292'-7½	Pv
					3PO(18'-8½)		
Route 10							
CM	4.3100	429.52	9.45	120	0.038883	10'-0	Pf 0.389
546	37'-5	481.95		67.733	Flow (q) from Route 24		Pe 0.120
548	37'-2			68.242		10'-0	Pv
RN	2.7050	52.24	2.92	120	0.007627	217'-9	Pf 2.232
548	37'-2			68.242	PO(18'-8½)	74'-10½	Pe -0.000
518	37'-2			70.474	3PO(18'-8½)	292'-7½	Pv
Route 11							
RN	2.7050	57.42	3.21	120	0.009085	217'-9	Pf 2.658
550	38'-0	593.53		66.424	PO(18'-8½), Flow (q) from Route	74'-10½	Pe -0.000
512	38'-0			69.083	25	292'-7½	Pv
					3PO(18'-8½)		
Route 12							
CM	4.3100	536.11	11.79	120	0.058596	10'-0	Pf 0.586
550	38'-0	593.53		66.424	Flow (q) from Route 25		Pe 0.120
552	37'-8½			67.131		10'-0	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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	54.16	3.02	120		0.008152	217'-9"	Pf 2.385
552	37'-8½"			67.131		PO(18'-8½")	74'-10½"	Pe -0.000
514	37'-8½"			69.516		3PO(18'-8½")	292'-7½"	Pv
Route 13								
RN	2.7050	64.88	3.62	120		0.011388	221'-9"	Pf 3.683
542	38'-6½"			64.625		PO(18'-8½")	101'-8½"	Pe -0.000
508	38'-6½"			68.308		3PO(18'-8½"), 4fE(6'-8½")	323'-5½"	Pv
Route 14								
RN	2.7050	72.10	4.03	120		0.013840	221'-9"	Pf 4.477
540	38'-10"			63.492		PO(18'-8½")	101'-8½"	Pe -0.000
506	38'-10"			67.968		3PO(18'-8½"), 4fE(6'-8½")	323'-5½"	Pv
Route 15								
RN	2.7050	64.14	3.58	120		0.011149	217'-9"	Pf 3.262
554	37'-0"	208.57		69.111		PO(18'-8½"), Flow (q) from Route 21	74'-10½"	Pe
526	37'-0"			72.374		21 3PO(18'-8½")	292'-7½"	Pv
Route 16								
CM	4.3100	144.43	3.18	120		0.005177	10'-0"	Pf 0.052
554	37'-0"	208.57		69.111		Flow (q) from Route 21		Pe
556	37'-0"			69.163			10'-0"	Pv
RN	2.7050	69.36	3.87	120		0.012883	217'-9"	Pf 3.770
556	37'-0"			69.163		PO(18'-8½")	74'-10½"	Pe
528	37'-0"			72.933		3PO(18'-8½")	292'-7½"	Pv
Route 17								
RN	2.7050	56.01	3.13	120		0.008675	217'-9"	Pf 2.538
558	37'-0"	324.20		68.846		PO(18'-8½"), Flow (q) from Route 22	74'-10½"	Pe -0.000
522	37'-0"			71.385		22 3PO(18'-8½")	292'-7½"	Pv
Route 18								
CM	4.3100	268.20	5.90	120		0.016270	10'-0"	Pf 0.163
558	37'-0"	324.20		68.846		Flow (q) from Route 22		Pe
560	37'-0"			69.009			10'-0"	Pv
RN	2.7050	59.63	3.33	120		0.009740	217'-9"	Pf 2.850
560	37'-0"			69.009		PO(18'-8½")	74'-10½"	Pe -0.000
524	37'-0"			71.859		3PO(18'-8½")	292'-7½"	Pv
Route 19								
RN	2.7050	53.07	2.96	120		0.007852	217'-9"	Pf 2.331
562	37'-0"	377.27		68.615		PO(18'-8½"), Flow (q) from Route 23	79'-2"	Pe -0.000
520	37'-0"			70.946		23 3PO(18'-8½"), Tr(4'-3½")	296'-11"	Pv
Route 20								
CM	4.3100	75.07	1.65	120		0.001543	10'-0"	Pf 0.015
556	37'-0"	69.36		69.163		Flow (q) from Route 16		Pe
564	37'-0"			69.178			10'-0"	Pv
RN	2.7050	75.07	4.19	120		0.014914	217'-9"	Pf 4.364
564	37'-0"			69.178		PO(18'-8½")	74'-10½"	Pe
530	37'-0"			73.543		3PO(18'-8½")	292'-7½"	Pv
Route 21								
CM	4.3100	208.57	4.59	120		0.010218	10'-0"	Pf 0.102
560	37'-0"	59.63		69.009		Flow (q) from Route 18		Pe
554	37'-0"			69.111			10'-0"	Pv
Route 22								
CM	4.3100	324.20	7.13	120		0.023108	10'-0"	Pf 0.231
562	37'-0"	377.27		68.615		Flow (q) from Route 23		Pe
558	37'-0"			68.846			10'-0"	Pv
Route 23								
CM	4.3100	377.27	8.30	120		0.030589	10'-0½"	Pf 0.307
548	37'-2"	52.24		68.242		Flow (q) from Route 10		Pe 0.066
562	37'-0"			68.615			10'-0½"	Pv
Route 24								
CM	4.3100	481.95	10.60	120		0.048118	10'-0"	Pf 0.481
552	37'-8½"	54.16		67.131		Flow (q) from Route 12		Pe 0.120
546	37'-5"			67.733			10'-0"	Pv
Route 25								
CM	4.3100	593.53	13.05	120		0.070733	10'-0"	Pf 0.708
544	38'-3"	62.22		65.596		Flow (q) from Route 2		Pe 0.120
550	38'-0"			66.424			10'-0"	Pv



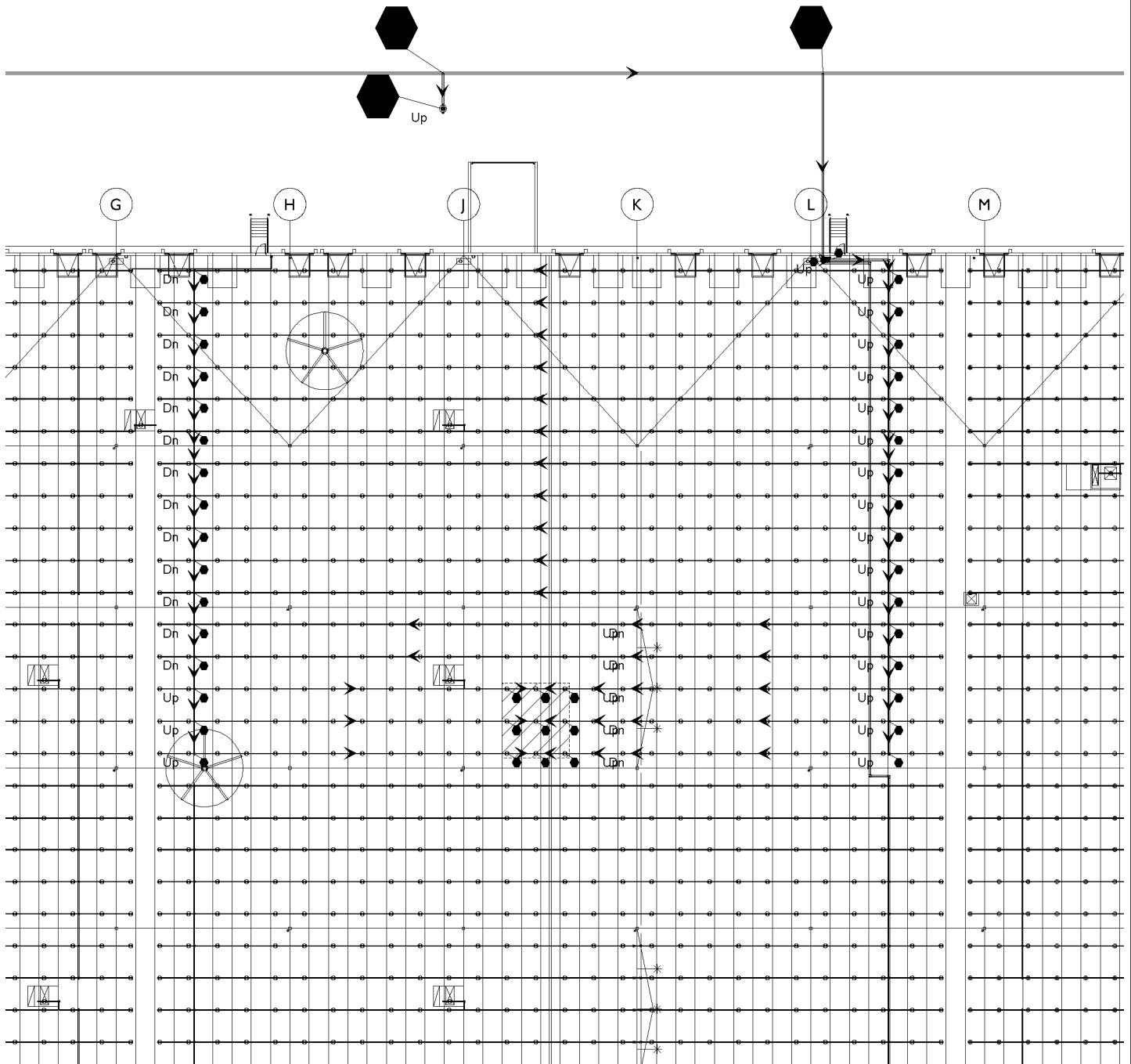
Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 05

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
				Multiplying Factor	0.713	1.16	1.33
							150
							1.51

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	BaV 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	DeV Deluge Valve	
SN Swing Nipple	Pf	Pressure loss due to friction between points	DPV Dry Pipe Valve	
SP Sprig	Pe	Pressure due to elevation difference between indicated points	E 90° Elbow	
ST Stand Pipe	Pv	Velocity pressure at a point in a pipe	EE 45° Elbow	
UG Underground			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	





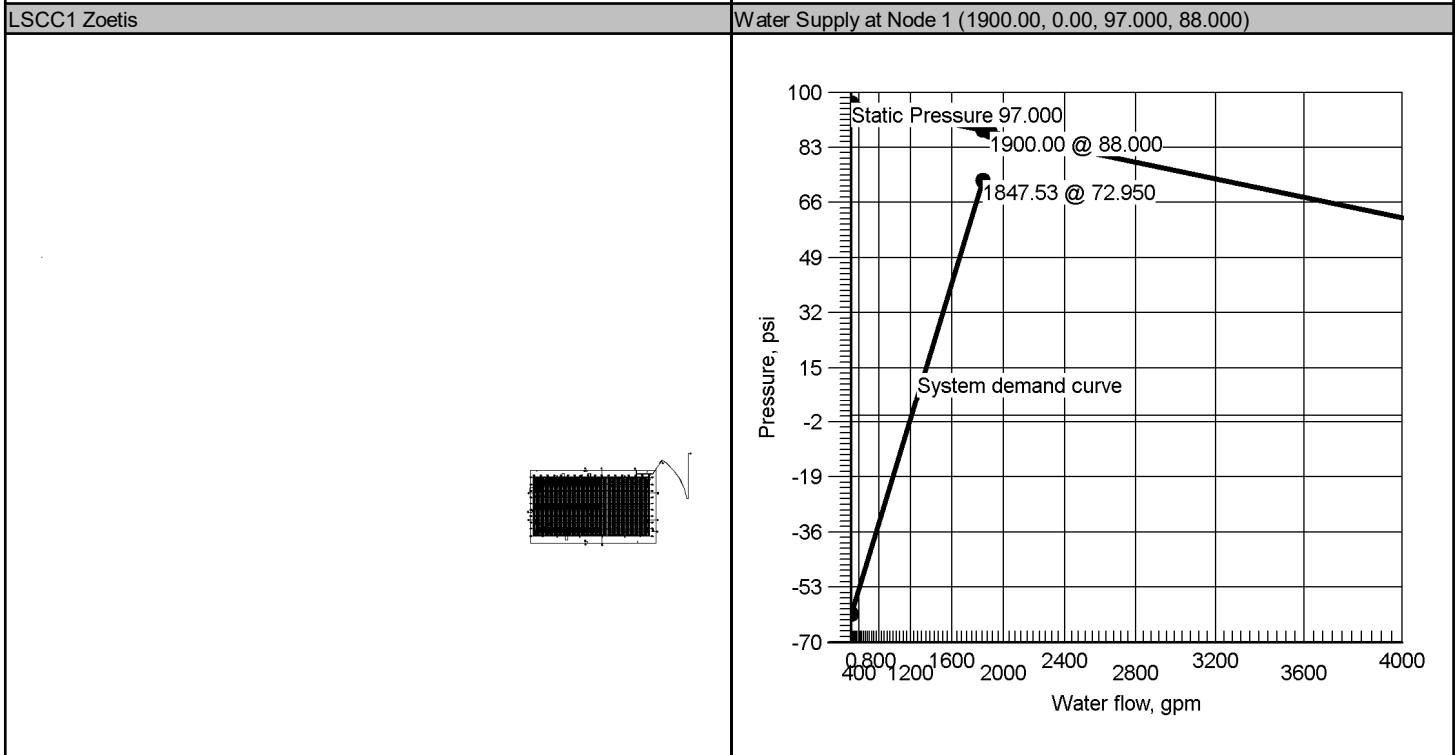
Hydraulic Overview

Job Number: 212189000
Report Description: FP Overhead System 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 28 K-Factor 177.09 at 40.000	Hose Streams 250.00
Coverage Per Sprinkler 100 ft²	Number Of Sprinklers Calculated 9 0
System Pressure Demand 72.950	System Flow Demand 1847.53
Total Demand 1847.53 @ 72.950	Pressure Result +15.504 (17.5%)

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 (461)	0.000	0	0.00
5	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									





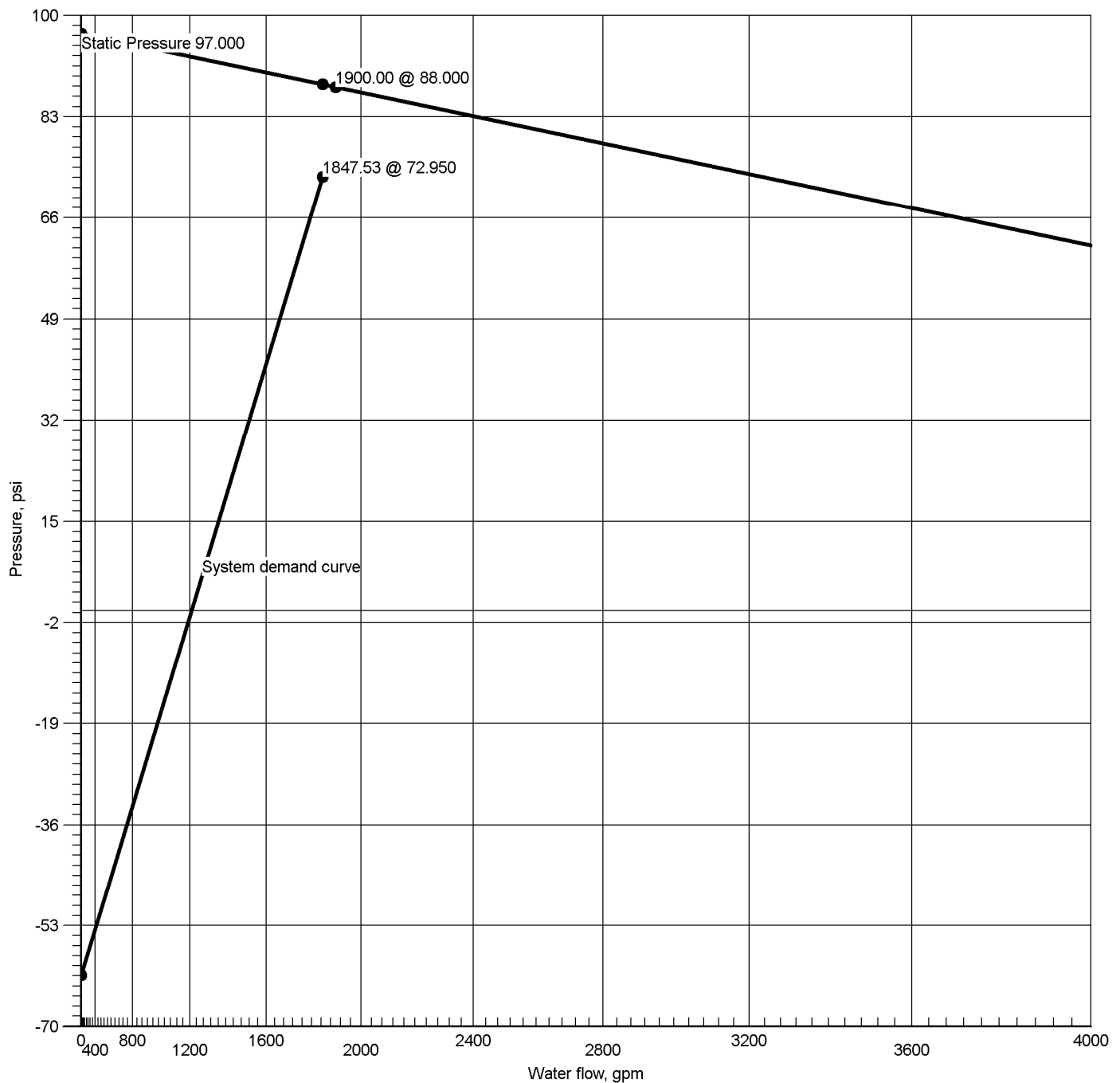
Hydraulic Summary

Job Number: 212189000
Report Description: FP Overhead System 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 28 K-Factor 177.09 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 9		Number Of Nozzles Calculated 0		Coverage Per Sprinkler 100 ft ²	
				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 72.862 Right: 72.931							
Total Hose Streams 250.00											
System Flow Demand 1847.53			Total Water Required (Including Hose Allowance) 1847.53								
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 17.53 between nodes 640 and 638											
Maximum Velocity Under Ground 12.80 between nodes 8 and 9											
Volume capacity of Wet Pipes 32132.49 gal			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	88.454		1847.53	72.950	15.504
5	Pump		84.000	60.000		2000.00	134.840		1847.53	119.336	15.504
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

88.454 @ 1847.53

Required Pressure at System Demand

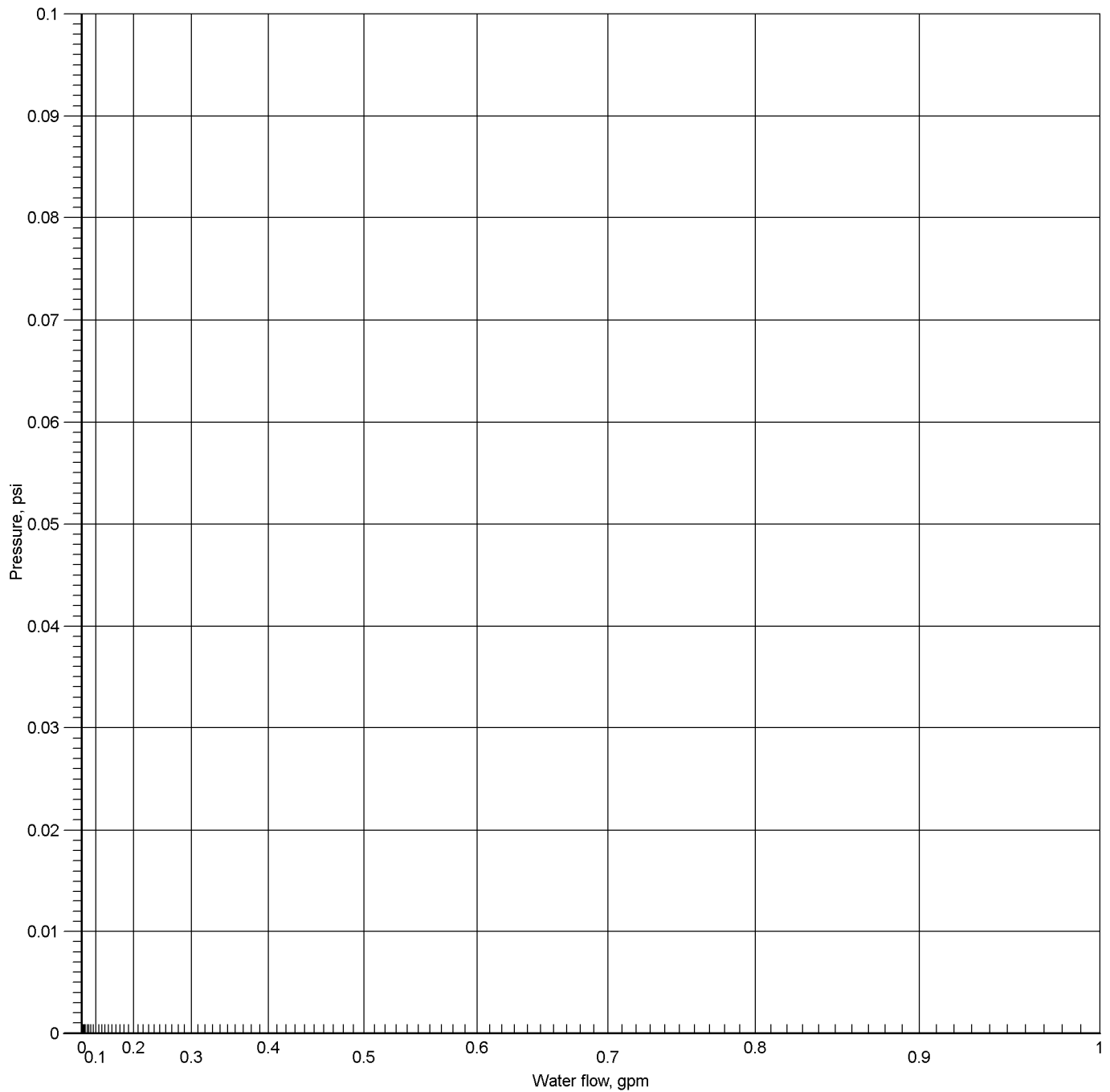
72.950 @ 1847.53

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

72.950 @ 1847.53



Pump Inlet at Node 461



Hydraulic Graph

Pump Inlet at Node 461

Static: Pressure

0.000

Residual: Pressure

N/A

Available Pressure at System Demand

N/A

Required Pressure at System Demand

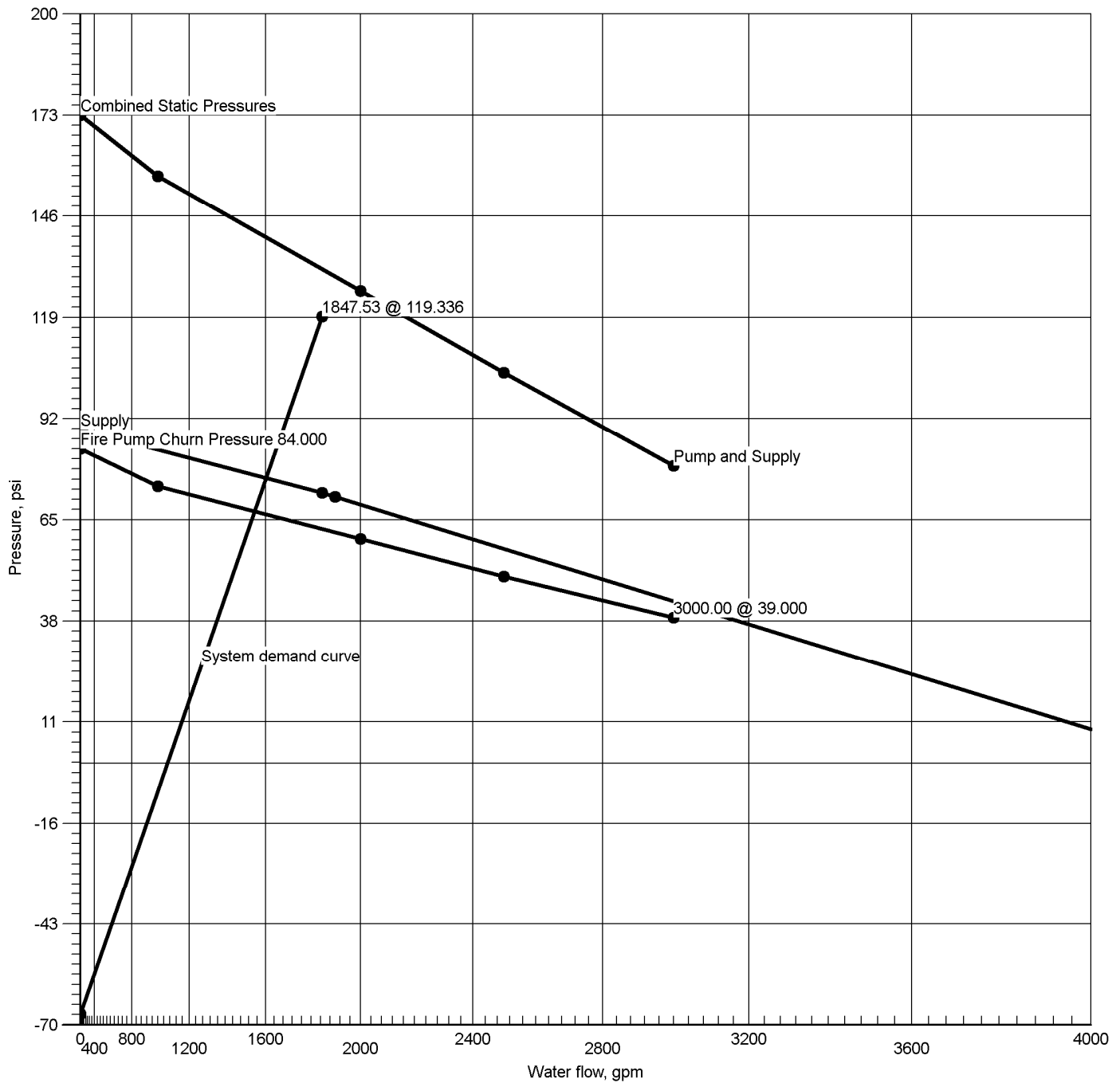
0.000 @ 0.00

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

N/A



Pump at Node 5



Hydraulic Graph

Static + Churn Pressure

Fire Pump Rating

Pump at Node 5

173.256

60.000 @ 2000.00

Static: Pressure

Fire Pump Churn Pressure

173.256

84.000

Residual: Pressure

62.644 @ 1847.53

Available Pressure at System Demand

134.840 @ 1847.53

Required Pressure at System Demand

119.336 @ 1847.53



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: FP Overhead System 06

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Hydrant	56	250.00	250.00	250	110.665			
⇒ Sprinkler	6111	177.09	177.09	28	40.000			
Sprinkler	6113	177.50	177.09	28	40.188			
Sprinkler	6115	177.48	177.09	28	40.177			
Sprinkler	6117	177.10	177.09	28	40.007			
Sprinkler	6119	177.52	177.09	28	40.193			
Sprinkler	6121	177.50	177.09	28	40.186			
Sprinkler	6123	177.51	177.09	28	40.192			
Sprinkler	6125	177.91	177.09	28	40.372			
Sprinkler	6127	177.92	177.09	28	40.378			

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: FP Overhead System 06

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	72.950	1847.53
56	1'-0	Hyd(-1.000)	110.665	250.00
6111	40'-0	Spr(-40.000)	40.000	177.09
6113	40'-0	Spr(-40.188)	40.188	177.50
6115	40'-0	Spr(-40.177)	40.177	177.48
6117	40'-2½	Spr(-40.007)	40.007	177.10
6119	40'-2½	Spr(-40.193)	40.193	177.52
6121	40'-2½	Spr(-40.186)	40.186	177.50
6123	40'-5	Spr(-40.192)	40.192	177.51
6125	40'-5	Spr(-40.372)	40.372	177.91
6127	40'-5	Spr(-40.378)	40.378	177.92
2	-8'-0	E(24'-7)	68.527	
4	1'-9	P1	56.693	
5	1'-9	P2(-62.644)	119.336	
6	1'-9		119.336	
7	6'-8½		115.018	
8	1'-0		117.355	
9	-8'-0	T(43'-10)	119.186	
10	-8'-0	T(43'-10)	114.693	
11	-8'-0	T(47'-3½)	114.728	
12	-8'-0	T(43'-10)	115.739	
13	-8'-0	T(47'-3½)	115.975	
14	-8'-0	T(43'-10)	116.069	
15	-8'-0	T(47'-3½)	117.080	
16	-8'-0	T(43'-10)	117.263	
17	-8'-0	T(47'-3½)	118.095	
18	-8'-0	T(43'-10)	118.236	
19	-8'-0	T(43'-10)	118.566	
51	1'-0	Hyd	1.000	
53	1'-0	Hyd	1.000	
54	1'-0	Hyd	1.000	
600	39'-1	PO(18'-8½)	65.183	
602	39'-3½	PO(18'-8½)	65.117	
604	39'-6	PO(18'-8½)	65.115	
606	39'-8½	PO(18'-8½)	65.210	
608	39'-11	PO(18'-8½)	65.341	
610	40'-1½	PO(18'-8½)	65.507	
612	40'-4	PO(18'-8½)	65.706	
614	40'-6½	PO(18'-8½)	65.937	
616	40'-9	PO(18'-8½)	66.201	
618	40'-11½	PO(18'-8½)	66.497	
620	40'-11½	PO(18'-8½)	66.921	
622	40'-8	PO(18'-8½)	67.504	
624	40'-5	PO(18'-8½)	68.129	
626	40'-1½	PO(18'-8½)	68.802	
628	39'-10	PO(18'-8½)	69.529	
630	1'-8½	PO(41'-1½)	108.147	
632	1'-0		108.450	
634	39'-2	PO(18'-8½)	58.562	
636	39'-4½	PO(18'-8½)	58.631	
638	39'-7	PO(18'-8½)	59.113	
640	39'-9½	PO(18'-8½)	60.244	
642	40'-0	PO(18'-8½)	61.156	
644	40'-2½	PO(18'-8½)	61.888	
646	40'-5	PO(18'-8½)	62.476	
648	40'-7½	PO(18'-8½)	62.939	
650	40'-10	PO(18'-8½)	63.295	
652	41'-0½	PO(18'-8½)	63.555	
654	41'-0½	PO(18'-8½)	63.822	
656	40'-9	PO(18'-8½)	64.127	
658	40'-6	PO(18'-8½)	64.362	
660	40'-2½	PO(18'-8½)	64.540	



Node Analysis

Job Number: 212189000
Report Description: FP Overhead System 06

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
662	39'-11	PO(18'-8½)	64.678	



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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	89.98	5.02	120		0.020853	9'-0	Pf 0.188
6111	40'-0	177.09	28	40.000		Sprinkler		Pe
6113	40'-0			40.188			9'-0	Pv
BL	2.7050	267.48	14.93	120		0.156493	119'-9	Pf 24.598
6113	40'-0	177.50	28	40.188		Sprinkler,	37'-5	Pe 0.397
600	39'-1			65.183		2PO(18'-8½)	157'-2	Pv
CM	6.3570	267.48	2.70	120		0.002440	10'-0	Pf 0.024
600	39'-1			65.183				Pe -0.090
602	39'-3½			65.117			10'-0	Pv
CM	6.3570	534.54	5.40	120		0.008782	10'-0	Pf 0.088
602	39'-3½	267.06		65.117		Flow (q) from Route 3		Pe -0.090
604	39'-6			65.115			10'-0	Pv
CM	6.3570	800.53	8.09	120		0.018538	10'-0	Pf 0.185
604	39'-6	265.99		65.115		Flow (q) from Route 5		Pe -0.090
606	39'-8½			65.210			10'-0	Pv
CM	6.3570	880.71	8.90	120		0.022118	10'-0	Pf 0.221
606	39'-8½	80.17		65.210		Flow (q) from Route 2		Pe -0.090
608	39'-11			65.341			10'-0	Pv
CM	6.3570	953.74	9.64	120		0.025631	10'-0	Pf 0.256
608	39'-11	73.03		65.341		Flow (q) from Route 9		Pe -0.090
610	40'-1½			65.507			10'-0	Pv
CM	6.3570	1017.65	10.29	120		0.028898	10'-0	Pf 0.289
610	40'-1½	63.91		65.507		Flow (q) from Route 15		Pe -0.090
612	40'-4			65.706			10'-0	Pv
CM	6.3570	1077.71	10.89	120		0.032132	10'-0	Pf 0.321
612	40'-4	60.06		65.706		Flow (q) from Route 19		Pe -0.090
614	40'-6½			65.937			10'-0	Pv
CM	6.3570	1134.96	11.47	120		0.035361	10'-0	Pf 0.354
614	40'-6½	57.25		65.937		Flow (q) from Route 18		Pe -0.090
616	40'-9			66.201			10'-0	Pv
CM	6.3570	1191.64	12.05	120		0.038698	10'-0	Pf 0.387
616	40'-9	56.68		66.201		Flow (q) from Route 17		Pe -0.090
618	40'-11½			66.497			10'-0	Pv
CM	6.3570	1248.72	12.62	120		0.042196	9'-11½	Pf 0.420
618	40'-11½	57.07		66.497		Flow (q) from Route 16		Pe 0.004
620	40'-11½			66.921			9'-11½	Pv
CM	6.3570	1310.70	13.25	120		0.046153	10'-0	Pf 0.462
620	40'-11½	61.98		66.921		Flow (q) from Route 10		Pe 0.121
622	40'-8			67.504			10'-0	Pv
CM	6.3570	1375.66	13.91	120		0.050473	10'-0	Pf 0.505
622	40'-8	64.96		67.504		Flow (q) from Route 11		Pe 0.121
624	40'-5			68.129			10'-0	Pv
CM	6.3570	1444.62	14.60	120		0.055253	10'-0	Pf 0.553
624	40'-5	68.96		68.129		Flow (q) from Route 12		Pe 0.121
626	40'-1½			68.802			10'-0	Pv
CM	6.3570	1518.38	15.35	120		0.060585	10'-0	Pf 0.606
626	40'-1½	73.76		68.802		Flow (q) from Route 13		Pe 0.121
628	39'-10			69.529			10'-0	Pv
CM	6.3570	1597.53	16.15	120		0.066557	216'-1	Pf 22.080
628	39'-10	79.15		69.529		Flow (q) from Route 14	115'-8	Pe 16.539
630	1'-8½			108.147		5fE(12'-7), 2f(-0.000), CV(40'-3), BV(12'-7)	331'-9	Pv
DY	8.2490	1597.53	9.59	120		0.018714	0'-0	Pf 0.000
630	1'-8½			108.147				Pe 0.303
632	1'-0			108.450			0'-0	Pv
UG	7.6800	1597.53	11.06	150		0.017540	67'-1½	Pf 2.341
632	1'-0			108.450			66'-4½	Pe 3.902
10	-8'-0			114.693		E(22'-6½), T(43'-10)	133'-5½	Pv
UG	7.6800	1419.35	9.83	150		0.014094	275'-0	Pf 4.493
10	-8'-0			114.693			43'-10	Pe
9	-8'-0			119.186		T(43'-10)	318'-9½	Pv
UG	7.6800	1847.53	12.80	150		0.022954	67'-8	Pf 2.071
9	-8'-0	428.18		119.186		Flow (q) from Route 7	22'-6½	Pe -3.902
8	1'-0			117.355		E(22'-6½)	90'-2½	Pv
FR	8.2490	1847.53	11.09	120		0.024489	5'-8½	Pf 0.140
8	1'-0			117.355				Pe -2.476
7	6'-8½			115.018			5'-8½	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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	1847.53	7.02	120		0.008035	13'-10½"	Pf 2.167
7	6'-8½"			115.018			255'-9"	Pe 2.151
6	1'-9"			119.336		4E(26'-0), T(48'-5½"), BV(21'-3½"), Tr(17'-0), CV(65'-0)	269'-8"	Pv
DY	7.9810	1847.53	11.85	120		0.028763	0'-0"	Pf 0.000
6	1'-9"			119.336				Pe 0.000
5	1'-9"			119.336			0'-0"	Pv
Pump		Velocity						
5		1847.53		119.336		Rating: 60.000 @ 2000.00		
4		Q=1847.53	8.51	56.693		Fire Pump Churn Pressure: 84.000		
UG	9.4200	1847.53	8.51	150		0.008491	305'-9½"	Pf 7.608
4	1'-9"			56.693			137'-6"	Pe 4.227
2	-8'-0"			68.527		GV(5'-7), T(45'-10), 3E(24'-7), EE(12'-3½"), BFP(-3.844)	443'-3½"	Pv
UG	11.2000	1847.53	6.02	150		0.003655	750'-9"	Pf 2.906
2	-8'-0"			68.527			44'-3"	Pe 1.517
1	-11'-6"			72.950		EE(14'-4½"), E(29'-10½"), S	795'-0"	Pv
		0.00				Hose Allowance At Source		
1		1847.53						
Route 2								
BL	2.7050	87.11	4.86	120		0.019638	9'-0"	Pf 0.177
6111	40'-0"	177.09	28	40.000		Sprinkler		Pe
6115	40'-0"			40.177			9'-0"	Pv
BL	2.7050	264.59	14.77	120		0.153373	80'-1"	Pf 18.024
6115	40'-0"	177.48	28	40.177		Sprinkler,	37'-5"	Pe 0.361
634	39'-2"			58.562		2PO(18'-8½")	117'-6"	Pv
CM	4.3100	264.59	5.82	120		0.015867	10'-0"	Pf 0.159
634	39'-2"			58.562				Pe -0.090
636	39'-4½"			58.631			10'-0"	Pv
CM	4.3100	529.64	11.65	120		0.057295	10'-0"	Pf 0.573
636	39'-4½"	265.06		58.631		Flow (q) from Route 4		Pe -0.090
638	39'-7"			59.113			10'-0"	Pv
CM	4.3100	797.00	17.53	120		0.122023	10'-0"	Pf 1.220
638	39'-7"	267.35		59.113		Flow (q) from Route 6		Pe -0.090
640	39'-9½"			60.244			10'-0"	Pv
RN	2.7050	80.17	4.48	120		0.016845	217'-10"	Pf 4.931
640	39'-9½"			60.244		PO(18'-8½")	74'-10½"	Pe 0.036
606	39'-8½"			65.210		3PO(18'-8½")	292'-8½"	Pv
Route 3								
BL	2.7050	89.55	5.00	120		0.020667	9'-0"	Pf 0.186
6117	40'-2½"	177.10	28	40.007		Sprinkler		Pe
6119	40'-2½"			40.193			9'-0"	Pv
BL	2.7050	267.06	14.91	120		0.156037	119'-9"	Pf 24.527
6119	40'-2½"	177.52	28	40.193		Sprinkler,	37'-5"	Pe 0.397
602	39'-3½"			65.117		2PO(18'-8½")	157'-2"	Pv
Route 4								
BL	2.7050	87.56	4.89	120		0.019827	9'-0"	Pf 0.178
6117	40'-2½"	177.10	28	40.007		Sprinkler		Pe
6121	40'-2½"			40.186			9'-0"	Pv
BL	2.7050	265.06	14.80	120		0.153877	80'-1"	Pf 18.084
6121	40'-2½"	177.50	28	40.186		Sprinkler,	37'-5"	Pe 0.361
636	39'-4½"			58.631		2PO(18'-8½")	117'-6"	Pv
Route 5								
BL	2.7050	88.08	4.92	120		0.020046	9'-0"	Pf 0.180
6123	40'-5"	177.51	28	40.192		Sprinkler		Pe
6125	40'-5"			40.372			9'-0"	Pv
BL	2.7050	265.99	14.85	120		0.154882	119'-9"	Pf 24.345
6125	40'-5"	177.91	28	40.372		Sprinkler,	37'-5"	Pe 0.397
604	39'-6"			65.115		2PO(18'-8½")	157'-2"	Pv
Route 6								
BL	2.7050	89.43	4.99	120		0.020619	9'-0"	Pf 0.186
6123	40'-5"	177.51	28	40.192		Sprinkler		Pe
6127	40'-5"			40.378			9'-0"	Pv
BL	2.7050	267.35	14.93	120		0.156353	80'-1"	Pf 18.375
6127	40'-5"	177.92	28	40.378		Sprinkler,	37'-5"	Pe 0.361
638	39'-7"			59.113		2PO(18'-8½")	117'-6"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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 7								
UG	6.2800	250.00	2.59	140		0.001718	20'-0	Pf 0.162
56	1'-0	250.00		110.665		Hydrant,	74'-1	Pe 3.902
11	-8'-0			114.728		E(22'-1), GV(4'-8½), T(47'-3½)	94'-1	Pv
UG	7.6800	428.18	2.97	150		0.001535	635'-11½	Pf 1.011
11	-8'-0	178.18		114.728		Flow (q) from Route 8	22'-6½	Pe
12	-8'-0			115.739		E(22'-6½)	658'-6	Pv
UG	7.6800	428.18	2.97	150		0.001535	153'-8	Pf 0.236
12	-8'-0			115.739				Pe
13	-8'-0			115.975			153'-8	Pv
UG	7.6800	428.18	2.97	150		0.001535	61'-1½	Pf 0.094
13	-8'-0			115.975				Pe
14	-8'-0			116.069			61'-1½	Pv
UG	7.6800	428.18	2.97	150		0.001535	635'-9	Pf 1.011
14	-8'-0			116.069			22'-6½	Pe
15	-8'-0			117.080		E(22'-6½)	658'-3½	Pv
UG	7.6800	428.18	2.97	150		0.001535	119'-3	Pf 0.183
15	-8'-0			117.080				Pe
16	-8'-0			117.263			119'-3	Pv
UG	7.6800	428.18	2.97	150		0.001535	519'-3½	Pf 0.832
16	-8'-0			117.263			22'-6½	Pe
17	-8'-0			118.095		E(22'-6½)	541'-10	Pv
UG	7.6800	428.18	2.97	150		0.001535	91'-11½	Pf 0.141
17	-8'-0			118.095				Pe
18	-8'-0			118.236			91'-11½	Pv
UG	7.6800	428.18	2.97	150		0.001535	214'-9	Pf 0.330
18	-8'-0			118.236				Pe
19	-8'-0			118.566			214'-9	Pv
UG	7.6800	428.18	2.97	150		0.001535	337'-8	Pf 0.620
19	-8'-0			118.566			66'-4½	Pe
9	-8'-0			119.186		E(22'-6½), T(43'-10)	404'-0½	Pv
Route 8								
UG	7.6800	178.18	1.23	150		0.000303	118'-2	Pf 0.036
10	-8'-0	1419.35		114.693		Flow (q) from Route 1		Pe
11	-8'-0			114.728			118'-2	Pv
Route 9								
CM	4.3100	716.82	15.76	120		0.100290	10'-0	Pf 1.003
640	39'-9½	80.17		60.244		Flow (q) from Route 2		Pe -0.090
642	40'-0			61.156			10'-0	Pv
RN	2.7050	73.03	4.08	120		0.014173	217'-10	Pf 4.149
642	40'-0			61.156		PO(18'-8½)	74'-10½	Pe 0.036
608	39'-11			65.341		3PO(18'-8½)	292'-8½	Pv
Route 10								
CM	4.3100	643.79	14.16	120		0.082211	10'-0	Pf 0.822
642	40'-0	73.03		61.156		Flow (q) from Route 9		Pe -0.090
644	40'-2½			61.888			10'-0	Pv
CM	4.3100	579.88	12.75	120		0.067753	10'-0	Pf 0.678
644	40'-2½			61.888				Pe -0.090
646	40'-5			62.476			10'-0	Pv
CM	4.3100	519.82	11.43	120		0.055345	10'-0	Pf 0.554
646	40'-5			62.476				Pe -0.090
648	40'-7½			62.939			10'-0	Pv
CM	4.3100	462.57	10.17	120		0.044599	10'-0	Pf 0.446
648	40'-7½			62.939				Pe -0.090
650	40'-10			63.295			10'-0	Pv
CM	4.3100	405.88	8.93	120		0.035018	10'-0	Pf 0.350
650	40'-10			63.295				Pe -0.090
652	41'-0½			63.555			10'-0	Pv
CM	4.3100	348.81	7.67	120		0.026457	9'-11½	Pf 0.264
652	41'-0½			63.555				Pe 0.004
654	41'-0½			63.822			9'-11½	Pv
RN	2.7050	61.98	3.46	120		0.010464	217'-10	Pf 3.063
654	41'-0½			63.822		PO(18'-8½)	74'-10½	Pe 0.036
620	40'-11½			66.921		3PO(18'-8½)	292'-8½	Pv
Route 11								
CM	4.3100	286.83	6.31	120		0.018422	10'-0	Pf 0.184
654	41'-0½	61.98		63.822		Flow (q) from Route 10		Pe 0.121
656	40'-9			64.127			10'-0	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 06

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream						Total Length	
RN	2.7050	64.96	3.63	120	0.011412	217'-10"	Pf 3.340
656	40'-9"			64.127	PO(18'-8½")	74'-10½"	Pe 0.036
622	40'-8"			67.504	3PO(18'-8½")	292'-8½"	Pv
Route 12							
CM	4.3100	221.87	4.88	120	0.011456	10'-0"	Pf 0.115
656	40'-9"	64.96		64.127	Flow (q) from Route 11		Pe 0.121
658	40'-6"			64.362		10'-0"	Pv
RN	2.7050	68.96	3.85	120	0.012745	217'-10"	Pf 3.731
658	40'-6"			64.362	PO(18'-8½")	74'-10½"	Pe 0.036
624	40'-5"			68.129	3PO(18'-8½")	292'-8½"	Pv
Route 13							
CM	4.3100	152.91	3.36	120	0.005754	10'-0"	Pf 0.058
658	40'-6"	68.96		64.362	Flow (q) from Route 12		Pe 0.121
660	40'-2½"			64.540		10'-0"	Pv
RN	2.7050	73.76	4.12	120	0.014437	217'-10"	Pf 4.226
660	40'-2½"			64.540	PO(18'-8½")	74'-10½"	Pe 0.036
626	40'-1½"			68.802	3PO(18'-8½")	292'-8½"	Pv
Route 14							
CM	4.3100	79.15	1.74	120	0.001702	10'-0"	Pf 0.017
660	40'-2½"	73.76		64.540	Flow (q) from Route 13		Pe 0.121
662	39'-11"			64.678		10'-0"	Pv
RN	2.7050	79.15	4.42	120	0.016450	217'-10"	Pf 4.815
662	39'-11"			64.678	PO(18'-8½")	74'-10½"	Pe 0.036
628	39'-10"			69.529	3PO(18'-8½")	292'-8½"	Pv
Route 15							
RN	2.7050	63.91	3.57	120	0.011074	221'-10"	Pf 3.583
644	40'-2½"			61.888	PO(18'-8½")	101'-8½"	Pe 0.036
610	40'-1½"			65.507	3PO(18'-8½"), 4fE(6'-8½")	323'-6½"	Pv
Route 16							
RN	2.7050	57.07	3.19	120	0.008983	221'-10"	Pf 2.906
652	41'-0½"			63.555	PO(18'-8½")	101'-8½"	Pe 0.036
618	40'-11½"			66.497	3PO(18'-8½"), 4fE(6'-8½")	323'-6½"	Pv
Route 17							
RN	2.7050	56.68	3.16	120	0.008869	221'-10"	Pf 2.869
650	40'-10"			63.295	PO(18'-8½")	101'-8½"	Pe 0.036
616	40'-9"			66.201	3PO(18'-8½"), 4fE(6'-8½")	323'-6½"	Pv
Route 18							
RN	2.7050	57.25	3.20	120	0.009035	221'-10"	Pf 2.962
648	40'-7½"			62.939	PO(18'-8½")	106'-0"	Pe 0.036
614	40'-6½"			65.937	3PO(18'-8½"), Tr(4'-3½"), 4fE(6'-8½")	327'-10"	Pv
Route 19							
RN	2.7050	60.06	3.35	120	0.009872	221'-10"	Pf 3.194
646	40'-5"			62.476	PO(18'-8½")	101'-8½"	Pe 0.036
612	40'-4"			65.706	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
Multipling Factor	0.713	1.16	1.33	1.51



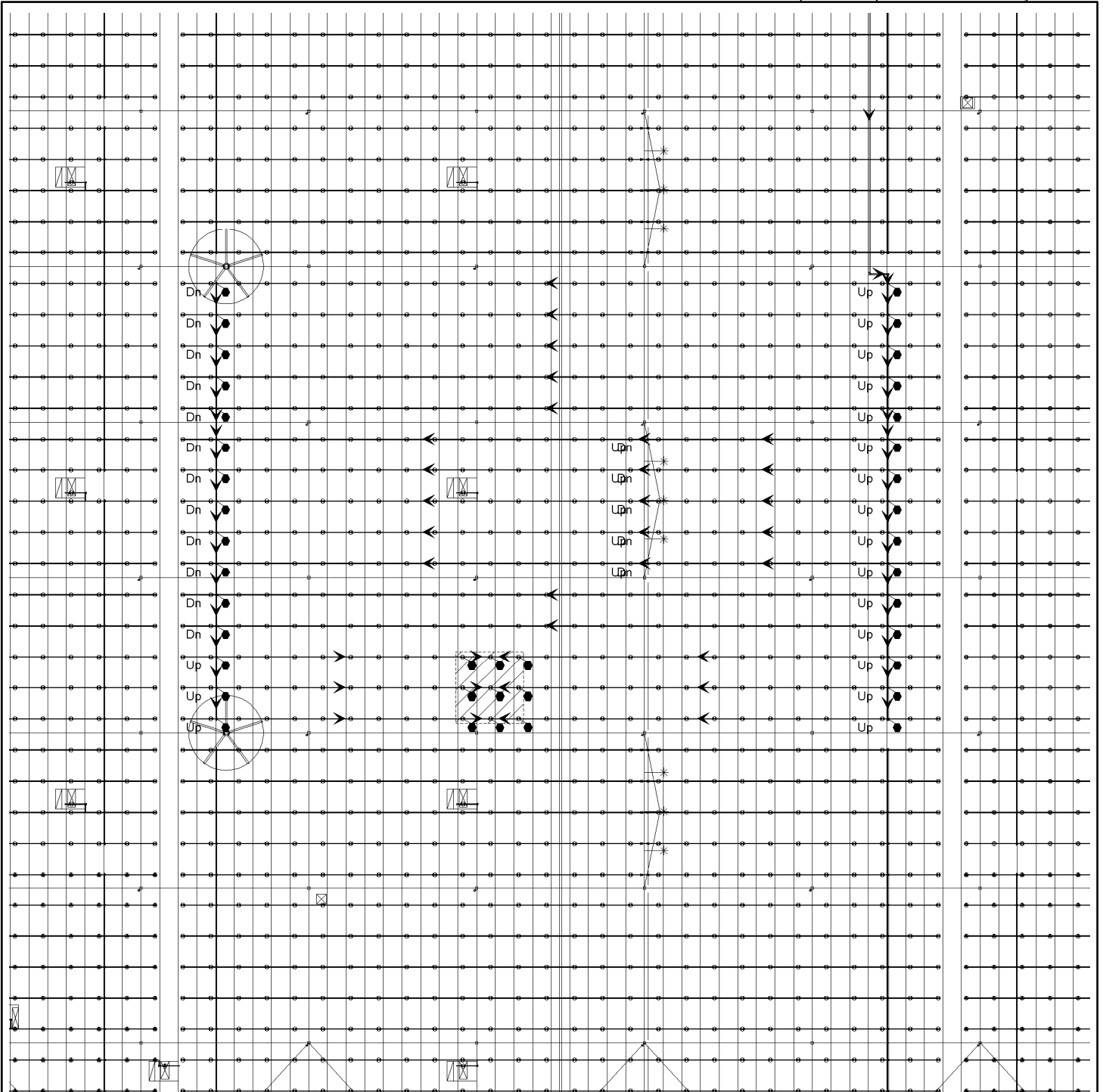
Hydraulic Analysis

Job Number: 212189000

Report Description: FP Overhead System 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	

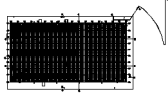
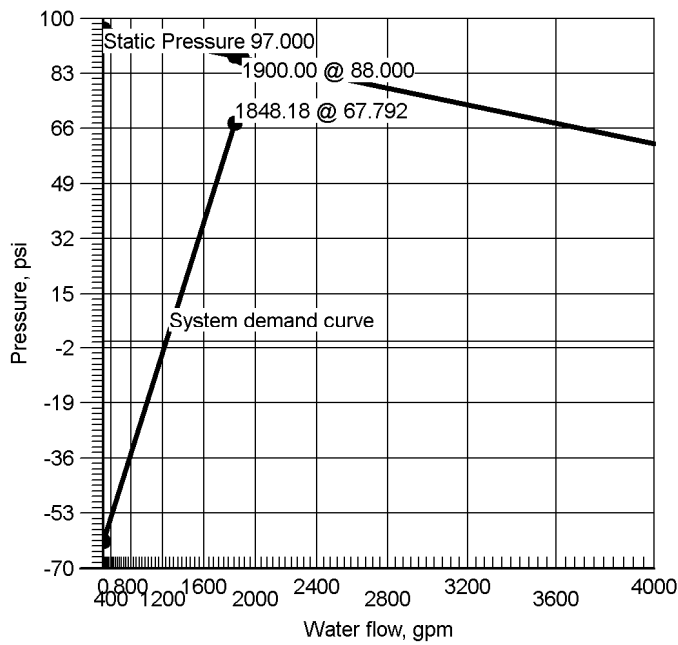
Pipe Type Legend	Units Legend		Fittings Legend	
AO Arm-Over	Diameter	Inch	ALV Alarm Valve	
BL Branch Line	Elevation	Foot	AngV Angle Valve	
CM Cross Main	Flow	gpm	b Bushing	
DN Drain	Discharge	gpm	BaIV Ball Valve	
DR Drop	Velocity	fps	BFP Backflow Preventer	
DY Dynamic	Pressure	psi	BV Butterfly Valve	
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	
SN Swing Nipple	Pf	Pressure loss due to friction between points	DPV Dry Pipe Valve	
SP Sprig	Pe	Pressure due to elevation difference between indicated points	E 90° Elbow	
ST Stand Pipe	Pv	Velocity pressure at a point in a pipe	EE 45° Elbow	
UG Underground			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: FP Overhead System 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 28 K-Factor 177.09 at 40.000					Hose Streams 250.00				
Coverage Per Sprinkler 100 ft²					Number Of Sprinklers Calculated 9			0	
System Pressure Demand 67.792					System Flow Demand 1848.18				
Total Demand 1848.18 @ 67.792					Pressure Result +20.657 (23.4%)				
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 (461)	0.000	0	0.00
5	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)				
									



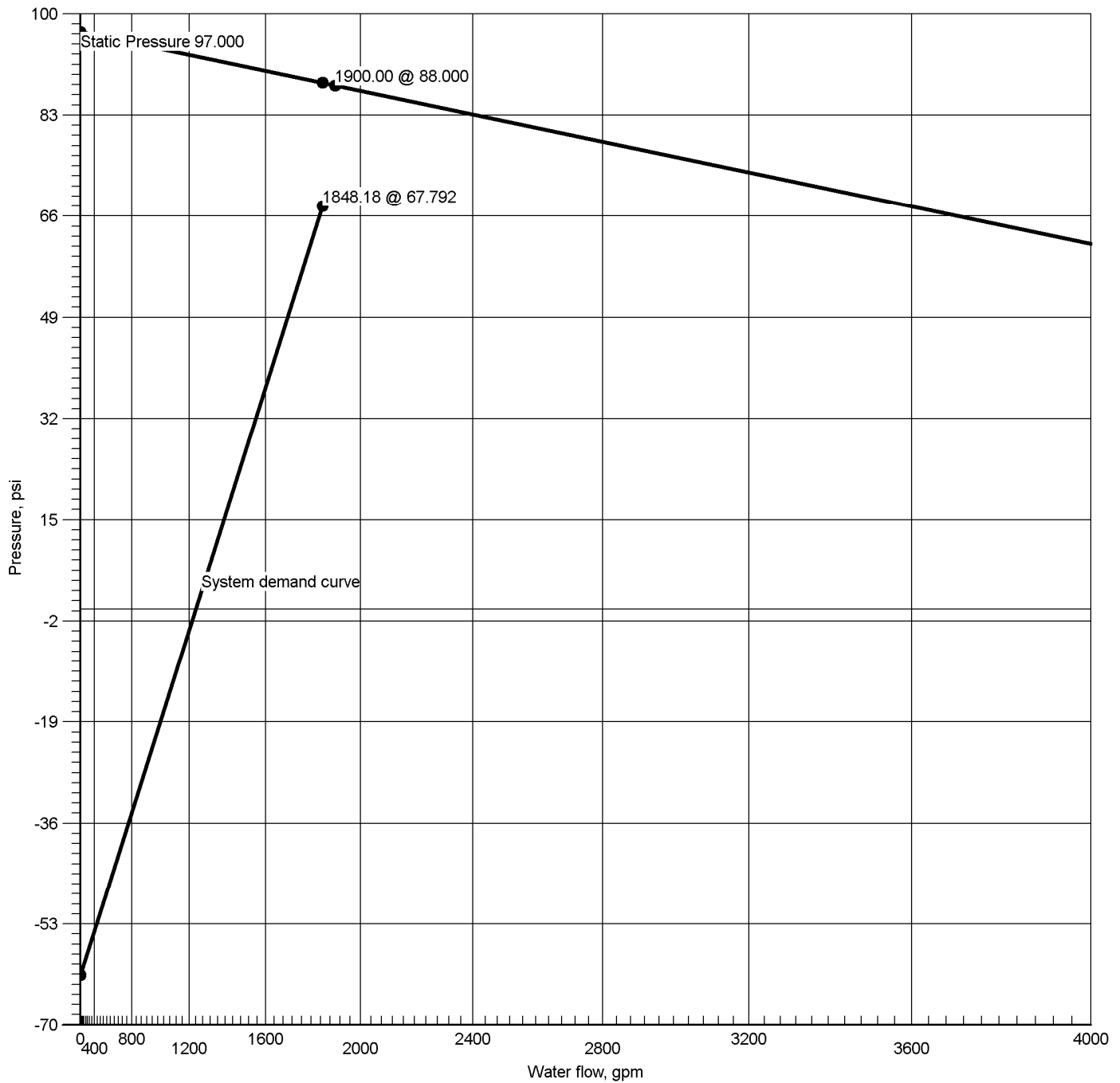
Hydraulic Summary

Job Number: 212189000
Report Description: FP Overhead System 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 28 K-Factor 177.09 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 53				Flow(gpm) 250.00			Number Of Sprinklers Calculated 9				
				Number Of Nozzles Calculated 0			Coverage Per Sprinkler 100 ft²				
				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 67.706 Right: 67.777							
Total Hose Streams 250.00											
System Flow Demand 1848.18			Total Water Required (Including Hose Allowance) 1848.18								
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 17.43 between nodes 740 and 738											
Maximum Velocity Under Ground 12.80 between nodes 8 and 9											
Volume capacity of Wet Pipes 32132.49 gal			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	88.449		1848.18	67.792	20.657
5	Pump		84.000	60.000		2000.00	134.819		1848.18	114.162	20.657
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

88.449 @ 1848.18

Required Pressure at System Demand

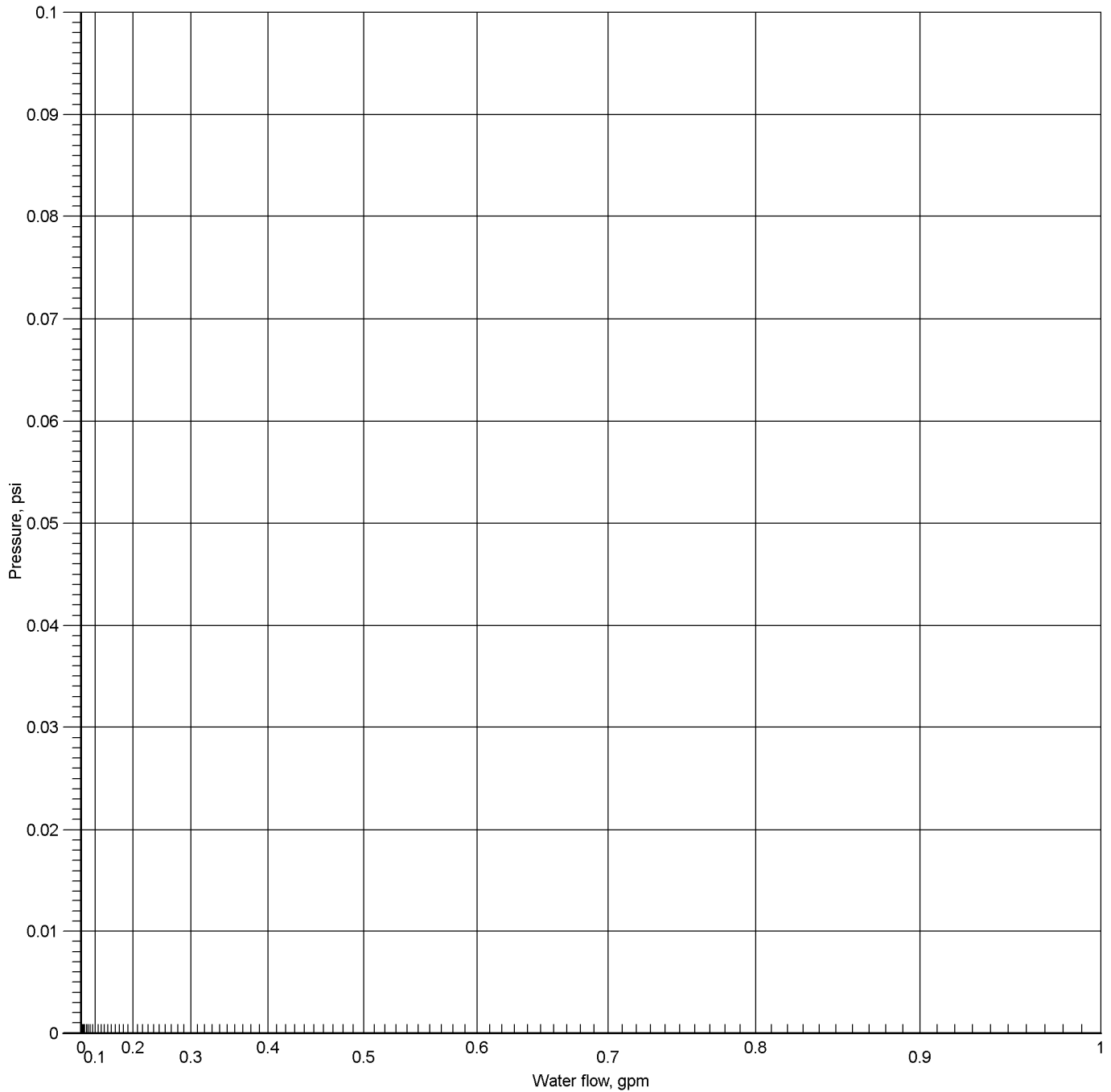
67.792 @ 1848.18

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

67.792 @ 1848.18



Pump Inlet at Node 461



Hydraulic Graph

Pump Inlet at Node 461

Static: Pressure

0.000

Residual: Pressure

N/A

Available Pressure at System Demand

N/A

Required Pressure at System Demand

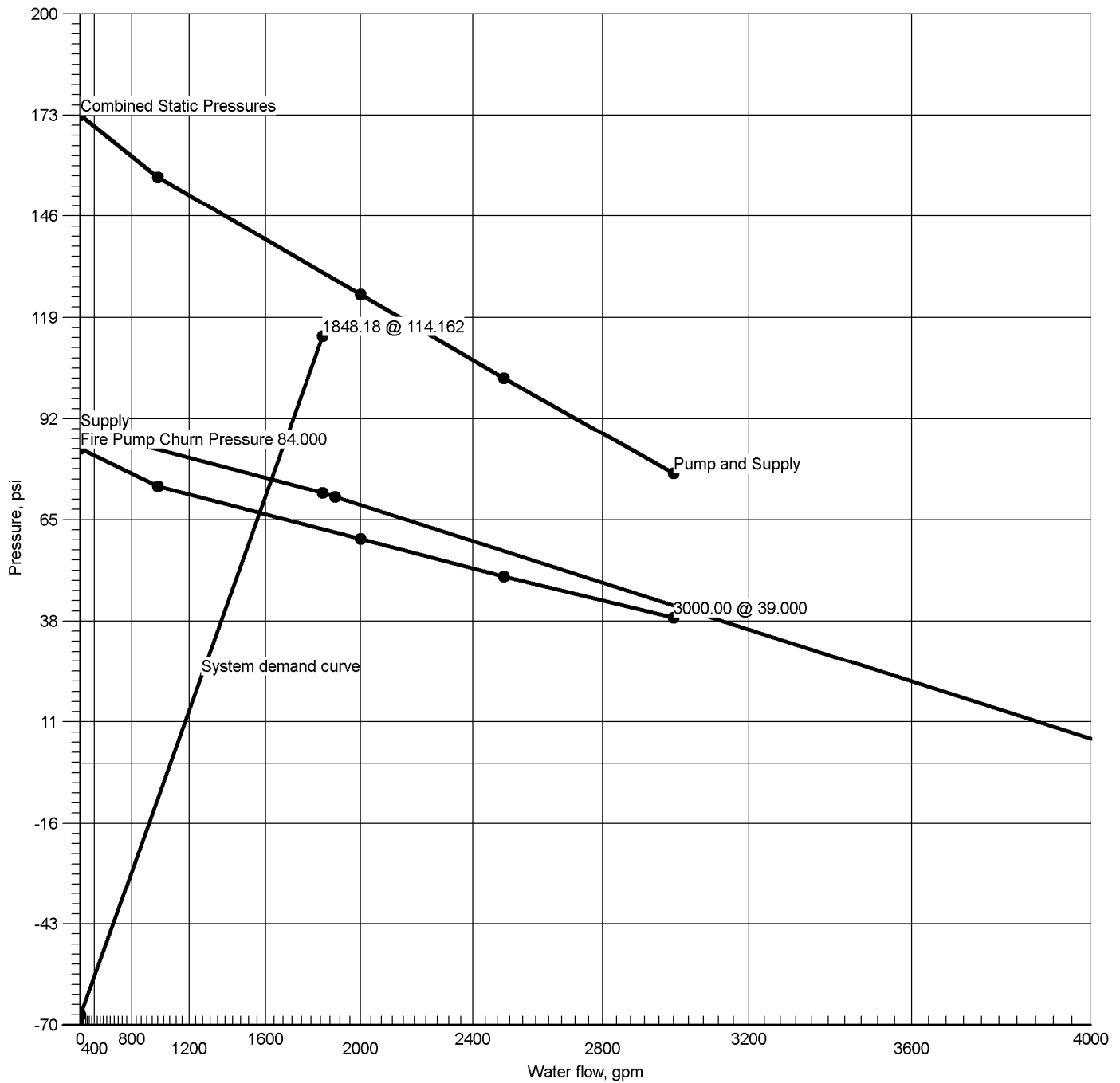
0.000 @ 0.00

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

N/A



Pump at Node 5



Hydraulic Graph
Pump at Node 5

Static + Churn Pressure
173.256
Fire Pump Churn Pressure
84.000

Fire Pump Rating
60.000 @ 2000.00

Static: Pressure
173.256

Residual: Pressure
62.633 @ 1848.18

Available Pressure at System Demand
134.819 @ 1848.18

Required Pressure at System Demand
114.162 @ 1848.18



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: FP Overhead System 07

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Hydrant	53	250.00	250.00	250	100.243			
⇒ Sprinkler	7111	177.09	177.09	28	40.000			
Sprinkler	7113	177.51	177.09	28	40.191			
Sprinkler	7115	177.47	177.09	28	40.174			
Sprinkler	7117	177.36	177.09	28	40.123			
Sprinkler	7119	177.78	177.09	28	40.312			
Sprinkler	7121	177.75	177.09	28	40.298			
Sprinkler	7123	177.47	177.09	28	40.175			
Sprinkler	7125	177.90	177.09	28	40.367			
Sprinkler	7127	177.86	177.09	28	40.349			

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: FP Overhead System 07

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	67.792	1848.18
53	1'-0	Hyd(-1.000)	100.243	250.00
7111	39'-9½	Spr(-40.000)	40.000	177.09
7113	39'-9½	Spr(-40.191)	40.191	177.51
7115	39'-9½	Spr(-40.174)	40.174	177.47
7117	39'-7	Spr(-40.123)	40.123	177.36
7119	39'-7	Spr(-40.312)	40.312	177.78
7121	39'-7	Spr(-40.298)	40.298	177.75
7123	39'-4½	Spr(-40.175)	40.175	177.47
7125	39'-4½	Spr(-40.367)	40.367	177.90
7127	39'-4½	Spr(-40.349)	40.349	177.86
2	-8'-0	E(24'-7)	63.367	
4	1'-9	P1	51.529	
5	1'-9	P2(-62.633)	114.162	
6	1'-9		114.162	
7	6'-8½		109.843	
8	1'-0		112.179	
9	-8'-0	T(43'-10)	114.009	
10	-8'-0	T(43'-10)	112.437	
11	-8'-0	T(47'-3½)	111.855	
12	-8'-0	T(43'-10)	108.609	
13	-8'-0	T(47'-3½)	107.852	
14	-8'-0	T(43'-10)	107.551	
15	-8'-0	T(47'-3½)	104.306	
16	-8'-0	T(43'-10)	104.011	
17	-8'-0	T(47'-3½)	108.336	
18	-8'-0	T(43'-10)	109.070	
19	-8'-0	T(43'-10)	110.784	
51	1'-0	Hyd	1.000	
54	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
700	38'-11½	PO(18'-8½)	67.304	
702	38'-9	PO(18'-8½)	67.419	
704	38'-6½	PO(18'-8½)	67.598	
706	38'-4	PO(18'-8½)	67.876	
708	38'-1½	PO(18'-8½)	68.186	
710	37'-11	PO(18'-8½)	68.527	
712	37'-8½	PO(18'-8½)	68.900	
714	37'-6	PO(18'-8½)	69.303	
716	37'-3½	PO(18'-8½)	69.736	
718	37'-1	PO(18'-8½)	70.200	
720	37'-0	PO(18'-8½)	70.646	
722	37'-0	PO(18'-8½)	71.084	
724	37'-0	PO(18'-8½)	71.559	
726	37'-0	PO(18'-8½)	72.073	
728	37'-0	PO(18'-8½)	72.632	
730	37'-0	PO(18'-8½)	73.241	
732	1'-2½		97.700	
734	38'-11½	PO(18'-8½)	61.195	
736	38'-9	PO(18'-8½)	61.443	
738	38'-6½	PO(18'-8½)	62.103	
740	38'-4	PO(18'-8½)	63.402	
742	38'-1½	PO(18'-8½)	64.504	
744	37'-11	PO(18'-8½)	65.445	
746	37'-0	PO(18'-8½)	68.316	
748	37'-0	PO(18'-8½)	68.547	
750	37'-0	PO(18'-8½)	68.710	
752	37'-0	PO(18'-8½)	68.812	
754	37'-0	PO(18'-8½)	68.864	
756	37'-0	PO(18'-8½)	68.879	
758	37'-8½	PO(18'-8½)	66.243	
760	37'-6	PO(18'-8½)	66.919	



Node Analysis

Job Number: 212189000
Report Description: FP Overhead System 07

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
762	37'-3½	PO(18'-8½)	67.490	
764	37'-1	PO(18'-8½)	67.969	



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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	90.84	5.07	120		0.021222	9'-0	Pf 0.191
7111	39'-9½	177.09	28	40.000		Sprinkler		Pe
7113	39'-9½			40.191			9'-0	Pv
BL	2.7050	268.35	14.98	120		0.157429	105'-8	Pf 26.752
7113	39'-9½	177.51	28	40.191		Sprinkler,	64'-3	Pe 0.361
700	38'-11½			67.304		4fE(6'-8½), 2PO(18'-8½)	169'-11	Pv
CM	6.3570	268.35	2.71	120		0.002454	10'-0	Pf 0.025
700	38'-11½			67.304				Pe 0.090
702	38'-9			67.419			10'-0	Pv
CM	6.3570	536.66	5.42	120		0.008846	10'-0	Pf 0.088
702	38'-9	268.31		67.419		Flow (q) from Route 3		Pe 0.090
704	38'-6½			67.598			10'-0	Pv
CM	6.3570	805.64	8.14	120		0.018758	10'-0	Pf 0.188
704	38'-6½	268.98		67.598		Flow (q) from Route 5		Pe 0.090
706	38'-4			67.876			10'-0	Pv
CM	6.3570	877.72	8.87	120		0.021980	10'-0	Pf 0.220
706	38'-4	72.08		67.876		Flow (q) from Route 9		Pe 0.090
708	38'-1½			68.186			10'-0	Pv
CM	6.3570	942.58	9.53	120		0.025079	10'-0	Pf 0.251
708	38'-1½	64.87		68.186		Flow (q) from Route 16		Pe 0.090
710	37'-11			68.527			10'-0	Pv
CM	6.3570	1004.79	10.16	120		0.028226	10'-0	Pf 0.282
710	37'-11	62.20		68.527		Flow (q) from Route 2		Pe 0.090
712	37'-8½			68.900			10'-0	Pv
CM	6.3570	1062.20	10.74	120		0.031282	10'-0	Pf 0.313
712	37'-8½	57.41		68.900		Flow (q) from Route 17		Pe 0.090
714	37'-6			69.303			10'-0	Pv
CM	6.3570	1116.34	11.28	120		0.034296	10'-0	Pf 0.343
714	37'-6	54.14		69.303		Flow (q) from Route 18		Pe 0.090
716	37'-3½			69.736			10'-0	Pv
CM	6.3570	1168.77	11.81	120		0.037335	10'-0	Pf 0.373
716	37'-3½	52.43		69.736		Flow (q) from Route 19		Pe 0.090
718	37'-1			70.200			10'-0	Pv
CM	6.3570	1221.00	12.34	120		0.040480	10'-0	Pf 0.406
718	37'-1	52.23		70.200		Flow (q) from Route 20		Pe 0.041
720	37'-0			70.646			10'-0	Pv
CM	6.3570	1274.06	12.88	120		0.043794	10'-0	Pf 0.438
720	37'-0	53.06		70.646		Flow (q) from Route 10		Pe
722	37'-0			71.084			10'-0	Pv
CM	6.3570	1330.05	13.44	120		0.047421	10'-0	Pf 0.474
722	37'-0	55.99		71.084		Flow (q) from Route 11		Pe
724	37'-0			71.559			10'-0	Pv
CM	6.3570	1389.66	14.05	120		0.051428	10'-0	Pf 0.514
724	37'-0	59.61		71.559		Flow (q) from Route 12		Pe
726	37'-0			72.073			10'-0	Pv
CM	6.3570	1453.79	14.70	120		0.055904	10'-0	Pf 0.559
726	37'-0	64.13		72.073		Flow (q) from Route 13		Pe
728	37'-0			72.632			10'-0	Pv
CM	6.3570	1523.13	15.40	120		0.060937	10'-0	Pf 0.609
728	37'-0	69.34		72.632		Flow (q) from Route 14		Pe
730	37'-0			73.241			10'-0	Pv
CM	6.3570	1598.18	16.16	120		0.066608	56'-3½	Pf 8.942
730	37'-0	75.05		73.241		Flow (q) from Route 15	77'-11½	Pe 15.517
732	1'-2½			97.700		2fE(12'-7), 2f(-0.000), CV(40'-3), BV(12'-7)	134'-3	Pv
UG	7.6800	1598.18	11.07	150		0.017554	65'-8½	Pf 2.318
732	1'-2½			97.700			66'-4½	Pe 3.992
16	-8'-0			104.011		E(22'-6½), T(43'-10)	132'-1	Pv
UG	7.6800	1043.81	7.23	150		0.007982	519'-3½	Pf 4.325
16	-8'-0			104.011			22'-6½	Pe
17	-8'-0			108.336		E(22'-6½)	541'-10	Pv
UG	7.6800	1043.81	7.23	150		0.007982	91'-11½	Pf 0.734
17	-8'-0			108.336				Pe
18	-8'-0			109.070			91'-11½	Pv
UG	7.6800	1043.81	7.23	150		0.007982	214'-9	Pf 1.714
18	-8'-0			109.070				Pe
19	-8'-0			110.784			214'-9	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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	7.6800	1043.81	7.23	150		0.007982	337'-8"	Pf 3.225
19	-8'-0"			110.784			66'-4½"	Pe
9	-8'-0"			114.009		E(22'-6½"), T(43'-10")	404'-0½"	Pv
UG	7.6800	1848.18	12.80	150		0.022969	67'-8"	Pf 2.072
9	-8'-0"	804.37		114.009		Flow (q) from Route 7	22'-6½"	Pe -3.902
8	1'-0"			112.179		E(22'-6½")	90'-2½"	Pv
FR	8.2490	1848.18	11.10	120		0.024505	5'-8½"	Pf 0.140
8	1'-0"			112.179				Pe -2.476
7	6'-8½"			109.843			5'-8½"	Pv
DY	10.3700	1848.18	7.02	120		0.008041	13'-10½"	Pf 2.168
7	6'-8½"			109.843			255'-9"	Pe 2.151
6	1'-9"			114.162		4E(26'-0"), T(48'-5½"), BV(21'-3½"), Tr(17'-0"), CV(65'-0")	269'-8"	Pv
DY	7.9810	1848.18	11.85	120		0.028781	0'-0"	Pf 0.000
6	1'-9"			114.162				Pe 0.000
5	1'-9"			114.162			0'-0"	Pv
Pump								
5		1848.18	Velocity	114.162		Rating: 60.000 @ 2000.00		
4		Q=1848.18	8.51	51.529		Fire Pump Churn Pressure: 84.000		
UG	9.4200	1848.18	8.51	150		0.008496	305'-9½"	Pf 7.611
4	1'-9"			51.529			137'-6"	Pe 4.227
2	-8'-0"			63.367		GV(5'-7"), T(45'-10"), 3E(24'-7"), EE(12'-3½"), BFP(-3.845)	443'-3½"	Pv
UG	11.2000	1848.18	6.02	150		0.003657	750'-9"	Pf 2.908
2	-8'-0"			63.367			44'-3"	Pe 1.517
1	-11'-6"			67.792		EE(14'-4½"), E(29'-10½"), S	795'-0"	Pv
		0.00				Hose Allowance At Source		
1		1848.18						
Route 2								
BL	2.7050	86.25	4.82	120		0.019283	9'-0"	Pf 0.174
7111	39'-9½"	177.09	28	40.000		Sprinkler		Pe
7115	39'-9½"			40.174			9'-0"	Pv
BL	2.7050	263.72	14.72	120		0.152448	98'-1"	Pf 20.660
7115	39'-9½"	177.47	28	40.174		Sprinkler,	37'-5"	Pe 0.361
734	38'-11½"			61.195		2PO(18'-8½")	135'-6"	Pv
CM	4.3100	263.72	5.80	120		0.015771	10'-0"	Pf 0.158
734	38'-11½"			61.195				Pe 0.090
736	38'-9"			61.443			10'-0"	Pv
CM	4.3100	528.30	11.62	120		0.057026	10'-0"	Pf 0.570
736	38'-9"	264.57		61.443		Flow (q) from Route 4		Pe 0.090
738	38'-6½"			62.103			10'-0"	Pv
CM	4.3100	792.54	17.43	120		0.120766	10'-0"	Pf 1.208
738	38'-6½"	264.25		62.103		Flow (q) from Route 6		Pe 0.090
740	38'-4"			63.402			10'-0"	Pv
CM	4.3100	720.47	15.84	120		0.101236	10'-0"	Pf 1.013
740	38'-4"			63.402				Pe 0.090
742	38'-1½"			64.504			10'-0"	Pv
CM	4.3100	655.60	14.42	120		0.085022	10'-0"	Pf 0.850
742	38'-1½"			64.504				Pe 0.090
744	37'-11"			65.445			10'-0"	Pv
RN	2.7050	62.20	3.47	120		0.010533	217'-9"	Pf 3.082
744	37'-11"			65.445		PO(18'-8½")	74'-10½"	Pe -0.000
710	37'-11"			68.527		3PO(18'-8½")	292'-7½"	Pv
Route 3								
BL	2.7050	90.53	5.05	120		0.021091	9'-0"	Pf 0.190
7117	39'-7"	177.36	28	40.123		Sprinkler		Pe
7119	39'-7"			40.312			9'-0"	Pv
BL	2.7050	268.31	14.98	120		0.157390	105'-8"	Pf 26.746
7119	39'-7"	177.78	28	40.312		Sprinkler,	64'-3"	Pe 0.361
702	38'-9"			67.419		4FE(6'-8½"), 2PO(18'-8½")	169'-11"	Pv
Route 4								
BL	2.7050	86.83	4.85	120		0.019521	9'-0"	Pf 0.176
7117	39'-7"	177.36	28	40.123		Sprinkler		Pe
7121	39'-7"			40.298			9'-0"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 07

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Fittings	Eq. Length	Summary
Upstream						Total Length	
BL	2.7050	264.57	14.77	120	0.153358	98'-1	Pf 20.783
7121	39'-7	177.75	28	40.298	Sprinkler,	37'-5	Pe 0.361
736	38'-9			61.443	2PO(18'-8½)	135'-6	Pv
Route 5							
BL	2.7050	91.08	5.09	120	0.021329	9'-0	Pf 0.192
7123	39'-4½	177.47	28	40.175	Sprinkler		Pe
7125	39'-4½			40.367		9'-0	Pv
BL	2.7050	268.98	15.02	120	0.158121	105'-8	Pf 26.870
7125	39'-4½	177.90	28	40.367	Sprinkler,	64'-3	Pe 0.361
704	38'-6½			67.598	4fE(6'-8½), 2PO(18'-8½)	169'-11	Pv
Route 6							
BL	2.7050	86.39	4.82	120	0.019340	9'-0	Pf 0.174
7123	39'-4½	177.47	28	40.175	Sprinkler		Pe
7127	39'-4½			40.349		9'-0	Pv
BL	2.7050	264.25	14.75	120	0.153012	98'-1	Pf 21.393
7127	39'-4½	177.86	28	40.349	Sprinkler,	41'-8½	Pe 0.361
738	38'-6½			62.103	Tr(4'-3½), 2PO(18'-8½)	139'-9½	Pv
Route 7							
UG	6.2800	250.00	2.59	140	0.001718	19'-9	Pf 0.161
53	1'-0	250.00		100.243	Hydrant,	74'-1	Pe 3.902
15	-8'-0			104.306	E(22'-1), GV(4'-8½), T(47'-3½)	93'-10	Pv
UG	7.6800	804.37	5.57	150	0.004929	635'-9	Pf 3.245
15	-8'-0	554.37		104.306	Flow (q) from Route 8	22'-6½	Pe
14	-8'-0			107.551	E(22'-6½)	658'-3½	Pv
UG	7.6800	804.37	5.57	150	0.004929	61'-1½	Pf 0.301
14	-8'-0			107.551			Pe
13	-8'-0			107.852		61'-1½	Pv
UG	7.6800	804.37	5.57	150	0.004929	153'-8	Pf 0.757
13	-8'-0			107.852			Pe
12	-8'-0			108.609		153'-8	Pv
UG	7.6800	804.37	5.57	150	0.004929	635'-11½	Pf 3.246
12	-8'-0			108.609		22'-6½	Pe
11	-8'-0			111.855	E(22'-6½)	658'-6	Pv
UG	7.6800	804.37	5.57	150	0.004929	118'-2	Pf 0.582
11	-8'-0			111.855			Pe
10	-8'-0			112.437		118'-2	Pv
UG	7.6800	804.37	5.57	150	0.004929	275'-0	Pf 1.571
10	-8'-0			112.437		43'-10	Pe
9	-8'-0			114.009	T(43'-10)	318'-9½	Pv
Route 8							
UG	7.6800	554.37	3.84	150	0.002476	119'-3	Pf 0.295
16	-8'-0	1043.81		104.011	Flow (q) from Route 1		Pe
15	-8'-0			104.306		119'-3	Pv
Route 9							
RN	2.7050	72.08	4.02	120	0.013834	221'-9	Pf 4.474
740	38'-4			63.402	PO(18'-8½)	101'-8½	Pe -0.000
706	38'-4			67.876	3PO(18'-8½), 4fE(6'-8½)	323'-5½	Pv
Route 10							
RN	2.7050	53.06	2.96	120	0.007848	217'-9	Pf 2.330
746	37'-0	377.18		68.316	PO(18'-8½), Flow (q) from Route	79'-2	Pe
720	37'-0			70.646	21	296'-11	Pv
					3PO(18'-8½), Tr(4'-3½)		
Route 11							
CM	4.3100	324.13	7.13	120	0.023098	10'-0	Pf 0.231
746	37'-0	377.18		68.316	Flow (q) from Route 21		Pe
748	37'-0			68.547		10'-0	Pv
RN	2.7050	55.99	3.13	120	0.008671	217'-9	Pf 2.537
748	37'-0			68.547	PO(18'-8½)	74'-10½	Pe
722	37'-0			71.084	3PO(18'-8½)	292'-7½	Pv
Route 12							
CM	4.3100	268.13	5.90	120	0.016263	10'-0	Pf 0.163
748	37'-0	55.99		68.547	Flow (q) from Route 11		Pe
750	37'-0			68.710		10'-0	Pv
RN	2.7050	59.61	3.33	120	0.009736	217'-9	Pf 2.849
750	37'-0			68.710	PO(18'-8½)	74'-10½	Pe
724	37'-0			71.559	3PO(18'-8½)	292'-7½	Pv
Route 13							



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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	
CM	4.3100	208.52	4.59	120		0.010213	10'-0"	Pf 0.102
750	37'-0"	59.61		68.710		Flow (q) from Route 12		Pe
752	37'-0"			68.812			10'-0"	Pv
RN	2.7050	64.13	3.58	120		0.011144	217'-9"	Pf 3.261
752	37'-0"			68.812		PO(18'-8½")	74'-10½"	Pe
726	37'-0"			72.073		3PO(18'-8½")	292'-7½"	Pv
Route 14								
CM	4.3100	144.39	3.18	120		0.005175	10'-0"	Pf 0.052
752	37'-0"	64.13		68.812		Flow (q) from Route 13		Pe
754	37'-0"			68.864			10'-0"	Pv
RN	2.7050	69.34	3.87	120		0.012878	217'-9"	Pf 3.768
754	37'-0"			68.864		PO(18'-8½")	74'-10½"	Pe
728	37'-0"			72.632		3PO(18'-8½")	292'-7½"	Pv
Route 15								
CM	4.3100	75.05	1.65	120		0.001542	10'-0"	Pf 0.015
754	37'-0"	69.34		68.864		Flow (q) from Route 14		Pe
756	37'-0"			68.879			10'-0"	Pv
RN	2.7050	75.05	4.19	120		0.014907	217'-9"	Pf 4.362
756	37'-0"			68.879		PO(18'-8½")	74'-10½"	Pe
730	37'-0"			73.241		3PO(18'-8½")	292'-7½"	Pv
Route 16								
RN	2.7050	64.87	3.62	120		0.011383	221'-9"	Pf 3.682
742	38'-1½"			64.504		PO(18'-8½")	101'-8½"	Pe -0.000
708	38'-1½"			68.186		3PO(18'-8½"), 4fE(6'-8½")	323'-5½"	Pv
Route 17								
CM	4.3100	593.40	13.05	120		0.070703	10'-0"	Pf 0.707
744	37'-11"	62.20		65.445		Flow (q) from Route 2		Pe 0.090
758	37'-8½"			66.243			10'-0"	Pv
RN	2.7050	57.41	3.21	120		0.009081	217'-9"	Pf 2.657
758	37'-8½"			66.243		PO(18'-8½")	74'-10½"	Pe -0.000
712	37'-8½"			68.900		3PO(18'-8½")	292'-7½"	Pv
Route 18								
CM	4.3100	535.99	11.79	120		0.058571	10'-0"	Pf 0.586
758	37'-8½"	57.41		66.243		Flow (q) from Route 17		Pe 0.090
760	37'-6"			66.919			10'-0"	Pv
RN	2.7050	54.14	3.02	120		0.008148	217'-9"	Pf 2.384
760	37'-6"			66.919		PO(18'-8½")	74'-10½"	Pe -0.000
714	37'-6"			69.303		3PO(18'-8½")	292'-7½"	Pv
Route 19								
CM	4.3100	481.84	10.60	120		0.048098	10'-0"	Pf 0.481
760	37'-6"	54.14		66.919		Flow (q) from Route 18		Pe 0.090
762	37'-3½"			67.490			10'-0"	Pv
RN	2.7050	52.43	2.93	120		0.007677	217'-9"	Pf 2.246
762	37'-3½"			67.490		PO(18'-8½")	74'-10½"	Pe -0.000
716	37'-3½"			69.736		3PO(18'-8½")	292'-7½"	Pv
Route 20								
CM	4.3100	429.42	9.44	120		0.038866	10'-0"	Pf 0.389
762	37'-3½"	52.43		67.490		Flow (q) from Route 19		Pe 0.090
764	37'-1"			67.969			10'-0"	Pv
RN	2.7050	52.23	2.92	120		0.007624	217'-9"	Pf 2.231
764	37'-1"			67.969		PO(18'-8½")	74'-10½"	Pe -0.000
718	37'-1"			70.200		3PO(18'-8½")	292'-7½"	Pv
Route 21								
CM	4.3100	377.18	8.29	120		0.030575	10'-0"	Pf 0.306
764	37'-1"	52.23		67.969		Flow (q) from Route 20		Pe 0.041
746	37'-0"			68.316			10'-0"	Pv

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

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

C Value Multiplier

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



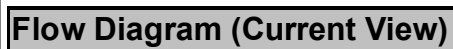
Hydraulic Analysis

Job Number: 212189000

Report Description: FP Overhead System 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	

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	
SN Swing Nipple	Pf	Pressure loss due to friction between points	DPV Dry Pipe Valve	
SP Sprig	Pe	Pressure due to elevation difference between indicated points	E 90° Elbow	
ST Stand Pipe	Pv	Velocity pressure at a point in a pipe	EE 45° Elbow	
UG Underground			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	



Job Number: 212189000
Report Description: FP Overhead System 07





Hydraulic Overview

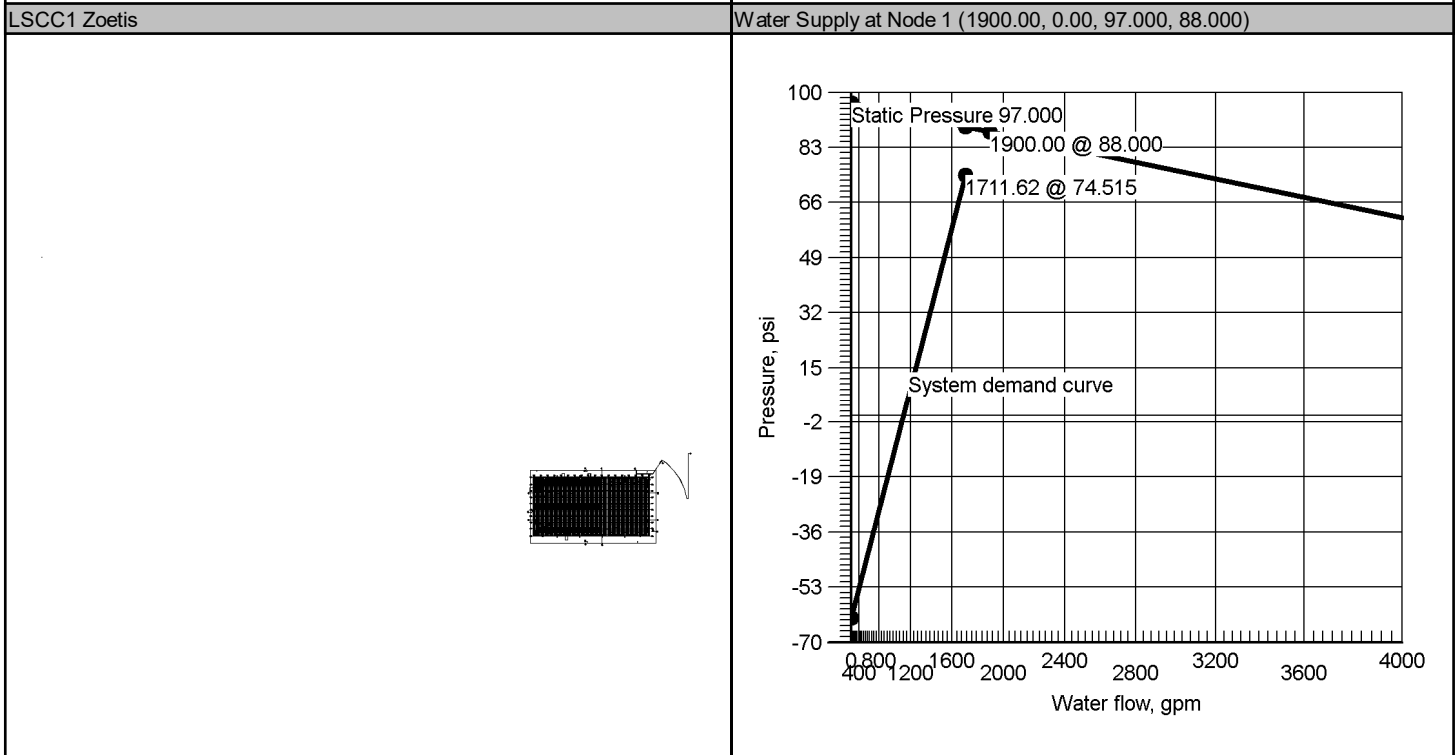
Job Number: 212189000
Report Description: FP Overhead System 08 (16.8K)

Job	
Job Number 212189000	Design Engineer Jay Colbert
Job Name: Lee's Summit Commerce Center	Phone 913.242.0057
Address 1 1120 NW Main St	FAX
Address 2	State Certification/License Number
Address 3 Lee's Summit, MO 64086	AHU City of Lee's Summit
	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 100 ft²	Number Of Sprinklers Calculated 12
System Pressure Demand 74.515	System Flow Demand 1711.62
Total Demand 1711.62 @ 74.515	Pressure Result +15.066 (16.8%)

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 (461)	0.000	0	0.00
5	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									

Pumps: Static = Churn (Pressure @ Zero Flow)





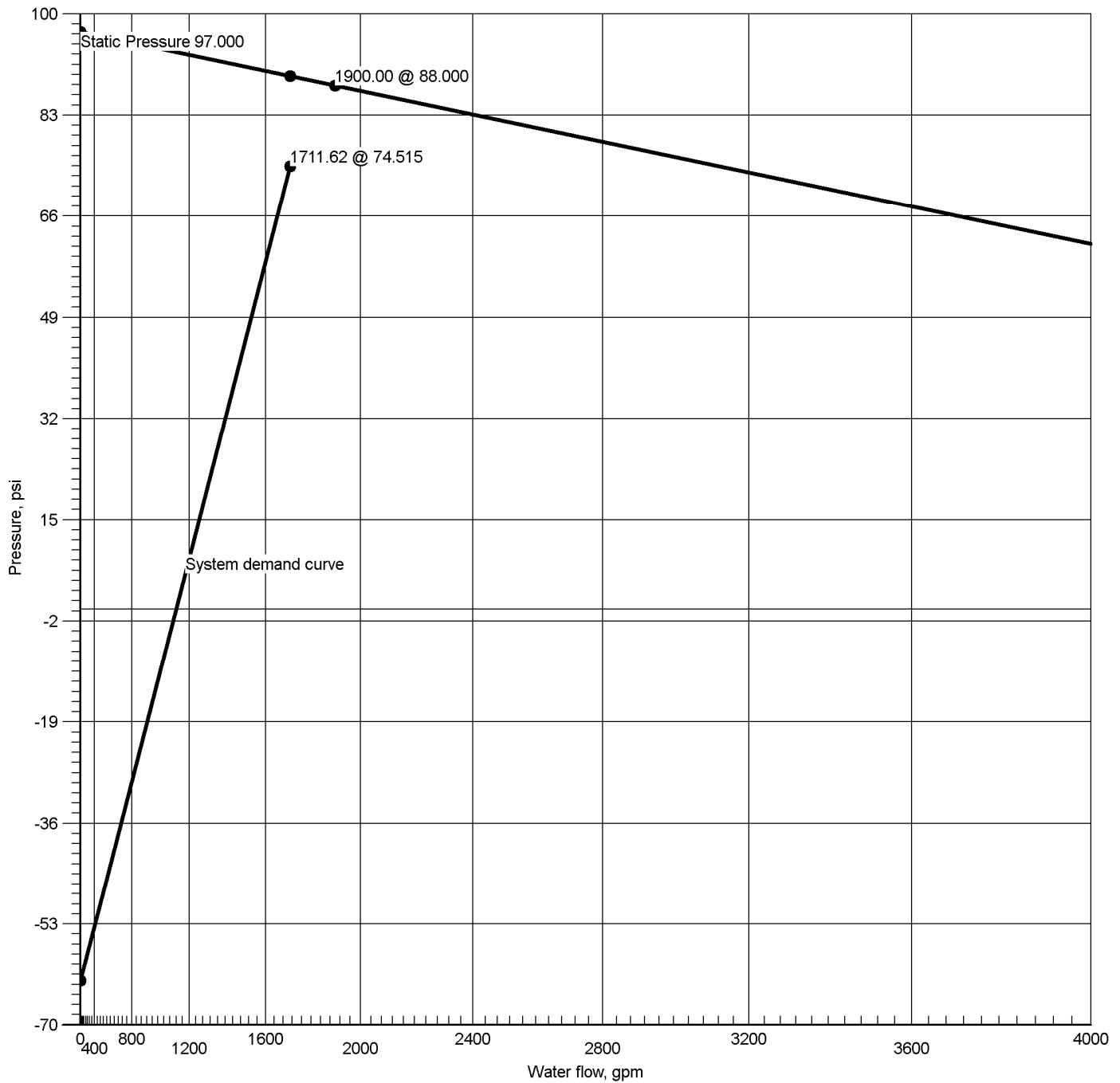
Hydraulic Summary

Job Number: 212189000
Report Description: FP Overhead System 08 (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 51				Flow(gpm) 250.00			Number Of Sprinklers Calculated 12				
				Number Of Nozzles Calculated 0			Coverage Per Sprinkler 100 ft²				
				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 74.500 Right: 74.465							
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 826 and 824											
Maximum Velocity Under Ground 11.85 between nodes 8 and 9											
Volume capacity of Wet Pipes 32132.49 gal			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		1711.62	74.515	15.066
5	Pump		84.000	60.000		2000.00	139.226		1711.62	124.161	15.066
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 @ 1711.62

Required Pressure at System Demand

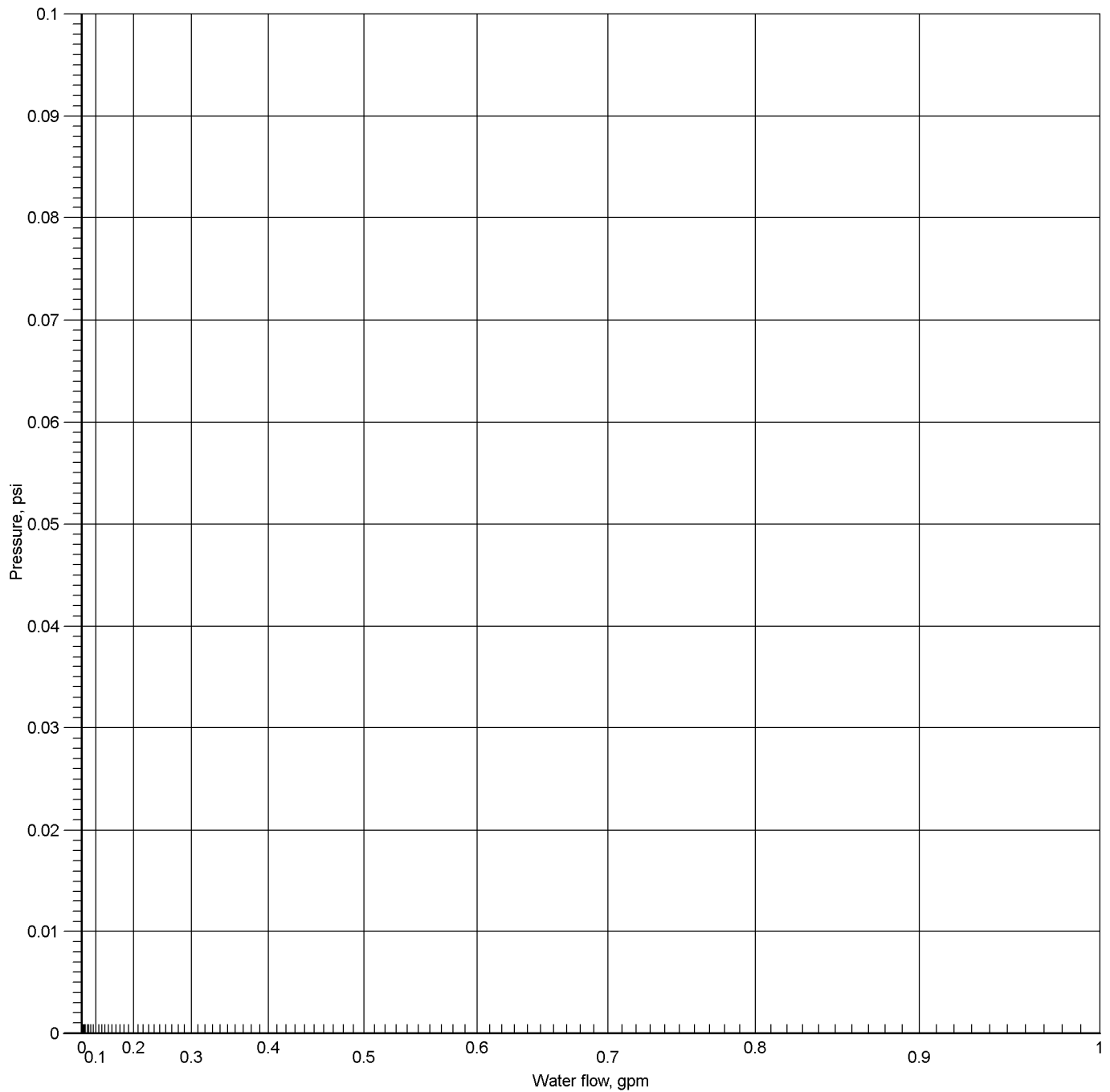
74.515 @ 1711.62

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

74.515 @ 1711.62



Pump Inlet at Node 461



Hydraulic Graph

Pump Inlet at Node 461

Static: Pressure

0.000

Residual: Pressure

N/A

Available Pressure at System Demand

N/A

Required Pressure at System Demand

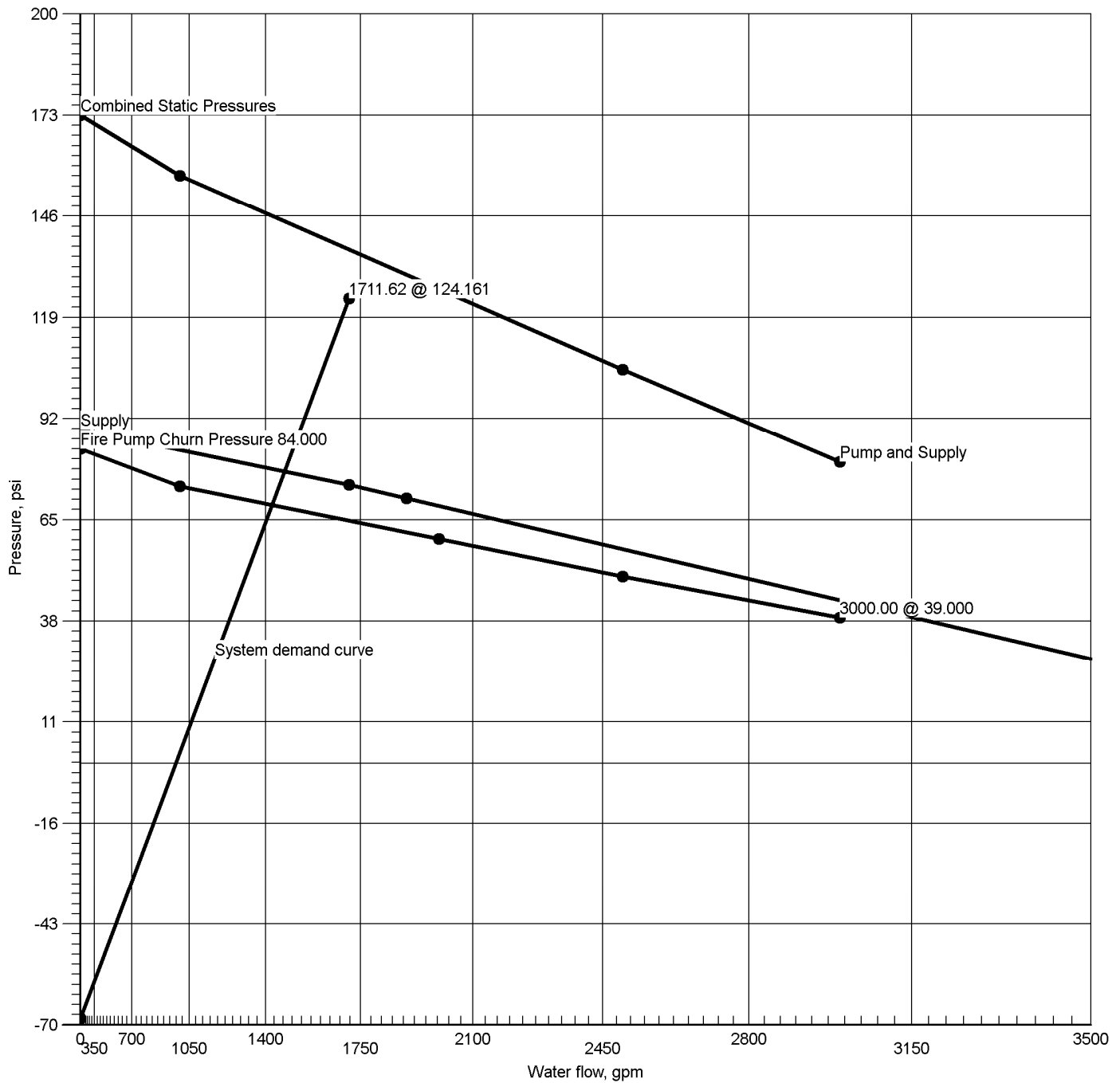
0.000 @ 0.00

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

N/A



Pump at Node 5



Hydraulic Graph
Pump at Node 5

Static + Churn Pressure
173.256
Fire Pump Churn Pressure
84.000

Fire Pump Rating
60.000 @ 2000.00

Static: Pressure
173.256

Residual: Pressure
64.849 @ 1711.62

Available Pressure at System Demand
139.226 @ 1711.62

Required Pressure at System Demand
124.161 @ 1711.62



Summary Of Outflowing Devices

Job Number: 212189000

Report Description: FP Overhead System 08 (16.8K)

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Hydrant	51	250.00	250.00	250	116.036			
⇒ 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: FP Overhead System 08 (16.8K)

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	74.515	1711.62
51	1'-0	Hyd(-1.000)	116.036	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	-8'-0	E(24'-7)	70.475	
4	1'-9	P1	59.312	
5	1'-9	P2(-64.849)	124.161	
6	1'-9		124.161	
7	6'-8½		120.129	
8	1'-0		122.483	
9	-8'-0	T(43'-10)	124.588	
10	-8'-0	T(43'-10)	124.048	
11	-8'-0	T(47'-3½)	123.848	
12	-8'-0	T(43'-10)	122.733	
13	-8'-0	T(47'-3½)	122.472	
14	-8'-0	T(43'-10)	122.369	
15	-8'-0	T(47'-3½)	121.254	
16	-8'-0	T(43'-10)	121.052	
17	-8'-0	T(47'-3½)	120.135	
18	-8'-0	T(43'-10)	120.100	
19	-8'-0	T(43'-10)	120.018	
53	1'-0	Hyd	1.000	
54	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
800	38'-3	PO(18'-8½)	84.631	
802	1'-8½	PO(37'-8½)	113.157	
804	1'-0		114.136	
806	38'-3	PO(18'-8½)	75.536	
808	38'-0	PO(18'-8½)	75.630	
810	37'-8½	PO(18'-8½)	75.662	
812	37'-5	PO(18'-8½)	75.597	
814	37'-5	PO(18'-8½)	83.685	
816	37'-8½	PO(18'-8½)	83.941	
818	38'-0	PO(18'-8½)	84.255	
820	37'-2	PO(18'-8½)	83.481	
822	37'-0	PO(18'-8½)	81.041	
824	37'-0	PO(18'-8½)	82.575	
826	37'-0		83.396	
828	37'-10	T(18'-8½)	74.419	
830	37'-0	PO(18'-8½)	78.076	
832	37'-0	PO(18'-8½)	78.193	
834	37'-0	PO(18'-8½)	78.699	
836	37'-0	PO(18'-8½)	79.759	
838	37'-0	PO(18'-8½)	78.053	
840	37'-0	PO(18'-8½)	73.557	
842	37'-0	PO(18'-8½)	72.538	
844	37'-0	PO(18'-8½)	72.062	
846	37'-0	PO(18'-8½)	71.933	
848	37'-0	PO(18'-8½)	75.012	
850	37'-0	PO(18'-8½)	74.377	
852	37'-2	PO(18'-8½)	75.408	



Hydraulic Analysis

Job Number: 212189000

Report Description: FP Overhead System 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	120.96	6.75	120		0.036048	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	242.48	13.54	120		0.130514	158'-0	Pf 25.507
8113	37'-10	121.52	16.8	52.324		Sprinkler,	37'-5	Pe 0.361
832	37'-0			78.193		2PO(18'-8½)	195'-5	Pv
CM	4.3100	495.39	10.89	120		0.050630	10'-0	Pf 0.506
832	37'-0	252.91		78.193		Flow (q) from Route 5		Pe
834	37'-0			78.699			10'-0	Pv
CM	4.3100	738.67	16.24	120		0.106018	10'-0	Pf 1.060
834	37'-0	243.27		78.699		Flow (q) from Route 3		Pe
836	37'-0			79.759			10'-0	Pv
CM	4.3100	818.58	18.00	120		0.128207	10'-0	Pf 1.282
836	37'-0	79.91		79.759		Flow (q) from Route 2		Pe
822	37'-0			81.041			10'-0	Pv
CM	4.3100	901.65	19.83	120		0.153311	10'-0	Pf 1.533
822	37'-0	83.07		81.041		Flow (q) from Route 11		Pe
824	37'-0			82.575			10'-0	Pv
CM	4.3100	990.60	21.78	120		0.182459	4'-6	Pf 0.821
824	37'-0	88.95		82.575		Flow (q) from Route 12		Pe
826	37'-0			83.396			4'-6	Pv
CM	6.3570	990.60	10.01	120		0.027494	5'-6½	Pf 0.152
826	37'-0			83.396				Pe -0.067
820	37'-2			83.481			5'-6½	Pv
CM	6.3570	1082.18	10.94	120		0.032379	10'-0	Pf 0.324
820	37'-2	91.58		83.481		Flow (q) from Route 13		Pe -0.120
814	37'-5			83.685			10'-0	Pv
CM	6.3570	1174.42	11.87	120		0.037669	10'-0	Pf 0.377
814	37'-5	92.24		83.685		Flow (q) from Route 14		Pe -0.120
816	37'-8½			83.941			10'-0	Pv
CM	6.3570	1267.83	12.82	120		0.043399	10'-0	Pf 0.434
816	37'-8½	93.42		83.941		Flow (q) from Route 15		Pe -0.120
818	38'-0			84.255			10'-0	Pv
CM	6.3570	1363.33	13.78	120		0.049640	10'-0	Pf 0.497
818	38'-0	95.50		84.255		Flow (q) from Route 16		Pe -0.120
800	38'-3			84.631			10'-0	Pv
CM	6.3570	1461.62	14.77	120		0.056462	71'-1	Pf 12.674
800	38'-3	98.29		84.631		Flow (q) from Route 17	153'-4½	Pe 15.852
802	1'-8½			113.157		5fE(12'-7), 2f(-0.000), CV(40'-3), BV(12'-7), PO(37'-8½)	224'-5½	Pv
CM	8.2490	1461.62	8.77	120		0.015875	1'-6	Pf 0.676
802	1'-8½			113.157			41'-1½	Pe 0.303
804	1'-0			114.136		PO(41'-1½)	42'-7½	Pv
UG	7.6800	1461.62	10.12	150		0.014880	66'-8½	Pf 1.980
804	1'-0			114.136			66'-4½	Pe 3.902
19	-8'-0			120.018		E(22'-6½), T(43'-10)	133'-1	Pv
UG	7.6800	1260.15	8.73	150		0.011309	337'-8	Pf 4.569
19	-8'-0			120.018			66'-4½	Pe
9	-8'-0			124.588		E(22'-6½), T(43'-10)	404'-0½	Pv
UG	7.6800	1711.62	11.85	150		0.019928	67'-8	Pf 1.798
9	-8'-0	451.47		124.588		Flow (q) from Route 7	22'-6½	Pe -3.902
8	1'-0			122.483		E(22'-6½)	90'-2½	Pv
FR	8.2490	1711.62	10.28	120		0.021261	5'-8½	Pf 0.121
8	1'-0			122.483				Pe -2.476
7	6'-8½			120.129			5'-8½	Pv
DY	10.3700	1711.62	6.50	120		0.006976	13'-10½	Pf 1.881
7	6'-8½			120.129			255'-9	Pe 2.151
6	1'-9			124.161		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
6	1'-9			124.161				Pe 0.000
5	1'-9			124.161			0'-0	Pv
Pump								
5		1711.62	Velocity	124.161		Rating: 60.000 @ 2000.00		
4		Q=1711.62	7.88	59.312		Fire Pump Churn Pressure: 84.000		



Hydraulic Analysis

Job Number: 212189000

Report Description: FP Overhead System 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	
UG	9.4200	1711.62	7.88	150		0.007371	305'-9½	Pf 6.937
4	1'-9			59.312			137'-6	Pe 4.227
2	-8'-0			70.475		GV(5'-7), T(45'-10), 3E(24'-7), EE(12'-3½), BFP(-3.669)	443'-3½	Pv
UG	11.2000	1711.62	5.57	150		0.003173	750'-9	Pf 2.523
2	-8'-0			70.475			44'-3	Pe 1.517
1	-11'-6			74.515		EE(14'-4½), E(29'-10½), S	795'-0	Pv
		0.00				Hose Allowance At Source		
1		1711.62						
Route 2								
BL	2.7050	0.19	0.01	120		0.000000	9'-0	Pf 0.000
8111	37'-10	121.15	16.8	52.000		Sprinkler	9'-0	Pe
8115	37'-10			52.000			9'-0	Pv
BL	2.7050	121.33	6.77	120		0.036255	9'-0	Pf 0.326
8115	37'-10	121.15	16.8	52.000		Sprinkler	9'-0	Pe
8117	37'-10			52.326			9'-0	Pv
BL	2.7050	242.86	13.56	120		0.130890	110'-7	Pf 19.374
8117	37'-10	121.53	16.8	52.326		Sprinkler,	37'-5	Pe 0.361
844	37'-0			72.062		2PO(18'-8½)	148'-0	Pv
CM	4.3100	479.25	10.54	120		0.047621	10'-0	Pf 0.476
844	37'-0	236.39		72.062		Flow (q) from Route 6	10'-0	Pe
842	37'-0			72.538			10'-0	Pv
CM	4.3100	722.95	15.90	120		0.101883	10'-0	Pf 1.019
842	37'-0	243.70		72.538		Flow (q) from Route 4	10'-0	Pe
840	37'-0			73.557			10'-0	Pv
RN	2.7050	79.91	4.46	120		0.016743	295'-7	Pf 6.203
840	37'-0			73.557		PO(18'-8½)	74'-10½	Pe -0.000
836	37'-0			79.759		3PO(18'-8½)	370'-5½	Pv
Route 3								
BL	2.7050	121.34	6.77	120		0.036260	9'-0	Pf 0.326
8119	37'-10	121.55	16.8	52.350		Sprinkler	9'-0	Pe
8121	37'-10			52.676			9'-0	Pv
BL	2.7050	243.27	13.58	120		0.131304	158'-0	Pf 25.662
8121	37'-10	121.93	16.8	52.676		Sprinkler,	37'-5	Pe 0.361
834	37'-0			78.699		2PO(18'-8½)	195'-5	Pv
Route 4								
BL	2.7050	0.21	0.01	120		0.000000	9'-0	Pf 0.000
8119	37'-10	121.55	16.8	52.350		Sprinkler	9'-0	Pe
8123	37'-10			52.350			9'-0	Pv
BL	2.7050	121.76	6.80	120		0.036493	9'-0	Pf 0.328
8123	37'-10	121.55	16.8	52.350		Sprinkler	9'-0	Pe
8125	37'-10			52.679			9'-0	Pv
BL	2.7050	243.70	13.61	120		0.131728	110'-7	Pf 19.498
8125	37'-10	121.93	16.8	52.679		Sprinkler,	37'-5	Pe 0.361
842	37'-0			72.538		2PO(18'-8½)	148'-0	Pv
Route 5								
BL	2.7050	8.21	0.46	120		0.000249	9'-0	Pf 0.002
8127	37'-10	122.13	16.8	52.851		Sprinkler	9'-0	Pe
8129	37'-10			52.853			9'-0	Pv
BL	2.7050	130.34	7.28	120		0.041392	9'-0	Pf 0.373
8129	37'-10	122.14	16.8	52.853		Sprinkler	9'-0	Pe
8131	37'-10			53.225			9'-0	Pv
BL	2.7050	252.91	14.12	120		0.141087	131'-6	Pf 21.194
8131	37'-10	122.57	16.8	53.225		Sprinkler,	18'-8½	Pe
828	37'-10			74.419		2E(9'-4½)	150'-2½	Pv
BL	2.7050	144.33	8.06	120		0.049984	28'-6	Pf 3.296
828	37'-10			74.419			37'-5	Pe 0.361
830	37'-0			78.076		2PO(18'-8½)	65'-11	Pv
CM	4.3100	252.91	5.56	120		0.014596	8'-0	Pf 0.117
830	37'-0	108.58		78.076		Flow (q) from Route 9	8'-0	Pe
832	37'-0			78.193			8'-0	Pv
Route 6								
BL	2.7050	113.92	6.36	120		0.032266	9'-0	Pf 0.290
8127	37'-10	122.13	16.8	52.851		Sprinkler	9'-0	Pe
8133	37'-10			53.141			9'-0	Pv



Hydraulic Analysis

Job Number: 212189000

Report Description: FP Overhead System 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	
BL	2.7050	236.39	13.20	120		0.124516	110'-7"	Pf 18.431
8133	37'-10"	122.47	16.8	53.141		Sprinkler,	37'-5"	Pe 0.361
846	37'-0"			71.933		2PO(18'-8½")	148'-0"	Pv
CM	4.3100	236.39	5.20	120		0.012882	10'-0"	Pf 0.129
846	37'-0"			71.933				Pe
844	37'-0"			72.062			10'-0"	Pv
Route 7								
UG	6.2800	250.00	2.59	140		0.001718	40'-9"	Pf 0.197
51	1'-0"	250.00		116.036		Hydrant,	74'-1"	Pe 3.902
17	-8'-0"			120.135		E(22'-1"), GV(4'-8½"), T(47'-3½")	114'-10"	Pv
UG	7.6800	451.47	3.13	150		0.001693	519'-3½"	Pf 0.917
17	-8'-0"	201.47		120.135		Flow (q) from Route 8	22'-6½"	Pe
16	-8'-0"			121.052		E(22'-6½")	541'-10"	Pv
UG	7.6800	451.47	3.13	150		0.001693	119'-3"	Pf 0.202
16	-8'-0"			121.052				Pe
15	-8'-0"			121.254			119'-3"	Pv
UG	7.6800	451.47	3.13	150		0.001693	635'-9"	Pf 1.115
15	-8'-0"			121.254			22'-6½"	Pe
14	-8'-0"			122.369		E(22'-6½")	658'-3½"	Pv
UG	7.6800	451.47	3.13	150		0.001693	61'-1½"	Pf 0.103
14	-8'-0"			122.369				Pe
13	-8'-0"			122.472			61'-1½"	Pv
UG	7.6800	451.47	3.13	150		0.001693	153'-8"	Pf 0.260
13	-8'-0"			122.472				Pe
12	-8'-0"			122.733			153'-8"	Pv
UG	7.6800	451.47	3.13	150		0.001693	635'-11½"	Pf 1.115
12	-8'-0"			122.733			22'-6½"	Pe
11	-8'-0"			123.848		E(22'-6½")	658'-6"	Pv
UG	7.6800	451.47	3.13	150		0.001693	118'-2"	Pf 0.200
11	-8'-0"			123.848				Pe
10	-8'-0"			124.048			118'-2"	Pv
UG	7.6800	451.47	3.13	150		0.001693	275'-0"	Pf 0.540
10	-8'-0"			124.048			43'-10"	Pe
9	-8'-0"			124.588		T(43'-10")	318'-9½"	Pv
Route 8								
UG	7.6800	201.47	1.40	150		0.000381	214'-9"	Pf 0.082
19	-8'-0"	1260.15		120.018		Flow (q) from Route 1		Pe
18	-8'-0"			120.100			214'-9"	Pv
UG	7.6800	201.47	1.40	150		0.000381	91'-11½"	Pf 0.035
18	-8'-0"			120.100				Pe
17	-8'-0"			120.135			91'-11½"	Pv
Route 9								
CM	4.3100	108.58	2.39	120		0.003054	7'-6"	Pf 0.023
838	37'-0"	108.58		78.053		Flow (q) from Route 10		Pe
830	37'-0"			78.076			7'-6"	Pv
Route 10								
BL	2.7050	108.58	6.06	120		0.029519	36'-0"	Pf 3.273
828	37'-10"			74.419		T(18'-8½")	74'-10½"	Pe 0.361
838	37'-0"			78.053		T(18'-8½"), 2PO(18'-8½")	110'-10½"	Pv
Route 11								
CM	4.3100	643.04	14.14	120		0.082033	10'-0"	Pf 0.820
840	37'-0"	79.91		73.557		Flow (q) from Route 2		Pe
850	37'-0"			74.377			10'-0"	Pv
RN	2.7050	83.07	4.64	120		0.017989	295'-7"	Pf 6.664
850	37'-0"			74.377		PO(18'-8½")	74'-10½"	Pe -0.000
822	37'-0"			81.041		3PO(18'-8½")	370'-5½"	Pv
Route 12								
CM	4.3100	559.97	12.31	120		0.063511	10'-0"	Pf 0.635
850	37'-0"	83.07		74.377		Flow (q) from Route 11		Pe
848	37'-0"			75.012			10'-0"	Pv
RN	2.7050	88.95	4.97	120		0.020413	295'-7"	Pf 7.562
848	37'-0"			75.012		PO(18'-8½")	74'-10½"	Pe -0.000
824	37'-0"			82.575		3PO(18'-8½")	370'-5½"	Pv
Route 13								
RN	2.7050	91.58	5.11	120		0.021542	295'-7"	Pf 8.073
852	37'-2"	471.02		75.408		PO(18'-8½"), Flow (q) from Route 18	79'-2"	Pe -0.000
820	37'-2"			83.481		3PO(18'-8½"), Tr(4'-3½")	374'-9"	Pv



Hydraulic Analysis

Job Number: 212189000

Report Description: FP Overhead System 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	
Route 14							
CM	4.3100	379.44	8.34	120	0.030915	10'-0	Pf 0.309
852	37'-2	471.02		75.408	Flow (q) from Route 18		Pe -0.120
812	37'-5			75.597		10'-0	Pv
RN	2.7050	92.24	5.15	120	0.021832	295'-7	Pf 8.088
812	37'-5			75.597	PO(18'-8½)	74'-10½	Pe -0.000
814	37'-5			83.685	3PO(18'-8½)	370'-5½	Pv
Route 15							
CM	4.3100	287.20	6.32	120	0.018467	10'-0	Pf 0.185
812	37'-5	92.24		75.597	Flow (q) from Route 14		Pe -0.120
810	37'-8½			75.662		10'-0	Pv
RN	2.7050	93.42	5.22	120	0.022350	295'-7	Pf 8.280
810	37'-8½			75.662	PO(18'-8½)	74'-10½	Pe -0.000
816	37'-8½			83.941	3PO(18'-8½)	370'-5½	Pv
Route 16							
CM	4.3100	193.79	4.26	120	0.008918	10'-0	Pf 0.089
810	37'-8½	93.42		75.662	Flow (q) from Route 15		Pe -0.120
808	38'-0			75.630		10'-0	Pv
RN	2.7050	95.50	5.33	120	0.023281	295'-7	Pf 8.625
808	38'-0			75.630	PO(18'-8½)	74'-10½	Pe -0.000
818	38'-0			84.255	3PO(18'-8½)	370'-5½	Pv
Route 17							
CM	4.3100	98.29	2.16	120	0.002540	10'-0	Pf 0.025
808	38'-0	95.50		75.630	Flow (q) from Route 16		Pe -0.120
806	38'-3			75.536		10'-0	Pv
RN	2.7050	98.29	5.49	120	0.024553	295'-7	Pf 9.096
806	38'-3			75.536	PO(18'-8½)	74'-10½	Pe -0.000
800	38'-3			84.631	3PO(18'-8½)	370'-5½	Pv
Route 18							
CM	4.3100	471.02	10.36	120	0.046117	10'-0½	Pf 0.462
848	37'-0	88.95		75.012	Flow (q) from Route 12		Pe -0.066
852	37'-2			75.408		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: FP Overhead System 08 (16.8K)

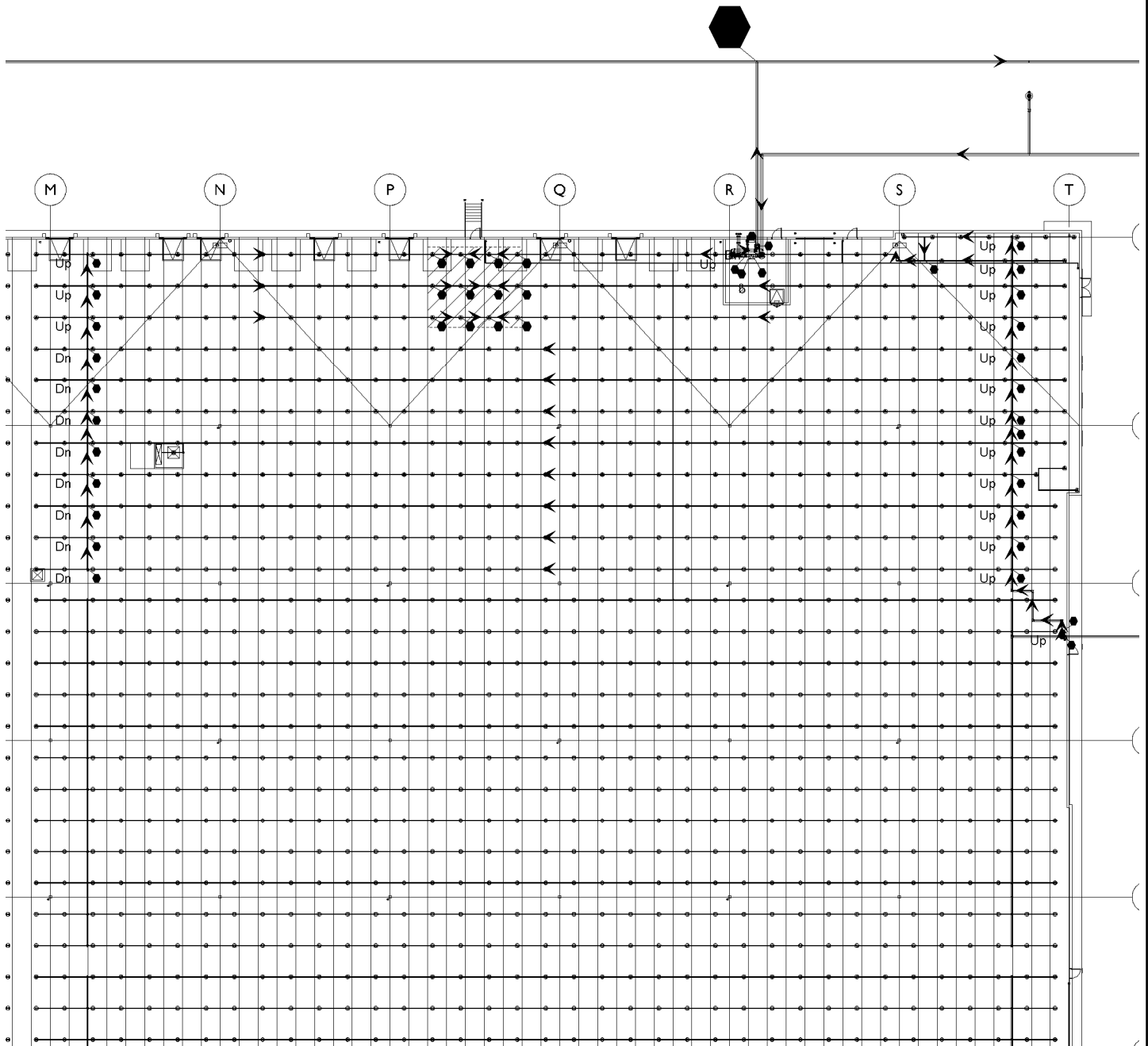
Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream					Fittings	Total Length	

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 SN Swing 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



Flow Diagram (Current View)

Job Number: 212189000
Report Description: FP Overhead System 08 (16.8K)





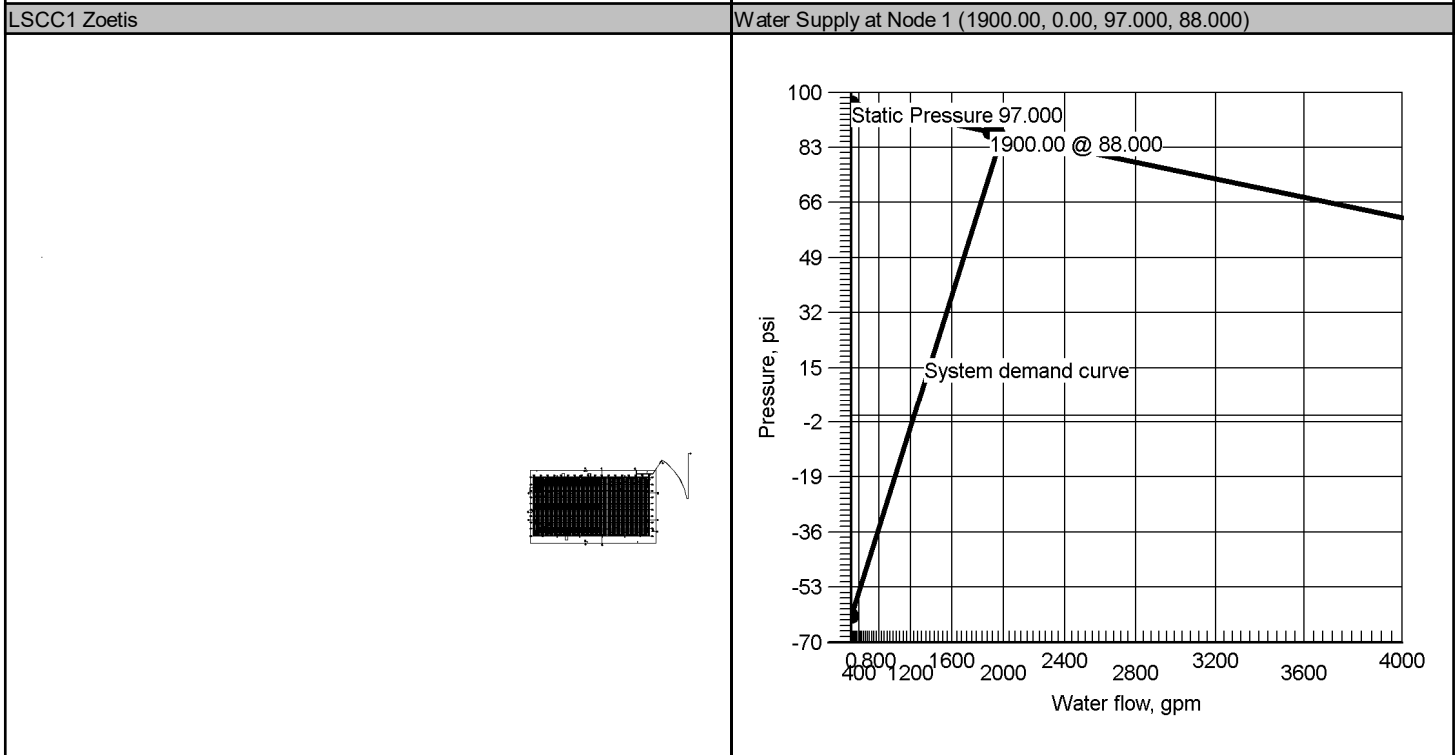
Hydraulic Overview

Job Number: 212189000
Report Description: FP Overhead System 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 100 ft²	Number Of Sprinklers Calculated 12 0
System Pressure Demand 82.791	System Flow Demand 1956.80
Total Demand 1956.80 @ 82.791	Pressure Result +4.705 (5.4%)

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 (461)	0.000	0	0.00
5	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									





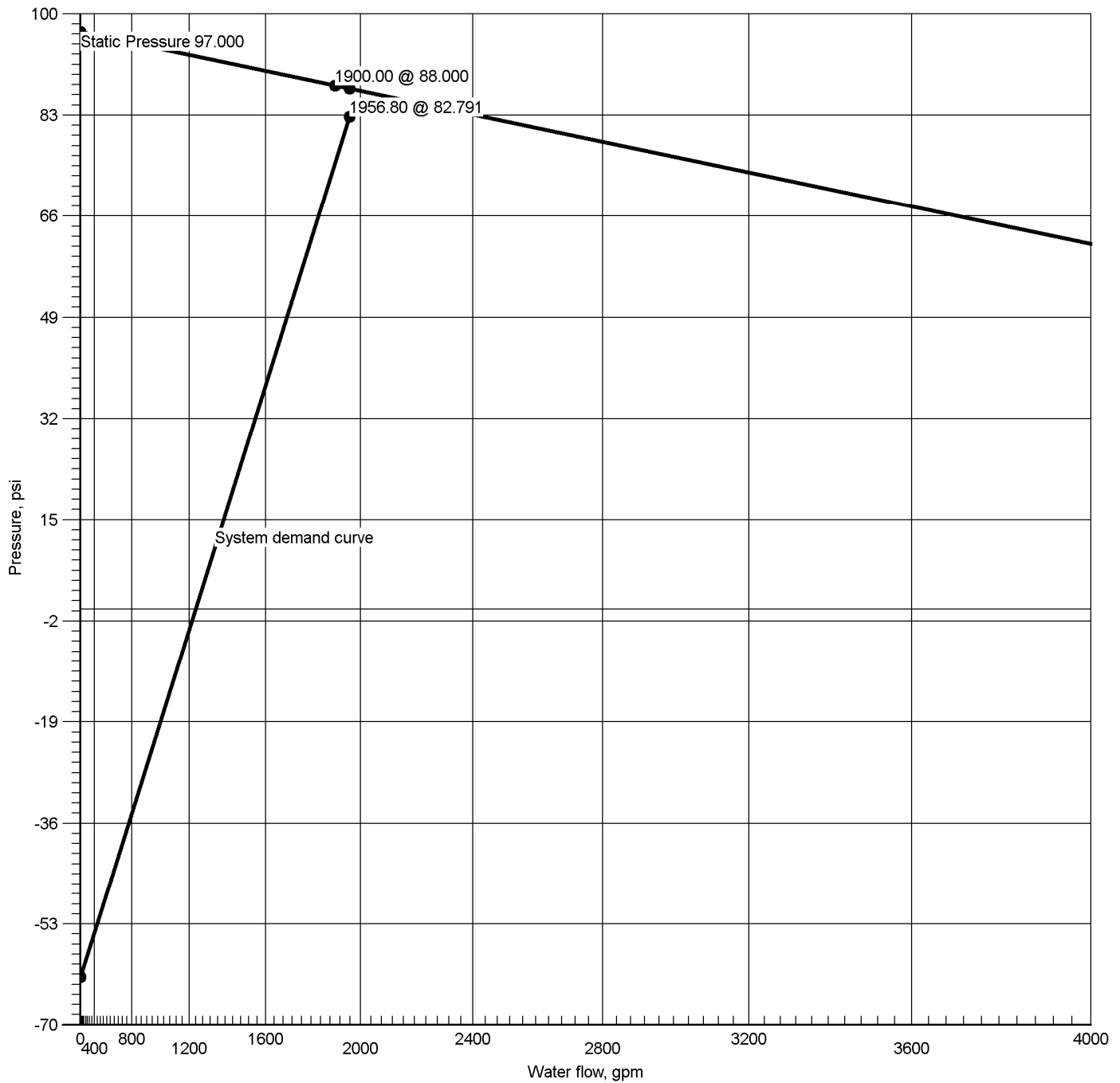
Hydraulic Summary

Job Number: 212189000
Report Description: FP Overhead System 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 51				Number Of Sprinklers Calculated 12			Number Of Nozzles Calculated 0		Coverage Per Sprinkler 100 ft²		
Flow(gpm) 250.00				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 82.752 Right: 82.740							
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 18.97 between nodes 812 and 810											
Maximum Velocity Under Ground 13.55 between nodes 8 and 9											
Volume capacity of Wet Pipes 32132.49 gal		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	82.791	4.705
5	Pump		84.000	60.000		2000.00	131.147		1956.80	126.442	4.705
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

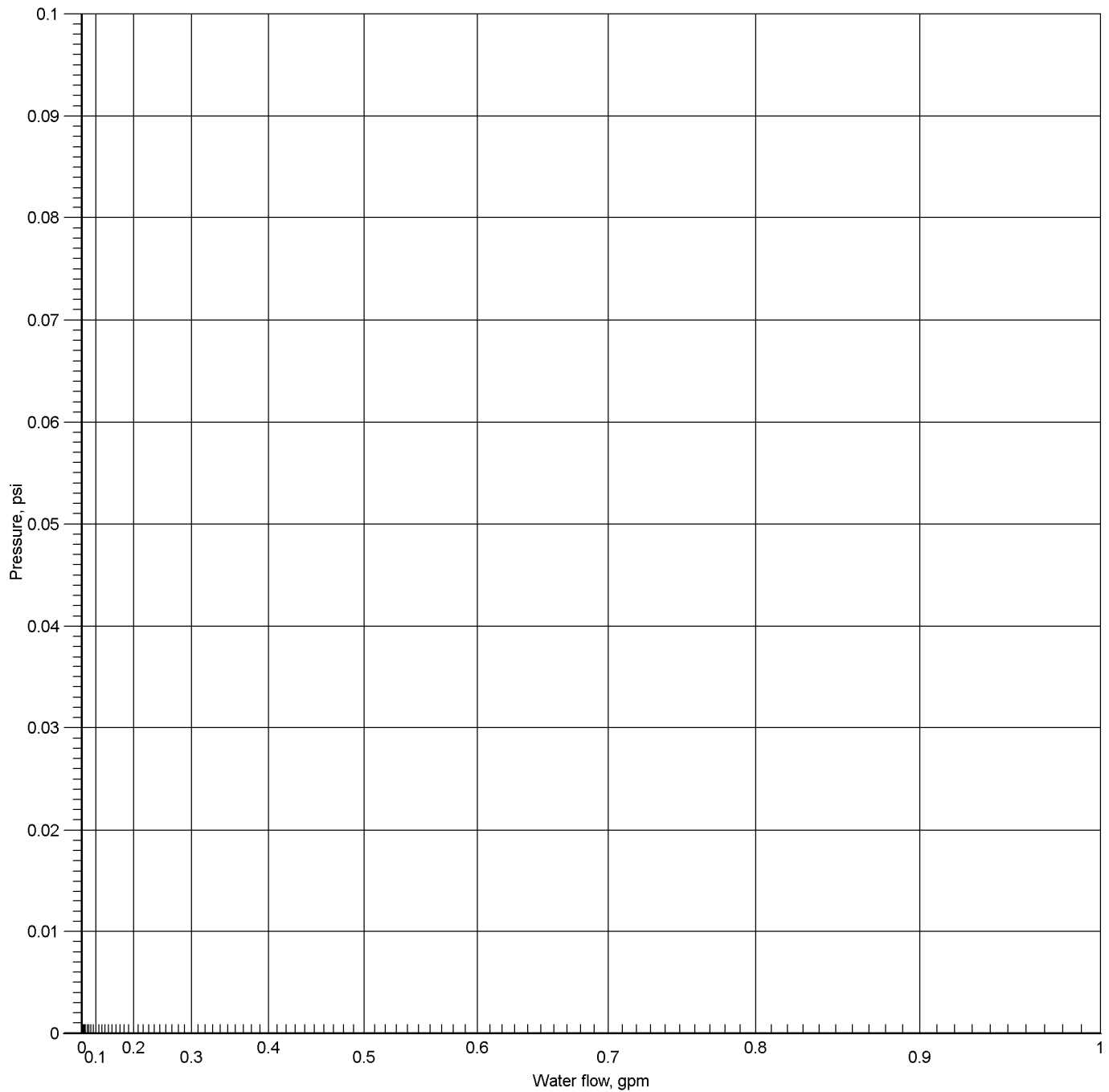
82.791 @ 1956.80

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

82.791 @ 1956.80



Pump Inlet at Node 461



Hydraulic Graph

Pump Inlet at Node 461

Static: Pressure

0.000

Residual: Pressure

N/A

Available Pressure at System Demand

N/A

Required Pressure at System Demand

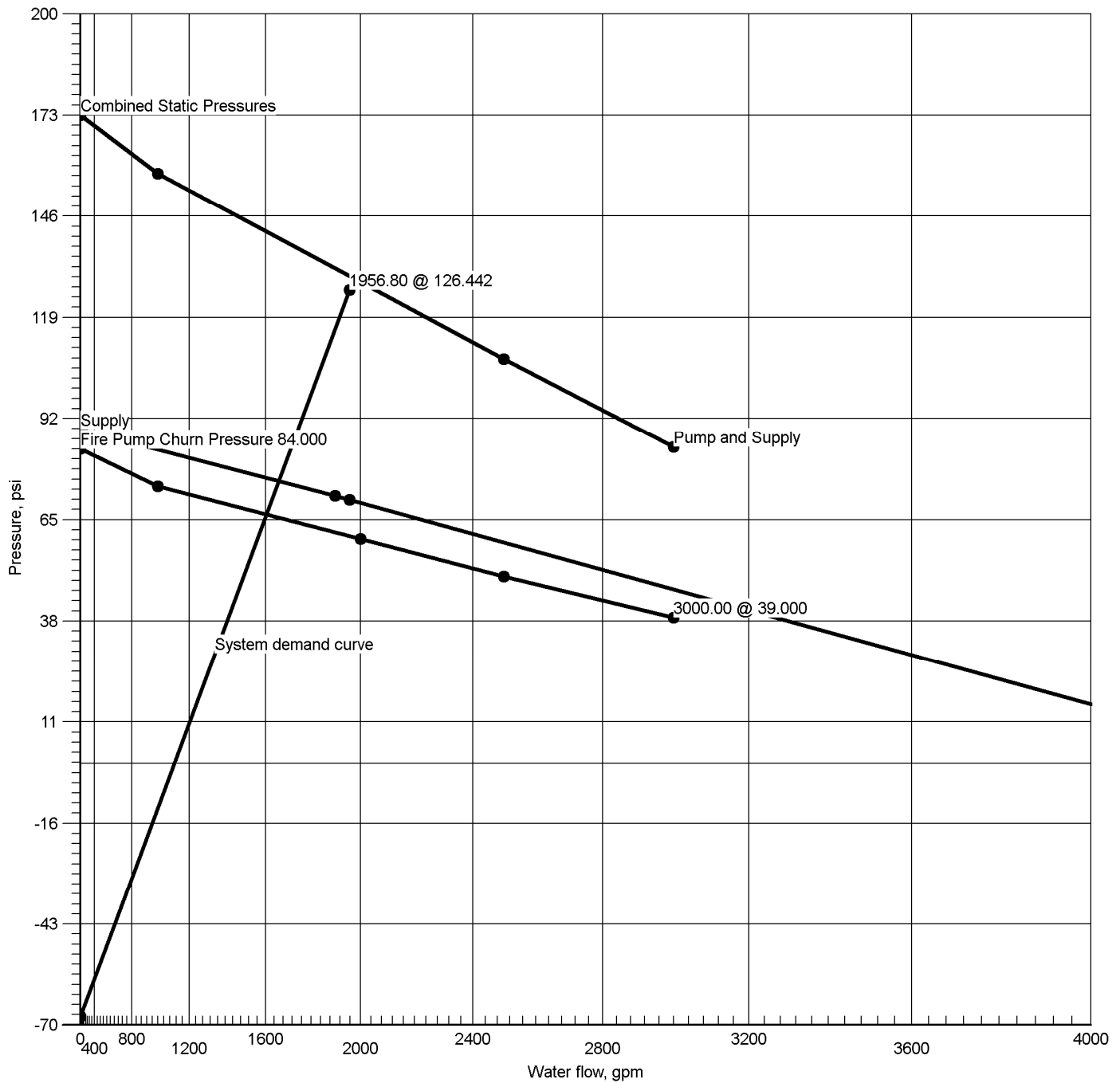
0.000 @ 0.00

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

N/A



Pump at Node 5



Hydraulic Graph

Static + Churn Pressure

Fire Pump Rating

Pump at Node 5

173.256

60.000 @ 2000.00

Static: Pressure

Fire Pump Churn Pressure

173.256

84.000

Residual: Pressure

60.767 @ 1956.80

Available Pressure at System Demand

131.147 @ 1956.80

Required Pressure at System Demand

126.442 @ 1956.80



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: FP Overhead System 08

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Hydrant	51	250.00	250.00	250	116.029			
⇒ 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	40.440			
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	40.683			
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: FP Overhead System 08

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	82.791	1956.80
51	1'-0	Hyd(-1.000)	116.029	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(-40.440)	40.440	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(-40.683)	40.683	142.87
8155	38'-6½	Spr(-40.277)	40.277	142.16
8157	38'-6½	Spr(-40.747)	40.747	142.99
2	-8'-0	E(24'-7)	78.042	
4	1'-9	P1	65.674	
5	1'-9	P2(-60.767)	126.442	
6	1'-9		126.442	
7	6'-8½		121.881	
8	1'-0		124.201	
9	-8'-0	T(43'-10)	125.800	
10	-8'-0	T(43'-10)	125.113	
11	-8'-0	T(47'-3½)	124.858	
12	-8'-0	T(43'-10)	123.437	
13	-8'-0	T(47'-3½)	123.106	
14	-8'-0	T(43'-10)	122.974	
15	-8'-0	T(47'-3½)	121.554	
16	-8'-0	T(43'-10)	121.297	
17	-8'-0	T(47'-3½)	120.128	
18	-8'-0	T(43'-10)	120.070	
19	-8'-0	T(43'-10)	119.935	
53	1'-0	Hyd	1.000	
54	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
800	38'-3	PO(18'-8½)	79.454	
802	1'-8½	PO(37'-8½)	112.191	
804	1'-0		113.395	
806	38'-3	PO(18'-8½)	62.114	
808	38'-0	PO(18'-8½)	62.417	
810	37'-8½	PO(18'-8½)	63.198	
812	37'-5	PO(18'-8½)	64.732	
814	37'-5	PO(18'-8½)	78.706	
816	37'-8½	PO(18'-8½)	78.799	
818	38'-0	PO(18'-8½)	79.036	
820	37'-2	PO(18'-8½)	78.667	
822	37'-0	PO(18'-8½)	77.789	
824	37'-0	PO(18'-8½)	78.322	
826	37'-0		78.669	
828	37'-10	T(18'-8½)	76.148	
830	37'-0	PO(18'-8½)	77.124	
832	37'-0	PO(18'-8½)	77.145	
834	37'-0	PO(18'-8½)	77.241	
836	37'-0	PO(18'-8½)	77.442	
838	37'-0	PO(18'-8½)	77.119	
840	37'-0	PO(18'-8½)	67.633	
842	37'-0	PO(18'-8½)	67.834	
844	37'-0	PO(18'-8½)	67.930	
846	37'-0	PO(18'-8½)	67.957	
848	37'-0	PO(18'-8½)	66.753	
850	37'-0	PO(18'-8½)	67.286	
852	37'-2	PO(18'-8½)	65.914	



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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	140.68	7.85	120		0.047666	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	283.10	15.81	120		0.173819	185'-0	Pf 38.664
8137	39'-1	142.43	22.4	40.429		Sprinkler,	37'-5	Pe 0.361
800	38'-3			79.454		2PO(18'-8½)	222'-5	Pv
CM	6.3570	1706.80	17.25	120		0.075223	71'-1	Pf 16.885
800	38'-3	1423.70		79.454		Flow (q) from Route 2	153'-4½	Pe 15.852
802	1'-8½			112.191		5fE(12'-7), 2f(-0.000), CV(40'-3), BV(12'-7), PO(37'-8½)	224'-5½	Pv
CM	8.2490	1706.80	10.25	120		0.021150	1'-6	Pf 0.901
802	1'-8½			112.191			41'-1½	Pe 0.303
804	1'-0			113.395		PO(41'-1½)	42'-7½	Pv
UG	7.6800	1706.80	11.82	150		0.019824	66'-8½	Pf 2.638
804	1'-0			113.395			66'-4½	Pe 3.902
19	-8'-0			119.935		E(22'-6½), T(43'-10)	133'-1	Pv
UG	7.6800	1442.22	9.99	150		0.014517	337'-8	Pf 5.865
19	-8'-0			119.935			66'-4½	Pe
9	-8'-0			125.800		E(22'-6½), T(43'-10)	404'-0½	Pv
UG	7.6800	1956.80	13.55	150		0.025528	67'-8	Pf 2.303
9	-8'-0	514.58		125.800		Flow (q) from Route 7	22'-6½	Pe -3.902
8	1'-0			124.201		E(22'-6½)	90'-2½	Pv
FR	8.2490	1956.80	11.75	120		0.027236	5'-8½	Pf 0.156
8	1'-0			124.201				Pe -2.476
7	6'-8½			121.881			5'-8½	Pv
DY	10.3700	1956.80	7.43	120		0.008937	13'-10½	Pf 2.410
7	6'-8½			121.881			255'-9	Pe 2.151
6	1'-9			126.442		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
6	1'-9			126.442				Pe 0.000
5	1'-9			126.442			0'-0	Pv
Pump								
5		1956.80		126.442		Rating: 60.000 @ 2000.00		
4		Q=1956.80	9.01	65.674		Fire Pump Churn Pressure: 84.000		
UG	9.4200	1956.80	9.01	150		0.009443	305'-9½	Pf 8.141
4	1'-9			65.674			137'-6	Pe 4.227
2	-8'-0			78.042		GV(5'-7), T(45'-10), 3E(24'-7), EE(12'-3½), BFP(-3.955)	443'-3½	Pv
UG	11.2000	1956.80	6.37	150		0.004065	750'-9	Pf 3.232
2	-8'-0			78.042			44'-3	Pe 1.517
1	-11'-6			82.791		EE(14'-4½), E(29'-10½), S	795'-0	Pv
		0.00				Hose Allowance At Source		
1		1956.80						
Route 2								
BL	2.7050	0.99	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	142.66	7.96	120		0.048919	9'-0	Pf 0.440
8139	39'-1	141.67	22.4	40.000		Sprinkler		Pe
8141	39'-1			40.440			9'-0	Pv
BL	2.7050	285.11	15.92	120		0.176107	83'-7	Pf 21.312
8141	39'-1	142.45	22.4	40.440		Sprinkler,	37'-5	Pe 0.361
806	38'-3			62.114		2PO(18'-8½)	121'-0	Pv
CM	4.3100	285.11	6.27	120		0.018219	10'-0	Pf 0.182
806	38'-3			62.114				Pe 0.120
808	38'-0			62.417			10'-0	Pv
CM	4.3100	572.14	12.58	120		0.066088	10'-0	Pf 0.661
808	38'-0	287.02		62.417		Flow (q) from Route 4		Pe 0.120
810	37'-8½			63.198			10'-0	Pv
CM	4.3100	862.83	18.97	120		0.141321	10'-0	Pf 1.414
810	37'-8½	290.69		63.198		Flow (q) from Route 6		Pe 0.120
812	37'-5			64.732			10'-0	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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	
RN	2.7050	123.96	6.92	120		0.037721	295'-7"	Pf 13.974
812	37'-5"			64.732		PO(18'-8½")	74'-10½"	Pe -0.000
814	37'-5"			78.706		3PO(18'-8½")	370'-5½"	Pv
CM	6.3570	862.83	8.72	120		0.021295	10'-0"	Pf 0.213
814	37'-5"	738.87		78.706		Flow (q) from Route 9		Pe -0.120
816	37'-8½"			78.799			10'-0"	Pv
CM	6.3570	1142.31	11.55	120		0.035786	10'-0"	Pf 0.358
816	37'-8½"	279.49		78.799		Flow (q) from Route 5		Pe -0.120
818	38'-0"			79.036			10'-0"	Pv
CM	6.3570	1423.70	14.39	120		0.053782	10'-0"	Pf 0.538
818	38'-0"	281.38		79.036		Flow (q) from Route 3		Pe -0.120
800	38'-3"			79.454			10'-0"	Pv
Route 3								
BL	2.7050	138.92	7.76	120		0.046573	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	281.38	15.71	120		0.171867	185'-0"	Pf 38.229
8145	38'-10"	142.46	22.4	40.446		Sprinkler,	37'-5"	Pe 0.361
818	38'-0"			79.036		2PO(18'-8½")	222'-5"	Pv
Route 4								
BL	2.7050	2.79	0.16	120		0.000034	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	144.51	8.07	120		0.050097	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	287.02	16.02	120		0.178299	83'-7"	Pf 21.578
8149	38'-10"	142.51	22.4	40.478		Sprinkler,	37'-5"	Pe 0.361
808	38'-0"			62.417		2PO(18'-8½")	121'-0"	Pv
Route 5								
BL	2.7050	136.61	7.63	120		0.045151	9'-0"	Pf 0.406
8151	38'-6½"	142.16	22.4	40.276		Sprinkler		Pe
8153	38'-6½"			40.683			9'-0"	Pv
BL	2.7050	279.49	15.60	120		0.169735	185'-0"	Pf 37.755
8153	38'-6½"	142.87	22.4	40.683		Sprinkler,	37'-5"	Pe 0.361
816	37'-8½"			78.799		2PO(18'-8½")	222'-5"	Pv
Route 6								
BL	2.7050	5.54	0.31	120		0.000120	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	147.70	8.25	120		0.052164	9'-0"	Pf 0.469
8155	38'-6½"	142.16	22.4	40.277		Sprinkler		Pe
8157	38'-6½"			40.747			9'-0"	Pv
BL	2.7050	290.69	16.23	120		0.182535	83'-7"	Pf 22.090
8157	38'-6½"	142.99	22.4	40.747		Sprinkler,	37'-5"	Pe 0.361
810	37'-8½"			63.198		2PO(18'-8½")	121'-0"	Pv
Route 7								
UG	6.2800	250.00	2.59	140		0.001718	40'-9"	Pf 0.197
51	1'-0"	250.00		116.029		Hydrant,	74'-1"	Pe 3.902
17	-8'-0"			120.128		E(22'-1), GV(4'-8½"), T(47'-3½")	114'-10"	Pv
UG	7.6800	514.58	3.56	150		0.002157	519'-3½"	Pf 1.169
17	-8'-0"	264.58		120.128		Flow (q) from Route 8	22'-6½"	Pe
16	-8'-0"			121.297		E(22'-6½")	541'-10"	Pv
UG	7.6800	514.58	3.56	150		0.002157	119'-3"	Pf 0.257
16	-8'-0"			121.297				Pe
15	-8'-0"			121.554			119'-3"	Pv
UG	7.6800	514.58	3.56	150		0.002157	635'-9"	Pf 1.420
15	-8'-0"			121.554			22'-6½"	Pe
14	-8'-0"			122.974		E(22'-6½")	658'-3½"	Pv
UG	7.6800	514.58	3.56	150		0.002157	61'-1½"	Pf 0.132
14	-8'-0"			122.974				Pe
13	-8'-0"			123.106			61'-1½"	Pv
UG	7.6800	514.58	3.56	150		0.002157	153'-8"	Pf 0.331
13	-8'-0"			123.106				Pe
12	-8'-0"			123.437			153'-8"	Pv
UG	7.6800	514.58	3.56	150		0.002157	635'-11½"	Pf 1.420
12	-8'-0"			123.437			22'-6½"	Pe
11	-8'-0"			124.858		E(22'-6½")	658'-6"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 08

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream						Total Length	
UG	7.6800	514.58	3.56	150	0.002157	118'-2	Pf 0.255
11	-8'-0			124.858			Pe
10	-8'-0			125.113		118'-2	Pv
UG	7.6800	514.58	3.56	150	0.002157	275'-0	Pf 0.688
10	-8'-0			125.113		43'-10	Pe
9	-8'-0			125.800	T(43'-10)	318'-9½	Pv
Route 8							
UG	7.6800	264.58	1.83	150	0.000630	214'-9	Pf 0.135
19	-8'-0	1442.22		119.935	Flow (q) from Route 1		Pe
18	-8'-0			120.070		214'-9	Pv
UG	7.6800	264.58	1.83	150	0.000630	91'-11½	Pf 0.058
18	-8'-0			120.070			Pe
17	-8'-0			120.128		91'-11½	Pv
Route 9							
CM	6.3570	738.87	7.47	120	0.015983	10'-0	Pf 0.160
820	37'-2	621.61 + 117.25		78.667	Flow (q) from Route 10 and 20		Pe -0.120
814	37'-5			78.706		10'-0	Pv
Route 10							
CM	4.3100	509.68	11.21	120	0.053364	10'-0	Pf 0.534
822	37'-0	403.45 + 106.23		77.789	Flow (q) from Route 11 and 19		Pe
824	37'-0			78.322		10'-0	Pv
CM	4.3100	621.61	13.67	120	0.077048	4'-6	Pf 0.347
824	37'-0	111.93		78.322	Flow (q) from Route 18		Pe
826	37'-0			78.669		4'-6	Pv
CM	6.3570	621.61	6.28	120	0.011610	5'-6½	Pf 0.064
826	37'-0			78.669			Pe -0.067
820	37'-2			78.667		5'-6½	Pv
Route 11							
BL	2.7050	58.21	3.25	120	0.009316	28'-6	Pf 0.614
828	37'-10	102.00		76.148	Flow (q) from Route 16	37'-5	Pe 0.361
830	37'-0			77.124	2PO(18'-8½)	65'-11	Pv
CM	4.3100	102.00	2.24	120	0.002720	8'-0	Pf 0.022
830	37'-0	43.79		77.124	Flow (q) from Route 12		Pe
832	37'-0			77.145		8'-0	Pv
CM	4.3100	200.98	4.42	120	0.009541	10'-0	Pf 0.095
832	37'-0	98.98		77.145	Flow (q) from Route 17		Pe
834	37'-0			77.241		10'-0	Pv
CM	4.3100	301.07	6.62	120	0.020150	10'-0	Pf 0.202
834	37'-0	100.09		77.241	Flow (q) from Route 15		Pe
836	37'-0			77.442		10'-0	Pv
CM	4.3100	403.45	8.87	120	0.034631	10'-0	Pf 0.346
836	37'-0	102.38		77.442	Flow (q) from Route 14		Pe
822	37'-0			77.789		10'-0	Pv
Route 12							
CM	4.3100	43.79	0.96	120	0.000569	7'-6	Pf 0.004
838	37'-0	43.79		77.119	Flow (q) from Route 13		Pe
830	37'-0			77.124		7'-6	Pv
Route 13							
BL	2.7050	43.79	2.44	120	0.005502	36'-0	Pf 0.610
828	37'-10	102.00		76.148	T(18'-8½), Flow (q) from Route	74'-10½	Pe 0.361
838	37'-0			77.119	16	110'-10½	Pv
					T(18'-8½), 2PO(18'-8½)		
Route 14							
RN	2.7050	102.38	5.72	120	0.026480	295'-7	Pf 9.810
840	37'-0	403.45		67.633	PO(18'-8½), Flow (q) from Route	74'-10½	Pe -0.000
836	37'-0			77.442	21	370'-5½	Pv
					3PO(18'-8½)		
Route 15							
CM	4.3100	301.07	6.62	120	0.020150	10'-0	Pf 0.202
840	37'-0	403.45		67.633	Flow (q) from Route 21		Pe
842	37'-0			67.834		10'-0	Pv
RN	2.7050	100.09	5.59	120	0.025392	295'-7	Pf 9.407
842	37'-0			67.834	PO(18'-8½)	74'-10½	Pe -0.000
834	37'-0			77.241	3PO(18'-8½)	370'-5½	Pv
Route 16							
CM	4.3100	200.98	4.42	120	0.009541	10'-0	Pf 0.095
842	37'-0	100.09		67.834	Flow (q) from Route 15		Pe
844	37'-0			67.930		10'-0	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 08

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	102.00	2.24	120	0.002720	10'-0	Pf 0.027
844	37'-0			67.930			Pe
846	37'-0			67.957		10'-0	Pv
RN	2.7050	102.00	5.69	120	0.026296	269'-1	Pf 8.553
846	37'-0			67.957	PO(18'-8½)	56'-2	Pe -0.361
828	37'-10			76.148	PO(18'-8½), 2E(9'-4½)	325'-3	Pv
Route 17							
RN	2.7050	98.98	5.53	120	0.024877	295'-7	Pf 9.216
844	37'-0			67.930	PO(18'-8½)	74'-10½	Pe -0.000
832	37'-0			77.145	3PO(18'-8½)	370'-5½	Pv
Route 18							
RN	2.7050	111.93	6.25	120	0.031230	295'-7	Pf 11.569
848	37'-0	621.61		66.753	PO(18'-8½), Flow (q) from Route	74'-10½	Pe -0.000
824	37'-0			78.322	22	370'-5½	Pv
					3PO(18'-8½)		
Route 19							
CM	4.3100	509.68	11.21	120	0.053364	10'-0	Pf 0.534
848	37'-0	621.61		66.753	Flow (q) from Route 22		Pe
850	37'-0			67.286		10'-0	Pv
RN	2.7050	106.23	5.93	120	0.028349	295'-7	Pf 10.502
850	37'-0			67.286	PO(18'-8½)	74'-10½	Pe -0.000
822	37'-0			77.789	3PO(18'-8½)	370'-5½	Pv
Route 20							
CM	4.3100	738.87	16.25	120	0.106070	10'-0	Pf 1.061
812	37'-5	123.96		64.732	Flow (q) from Route 2		Pe 0.120
852	37'-2			65.914		10'-0	Pv
RN	2.7050	117.25	6.55	120	0.034030	295'-7	Pf 12.753
852	37'-2			65.914	PO(18'-8½)	79'-2	Pe -0.000
820	37'-2			78.667	3PO(18'-8½), Tr(4'-3½)	374'-9	Pv
Route 21							
CM	4.3100	403.45	8.87	120	0.034631	10'-0	Pf 0.346
850	37'-0	106.23		67.286	Flow (q) from Route 19		Pe
840	37'-0			67.633		10'-0	Pv
Route 22							
CM	4.3100	621.61	13.67	120	0.077048	10'-0½	Pf 0.772
852	37'-2	117.25		65.914	Flow (q) from Route 20		Pe 0.066
848	37'-0			66.753		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

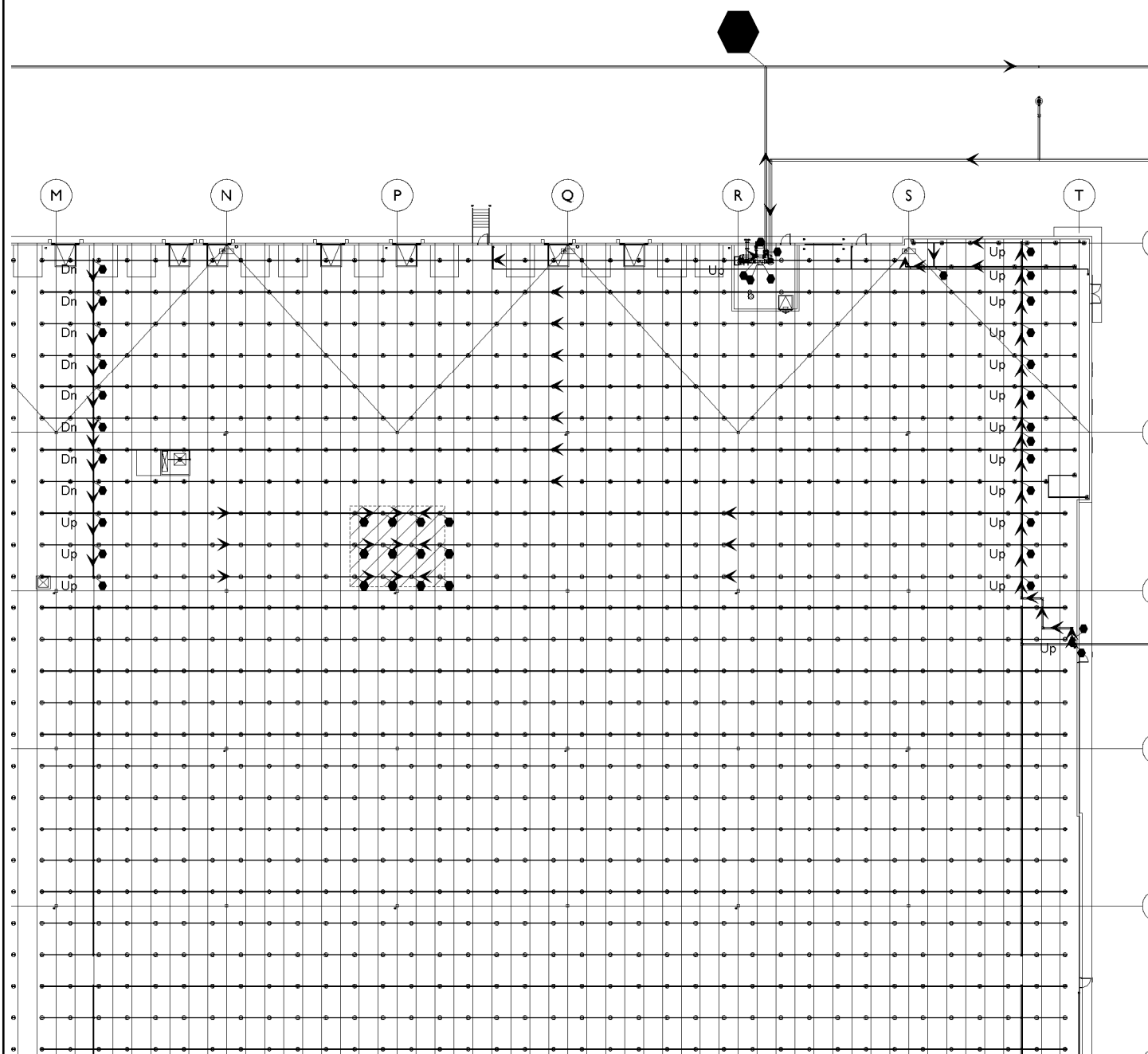
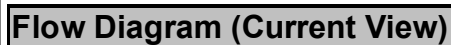


Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 08

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 SN Swing 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





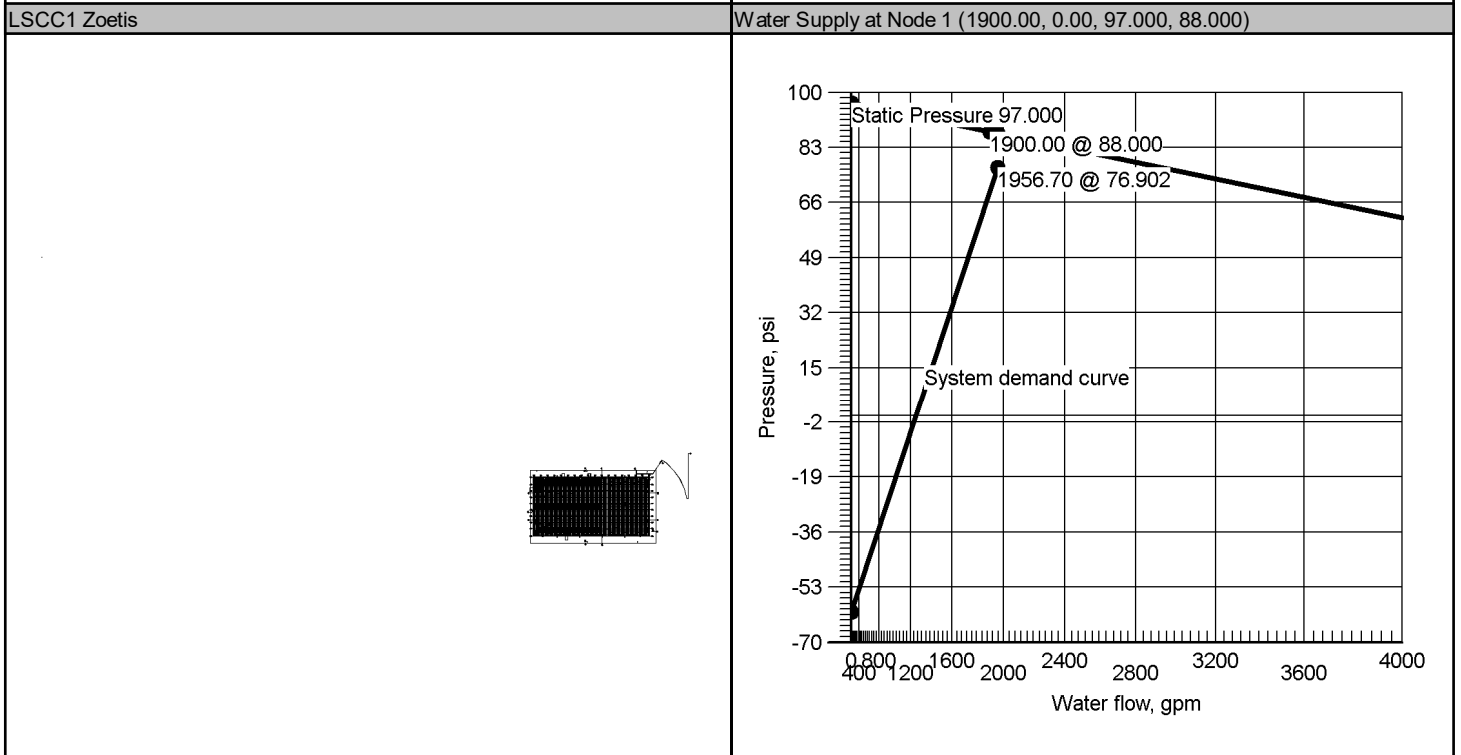
Hydraulic Overview

Job Number: 212189000
Report Description: FP Overhead System 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 100 ft²	Number Of Sprinklers Calculated 12 0
System Pressure Demand 76.902	System Flow Demand 1956.70
Total Demand 1956.70 @ 76.902	Pressure Result +10.594 (12.1%)

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 (461)	0.000	0	0.00
5	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									





Job Number: 212189000

Report Description: FP Overhead System 09

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 <u>Node</u> Hydrant At Node 51		<u>Flow(gpm)</u> 250.00		Number Of Sprinklers Calculated 12	
		Number Of Nozzles Calculated 0		Coverage Per Sprinkler 100 ft²	
		AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 76.851 Right: 76.861			
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 18.84 between nodes 930 and 928					
Maximum Velocity Under Ground 13.55 between nodes 8 and 9					
Volume capacity of Wet Pipes 32132.49 gal		Volume capacity of Dry Pipes			

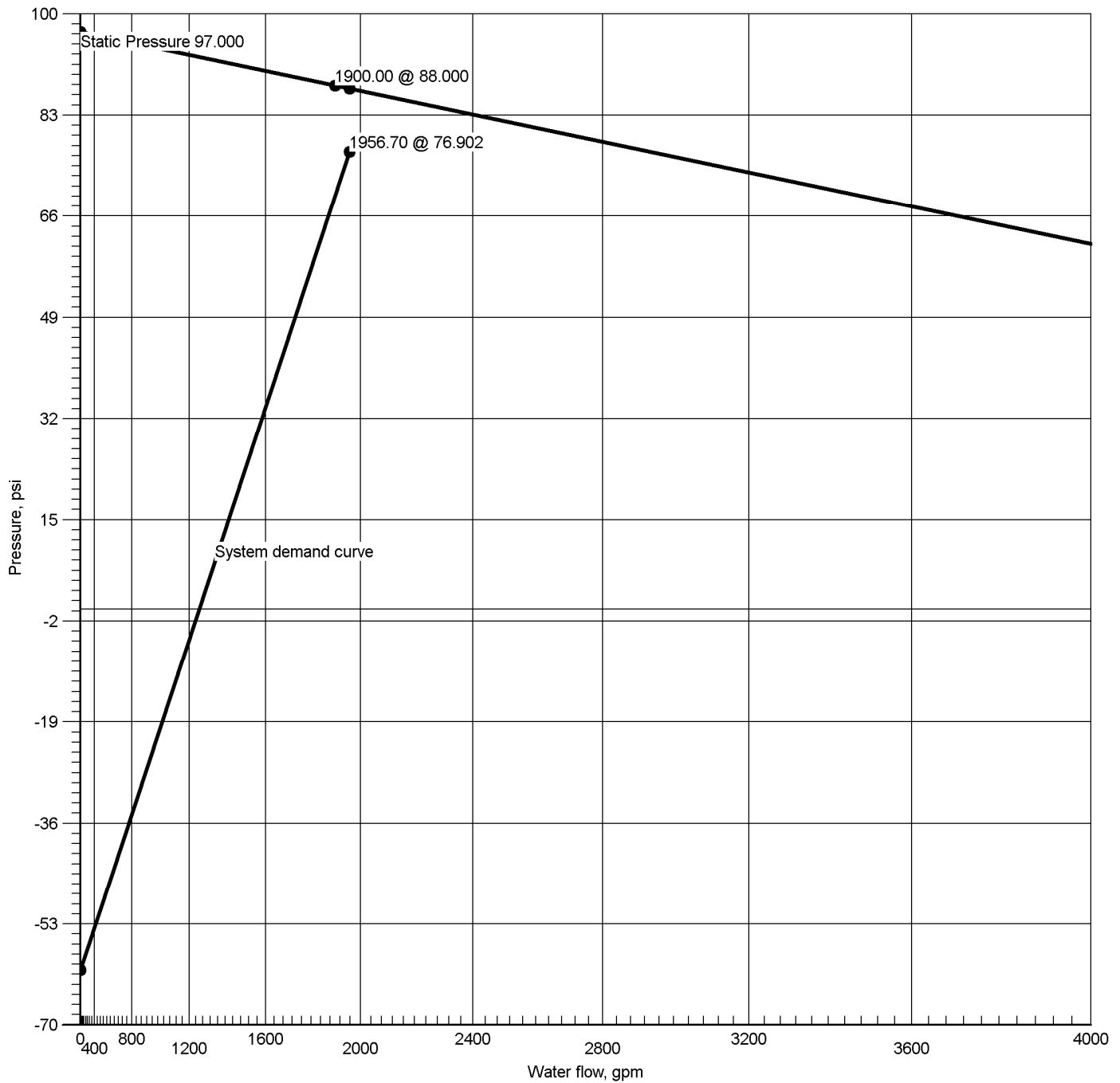
Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@ Flow (gpm)	Available (psi)	@ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply		97.000	88.000	1900.00	87.497	1956.70	76.902	10.594
5	Pump		84.000	60.000	2000.00	131.150	1956.70	120.556	10.594

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

87.497 @ 1956.70

Required Pressure at System Demand

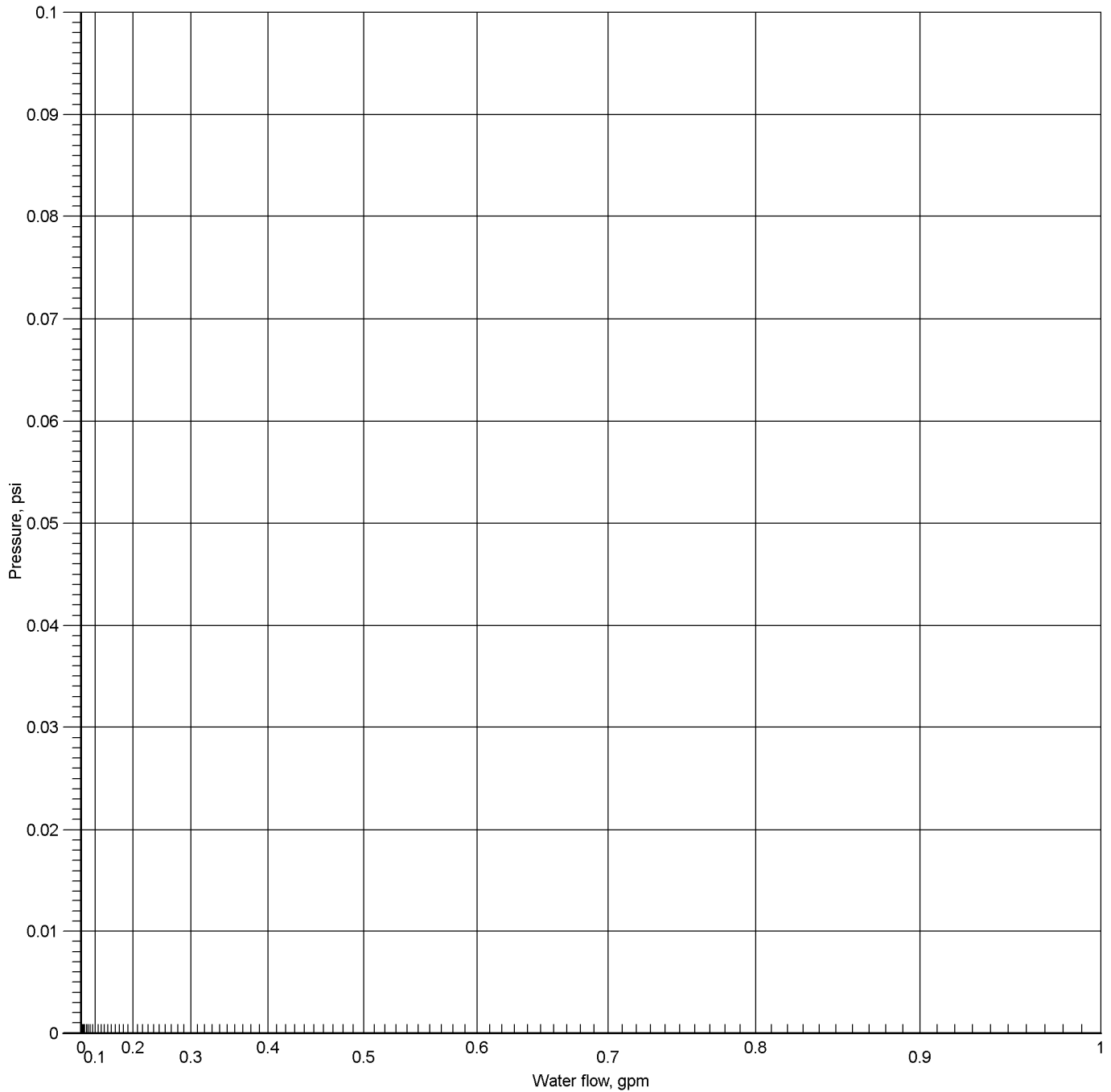
76.902 @ 1956.70

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

76.902 @ 1956.70



Pump Inlet at Node 461



Hydraulic Graph

Pump Inlet at Node 461

Static: Pressure

0.000

Residual: Pressure

N/A

Available Pressure at System Demand

N/A

Required Pressure at System Demand

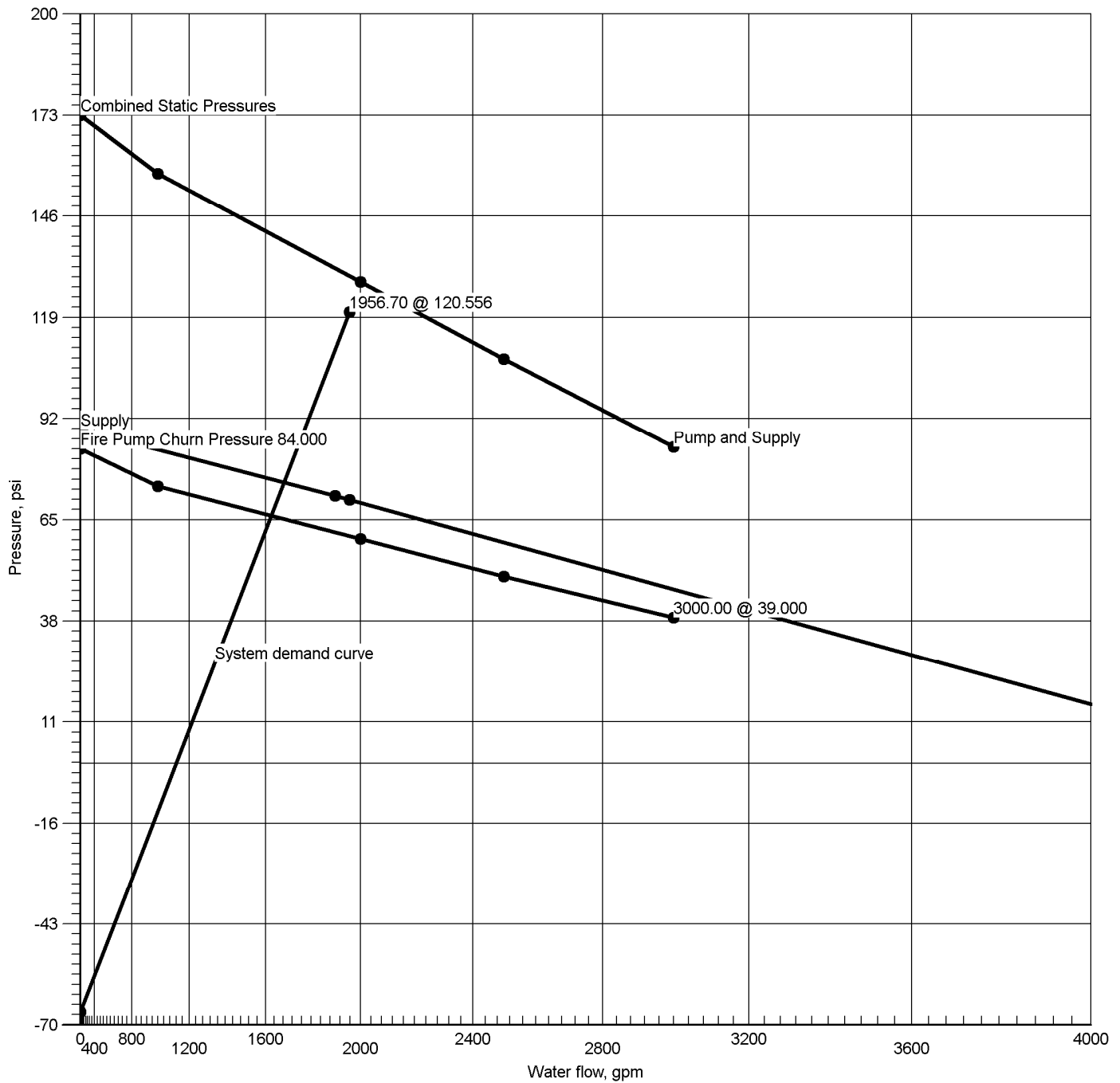
0.000 @ 0.00

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

N/A



Pump at Node 5



Hydraulic Graph

Static + Churn Pressure

Fire Pump Rating

Pump at Node 5

173.256

60.000 @ 2000.00

Static: Pressure

Fire Pump Churn Pressure

173.256

84.000

Residual: Pressure

60.769 @ 1956.70

Available Pressure at System Demand

131.150 @ 1956.70

Required Pressure at System Demand

120.556 @ 1956.70



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: FP Overhead System 09

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Hydrant	51	250.00	250.00	250	110.145			
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	40.437			
Sprinkler	9119	141.70	141.67	22.4	40.017			
Sprinkler	9121	142.46	141.67	22.4	40.447			
Sprinkler	9123	141.70	141.67	22.4	40.017			
Sprinkler	9125	142.48	141.67	22.4	40.456			
Sprinkler	9127	142.15	141.67	22.4	40.272			
Sprinkler	9129	142.90	141.67	22.4	40.697			
Sprinkler	9131	142.15	141.67	22.4	40.273			
Sprinkler	9133	142.94	141.67	22.4	40.723			

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: FP Overhead System 09

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	76.902	1956.70
51	1'-0	Hyd(-1.000)	110.145	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(-40.437)	40.437	142.44
9119	41'-10½	Spr(-40.017)	40.017	141.70
9121	41'-10½	Spr(-40.447)	40.447	142.46
9123	41'-10½	Spr(-40.017)	40.017	141.70
9125	41'-10½	Spr(-40.456)	40.456	142.48
9127	41'-10½	Spr(-40.272)	40.272	142.15
9129	41'-10½	Spr(-40.697)	40.697	142.90
9131	41'-10½	Spr(-40.273)	40.273	142.15
9133	41'-10½	Spr(-40.723)	40.723	142.94
2	-8'-0	E(24'-7)	72.154	
4	1'-9	P1	59.787	
5	1'-9	P2(-60.769)	120.556	
6	1'-9		120.556	
7	6'-8½		115.995	
8	1'-0		118.316	
9	-8'-0	T(43'-10)	119.915	
10	-8'-0	T(43'-10)	119.227	
11	-8'-0	T(47'-3½)	118.973	
12	-8'-0	T(43'-10)	117.552	
13	-8'-0	T(47'-3½)	117.221	
14	-8'-0	T(43'-10)	117.089	
15	-8'-0	T(47'-3½)	115.669	
16	-8'-0	T(43'-10)	115.412	
17	-8'-0	T(47'-3½)	114.244	
18	-8'-0	T(43'-10)	114.186	
19	-8'-0	T(43'-10)	114.050	
53	1'-0	Hyd	1.000	
54	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
804	1'-0		107.510	
900	40'-9	PO(18'-8½)	76.519	
902	40'-11½	PO(18'-8½)	76.456	
904	40'-11½	PO(18'-8½)	76.558	
906	40'-8	PO(18'-8½)	76.885	
908	40'-5	PO(18'-8½)	77.260	
910	40'-1½	PO(18'-8½)	77.684	
912	39'-10	PO(18'-8½)	78.159	
914	39'-7	PO(18'-8½)	78.688	
916	39'-3½	PO(18'-8½)	79.273	
918	39'-0	PO(18'-8½)	79.919	
920	38'-9½	ft(31'-5)	82.379	
922	1'-8½	PO(41'-1½)	107.208	
924	40'-10	PO(18'-8½)	65.185	
926	41'-0½	PO(18'-8½)	65.276	
928	41'-0½	PO(18'-8½)	65.933	
930	40'-9	PO(18'-8½)	67.450	
932	38'-5½	PO(18'-8½)	82.462	
934	38'-9	PO(18'-8½)	82.346	
936	40'-6	PO(18'-8½)	68.679	
938	40'-2½	PO(18'-8½)	69.665	
940	39'-11	PO(18'-8½)	70.443	
942	39'-8	PO(18'-8½)	71.042	
944	39'-4½	PO(18'-8½)	71.490	
946	39'-1	PO(18'-8½)	71.812	
948	38'-10	PO(18'-8½)	72.035	
950	38'-6½	PO(18'-8½)	72.184	



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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	141.27	7.89	120		0.048040	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	283.71	15.84	120		0.174503	167'-1	Pf 35.689
9115	41'-8	142.43	22.4	40.432		Sprinkler,	37'-5	Pe 0.397
900	40'-9			76.519		2PO(18'-8½)	204'-6	Pv
CM	6.3570	283.71	2.87	120		0.002720	10'-0	Pf 0.027
900	40'-9			76.519				Pe -0.090
902	40'-11½			76.456			10'-0	Pv
CM	6.3570	567.08	5.73	120		0.009796	9'-11½	Pf 0.098
902	40'-11½	283.37		76.456		Flow (q) from Route 3		Pe 0.004
904	40'-11½			76.558			9'-11½	Pv
CM	6.3570	849.81	8.59	120		0.020704	10'-0	Pf 0.207
904	40'-11½	282.74		76.558		Flow (q) from Route 5		Pe 0.120
906	40'-8			76.885			10'-0	Pv
CM	6.3570	949.85	9.60	120		0.025438	10'-0	Pf 0.254
906	40'-8	100.04		76.885		Flow (q) from Route 2		Pe 0.120
908	40'-5			77.260			10'-0	Pv
CM	6.3570	1044.86	10.56	120		0.030344	10'-0	Pf 0.304
908	40'-5	95.01		77.260		Flow (q) from Route 10		Pe 0.120
910	40'-1½			77.684			10'-0	Pv
CM	6.3570	1136.44	11.49	120		0.035447	10'-0	Pf 0.355
910	40'-1½	91.58		77.684		Flow (q) from Route 11		Pe 0.120
912	39'-10			78.159			10'-0	Pv
CM	6.3570	1226.13	12.39	120		0.040795	10'-0	Pf 0.408
912	39'-10	89.69		78.159		Flow (q) from Route 12		Pe 0.120
914	39'-7			78.688			10'-0	Pv
CM	6.3570	1315.37	13.30	120		0.046457	10'-0	Pf 0.465
914	39'-7	89.24		78.688		Flow (q) from Route 13		Pe 0.120
916	39'-3½			79.273			10'-0	Pv
CM	6.3570	1405.47	14.21	120		0.052515	10'-0	Pf 0.525
916	39'-3½	90.11		79.273		Flow (q) from Route 14		Pe 0.120
918	39'-0			79.919			10'-0	Pv
CM	6.3570	1497.60	15.14	120		0.059060	8'-6	Pf 2.358
918	39'-0	92.12		79.919		Flow (q) from Route 15	31'-5	Pe 0.102
920	38'-9½			82.379		fT(31'-5)	39'-11	Pv
CM	6.3570	1706.70	17.25	120		0.075215	51'-0	Pf 8.754
920	38'-9½	209.10		82.379		Flow (q) from Route 9	65'-4½	Pe 16.076
922	1'-8½			107.208		fE(12'-7), 2f(-0.000), CV(40'-3), BV(12'-7)	116'-4½	Pv
DY	8.2490	1706.70	10.25	120		0.021148	0'-0	Pf 0.000
922	1'-8½			107.208				Pe 0.303
804	1'-0			107.510			0'-0	Pv
UG	7.6800	1706.70	11.82	150		0.019822	66'-8½	Pf 2.638
804	1'-0			107.510			66'-4½	Pe 3.902
19	-8'-0			114.050		E(22'-6½), T(43'-10)	133'-1	Pv
UG	7.6800	1442.15	9.99	150		0.014515	337'-8	Pf 5.865
19	-8'-0			114.050			66'-4½	Pe
9	-8'-0			119.915		E(22'-6½), T(43'-10)	404'-0½	Pv
UG	7.6800	1956.70	13.55	150		0.025526	67'-8	Pf 2.303
9	-8'-0	514.55		119.915		Flow (q) from Route 7	22'-6½	Pe -3.902
8	1'-0			118.316		E(22'-6½)	90'-2½	Pv
FR	8.2490	1956.70	11.75	120		0.027233	5'-8½	Pf 0.156
8	1'-0			118.316				Pe -2.476
7	6'-8½			115.995			5'-8½	Pv
DY	10.3700	1956.70	7.43	120		0.008936	13'-10½	Pf 2.410
7	6'-8½			115.995			255'-9	Pe 2.151
6	1'-9			120.556		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
6	1'-9			120.556				Pe 0.000
5	1'-9			120.556			0'-0	Pv
Pump								
5		1956.70		120.556		Rating: 60.000 @ 2000.00		
4		Q=1956.70	9.01	59.787		Fire Pump Churn Pressure: 84.00		
						0		



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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	
UG	9.4200	1956.70	9.01	150		0.009442	305'-9½	Pf 8.140
4	1'-9			59.787			137'-6	Pe 4.227
2	-8'-0			72.154		GV(5'-7), T(45'-10), 3E(24'-7), EE(12'-3½), BFP(-3.955)	443'-3½	Pv
UG	11.2000	1956.70	6.37	150		0.004064	750'-9	Pf 3.231
2	-8'-0			72.154			44'-3	Pe 1.517
1	-11'-6			76.902		EE(14'-4½), E(29'-10½), S	795'-0	Pv
		0.00				Hose Allowance At Source		
1		1956.70						
Route 2								
BL	2.7050	0.40	0.02	120		0.000001	9'-0	Pf 0.000
9113	41'-8	141.67	22.4	40.000		Sprinkler	9'-0	Pe
9111	41'-8			40.000			9'-0	Pv
BL	2.7050	142.07	7.93	120		0.048542	9'-0	Pf 0.437
9111	41'-8	141.67	22.4	40.000		Sprinkler	9'-0	Pe
9117	41'-8			40.437			9'-0	Pv
BL	2.7050	284.51	15.88	120		0.175420	101'-7	Pf 24.387
9117	41'-8	142.44	22.4	40.437		Sprinkler,	37'-5	Pe 0.361
924	40'-10			65.185		2PO(18'-8½)	139'-0	Pv
CM	4.3100	284.51	6.26	120		0.018148	10'-0	Pf 0.182
924	40'-10			65.185			10'-0	Pe -0.090
926	41'-0½			65.276			10'-0	Pv
CM	4.3100	569.47	12.52	120		0.065520	9'-11½	Pf 0.653
926	41'-0½	284.96		65.276		Flow (q) from Route 4	9'-11½	Pe 0.005
928	41'-0½			65.933			9'-11½	Pv
CM	4.3100	856.88	18.84	120		0.139526	10'-0	Pf 1.396
928	41'-0½	287.41		65.933		Flow (q) from Route 6	10'-0	Pe 0.120
930	40'-9			67.450			10'-0	Pv
RN	2.7050	100.04	5.58	120		0.025368	295'-8	Pf 9.400
930	40'-9			67.450		PO(18'-8½)	74'-10½	Pe 0.036
906	40'-8			76.885		3PO(18'-8½)	370'-6½	Pv
Route 3								
BL	2.7050	140.91	7.87	120		0.047813	9'-0	Pf 0.430
9119	41'-10½	141.70	22.4	40.017		Sprinkler	9'-0	Pe
9121	41'-10½			40.447			9'-0	Pv
BL	2.7050	283.37	15.82	120		0.174122	167'-1	Pf 35.611
9121	41'-10½	142.46	22.4	40.447		Sprinkler,	37'-5	Pe 0.398
902	40'-11½			76.456		2PO(18'-8½)	204'-6	Pv
Route 4								
BL	2.7050	0.79	0.04	120		0.000003	9'-0	Pf 0.000
9119	41'-10½	141.70	22.4	40.017		Sprinkler	9'-0	Pe
9123	41'-10½			40.017			9'-0	Pv
BL	2.7050	142.49	7.95	120		0.048808	9'-0	Pf 0.439
9123	41'-10½	141.70	22.4	40.017		Sprinkler	9'-0	Pe
9125	41'-10½			40.456			9'-0	Pv
BL	2.7050	284.96	15.91	120		0.175938	101'-7	Pf 24.459
9125	41'-10½	142.48	22.4	40.456		Sprinkler,	37'-5	Pe 0.361
926	41'-0½			65.276		2PO(18'-8½)	139'-0	Pv
Route 5								
BL	2.7050	139.84	7.81	120		0.047141	9'-0	Pf 0.424
9127	41'-10½	142.15	22.4	40.272		Sprinkler	9'-0	Pe
9129	41'-10½			40.697			9'-0	Pv
BL	2.7050	282.74	15.78	120		0.173402	167'-1	Pf 35.464
9129	41'-10½	142.90	22.4	40.697		Sprinkler,	37'-5	Pe 0.397
904	40'-11½			76.558		2PO(18'-8½)	204'-6	Pv
Route 6								
BL	2.7050	2.31	0.13	120		0.000024	9'-0	Pf 0.000
9127	41'-10½	142.15	22.4	40.272		Sprinkler	9'-0	Pe
9131	41'-10½			40.273			9'-0	Pv
BL	2.7050	144.47	8.07	120		0.050068	9'-0	Pf 0.451
9131	41'-10½	142.15	22.4	40.273		Sprinkler	9'-0	Pe
9133	41'-10½			40.723			9'-0	Pv
BL	2.7050	287.41	16.05	120		0.178743	101'-7	Pf 24.849
9133	41'-10½	142.94	22.4	40.723		Sprinkler,	37'-5	Pe 0.361
928	41'-0½			65.933		2PO(18'-8½)	139'-0	Pv
Route 7								



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 09

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream						Total Length	
UG	6.2800	250.00	2.59	140	0.001718	40'-9"	Pf 0.197
51	1'-0"	250.00		110.145	Hydrant,	74'-1"	Pe 3.902
17	-8'-0"			114.244	E(22'-1), GV(4'-8½), T(47'-3½)	114'-10"	Pv
UG	7.6800	514.55	3.56	150	0.002157	519'-3½"	Pf 1.169
17	-8'-0"	264.55		114.244	Flow (q) from Route 8	22'-6½"	Pe
16	-8'-0"			115.412	E(22'-6½)	541'-10"	Pv
UG	7.6800	514.55	3.56	150	0.002157	119'-3"	Pf 0.257
16	-8'-0"			115.412			Pe
15	-8'-0"			115.669		119'-3"	Pv
UG	7.6800	514.55	3.56	150	0.002157	635'-9"	Pf 1.420
15	-8'-0"			115.669		22'-6½"	Pe
14	-8'-0"			117.089	E(22'-6½)	658'-3½"	Pv
UG	7.6800	514.55	3.56	150	0.002157	61'-1½"	Pf 0.132
14	-8'-0"			117.089			Pe
13	-8'-0"			117.221		61'-1½"	Pv
UG	7.6800	514.55	3.56	150	0.002157	153'-8"	Pf 0.331
13	-8'-0"			117.221			Pe
12	-8'-0"			117.552		153'-8"	Pv
UG	7.6800	514.55	3.56	150	0.002157	635'-11½"	Pf 1.420
12	-8'-0"			117.552		22'-6½"	Pe
11	-8'-0"			118.973	E(22'-6½)	658'-6"	Pv
UG	7.6800	514.55	3.56	150	0.002157	118'-2"	Pf 0.255
11	-8'-0"			118.973			Pe
10	-8'-0"			119.227		118'-2"	Pv
UG	7.6800	514.55	3.56	150	0.002157	275'-0"	Pf 0.688
10	-8'-0"			119.227		43'-10"	Pe
9	-8'-0"			119.915	T(43'-10)	318'-9½"	Pv
Route 8							
UG	7.6800	264.55	1.83	150	0.000630	214'-9"	Pf 0.135
19	-8'-0"	1442.15		114.050	Flow (q) from Route 1		Pe
18	-8'-0"			114.186		214'-9"	Pv
UG	7.6800	264.55	1.83	150	0.000630	91'-11½"	Pf 0.058
18	-8'-0"			114.186			Pe
17	-8'-0"			114.244		91'-11½"	Pv
Route 9							
CM	6.3570	104.13	1.05	120	0.000426	10'-0"	Pf 0.004
932	38'-5½"	104.13		82.462	Flow (q) from Route 17		Pe -0.120
934	38'-9"			82.346		10'-0"	Pv
CM	6.3570	209.10	2.11	120	0.001547	1'-6"	Pf 0.051
934	38'-9"	104.97		82.346	Flow (q) from Route 16	31'-5"	Pe -0.018
920	38'-9½"			82.379	ft(31'-5)	32'-11½"	Pv
Route 10							
CM	4.3100	756.85	16.64	120	0.110896	10'-0"	Pf 1.109
930	40'-9"	100.04		67.450	Flow (q) from Route 2		Pe 0.120
936	40'-6"			68.679		10'-0"	Pv
RN	2.7050	95.01	5.30	120	0.023061	295'-8"	Pf 8.545
936	40'-6"			68.679	PO(18'-8½)	74'-10½"	Pe 0.036
908	40'-5"			77.260	3PO(18'-8½)	370'-6½"	Pv
Route 11							
CM	4.3100	661.84	14.55	120	0.086524	10'-0"	Pf 0.866
936	40'-6"	95.01		68.679	Flow (q) from Route 10		Pe 0.120
938	40'-2½"			69.665		10'-0"	Pv
RN	2.7050	91.58	5.11	120	0.021544	295'-8"	Pf 7.983
938	40'-2½"			69.665	PO(18'-8½)	74'-10½"	Pe 0.036
910	40'-1½"			77.684	3PO(18'-8½)	370'-6½"	Pv
Route 12							
CM	4.3100	570.26	12.54	120	0.065687	10'-0"	Pf 0.657
938	40'-2½"	91.58		69.665	Flow (q) from Route 11		Pe 0.120
940	39'-11"			70.443		10'-0"	Pv
RN	2.7050	89.69	5.01	120	0.020728	295'-8"	Pf 7.680
940	39'-11"			70.443	PO(18'-8½)	74'-10½"	Pe 0.036
912	39'-10"			78.159	3PO(18'-8½)	370'-6½"	Pv
Route 13							
CM	4.3100	480.57	10.57	120	0.047863	10'-0"	Pf 0.479
940	39'-11"	89.69		70.443	Flow (q) from Route 12		Pe 0.120
942	39'-8"			71.042		10'-0"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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	
RN	2.7050	89.24	4.98	120	0.020537	295'-8"	Pf 7.610
942	39'-8"			71.042	PO(18'-8½")	74'-10½"	Pe 0.036
914	39'-7"			78.688	3PO(18'-8½")	370'-6½"	Pv
Route 14							
CM	4.3100	391.33	8.61	120	0.032731	10'-0"	Pf 0.327
942	39'-8"	89.24		71.042	Flow (q) from Route 13		Pe 0.120
944	39'-4½"			71.490		10'-0"	Pv
RN	2.7050	90.11	5.03	120	0.020907	295'-8"	Pf 7.747
944	39'-4½"			71.490	PO(18'-8½")	74'-10½"	Pe 0.036
916	39'-3½"			79.273	3PO(18'-8½")	370'-6½"	Pv
Route 15							
CM	4.3100	301.22	6.62	120	0.020169	10'-0"	Pf 0.202
944	39'-4½"	90.11		71.490	Flow (q) from Route 14		Pe 0.120
946	39'-1"			71.812		10'-0"	Pv
RN	2.7050	92.12	5.14	120	0.021781	295'-8"	Pf 8.071
946	39'-1"			71.812	PO(18'-8½")	74'-10½"	Pe 0.036
918	39'-0"			79.919	3PO(18'-8½")	370'-6½"	Pv
Route 16							
CM	4.3100	209.10	4.60	120	0.010266	10'-0"	Pf 0.103
946	39'-1"	92.12		71.812	Flow (q) from Route 15		Pe 0.120
948	38'-10"			72.035		10'-0"	Pv
RN	2.7050	104.97	5.86	120	0.027729	295'-8"	Pf 10.275
948	38'-10"			72.035	PO(18'-8½")	74'-10½"	Pe 0.036
934	38'-9"			82.346	3PO(18'-8½")	370'-6½"	Pv
Route 17							
CM	4.3100	104.13	2.29	120	0.002827	10'-0"	Pf 0.028
948	38'-10"	104.97		72.035	Flow (q) from Route 16		Pe 0.120
950	38'-6½"			72.184		10'-0"	Pv
RN	2.7050	104.13	5.81	120	0.027324	295'-8"	Pf 10.242
950	38'-6½"			72.184	PO(18'-8½")	79'-2"	Pe 0.036
932	38'-5½"			82.462	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: FP Overhead System 09

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
SN	Swing Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

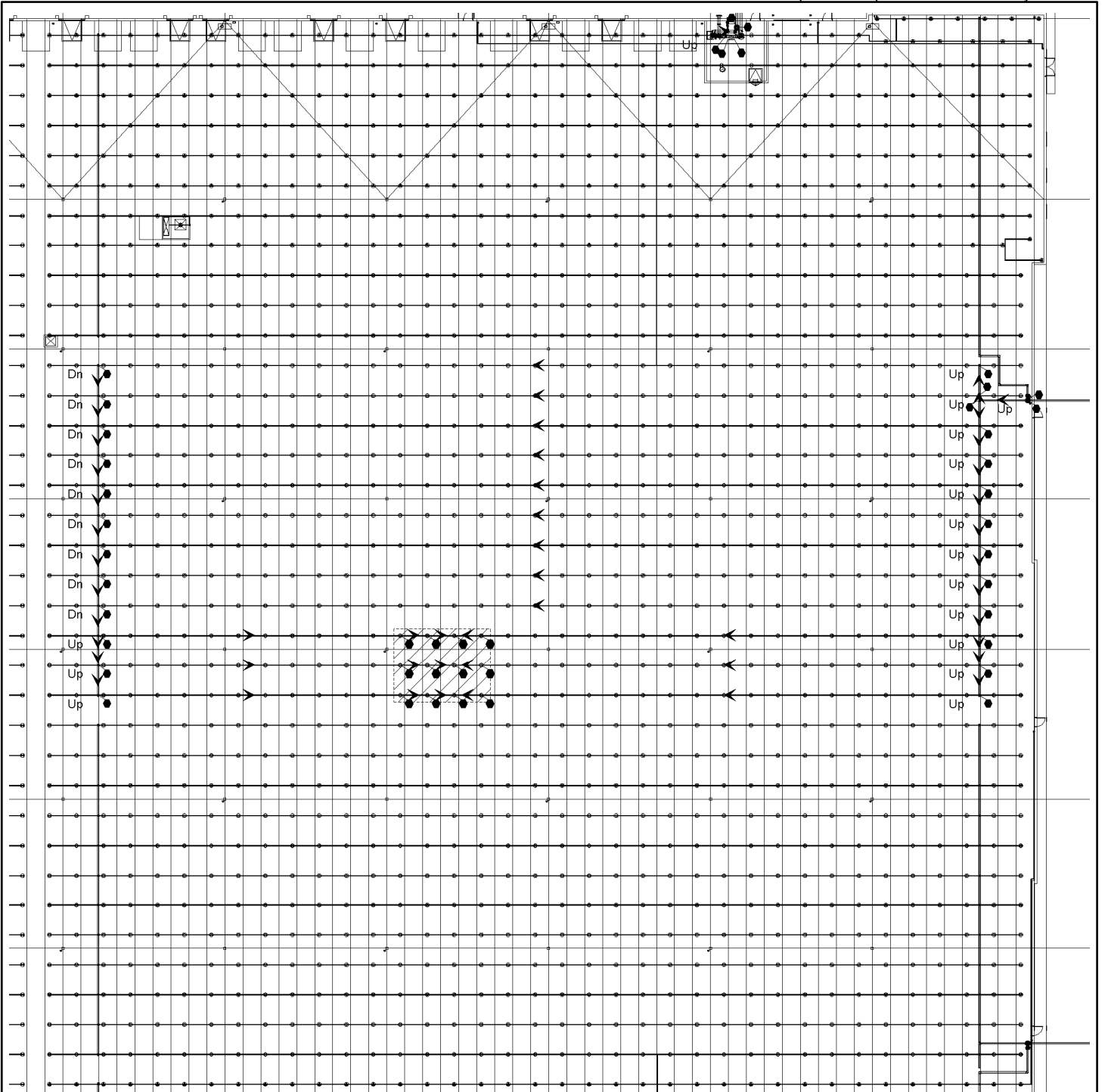
Units Legend	
Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to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



Flow Diagram (Current View)

Job Number: 212189000
Report Description: FP Overhead System 09





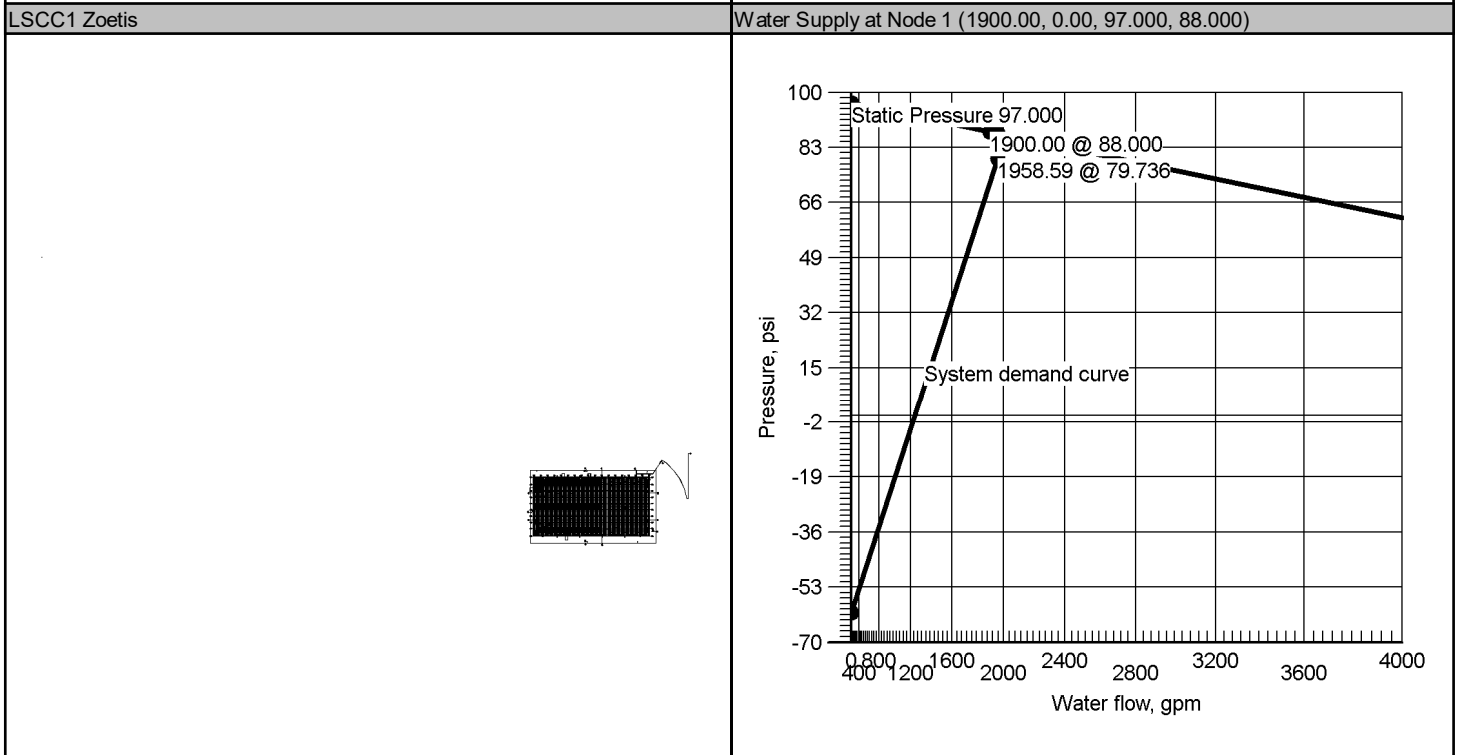
Hydraulic Overview

Job Number: 212189000
Report Description: FP Overhead System 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 100 ft²	Number Of Sprinklers Calculated 12 0
System Pressure Demand 79.736	System Flow Demand 1958.59
Total Demand 1958.59 @ 79.736	Pressure Result +7.744 (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 (461)	0.000	0	0.00
5	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									





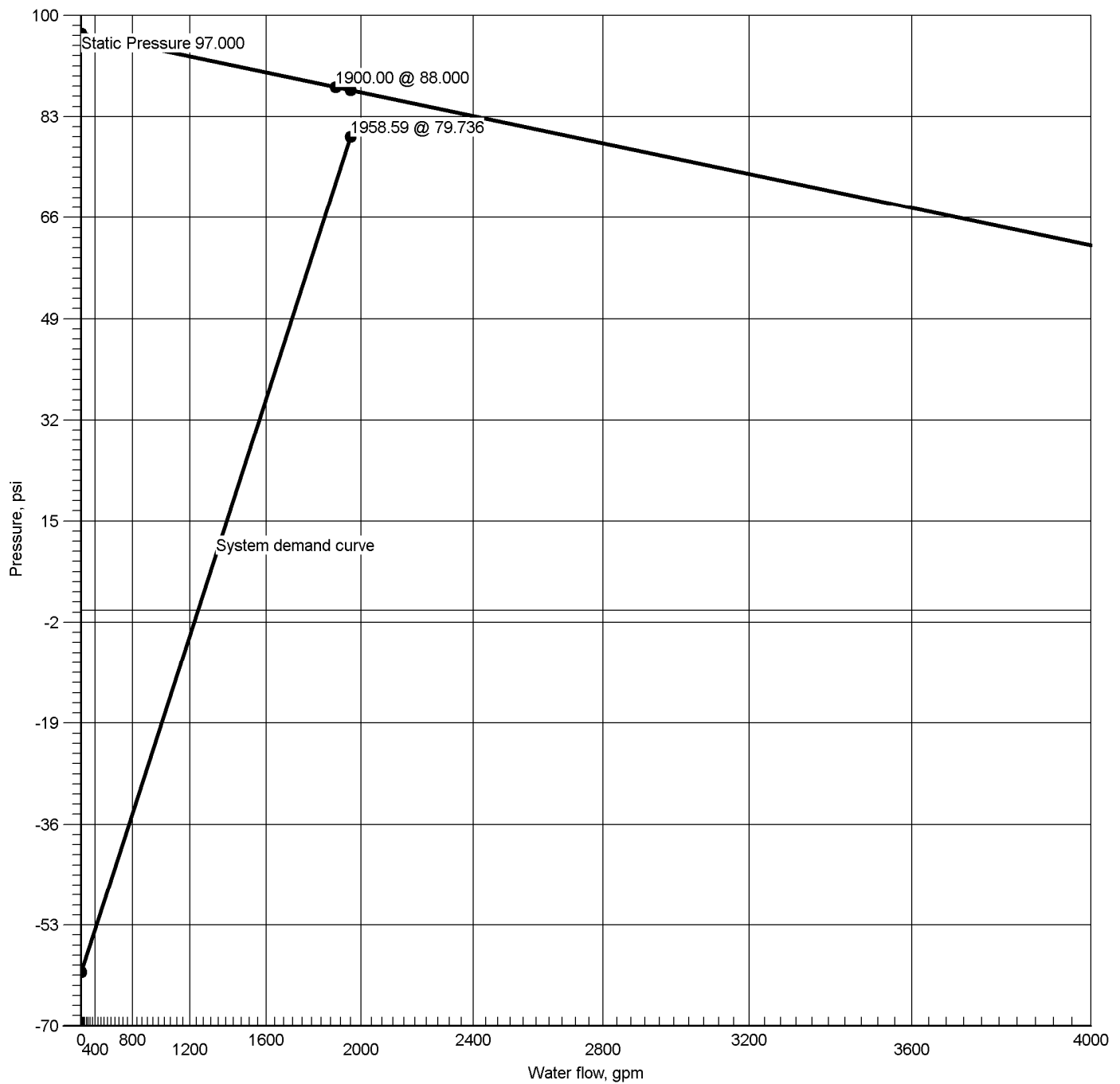
Hydraulic Summary

Job Number: 212189000
Report Description: FP Overhead System 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 51				Flow(gpm) 250.00			Number Of Sprinklers Calculated 12				
				Number Of Nozzles Calculated 0			Coverage Per Sprinkler 100 ft²				
				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 79.680 Right: 79.699							
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 18.85 between nodes 1034 and 1032											
Maximum Velocity Under Ground 13.56 between nodes 8 and 9											
Volume capacity of Wet Pipes 32132.49 gal			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	79.736	7.744
5	Pump		84.000	60.000		2000.00	131.085		1958.59	123.341	7.744
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

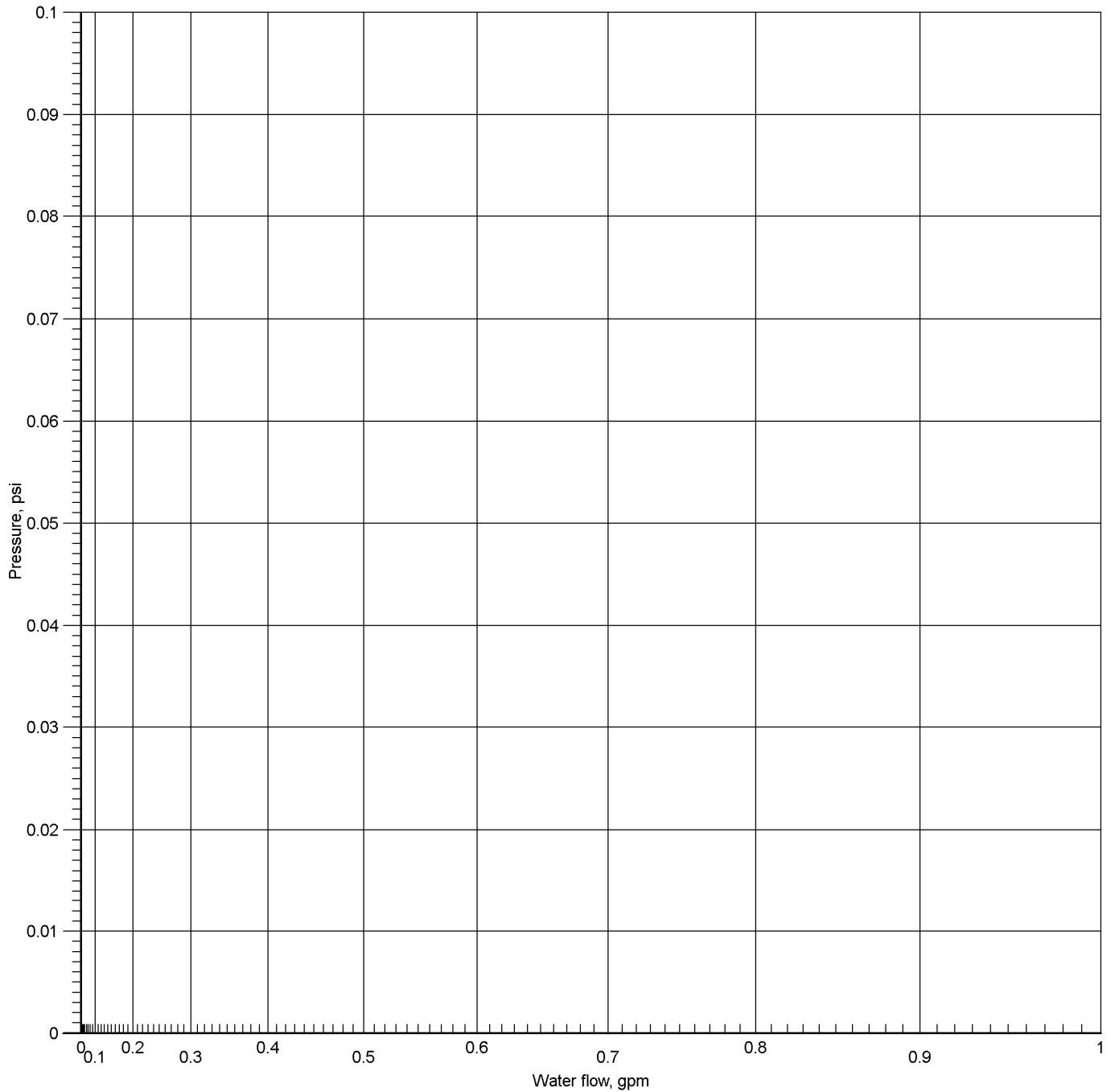
79.736 @ 1958.59

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

79.736 @ 1958.59



Pump Inlet at Node 461



Hydraulic Graph

Pump Inlet at Node 461

Static: Pressure

0.000

Residual: Pressure

N/A

Available Pressure at System Demand

N/A

Required Pressure at System Demand

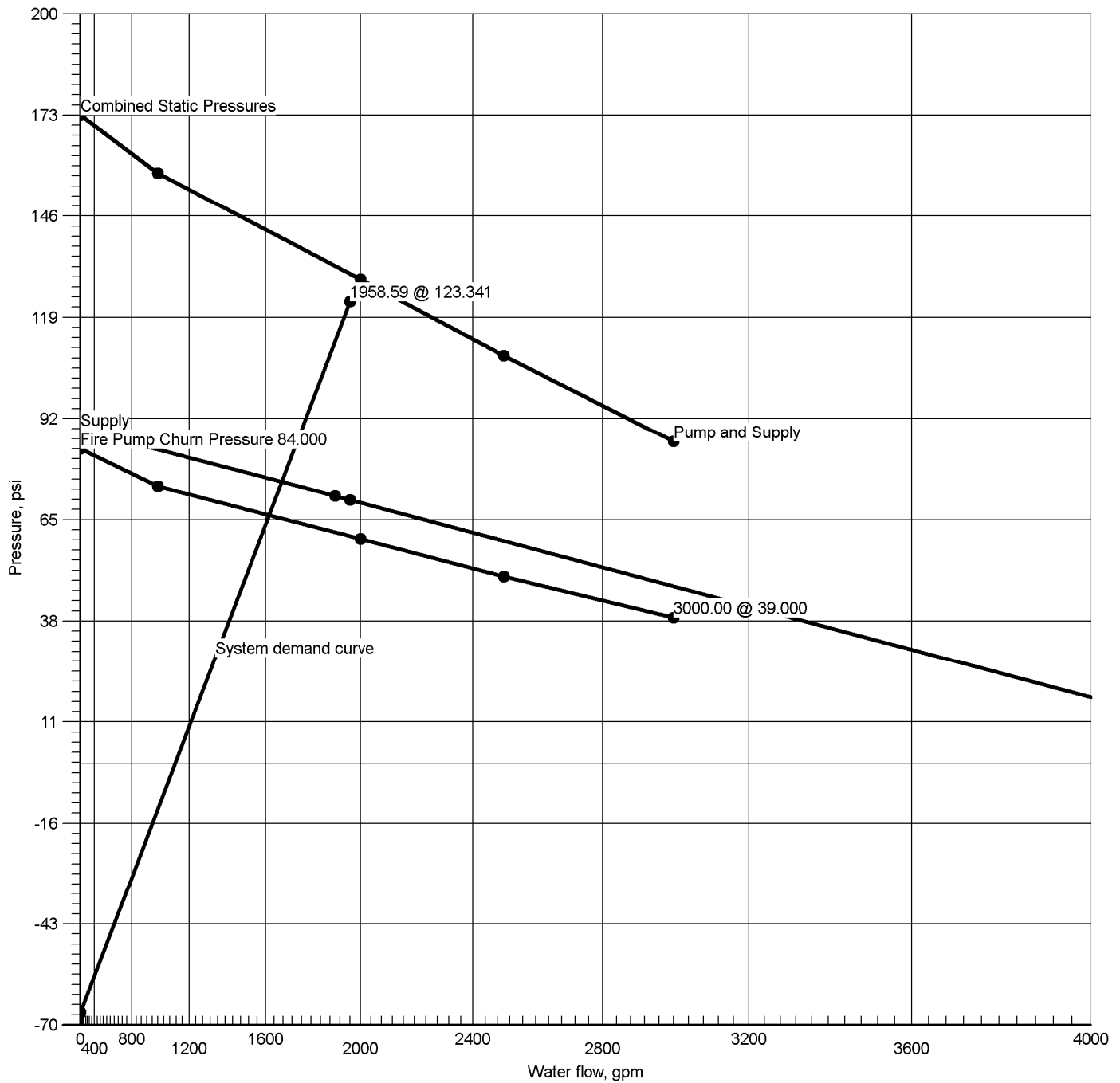
0.000 @ 0.00

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

N/A



Pump at Node 5



Hydraulic Graph	Static + Churn Pressure	Fire Pump Rating
Pump at Node 5	173.256	60.000 @ 2000.00
Static: Pressure	173.256	Fire Pump Churn Pressure
	84.000	
Residual: Pressure		
60.736 @ 1958.59		
Available Pressure at System Demand		
131.085 @ 1958.59		
Required Pressure at System Demand		
123.341 @ 1958.59		



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: FP Overhead System 10

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Hydrant	51	250.00	250.00	250	110.781			
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	40.434			
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	40.557			
Sprinkler	10125	142.66	141.67	22.4	40.564			
Sprinkler	10127	142.43	141.67	22.4	40.432			
Sprinkler	10129	143.18	141.67	22.4	40.859			
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: FP Overhead System 10

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	79.736	1958.59
51	1'-0	Hyd(-1.000)	110.781	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(-40.434)	40.434	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(-40.557)	40.557	142.65
10125	41'-3	Spr(-40.564)	40.564	142.66
10127	41'-0½	Spr(-40.432)	40.432	142.43
10129	41'-0½	Spr(-40.859)	40.859	143.18
10131	41'-0½	Spr(-40.432)	40.432	142.43
10133	41'-0½	Spr(-40.884)	40.884	143.23
2	-8'-0	E(24'-7)	74.982	
4	1'-9	P1	62.605	
5	1'-9	P2(-60.736)	123.341	
6	1'-9		123.341	
7	6'-8½		118.776	
8	1'-0		121.096	
9	-8'-0	T(43'-10)	122.691	
10	-8'-0	T(43'-10)	121.744	
11	-8'-0	T(47'-3½)	121.393	
12	-8'-0	T(43'-10)	119.437	
13	-8'-0	T(47'-3½)	118.981	
14	-8'-0	T(43'-10)	118.799	
15	-8'-0	T(47'-3½)	116.844	
16	-8'-0	T(43'-10)	116.489	
17	-8'-0	T(47'-3½)	114.880	
18	-8'-0	T(43'-10)	114.777	
19	-8'-0	T(43'-10)	117.523	
53	1'-0	Hyd	1.000	
54	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
1000	40'-6½	PO(18'-8½)	76.575	
1002	40'-4	PO(18'-8½)	76.693	
1004	40'-1½	PO(18'-8½)	76.882	
1006	39'-11	PO(18'-8½)	77.180	
1008	39'-8½	PO(18'-8½)	77.525	
1010	39'-6	PO(18'-8½)	77.921	
1012	39'-3½	PO(18'-8½)	78.367	
1014	39'-1	PO(18'-8½)	78.868	
1016	38'-10½	PO(18'-8½)	79.426	
1018	38'-8	PO(18'-8½)	80.045	
1020	38'-5½	PO(18'-8½)	80.731	
1022	38'-3	PO(18'-8½)	83.323	
1024	1'-8½	PO(41'-1½)	107.929	
1026	1'-0		108.231	
1028	40'-7½	PO(18'-8½)	65.146	
1030	40'-5	PO(18'-8½)	65.417	
1032	40'-2½	PO(18'-8½)	66.163	
1034	40'-0	PO(18'-8½)	67.650	
1036	39'-9½	PO(18'-8½)	68.849	
1038	39'-7	PO(18'-8½)	69.803	
1040	39'-4½	PO(18'-8½)	70.548	
1042	39'-2	PO(18'-8½)	71.113	
1044	38'-11½	PO(18'-8½)	71.527	
1046	38'-9	PO(18'-8½)	71.815	
1048	38'-6½	PO(18'-8½)	72.004	
1050	38'-4	PO(18'-8½)	72.125	
6973	38'-4	ft(31'-5)	83.306	



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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	141.51	7.90	120		0.048188	9'-0	Pf 0.434
10113	41'-5½	141.67	22.4	40.000		Sprinkler		Pe
10115	41'-5½			40.434			9'-0	Pv
BL	2.7050	283.94	15.85	120		0.174773	167'-1	Pf 35.744
10115	41'-5½	142.44	22.4	40.434		Sprinkler,	37'-5	Pe 0.397
1000	40'-6½			76.575		2PO(18'-8½)	204'-6	Pv
CM	6.3570	283.94	2.87	120		0.002725	10'-0	Pf 0.027
1000	40'-6½			76.575				Pe 0.090
1002	40'-4			76.693			10'-0	Pv
CM	6.3570	567.86	5.74	120		0.009821	10'-0	Pf 0.098
1002	40'-4	283.92		76.693		Flow (q) from Route 3		Pe 0.090
1004	40'-1½			76.882			10'-0	Pv
CM	6.3570	851.29	8.61	120		0.020771	10'-0	Pf 0.208
1004	40'-1½	283.43		76.882		Flow (q) from Route 5		Pe 0.090
1006	39'-11			77.180			10'-0	Pv
CM	6.3570	951.87	9.62	120		0.025538	10'-0	Pf 0.255
1006	39'-11	100.57		77.180		Flow (q) from Route 2		Pe 0.090
1008	39'-8½			77.525			10'-0	Pv
CM	6.3570	1047.45	10.59	120		0.030483	10'-0	Pf 0.305
1008	39'-8½	95.58		77.525		Flow (q) from Route 10		Pe 0.090
1010	39'-6			77.921			10'-0	Pv
CM	6.3570	1139.64	11.52	120		0.035631	10'-0	Pf 0.356
1010	39'-6	92.19		77.921		Flow (q) from Route 11		Pe 0.090
1012	39'-3½			78.367			10'-0	Pv
CM	6.3570	1229.97	12.43	120		0.041032	10'-0	Pf 0.410
1012	39'-3½	90.34		78.367		Flow (q) from Route 12		Pe 0.090
1014	39'-1			78.868			10'-0	Pv
CM	6.3570	1319.90	13.34	120		0.046754	10'-0	Pf 0.468
1014	39'-1	89.93		78.868		Flow (q) from Route 13		Pe 0.090
1016	38'-10½			79.426			10'-0	Pv
CM	6.3570	1410.73	14.26	120		0.052880	10'-0	Pf 0.529
1016	38'-10½	90.83		79.426		Flow (q) from Route 14		Pe 0.090
1018	38'-8			80.045			10'-0	Pv
CM	6.3570	1503.62	15.20	120		0.059500	10'-0	Pf 0.595
1018	38'-8	92.88		80.045		Flow (q) from Route 15		Pe 0.090
1020	38'-5½			80.731			10'-0	Pv
CM	6.3570	1599.50	16.17	120		0.066709	6'-4	Pf 2.518
1020	38'-5½	95.88		80.731		Flow (q) from Route 16	31'-5	Pe 0.057
6973	38'-4			83.306		fT(31'-5)	37'-9	Pv
CM	6.3570	1708.59	17.27	120		0.075369	50'-6½	Pf 8.738
6973	38'-4	109.09		83.306		Flow (q) from Route 9	65'-4½	Pe 15.884
1024	1'-8½			107.929		fE(12'-7), 2f(-0.000), CV(40'-3), BV(12'-7)	115'-11½	Pv
DY	8.2490	1708.59	10.26	120		0.021191	0'-0	Pf 0.000
1024	1'-8½			107.929				Pe 0.303
1026	1'-0			108.231			0'-0	Pv
UG	7.6800	1708.59	11.83	150		0.019863	66'-8½	Pf 2.644
1026	1'-0			108.231			66'-4½	Pe 3.902
18	-8'-0			114.777		E(22'-6½), T(43'-10)	133'-1	Pv
UG	7.6800	1346.83	9.33	150		0.012791	214'-9	Pf 2.747
18	-8'-0			114.777				Pe
19	-8'-0			117.523			214'-9	Pv
UG	7.6800	1346.83	9.33	150		0.012791	337'-8	Pf 5.168
19	-8'-0			117.523			66'-4½	Pe
9	-8'-0			122.691		E(22'-6½), T(43'-10)	404'-0½	Pv
UG	7.6800	1958.59	13.56	150		0.025571	67'-8	Pf 2.307
9	-8'-0	611.76		122.691		Flow (q) from Route 7	22'-6½	Pe -3.902
8	1'-0			121.096		E(22'-6½)	90'-2½	Pv
FR	8.2490	1958.59	11.76	120		0.027282	5'-8½	Pf 0.156
8	1'-0			121.096				Pe -2.476
7	6'-8½			118.776			5'-8½	Pv
DY	10.3700	1958.59	7.44	120		0.008952	13'-10½	Pf 2.414
7	6'-8½			118.776			255'-9	Pe 2.151
6	1'-9			123.341		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: FP Overhead System 10

Pipe Type	Diameter	Flow	Velocity	HWC	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
6	1'-9			123.341			Pe 0.000
5	1'-9			123.341		0'-0	Pv
Pump							
5		1958.59		123.341	Rating: 60.000 @ 2000.00		
4		Q=1958.59	9.02	62.605	Fire Pump Churn Pressure: 84.00		
					0		
UG	9.4200	1958.59	9.02	150	0.009459	305'-9½	Pf 8.150
4	1'-9			62.605		137'-6	Pe 4.227
2	-8'-0			74.982	GV(5'-7), T(45'-10), 3E(24'-7), EE(12'-3½), BFP(-3.957)	443'-3½	Pv
UG	11.2000	1958.59	6.38	150	0.004072	750'-9	Pf 3.237
2	-8'-0			74.982		44'-3	Pe 1.517
1	-11'-6			79.736	EE(14'-4½), E(29'-10½), S	795'-0	Pv
		0.00			Hose Allowance At Source		
1		1958.59					
Route 2							
BL	2.7050	0.16	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	141.83	7.92	120	0.048394	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	284.27	15.87	120	0.175149	101'-7	Pf 24.349
10117	41'-5½	142.44	22.4	40.436	Sprinkler,	37'-5	Pe 0.361
1028	40'-7½			65.146	2PO(18'-8½)	139'-0	Pv
CM	4.3100	284.27	6.25	120	0.018120	10'-0	Pf 0.181
1028	40'-7½			65.146			Pe 0.090
1030	40'-5			65.417		10'-0	Pv
CM	4.3100	569.45	12.52	120	0.065515	10'-0	Pf 0.655
1030	40'-5	285.18		65.417	Flow (q) from Route 4		Pe 0.090
1032	40'-2½			66.163		10'-0	Pv
CM	4.3100	857.29	18.85	120	0.139649	10'-0	Pf 1.397
1032	40'-2½	287.84		66.163	Flow (q) from Route 6		Pe 0.090
1034	40'-0			67.650		10'-0	Pv
RN	2.7050	100.57	5.61	120	0.025621	295'-8	Pf 9.493
1034	40'-0			67.650	PO(18'-8½)	74'-10½	Pe 0.036
1006	39'-11			77.180	3PO(18'-8½)	370'-6½	Pv
Route 3							
BL	2.7050	141.27	7.89	120	0.048037	9'-0	Pf 0.432
10121	41'-3	141.89	22.4	40.124	Sprinkler		Pe
10123	41'-3			40.557		9'-0	Pv
BL	2.7050	283.92	15.85	120	0.174748	167'-1	Pf 35.739
10123	41'-3	142.65	22.4	40.557	Sprinkler,	37'-5	Pe 0.397
1002	40'-4			76.693	2PO(18'-8½)	204'-6	Pv
Route 4							
BL	2.7050	0.62	0.03	120	0.000002	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	142.51	7.96	120	0.048823	9'-0	Pf 0.439
10119	41'-3	141.89	22.4	40.124	Sprinkler		Pe
10125	41'-3			40.564		9'-0	Pv
BL	2.7050	285.18	15.92	120	0.176181	101'-7	Pf 24.493
10125	41'-3	142.66	22.4	40.564	Sprinkler,	37'-5	Pe 0.361
1030	40'-5			65.417	2PO(18'-8½)	139'-0	Pv
Route 5							
BL	2.7050	140.25	7.83	120	0.047399	9'-0	Pf 0.427
10127	41'-0½	142.43	22.4	40.432	Sprinkler		Pe
10129	41'-0½			40.859		9'-0	Pv
BL	2.7050	283.43	15.82	120	0.174192	167'-1	Pf 35.626
10129	41'-0½	143.18	22.4	40.859	Sprinkler,	37'-5	Pe 0.397
1004	40'-1½			76.882	2PO(18'-8½)	204'-6	Pv
Route 6							
BL	2.7050	2.18	0.12	120	0.000021	9'-0	Pf 0.000
10127	41'-0½	142.43	22.4	40.432	Sprinkler		Pe
10131	41'-0½			40.432		9'-0	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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	144.62	8.07	120		0.050166	9'-0	Pf 0.451
10131	41'-0½	142.43	22.4	40.432		Sprinkler		Pe
10133	41'-0½			40.884			9'-0	Pv
BL	2.7050	287.84	16.07	120		0.179242	101'-7	Pf 24.918
10133	41'-0½	143.23	22.4	40.884		Sprinkler,	37'-5	Pe 0.361
1032	40'-2½			66.163		2PO(18'-8½)	139'-0	Pv
Route 7								
UG	6.2800	250.00	2.59	140		0.001718	40'-9	Pf 0.197
51	1'-0	250.00		110.781		Hydrant,	74'-1	Pe 3.902
17	-8'-0			114.880		E(22'-1), GV(4'-8½), T(47'-3½)	114'-10	Pv
UG	7.6800	611.76	4.24	150		0.002971	519'-3½	Pf 1.610
17	-8'-0	361.76		114.880		Flow (q) from Route 8	22'-6½	Pe
16	-8'-0			116.489		E(22'-6½)	541'-10	Pv
UG	7.6800	611.76	4.24	150		0.002971	119'-3	Pf 0.354
16	-8'-0			116.489				Pe
15	-8'-0			116.844			119'-3	Pv
UG	7.6800	611.76	4.24	150		0.002971	635'-9	Pf 1.955
15	-8'-0			116.844			22'-6½	Pe
14	-8'-0			118.799		E(22'-6½)	658'-3½	Pv
UG	7.6800	611.76	4.24	150		0.002971	61'-1½	Pf 0.182
14	-8'-0			118.799				Pe
13	-8'-0			118.981			61'-1½	Pv
UG	7.6800	611.76	4.24	150		0.002971	153'-8	Pf 0.456
13	-8'-0			118.981				Pe
12	-8'-0			119.437			153'-8	Pv
UG	7.6800	611.76	4.24	150		0.002971	635'-11½	Pf 1.956
12	-8'-0			119.437			22'-6½	Pe
11	-8'-0			121.393		E(22'-6½)	658'-6	Pv
UG	7.6800	611.76	4.24	150		0.002971	118'-2	Pf 0.351
11	-8'-0			121.393				Pe
10	-8'-0			121.744			118'-2	Pv
UG	7.6800	611.76	4.24	150		0.002971	275'-0	Pf 0.947
10	-8'-0			121.744			43'-10	Pe
9	-8'-0			122.691		T(43'-10)	318'-9½	Pv
Route 8								
UG	7.6800	361.76	2.51	150		0.001124	91'-11½	Pf 0.103
18	-8'-0	1346.83		114.777		Flow (q) from Route 1		Pe
17	-8'-0			114.880			91'-11½	Pv
Route 9								
CM	6.3570	109.09	1.10	120		0.000464	3'-8	Pf 0.016
1022	38'-3	109.09		83.323		Flow (q) from Route 17	31'-5	Pe -0.033
6973	38'-4			83.306		ft(31'-5)	35'-1½	Pv
Route 10								
CM	4.3100	756.72	16.64	120		0.110861	10'-0	Pf 1.109
1034	40'-0	100.57		67.650		Flow (q) from Route 2		Pe 0.090
1036	39'-9½			68.849			10'-0	Pv
RN	2.7050	95.58	5.34	120		0.023318	295'-8	Pf 8.640
1036	39'-9½			68.849		PO(18'-8½)	74'-10½	Pe 0.036
1008	39'-8½			77.525		3PO(18'-8½)	370'-6½	Pv
Route 11								
CM	4.3100	661.14	14.54	120		0.086356	10'-0	Pf 0.864
1036	39'-9½	95.58		68.849		Flow (q) from Route 10		Pe 0.090
1038	39'-7			69.803			10'-0	Pv
RN	2.7050	92.19	5.15	120		0.021809	295'-8	Pf 8.081
1038	39'-7			69.803		PO(18'-8½)	74'-10½	Pe 0.036
1010	39'-6			77.921		3PO(18'-8½)	370'-6½	Pv
Route 12								
CM	4.3100	568.95	12.51	120		0.065409	10'-0	Pf 0.654
1038	39'-7	92.19		69.803		Flow (q) from Route 11		Pe 0.090
1040	39'-4½			70.548			10'-0	Pv
RN	2.7050	90.34	5.04	120		0.021006	295'-8	Pf 7.783
1040	39'-4½			70.548		PO(18'-8½)	74'-10½	Pe 0.036
1012	39'-3½			78.367		3PO(18'-8½)	370'-6½	Pv
Route 13								
CM	4.3100	478.62	10.52	120		0.047503	10'-0	Pf 0.475
1040	39'-4½	90.34		70.548		Flow (q) from Route 12		Pe 0.090
1042	39'-2			71.113			10'-0	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 10

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream					Fittings	Total Length	
RN	2.7050	89.93	5.02	120	0.020831	295'-8"	Pf 7.719
1042	39'-2"			71.113	PO(18'-8½")	74'-10½"	Pe 0.036
1014	39'-1"			78.868	3PO(18'-8½")	370'-6½"	Pv
Route 14							
CM	4.3100	388.69	8.55	120	0.032323	10'-0"	Pf 0.323
1042	39'-2"	89.93		71.113	Flow (q) from Route 13		Pe 0.090
1044	38'-11½"			71.527		10'-0"	Pv
RN	2.7050	90.83	5.07	120	0.021220	295'-8"	Pf 7.863
1044	38'-11½"			71.527	PO(18'-8½")	74'-10½"	Pe 0.036
1016	38'-10½"			79.426	3PO(18'-8½")	370'-6½"	Pv
Route 15							
CM	4.3100	297.85	6.55	120	0.019754	10'-0"	Pf 0.198
1044	38'-11½"	90.83		71.527	Flow (q) from Route 14		Pe 0.090
1046	38'-9"			71.815		10'-0"	Pv
RN	2.7050	92.88	5.19	120	0.022115	295'-8"	Pf 8.194
1046	38'-9"			71.815	PO(18'-8½")	74'-10½"	Pe 0.036
1018	38'-8"			80.045	3PO(18'-8½")	370'-6½"	Pv
Route 16							
CM	4.3100	204.97	4.51	120	0.009894	10'-0"	Pf 0.099
1046	38'-9"	92.88		71.815	Flow (q) from Route 15		Pe 0.090
1048	38'-6½"			72.004		10'-0"	Pv
RN	2.7050	95.88	5.35	120	0.023454	295'-8"	Pf 8.690
1048	38'-6½"			72.004	PO(18'-8½")	74'-10½"	Pe 0.036
1020	38'-5½"			80.731	3PO(18'-8½")	370'-6½"	Pv
Route 17							
CM	4.3100	109.09	2.40	120	0.003081	10'-0"	Pf 0.031
1048	38'-6½"	95.88		72.004	Flow (q) from Route 16		Pe 0.090
1050	38'-4"			72.125		10'-0"	Pv
RN	2.7050	109.09	6.09	120	0.029778	295'-8"	Pf 11.162
1050	38'-4"			72.125	PO(18'-8½")	79'-2"	Pe 0.036
1022	38'-3"			83.323	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



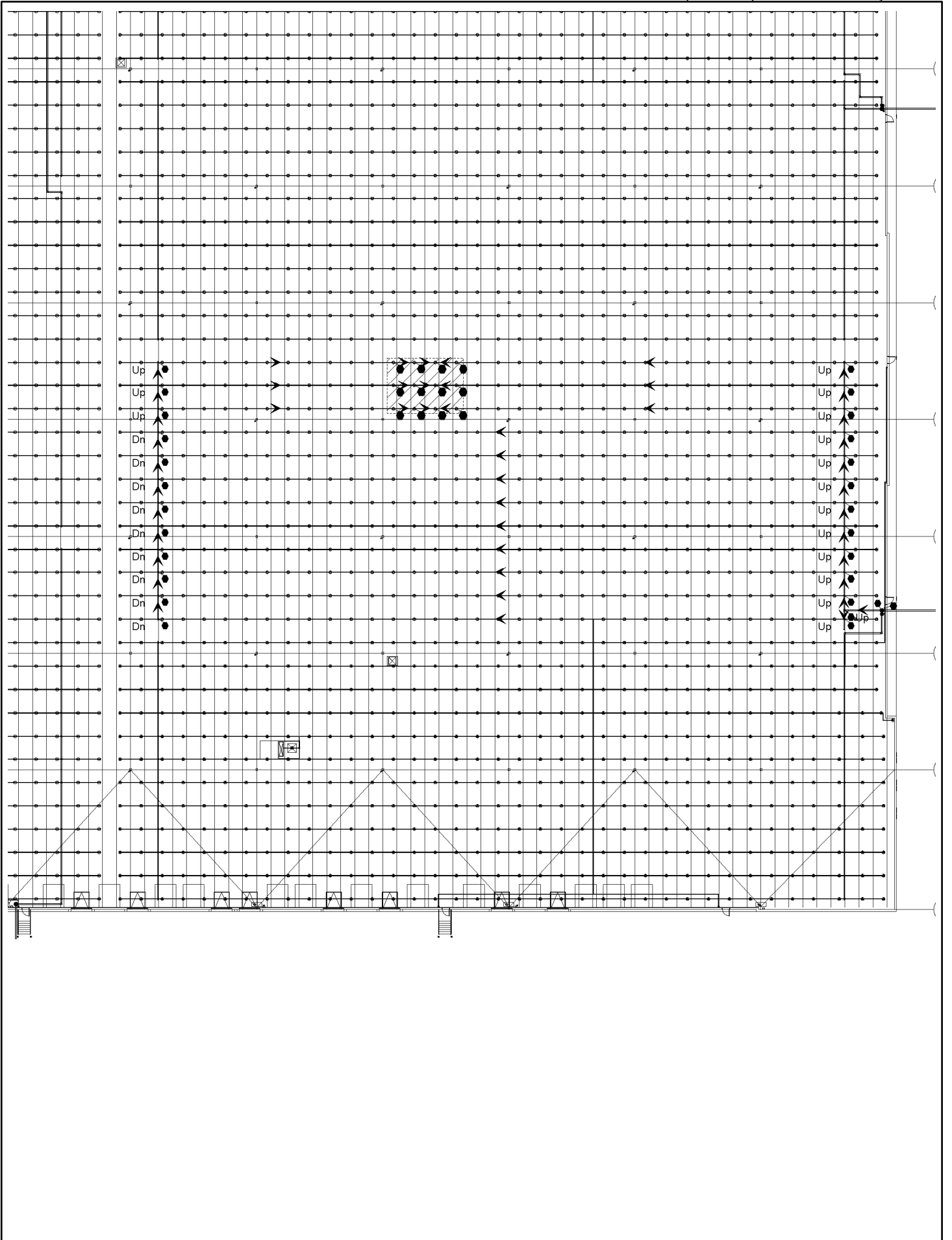
Hydraulic Analysis

Job Number: 212189000

Report Description: FP Overhead System 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	
SN Swing Nipple	Pf	Pressure loss due to friction between points	DPV Dry Pipe Valve	
SP Sprig	Pe	Pressure due to elevation difference between indicated points	E 90° Elbow	
ST Stand Pipe	Pv	Velocity pressure at a point in a pipe	EE 45° Elbow	
UG Underground			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	





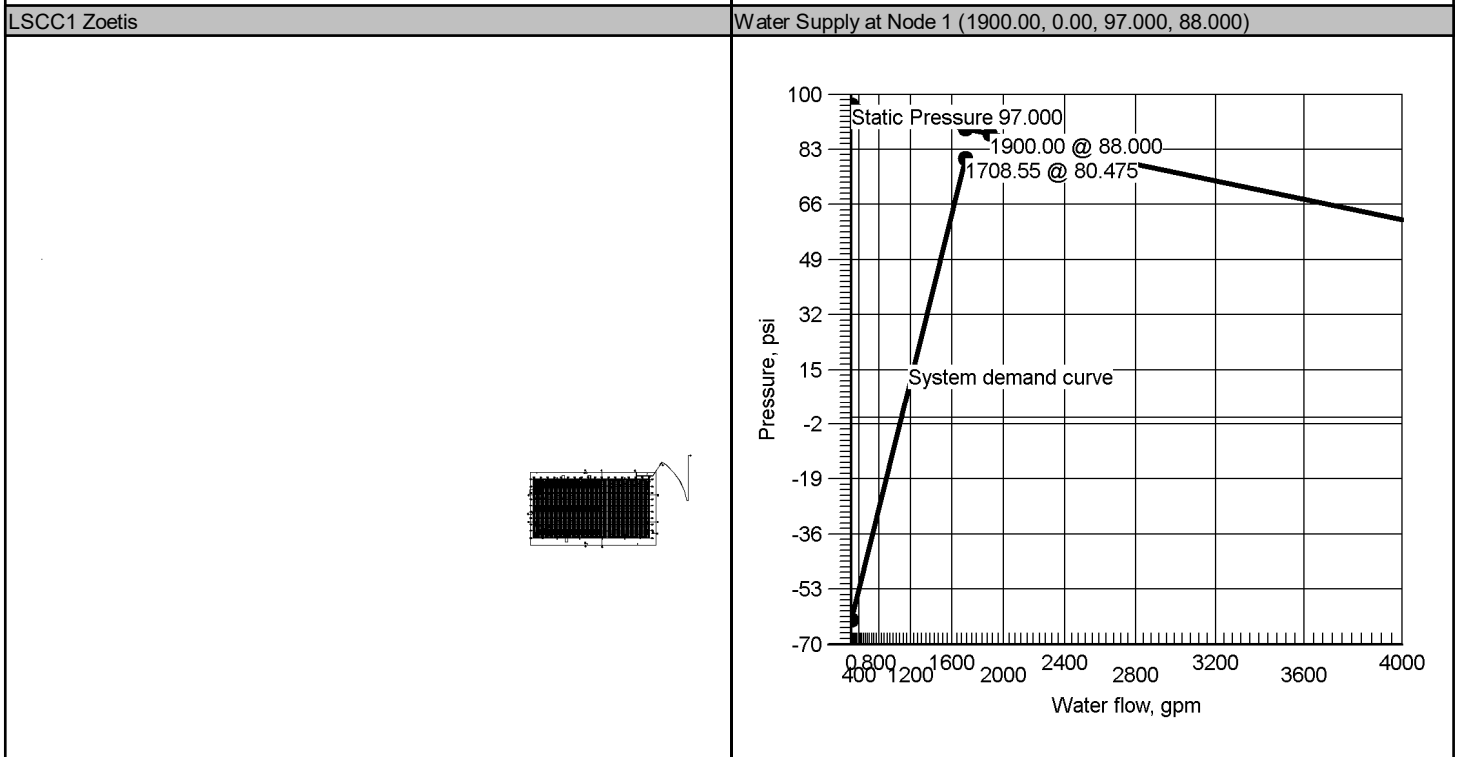
Hydraulic Overview

Job Number: 212189000
Report Description: FP Overhead System 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 100 ft²	Number Of Sprinklers Calculated 12 0
System Pressure Demand 80.475	System Flow Demand 1708.55
Total Demand 1708.55 @ 80.475	Pressure Result +9.131 (10.2%)

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 (461)	0.000	0	0.00
5	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									





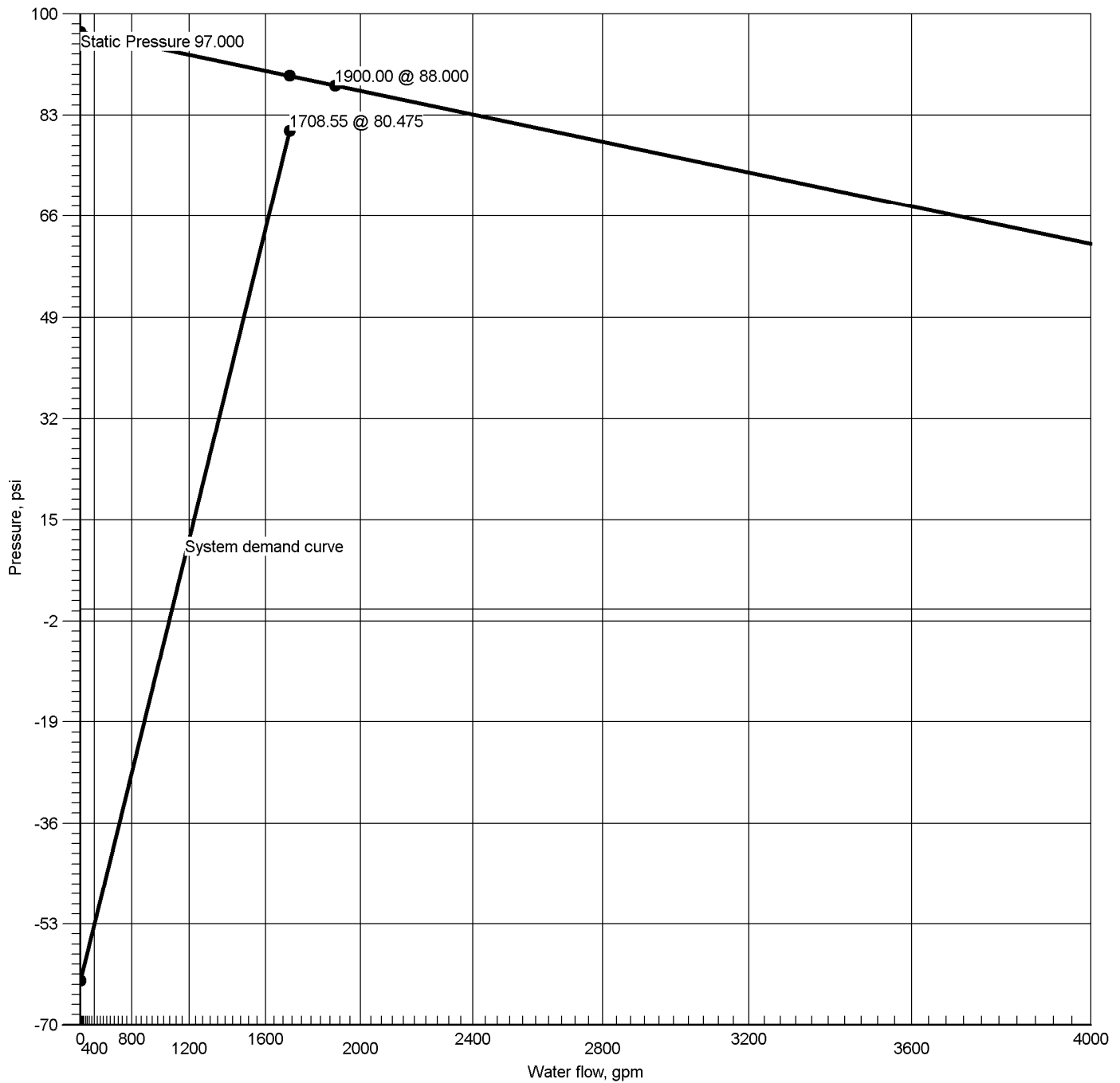
Hydraulic Summary

Job Number: 212189000
Report Description: FP Overhead System 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 51				Flow(gpm) 250.00		Number Of Sprinklers Calculated 12		Number Of Nozzles Calculated 0		Coverage Per Sprinkler 100 ft ²	
				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Left: 80.470 Right: 80.412							
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 11.83 between nodes 8 and 9											
Volume capacity of Wet Pipes 32132.49 gal		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	80.475	9.131
5	Pump		84.000	60.000		2000.00	139.325		1708.55	130.194	9.131
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

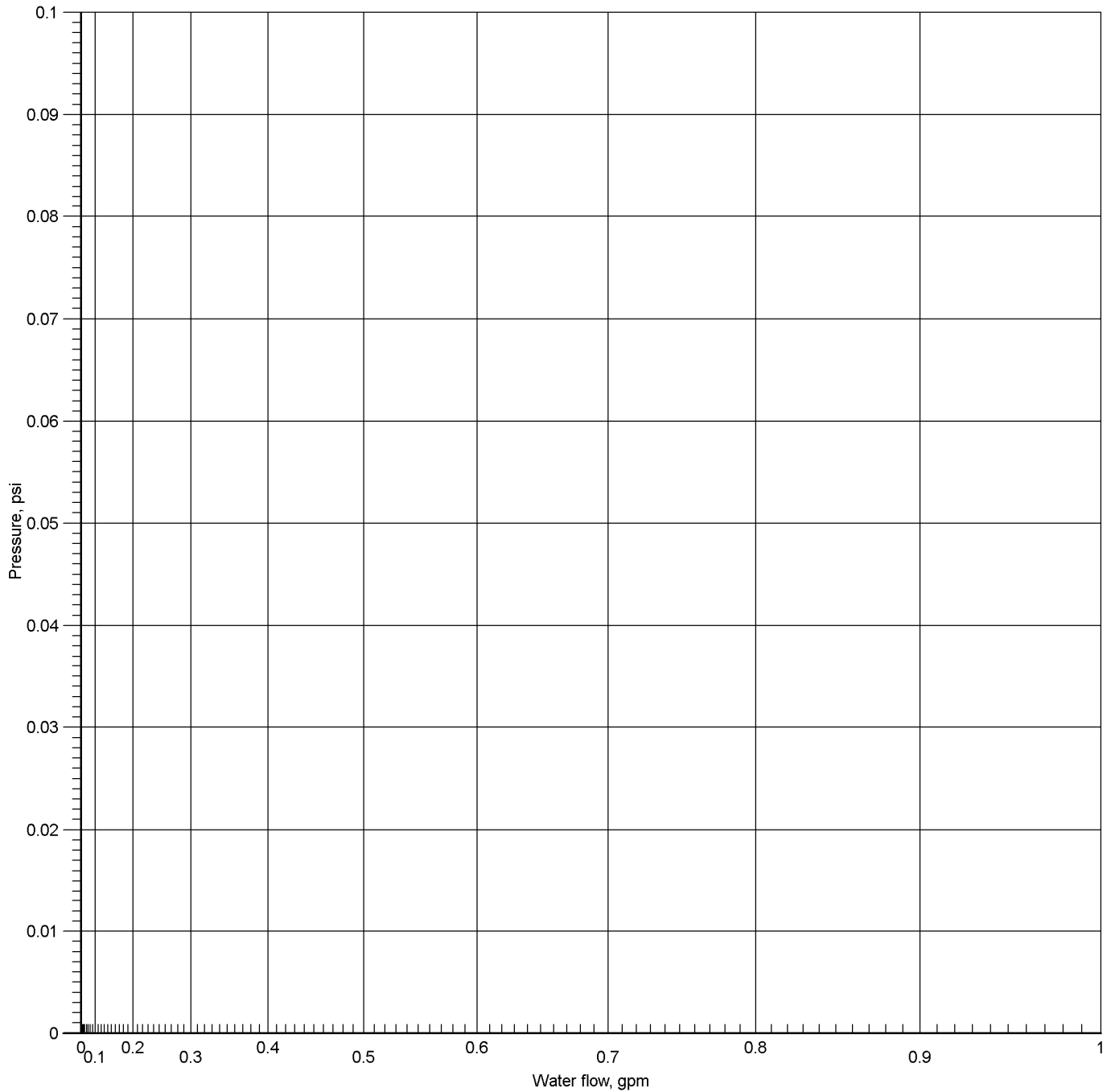
80.475 @ 1708.55

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

80.475 @ 1708.55



Pump Inlet at Node 461



Hydraulic Graph

Pump Inlet at Node 461

Static: Pressure

0.000

Residual: Pressure

N/A

Available Pressure at System Demand

N/A

Required Pressure at System Demand

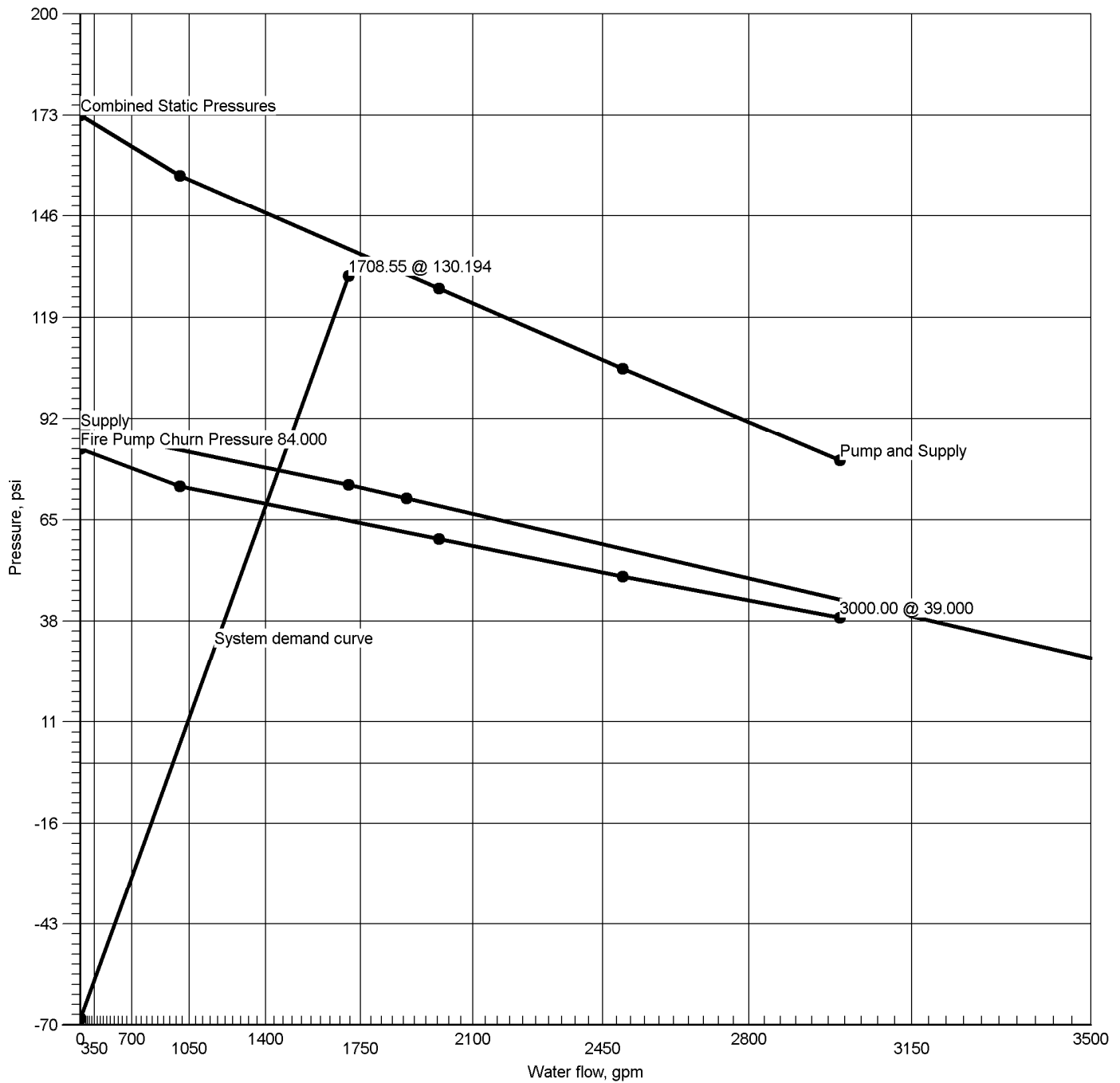
0.000 @ 0.00

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

N/A



Pump at Node 5



Hydraulic Graph
Pump at Node 5

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
139.325 @ 1708.55

Required Pressure at System Demand
130.194 @ 1708.55



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: FP Overhead System 11

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Hydrant	51	250.00	250.00	250	120.457			
⇒ 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: FP Overhead System 11

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	80.475	1708.55
51	1'-0	Hyd(-1.000)	120.457	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	-8'-0	E(24'-7)	76.443	
4	1'-9	P1	65.297	
5	1'-9	P2(-64.897)	130.194	
6	1'-9		130.194	
7	6'-8½		126.168	
8	1'-0		128.523	
9	-8'-0	T(43'-10)	130.633	
10	-8'-0	T(43'-10)	129.897	
11	-8'-0	T(47'-3½)	129.624	
12	-8'-0	T(43'-10)	128.102	
13	-8'-0	T(47'-3½)	127.747	
14	-8'-0	T(43'-10)	127.605	
15	-8'-0	T(47'-3½)	126.084	
16	-8'-0	T(43'-10)	125.809	
17	-8'-0	T(47'-3½)	124.556	
18	-8'-0	T(43'-10)	124.490	
19	-8'-0	T(43'-10)	126.622	
53	1'-0	Hyd	1.000	
54	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
1026	1'-0		118.616	
1100	37'-0	PO(18'-8½)	76.620	
1102	37'-0	PO(18'-8½)	76.753	
1104	37'-0	PO(18'-8½)	77.232	
1106	37'-0	PO(18'-8½)	78.249	
1108	37'-0	PO(18'-8½)	79.410	
1110	37'-0	PO(18'-8½)	80.730	
1112	37'-1	PO(18'-8½)	82.197	
1114	37'-3½	PO(18'-8½)	83.831	
1116	37'-6	PO(18'-8½)	85.729	
1118	37'-8½	PO(18'-8½)	87.951	
1120	37'-11	PO(18'-8½)	90.569	
1122	37'-11		90.732	
1124	38'-1½	PO(18'-8½)	91.103	
1126	1'-8½	PO(37'-8½)	117.639	
1128	37'-0	PO(18'-8½)	73.589	
1130	37'-0	PO(18'-8½)	73.727	
1132	37'-0	PO(18'-8½)	74.224	
1134	37'-0	PO(18'-8½)	75.278	
1136	37'-0	PO(18'-8½)	76.195	
1138	37'-0	PO(18'-8½)	76.977	
1140	37'-1	PO(18'-8½)	77.585	
1142	37'-3½	PO(18'-8½)	78.006	
1144	37'-6	PO(18'-8½)	78.290	
1146	37'-8½	PO(18'-8½)	78.443	
1148	37'-11	PO(18'-8½)	78.477	
1150	38'-1½	PO(18'-8½)	78.422	



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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	118.82	6.63	120		0.034877	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	240.33	13.42	120		0.128379	149'-1	Pf 23.945
11113	37'-10	121.51	16.8	52.314		Sprinkler,	37'-5	Pe 0.361
1100	37'-0			76.620		2PO(18'-8½)	186'-6	Pv
CM	4.3100	240.33	5.28	120		0.013281	10'-0	Pf 0.133
1100	37'-0			76.620				Pe
1102	37'-0			76.753			10'-0	Pv
CM	4.3100	480.85	10.57	120		0.047915	10'-0	Pf 0.479
1102	37'-0	240.52		76.753		Flow (q) from Route 3		Pe
1104	37'-0			77.232			10'-0	Pv
CM	4.3100	722.08	15.88	120		0.101656	10'-0	Pf 1.017
1104	37'-0	241.22		77.232		Flow (q) from Route 5		Pe
1106	37'-0			78.249			10'-0	Pv
CM	4.3100	775.75	17.06	120		0.116075	10'-0	Pf 1.161
1106	37'-0	53.67		78.249		Flow (q) from Route 2		Pe
1108	37'-0			79.410			10'-0	Pv
CM	4.3100	831.77	18.29	120		0.132054	10'-0	Pf 1.321
1108	37'-0	56.01		79.410		Flow (q) from Route 9		Pe
1110	37'-0			80.730			10'-0	Pv
CM	4.3100	892.67	19.63	120		0.150497	10'-0	Pf 1.508
1110	37'-0	60.90		80.730		Flow (q) from Route 10		Pe -0.041
1112	37'-1			82.197			10'-0	Pv
CM	4.3100	960.75	21.13	120		0.172416	10'-0	Pf 1.725
1112	37'-1	68.08		82.197		Flow (q) from Route 13		Pe -0.090
1114	37'-3½			83.831			10'-0	Pv
CM	4.3100	1037.51	22.82	120		0.198763	10'-0	Pf 1.988
1114	37'-3½	76.76		83.831		Flow (q) from Route 12		Pe -0.090
1116	37'-6			85.729			10'-0	Pv
CM	4.3100	1125.66	24.75	120		0.231129	10'-0	Pf 2.312
1116	37'-6	88.15		85.729		Flow (q) from Route 16		Pe -0.090
1118	37'-8½			87.951			10'-0	Pv
CM	4.3100	1226.32	26.97	120		0.270811	10'-0	Pf 2.709
1118	37'-8½	100.66		87.951		Flow (q) from Route 15		Pe -0.090
1120	37'-11			90.569			10'-0	Pv
CM	4.3100	1340.95	29.49	120		0.319492	0'-6½	Pf 0.168
1120	37'-11	114.63		90.569		Flow (q) from Route 14		Pe -0.004
1122	37'-11			90.732			0'-6½	Pv
CM	6.3570	1340.95	13.55	120		0.048142	9'-5½	Pf 0.456
1122	37'-11			90.732				Pe -0.086
1124	38'-1½			91.103			9'-5½	Pv
CM	6.3570	1458.55	14.74	120		0.056243	62'-8½	Pf 10.740
1124	38'-1½	117.61		91.103		Flow (q) from Route 11	128'-3	Pe 15.797
1126	1'-8½			117.639		3fE(12'-7), 2f(-0.000), CV(40'-3), BV(12'-7), PO(37'-8½)	190'-11½	Pv
CM	8.2490	1458.55	8.76	120		0.015814	1'-6	Pf 0.674
1126	1'-8½			117.639			41'-1½	Pe 0.303
1026	1'-0			118.616		PO(41'-1½)	42'-7½	Pv
UG	7.6800	1458.55	10.10	150		0.014822	66'-8½	Pf 1.973
1026	1'-0			118.616			66'-4½	Pe 3.902
18	-8'-0			124.490		E(22'-6½), T(43'-10)	133'-1	Pv
UG	7.6800	1174.43	8.13	150		0.009928	214'-9	Pf 2.132
18	-8'-0			124.490				Pe
19	-8'-0			126.622			214'-9	Pv
UG	7.6800	1174.43	8.13	150		0.009928	337'-8	Pf 4.011
19	-8'-0			126.622			66'-4½	Pe
9	-8'-0			130.633		E(22'-6½), T(43'-10)	404'-0½	Pv
UG	7.6800	1708.55	11.83	150		0.019862	67'-8	Pf 1.792
9	-8'-0	534.12		130.633		Flow (q) from Route 7	22'-6½	Pe -3.902
8	1'-0			128.523		E(22'-6½)	90'-2½	Pv
FR	8.2490	1708.55	10.26	120		0.021191	5'-8½	Pf 0.121
8	1'-0			128.523				Pe -2.476
7	6'-8½			126.168			5'-8½	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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
7	6'-8½"			126.168			255'-9"	Pe 2.151
6	1'-9"			130.194		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
6	1'-9"			130.194				Pe 0.000
5	1'-9"			130.194			0'-0"	Pv
Pump		Velocity						
5		1708.55		130.194		Rating: 60.000 @ 2000.00		
4		Q=1708.55	7.87	65.297		Fire Pump Churn Pressure: 84.000		
UG	9.4200	1708.55	7.87	150		0.007347	305'-9½"	Pf 6.919
4	1'-9"			65.297			137'-6"	Pe 4.227
2	-8'-0"			76.443		GV(5'-7"), T(45'-10"), 3E(24'-7"), EE(12'-3½"), BFP(-3.663)	443'-3½"	Pv
UG	11.2000	1708.55	5.56	150		0.003163	750'-9"	Pf 2.514
2	-8'-0"			76.443			44'-3"	Pe 1.517
1	-11'-6"			80.475		EE(14'-4½"), E(29'-10½"), S	795'-0"	Pv
		0.00				Hose Allowance At Source		
1		1708.55						
Route 2								
BL	2.7050	2.33	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	123.47	6.89	120		0.037447	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	245.01	13.68	120		0.133045	119'-7"	Pf 20.891
11117	37'-10"	121.54	16.8	52.337		Sprinkler,	37'-5"	Pe 0.361
1128	37'-0"			73.589		2PO(18'-8½")	157'-0"	Pv
CM	4.3100	245.01	5.39	120		0.013764	10'-0"	Pf 0.138
1128	37'-0"			73.589				Pe
1130	37'-0"			73.727			10'-0"	Pv
CM	4.3100	490.28	10.78	120		0.049668	10'-0"	Pf 0.497
1130	37'-0"	245.27		73.727		Flow (q) from Route 4		Pe
1132	37'-0"			74.224			10'-0"	Pv
CM	4.3100	736.47	16.20	120		0.105436	10'-0"	Pf 1.054
1132	37'-0"	246.19		74.224		Flow (q) from Route 6		Pe
1134	37'-0"			75.278			10'-0"	Pv
RN	2.7050	53.67	3.00	120		0.008018	295'-8"	Pf 2.971
1134	37'-0"			75.278		PO(18'-8½")	74'-10½"	Pe
1106	37'-0"			78.249		3PO(18'-8½")	370'-6½"	Pv
Route 3								
BL	2.7050	118.90	6.64	120		0.034921	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	240.52	13.43	120		0.128571	149'-1"	Pf 23.981
11121	37'-10"	121.62	16.8	52.411		Sprinkler,	37'-5"	Pe 0.361
1102	37'-0"			76.753		2PO(18'-8½")	186'-6"	Pv
Route 4								
BL	2.7050	2.36	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	123.62	6.90	120		0.037527	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	245.27	13.69	120		0.133303	119'-7"	Pf 20.931
11125	37'-10"	121.65	16.8	52.435		Sprinkler,	37'-5"	Pe 0.361
1130	37'-0"			73.727		2PO(18'-8½")	157'-0"	Pv
Route 5								
BL	2.7050	119.20	6.65	120		0.035082	9'-0"	Pf 0.316
11127	37'-10"	121.66	16.8	52.445		Sprinkler		Pe
11129	37'-10"			52.761			9'-0"	Pv
BL	2.7050	241.22	13.47	120		0.129265	149'-1"	Pf 24.110
11129	37'-10"	122.03	16.8	52.761		Sprinkler,	37'-5"	Pe 0.361
1104	37'-0"			77.232		2PO(18'-8½")	186'-6"	Pv
Route 6								



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 11

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	2.47	0.14	120	0.000027	9'-0	Pf 0.000
11127	37'-10	121.66	16.8	52.445	Sprinkler	9'-0	Pe
11131	37'-10			52.445		9'-0	Pv
BL	2.7050	124.13	6.93	120	0.037817	9'-0	Pf 0.340
11131	37'-10	121.66	16.8	52.445	Sprinkler	9'-0	Pe
11133	37'-10			52.786		9'-0	Pv
BL	2.7050	246.19	13.74	120	0.134230	119'-7	Pf 21.077
11133	37'-10	122.06	16.8	52.786	Sprinkler,	37'-5	Pe 0.361
1132	37'-0			74.224	2PO(18'-8½)	157'-0	Pv
Route 7							
UG	6.2800	250.00	2.59	140	0.001718	40'-9	Pf 0.197
51	1'-0	250.00		120.457	Hydrant,	74'-1	Pe 3.902
17	-8'-0			124.556	E(22'-1), GV(4'-8½), T(47'-3½)	114'-10	Pv
UG	7.6800	534.12	3.70	150	0.002311	519'-3½	Pf 1.252
17	-8'-0	284.12		124.556	Flow (q) from Route 8	22'-6½	Pe
16	-8'-0			125.809	E(22'-6½)	541'-10	Pv
UG	7.6800	534.12	3.70	150	0.002311	119'-3	Pf 0.276
16	-8'-0			125.809		119'-3	Pe
15	-8'-0			126.084		119'-3	Pv
UG	7.6800	534.12	3.70	150	0.002311	635'-9	Pf 1.521
15	-8'-0			126.084		22'-6½	Pe
14	-8'-0			127.605	E(22'-6½)	658'-3½	Pv
UG	7.6800	534.12	3.70	150	0.002311	61'-1½	Pf 0.141
14	-8'-0			127.605		61'-1½	Pe
13	-8'-0			127.747		61'-1½	Pv
UG	7.6800	534.12	3.70	150	0.002311	153'-8	Pf 0.355
13	-8'-0			127.747		153'-8	Pe
12	-8'-0			128.102		153'-8	Pv
UG	7.6800	534.12	3.70	150	0.002311	635'-11½	Pf 1.522
12	-8'-0			128.102		22'-6½	Pe
11	-8'-0			129.624	E(22'-6½)	658'-6	Pv
UG	7.6800	534.12	3.70	150	0.002311	118'-2	Pf 0.273
11	-8'-0			129.624		118'-2	Pe
10	-8'-0			129.897		118'-2	Pv
UG	7.6800	534.12	3.70	150	0.002311	275'-0	Pf 0.737
10	-8'-0			129.897		43'-10	Pe
9	-8'-0			130.633	T(43'-10)	318'-9½	Pv
Route 8							
UG	7.6800	284.12	1.97	150	0.000719	91'-11½	Pf 0.066
18	-8'-0	1174.43		124.490	Flow (q) from Route 1	91'-11½	Pe
17	-8'-0			124.556		91'-11½	Pv
Route 9							
CM	4.3100	682.80	15.02	120	0.091662	10'-0	Pf 0.917
1134	37'-0	53.67		75.278	Flow (q) from Route 2	10'-0	Pe
1136	37'-0			76.195		10'-0	Pv
RN	2.7050	56.01	3.13	120	0.008677	295'-8	Pf 3.215
1136	37'-0			76.195	PO(18'-8½)	74'-10½	Pe
1108	37'-0			79.410	3PO(18'-8½)	370'-6½	Pv
Route 10							
CM	4.3100	626.78	13.78	120	0.078238	10'-0	Pf 0.782
1136	37'-0	56.01		76.195	Flow (q) from Route 9	10'-0	Pe
1138	37'-0			76.977		10'-0	Pv
RN	2.7050	60.90	3.40	120	0.010129	295'-8	Pf 3.753
1138	37'-0			76.977	PO(18'-8½)	74'-10½	Pe
1110	37'-0			80.730	3PO(18'-8½)	370'-6½	Pv
Route 11							
CM	4.3100	565.88	12.44	120	0.064758	10'-0	Pf 0.649
1138	37'-0	60.90		76.977	Flow (q) from Route 10	10'-0	Pe -0.041
1140	37'-1			77.585		10'-0	Pv
CM	4.3100	497.80	10.95	120	0.051086	10'-0	Pf 0.511
1140	37'-1			77.585		10'-0	Pe -0.090
1142	37'-3½			78.006		10'-0	Pv
CM	4.3100	421.04	9.26	120	0.037476	10'-0	Pf 0.375
1142	37'-3½			78.006		10'-0	Pe -0.090
1144	37'-6			78.290		10'-0	Pv
CM	4.3100	332.89	7.32	120	0.024266	10'-0	Pf 0.243
1144	37'-6			78.290		10'-0	Pe -0.090
1146	37'-8½			78.443		10'-0	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Overhead System 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	232.23	5.11	120	0.012465	10'-0	Pf 0.125
1146	37'-8½			78.443			Pe -0.090
1148	37'-11			78.477		10'-0	Pv
CM	4.3100	117.61	2.59	120	0.003540	10'-0	Pf 0.035
1148	37'-11			78.477			Pe -0.090
1150	38'-1½			78.422		10'-0	Pv
RN	2.7050	117.61	6.57	120	0.034222	295'-8	Pf 12.680
1150	38'-1½			78.422	PO(18'-8½)	74'-10½	Pe -0.000
1124	38'-1½			91.103	3PO(18'-8½)	370'-6½	Pv
Route 12							
RN	2.7050	76.76	4.29	120	0.015542	295'-8	Pf 5.826
1142	37'-3½			78.006	PO(18'-8½)	79'-2	Pe -0.000
1114	37'-3½			83.831	3PO(18'-8½), Tr(4'-3½)	374'-10	Pv
Route 13							
RN	2.7050	68.08	3.80	120	0.012447	295'-8	Pf 4.612
1140	37'-1			77.585	PO(18'-8½)	74'-10½	Pe -0.000
1112	37'-1			82.197	3PO(18'-8½)	370'-6½	Pv
Route 14							
RN	2.7050	114.63	6.40	120	0.032634	295'-8	Pf 12.092
1148	37'-11			78.477	PO(18'-8½)	74'-10½	Pe -0.000
1120	37'-11			90.569	3PO(18'-8½)	370'-6½	Pv
Route 15							
RN	2.7050	100.66	5.62	120	0.025660	295'-8	Pf 9.508
1146	37'-8½			78.443	PO(18'-8½)	74'-10½	Pe -0.000
1118	37'-8½			87.951	3PO(18'-8½)	370'-6½	Pv
Route 16							
RN	2.7050	88.15	4.92	120	0.020076	295'-8	Pf 7.439
1144	37'-6			78.290	PO(18'-8½)	74'-10½	Pe -0.000
1116	37'-6			85.729	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



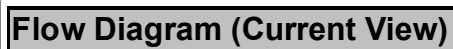
Hydraulic Analysis

Job Number: 212189000

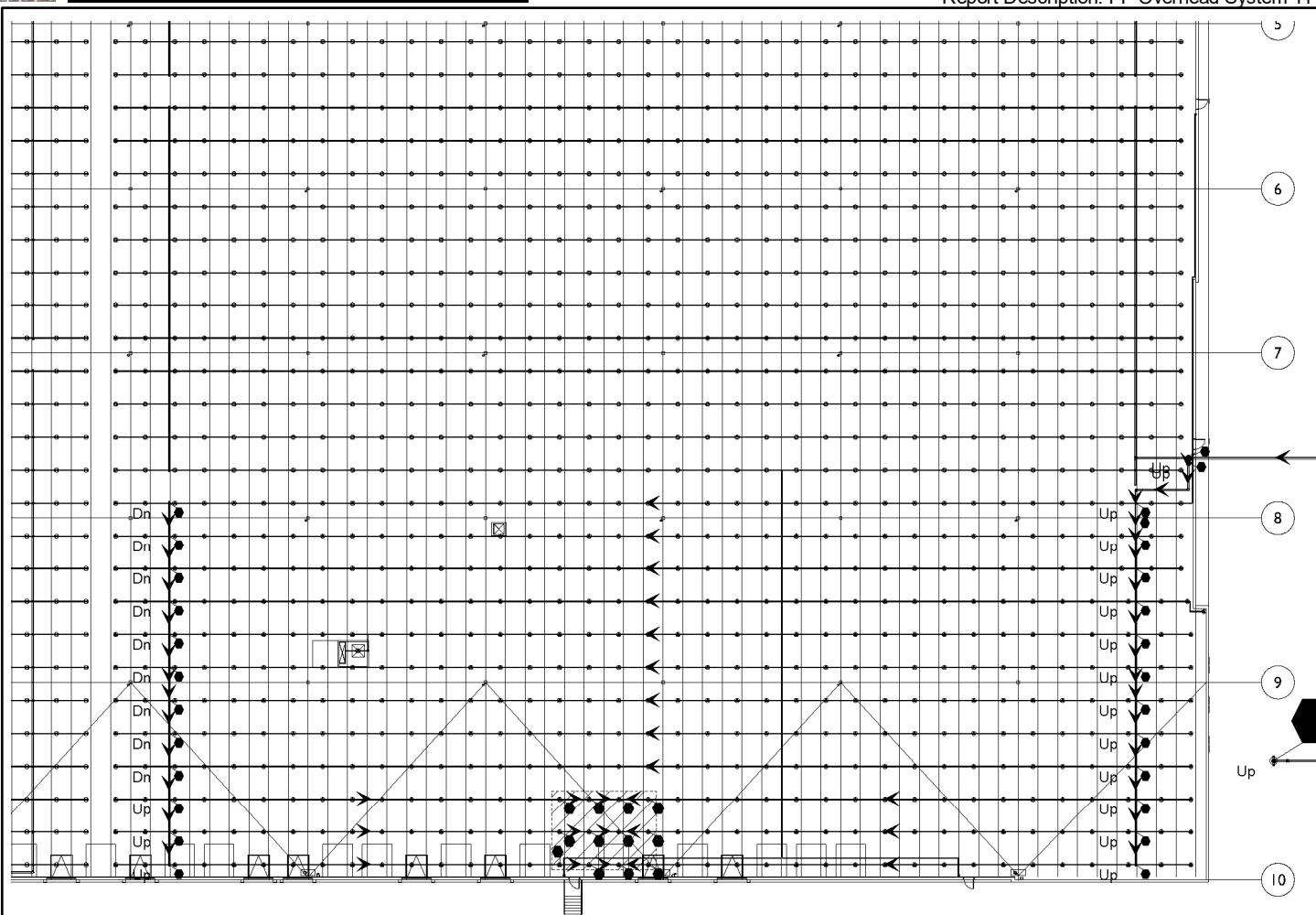
Report Description: FP Overhead System 11

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	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	
SN Swing Nipple	Pf	Pressure loss due to friction between points	DPV Dry Pipe Valve	
SP Sprig	Pe	Pressure due to elevation difference between indicated points	E 90° Elbow	
ST Stand Pipe	Pv	Velocity pressure at a point in a pipe	EE 45° Elbow	
UG Underground			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	



Job Number: 212189000
Report Description: FP Overhead System 11





Hydraulic Overview

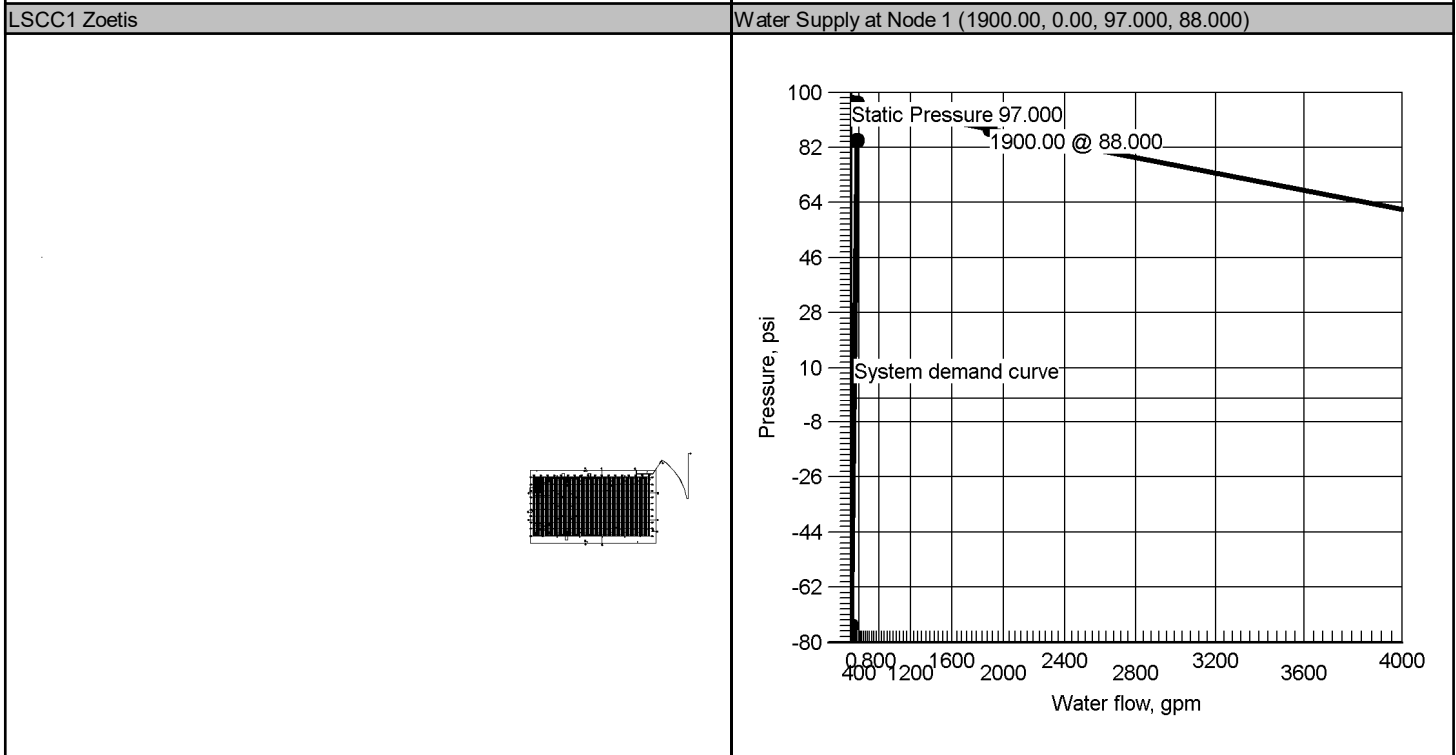
Job Number: 212189000
Report Description: FP Office System

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 0.10 gpm/ft ²	Area of Application 1500 ft ² (Actual 1097 ft ²)
Most Demanding Sprinkler Data 5.6 K-Factor 39.99 at 51.000	Hose Streams 100.00
Coverage Per Sprinkler 400 ft ²	Number Of Sprinklers Calculated 6 0
System Pressure Demand 84.542	System Flow Demand 347.11
Total Demand 347.11 @ 84.542	Pressure Result +12.070 (12.5%)

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 (461)	0.000	0	0.00
5	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									

Pumps: Static = Churn (Pressure @ Zero Flow)





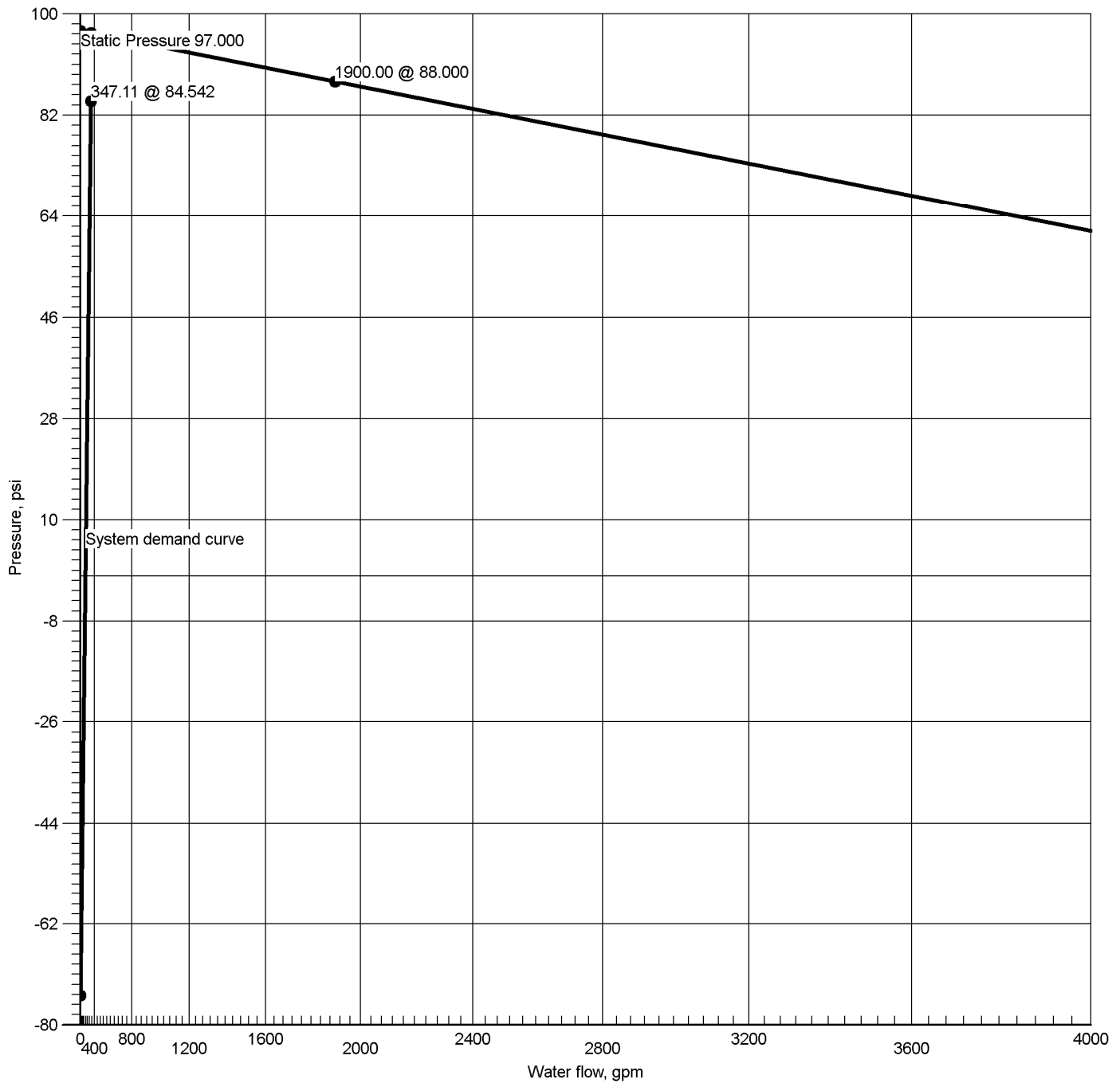
Hydraulic Summary

Job Number: 212189000
Report Description: FP Office System

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 0.10 gpm/ft²			Area of Application 1500 ft² (Actual 1097 ft²)				
Additional Hose Supplies Node Hydrant At Node 54				Flow(gpm) 100.00			Number Of Sprinklers Calculated 6				
				Number Of Nozzles Calculated 0			Coverage Per Sprinkler 400 ft²				
				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Right: 75.639							
Total Hose Streams 100.00											
System Flow Demand 347.11			Total Water Required (Including Hose Allowance) 347.11								
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 21.10 between nodes 160 and 158											
Maximum Velocity Under Ground 2.40 between nodes 8 and 9											
Volume capacity of Wet Pipes 32132.49 gal			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	96.612		347.11	84.542	12.070
5	Pump		84.000	60.000		2000.00	168.814		347.11	156.744	12.070
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

96.612 @ 347.11

Required Pressure at System Demand

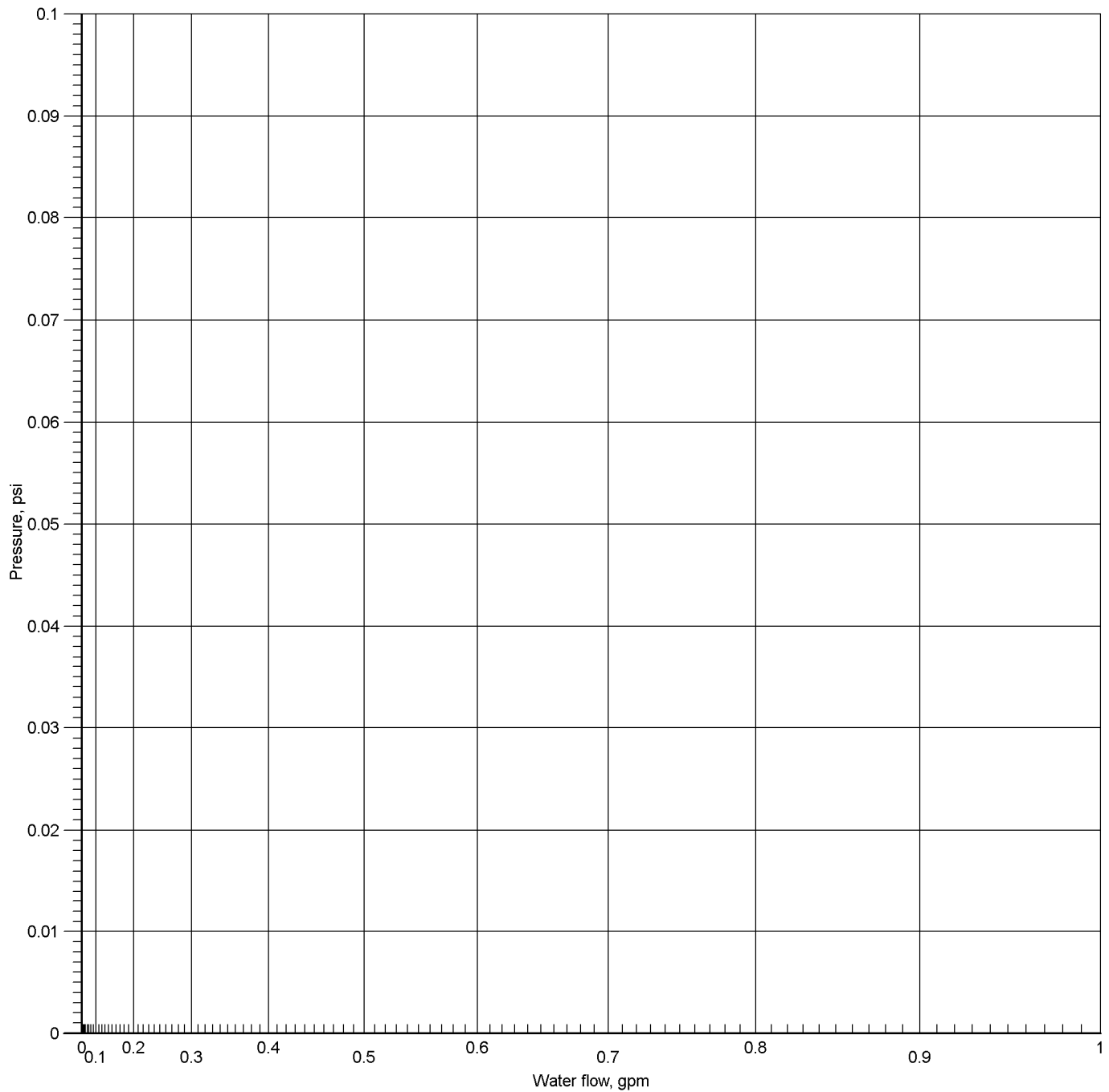
84.542 @ 347.11

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

84.542 @ 347.11



Pump Inlet at Node 461



Hydraulic Graph

Pump Inlet at Node 461

Static: Pressure

0.000

Residual: Pressure

N/A

Available Pressure at System Demand

N/A

Required Pressure at System Demand

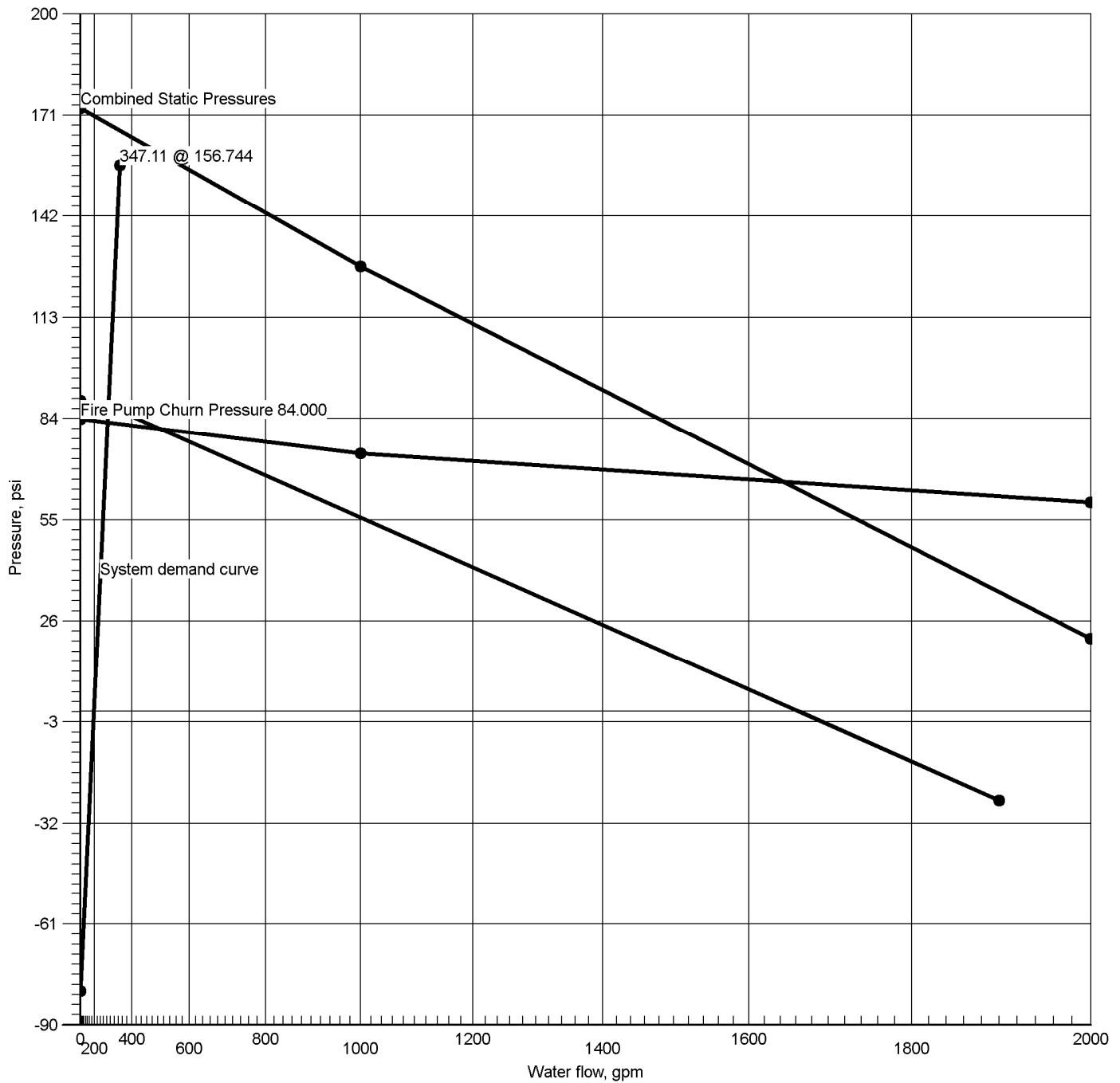
0.000 @ 0.00

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

N/A



Pump at Node 5



Hydraulic Graph

Static + Churn Pressure

Fire Pump Rating

Pump at Node 5

173.256

60.000 @ 2000.00

Static Pressure

Fire Pump Churn Pressure

173.256

84.000

Residual Pressure

82.588 @ 347.11

Available Pressure at System Demand

168.814 @ 347.11

Required Pressure at System Demand

156.744 @ 347.11



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: FP Office System

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Hydrant	54	100.00	100.00	250	156.418			
Sprinkler	1159	40.25	39.99	5.6	51.655			
⇒ Sprinkler	1161	39.99	39.99	5.6	51.000			
Sprinkler	1163	40.65	39.99	5.6	52.693			
Sprinkler	1165	41.56	39.99	5.6	55.075			
Sprinkler	1167	41.56	39.99	5.6	55.078			
Sprinkler	1169	43.10	39.99	5.6	59.239			

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: FP Office System

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	84.542	347.11
54	1'-0	Hyd(-0.160)	156.418	100.00
1159	9'-8	Spr(-51.655), fd(56'-0)	51.655	40.25
1161	9'-8	Spr(-51.000), fd(56'-0)	51.000	39.99
1163	9'-8	Spr(-52.693), fd(56'-0)	52.693	40.65
1165	9'-8	Spr(-55.075), fd(56'-0)	55.075	41.56
1167	9'-8	Spr(-55.078), fd(56'-0)	55.078	41.56
1169	9'-8	Spr(-59.239), fd(56'-0)	59.239	43.10
2	-8'-0	E(24'-7)	82.893	
4	1'-9	P1	74.156	
5	1'-9	P2(-82.588)	156.744	
6	1'-9		156.744	
7	6'-8½		154.495	
8	1'-0		156.964	
9	-8'-0	T(43'-10)	160.772	
10	-8'-0	T(43'-10)	160.648	
11	-8'-0	T(47'-3½)	160.602	
12	-8'-0	T(43'-10)	160.346	
13	-8'-0	T(47'-3½)	160.349	
14	-8'-0	T(43'-10)	160.362	
15	-8'-0	T(47'-3½)	160.495	
16	-8'-0	T(43'-10)	160.519	
17	-8'-0	T(47'-3½)	160.628	
18	-8'-0	T(43'-10)	160.647	
19	-8'-0	T(43'-10)	160.690	
51	1'-0	Hyd	1.000	
53	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
122	1'-8½	PO(37'-8½)	156.058	
124	1'-0		156.386	
154	10'-8	PO(6'-2½)	78.279	
156	10'-8	PO(5'-0)	79.172	
158	10'-8	PO(5'-0)	81.743	
160	10'-8	PO(9'-11)	91.911	
162	10'-8	PO(9'-11)	92.852	
166	10'-8	PO(13'-7½)	151.965	
168	10'-8	PO(6'-2½)	84.319	
170	10'-8	PO(5'-0)	85.360	
172	10'-8	PO(5'-0)	91.661	



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Office System

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								
DY	1.0490	39.99	14.85	120		0.468950	0'-0	Pf 28.606
1161	9'-8	39.99	5.6	51.000		Sprinkler,	61'-0	Pe -0.434
156	10'-8			79.172		PO(5'-0), fd(56'-0)	61'-0	Pv
BL	1.5300	80.24	14.00	120		0.270600	9'-6	Pf 2.570
156	10'-8	40.25		79.172		Flow (q) from Route 2		Pe
158	10'-8			81.743			9'-6	Pv
BL	1.5300	120.89	21.10	120		0.577603	7'-8½	Pf 10.169
158	10'-8	40.65		81.743		Flow (q) from Route 3	9'-11	Pe
160	10'-8			91.911		PO(9'-11)	17'-7½	Pv
BL	2.2030	120.89	10.18	120		0.097858	9'-7½	Pf 0.941
160	10'-8			91.911				Pe
162	10'-8			92.852			9'-7½	Pv
BL	2.2030	247.11	20.80	120		0.367301	124'-1½	Pf 59.113
162	10'-8	83.12 + 43.10		92.852		Flow (q) from Route 4 and 6	36'-10	Pe 0.000
166	10'-8			151.965		2PO(13'-7½), 2fE(4'-9½)	160'-11½	Pv
FR	6.3570	247.11	2.50	120		0.002107	6'-10	Pf 0.205
166	10'-8			151.965			90'-6½	Pe 3.888
122	1'-8½			156.058		2f(-0.000), CV(40'-3), BV(12'-7), PO(37'-8½)	97'-4	Pv
CM	8.2490	247.11	1.48	120		0.000592	1'-6	Pf 0.025
122	1'-8½			156.058			41'-1½	Pe 0.303
124	1'-0			156.386		PO(41'-1½)	42'-7½	Pv
UG	7.6800	247.11	1.71	150		0.000555	38'-9½	Pf 0.058
124	1'-0			156.386			66'-4½	Pe 3.902
12	-8'-0			160.346		E(22'-6½), T(43'-10)	105'-2	Pv
UG	7.6800	203.94	1.41	150		0.000389	635'-11½	Pf 0.256
12	-8'-0			160.346			22'-6½	Pe
11	-8'-0			160.602		E(22'-6½)	658'-6	Pv
UG	7.6800	203.94	1.41	150		0.000389	118'-2	Pf 0.046
11	-8'-0			160.602				Pe
10	-8'-0			160.648			118'-2	Pv
UG	7.6800	203.94	1.41	150		0.000389	275'-0	Pf 0.124
10	-8'-0			160.648			43'-10	Pe
9	-8'-0			160.772		T(43'-10)	318'-9½	Pv
UG	7.6800	347.11	2.40	150		0.001041	67'-8	Pf 0.094
9	-8'-0	143.17		160.772		Flow (q) from Route 7	22'-6½	Pe -3.902
8	1'-0			156.964		E(22'-6½)	90'-2½	Pv
FR	8.2490	347.11	2.08	120		0.001111	5'-8½	Pf 0.006
8	1'-0			156.964				Pe -2.476
7	6'-8½			154.495			5'-8½	Pv
DY	10.3700	347.11	1.32	120		0.000364	13'-10½	Pf 0.098
7	6'-8½			154.495			255'-9	Pe 2.151
6	1'-9			156.744		4E(26'-0), T(48'-5½), BV(21'-3½), Tr(17'-0), CV(65'-0)	269'-8	Pv
DY	7.9810	347.11	2.23	120		0.001305	0'-0	Pf 0.000
6	1'-9			156.744				Pe 0.000
5	1'-9			156.744			0'-0	Pv
Pump								
5		347.11	Velocity	156.744		Rating: 60.000 @ 2000.00		
4		Q=347.11	1.60	74.156		Fire Pump Churn Pressure: 84.000		
UG	9.4200	347.11	1.60	150		0.000385	305'-9½	Pf 4.510
4	1'-9			74.156			137'-6	Pe 4.227
2	-8'-0			82.893		GV(5'-7), T(45'-10), 3E(24'-7), EE(12'-3½), BFP(-4.340)	443'-3½	Pv
UG	11.2000	347.11	1.13	150		0.000166	750'-9	Pf 0.132
2	-8'-0			82.893			44'-3	Pe 1.517
1	-11'-6			84.542		EE(14'-4½), E(29'-10½), S	795'-0	Pv
		0.00				Hose Allowance At Source		
1		347.11						
Route 2								
BL	1.0970	40.25	13.66	120		0.381612	2'-5½	Pf 27.058
1159	9'-8	40.25	5.6	51.655		Sprinkler,	68'-5	Pe -0.434
154	10'-8			78.279		2PO(6'-2½), fd(56'-0)	70'-11	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Office System

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	1.5300	40.25	7.02	120		0.075506	11'-10"	Pf 0.894
154	10'-8"			78.279				Pe
156	10'-8"			79.172			11'-10"	Pv
Route 3								
DY	1.0490	40.65	15.09	120		0.483331	0'-0"	Pf 29.483
1163	9'-8"	40.65	5.6	52.693		Sprinkler,	61'-0"	Pe -0.434
158	10'-8"			81.743		PO(5'-0), fd(56'-0)	61'-0"	Pv
Route 4								
BL	1.0970	41.56	14.11	120		0.404929	4'-10½"	Pf 29.677
1165	9'-8"	41.56	5.6	55.075		Sprinkler,	68'-5"	Pe -0.434
168	10'-8"			84.319		2PO(6'-2½), fd(56'-0)	73'-3½"	Pv
BL	1.5300	41.56	7.25	120		0.080120	13'-0"	Pf 1.042
168	10'-8"			84.319				Pe
170	10'-8"			85.360			13'-0"	Pv
BL	1.5300	83.12	14.50	120		0.288838	16'-0"	Pf 7.492
170	10'-8"	41.56		85.360		Flow (q) from Route 5	9'-11"	Pe
162	10'-8"			92.852		PO(9'-11)	25'-11½"	Pv
Route 5								
DY	1.0490	41.56	15.43	120		0.503535	0'-0"	Pf 30.716
1167	9'-8"	41.56	5.6	55.078		Sprinkler,	61'-0"	Pe -0.434
170	10'-8"			85.360		PO(5'-0), fd(56'-0)	61'-0"	Pv
Route 6								
DY	1.0490	43.10	16.00	120		0.538621	0'-0"	Pf 32.856
1169	9'-8"	43.10	5.6	59.239		Sprinkler,	61'-0"	Pe -0.434
172	10'-8"			91.661		PO(5'-0), fd(56'-0)	61'-0"	Pv
BL	1.5300	43.10	7.52	120		0.085706	4'-0"	Pf 1.191
172	10'-8"			91.661			9'-11"	Pe
162	10'-8"			92.852		PO(9'-11)	13'-11"	Pv
Route 7								
UG	6.2800	100.00	1.04	140		0.000315	19'-10"	Pf 0.030
54	1'-0"	100.00		156.418		Hydrant,	74'-1"	Pe 3.902
13	-8'-0"			160.349		E(22'-1), GV(4'-8½), T(47'-3½)	93'-10½"	Pv
UG	7.6800	143.17	0.99	150		0.000202	61'-1½"	Pf 0.012
13	-8'-0"	43.17		160.349		Flow (q) from Route 8		Pe
14	-8'-0"			160.362			61'-1½"	Pv
UG	7.6800	143.17	0.99	150		0.000202	635'-9"	Pf 0.133
14	-8'-0"			160.362			22'-6½"	Pe
15	-8'-0"			160.495		E(22'-6½)	658'-3½"	Pv
UG	7.6800	143.17	0.99	150		0.000202	119'-3"	Pf 0.024
15	-8'-0"			160.495				Pe
16	-8'-0"			160.519			119'-3"	Pv
UG	7.6800	143.17	0.99	150		0.000202	519'-3½"	Pf 0.110
16	-8'-0"			160.519			22'-6½"	Pe
17	-8'-0"			160.628		E(22'-6½)	541'-10"	Pv
UG	7.6800	143.17	0.99	150		0.000202	91'-11½"	Pf 0.019
17	-8'-0"			160.628				Pe
18	-8'-0"			160.647			91'-11½"	Pv
UG	7.6800	143.17	0.99	150		0.000202	214'-9"	Pf 0.043
18	-8'-0"			160.647				Pe
19	-8'-0"			160.690			214'-9"	Pv
UG	7.6800	143.17	0.99	150		0.000202	337'-8"	Pf 0.082
19	-8'-0"			160.690			66'-4½"	Pe
9	-8'-0"			160.772		E(22'-6½), T(43'-10)	404'-0½"	Pv
Route 8								
UG	7.6800	43.17	0.30	150		0.000022	153'-8"	Pf 0.003
12	-8'-0"	203.94		160.346		Flow (q) from Route 1		Pe
13	-8'-0"			160.349			153'-8"	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

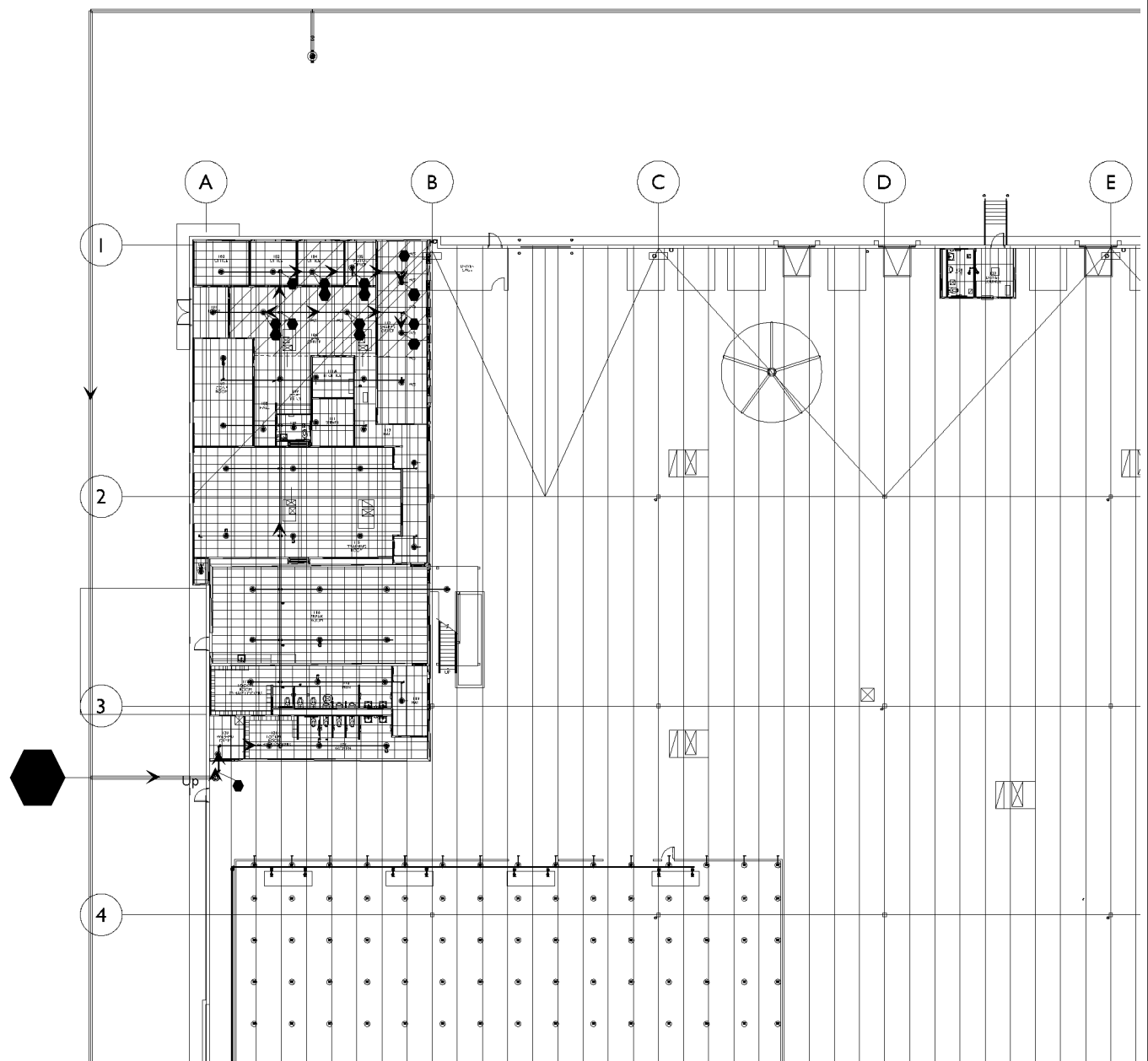


Hydraulic Analysis

Job Number: 212189000
Report Description: FP Office System

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 SN Swing 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





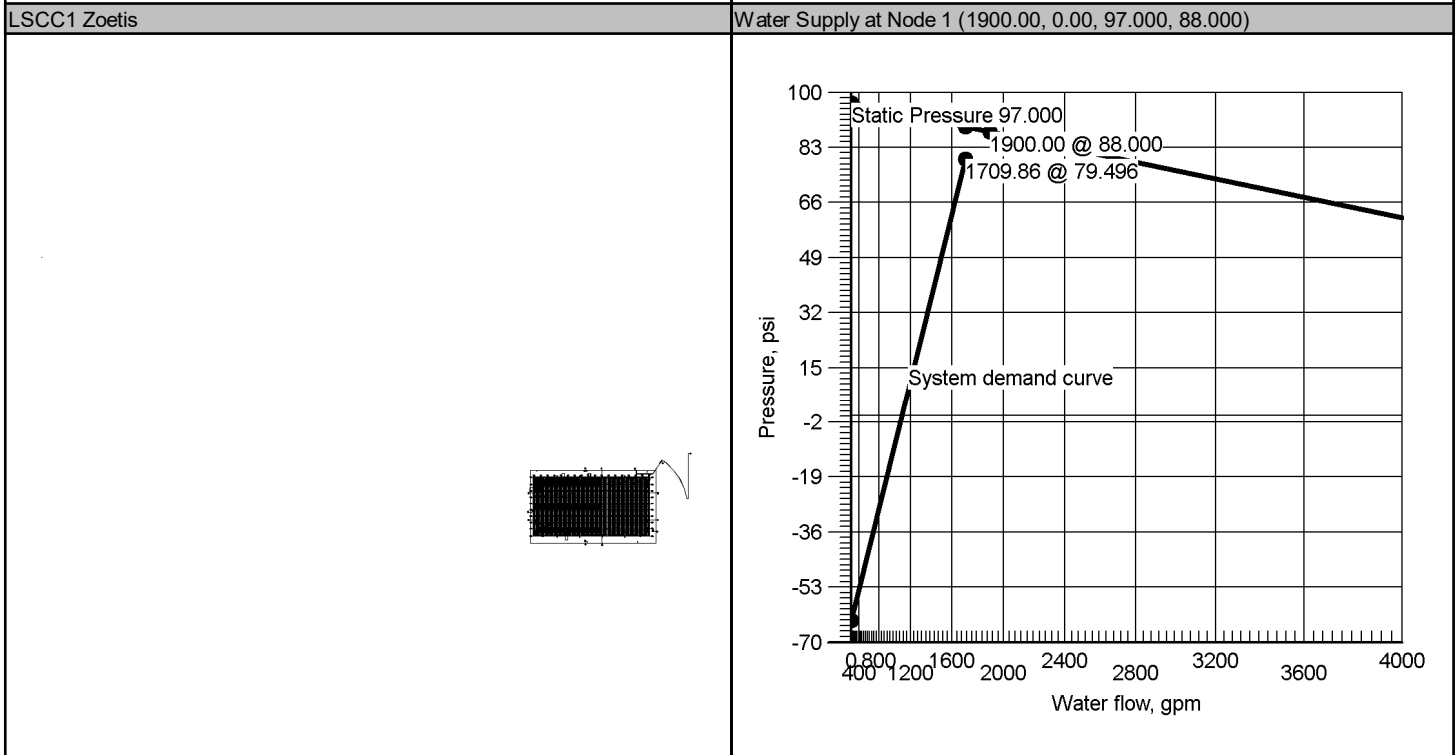
Hydraulic Overview

Job Number: 212189000
Report Description: FP Cooler System

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 90 ft ²	Number Of Sprinklers Calculated 12 0
System Pressure Demand 79.496	System Flow Demand 1709.86
Total Demand 1709.86 @ 79.496	Pressure Result +10.099 (11.3%)

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 (461)	0.000	0	0.00
5	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									





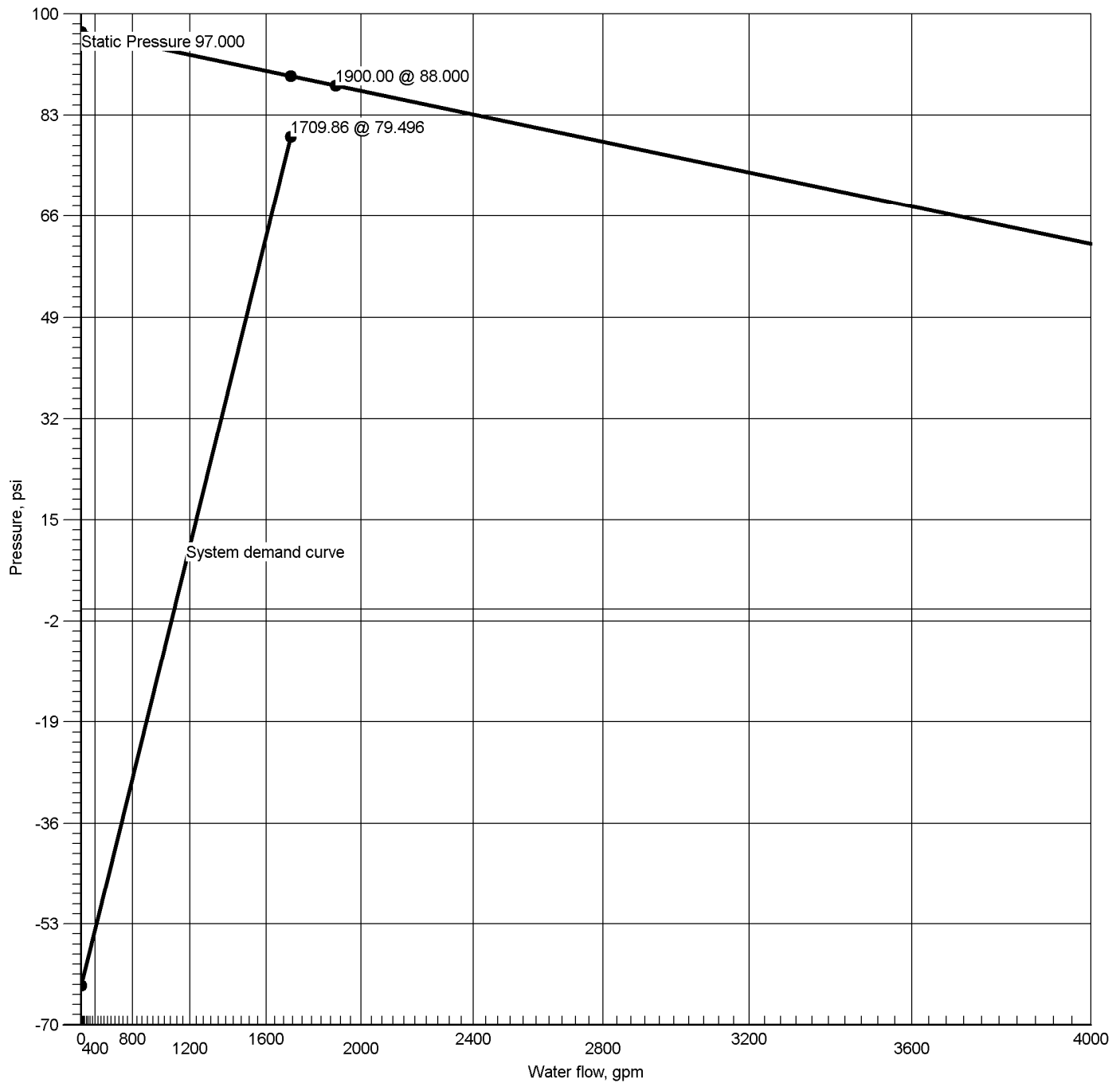
Hydraulic Summary

Job Number: 212189000
Report Description: FP Cooler System

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 90 ft²				
				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area							
Total Hose Streams 250.00											
System Flow Demand 1709.86			Total Water Required (Including Hose Allowance) 1709.86								
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 19.28 between nodes 398 and 3151											
Maximum Velocity Under Ground 11.84 between nodes 8 and 9											
Volume capacity of Wet Pipes 32132.49 gal			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	89.595		1709.86	79.496	10.099
5	Pump		84.000	60.000		2000.00	139.283		1709.86	129.184	10.099
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

89.595 @ 1709.86

Required Pressure at System Demand

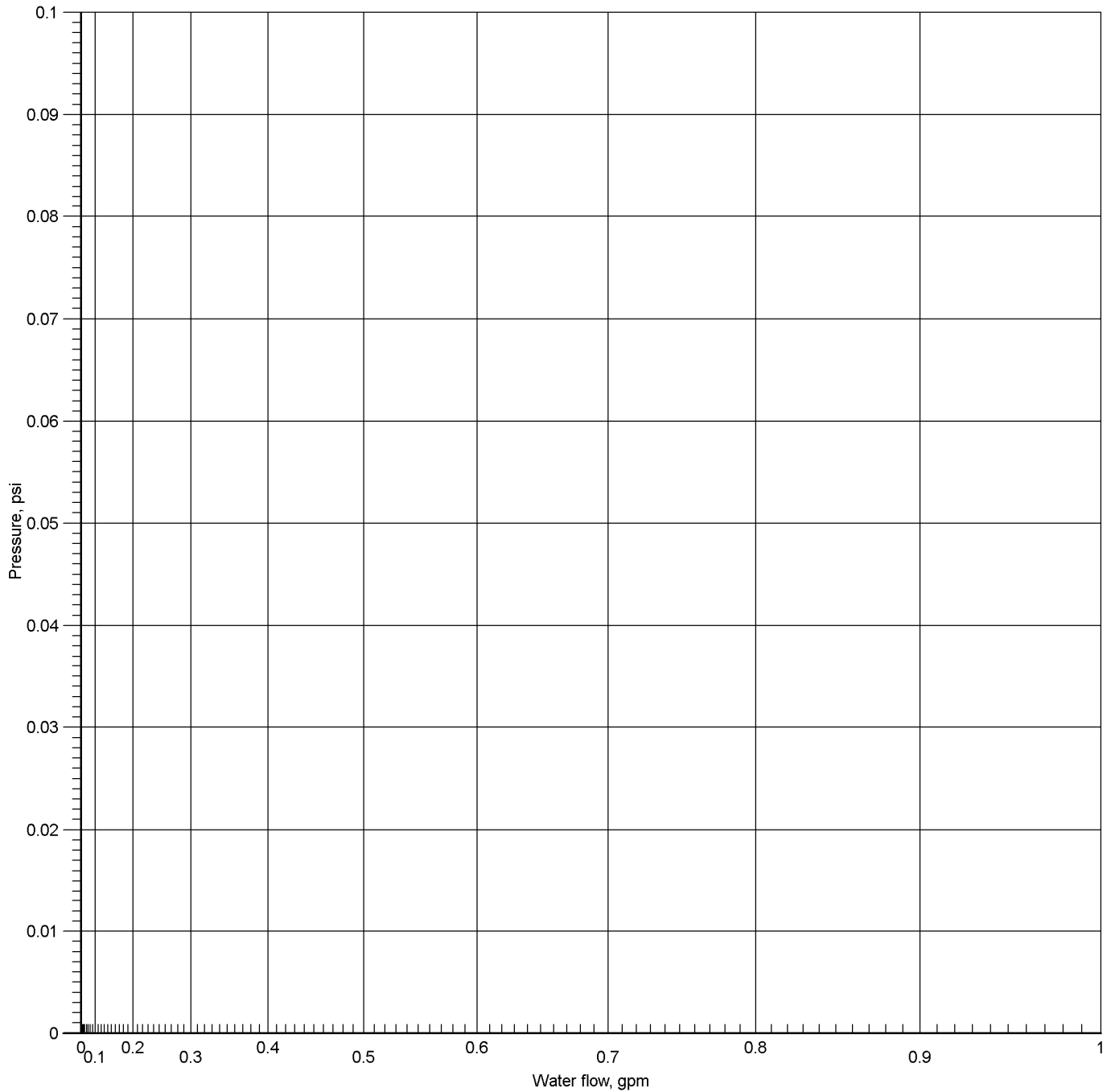
79.496 @ 1709.86

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

79.496 @ 1709.86



Pump Inlet at Node 461



Hydraulic Graph

Pump Inlet at Node 461

Static: Pressure

0.000

Residual: Pressure

N/A

Available Pressure at System Demand

N/A

Required Pressure at System Demand

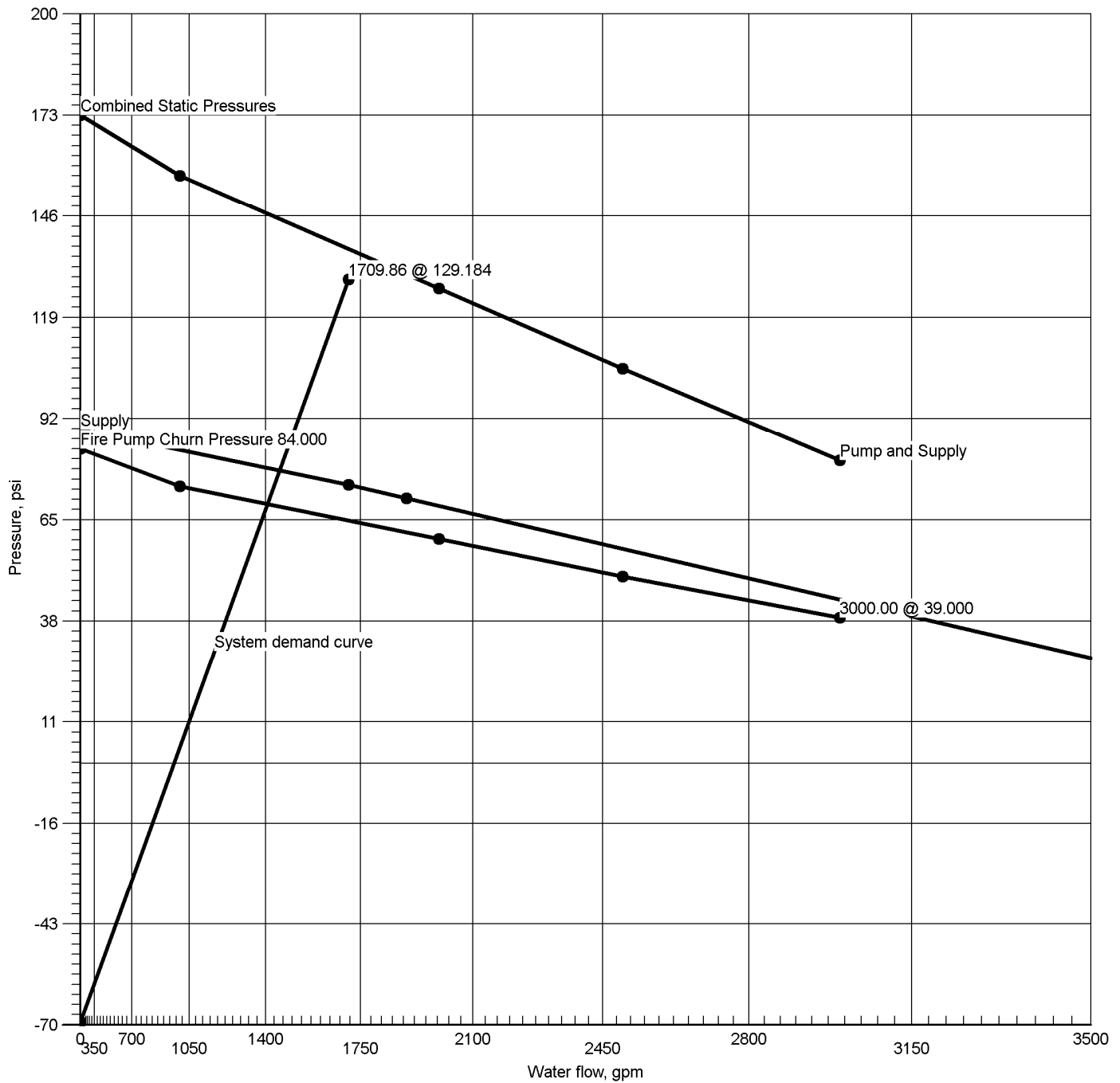
0.000 @ 0.00

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

N/A



Pump at Node 5



Hydraulic Graph
Pump at Node 5

Static + Churn Pressure
173.256
Fire Pump Churn Pressure
84.000

Fire Pump Rating
60.000 @ 2000.00

Static: Pressure
173.256

Residual: Pressure
64.877 @ 1709.86

Available Pressure at System Demand
139.283 @ 1709.86

Required Pressure at System Demand
129.184 @ 1709.86



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: FP Cooler System

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Hydrant	54	250.00	250.00	250	117.011			
⇒ Sprinkler	3129	121.15	121.15	16.8	52.000			
Sprinkler	3131	121.20	121.15	16.8	52.050			
Sprinkler	3133	121.26	121.15	16.8	52.098			
Sprinkler	3135	121.50	121.15	16.8	52.305			
Sprinkler	3137	121.55	121.15	16.8	52.351			
Sprinkler	3139	121.62	121.15	16.8	52.410			
Sprinkler	3141	121.71	121.15	16.8	52.482			
Sprinkler	3143	121.76	121.15	16.8	52.526			
Sprinkler	3145	121.80	121.15	16.8	52.563			
Sprinkler	3147	121.83	121.15	16.8	52.589			
Sprinkler	3149	122.14	121.15	16.8	52.853			
Sprinkler	3151	122.34	121.15	16.8	53.027			

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: FP Cooler System

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	79.496	1709.86
54	1'-0	Hyd(-1.000)	117.011	250.00
3129	35'-9	Spr(-52.000)	52.000	121.15
3131	35'-9	Spr(-52.050)	52.050	121.20
3133	35'-9	Spr(-52.098)	52.098	121.26
3135	35'-9	Spr(-52.305)	52.305	121.50
3137	35'-9	Spr(-52.351)	52.351	121.55
3139	35'-9	Spr(-52.410)	52.410	121.62
3141	35'-9	Spr(-52.482)	52.482	121.71
3143	35'-9	Spr(-52.526)	52.526	121.76
3145	35'-9	Spr(-52.563)	52.563	121.80
3147	35'-9	Spr(-52.589)	52.589	121.83
3149	35'-9	Spr(-52.853)	52.853	122.14
3151	35'-9	Spr(-53.027)	53.027	122.34
2	-8'-0	E(24'-7)	75.461	
4	1'-9	P1	64.307	
5	1'-9	P2(-64.877)	129.184	
6	1'-9		129.184	
7	6'-8½		125.155	
8	1'-0		127.510	
9	-8'-0	T(43'-10)	129.618	
10	-8'-0	T(43'-10)	127.437	
11	-8'-0	T(47'-3½)	126.629	
12	-8'-0	T(43'-10)	122.125	
13	-8'-0	T(47'-3½)	121.074	
14	-8'-0	T(43'-10)	120.834	
15	-8'-0	T(47'-3½)	123.682	
16	-8'-0	T(43'-10)	124.198	
17	-8'-0	T(47'-3½)	126.543	
18	-8'-0	T(43'-10)	126.940	
19	-8'-0	T(43'-10)	127.870	
51	1'-0	Hyd	1.000	
53	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
300	40'-6½	PO(18'-8½)	84.124	
302	40'-4	PO(18'-8½)	84.243	
304	40'-1½	PO(18'-8½)	84.435	
306	39'-11	PO(18'-8½)	84.741	
308	39'-8½	PO(18'-8½)	85.078	
310	39'-6	PO(18'-8½)	85.447	
312	39'-3½	PO(18'-8½)	85.847	
314	39'-1	PO(18'-8½)	86.282	
316	38'-10½	PO(18'-8½)	86.752	
318	38'-8	PO(18'-8½)	87.261	
320	38'-5½	PO(18'-8½)	87.812	
322	38'-3½	FT(31'-5)	89.867	
324	1'-8½	PO(37'-8½)	114.394	
326	40'-7½	PO(18'-8½)	79.057	
328	40'-5	PO(18'-8½)	79.238	
330	40'-2½	PO(18'-8½)	79.657	
332	40'-0	PO(18'-8½)	80.449	
334	39'-9½	PO(18'-8½)	81.105	
336	39'-7	PO(18'-8½)	81.643	
338	39'-4½	PO(18'-8½)	82.078	
340	39'-2	PO(18'-8½)	82.423	
342	38'-11½	PO(18'-8½)	82.689	
344	38'-9	PO(18'-8½)	82.890	
346	38'-6½	PO(18'-8½)	83.036	
348	38'-4	PO(18'-8½)	83.145	
350	38'-3	PO(18'-8½)	89.877	
352	36'-9	T(8'-11½), Tr(2'-7)	53.849	
354	41'-5½	PO(11'-3½)	59.232	



Node Analysis

Job Number: 212189000
Report Description: FP Cooler System

Node	Elevation(foot)	Fittings	Pressure(psi)	Discharge(gpm)
356	41'-5½"	PO(11'-3½")	59.290	
358	41'-5½"	PO(11'-3½")	59.892	
360	36'-9"	T(8'-11½"), Tr(2'-7")	53.900	
362	36'-9"	T(8'-11½"), Tr(2'-7")	53.950	
364	41'-5½"	PO(11'-3½")	59.347	
366	36'-9"	T(8'-11½"), Tr(2'-7")	54.166	
368	41'-3"	PO(11'-3½")	59.613	
370	41'-3"	PO(11'-3½")	59.667	
372	41'-3"	PO(11'-3½")	60.256	
374	36'-9"	T(8'-11½"), Tr(2'-7")	54.213	
376	36'-9"	T(8'-11½"), Tr(2'-7")	54.275	
378	41'-3"	PO(11'-3½")	59.736	
380	36'-9"	T(8'-11½"), Tr(2'-7")	54.350	
382	41'-0½"	PO(11'-3½")	59.844	
384	41'-0½"	PO(11'-3½")	59.895	
386	41'-0½"	PO(11'-3½")	60.482	
388	36'-9"	T(8'-11½"), Tr(2'-7")	54.396	
390	36'-9"	T(8'-11½"), Tr(2'-7")	54.434	
392	36'-9"	T(8'-11½"), Tr(2'-7")	54.461	
394	41'-0½"	PO(11'-3½")	59.968	
396	36'-9"	T(8'-11½"), Tr(2'-7")	54.737	
398	36'-9"	T(8'-11½"), Tr(2'-7")	54.918	
428	1'-0"		115.371	



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Cooler System

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 2.282
3129	35'-9	121.15	16.8	52.000		Sprinkler,	2'-7	Pe -0.434
352	36'-9			53.849		Tr(2'-7)	3'-7	Pv
BL	1.7280	121.15	16.57	120		0.320583	4'-9	Pf 7.438
352	36'-9			53.849			18'-5½	Pe -2.055
354	41'-5½			59.232		E(3'-7), cplg(3'-7), PO(11'-3½)	23'-2½	Pv
BL	2.7050	47.75	2.67	120		0.006458	9'-0	Pf 0.058
354	41'-5½			59.232			9'-0	Pe
356	41'-5½			59.290			9'-0	Pv
BL	2.7050	168.96	9.43	120		0.066893	9'-0	Pf 0.602
356	41'-5½	121.20		59.290		Flow (q) from Route 2	9'-0	Pe
358	41'-5½			59.892			9'-0	Pv
BL	2.7050	290.76	16.23	120		0.182611	93'-1	Pf 23.834
358	41'-5½	121.80		59.892		Flow (q) from Route 9	37'-5	Pe 0.397
300	40'-6½			84.124		2PO(18'-8½)	130'-6	Pv
CM	6.3570	290.76	2.94	120		0.002847	10'-0	Pf 0.028
300	40'-6½			84.124			10'-0	Pe 0.090
302	40'-4			84.243			10'-0	Pv
CM	6.3570	579.90	5.86	120		0.010210	10'-0	Pf 0.102
302	40'-4	289.14		84.243		Flow (q) from Route 4	10'-0	Pe 0.090
304	40'-1½			84.435			10'-0	Pv
CM	6.3570	868.81	8.78	120		0.021569	10'-0	Pf 0.216
304	40'-1½	288.92		84.435		Flow (q) from Route 7	10'-0	Pe 0.090
306	39'-11			84.741			10'-0	Pv
CM	6.3570	934.00	9.44	120		0.024658	10'-0	Pf 0.247
306	39'-11	65.18		84.741		Flow (q) from Route 3	10'-0	Pe 0.090
308	39'-8½			85.078			10'-0	Pv
CM	6.3570	996.50	10.07	120		0.027797	10'-0	Pf 0.278
308	39'-8½	62.50		85.078		Flow (q) from Route 16	10'-0	Pe 0.090
310	39'-6			85.447			10'-0	Pv
CM	6.3570	1057.52	10.69	120		0.031028	10'-0	Pf 0.310
310	39'-6	61.03		85.447		Flow (q) from Route 17	10'-0	Pe 0.090
312	39'-3½			85.847			10'-0	Pv
CM	6.3570	1118.25	11.30	120		0.034404	10'-0	Pf 0.344
312	39'-3½	60.73		85.847		Flow (q) from Route 18	10'-0	Pe 0.090
314	39'-1			86.282			10'-0	Pv
CM	6.3570	1179.76	11.93	120		0.037987	10'-0	Pf 0.380
314	39'-1	61.51		86.282		Flow (q) from Route 19	10'-0	Pe 0.090
316	38'-10½			86.752			10'-0	Pv
CM	6.3570	1243.02	12.57	120		0.041841	10'-0	Pf 0.418
316	38'-10½	63.26		86.752		Flow (q) from Route 20	10'-0	Pe 0.090
318	38'-8			87.261			10'-0	Pv
CM	6.3570	1308.86	13.23	120		0.046033	10'-0	Pf 0.460
318	38'-8	65.84		87.261		Flow (q) from Route 21	10'-0	Pe 0.090
320	38'-5½			87.812			10'-0	Pv
CM	6.3570	1377.10	13.92	120		0.050571	7'-10	Pf 1.985
320	38'-5½	68.24		87.812		Flow (q) from Route 22	31'-5	Pe 0.071
322	38'-3½			89.867		ft(31'-5)	39'-3	Pv
CM	6.3570	1459.86	14.76	120		0.056336	50'-6½	Pf 8.656
322	38'-3½	82.76		89.867		Flow (q) from Route 23	103'-1	Pe 15.871
324	1'-8½			114.394		fE(12'-7), 2f(-0.000), CV(40'-3), BV(12'-7), PO(37'-8½)	153'-8	Pv
CM	8.2490	1459.86	8.76	120		0.015840	1'-6	Pf 0.675
324	1'-8½			114.394			41'-1½	Pe 0.303
428	1'-0			115.371		PO(41'-1½)	42'-7½	Pv
UG	7.6800	1459.86	10.11	150		0.014847	38'-9½	Pf 1.561
428	1'-0			115.371			66'-4½	Pe 3.902
14	-8'-0			120.834		E(22'-6½), T(43'-10)	105'-2	Pv
UG	7.6800	710.22	4.92	150		0.003915	61'-1½	Pf 0.239
14	-8'-0			120.834			61'-1½	Pe
13	-8'-0			121.074			61'-1½	Pv
UG	7.6800	960.22	6.65	150		0.006840	153'-8	Pf 1.051
13	-8'-0	250.00		121.074		Flow (q) from Route 13	153'-8	Pe
12	-8'-0			122.125			153'-8	Pv
UG	7.6800	960.22	6.65	150		0.006840	635'-11½	Pf 4.504
12	-8'-0			122.125			22'-6½	Pe
11	-8'-0			126.629		E(22'-6½)	658'-6	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Cooler System

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	7.6800	960.22	6.65	150		0.006840	118'-2	Pf 0.808
11	-8'-0			126.629				Pe
10	-8'-0			127.437			118'-2	Pv
UG	7.6800	960.22	6.65	150		0.006840	275'-0	Pf 2.181
10	-8'-0			127.437			43'-10	Pe
9	-8'-0			129.618		T(43'-10)	318'-9½	Pv
UG	7.6800	1709.86	11.84	150		0.019890	67'-8	Pf 1.794
9	-8'-0	749.64		129.618		Flow (q) from Route 14	22'-6½	Pe -3.902
8	1'-0			127.510		E(22'-6½)	90'-2½	Pv
FR	8.2490	1709.86	10.26	120		0.021220	5'-8½	Pf 0.121
8	1'-0			127.510				Pe -2.476
7	6'-8½			125.155			5'-8½	Pv
DY	10.3700	1709.86	6.50	120		0.006963	13'-10½	Pf 1.878
7	6'-8½			125.155			255'-9	Pe 2.151
6	1'-9			129.184		4E(26'-0), T(48'-5½), BV(21'-3½), Tr(17'-0), CV(65'-0)	269'-8	Pv
DY	7.9810	1709.86	10.97	120		0.024924	0'-0	Pf 0.000
6	1'-9			129.184				Pe 0.000
5	1'-9			129.184			0'-0	Pv
Pump		Velocity						
5		1709.86		129.184		Rating: 60.000 @ 2000.00		
4		Q=1709.86	7.87	64.307		Fire Pump Churn Pressure: 84.000		
UG	9.4200	1709.86	7.87	150		0.007357	305'-9½	Pf 6.927
4	1'-9			64.307			137'-6	Pe 4.227
2	-8'-0			75.461		GV(5'-7), T(45'-10), 3E(24'-7), EE(12'-3½), BFP(-3.665)	443'-3½	Pv
UG	11.2000	1709.86	5.57	150		0.003167	750'-9	Pf 2.518
2	-8'-0			75.461			44'-3	Pe 1.517
1	-11'-6			79.496		EE(14'-4½), E(29'-10½), S	795'-0	Pv
		0.00				Hose Allowance At Source		
1		1709.86						
Route 2								
DR	1.6100	121.20	19.10	100		0.634460	1'-0	Pf 2.284
3131	35'-9	121.20	16.8	52.050		Sprinkler,	2'-7	Pe -0.434
360	36'-9			53.900		Tr(2'-7)	3'-7	Pv
BL	1.7280	121.20	16.58	120		0.320866	4'-9	Pf 7.445
360	36'-9			53.900			18'-5½	Pe -2.055
356	41'-5½			59.290		E(3'-7), cplg(3'-7), PO(11'-3½)	23'-2½	Pv
Route 3								
DR	1.6100	121.26	19.11	100		0.635001	1'-0	Pf 2.286
3133	35'-9	121.26	16.8	52.098		Sprinkler,	2'-7	Pe -0.434
362	36'-9			53.950		Tr(2'-7)	3'-7	Pv
BL	1.7280	121.26	16.59	120		0.321139	4'-9	Pf 7.451
362	36'-9			53.950			18'-5½	Pe -2.055
364	41'-5½			59.347		E(3'-7), cplg(3'-7), PO(11'-3½)	23'-2½	Pv
BL	2.7050	194.65	10.87	120		0.086924	176'-7	Pf 19.349
364	41'-5½	73.39		59.347		Flow (q) from Route 26	46'-0	Pe 0.361
326	40'-7½			79.057		2Tr(4'-3½), 2PO(18'-8½)	222'-7	Pv
CM	4.3100	194.65	4.28	120		0.008993	10'-0	Pf 0.090
326	40'-7½			79.057				Pe 0.090
328	40'-5			79.238			10'-0	Pv
CM	4.3100	392.33	8.63	120		0.032885	10'-0	Pf 0.329
328	40'-5	197.67		79.238		Flow (q) from Route 6		Pe 0.090
330	40'-2½			79.657			10'-0	Pv
CM	4.3100	591.04	13.00	120		0.070185	10'-0	Pf 0.702
330	40'-2½	198.71		79.657		Flow (q) from Route 10		Pe 0.090
332	40'-0			80.449			10'-0	Pv
RN	2.7050	65.18	3.64	120		0.011486	295'-8	Pf 4.256
332	40'-0			80.449		PO(18'-8½)	74'-10½	Pe 0.036
306	39'-11			84.741		3PO(18'-8½)	370'-6½	Pv
Route 4								
DR	1.6100	121.50	19.15	100		0.637342	1'-0	Pf 2.294
3135	35'-9	121.50	16.8	52.305		Sprinkler,	2'-7	Pe -0.434
366	36'-9			54.166		Tr(2'-7)	3'-7	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Cooler System

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	121.50	16.62	120		0.322323	4'-6½"	Pf 7.412
366	36'-9"			54.166			18'-5½"	Pe -1.964
368	41'-3"			59.613		E(3'-7), cplg(3'-7), PO(11'-3½)	23'-0"	Pv
BL	2.7050	45.45	2.54	120		0.005894	9'-0"	Pf 0.053
368	41'-3"			59.613			9'-0"	Pe
370	41'-3"			59.667				Pv
BL	2.7050	167.00	9.32	120		0.065470	9'-0"	Pf 0.589
370	41'-3"	121.55		59.667		Flow (q) from Route 5	9'-0"	Pe
372	41'-3"			60.256				Pv
BL	2.7050	289.14	16.14	120		0.180738	93'-1"	Pf 23.590
372	41'-3"	122.14		60.256		Flow (q) from Route 11	37'-5"	Pe 0.397
302	40'-4"			84.243		2PO(18'-8½)	130'-6"	Pv
Route 5								
DR	1.6100	121.55	19.16	100		0.637853	1'-0"	Pf 2.296
3137	35'-9"	121.55	16.8	52.351		Sprinkler,	2'-7"	Pe -0.434
374	36'-9"			54.213		Tr(2'-7)	3'-7"	Pv
BL	1.7280	121.55	16.63	120		0.322581	4'-6½"	Pf 7.418
374	36'-9"			54.213			18'-5½"	Pe -1.964
370	41'-3"			59.667		E(3'-7), cplg(3'-7), PO(11'-3½)	23'-0"	Pv
Route 6								
DR	1.6100	121.62	19.17	100		0.638518	1'-0"	Pf 2.299
3139	35'-9"	121.62	16.8	52.410		Sprinkler,	2'-7"	Pe -0.434
376	36'-9"			54.275		Tr(2'-7)	3'-7"	Pv
BL	1.7280	121.62	16.64	120		0.322918	4'-6½"	Pf 7.425
376	36'-9"			54.275			18'-5½"	Pe -1.964
378	41'-3"			59.736		E(3'-7), cplg(3'-7), PO(11'-3½)	23'-0"	Pv
BL	2.7050	197.67	11.04	120		0.089435	176'-7"	Pf 19.141
378	41'-3"	76.05		59.736		Flow (q) from Route 25	37'-5"	Pe 0.361
328	40'-5"			79.238		2PO(18'-8½)	214'-0"	Pv
Route 7								
DR	1.6100	121.71	19.18	100		0.639335	1'-0"	Pf 2.302
3141	35'-9"	121.71	16.8	52.482		Sprinkler,	2'-7"	Pe -0.434
380	36'-9"			54.350		Tr(2'-7)	3'-7"	Pv
BL	1.7280	121.71	16.65	120		0.323331	4'-4"	Pf 7.368
380	36'-9"			54.350			18'-5½"	Pe -1.874
382	41'-0½"			59.844		E(3'-7), cplg(3'-7), PO(11'-3½)	22'-9½"	Pv
BL	2.7050	44.82	2.50	120		0.005745	9'-0"	Pf 0.052
382	41'-0½"			59.844			9'-0"	Pe
384	41'-0½"			59.895				Pv
BL	2.7050	166.58	9.30	120		0.065163	9'-0"	Pf 0.586
384	41'-0½"	121.76		59.895		Flow (q) from Route 8	9'-0"	Pe
386	41'-0½"			60.482				Pv
BL	2.7050	288.92	16.13	120		0.180481	93'-1"	Pf 23.556
386	41'-0½"	122.34		60.482		Flow (q) from Route 12	37'-5"	Pe 0.397
304	40'-1½"			84.435		2PO(18'-8½)	130'-6"	Pv
Route 8								
DR	1.6100	121.76	19.19	100		0.639833	1'-0"	Pf 2.303
3143	35'-9"	121.76	16.8	52.526		Sprinkler,	2'-7"	Pe -0.434
388	36'-9"			54.396		Tr(2'-7)	3'-7"	Pv
BL	1.7280	121.76	16.66	120		0.323583	4'-4"	Pf 7.373
388	36'-9"			54.396			18'-5½"	Pe -1.874
384	41'-0½"			59.895		E(3'-7), cplg(3'-7), PO(11'-3½)	22'-9½"	Pv
Route 9								
DR	1.6100	121.80	19.19	100		0.640246	1'-0"	Pf 2.305
3145	35'-9"	121.80	16.8	52.563		Sprinkler,	2'-7"	Pe -0.434
390	36'-9"			54.434		Tr(2'-7)	3'-7"	Pv
BL	1.7280	121.80	16.66	120		0.323792	4'-9"	Pf 7.513
390	36'-9"			54.434			18'-5½"	Pe -2.055
358	41'-5½"			59.892		E(3'-7), cplg(3'-7), PO(11'-3½)	23'-2½"	Pv
Route 10								
DR	1.6100	121.83	19.20	100		0.640536	1'-0"	Pf 2.306
3147	35'-9"	121.83	16.8	52.589		Sprinkler,	2'-7"	Pe -0.434
392	36'-9"			54.461		Tr(2'-7)	3'-7"	Pv
BL	1.7280	121.83	16.67	120		0.323938	4'-4"	Pf 7.381
392	36'-9"			54.461			18'-5½"	Pe -1.874
394	41'-0½"			59.968		E(3'-7), cplg(3'-7), PO(11'-3½)	22'-9½"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Cooler System

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	198.71	11.09	120		0.090307	176'-7"	Pf 19.327
394	41'-0½"	76.88		59.968		Flow (q) from Route 24	37'-5"	Pe 0.361
330	40'-2½"			79.657		2PO(18'-8½")	214'-0"	Pv
Route 11								
DR	1.6100	122.14	19.25	100		0.643519	1'-0"	Pf 2.317
3149	35'-9"	122.14	16.8	52.853		Sprinkler,	2'-7"	Pe -0.434
396	36'-9"			54.737		Tr(2'-7")	3'-7"	Pv
BL	1.7280	122.14	16.71	120		0.325447	4'-6½"	Pf 7.484
396	36'-9"			54.737			18'-5½"	Pe -1.964
372	41'-3"			60.256		E(3'-7), cplg(3'-7), PO(11'-3½")	23'-0"	Pv
Route 12								
DR	1.6100	122.34	19.28	100		0.645477	1'-0"	Pf 2.324
3151	35'-9"	122.34	16.8	53.027		Sprinkler,	2'-7"	Pe -0.434
398	36'-9"			54.918		Tr(2'-7")	3'-7"	Pv
BL	1.7280	122.34	16.74	120		0.326437	4'-4"	Pf 7.438
398	36'-9"			54.918			18'-5½"	Pe -1.874
386	41'-0½"			60.482		E(3'-7), cplg(3'-7), PO(11'-3½")	22'-9½"	Pv
Route 13								
UG	6.2800	250.00	2.59	140		0.001718	19'-10"	Pf 0.161
54	1'-0"	250.00		117.011		Hydrant,	74'-1"	Pe 3.902
13	-8'-0"			121.074		E(22'-1), GV(4'-8½"), T(47'-3½")	93'-10½"	Pv
Route 14								
UG	7.6800	749.64	5.19	150		0.004326	119'-3"	Pf 0.516
15	-8'-0"	749.64		123.682		Flow (q) from Route 15		Pe
16	-8'-0"			124.198			119'-3"	Pv
UG	7.6800	749.64	5.19	150		0.004326	519'-3½"	Pf 2.344
16	-8'-0"			124.198			22'-6½"	Pe
17	-8'-0"			126.543		E(22'-6½")	541'-10"	Pv
UG	7.6800	749.64	5.19	150		0.004326	91'-11½"	Pf 0.398
17	-8'-0"			126.543				Pe
18	-8'-0"			126.940			91'-11½"	Pv
UG	7.6800	749.64	5.19	150		0.004326	214'-9"	Pf 0.929
18	-8'-0"			126.940				Pe
19	-8'-0"			127.870			214'-9"	Pv
UG	7.6800	749.64	5.19	150		0.004326	337'-8"	Pf 1.748
19	-8'-0"			127.870			66'-4½"	Pe
9	-8'-0"			129.618		E(22'-6½"), T(43'-10")	404'-0½"	Pv
Route 15								
UG	7.6800	749.64	5.19	150		0.004326	635'-9"	Pf 2.848
14	-8'-0"	710.22		120.834		Flow (q) from Route 1	22'-6½"	Pe
15	-8'-0"			123.682		E(22'-6½")	658'-3½"	Pv
Route 16								
CM	4.3100	525.86	11.56	120		0.056540	10'-0"	Pf 0.566
332	40'-0"	65.18		80.449		Flow (q) from Route 3		Pe 0.090
334	39'-9½"			81.105			10'-0"	Pv
RN	2.7050	62.50	3.49	120		0.010625	295'-8"	Pf 3.937
334	39'-9½"			81.105		PO(18'-8½")	74'-10½"	Pe 0.036
308	39'-8½"			85.078		3PO(18'-8½")	370'-6½"	Pv
Route 17								
CM	4.3100	463.36	10.19	120		0.044741	10'-0"	Pf 0.448
334	39'-9½"	62.50		81.105		Flow (q) from Route 16		Pe 0.090
336	39'-7"			81.643			10'-0"	Pv
RN	2.7050	61.03	3.41	120		0.010168	295'-8"	Pf 3.768
336	39'-7"			81.643		PO(18'-8½")	74'-10½"	Pe 0.036
310	39'-6"			85.447		3PO(18'-8½")	370'-6½"	Pv
Route 18								
CM	4.3100	402.33	8.85	120		0.034454	10'-0"	Pf 0.345
336	39'-7"	61.03		81.643		Flow (q) from Route 17		Pe 0.090
338	39'-4½"			82.078			10'-0"	Pv
RN	2.7050	60.73	3.39	120		0.010075	295'-8"	Pf 3.733
338	39'-4½"			82.078		PO(18'-8½")	74'-10½"	Pe 0.036
312	39'-3½"			85.847		3PO(18'-8½")	370'-6½"	Pv
Route 19								
CM	4.3100	341.61	7.51	120		0.025455	10'-0"	Pf 0.255
338	39'-4½"	60.73		82.078		Flow (q) from Route 18		Pe 0.090
340	39'-2"			82.423			10'-0"	Pv



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Cooler System

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	61.51	3.43	120		0.010317	295'-8"	Pf 3.823
340	39'-2"			82.423		PO(18'-8½")	74'-10½"	Pe 0.036
314	39'-1"			86.282		3PO(18'-8½")	370'-6½"	Pv
Route 20								
CM	4.3100	280.10	6.16	120		0.017631	10'-0"	Pf 0.176
340	39'-2"	61.51		82.423		Flow (q) from Route 19		Pe 0.090
342	38'-11½"			82.689			10'-0"	Pv
RN	2.7050	63.26	3.53	120		0.010866	295'-8"	Pf 4.026
342	38'-11½"			82.689		PO(18'-8½")	74'-10½"	Pe 0.036
316	38'-10½"			86.752		3PO(18'-8½")	370'-6½"	Pv
Route 21								
CM	4.3100	216.84	4.77	120		0.010980	10'-0"	Pf 0.110
342	38'-11½"	63.26		82.689		Flow (q) from Route 20		Pe 0.090
344	38'-9"			82.890			10'-0"	Pv
RN	2.7050	65.84	3.68	120		0.011700	295'-8"	Pf 4.335
344	38'-9"			82.890		PO(18'-8½")	74'-10½"	Pe 0.036
318	38'-8"			87.261		3PO(18'-8½")	370'-6½"	Pv
Route 22								
CM	4.3100	151.00	3.32	120		0.005621	10'-0"	Pf 0.056
344	38'-9"	65.84		82.890		Flow (q) from Route 21		Pe 0.090
346	38'-6½"			83.036			10'-0"	Pv
RN	2.7050	68.24	3.81	120		0.012501	295'-8"	Pf 4.739
346	38'-6½"			83.036		PO(18'-8½")	83'-5½"	Pe 0.036
320	38'-5½"			87.812		3PO(18'-8½"), 2Tr(4'-3½")	379'-1½"	Pv
Route 23								
CM	4.3100	82.76	1.82	120		0.001848	10'-0"	Pf 0.018
346	38'-6½"	68.24		83.036		Flow (q) from Route 22		Pe 0.090
348	38'-4"			83.145			10'-0"	Pv
RN	2.7050	82.76	4.62	120		0.017864	295'-8"	Pf 6.696
348	38'-4"			83.145		PO(18'-8½")	79'-2"	Pe 0.036
350	38'-3"			89.877		3PO(18'-8½"), Tr(4'-3½")	374'-10"	Pv
CM	6.3570	82.76	0.84	120		0.000278	2'-2"	Pf 0.009
350	38'-3"			89.877			31'-5"	Pe -0.020
322	38'-3½"			89.867		fT(31'-5")	33'-7½"	Pv
Route 24								
BL	2.7050	76.88	4.29	120		0.015588	8'-0"	Pf 0.125
382	41'-0½"	44.82		59.844		Flow (q) from Route 7		Pe
394	41'-0½"			59.968			8'-0"	Pv
Route 25								
BL	2.7050	76.05	4.25	120		0.015278	8'-0"	Pf 0.122
368	41'-3"	45.45		59.613		Flow (q) from Route 4		Pe
378	41'-3"			59.736			8'-0"	Pv
Route 26								
BL	2.7050	73.39	4.10	120		0.014305	8'-0"	Pf 0.114
354	41'-5½"	47.75		59.232		Flow (q) from Route 1		Pe
364	41'-5½"			59.347			8'-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

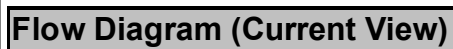


Hydraulic Analysis

Job Number: 212189000
Report Description: FP Cooler System

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	
SN Swing Nipple	Pf	Pressure loss due to friction between points	DPV Dry Pipe Valve	
SP Sprig	Pe	Pressure due to elevation difference between indicated points	E 90° Elbow	
ST Stand Pipe	Pv	Velocity pressure at a point in a pipe	EE 45° Elbow	
UG Underground			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: FP Cooler System





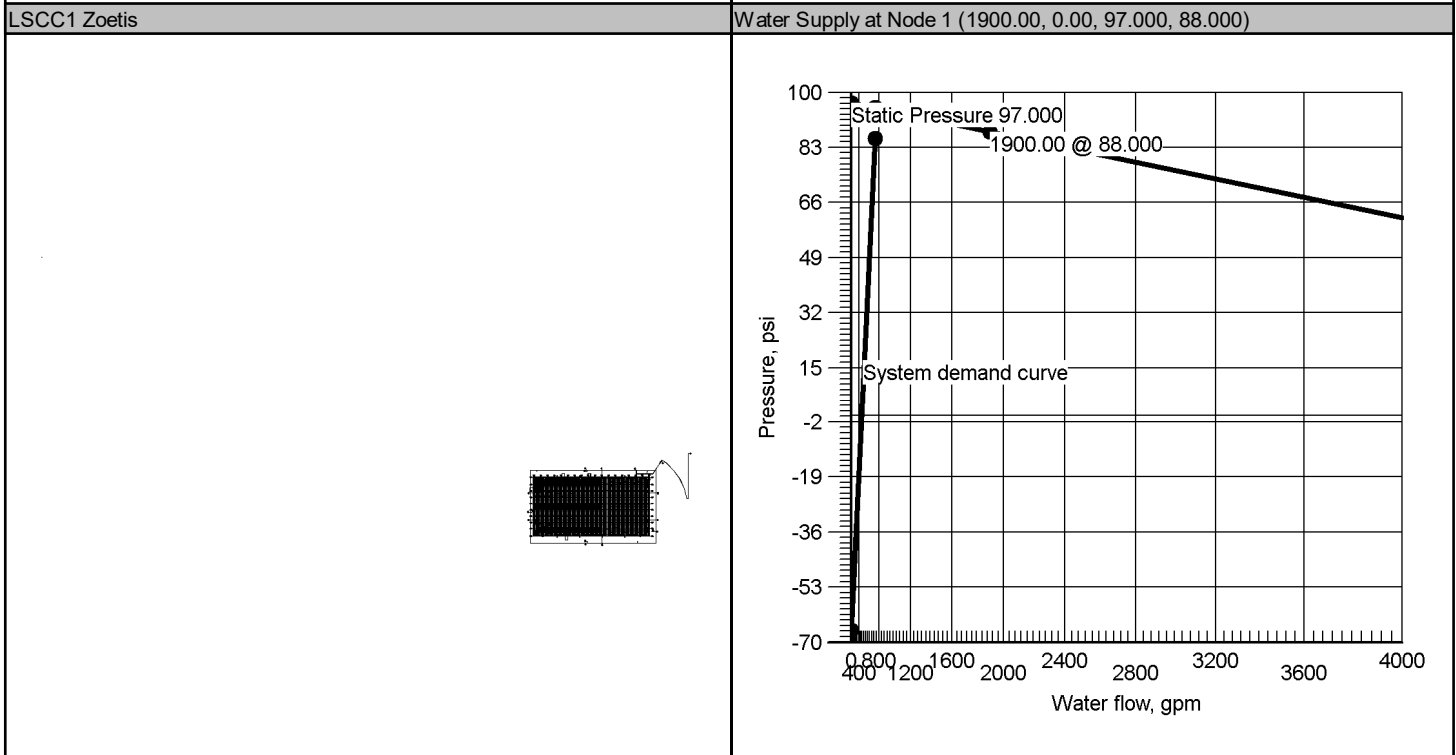
Hydraulic Overview

Job Number: 212189000
Report Description: FP Evaporator System 12

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 90 ft ²	Number Of Sprinklers Calculated 4 0
System Pressure Demand 85.905	System Flow Demand 741.02
Total Demand 741.02 @ 85.905	Pressure Result +9.519 (10.0%)

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 (461)	0.000	0	0.00
5	Pump	2000.00		84.000	60.000				
Pumps: Static = Churn (Pressure @ Zero Flow)									





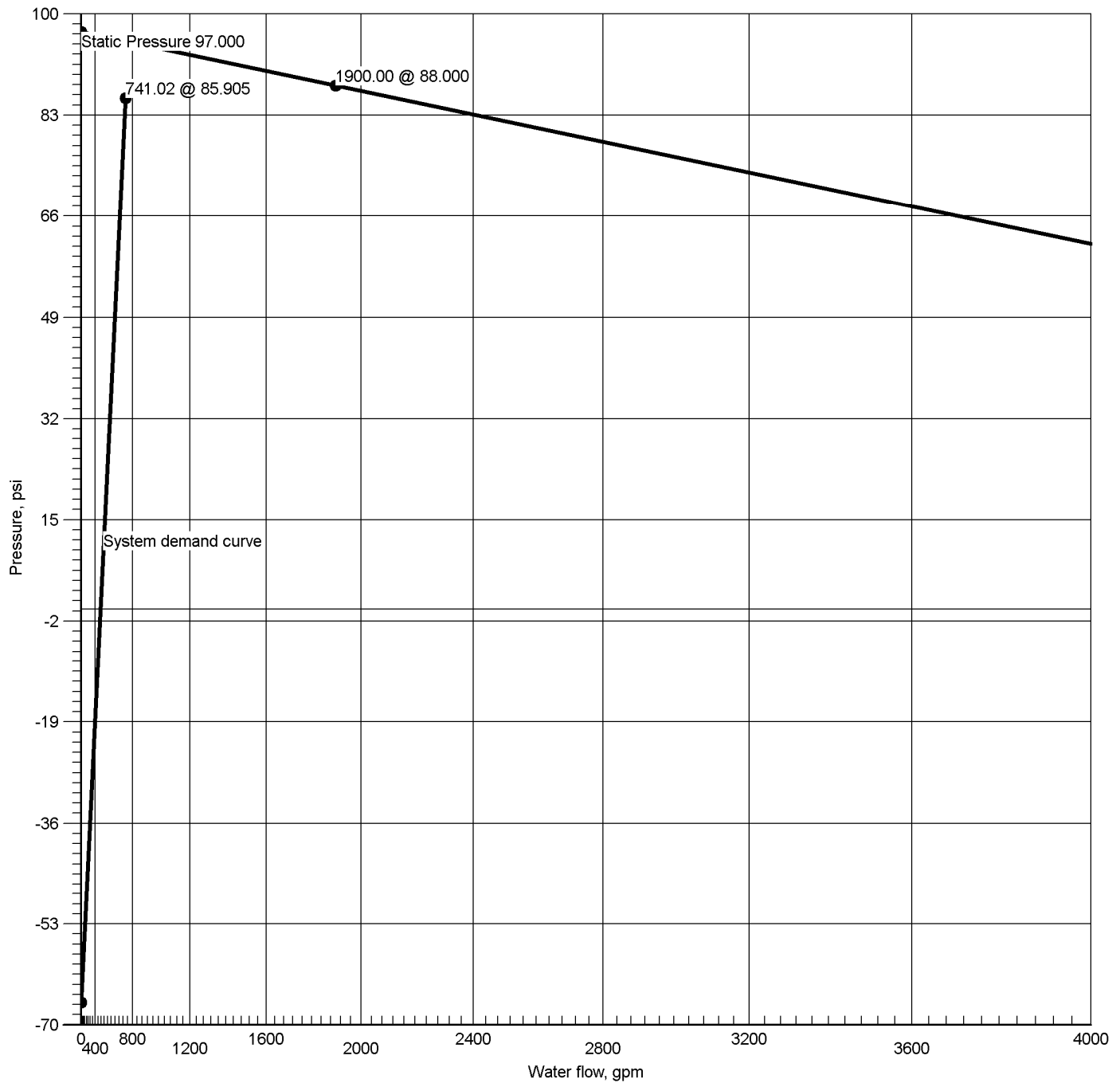
Hydraulic Summary

Job Number: 212189000
Report Description: FP Evaporator System 12

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 4		Number Of Nozzles Calculated 0		Coverage Per Sprinkler 90 ft ²	
				AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area							
Total Hose Streams 250.00											
System Flow Demand 741.02		Total Water Required (Including Hose Allowance) 741.02									
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 18.87 between nodes 256 and 254											
Maximum Velocity Under Ground 5.13 between nodes 8 and 9											
Volume capacity of Wet Pipes 32132.49 gal		Volume capacity of Dry Pipes 376.49 gal									
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	95.423		741.02	85.905	9.519
5	Pump		84.000	60.000		2000.00	163.184		741.02	153.665	9.519
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

95.423 @ 741.02

Required Pressure at System Demand

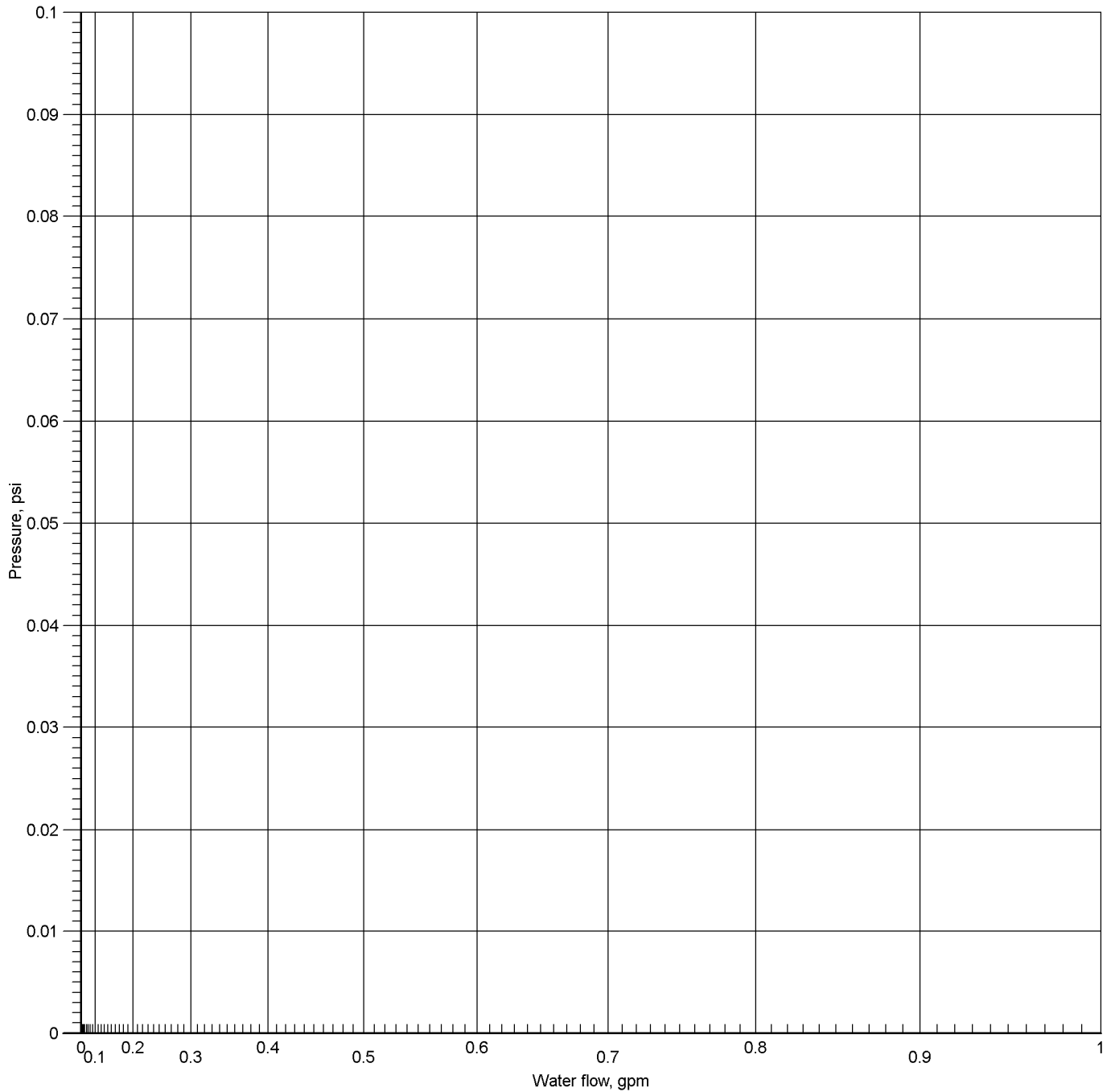
85.905 @ 741.02

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

85.905 @ 741.02



Pump Inlet at Node 461



Hydraulic Graph

Pump Inlet at Node 461

Static: Pressure

0.000

Residual: Pressure

N/A

Available Pressure at System Demand

N/A

Required Pressure at System Demand

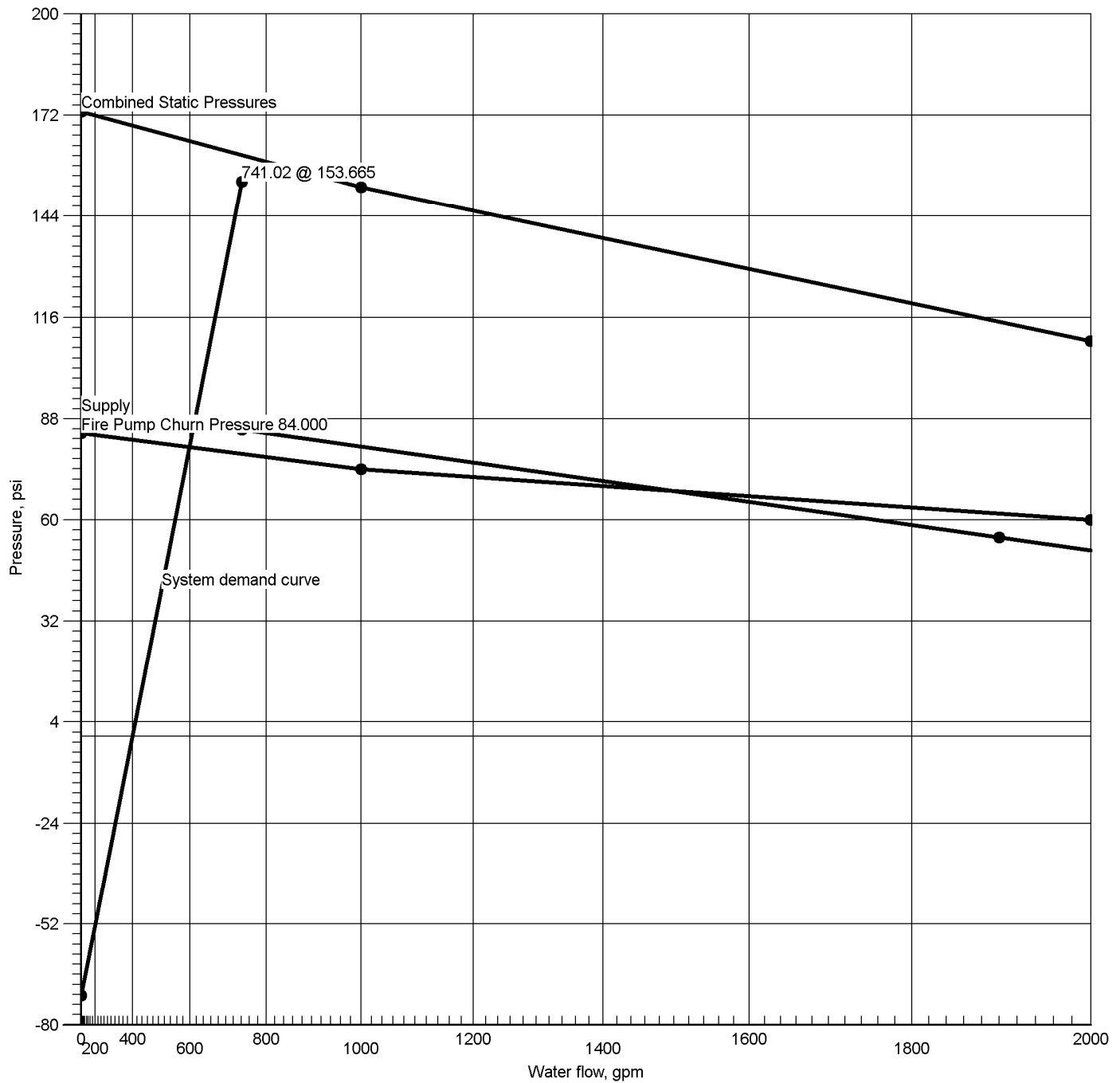
0.000 @ 0.00

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

N/A



Pump at Node 5



Hydraulic Graph
Pump at Node 5

Static + Churn Pressure
173.256
Fire Pump Churn Pressure
84.000

Fire Pump Rating
60.000 @ 2000.00

Static Pressure
173.256

Residual Pressure
78.256 @ 741.02

Available Pressure at System Demand
163.184 @ 741.02

Required Pressure at System Demand
153.665 @ 741.02



Summary Of Outflowing Devices

Job Number: 212189000
Report Description: FP Evaporator System 12

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Hydrant	54	250.00	250.00	250	151.188			
⇒ Sprinkler	2129	121.15	121.15	16.8	52.000			
Sprinkler	2131	121.33	121.15	16.8	52.162			
Sprinkler	2133	123.56	121.15	16.8	54.092			
Sprinkler	2135	124.98	121.15	16.8	55.339			

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 212189000
Report Description: FP Evaporator System 12

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-11'-6	S	85.905	741.02
54	1'-0	Hyd(-1.000)	151.188	250.00
2129	29'-2	Spr(-52.000)	52.000	121.15
2131	29'-2	Spr(-52.162)	52.162	121.33
2133	29'-2	Spr(-54.092)	54.092	123.56
2135	29'-2	Spr(-55.339)	55.339	124.98
2	-8'-0	E(24'-7)	83.851	
4	1'-9	P1	75.409	
5	1'-9	P2(-78.256)	153.665	
6	1'-9		153.665	
7	6'-8½		151.115	
8	1'-0		153.565	
9	-8'-0	T(43'-10)	157.085	
10	-8'-0	T(43'-10)	156.617	
11	-8'-0	T(47'-3½)	156.443	
12	-8'-0	T(43'-10)	155.476	
13	-8'-0	T(47'-3½)	155.251	
14	-8'-0	T(43'-10)	155.234	
15	-8'-0	T(47'-3½)	155.834	
16	-8'-0	T(43'-10)	155.943	
17	-8'-0	T(47'-3½)	156.437	
18	-8'-0	T(43'-10)	156.521	
19	-8'-0	T(43'-10)	156.716	
51	1'-0	Hyd	1.000	
53	1'-0	Hyd	1.000	
56	1'-0	Hyd	1.000	
224	40'-3½	PO(14'-4½)	48.091	
250	40'-2	PO(14'-4½)	50.091	
254	40'-1½	PO(14'-4½)	51.368	
258	37'-5		131.590	
262	1'-8½	PO(41'-1½)	150.822	
428	1'-0		151.124	



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Evaporator System 12

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	3.2600	121.15	4.66	100		0.020412	20'-2½	Pf 0.901
2129	29'-2	121.15	16.8	52.000		Sprinkler,	23'-11½	Pe -4.811
224	40'-3½			48.091		2fE(4'-9½), PO(14'-4½)	44'-2	Pv
BL	3.2600	242.48	9.32	100		0.073693	26'-6	Pf 1.953
224	40'-3½	121.33		48.091		Flow (q) from Route 2	26'-6	Pe 0.048
250	40'-2			50.091				Pv
BL	3.2600	366.04	14.07	100		0.157869	8'-0	Pf 1.263
250	40'-2	123.56		50.091		Flow (q) from Route 3	8'-0	Pe 0.014
254	40'-1½			51.368				Pv
BL	3.2600	491.02	18.87	100		0.271829	262'-0	Pf 79.039
254	40'-1½	124.98		51.368		Flow (q) from Route 4	28'-9	Pe 1.183
258	37'-5			131.590		2fE(4'-9½), PO(14'-4½), fT(4'-9½)	290'-9	Pv
CM	4.2600	491.02	11.05	100		0.073865	36'-11	Pf 3.753
258	37'-5			131.590			13'-10½	Pe 15.479
262	1'-8½			150.822		fE(6'-4½), DPV, BV(7'-6)	50'-9½	Pv
DY	8.2490	491.02	2.95	120		0.002110	0'-0	Pf 0.000
262	1'-8½			150.822			0'-0	Pe 0.303
428	1'-0			151.124				Pv
UG	7.6800	491.02	3.40	150		0.001978	38'-9½	Pf 0.208
428	1'-0			151.124			66'-4½	Pe 3.902
14	-8'-0			155.234		E(22'-6½), T(43'-10)	105'-2	Pv
UG	7.6800	167.97	1.16	150		0.000272	61'-1½	Pf 0.017
14	-8'-0			155.234			61'-1½	Pe
13	-8'-0			155.251				Pv
UG	7.6800	417.97	2.89	150		0.001468	153'-8	Pf 0.226
13	-8'-0	250.00		155.251		Flow (q) from Route 5	153'-8	Pe
12	-8'-0			155.476				Pv
UG	7.6800	417.97	2.89	150		0.001468	635'-11½	Pf 0.967
12	-8'-0			155.476			22'-6½	Pe
11	-8'-0			156.443		E(22'-6½)	658'-6	Pv
UG	7.6800	417.97	2.89	150		0.001468	118'-2	Pf 0.173
11	-8'-0			156.443			118'-2	Pe
10	-8'-0			156.617				Pv
UG	7.6800	417.97	2.89	150		0.001468	275'-0	Pf 0.468
10	-8'-0			156.617			43'-10	Pe
9	-8'-0			157.085		T(43'-10)	318'-9½	Pv
UG	7.6800	741.02	5.13	150		0.004235	67'-8	Pf 0.382
9	-8'-0	323.04		157.085		Flow (q) from Route 6	22'-6½	Pe -3.902
8	1'-0			153.565		E(22'-6½)	90'-2½	Pv
FR	8.2490	741.02	4.45	120		0.004518	5'-8½	Pf 0.026
8	1'-0			153.565			5'-8½	Pe -2.476
7	6'-8½			151.115				Pv
DY	10.3700	741.02	2.81	120		0.001482	13'-10½	Pf 0.400
7	6'-8½			151.115			255'-9	Pe 2.151
6	1'-9			153.665		4E(26'-0), T(48'-5½), BV(21'-3½), Tr(17'-0), CV(65'-0)	269'-8	Pv
DY	7.9810	741.02	4.75	120		0.005307	0'-0	Pf 0.000
6	1'-9			153.665			0'-0	Pe 0.000
5	1'-9			153.665				Pv
Pump								
5		741.02	3.41	153.665		Rating: 60.000 @ 2000.00		
4		Q=741.02		75.409		Fire Pump Churn Pressure: 84.000		
UG	9.4200	741.02	3.41	150		0.001566	305'-9½	Pf 4.215
4	1'-9			75.409			137'-6	Pe 4.227
2	-8'-0			83.851		GV(5'-7), T(45'-10), 3E(24'-7), EE(12'-3½), BFP(-3.521)	443'-3½	Pv
UG	11.2000	741.02	2.41	150		0.000674	750'-9	Pf 0.536
2	-8'-0			83.851			44'-3	Pe 1.517
1	-11'-6			85.905		EE(14'-4½), E(29'-10½), S	795'-0	Pv
		0.00				Hose Allowance At Source		
1		741.02						
Route 2								



Hydraulic Analysis

Job Number: 212189000
Report Description: FP Evaporator System 12

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream						Total Length	
BL	3.2600	121.33	4.66	100	0.020471	12'-2	Pf 0.739
2131	29'-2	121.33	16.8	52.162	Sprinkler,	23'-11½	Pe -4.811
224	40'-3½			48.091	2fE(4'-9½), PO(14'-4½)	36'-1½	Pv
Route 3							
BL	3.2600	123.56	4.75	100	0.021171	12'-0½	Pf 0.762
2133	29'-2	123.56	16.8	54.092	Sprinkler,	23'-11½	Pe -4.763
250	40'-2			50.091	2fE(4'-9½), PO(14'-4½)	36'-0	Pv
Route 4							
BL	3.2600	124.98	4.80	100	0.021622	12'-0	Pf 0.778
2135	29'-2	124.98	16.8	55.339	Sprinkler,	23'-11½	Pe -4.749
254	40'-1½			51.368	2fE(4'-9½), PO(14'-4½)	35'-11½	Pv
Route 5							
UG	6.2800	250.00	2.59	140	0.001718	19'-10	Pf 0.161
54	1'-0	250.00		151.188	Hydrant,	74'-1	Pe 3.902
13	-8'-0			155.251	E(22'-1), GV(4'-8½), T(47'-3½)	93'-10½	Pv
Route 6							
UG	7.6800	323.04	2.24	150	0.000912	119'-3	Pf 0.109
15	-8'-0	323.04		155.834	Flow (q) from Route 7		Pe
16	-8'-0			155.943		119'-3	Pv
UG	7.6800	323.04	2.24	150	0.000912	519'-3½	Pf 0.494
16	-8'-0			155.943		22'-6½	Pe
17	-8'-0			156.437	E(22'-6½)	541'-10	Pv
UG	7.6800	323.04	2.24	150	0.000912	91'-11½	Pf 0.084
17	-8'-0			156.437			Pe
18	-8'-0			156.521		91'-11½	Pv
UG	7.6800	323.04	2.24	150	0.000912	214'-9	Pf 0.196
18	-8'-0			156.521			Pe
19	-8'-0			156.716		214'-9	Pv
UG	7.6800	323.04	2.24	150	0.000912	337'-8	Pf 0.368
19	-8'-0			156.716		66'-4½	Pe
9	-8'-0			157.085	E(22'-6½), T(43'-10)	404'-0½	Pv
Route 7							
UG	7.6800	323.04	2.24	150	0.000912	635'-9	Pf 0.600
14	-8'-0	167.97		155.234	Flow (q) from Route 1	22'-6½	Pe
15	-8'-0			155.834	E(22'-6½)	658'-3½	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

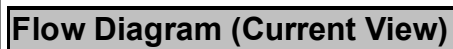
Job Number: 212189000
Report Description: FP Evaporator System 12

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	
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
SN	Swing 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



Report Description: FP Evaporator System 12

