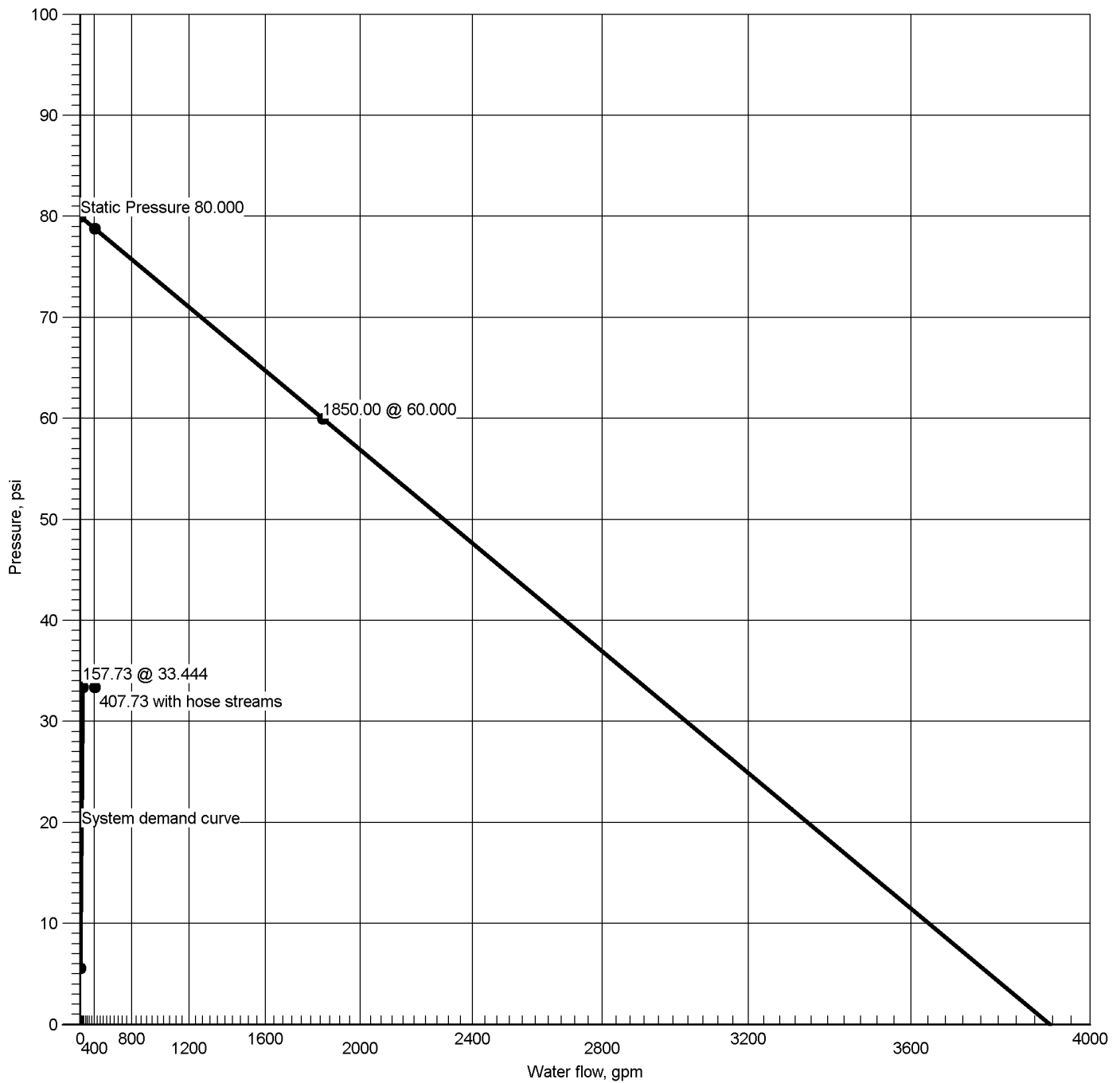


STATE OF MISSOURI
TOM R. HAMPTON
E-10846
REGISTERED PROFESSIONAL ENGINEER
4/10/22



Water Supply at Node 1



Hydraulic Graph

Water Supply at Node 1

Static: Pressure
80.000

Residual: Pressure
60.000 @ 1850.00

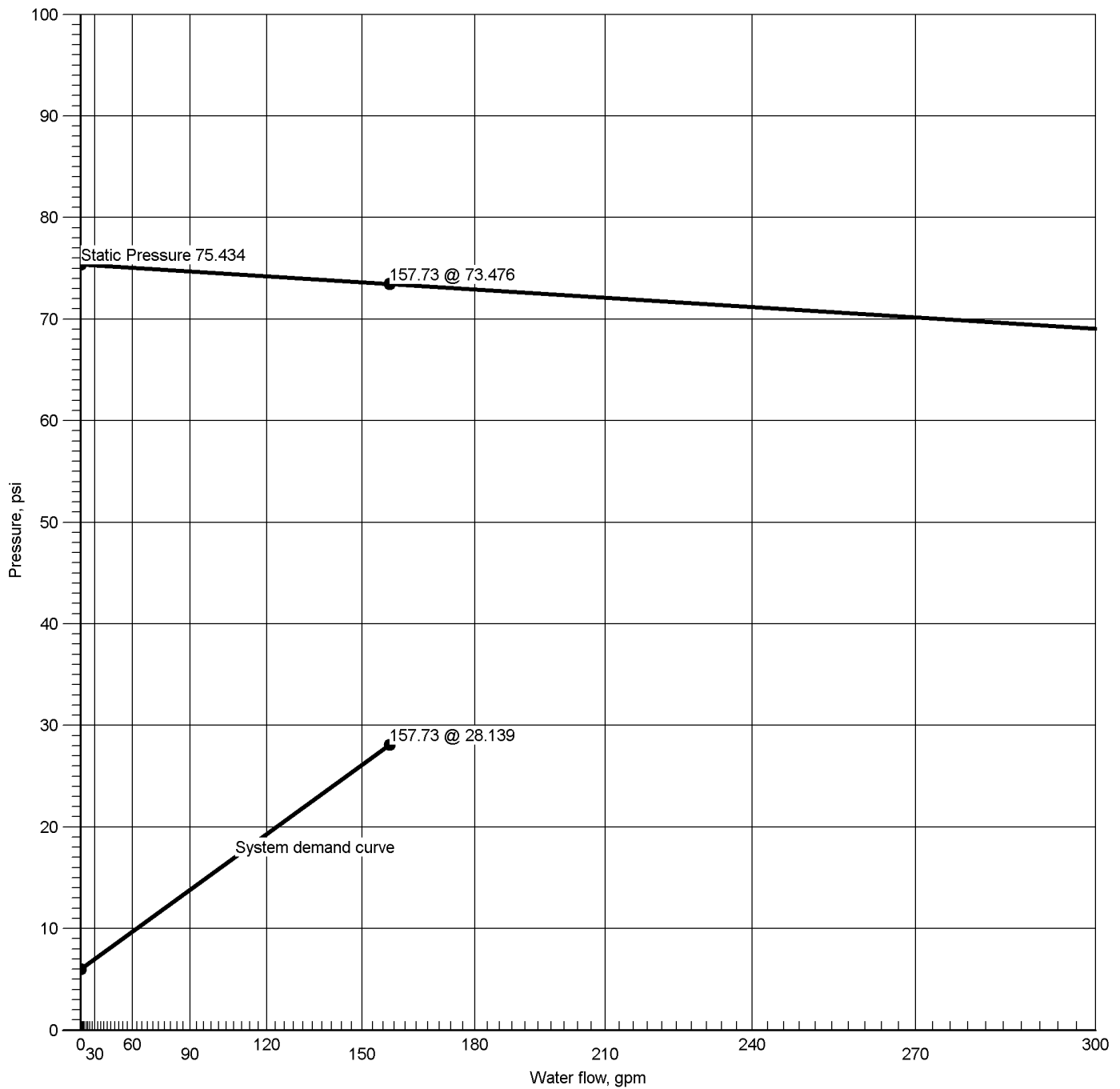
Available Pressure at System Demand
78.781 @ 407.73

Required Pressure at System Demand
33.444 @ 157.73

Required Pressure at System Demand (Including Hose Allowance at Source)
33.444 @ 407.73



BOR at Node 4



Hydraulic Graph

BOR at Node 4

Static: Pressure

75.434

Residual: Pressure

N/A

Available Pressure at System Demand

73.476 @ 157.73

Required Pressure at System Demand

28.139 @ 157.73

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

N/A



Summary Of Outflowing Devices

Job Number: SK0917

Report Description: Ordinary Group I (1)

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Sprinkler	100	18.81	16.20	5.6	11.284		
Sprinkler	101	18.17	14.82	5.6	10.526		
Sprinkler	102	21.58	14.82	5.6	14.846		
Sprinkler	103	15.47	14.82	5.6	7.628		
⇒ Sprinkler	104	14.82	14.82	5.6	7.000		
Sprinkler	105	17.21	14.82	5.6	9.449		
Sprinkler	106	15.34	14.82	5.6	7.501		
Sprinkler	107	14.90	14.82	5.6	7.079		

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: SK0917

Report Description: Ordinary Group I (1)

Node	Elevation(Feet)	Fittings	Pressure(psi)	Discharge(gpm)
1	-3'-0	S	33.444	157.73
100	9'-0	Spr(-11.284), fd(22'-0)	11.284	18.81
101	9'-0	Spr(-10.526), fd(22'-0)	10.526	18.17
102	9'-11	Spr(-14.846)	14.846	21.58
103	9'-0	Spr(-7.628), fd(22'-0)	7.628	15.47
104	9'-0	Spr(-7.000), fd(22'-0)	7.000	14.82
105	9'-0	Spr(-9.449), fd(22'-0)	9.449	17.21
106	9'-0	Spr(-7.501), fd(22'-0)	7.501	15.34
107	9'-0	Spr(-7.079), fd(22'-0)	7.079	14.90
108	9'-11	Spr(-14.663)	14.663	21.44
2	-7'-0	E(44'-3)	35.154	
3	-4'-0	EE(15'-3)	28.175	
4	-4'-0	E(17'-7), BOR	28.139	
5	8'-7	PO(20'-2)	20.735	
6	9'-11	PO(6'-0)	15.936	
7	9'-11	C(5'-0)	14.024	
8	9'-11	C(5'-0)	13.673	
9	9'-11	PO(8'-0)	15.849	
10	9'-11	T(5'-0)	15.656	
11	9'-11	PO(8'-0)	15.764	
12	9'-11	T(5'-0)	12.013	
13	9'-11	C(5'-0)	10.040	
14	9'-11	T(5'-0)	9.479	
15	9'-11	PO(5'-0)	15.760	
16	9'-6	PO(26'-4)	21.715	



Hydraulic Analysis

Job Number: SK0917
Report Description: Ordinary Group I (1)

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
BL	1.0490	14.82	5.50	120		0.074703	9'-6"	Pf 2.877
104	9'-0	14.82	5.6	7.000		Sprinkler,	29'-0"	Pe -0.397
14	9'-11			9.479		E(2'-0), T(5'-0), fd(22'-0)	38'-6"	Pv
BL	1.3800	29.72	6.37	120		0.071200	7'-10½"	Pf 0.560
14	9'-11	14.90		9.479		Flow (q) from Route 2		Pe
13	9'-11			10.040			7'-10½"	Pv
BL	1.3800	60.52	12.98	120		0.265438	7'-5"	Pf 1.974
13	9'-11	15.34 + 15.47		10.040		Flow (q) from Route 3 and 4		Pe
12	9'-11			12.013			7'-5"	Pv
BL	1.6100	77.73	12.25	120		0.199088	10'-10"	Pf 3.750
12	9'-11	17.21		12.013		Flow (q) from Route 5	8'-0"	Pe
11	9'-11			15.764		PO(8'-0)	18'-10"	Pv
CM	3.2600	99.18	3.81	120		0.010061	8'-6½"	Pf 0.086
11	9'-11	21.44		15.764		Flow (q) from Route 8		Pe
9	9'-11			15.849			8'-6½"	Pv
CM	3.2600	120.75	4.64	120		0.014481	6'-0"	Pf 0.087
9	9'-11	21.58		15.849		Flow (q) from Route 9		Pe
6	9'-11			15.936			6'-0"	Pv
CM	3.2600	157.73	6.06	120		0.023738	106'-7"	Pf 4.221
6	9'-11	36.98		15.936		Flow (q) from Route 6	71'-3"	Pe 0.578
5	8'-7			20.735		3E(9'-5), f(-0.000), BV(9'-5), 2fE (6'-8½), PO(20'-2)	177'-9½"	Pv
FM	4.2600	157.73	3.55	120		0.006450	134'-6½"	Pf 1.377
5	8'-7			20.735			79'-0"	Pe -0.397
16	9'-6			21.715		T(26'-4), 2E(13'-2), PO(26'-4)	213'-6½"	Pv
CM	6.3570	157.73	1.59	120		0.000918	398'-5½"	Pf 0.571
16	9'-6			21.715			228'-10"	Pe 5.853
4	-4'-0			28.139		12E(17'-7), f(-0.000), CV(-0.015), BV(17'-7), BOR	627'-3½"	Pv
UG	8.3900	157.73	0.92	140		0.000179	93'-10"	Pf 0.036
4	-4'-0			28.139			106'-10½"	Pe
3	-4'-0			28.175		3E(30'-6½), EE(15'-3)	200'-9"	Pv
UG	12.4600	157.73	0.42	140		0.000026	1237'-10"	Pf 5.678
3	-4'-0			28.175			44'-3"	Pe 1.301
2	-7'-0			35.154		BFP(-5.482), E(44'-3)	1282'-1"	Pv
UG	6.2800	157.73	1.63	140		0.000733	11'-6½"	Pf 0.025
2	-7'-0			35.154			22'-1"	Pe -1.734
1	-3'-0			33.444		E(22'-1), S	33'-7½"	Pv
		250.00				Hose Allowance At Source		
1		407.73						
Route 2								
BL	1.0490	14.90	5.53	120		0.075487	13'-0½"	Pf 2.797
107	9'-0	14.90	5.6	7.079		Sprinkler,	24'-0"	Pe -0.397
14	9'-11			9.479		E(2'-0), fd(22'-0)	37'-0½"	Pv
Route 3								
BL	1.0490	15.34	5.69	120		0.079639	7'-10½"	Pf 2.936
106	9'-0	15.34	5.6	7.501		Sprinkler,	29'-0"	Pe -0.397
13	9'-11			10.040		E(2'-0), C(5'-0), fd(22'-0)	36'-10½"	Pv
Route 4								
BL	1.0490	15.47	5.74	120		0.080884	5'-8½"	Pf 2.809
103	9'-0	15.47	5.6	7.628		Sprinkler,	29'-0"	Pe -0.397
13	9'-11			10.040		E(2'-0), C(5'-0), fd(22'-0)	34'-8½"	Pv
Route 5								
BL	1.0490	17.21	6.39	120		0.098592	3'-0½"	Pf 2.962
105	9'-0	17.21	5.6	9.449		Sprinkler,	27'-0"	Pe -0.397
12	9'-11			12.013		T(5'-0), fd(22'-0)	30'-0½"	Pv
Route 6								
DY	1.0490	18.81	6.98	120		0.116189	0'-0"	Pf 3.137
100	9'-0	18.81	5.6	11.284		Sprinkler,	27'-0"	Pe -0.397
7	9'-11			14.024		C(5'-0), fd(22'-0)	27'-0"	Pv
BL	1.3800	36.98	7.93	120		0.106703	11'-11"	Pf 1.912
7	9'-11	18.17		14.024		Flow (q) from Route 7	6'-0"	Pe
6	9'-11			15.936		PO(6'-0)	17'-11"	Pv
Route 7								



Hydraulic Analysis

Job Number: SK0917
Report Description: Ordinary Group I (1)

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream					Fittings	Total Length	
BL	1.0490	18.17	6.74	120	0.108943	3'-6½"	Pf 3.545
101	9'-0	18.17	5.6	10.526	Sprinkler,	29'-0	Pe -0.397
8	9'-11			13.673	E(2'-0), C(5'-0), fd(22'-0)	32'-6½"	Pv
BL	1.3800	18.17	3.90	120	0.028653	12'-3	Pf 0.351
8	9'-11			13.673			Pe
7	9'-11			14.024		12'-3	Pv

Route 8

BL	1.0490	21.44	7.96	120	0.148041	2'-5	Pf 1.097
108	9'-11	21.44	5.6	14.663	Sprinkler,	5'-0	Pe
15	9'-11			15.760	PO(5'-0)	7'-5	Pv
CM	3.2600	21.44	0.82	120	0.000592	5'-1	Pf 0.003
15	9'-11			15.760			Pe
11	9'-11			15.764		5'-1	Pv

Route 9

BL	1.0490	21.58	8.01	120	0.149746	0'-5	Pf 0.810
102	9'-11	21.58	5.6	14.846	Sprinkler,	5'-0	Pe
10	9'-11			15.656	T(5'-0)	5'-5	Pv
BL	1.6100	21.58	3.40	120	0.018590	2'-5	Pf 0.194
10	9'-11			15.656		8'-0	Pe
9	9'-11			15.849	PO(8'-0)	10'-5	Pv

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



Hydraulic Analysis

Job Number: SK0917
Report Description: Ordinary Group I (1)

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

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