



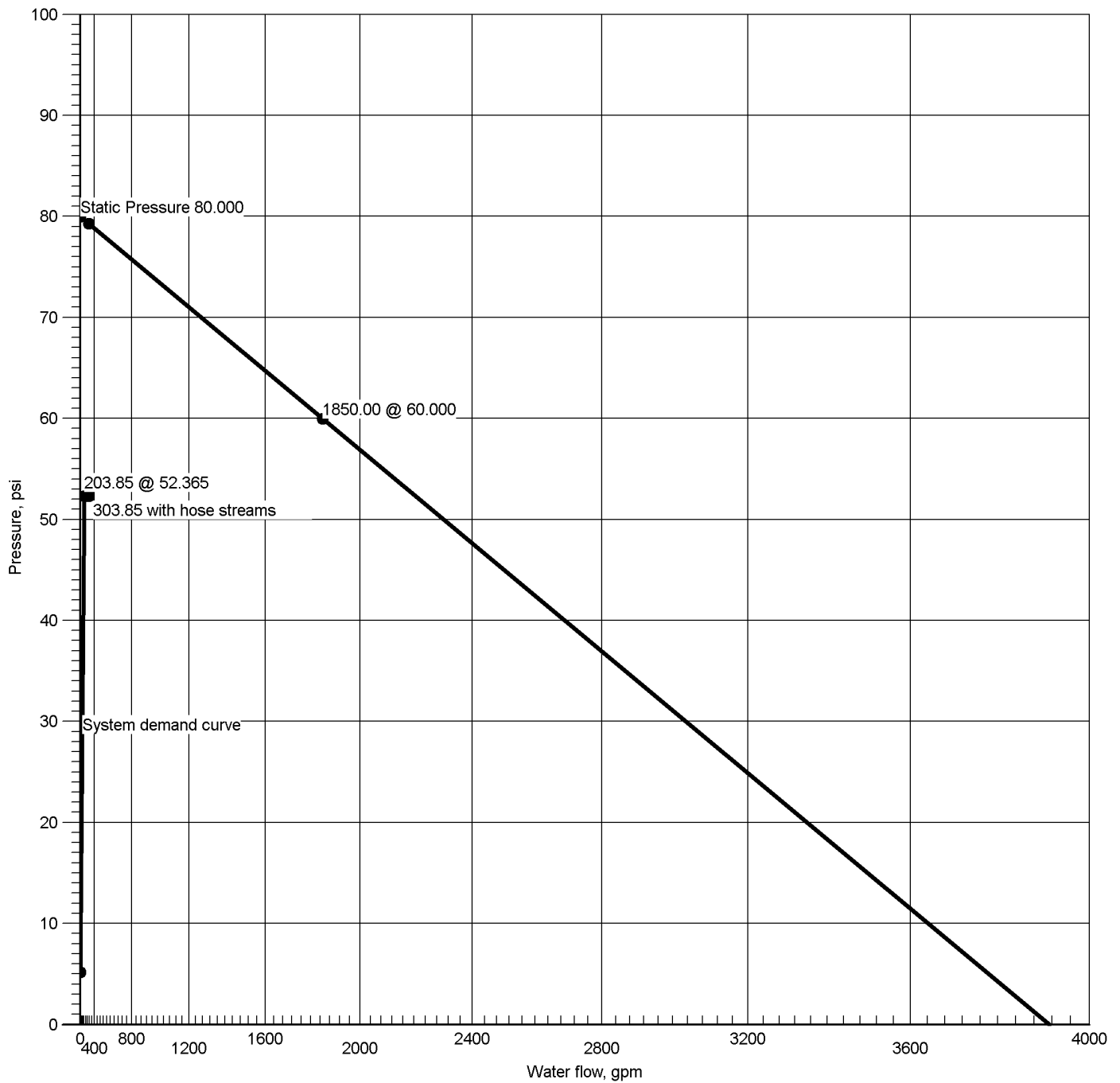
Hydraulic Summary

Job Number: SK0917
Report Description: Light Hazard (2)

Job											
Job Number SK0917	Design Engineer BROOKE LYNN										
Job Name LSMC - ICU EXPANSION	State Certification/License Number										
Address 1 2100 SE BLUE PARKWAY	AHJ										
Address 2 LEE'S SUMMIT, MO 64063	Job Site/Building										
Address 3	Drawing Name LSMC ICU Expansion.cad										
System	Remote Area(s)										
Most Demanding Sprinkler Data 5.6 K-Factor 18.20 at 10.562	Occupancy Light Hazard										
Hose Allowance At Source 100.00	Density 0.10gpm/ft ²										
Additional Hose Supplies <u>Node</u> <u>Flow(gpm)</u>	Area of Application 1500ft ² (Actual 937ft ²)										
	Number Of Sprinklers Calculated 11										
	Number Of Nozzles Calculated 0										
	Coverage Per Sprinkler 130ft ²										
	AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area										
Total Hose Streams 100.00											
System Flow Demand 203.85											
Total Water Required (Including Hose Allowance) 303.85											
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 13.89 between nodes 20 and 22											
Maximum Velocity Under Ground 2.11 between nodes 1 and 2											
Volume capacity of Wet Pipes 9244.17gal	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	100.00	80.000	60.000		1850.00	79.293		303.85	52.365	26.928
Contractor											
Contractor Number		Contact Name				Contact Title					
Name of Contractor		Phone				Extension					
Address 1		FAX									
Address 2		E-mail									
Address 3		Web-Site									



Water Supply at Node 1



Hydraulic Graph

Water Supply at Node 1

Static: Pressure
80.000

Residual: Pressure
60.000 @ 1850.00

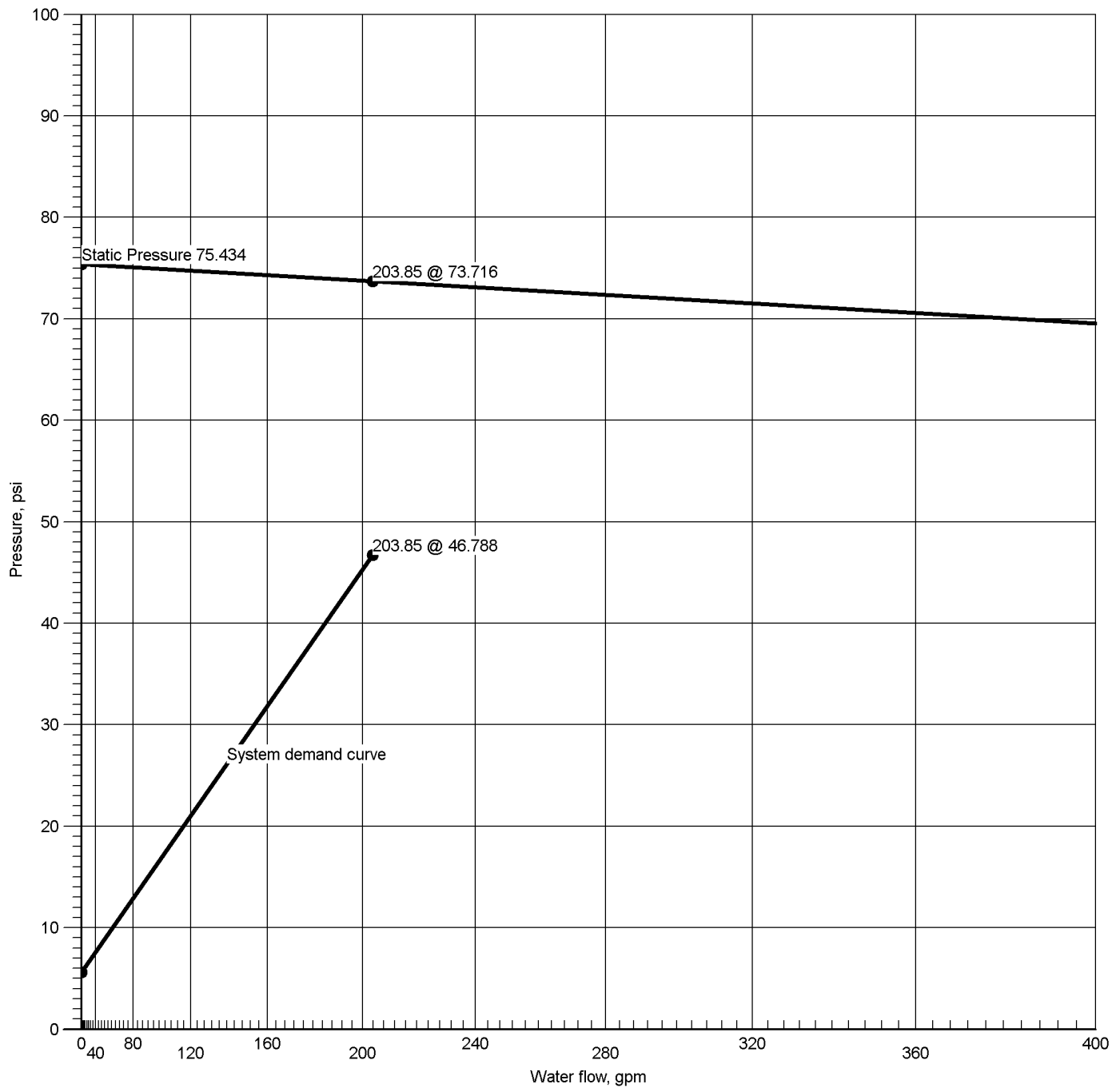
Available Pressure at System Demand
79.293 @ 303.85

Required Pressure at System Demand
52.365 @ 203.85

Required Pressure at System Demand (Including Hose Allowance at Source)
52.365 @ 303.85



BOR at Node 4



Hydraulic Graph

BOR at Node 4

Static: Pressure

75.434

Residual: Pressure

N/A

Available Pressure at System Demand

73.716 @ 203.85

Required Pressure at System Demand

46.788 @ 203.85

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

N/A



Summary Of Outflowing Devices

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Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Sprinkler	200	20.78	14.82	5.6	13.770		
Sprinkler	201	18.96	14.82	5.6	11.466		
Sprinkler	202	19.57	14.82	5.6	12.217		
Sprinkler	203	18.98	14.82	5.6	11.487		
Sprinkler	204	17.61	14.82	5.6	9.886		
Sprinkler	205	18.86	14.82	5.6	11.341		
Sprinkler	206	18.71	14.82	5.6	11.162		
Sprinkler	207	17.10	14.82	5.6	9.324		
⇒ Sprinkler	208	18.20	18.20	5.6	10.562		
Sprinkler	209	17.01	14.82	5.6	9.226		
Sprinkler	210	18.07	14.82	5.6	10.408		

⇒ Most Demanding Sprinkler Data



Node Analysis

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Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	-3'-0	S	52.365	203.85
200	9'-0	Spr(-13.770), fd(22'-0)	13.770	20.78
201	9'-0	Spr(-11.466), fd(22'-0)	11.466	18.96
202	9'-0	Spr(-12.217), fd(22'-0)	12.217	19.57
203	9'-0	Spr(-11.487), fd(22'-0)	11.487	18.98
204	9'-0	Spr(-9.886), fd(22'-0)	9.886	17.61
205	9'-0	Spr(-11.341), fd(22'-0)	11.341	18.86
206	9'-0	Spr(-11.162), fd(22'-0)	11.162	18.71
207	9'-0	Spr(-9.324), fd(22'-0)	9.324	17.10
208	9'-0	Spr(-10.562), fd(22'-0)	10.562	18.20
209	9'-0	Spr(-9.226), fd(22'-0)	9.226	17.01
210	9'-0	Spr(-10.408), fd(22'-0)	10.408	18.07
2	-7'-0	E(44'-3)	54.059	
3	-4'-0	EE(15'-3)	46.845	
4	-4'-0	E(17'-7), BOR	46.788	
5	8'-7	PO(20'-2)	38.174	
16	9'-6	PO(26'-4)	39.990	
17	9'-11	cplg(5'-2½)	28.673	
18	9'-11	PO(5'-0)	17.144	
19	9'-11	PO(7'-5)	18.153	
20	9'-11	PO(7'-5)	17.670	
21	9'-11	PO(7'-5)	17.502	
22	9'-11	PO(5'-0)	14.252	
23	9'-11	PO(5'-0)	15.196	
24	9'-11	PO(5'-0)	14.279	
25	9'-11	PO(5'-0)	12.264	
26	9'-11	PO(5'-0)	14.095	
27	9'-11	PO(5'-0)	13.870	
28	9'-11	PO(5'-0)	11.556	
29	9'-11	PO(5'-0)	13.115	
30	9'-11	PO(5'-0)	11.433	
31	9'-11	PO(5'-0)	12.921	



Hydraulic Analysis

Job Number: SK0917
Report Description: Light Hazard (2)

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								
DY	1.0490	18.20	6.76	120		0.109292	0'-0	Pf 2.951
208	9'-0	18.20	5.6	10.562		Sprinkler,	27'-0	Pe -0.397
29	9'-11			13.115		PO(5'-0), fd(22'-0)	27'-0	Pv
BL	1.4420	36.27	7.12	120		0.083092	14'-0	Pf 1.163
29	9'-11	18.07		13.115		Flow (q) from Route 5		Pe
24	9'-11			14.279			14'-0	Pv
BL	1.4420	55.25	10.85	120		0.181027	13'-11½	Pf 3.874
24	9'-11	18.98		14.279		Flow (q) from Route 9	7'-5	Pe
19	9'-11			18.153		PO(7'-5)	21'-5	Pv
CM	2.6350	203.85	11.99	120		0.107563	62'-11	Pf 10.520
19	9'-11	148.60		18.153		Flow (q) from Route 2	34'-10½	Pe
17	9'-11			28.673		2fT(14'-10), cplg(5'-2½)	97'-9½	Pv
CM	3.2600	203.85	7.84	120		0.038150	145'-2	Pf 8.923
17	9'-11			28.673			88'-8½	Pe 0.578
5	8'-7			38.174		3fE(6'-8½), 2E(9'-5), T(20'-2), f(-0.000), BV(9'-5), PO(20'-2)	233'-10½	Pv
FM	4.2600	203.85	4.59	120		0.010367	134'-6½	Pf 2.214
5	8'-7			38.174			79'-0	Pe -0.397
16	9'-6			39.990		T(26'-4), 2E(13'-2), PO(26'-4)	213'-6½	Pv
CM	6.3570	203.85	2.06	120		0.001476	398'-5½	Pf 0.945
16	9'-6			39.990			228'-10	Pe 5.853
4	-4'-0			46.788		12E(17'-7), f(-0.000), CV(-0.015), BV(17'-7), BOR	627'-3½	Pv
UG	8.3900	203.85	1.18	140		0.000287	93'-10	Pf 0.058
4	-4'-0			46.788			106'-10½	Pe
3	-4'-0			46.845		3E(30'-6½), EE(15'-3)	200'-9	Pv
UG	12.4600	203.85	0.54	140		0.000042	1237'-10	Pf 5.913
3	-4'-0			46.845			44'-3	Pe 1.301
2	-7'-0			54.059		BFP(-5.482), E(44'-3)	1282'-1	Pv
UG	6.2800	203.85	2.11	140		0.001177	11'-6½	Pf 0.040
2	-7'-0			54.059			22'-1	Pe -1.734
1	-3'-0			52.365		E(22'-1), S	33'-7½	Pv
		100.00				Hose Allowance At Source		
1		303.85						
Route 2								
DY	1.0490	17.01	6.31	120		0.096446	0'-0	Pf 2.604
209	9'-0	17.01	5.6	9.226		Sprinkler,	27'-0	Pe -0.397
30	9'-11			11.433		PO(5'-0), fd(22'-0)	27'-0	Pv
BL	1.4420	17.01	3.34	120		0.020479	6'-0	Pf 0.123
30	9'-11			11.433				Pe
28	9'-11			11.556			6'-0	Pv
BL	1.4420	34.11	6.70	120		0.074186	9'-6½	Pf 0.708
28	9'-11	17.10		11.556		Flow (q) from Route 3		Pe
25	9'-11			12.264			9'-6½	Pv
BL	1.4420	51.72	10.16	120		0.160220	12'-5	Pf 1.988
25	9'-11	17.61		12.264		Flow (q) from Route 4		Pe
22	9'-11			14.252			12'-5	Pv
BL	1.4420	70.68	13.89	120		0.285552	4'-6½	Pf 3.418
22	9'-11	18.96		14.252		Flow (q) from Route 8	7'-5	Pe
20	9'-11			17.670		PO(7'-5)	11'-11½	Pv
CM	2.6350	148.60	8.74	120		0.059937	8'-0½	Pf 0.483
20	9'-11	77.92		17.670		Flow (q) from Route 6		Pe
19	9'-11			18.153			8'-0½	Pv
Route 3								
DY	1.0490	17.10	6.35	120		0.097389	0'-0	Pf 2.630
207	9'-0	17.10	5.6	9.324		Sprinkler,	27'-0	Pe -0.397
28	9'-11			11.556		PO(5'-0), fd(22'-0)	27'-0	Pv
Route 4								
DY	1.0490	17.61	6.54	120		0.102802	0'-0	Pf 2.776
204	9'-0	17.61	5.6	9.886		Sprinkler,	27'-0	Pe -0.397
25	9'-11			12.264		PO(5'-0), fd(22'-0)	27'-0	Pv
Route 5								
DY	1.0490	18.07	6.71	120		0.107815	0'-0	Pf 2.911
210	9'-0	18.07	5.6	10.408		Sprinkler,	27'-0	Pe -0.397
31	9'-11			12.921		PO(5'-0), fd(22'-0)	27'-0	Pv



Hydraulic Analysis

Job Number: SK0917
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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	1.4420	18.07	3.55	120		0.022893	8'-5½"	Pf 0.194
31	9'-11			12.921				Pe
29	9'-11			13.115			8'-5½"	Pv
Route 6								
DY	1.0490	18.71	6.95	120		0.115024	0'-0"	Pf 3.106
206	9'-0	18.71	5.6	11.162		Sprinkler,	27'-0"	Pe -0.397
27	9'-11			13.870		PO(5'-0), fd(22'-0)	27'-0"	Pv
BL	1.4420	18.71	3.68	120		0.024423	9'-2½"	Pf 0.225
27	9'-11			13.870				Pe
26	9'-11			14.095			9'-2½"	Pv
BL	1.4420	37.57	7.38	120		0.088696	12'-5"	Pf 1.101
26	9'-11	18.86		14.095		Flow (q) from Route 7		Pe
23	9'-11			15.196			12'-5"	Pv
BL	1.4420	57.14	11.23	120		0.192687	4'-6½"	Pf 2.306
23	9'-11	19.57		15.196		Flow (q) from Route 10	7'-5"	Pe
21	9'-11			17.502		PO(7'-5)	11'-11½"	Pv
CM	2.6350	77.92	4.58	120		0.018156	9'-3"	Pf 0.168
21	9'-11	20.78		17.502		Flow (q) from Route 11		Pe
20	9'-11			17.670			9'-3"	Pv
Route 7								
DY	1.0490	18.86	7.00	120		0.116726	0'-0"	Pf 3.152
205	9'-0	18.86	5.6	11.341		Sprinkler,	27'-0"	Pe -0.397
26	9'-11			14.095		PO(5'-0), fd(22'-0)	27'-0"	Pv
Route 8								
DY	1.0490	18.96	7.04	120		0.117917	0'-0"	Pf 3.184
201	9'-0	18.96	5.6	11.466		Sprinkler,	27'-0"	Pe -0.397
22	9'-11			14.252		PO(5'-0), fd(22'-0)	27'-0"	Pv
Route 9								
DY	1.0490	18.98	7.05	120		0.118118	0'-0"	Pf 3.189
203	9'-0	18.98	5.6	11.487		Sprinkler,	27'-0"	Pe -0.397
24	9'-11			14.279		PO(5'-0), fd(22'-0)	27'-0"	Pv
Route 10								
DY	1.0490	19.57	7.27	120		0.125044	0'-0"	Pf 3.376
202	9'-0	19.57	5.6	12.217		Sprinkler,	27'-0"	Pe -0.397
23	9'-11			15.196		PO(5'-0), fd(22'-0)	27'-0"	Pv
Route 11								
DY	1.0490	20.78	7.71	120		0.139681	0'-0"	Pf 3.771
200	9'-0	20.78	5.6	13.770		Sprinkler,	27'-0"	Pe -0.397
18	9'-11			17.144		PO(5'-0), fd(22'-0)	27'-0"	Pv
BL	1.4420	20.78	4.08	120		0.029659	4'-7½"	Pf 0.358
18	9'-11			17.144			7'-5"	Pe
21	9'-11			17.502		PO(7'-5)	12'-1"	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



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