Hydraulic Summary

Job Number: NC-1403
Report Description: ESFR (NW System 1)

Job

Job Number: NC-1403	Designer: DB
Job Name: Town Center 22	State Certification/License Number:
Address 1: NE Town Center Blvd. Lee's Summit MO 64064	AHJ: Lee's Summit
Address 2:	Job Site/Building:
Address 3:	Drawing Name: Town Center 22 draw

System

Most Demanding Sprinkler Data: 16.8 K-Factor 121.15 at 52.000

Hose Allowance At Source: 0.00

Additional Hose Supplies

Node	Flow(gpm)
Hydrant At Node 4790	250.00

Total Hose Streams: 250.00

System Flow Demand	Total Water Required (Including Hose Allowance)
1708.95	1708.95

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 32.08 between nodes 9 and 8

Maximum Velocity Under Ground	
8.47 between nodes 53 and 52	

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
20665.71 gal	

Remote Area(s)

Occupancy	Job Suffix
ESFR	

Pressure	Area of Application
52.000	NA

Number Of Sprinklers Calculated	Number Of Nozzles Calculated	Coverage Per Sprinkler
12	0	100.00 ft²

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi) @ Flow (gpm)	Available (psi) @ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
16	Water Supply		82.000	50.000 @ 1900.00	55.697 @ 1708.95	41.335	14.362
72	Pump		147.000	130.000 @ 1500.00	171.116 @ 1458.95	156.753	14.362

Pumps: Static = Churn (Pressure @ Zero Flow)

Contractor

	Contractor Number	Contact Name	Contact Title
	1	Derek Bisoglio	Design

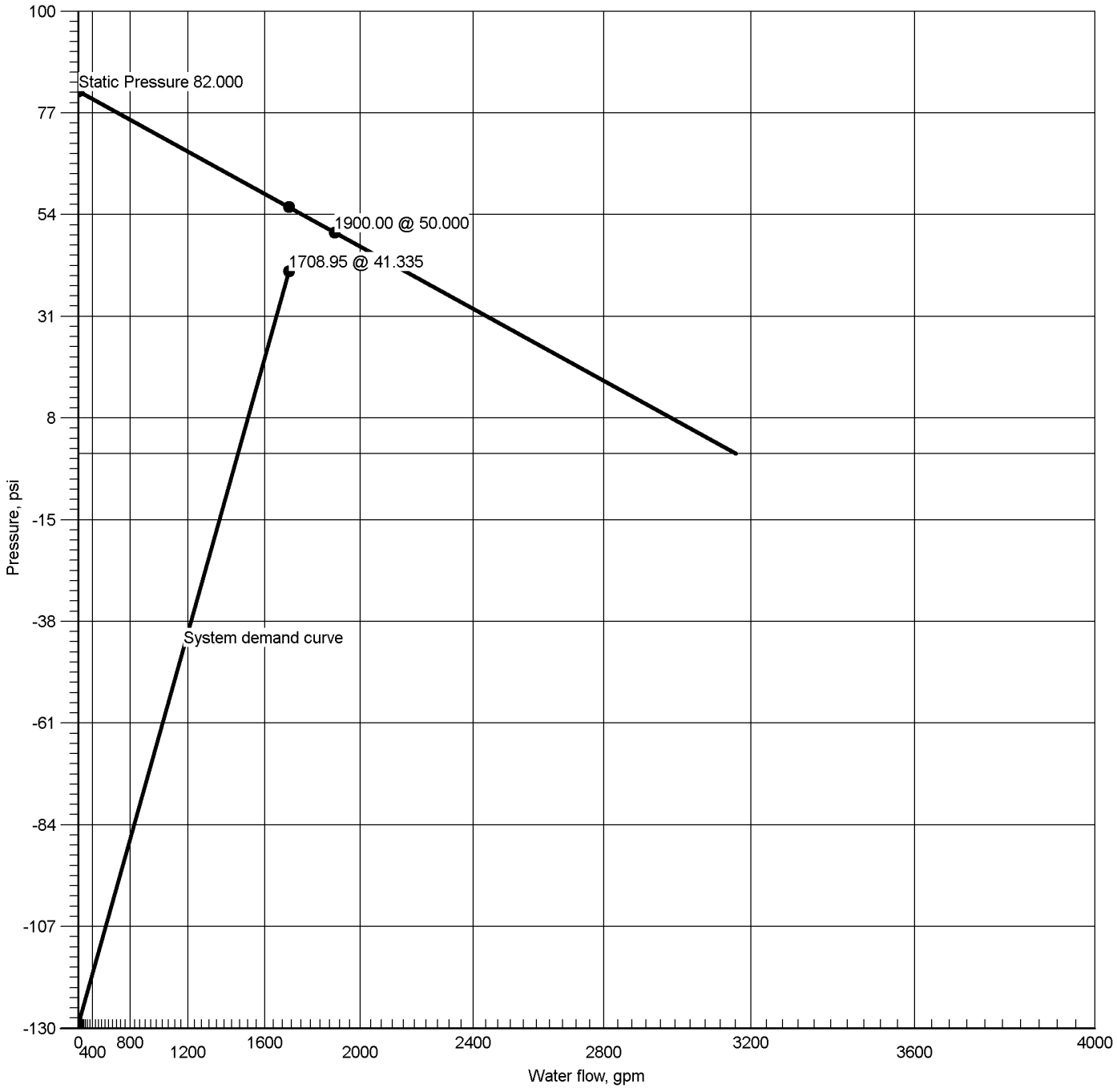
Name of Contractor:	Phone	Extension
Alliance Fire Protection	816-679-8021	

Address 1	FAX
130 w 9th Ave. Suite 100	

Address 2	E-mail
North Kansas City, MO 64116	dbisoglio@afpsprink.com

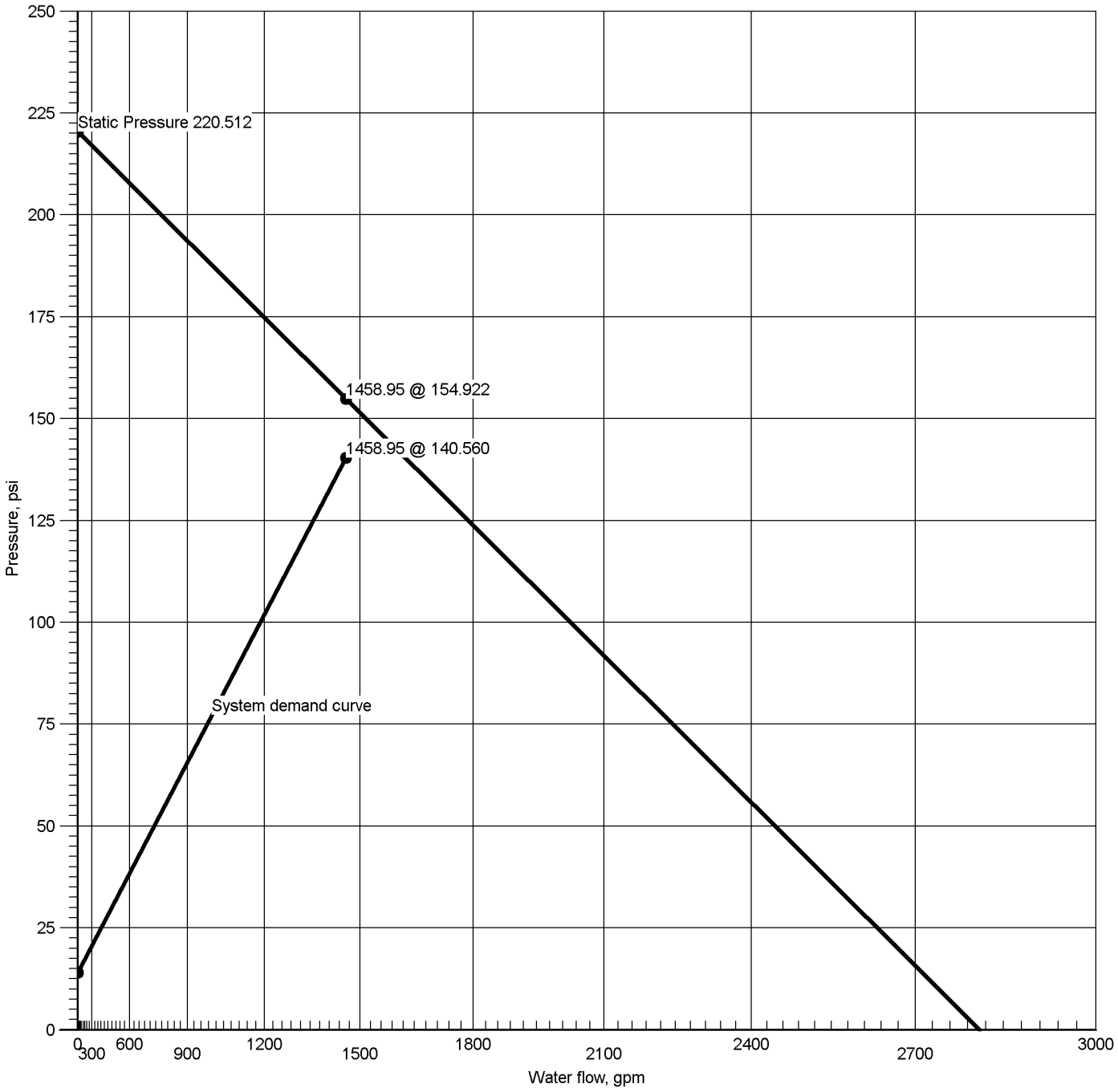
Address 3	Web-Site

Water Supply at Node 16



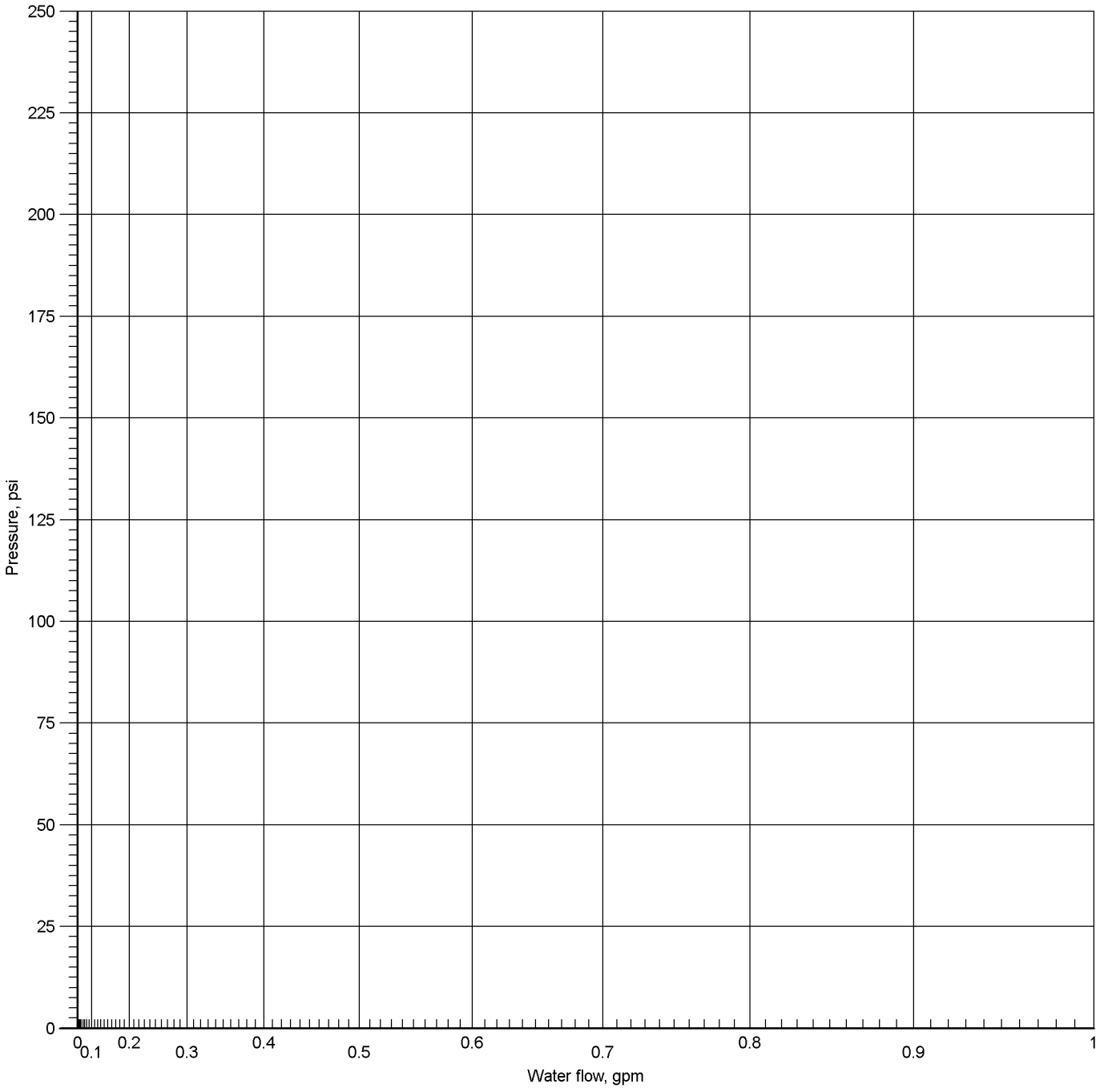
Hydraulic Graph	Water Supply at Node 16
Static: Pressure	82.000
Residual: Pressure	50.000 @ 1900.00
Available Pressure at System Demand	55.697 @ 1708.95
Required Pressure at System Demand	41.335 @ 1708.95
Required Pressure at System Demand (Including Hose Allowance at Source)	41.335 @ 1708.95

BOR 1 at Node 11



Hydraulic Graph	BOR 1 at Node 11
Static: Pressure	220.512
Residual: Pressure	N/A
Available Pressure at System Demand	154.922 @ 1458.95
Required Pressure at System Demand	140.560 @ 1458.95
Required Pressure at System Demand (Including Hose Allowance at Source)	N/A

BOR 2 at Node 70



Hydraulic Graph
BOR 2 at Node 70

Static: Pressure
220.381

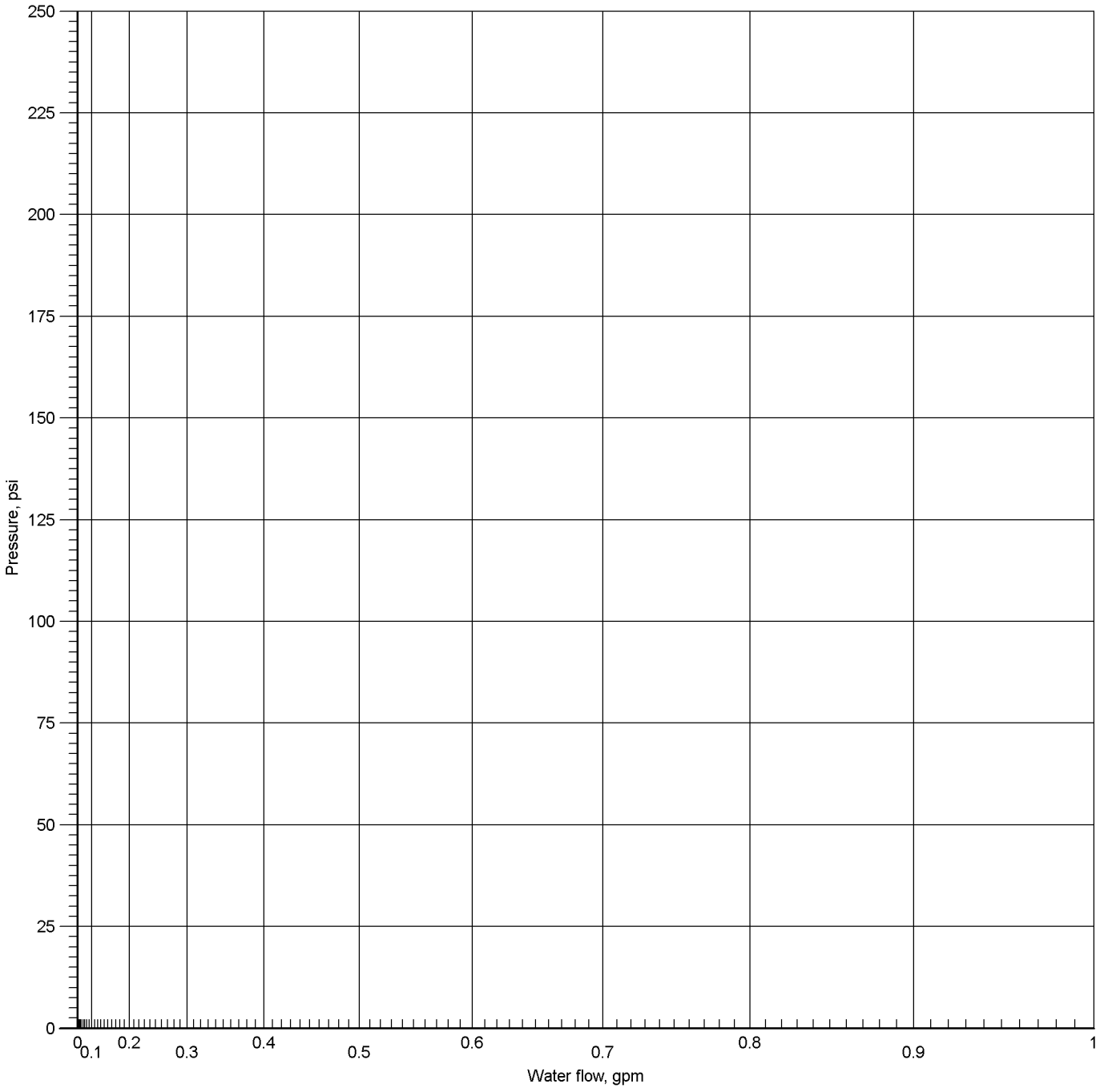
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
142.303 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 3 at Node 51



Hydraulic Graph
BOR 3 at Node 51

Static: Pressure
221.054

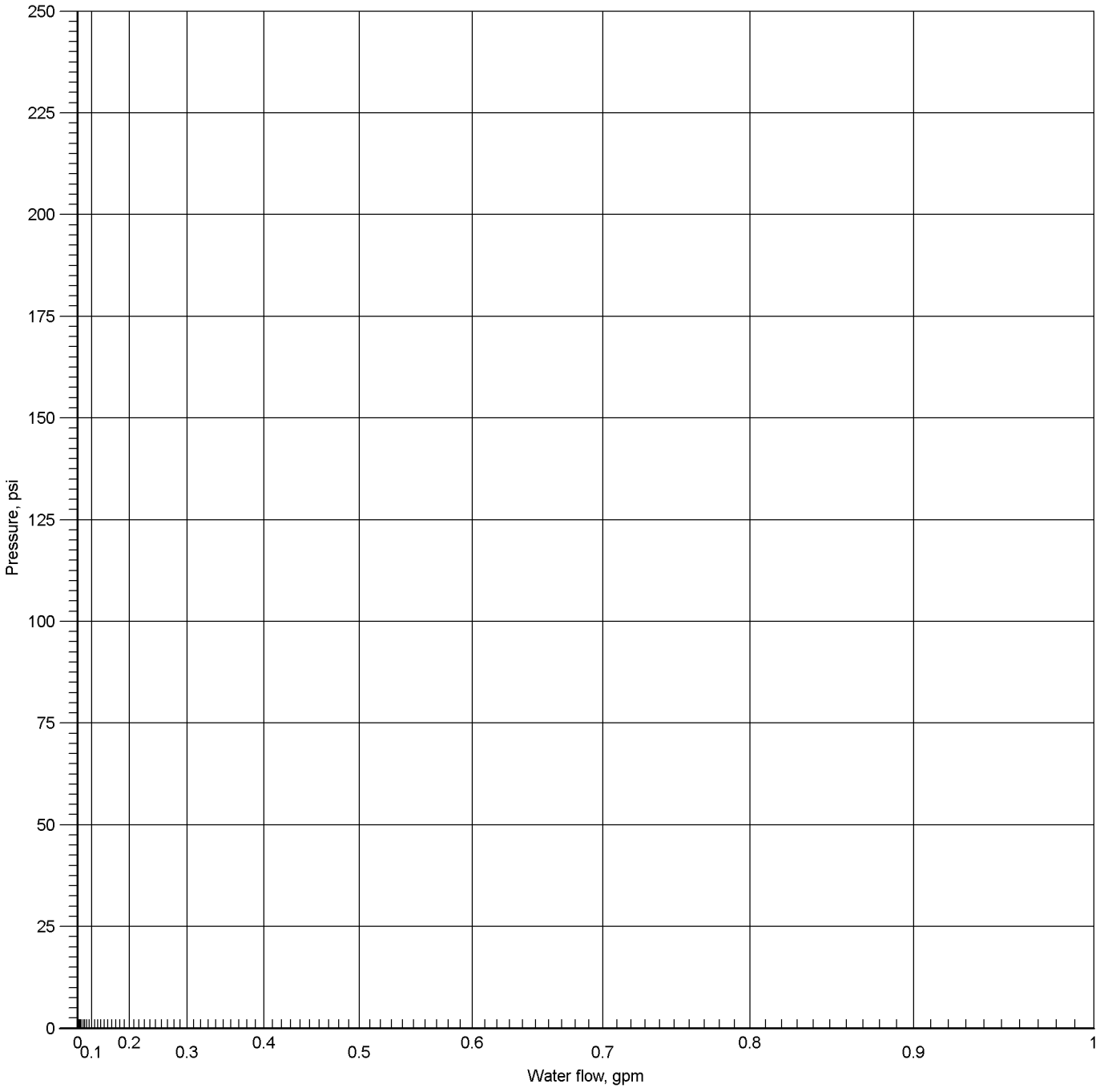
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
143.527 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 6 at Node 117



Hydraulic Graph
BOR 6 at Node 117

Static: Pressure
221.054

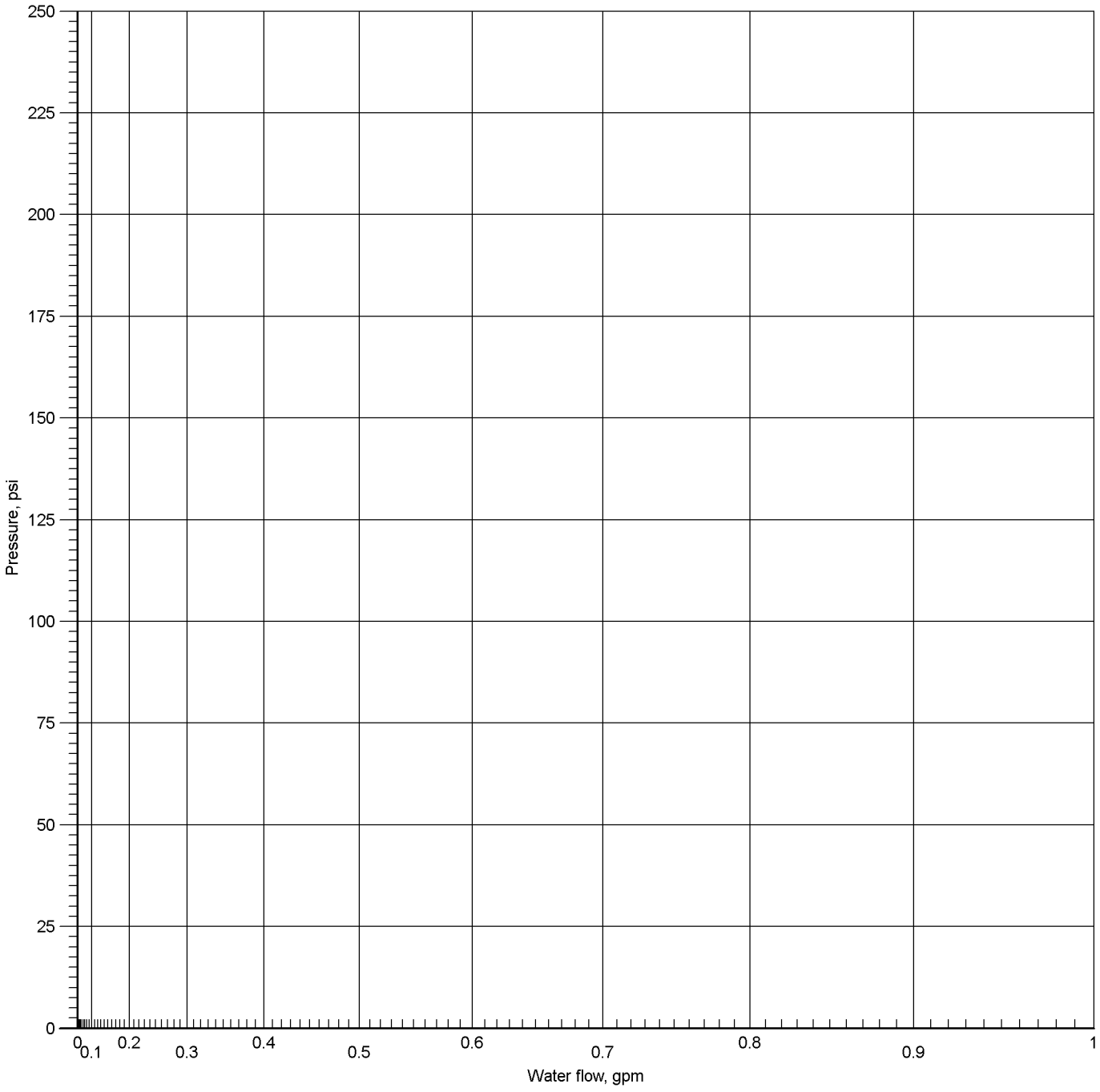
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
144.860 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 4 at Node 35



Hydraulic Graph
BOR 4 at Node 35

Static: Pressure
221.054

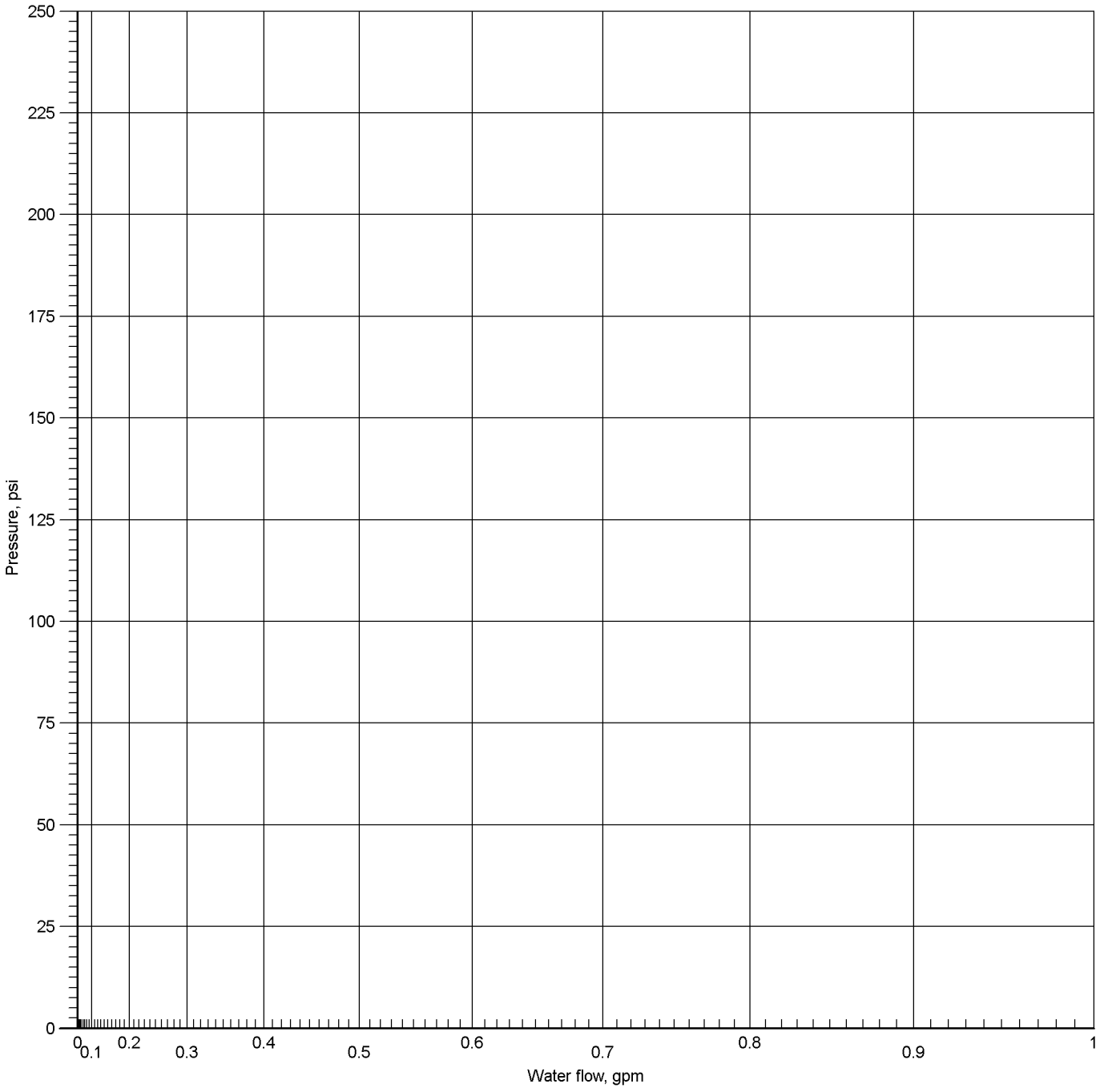
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
144.860 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 5 at Node 86



Hydraulic Graph
BOR 5 at Node 86

Static: Pressure
221.054

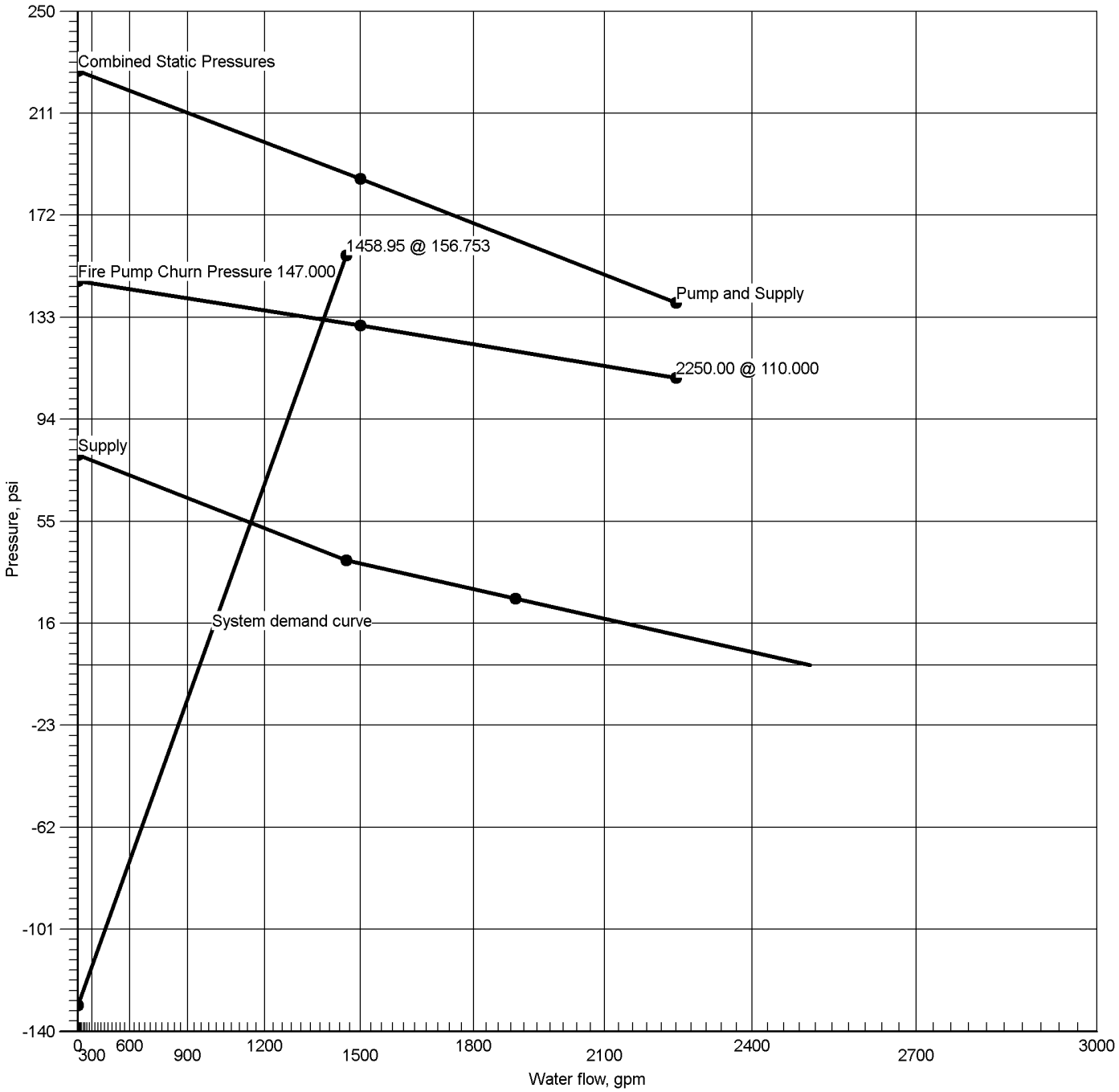
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
144.860 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

Pump at Node 72



Hydraulic Graph	Static + Churn Pressure	Fire Pump Rating
Pump at Node 72	227.555	130.000 @ 1500.00
Static: Pressure	**Fire Pump Churn Pressure**	
227.555	147.000	
Residual: Pressure		
130.941 @ 1458.95		
Available Pressure at System Demand		
171.116 @ 1458.95		
Required Pressure at System Demand		
156.753 @ 1458.95		

Summary Of Outflowing Devices

Job Number: NC-1403
Report Description: ESFR (NW System 1)

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Sprinkler	**101**	**121.15**	**121.15**	**16.8**	**52.000**			
Sprinkler	102	121.37	121.15	16.8	52.196			
Sprinkler	103	121.18	121.15	16.8	52.030			
Sprinkler	104	121.85	121.15	16.8	52.603			
Sprinkler	105	121.21	121.15	16.8	52.055			
Sprinkler	106	121.44	121.15	16.8	52.250			
Sprinkler	107	121.25	121.15	16.8	52.086			
Sprinkler	108	121.91	121.15	16.8	52.661			
Sprinkler	109	121.65	121.15	16.8	52.436			
Sprinkler	110	121.88	121.15	16.8	52.628			
Sprinkler	111	121.69	121.15	16.8	52.469			
Sprinkler	112	122.37	121.15	16.8	53.055			
Hydrant	4790	250.00	250.00	0	28.130			

Most Demanding Sprinkler Data

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
16	-4'-0	S, E(27'-2)	41.335	1708.95	
101	37'-4½	Spr(-52.000)	52.000	121.15	
102	37'-4½	Spr(-52.196)	52.196	121.37	
103	37'-4½	Spr(-52.030)	52.030	121.18	
104	37'-4½	Spr(-52.603)	52.603	121.85	
105	37'-7	Spr(-52.055)	52.055	121.21	
106	37'-7	Spr(-52.250)	52.250	121.44	
107	37'-7	Spr(-52.086)	52.086	121.25	
108	37'-7	Spr(-52.661)	52.661	121.91	
109	37'-9½	Spr(-52.436)	52.436	121.65	
110	37'-9½	Spr(-52.628)	52.628	121.88	
111	37'-9½	Spr(-52.469)	52.469	121.69	
112	37'-9½	Spr(-53.055)	53.055	122.37	
4790	0'-0	Hyd	28.130	250.00	
1	35'-2½	PO(18'-8½)	98.250		
2	35'-5	PO(18'-8½)	98.262		
3	35'-7½	PO(18'-8½)	98.539		
4	35'-10	PO(18'-8½)	99.225		
5	36'-0½	PO(18'-8½)	100.323		
6	36'-3	PO(18'-8½)	101.913		
7	36'-5½	PO(18'-8½)	104.083		
8	36'-8	PO(18'-8½)	106.932		
9	36'-8½	E(13'-11)	112.895		
10	35'-2	E(17'-7)	126.871		
11	5'-2½	BV(14'-1), BOR 1	140.560		
14	2'-10	T(41'-1½)	25.121		
15	-4'-0	T(59'-4½)	29.815		
17	35'-2½	PO(18'-8½)	63.804		
18	35'-5	PO(18'-8½)	63.887		
19	35'-7½	PO(18'-8½)	64.421		
20	35'-10	PO(18'-8½)	65.659		
21	36'-0½	PO(18'-8½)	66.461		
22	36'-3	PO(18'-8½)	66.908		
23	36'-5½	PO(18'-8½)	67.079		
24	36'-8	PO(18'-8½)	67.064		
52	3'-0	PO(41'-1½), C(41'-1½)	144.860		
53	1'-11	BV(20'-4½)	148.394		
71	-0'-10½		156.753		
72	-0'-10½	P2(-130.851)	156.753		
73	-0'-8	P1	25.812		
149	-4'-0	E(22'-1)	29.914		
150	-4'-0	T(59'-4½)	29.949		

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •								
CM	2.7050	86.95	4.85	120		0.019572	10'-0	Pf 0.196
101	37'-4½	121.15	16.8	52.000		Sprinkler		Pe 0.000
102	37'-4½			52.196			10'-0	Pv
CM	2.7050	208.32	11.63	120		0.098551	420'-4	Pf 45.115
102	37'-4½	121.37	16.8	52.196		Sprinkler,	37'-5	Pe 0.939
1	35'-2½			98.250		2PO(18'-8½)	457'-9½	Pv
CM	4.3100	208.32	4.58	120		0.010196	10'-0	Pf 0.102
1	35'-2½			98.250				Pe -0.090
2	35'-5			98.262			10'-0	Pv
CM	4.3100	416.54	9.16	120		0.036737	10'-0	Pf 0.367
2	35'-5	208.22		98.262		Flow (q) from Route 3		Pe -0.090
3	35'-7½			98.539			10'-0	Pv
CM	4.3100	624.50	13.73	120		0.077711	10'-0	Pf 0.777
3	35'-7½	207.96		98.539		Flow (q) from Route 5		Pe -0.090
4	35'-10			99.225			10'-0	Pv
CM	4.3100	785.61	17.28	120		0.118819	10'-0	Pf 1.188
4	35'-10	161.11		99.225		Flow (q) from Route 12		Pe -0.090
5	36'-0½			100.323			10'-0	Pv
CM	4.3100	947.49	20.84	120		0.168040	10'-0	Pf 1.680
5	36'-0½	161.88		100.323		Flow (q) from Route 11		Pe -0.090
6	36'-3			101.913			10'-0	Pv
CM	4.3100	1112.30	24.46	120		0.226079	10'-0	Pf 2.260
6	36'-3	164.81		101.913		Flow (q) from Route 10		Pe -0.090
7	36'-5½			104.083			10'-0	Pv
CM	4.3100	1282.13	28.19	120		0.294053	10'-0	Pf 2.940
7	36'-5½	169.83		104.083		Flow (q) from Route 9		Pe -0.090
8	36'-8			106.932			10'-0	Pv
CM	4.3100	1458.95	32.08	120		0.373442	2'-1	Pf 5.981
8	36'-8	176.82		106.932		Flow (q) from Route 2	13'-11	Pe -0.019
9	36'-8½			112.895		E(13'-11)	16'-0	Pv
CM	6.3570	1458.95	14.75	120		0.056272	183'-10	Pf 13.315
9	36'-8½			112.895			52'-9½	Pe 0.661
10	35'-2			126.871		3E(17'-7)	236'-7½	Pv
FR	8.2490	1458.95	8.76	120		0.015822	29'-11½	Pf 0.697
10	35'-2			126.871			14'-1	Pe 12.992
11	5'-2½			140.560		f(-0.000), BV(14'-1), BOR 1	44'-0½	Pv
CM	8.2490	1458.95	8.76	120		0.015822	6'-0	Pf 3.347
11	5'-2½			140.560			205'-6½	Pe 0.953
52	3'-0			144.860		3PO(41'-1½), T(41'-1½), C(41'-1½)	211'-6½	Pv
UG	8.3900	1458.95	8.47	140		0.010954	91'-11	Pf 3.070
52	3'-0			144.860			188'-3½	Pe 0.464
53	1'-11			148.394		sCV(76'-4), 3E(30'-6½), BV(20'-4½)	280'-3	Pv
DY	8.2490	1458.95	8.76	120		0.015822	2'-8	Pf 7.144
53	1'-11			148.394			164'-5	Pe 1.216
71	-0'-10½			156.753		2E(21'-1½), T(41'-1½), PRV(-4.500), 2BV(14'-1), sCV(52'-10)	167'-1	Pv
DY	6.0650	1458.95	16.20	120		0.070753	0'-0	Pf 0.000
71	-0'-10½			156.753				Pe -0.000
72	-0'-10½			156.753			0'-0	Pv
Pump			**Velocity**					
72		1458.95		156.753		Rating: 130.000 @ 1500.00		
73		Q=1458.95	8.76	25.812		Fire Pump Churn Pressure: 147.000		
FR	8.2490	1458.95	8.76	120		0.015822	6'-5½	Pf 0.827
73	-0'-8			25.812			45'-9½	Pe -1.518
14	2'-10			25.121		GV(4'-8½), T(41'-1½)	52'-3	Pv
UG	8.3900	1458.95	8.47	140		0.010954	68'-2	Pf 1.732
14	2'-10			25.121			89'-11	Pe 2.962
15	-4'-0			29.815		E(30'-6½), T(59'-4½)	158'-1	Pv
CM	7.9800	666.51	4.28	150		0.002888	2122'-8½	Pf 11.519
15	-4'-0			29.815			134'-3½	Pe
16	-4'-0			41.335		6EE(13'-7), BFP(-5.000), T(52'-10)	2257'-0½	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
		0.00				Hose Allowance At Source		
16		1708.95						
• • • • • Route 2 • • • • •								
CM	2.7050	34.20	1.91	120		0.003483	8'-9	Pf 0.030
101	37'-4½	121.15	16.8	52.000		Sprinkler		Pe -0.000
103	37'-4½			52.030			8'-9	Pv
CM	2.7050	155.38	8.67	120		0.057291	10'-0	Pf 0.573
103	37'-4½	121.18	16.8	52.030		Sprinkler		Pe -0.000
104	37'-4½			52.603			10'-0	Pv
CM	2.7050	277.23	15.48	120		0.167204	23'-11	Pf 10.262
104	37'-4½	121.85	16.8	52.603		Sprinkler,	37'-5	Pe 0.939
17	35'-2½			63.804		2PO(18'-8½)	61'-4½	Pv
CM	4.3100	277.23	6.10	120		0.017298	10'-0	Pf 0.173
17	35'-2½			63.804				Pe -0.090
18	35'-5			63.887			10'-0	Pv
CM	4.3100	554.82	12.20	120		0.062436	10'-0	Pf 0.624
18	35'-5	277.59		63.887		Flow (q) from Route 4		Pe -0.090
19	35'-7½			64.421			10'-0	Pv
CM	4.3100	834.45	18.35	120		0.132843	10'-0	Pf 1.328
19	35'-7½	279.63		64.421		Flow (q) from Route 6		Pe -0.090
20	35'-10			65.659			10'-0	Pv
CM	4.3100	673.34	14.81	120		0.089326	10'-0	Pf 0.893
20	35'-10			65.659				Pe -0.090
21	36'-0½			66.461			10'-0	Pv
CM	4.3100	511.46	11.25	120		0.053709	10'-0	Pf 0.537
21	36'-0½			66.461				Pe -0.090
22	36'-3			66.908			10'-0	Pv
CM	4.3100	346.65	7.62	120		0.026154	10'-0	Pf 0.262
22	36'-3			66.908				Pe -0.090
23	36'-5½			67.079			10'-0	Pv
CM	4.3100	176.82	3.89	120		0.007528	10'-0	Pf 0.075
23	36'-5½			67.079				Pe -0.090
24	36'-8			67.064			10'-0	Pv
RN	2.7050	176.82	9.87	120		0.072764	473'-0½	Pf 39.868
24	36'-8			67.064		PO(18'-8½)	74'-10½	Pe 0.000
8	36'-8			106.932		3PO(18'-8½)	547'-11	Pv
• • • • • Route 3 • • • • •								
CM	2.7050	86.78	4.84	120		0.019501	10'-0	Pf 0.195
105	37'-7	121.21	16.8	52.055		Sprinkler		Pe 0.000
106	37'-7			52.250			10'-0	Pv
CM	2.7050	208.22	11.62	120		0.098457	420'-4	Pf 45.073
106	37'-7	121.44	16.8	52.250		Sprinkler,	37'-5	Pe 0.939
2	35'-5			98.262		2PO(18'-8½)	457'-9½	Pv
• • • • • Route 4 • • • • •								
CM	2.7050	34.43	1.92	120		0.003527	8'-9	Pf 0.031
105	37'-7	121.21	16.8	52.055		Sprinkler		Pe -0.000
107	37'-7			52.086			8'-9	Pv
CM	2.7050	155.68	8.69	120		0.057495	10'-0	Pf 0.575
107	37'-7	121.25	16.8	52.086		Sprinkler		Pe -0.000
108	37'-7			52.661			10'-0	Pv
CM	2.7050	277.59	15.50	120		0.167612	23'-11	Pf 10.287
108	37'-7	121.91	16.8	52.661		Sprinkler,	37'-5	Pe 0.939
18	35'-5			63.887		2PO(18'-8½)	61'-4½	Pv
• • • • • Route 5 • • • • •								
CM	2.7050	86.09	4.81	120		0.019214	10'-0	Pf 0.192
109	37'-9½	121.65	16.8	52.436		Sprinkler		Pe 0.000
110	37'-9½			52.628			10'-0	Pv
CM	2.7050	207.96	11.61	120		0.098236	420'-4	Pf 44.971
110	37'-9½	121.88	16.8	52.628		Sprinkler,	37'-5	Pe 0.939
3	35'-7½			98.539		2PO(18'-8½)	457'-9½	Pv
• • • • • Route 6 • • • • •								
CM	2.7050	35.57	1.99	120		0.003745	8'-9	Pf 0.033
109	37'-9½	121.65	16.8	52.436		Sprinkler		Pe -0.000
111	37'-9½			52.469			8'-9	Pv
CM	2.7050	157.26	8.78	120		0.058579	10'-0	Pf 0.586
111	37'-9½	121.69	16.8	52.469		Sprinkler		Pe -0.000
112	37'-9½			53.055			10'-0	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
CM	2.7050	279.63	15.61	120	0.169893	23'-11	Pf 10.427
112	37'-9½	122.37	16.8	53.055	Sprinkler,	37'-5	Pe 0.939
19	35'-7½			64.421	2PO(18'-8½)	61'-4½	Pv
• • • • • Route 7 • • • • •							
FR	6.2800	250.00	2.59	140	0.001718	4'-0	Pf 0.045
4790	0'-0	250.00		28.130	Hydrant,	22'-1	Pe 1.739
149	-4'-0			29.914	E(22'-1)	26'-1	Pv
UG	8.3900	250.00	1.45	140	0.000419	22'-5	Pf 0.034
149	-4'-0			29.914		59'-4½	Pe
150	-4'-0			29.949	T(59'-4½)	81'-9½	Pv
CM	7.9800	1042.44	6.69	150	0.006607	885'-0½	Pf 11.386
150	-4'-0	792.44		29.949	Flow (q) from Route 8	81'-6	Pe
16	-4'-0			41.335	4EE(13'-7), BFP(-5.000), S, E(27'-2)	966'-6½	Pv
• • • • • Route 8 • • • • •							
CM	7.9800	792.44	5.08	150	0.003978	33'-6	Pf 0.133
15	-4'-0	666.51		29.815	Flow (q) from Route 1		Pe
150	-4'-0			29.949		33'-6	Pv
• • • • • Route 9 • • • • •							
RN	2.7050	169.83	9.48	120	0.067536	473'-0½	Pf 37.004
23	36'-5½			67.079	PO(18'-8½)	74'-10½	Pe 0.000
7	36'-5½			104.083	3PO(18'-8½)	547'-11	Pv
• • • • • Route 10 • • • • •							
RN	2.7050	164.81	9.20	120	0.063888	473'-0½	Pf 35.005
22	36'-3			66.908	PO(18'-8½)	74'-10½	Pe 0.000
6	36'-3			101.913	3PO(18'-8½)	547'-11	Pv
• • • • • Route 11 • • • • •							
RN	2.7050	161.88	9.04	120	0.061801	473'-0½	Pf 33.862
21	36'-0½			66.461	PO(18'-8½)	74'-10½	Pe 0.000
5	36'-0½			100.323	3PO(18'-8½)	547'-11	Pv
• • • • • Route 12 • • • • •							
RN	2.7050	161.11	8.99	120	0.061263	473'-0½	Pf 33.567
20	35'-10			65.659	PO(18'-8½)	74'-10½	Pe 0.000
4	35'-10			99.225	3PO(18'-8½)	547'-11	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

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

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
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
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 Summary

Job Number: NC-1403
Report Description: ESFR (W System 2)

Job

Job Number: NC-1403	Designer: DB
Job Name: Town Center 22	State Certification/License Number:
Address 1: NE Town Center Blvd. Lee's Summit MO 64064	AHJ: Lee's Summit
Address 2:	Job Site/Building:
Address 3:	Drawing Name: Town Center 22 draw

System

Most Demanding Sprinkler Data: 22.4 K-Factor 141.67 at 40.000

Hose Allowance At Source: 0.00

Additional Hose Supplies

Node	Flow(gpm)
Hydrant At Node 4790	250.00

Total Hose Streams: 250.00

System Flow Demand	Total Water Required (Including Hose Allowance)
1955.23	1955.23

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 38.38 between nodes 68 and 66

Maximum Velocity Under Ground	
9.90 between nodes 53 and 52	

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
20665.71 gal	

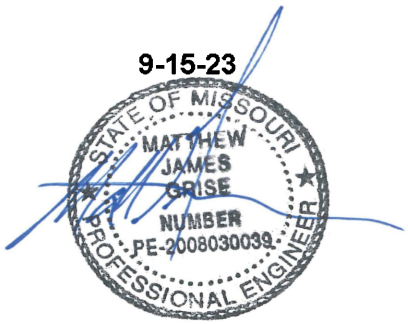
Remote Area(s)

Occupancy	Job Suffix
ESFR	

Pressure	Area of Application
40.000	NA

Number Of Sprinklers Calculated	Number Of Nozzles Calculated	Coverage Per Sprinkler
12	0	100.00 ft²

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area



Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi) @ Flow (gpm)	Available (psi) @ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
16	Water Supply		82.000	50.000 @ 1900.00	48.258 @ 1955.23	37.402	10.856
72	Pump		147.000	130.000 @ 1500.00	155.326 @ 1705.23	144.470	10.856

Pumps: Static = Churn (Pressure @ Zero Flow)

Contractor

	Contractor Number	Contact Name	Contact Title
	1	Derek Bisoglio	Design

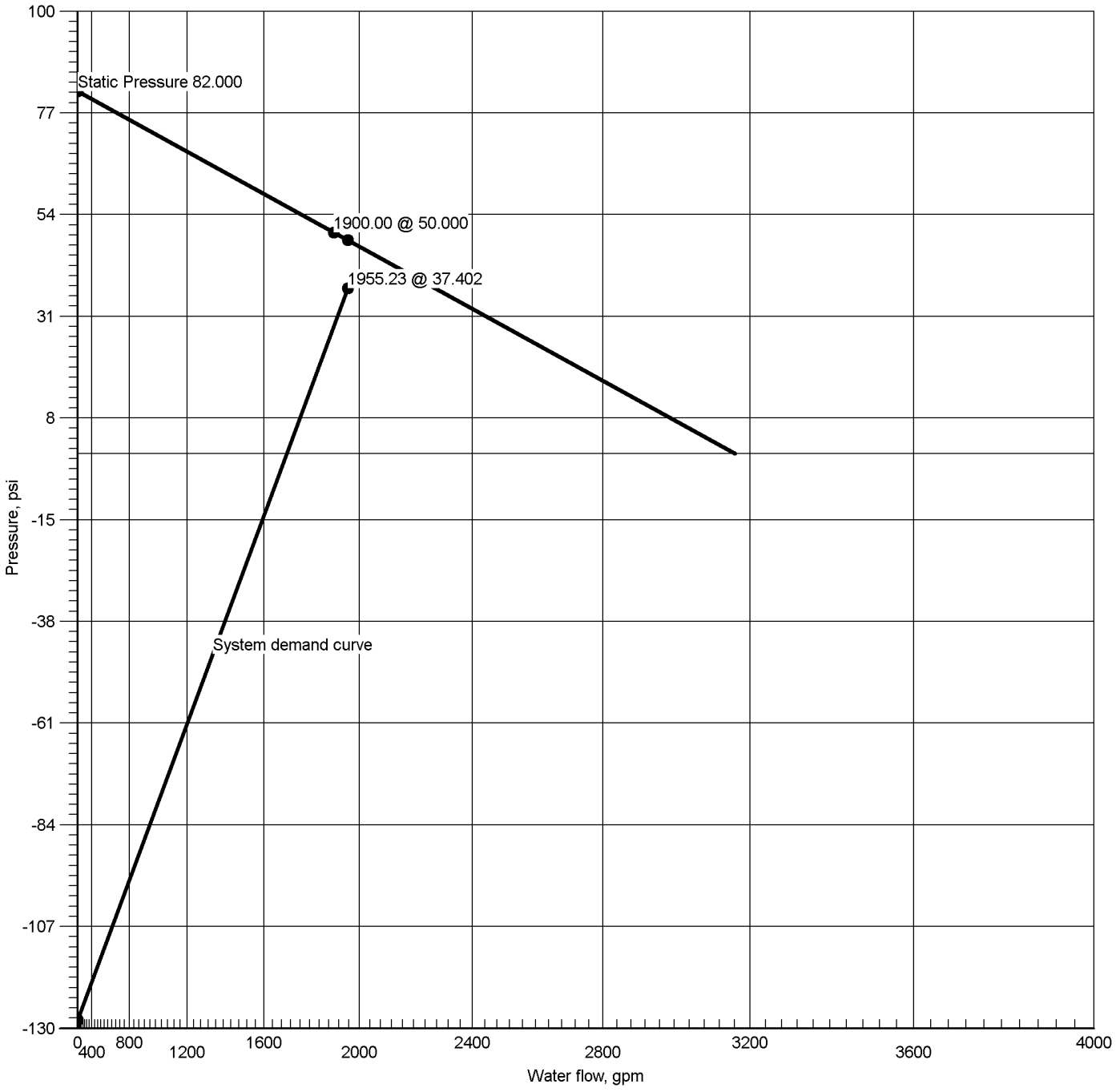
Name of Contractor:	Phone	Extension
Alliance Fire Protection	816-679-8021	

Address 1	FAX
130 w 9th Ave. Suite 100	

Address 2	E-mail
North Kansas City, MO 64116	dbisoglio@afpsprink.com

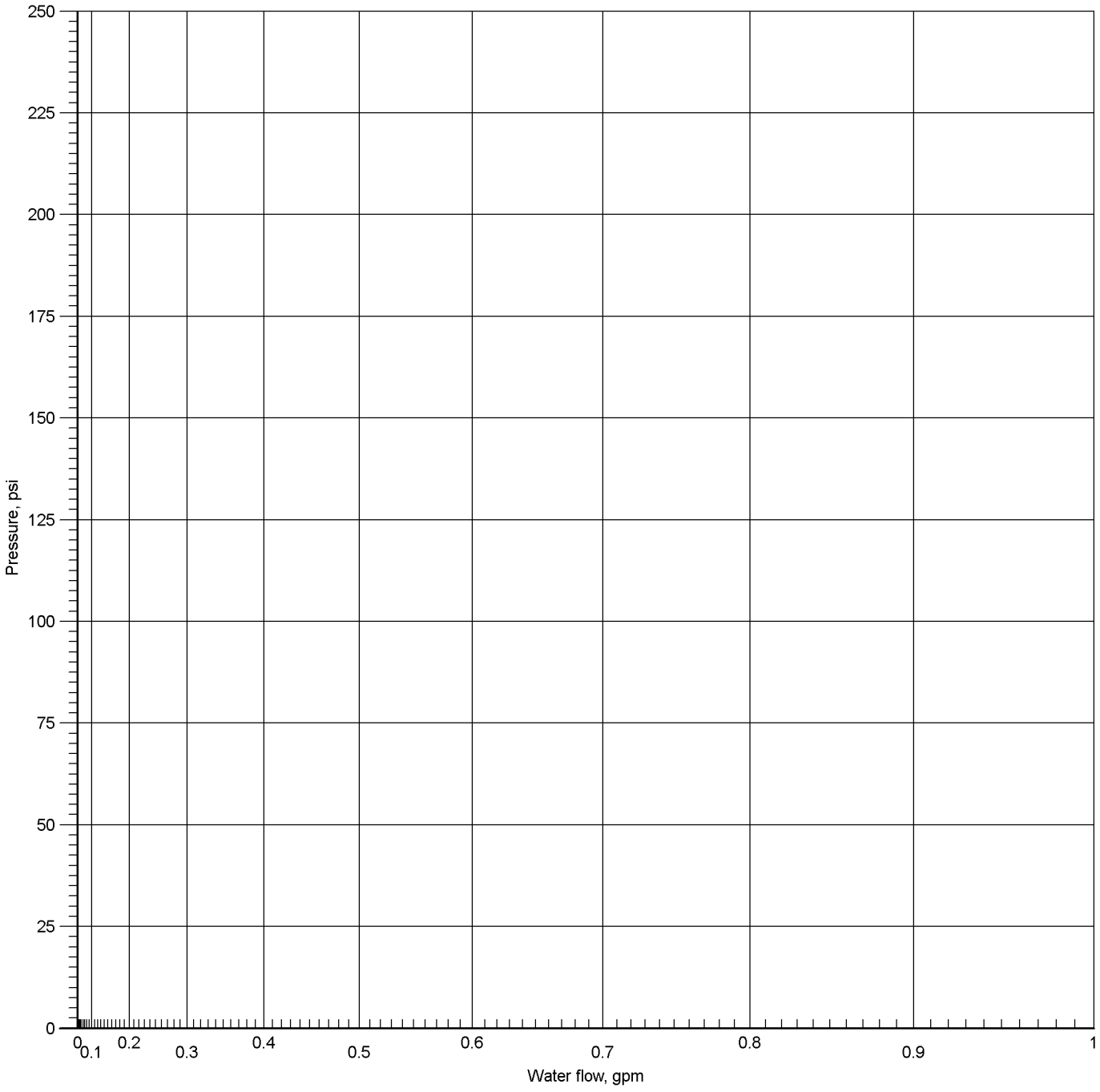
Address 3	Web-Site

Water Supply at Node 16



Hydraulic Graph	Water Supply at Node 16
Static: Pressure	82.000
Residual: Pressure	50.000 @ 1900.00
Available Pressure at System Demand	48.258 @ 1955.23
Required Pressure at System Demand	37.402 @ 1955.23
Required Pressure at System Demand (Including Hose Allowance at Source)	37.402 @ 1955.23

BOR 1 at Node 11



Hydraulic Graph
BOR 1 at Node 11

Static: Pressure
220.512

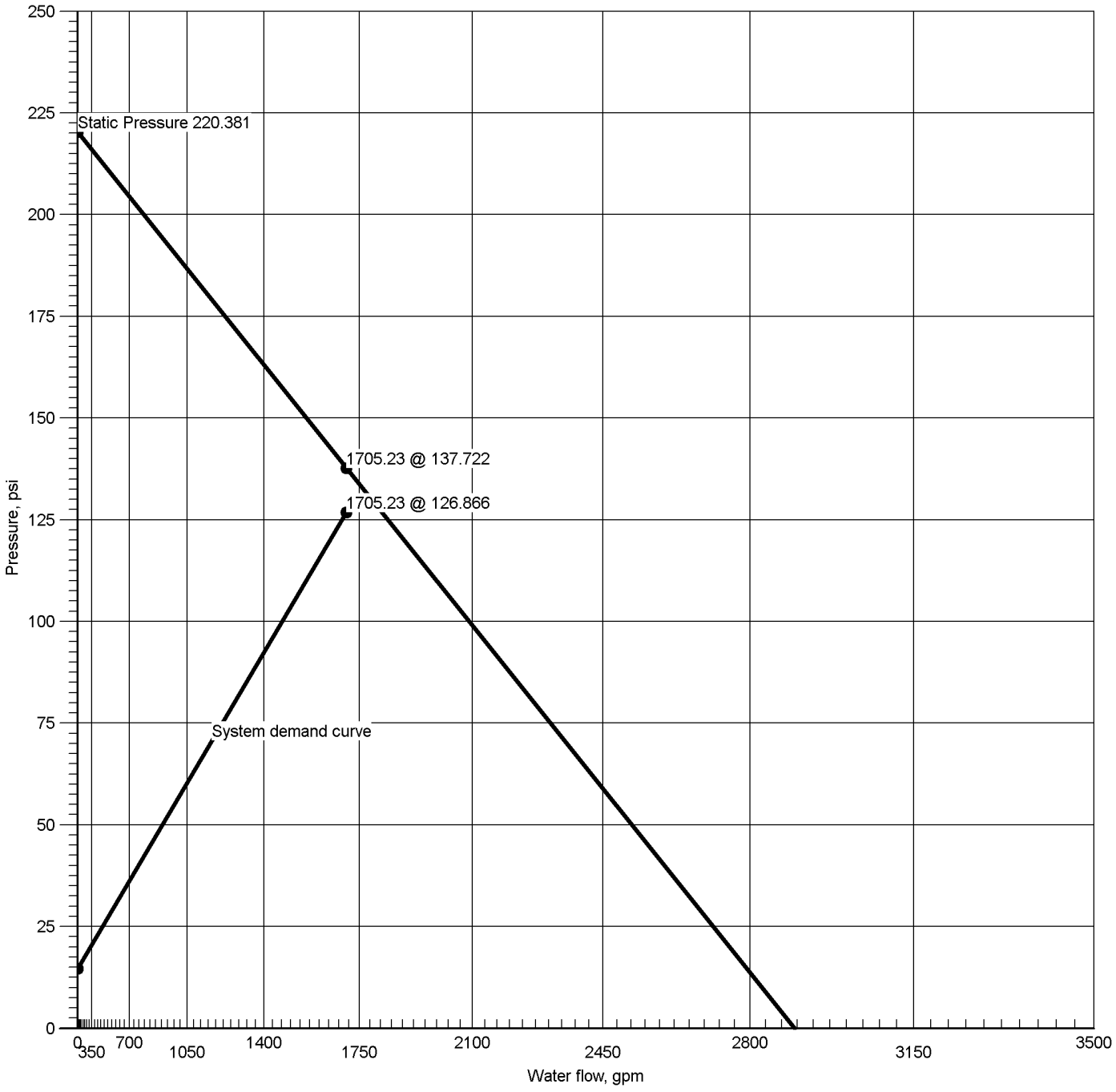
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
125.691 @ 0.00

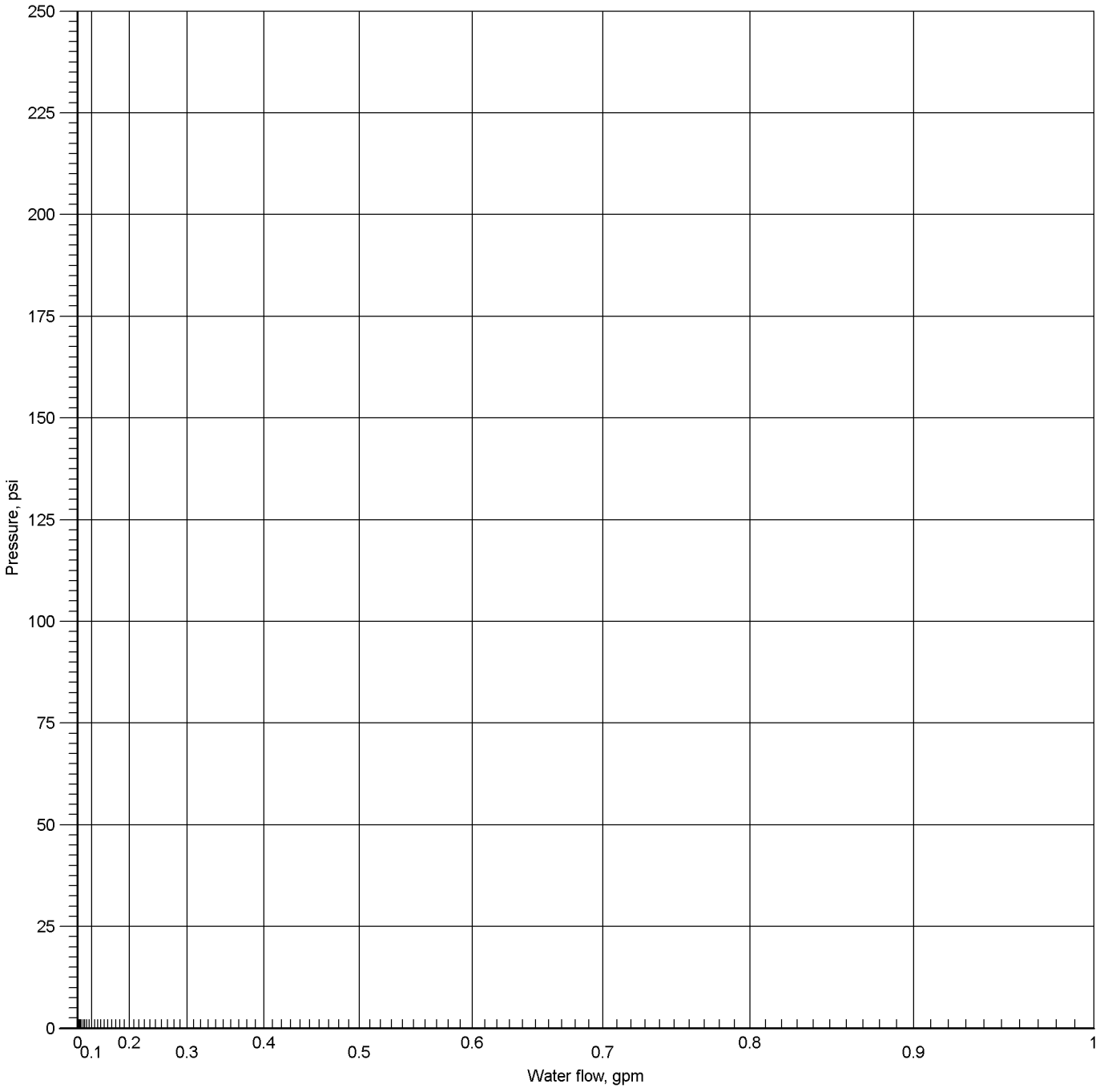
Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 2 at Node 70



Hydraulic Graph	BOR 2 at Node 70
Static: Pressure	220.381
Residual: Pressure	N/A
Available Pressure at System Demand	137.722 @ 1705.23
Required Pressure at System Demand	126.866 @ 1705.23
Required Pressure at System Demand (Including Hose Allowance at Source)	N/A

BOR 3 at Node 51



Hydraulic Graph
BOR 3 at Node 51

Static: Pressure
221.054

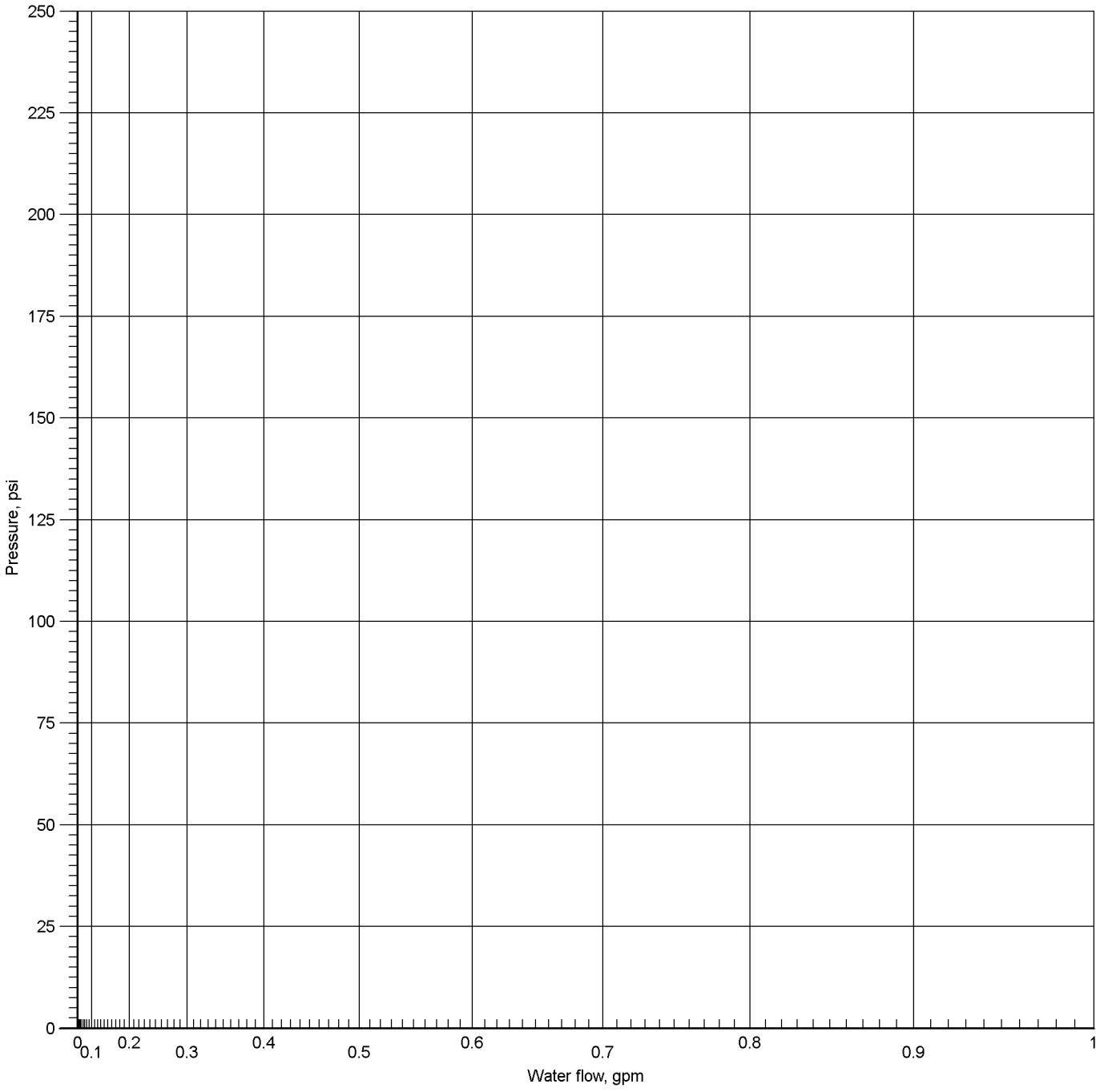
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
128.887 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 6 at Node 117



Hydraulic Graph
BOR 6 at Node 117

Static: Pressure
221.054

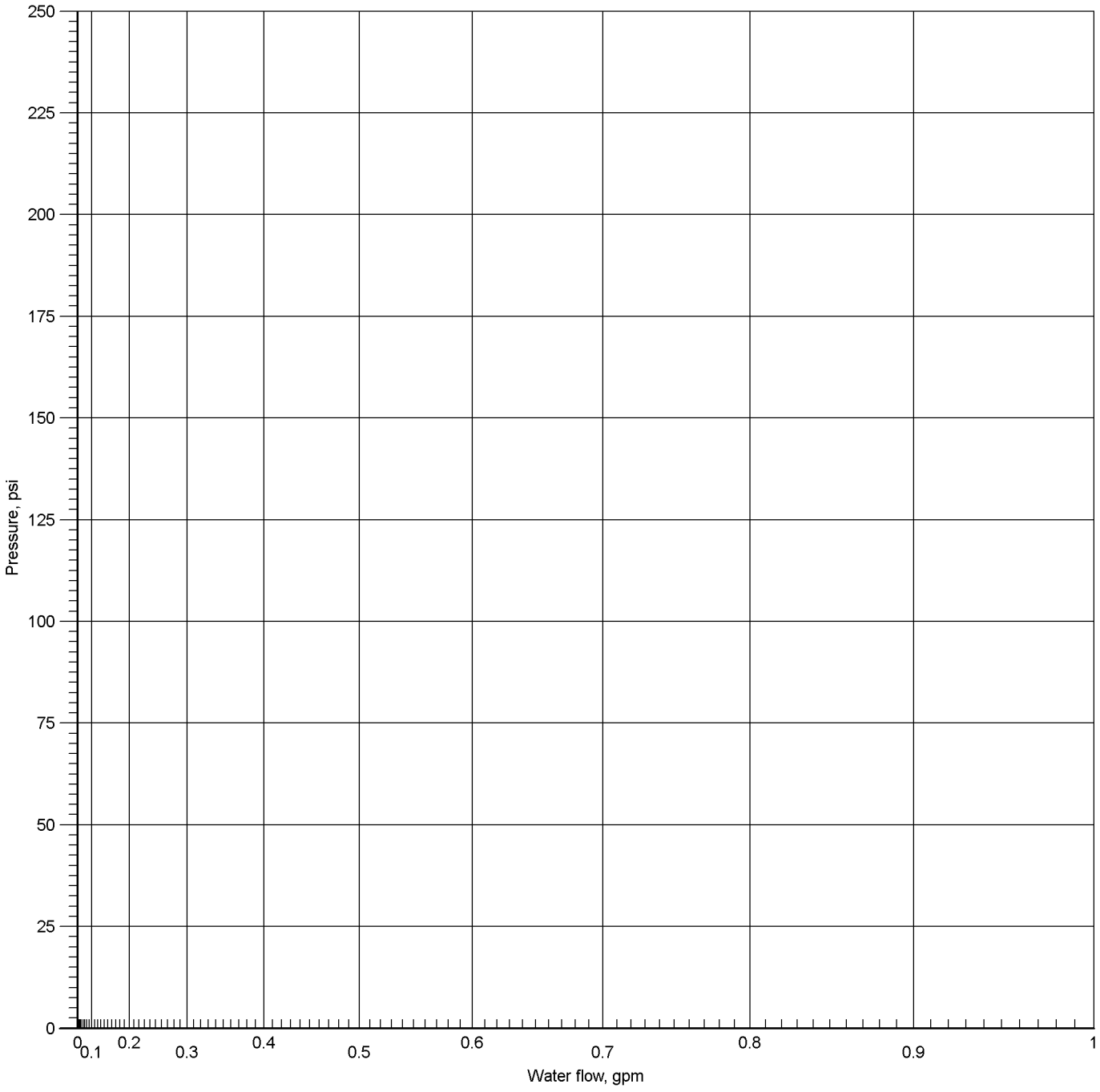
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
130.665 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 4 at Node 35



Hydraulic Graph
BOR 4 at Node 35

Static: Pressure
221.054

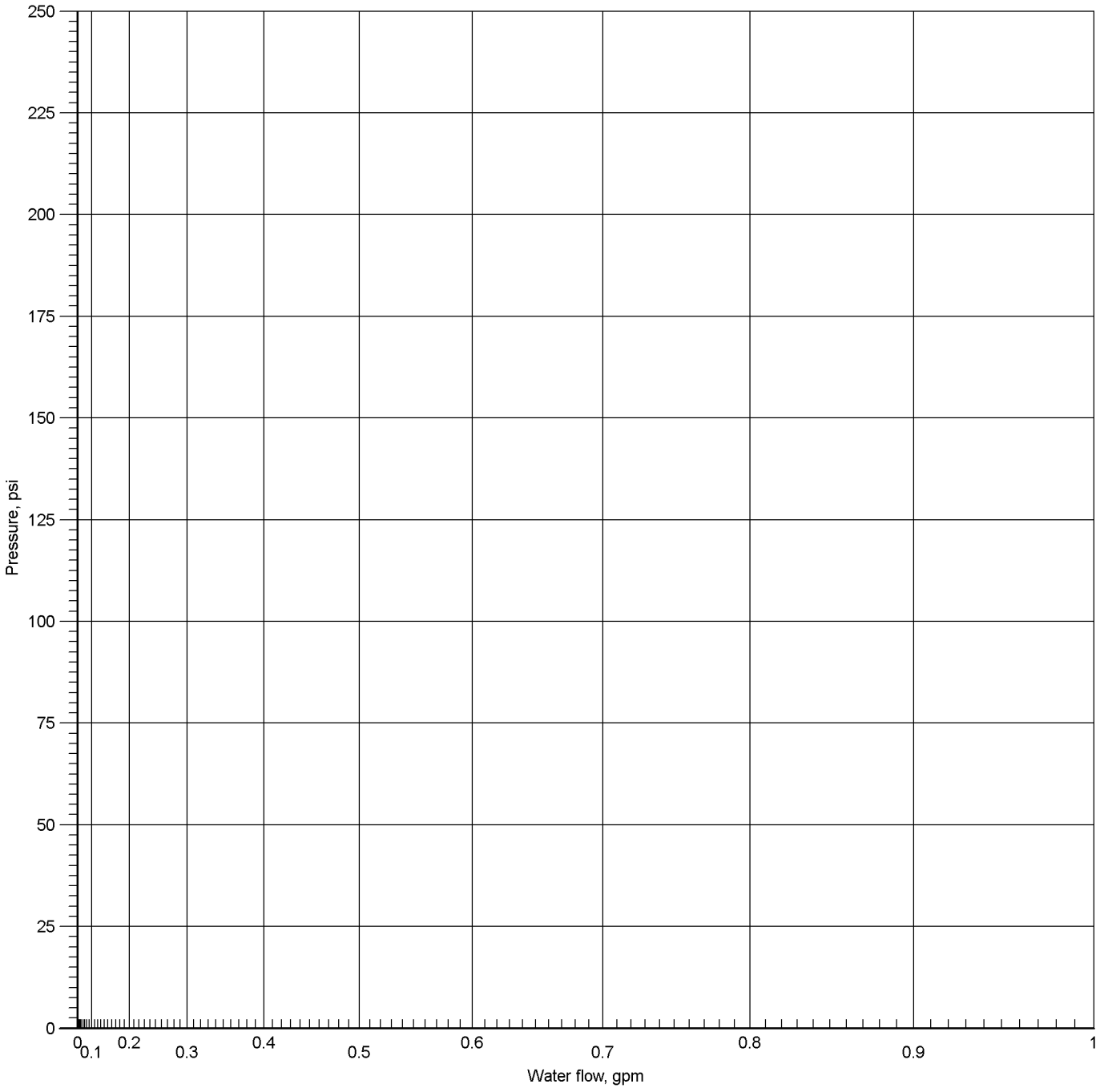
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
130.665 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 5 at Node 86



Hydraulic Graph
BOR 5 at Node 86

Static: Pressure
221.054

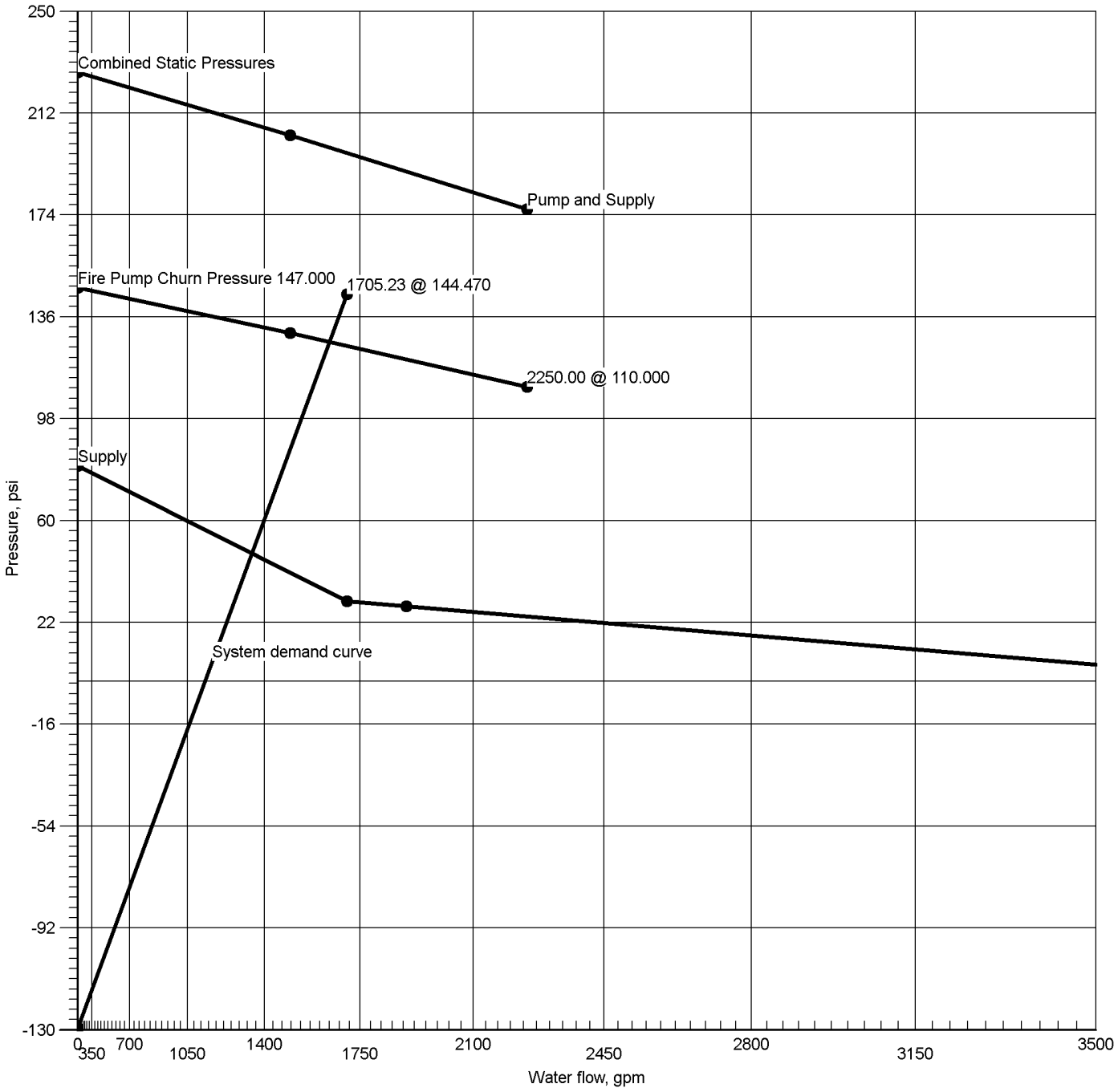
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
130.665 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

Pump at Node 72



Hydraulic Graph	Static + Churn Pressure	Fire Pump Rating
Pump at Node 72	227.555	130.000 @ 1500.00
Static: Pressure	**Fire Pump Churn Pressure**	
227.555	147.000	
Residual: Pressure		
125.297 @ 1705.23		
Available Pressure at System Demand		
155.326 @ 1705.23		
Required Pressure at System Demand		
144.470 @ 1705.23		

Summary Of Outflowing Devices

Job Number: NC-1403
Report Description: ESFR (W System 2)

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Sprinkler	**201**	**141.67**	**141.67**	**22.4**	**40.000**			
Sprinkler	202	141.67	141.67	22.4	40.000			
Sprinkler	203	141.99	141.67	22.4	40.182			
Sprinkler	204	141.97	141.67	22.4	40.167			
Sprinkler	205	141.76	141.67	22.4	40.052			
Sprinkler	206	141.76	141.67	22.4	40.052			
Sprinkler	207	142.09	141.67	22.4	40.238			
Sprinkler	208	142.05	141.67	22.4	40.216			
Sprinkler	209	142.41	141.67	22.4	40.419			
Sprinkler	210	142.41	141.67	22.4	40.420			
Sprinkler	211	142.75	141.67	22.4	40.612			
Sprinkler	212	142.69	141.67	22.4	40.579			
Hydrant	4790	250.00	250.00	0	22.396			

Most Demanding Sprinkler Data

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
16	-4'-0	S, E(27'-2)	37.402	1955.23	
201	39'-3	Spr(-40.000)	40.000	141.67	
202	39'-3	Spr(-40.000)	40.000	141.67	
203	39'-3	Spr(-40.182)	40.182	141.99	
204	39'-3	Spr(-40.167)	40.167	141.97	
205	39'-5½	Spr(-40.052)	40.052	141.76	
206	39'-5½	Spr(-40.052)	40.052	141.76	
207	39'-5½	Spr(-40.238)	40.238	142.09	
208	39'-5½	Spr(-40.216)	40.216	142.05	
209	39'-8	Spr(-40.419)	40.419	142.41	
210	39'-8	Spr(-40.420)	40.420	142.41	
211	39'-8	Spr(-40.612)	40.612	142.75	
212	39'-8	Spr(-40.579)	40.579	142.69	
4790	0'-0	Hyd	22.396	250.00	
14	2'-10	T(41'-1½)	18.758		
15	-4'-0	T(59'-4½)	24.031		
52	3'-0	PO(41'-1½), C(41'-1½)	130.665		
53	1'-11	BV(20'-4½)	135.226		
59	36'-10½	PO(22'-6)	62.741		
60	36'-10½	PO(22'-6)	63.107		
61	36'-11	PO(22'-6)	64.085		
62	36'-11½	PO(22'-6)	65.944		
63	36'-11½	PO(22'-6)	68.355		
64	37'-0	PO(22'-6)	71.439		
65	37'-0	PO(22'-6)	75.360		
66	37'-0½	E(13'-11)	83.214		
68	36'-7		104.338		
69	35'-1½	E(17'-7)	113.100		
70	5'-6	BV(14'-1), BOR 2	126.866		
71	-0'-10½		144.470		
72	-0'-10½	P2(-125.207)	144.470		
73	-0'-8	P1	19.172		
74	36'-10½	PO(22'-6)	53.542		
75	36'-10½	PO(22'-6)	53.581		
113	36'-11	PO(22'-6)	53.947		
115	36'-11½	PO(22'-6)	54.898		
116	37'-0	PO(22'-6)	55.501		
120	37'-0	PO(22'-6)	55.809		
131	36'-10	PO(22'-6)	62.706		
132	37'-0½	PO(22'-6)	55.895		
133	36'-10	PO(22'-6)	53.601		
149	-4'-0	E(22'-1)	24.180		
150	-4'-0	T(59'-4½)	24.215		

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •								
CM	3.3340	3.36	0.12	120		0.000017	8'-9	Pf 0.000
201	39'-3	141.67	22.4	40.000		Sprinkler		Pe 0.000
202	39'-3			40.000			8'-9	Pv
CM	3.3340	145.04	5.33	120		0.018219	10'-0	Pf 0.182
202	39'-3	141.67	22.4	40.000		Sprinkler		Pe 0.000
203	39'-3			40.182			10'-0	Pv
CM	3.3340	287.03	10.55	120		0.064412	289'-3½	Pf 21.532
203	39'-3	141.99	22.4	40.182		Sprinkler,	44'-11½	Pe 1.026
59	36'-10½			62.741		2PO(22'-6)	334'-3½	Pv
CM	4.3100	423.01	9.30	120		0.037801	10'-0	Pf 0.378
59	36'-10½	135.98		62.741		Flow (q) from Route 8		Pe -0.011
60	36'-10½			63.107			10'-0	Pv
CM	4.3100	711.62	15.65	120		0.098949	10'-0	Pf 0.989
60	36'-10½	288.61		63.107		Flow (q) from Route 3		Pe -0.011
61	36'-11			64.085			10'-0	Pv
CM	4.3100	1003.89	22.08	120		0.187010	10'-0	Pf 1.870
61	36'-11	292.27		64.085		Flow (q) from Route 5		Pe -0.011
62	36'-11½			65.944			10'-0	Pv
CM	4.3100	1154.60	25.39	120		0.242241	10'-0	Pf 2.422
62	36'-11½	150.71		65.944		Flow (q) from Route 11		Pe -0.011
63	36'-11½			68.355			10'-0	Pv
CM	4.3100	1318.26	28.99	120		0.309562	10'-0	Pf 3.096
63	36'-11½	163.65		68.355		Flow (q) from Route 10		Pe -0.011
64	37'-0			71.439			10'-0	Pv
CM	4.3100	1500.24	32.99	120		0.393228	10'-0	Pf 3.932
64	37'-0	181.98		71.439		Flow (q) from Route 2		Pe -0.011
65	37'-0			75.360			10'-0	Pv
CM	4.3100	1705.23	37.50	120		0.498365	1'-10	Pf 7.856
65	37'-0	204.99		75.360		Flow (q) from Route 9	13'-11	Pe -0.002
66	37'-0½			83.214		E(13'-11)	15'-9	Pv
CM	4.2600	1705.23	38.38	120		0.527505	26'-6	Pf 20.934
66	37'-0½			83.214			13'-2	Pe 0.190
68	36'-7			104.338		E(13'-2)	39'-8	Pv
CM	6.3570	1705.23	17.24	120		0.075095	73'-0½	Pf 8.129
68	36'-7			104.338			35'-2½	Pe 0.634
69	35'-1½			113.100		2E(17'-7)	108'-3	Pv
FR	8.2490	1705.23	10.24	120		0.021114	29'-7½	Pf 0.923
69	35'-1½			113.100			14'-1	Pe 12.843
70	5'-6			126.866		f(-0.000), BV(14'-1), BOR 2	43'-8½	Pv
FR	8.2490	1705.23	10.24	120		0.021114	5'-3	Pf 2.715
70	5'-6			126.866			123'-4	Pe 1.084
52	3'-0			130.665		2PO(41'-1½), C(41'-1½)	128'-7	Pv
UG	8.3900	1705.23	9.90	140		0.014618	91'-11	Pf 4.096
52	3'-0			130.665			188'-3½	Pe 0.464
53	1'-11			135.226		sCV(76'-4), 3E(30'-6½), BV(20'-4½)	280'-3	Pv
DY	8.2490	1705.23	10.24	120		0.021114	2'-8	Pf 8.028
53	1'-11			135.226			164'-5	Pe 1.216
71	-0'-10½			144.470		2E(21'-1½), T(41'-1½), PRV(-4.500), 2BV(14'-1), sCV(52'-10)	167'-1	Pv
DY	6.0650	1705.23	18.94	120		0.094420	0'-0	Pf 0.000
71	-0'-10½			144.470				Pe -0.000
72	-0'-10½			144.470			0'-0	Pv
Pump			**Velocity**					
72		1705.23		144.470		Rating: 130.000 @ 1500.00		
73		Q=1705.23	10.24	19.172		Fire Pump Churn Pressure: 147.000		
FR	8.2490	1705.23	10.24	120		0.021114	6'-5½	Pf 1.103
73	-0'-8			19.172			45'-9½	Pe -1.518
14	2'-10			18.758		GV(4'-8½), T(41'-1½)	52'-3	Pv
UG	8.3900	1705.23	9.90	140		0.014618	68'-2	Pf 2.311
14	2'-10			18.758			89'-11	Pe 2.962
15	-4'-0			24.031		E(30'-6½), T(59'-4½)	158'-1	Pv
CM	7.9800	762.94	4.89	150		0.003709	2122'-8½	Pf 13.371
15	-4'-0			24.031			134'-3½	Pe
16	-4'-0			37.402		6EE(13'-7), BFP(-5.000), T(52'-10)	2257'-0½	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
		0.00				Hose Allowance At Source		
16		1955.23						
• • • • • Route 2 • • • • •								
CM	3.3340	138.31	5.08	120		0.016686	10'-0	Pf 0.167
201	39'-3	141.67	22.4	40.000		Sprinkler		Pe -0.000
204	39'-3			40.167			10'-0	Pv
CM	3.3340	280.27	10.30	120		0.061635	155'-4½	Pf 12.349
204	39'-3	141.97	22.4	40.167		Sprinkler,	44'-11½	Pe 1.026
74	36'-10½			53.542		2PO(22'-6)	200'-4½	Pv
CM	4.3100	144.29	3.17	120		0.005168	10'-0	Pf 0.052
74	36'-10½			53.542				Pe -0.013
75	36'-10½			53.581			10'-0	Pv
CM	4.3100	423.34	9.31	120		0.037856	10'-0	Pf 0.379
75	36'-10½	279.06		53.581		Flow (q) from Route 4		Pe -0.013
113	36'-11			53.947			10'-0	Pv
CM	4.3100	701.34	15.42	120		0.096321	10'-0	Pf 0.963
113	36'-11	278.00		53.947		Flow (q) from Route 6		Pe -0.013
115	36'-11½			54.898			10'-0	Pv
CM	4.3100	550.63	12.11	120		0.061565	10'-0	Pf 0.616
115	36'-11½			54.898				Pe -0.013
116	37'-0			55.501			10'-0	Pv
CM	4.3100	386.97	8.51	120		0.032060	10'-0	Pf 0.321
116	37'-0			55.501				Pe -0.013
120	37'-0			55.809			10'-0	Pv
RN	3.3340	181.98	6.69	120		0.027725	473'-7	Pf 15.624
120	37'-0			55.809		PO(22'-6)	89'-11½	Pe 0.007
64	37'-0			71.439		3PO(22'-6)	563'-6½	Pv
• • • • • Route 3 • • • • •								
CM	3.3340	4.76	0.17	120		0.000033	8'-9	Pf 0.000
205	39'-5½	141.76	22.4	40.052		Sprinkler		Pe 0.000
206	39'-5½			40.052			8'-9	Pv
CM	3.3340	146.52	5.38	120		0.018566	10'-0	Pf 0.186
206	39'-5½	141.76	22.4	40.052		Sprinkler		Pe 0.000
207	39'-5½			40.238			10'-0	Pv
CM	3.3340	288.61	10.61	120		0.065071	289'-6	Pf 21.764
207	39'-5½	142.09	22.4	40.238		Sprinkler,	44'-11½	Pe 1.105
60	36'-10½			63.107		2PO(22'-6)	334'-5½	Pv
• • • • • Route 4 • • • • •								
CM	3.3340	137.00	5.03	120		0.016397	10'-0	Pf 0.164
205	39'-5½	141.76	22.4	40.052		Sprinkler		Pe -0.000
208	39'-5½			40.216			10'-0	Pv
CM	3.3340	279.06	10.26	120		0.061142	155'-7	Pf 12.262
208	39'-5½	142.05	22.4	40.216		Sprinkler,	44'-11½	Pe 1.103
75	36'-10½			53.581		2PO(22'-6)	200'-6½	Pv
• • • • • Route 5 • • • • •								
CM	3.3340	7.10	0.26	120		0.000069	8'-9	Pf 0.001
209	39'-8	142.41	22.4	40.419		Sprinkler		Pe 0.000
210	39'-8			40.420			8'-9	Pv
CM	3.3340	149.51	5.49	120		0.019274	10'-0	Pf 0.193
210	39'-8	142.41	22.4	40.420		Sprinkler		Pe 0.000
211	39'-8			40.612			10'-0	Pv
CM	3.3340	292.27	10.74	120		0.066604	289'-8	Pf 22.289
211	39'-8	142.75	22.4	40.612		Sprinkler,	44'-11½	Pe 1.184
61	36'-11			64.085		2PO(22'-6)	334'-8	Pv
• • • • • Route 6 • • • • •								
CM	3.3340	135.31	4.97	120		0.016023	10'-0	Pf 0.160
209	39'-8	142.41	22.4	40.419		Sprinkler		Pe -0.000
212	39'-8			40.579			10'-0	Pv
CM	3.3340	278.00	10.22	120		0.060714	155'-9	Pf 12.187
212	39'-8	142.69	22.4	40.579		Sprinkler,	44'-11½	Pe 1.181
113	36'-11			53.947		2PO(22'-6)	200'-8½	Pv
• • • • • Route 7 • • • • •								
FR	6.2800	250.00	2.59	140		0.001718	4'-0	Pf 0.045
4790	0'-0	250.00		22.396		Hydrant,	22'-1	Pe 1.739
149	-4'-0			24.180		E(22'-1)	26'-1	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
UG	8.3900	250.00	1.45	140	0.000419	22'-5	Pf 0.034
149	-4'-0			24.180		59'-4½	Pe
150	-4'-0			24.215	T(59'-4½)	81'-9½	Pv
CM	7.9800	1192.29	7.65	150	0.008471	885'-0½	Pf 13.187
150	-4'-0	942.29		24.215	Flow (q) from Route 13	81'-6	Pe
16	-4'-0			37.402	4EE(13'-7), BFP(-5.000), S, E(27'-2)	966'-6½	Pv
• • • • • Route 8 • • • • •							
CM	4.3100	135.98	2.99	120	0.004631	10'-0	Pf 0.046
131	36'-10	135.98		62.706	Flow (q) from Route 12		Pe -0.011
59	36'-10½			62.741		10'-0	Pv
• • • • • Route 9 • • • • •							
CM	4.3100	204.99	4.51	120	0.009896	10'-0	Pf 0.099
120	37'-0	181.98		55.809	Flow (q) from Route 2		Pe -0.013
132	37'-0½			55.895		10'-0	Pv
RN	3.3340	204.99	7.53	120	0.034556	473'-1½	Pf 19.457
132	37'-0½			55.895	PO(22'-6)	89'-11½	Pe 0.008
65	37'-0			75.360	3PO(22'-6)	563'-0½	Pv
• • • • • Route 10 • • • • •							
RN	3.3340	163.65	6.01	120	0.022781	474'-1	Pf 12.849
116	37'-0			55.501	PO(22'-6)	89'-11½	Pe 0.005
63	36'-11½			68.355	3PO(22'-6)	564'-0	Pv
• • • • • Route 11 • • • • •							
RN	3.3340	150.71	5.54	120	0.019561	474'-6½	Pf 11.042
115	36'-11½			54.898	PO(22'-6)	89'-11½	Pe 0.004
62	36'-11½			65.944	3PO(22'-6)	564'-6	Pv
• • • • • Route 12 • • • • •							
CM	4.3100	135.98	2.99	120	0.004631	10'-0	Pf 0.046
74	36'-10½	144.29		53.542	Flow (q) from Route 2		Pe 0.013
133	36'-10			53.601		10'-0	Pv
RN	3.3340	135.98	5.00	120	0.016172	473'-1	Pf 9.105
133	36'-10			53.601	PO(22'-6)	89'-11½	Pe -0.001
131	36'-10			62.706	3PO(22'-6)	563'-0½	Pv
• • • • • Route 13 • • • • •							
CM	7.9800	942.29	6.04	150	0.005481	33'-6	Pf 0.184
15	-4'-0	762.94		24.031	Flow (q) from Route 1		Pe
150	-4'-0			24.215		33'-6	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

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

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
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
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

Hydraulic Summary

Job Number: NC-1403
Report Description: ESFR (SW System 3)

Job

Job Number: NC-1403	Designer: DB
Job Name: Town Center 22	State Certification/License Number:
Address 1: NE Town Center Blvd. Lee's Summit MO 64064	AHJ: Lee's Summit
Address 2:	Job Site/Building:
Address 3:	Drawing Name: Town Center 22 draw

System

Most Demanding Sprinkler Data: 16.8 K-Factor 121.15 at 52.000

Hose Allowance At Source: 0.00

Additional Hose Supplies

Node	Flow(gpm)

Total Hose Streams: 250.00

System Flow Demand	Total Water Required (Including Hose Allowance)
1919.02	1919.02

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 37.57 between nodes 49 and 48

Maximum Velocity Under Ground	
9.69 between nodes 53 and 52	

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
20665.71 gal	

Remote Area(s)

Occupancy	Job Suffix
ESFR	

Pressure	Area of Application
52.000	NA

Number Of Sprinklers Calculated	Number Of Nozzles Calculated	Coverage Per Sprinkler
12	0	100.00 ft²

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@ Flow (gpm)	Available (psi)	@ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
16	Water Supply		82.000	50.000	1900.00	49.405	1919.02	42.817	6.588
72	Pump		147.000	130.000	1500.00	157.774	1669.02	151.187	6.588

Pumps: Static = Churn (Pressure @ Zero Flow)

Contractor

	Contractor Number	Contact Name	Contact Title
	1	Derek Bisoglio	Design

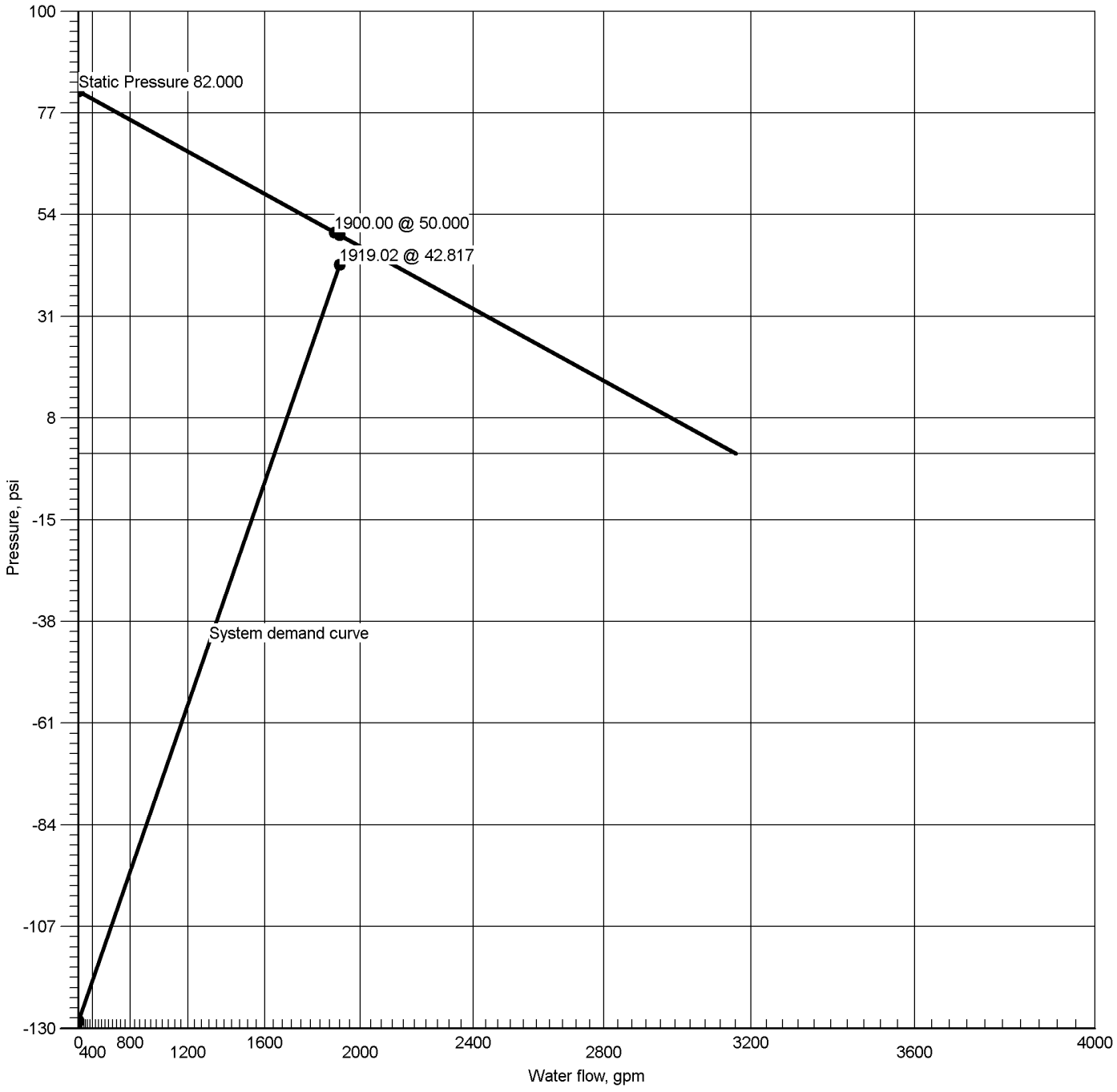
Name of Contractor:	Phone	Extension
Alliance Fire Protection	816-679-8021	

Address 1	FAX
130 w 9th Ave. Suite 100	

Address 2	E-mail
North Kansas City, MO 64116	dbisoglio@afpsprink.com

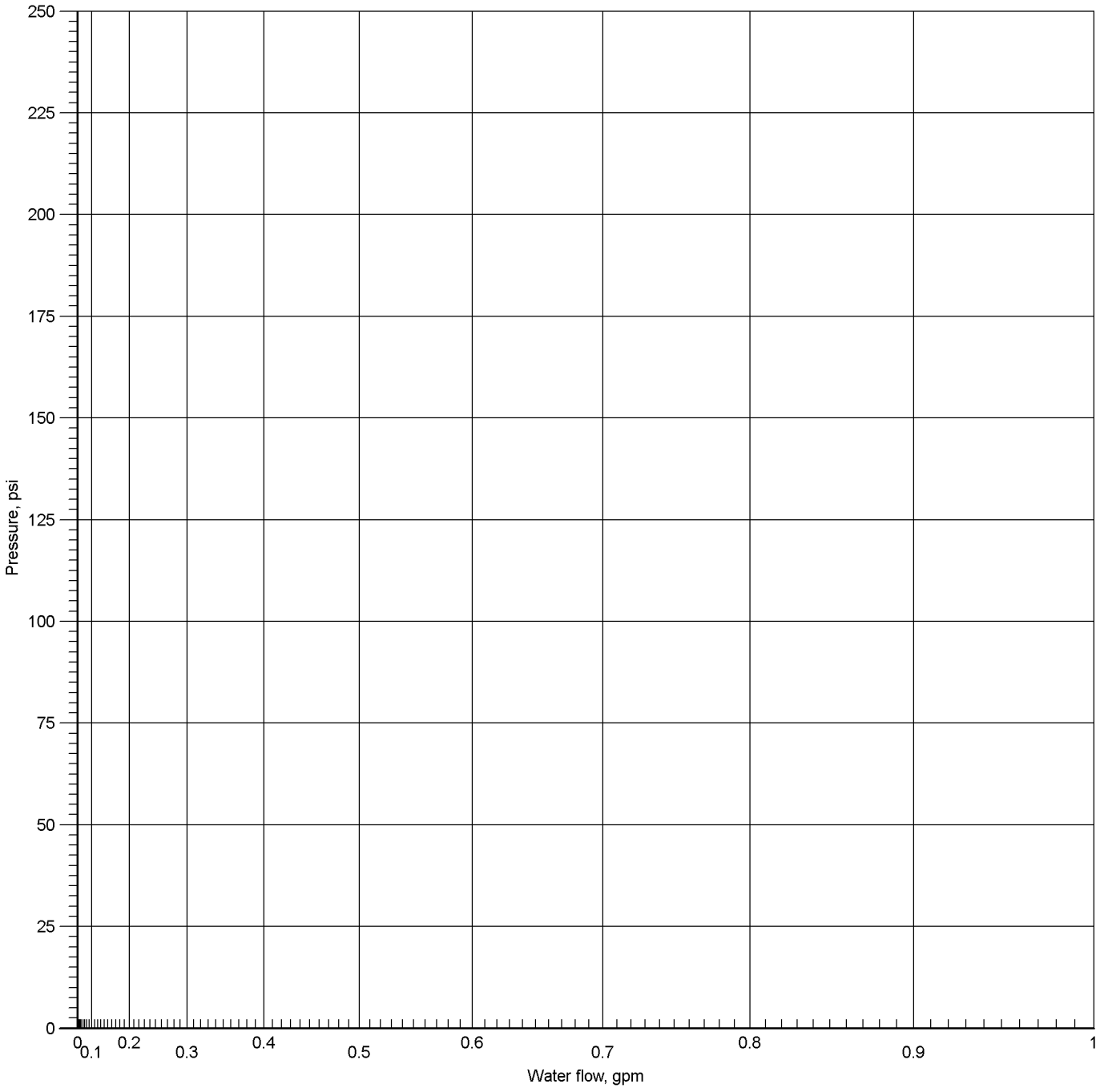
Address 3	Web-Site

Water Supply at Node 16



Hydraulic Graph	Water Supply at Node 16
Static: Pressure	82.000
Residual: Pressure	50.000 @ 1900.00
Available Pressure at System Demand	49.405 @ 1919.02
Required Pressure at System Demand	42.817 @ 1919.02
Required Pressure at System Demand (Including Hose Allowance at Source)	42.817 @ 1919.02

BOR 1 at Node 11



Hydraulic Graph
BOR 1 at Node 11

Static: Pressure
220.512

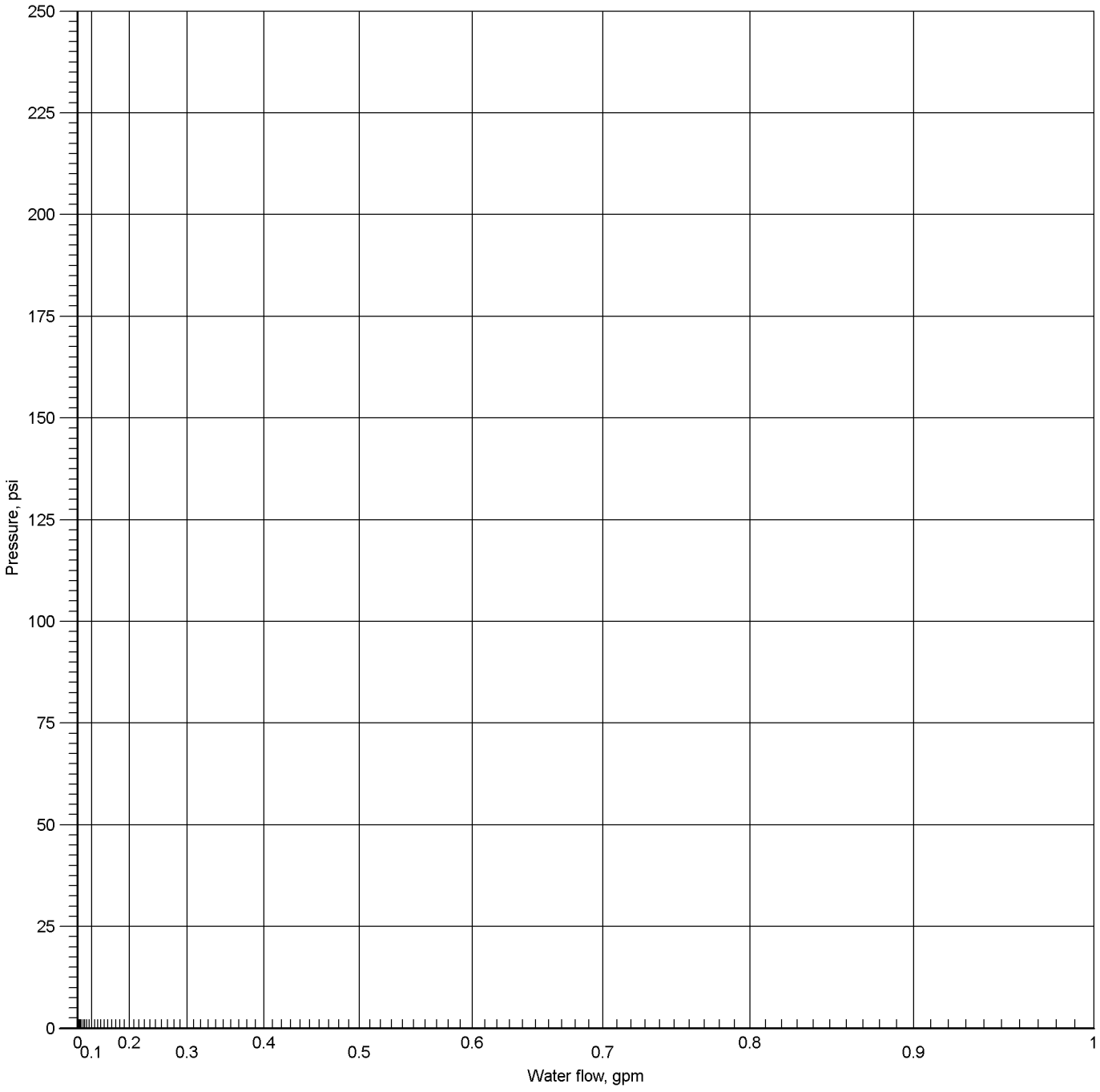
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
132.774 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 2 at Node 70



Hydraulic Graph
BOR 2 at Node 70

Static: Pressure
220.381

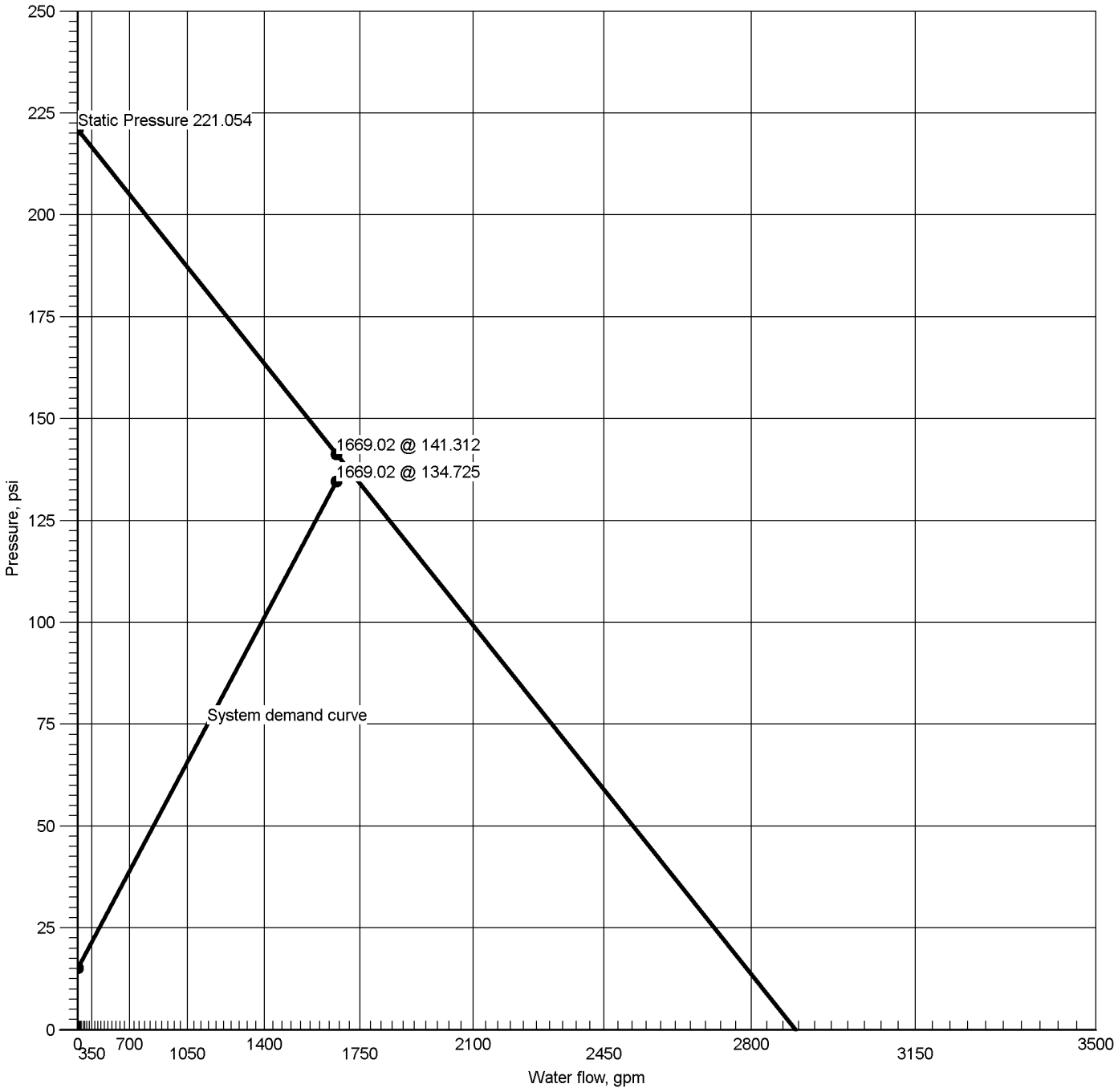
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
133.949 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 3 at Node 51



Hydraulic Graph
BOR 3 at Node 51

Static: Pressure
221.054

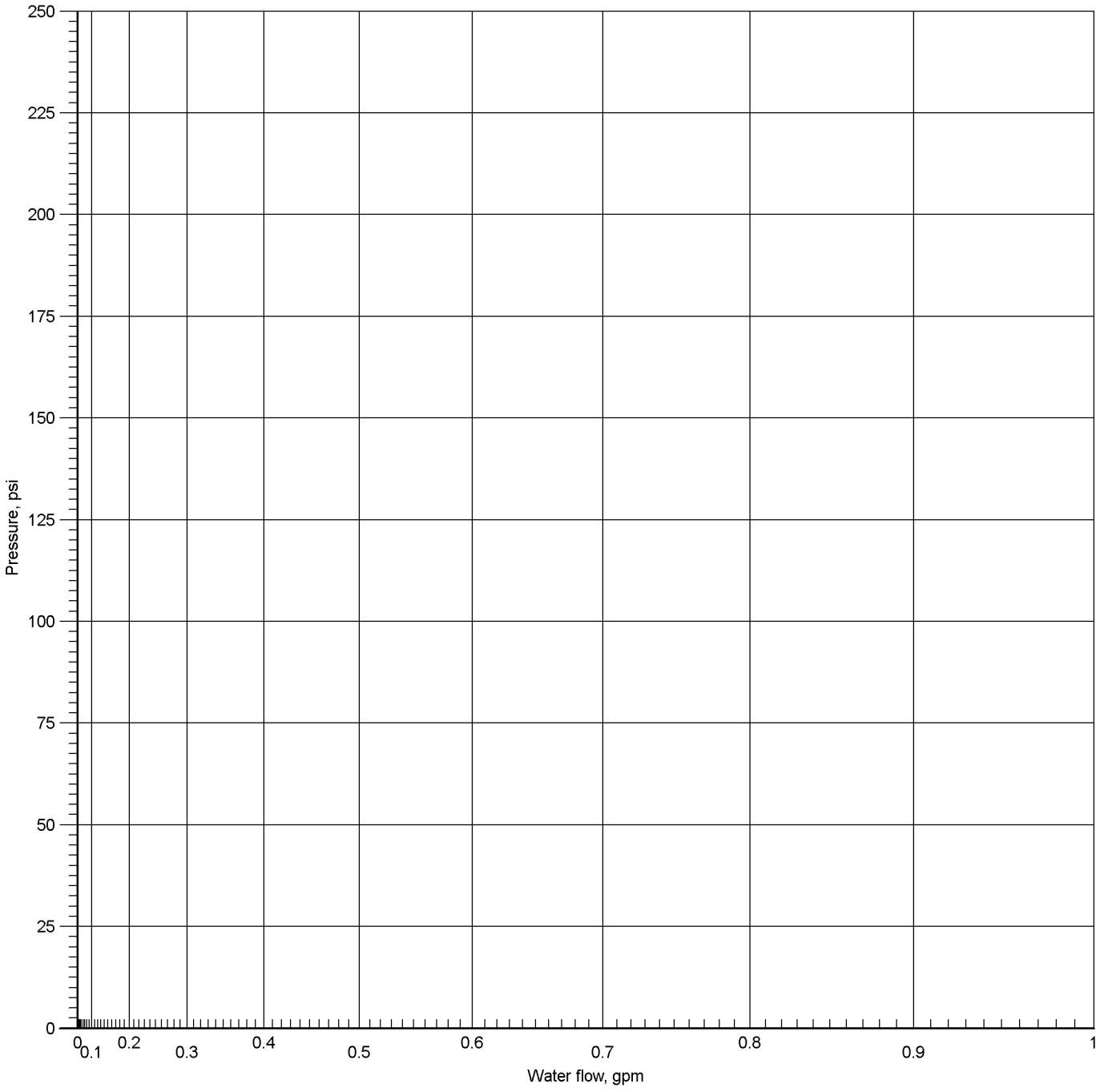
Residual: Pressure
N/A

Available Pressure at System Demand
141.312 @ 1669.02

Required Pressure at System Demand
134.725 @ 1669.02

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 6 at Node 117



Hydraulic Graph
BOR 6 at Node 117

Static: Pressure
221.054

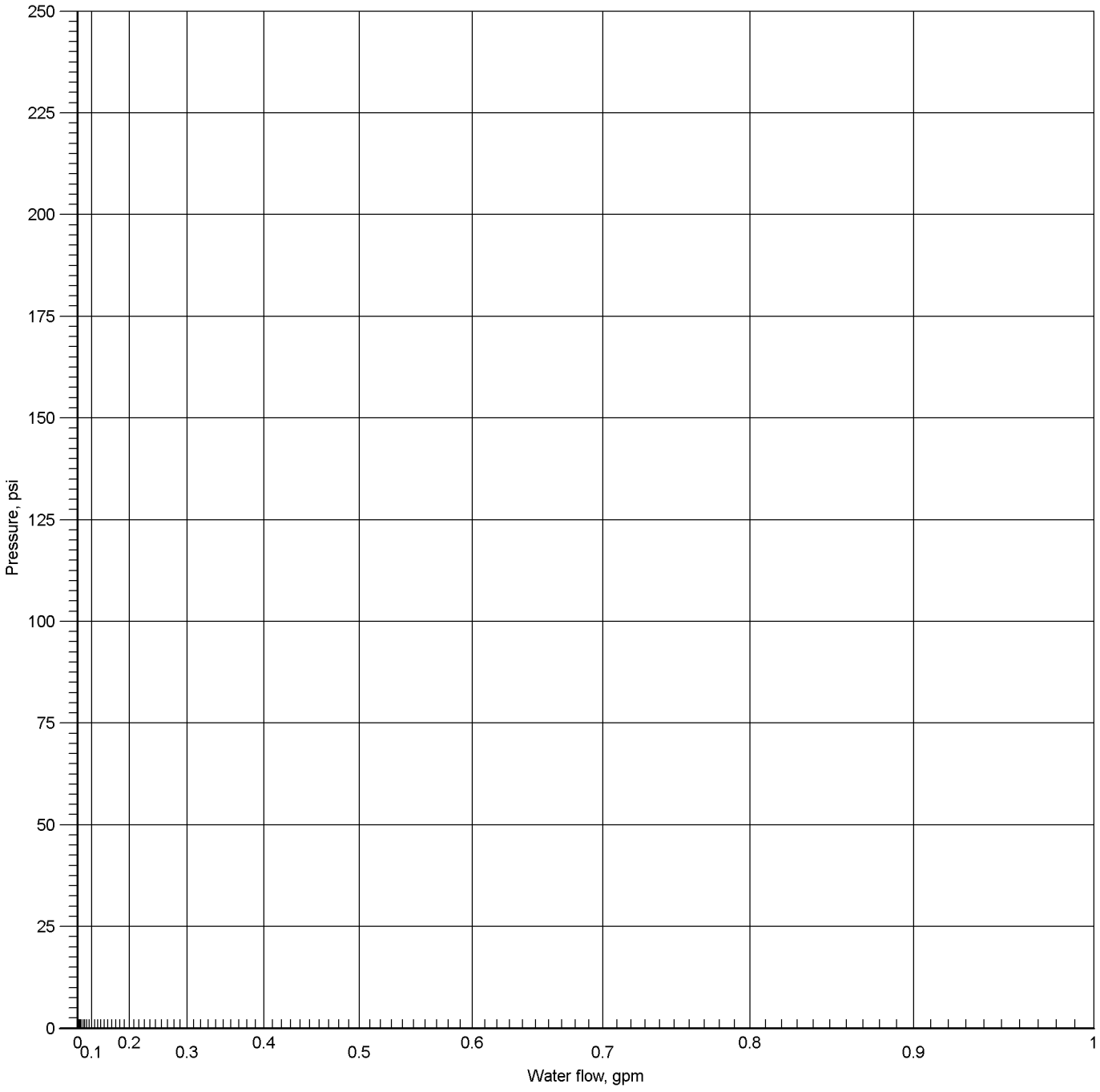
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
137.679 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 4 at Node 35



Hydraulic Graph
BOR 4 at Node 35

Static: Pressure
221.054

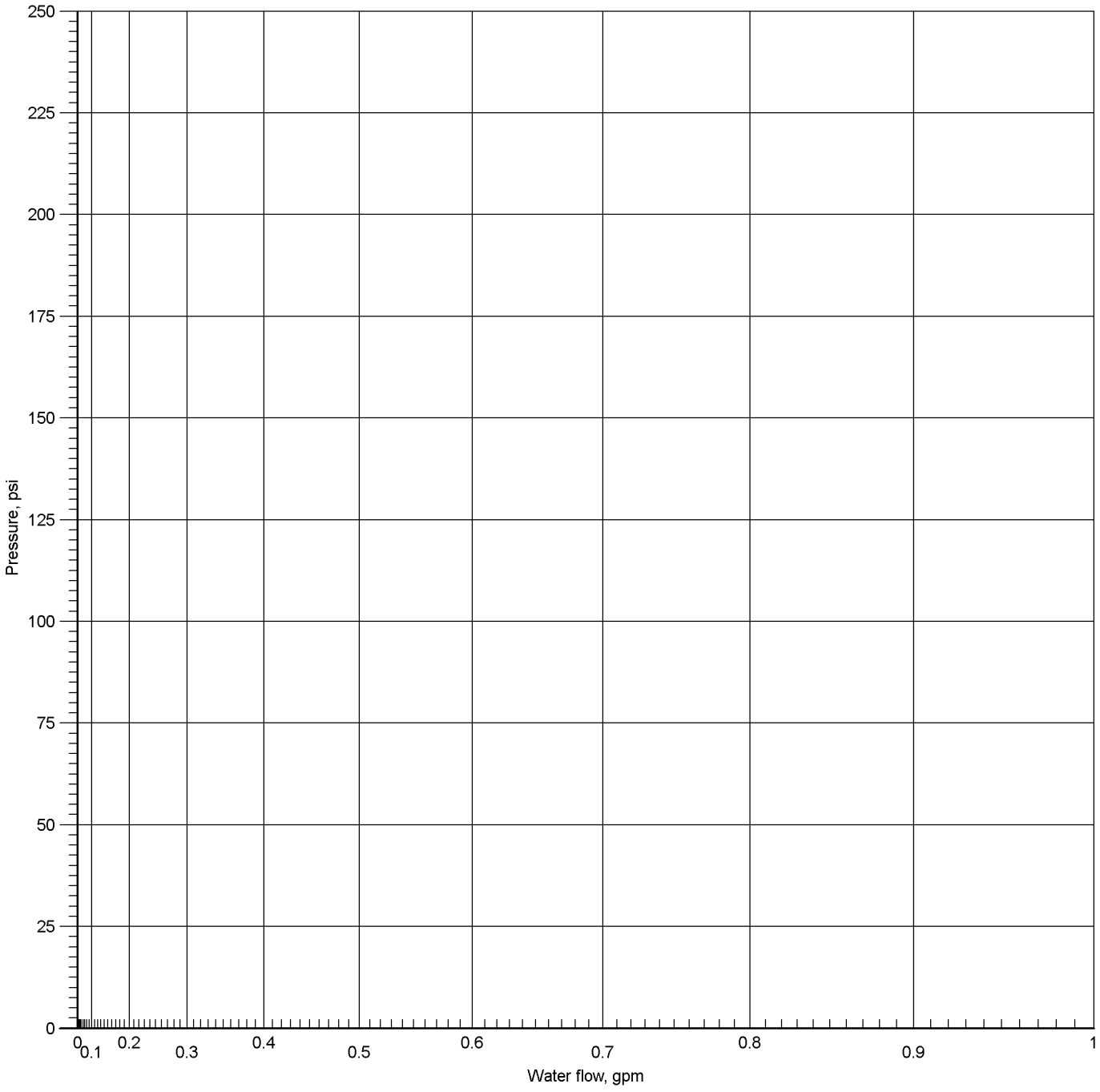
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
137.679 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 5 at Node 86



Hydraulic Graph
BOR 5 at Node 86

Static: Pressure
221.054

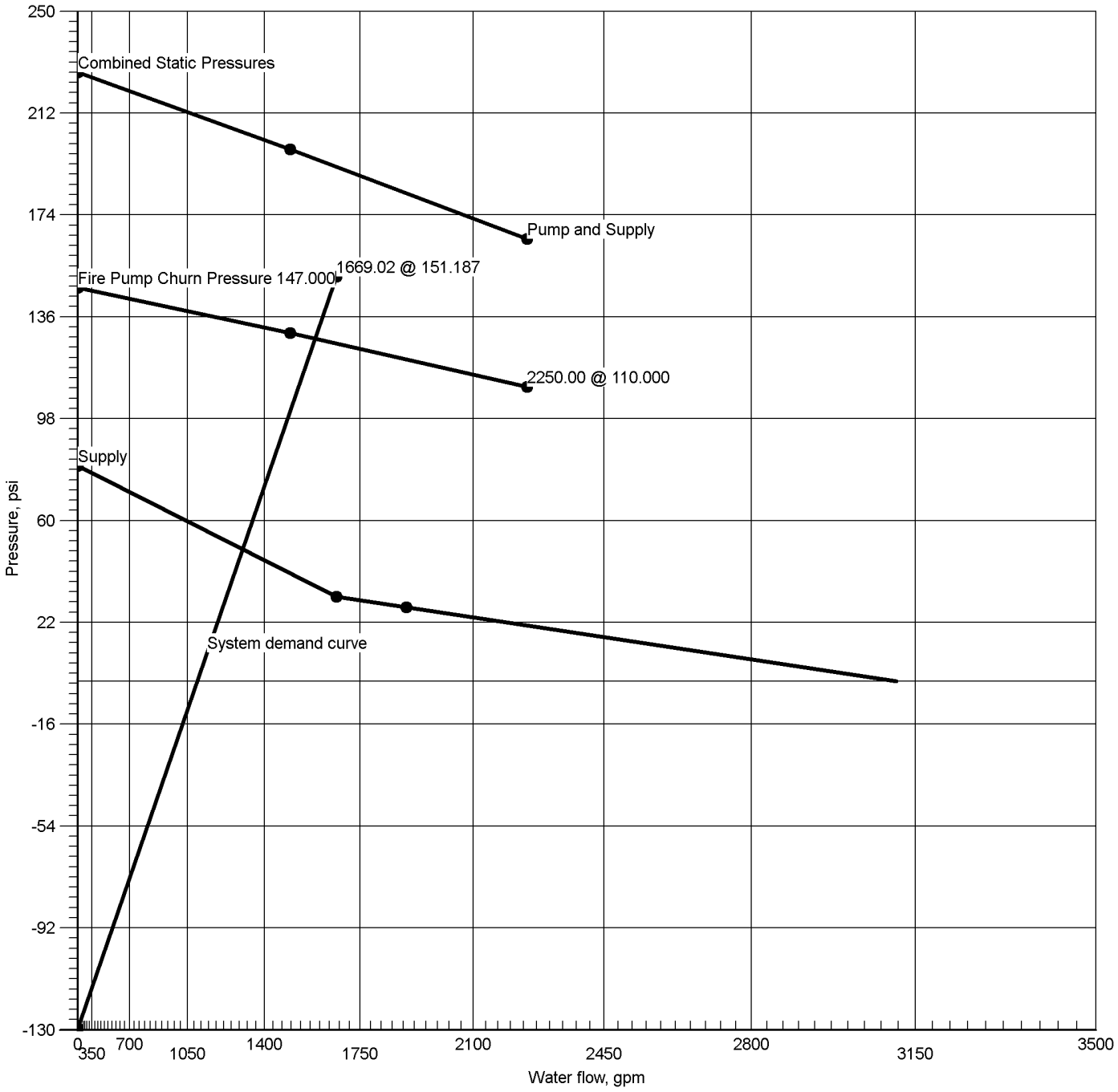
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
137.679 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

Pump at Node 72



Hydraulic Graph	Static + Churn Pressure	Fire Pump Rating
Pump at Node 72	227.555	130.000 @ 1500.00
Static: Pressure	**Fire Pump Churn Pressure**	
227.555	147.000	
Residual: Pressure		
126.181 @ 1669.02		
Available Pressure at System Demand		
157.774 @ 1669.02		
Required Pressure at System Demand		
151.187 @ 1669.02		

Summary Of Outflowing Devices

Job Number: NC-1403
Report Description: ESFR (SW System 3)

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Sprinkler	**301**	**121.15**	**121.15**	**16.8**	**52.000**			
Sprinkler	302	121.51	121.15	16.8	52.312			
Sprinkler	303	121.15	121.15	16.8	52.000			
Sprinkler	304	121.52	121.15	16.8	52.321			
Sprinkler	305	121.74	121.15	16.8	52.510			
Sprinkler	306	122.10	121.15	16.8	52.824			
Sprinkler	307	121.74	121.15	16.8	52.510			
Sprinkler	308	122.11	121.15	16.8	52.834			
Sprinkler	309	173.84	141.67	22.4	60.226			
Sprinkler	310	173.84	141.67	22.4	60.231			
Sprinkler	311	174.24	141.67	22.4	60.503			
Sprinkler	312	174.09	141.67	22.4	60.404			
Hydrant	4790	250.00	250.00	0	28.089			

Most Demanding Sprinkler Data

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
16	-4'-0	S, E(27'-2)	42.817	1919.02	
301	38'-9½	Spr(-52.000)	52.000	121.15	
302	38'-9½	Spr(-52.312)	52.312	121.51	
303	38'-9½	Spr(-52.000)	52.000	121.15	
304	38'-9½	Spr(-52.321)	52.321	121.52	
305	38'-7	Spr(-52.510)	52.510	121.74	
306	38'-7	Spr(-52.824)	52.824	122.10	
307	38'-7	Spr(-52.510)	52.510	121.74	
308	38'-7	Spr(-52.834)	52.834	122.11	
309	39'-0	Spr(-60.226)	60.226	173.84	
310	39'-0	Spr(-60.231)	60.231	173.84	
311	39'-0	Spr(-60.503)	60.503	174.24	
312	39'-0	Spr(-60.404)	60.404	174.09	
4790	0'-0	Hyd	28.089	250.00	
12	36'-7½	PO(18'-8½)	96.949		
13	36'-5	PO(18'-8½)	97.829		
14	2'-10	T(41'-1½)	24.548		
15	-4'-0	T(59'-4½)	29.732		
43	36'-2½	PO(18'-8½)	99.385		
44	36'-0	PO(18'-8½)	101.348		
45	35'-9½	PO(18'-8½)	103.777		
46	35'-7	PO(18'-8½)	106.741		
47	35'-4½	PO(18'-8½)	110.325		
48	35'-2	PO(18'-8½)	114.636		
49	35'-1½		115.479		
50	35'-1½	E(17'-7)	120.290		
51	3'-11½	BV(14'-1), BOR 3	134.725		
52	3'-0	PO(41'-1½), C(41'-1½)	137.679		
53	1'-11	BV(20'-4½)	142.080		
54	36'-8	PO(18'-8½)	77.448		
55	36'-5½	PO(18'-8½)	78.198		
56	36'-3	PO(18'-8½)	79.563		
57	36'-0½	PO(18'-8½)	80.601		
58	35'-10	PO(18'-8½)	81.349		
67	35'-7½	PO(18'-8½)	81.848		
71	-0'-10½		151.187		
72	-0'-10½	P2(-126.090)	151.187		
73	-0'-8	P1	25.006		
127	36'-10½	PO(22'-6)	96.548		
128	36'-10	PO(22'-6)	77.122		
129	35'-5	PO(18'-8½)	82.144		
130	35'-2½	PO(18'-8½)	82.296		
149	-4'-0	E(22'-1)	29.873		

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •								
CM	2.7050	120.29	6.72	120		0.035681	8'-9	Pf 0.312
301	38'-9½	121.15	16.8	52.000		Sprinkler		Pe -0.000
302	38'-9½			52.312			8'-9	Pv
CM	2.7050	241.80	13.50	120		0.129836	299'-1½	Pf 43.696
302	38'-9½	121.51	16.8	52.312		Sprinkler,	37'-5	Pe 0.941
12	36'-7½			96.949		2PO(18'-8½)	336'-6½	Pv
CM	4.2600	609.84	13.73	120		0.078719	10'-0	Pf 0.787
12	36'-7½	368.04		96.949		Flow (q) from Route 5		Pe 0.092
13	36'-5			97.829			10'-0	Pv
CM	4.2600	852.73	19.19	120		0.146362	10'-0	Pf 1.464
13	36'-5	242.89		97.829		Flow (q) from Route 3		Pe 0.092
43	36'-2½			99.385			10'-0	Pv
CM	4.2600	973.90	21.92	120		0.187145	10'-0	Pf 1.871
43	36'-2½	121.17		99.385		Flow (q) from Route 11		Pe 0.092
44	36'-0			101.348			10'-0	Pv
CM	4.2600	1098.09	24.72	120		0.233671	10'-0	Pf 2.336
44	36'-0	124.19		101.348		Flow (q) from Route 10		Pe 0.092
45	35'-9½			103.777			10'-0	Pv
CM	4.2600	1227.61	27.63	120		0.287203	10'-0	Pf 2.871
45	35'-9½	129.52		103.777		Flow (q) from Route 9		Pe 0.092
46	35'-7			106.741			10'-0	Pv
CM	4.2600	1364.64	30.72	120		0.349310	10'-0	Pf 3.492
46	35'-7	137.03		106.741		Flow (q) from Route 2		Pe 0.092
47	35'-4½			110.325			10'-0	Pv
CM	4.2600	1511.17	34.02	120		0.421851	10'-0	Pf 4.218
47	35'-4½	146.53		110.325		Flow (q) from Route 12		Pe 0.092
48	35'-2			114.636			10'-0	Pv
CM	4.2600	1669.02	37.57	120		0.506972	1'-7½	Pf 0.829
48	35'-2	157.85		114.636		Flow (q) from Route 13		Pe 0.015
49	35'-1½			115.479			1'-7½	Pv
CM	6.3570	1669.02	16.87	120		0.072172	13'-11	Pf 4.816
49	35'-1½			115.479			52'-9½	Pe -0.005
50	35'-1½			120.290		3E(17'-7)	66'-8½	Pv
FR	8.2490	1669.02	10.02	120		0.020292	31'-2	Pf 0.919
50	35'-1½			120.290			14'-1	Pe 13.516
51	3'-11½			134.725		f(-0.000), BV(14'-1), BOR 3	45'-3	Pv
CM	8.2490	1669.02	10.02	120		0.020292	2'-0	Pf 2.543
51	3'-11½			134.725			123'-4	Pe 0.411
52	3'-0			137.679		2PO(41'-1½), C(41'-1½)	125'-4	Pv
UG	8.3900	1669.02	9.69	140		0.014049	91'-11	Pf 3.937
52	3'-0			137.679			188'-3½	Pe 0.464
53	1'-11			142.080		sCV(76'-4), 3E(30'-6½), BV(20'-4½)	280'-3	Pv
DY	8.2490	1669.02	10.02	120		0.020292	2'-8	Pf 7.891
53	1'-11			142.080			164'-5	Pe 1.216
71	-0'-10½			151.187		2E(21'-1½), T(41'-1½), PRV(-4.500), 2BV(14'-1), sCV(52'-10)	167'-1	Pv
DY	6.0650	1669.02	18.53	120		0.090745	0'-0	Pf 0.000
71	-0'-10½			151.187				Pe -0.000
72	-0'-10½			151.187			0'-0	Pv
Pump			**Velocity**					
72		1669.02		151.187		Rating: 130.000 @ 1500.00		
73		Q=1669.02	10.02	25.006		Fire Pump Churn Pressure: 147.000		
FR	8.2490	1669.02	10.02	120		0.020292	6'-5½	Pf 1.060
73	-0'-8			25.006			45'-9½	Pe -1.518
14	2'-10			24.548		GV(4'-8½), T(41'-1½)	52'-3	Pv
UG	8.3900	1669.02	9.69	140		0.014049	68'-2	Pf 2.221
14	2'-10			24.548			89'-11	Pe 2.962
15	-4'-0			29.732		E(30'-6½), T(59'-4½)	158'-1	Pv
CM	7.9800	748.77	4.80	150		0.003582	2122'-8½	Pf 13.085
15	-4'-0			29.732			134'-3½	Pe
16	-4'-0			42.817		6EE(13'-7), BFP(-5.000), T(52'-10)	2257'-0½	Pv
		0.00				Hose Allowance At Source		
16		1919.02						

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 2 • • • • •								
CM	2.7050	0.86	0.05	120		0.000004	10'-0	Pf 0.000
301	38'-9½	121.15	16.8	52.000		Sprinkler		Pe 0.000
303	38'-9½			52.000			10'-0	Pv
CM	2.7050	122.00	6.81	120		0.036625	8'-9	Pf 0.320
303	38'-9½	121.15	16.8	52.000		Sprinkler		Pe 0.000
304	38'-9½			52.321			8'-9	Pv
CM	2.7050	243.52	13.60	120		0.131550	146'-5	Pf 24.188
304	38'-9½	121.52	16.8	52.321		Sprinkler,	37'-5	Pe 0.939
54	36'-8			77.448		2PO(18'-8½)	183'-10½	Pv
CM	4.3100	571.49	12.57	120		0.065950	10'-0	Pf 0.659
54	36'-8	327.97		77.448		Flow (q) from Route 6		Pe 0.090
55	36'-5½			78.198			10'-0	Pv
CM	4.3100	816.30	17.95	120		0.127546	10'-0	Pf 1.275
55	36'-5½	244.81		78.198		Flow (q) from Route 4		Pe 0.090
56	36'-3			79.563			10'-0	Pv
CM	4.3100	695.13	15.29	120		0.094748	10'-0	Pf 0.947
56	36'-3			79.563				Pe 0.090
57	36'-0½			80.601			10'-0	Pv
CM	4.3100	570.94	12.56	120		0.065832	10'-0	Pf 0.658
57	36'-0½			80.601				Pe 0.090
58	35'-10			81.349			10'-0	Pv
CM	4.3100	441.42	9.71	120		0.040899	10'-0	Pf 0.409
58	35'-10			81.349				Pe 0.090
67	35'-7½			81.848			10'-0	Pv
RN	2.7050	137.03	7.65	120		0.045405	473'-1	Pf 24.879
67	35'-7½			81.848		PO(18'-8½)	74'-10½	Pe 0.013
46	35'-7			106.741		3PO(18'-8½)	547'-11½	Pv
• • • • • Route 3 • • • • •								
CM	2.7050	120.79	6.74	120		0.035952	8'-9	Pf 0.315
305	38'-7	121.74	16.8	52.510		Sprinkler		Pe -0.000
306	38'-7			52.824			8'-9	Pv
CM	2.7050	242.89	13.56	120		0.130919	299'-1½	Pf 44.061
306	38'-7	122.10	16.8	52.824		Sprinkler,	37'-5	Pe 0.943
13	36'-5			97.829		2PO(18'-8½)	336'-6½	Pv
• • • • • Route 4 • • • • •								
CM	2.7050	0.95	0.05	120		0.000005	10'-0	Pf 0.000
305	38'-7	121.74	16.8	52.510		Sprinkler		Pe 0.000
307	38'-7			52.510			10'-0	Pv
CM	2.7050	122.69	6.85	120		0.037009	8'-9	Pf 0.324
307	38'-7	121.74	16.8	52.510		Sprinkler		Pe 0.000
308	38'-7			52.834			8'-9	Pv
CM	2.7050	244.81	13.67	120		0.132837	146'-5	Pf 24.425
308	38'-7	122.11	16.8	52.834		Sprinkler,	37'-5	Pe 0.939
55	36'-5½			78.198		2PO(18'-8½)	183'-10½	Pv
• • • • • Route 5 • • • • •								
CM	3.3340	19.96	0.73	120		0.000465	10'-0	Pf 0.005
309	39'-0	173.84	22.4	60.226		Sprinkler		Pe -0.000
310	39'-0			60.231			10'-0	Pv
CM	3.3340	193.80	7.12	120		0.031148	8'-9	Pf 0.273
310	39'-0	173.84	22.4	60.231		Sprinkler		Pe -0.000
311	39'-0			60.503			8'-9	Pv
CM	3.3340	368.04	13.53	120		0.102026	299'-1½	Pf 35.105
311	39'-0	174.24	22.4	60.503		Sprinkler,	44'-11½	Pe 0.939
127	36'-10½			96.548		2PO(22'-6)	344'-1	Pv
CM	4.2600	368.04	8.28	120		0.030926	10'-0	Pf 0.309
127	36'-10½			96.548				Pe 0.092
12	36'-7½			96.949			10'-0	Pv
• • • • • Route 6 • • • • •								
CM	3.3340	153.88	5.65	120		0.020327	8'-9	Pf 0.178
309	39'-0	173.84	22.4	60.226		Sprinkler		Pe 0.000
312	39'-0			60.404			8'-9	Pv
CM	3.3340	327.97	12.05	120		0.082433	146'-5	Pf 15.779
312	39'-0	174.09	22.4	60.404		Sprinkler,	44'-11½	Pe 0.939
128	36'-10			77.122		2PO(22'-6)	191'-5	Pv
CM	4.3100	327.97	7.21	120		0.023607	10'-0	Pf 0.236
128	36'-10			77.122				Pe 0.090
54	36'-8			77.448			10'-0	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 7 • • • • •								
FR	6.2800	250.00	2.59	140		0.001718	4'-0	**Pf** 0.045
4790	0'-0	250.00		28.089		Hydrant,	22'-1	**Pe** 1.739
149	-4'-0			29.873		E(22'-1)	26'-1	**Pv**
UG	8.3900	250.00	1.45	140		0.000419	22'-5	**Pf** 0.034
149	-4'-0			29.873			59'-4½	**Pe**
150	-4'-0			29.908		T(59'-4½)	81'-9½	**Pv**
CM	7.9800	1170.26	7.51	150		0.008183	885'-0½	**Pf** 12.910
150	-4'-0	920.26		29.908		Flow (q) from Route 8	81'-6	**Pe**
16	-4'-0			42.817		4EE(13'-7), BFP(-5.000), S, E(27'-2)	966'-6½	**Pv**
• • • • • Route 8 • • • • •								
CM	7.9800	920.26	5.90	150		0.005246	33'-6	**Pf** 0.176
15	-4'-0	748.77		29.732		Flow (q) from Route 1		**Pe**
150	-4'-0			29.908			33'-6	**Pv**
• • • • • Route 9 • • • • •								
RN	2.7050	129.52	7.23	120		0.040911	473'-1	**Pf** 22.417
58	35'-10			81.349		PO(18'-8½)	74'-10½	**Pe** 0.011
45	35'-9½			103.777		3PO(18'-8½)	547'-11½	**Pv**
• • • • • Route 10 • • • • •								
RN	2.7050	124.19	6.93	120		0.037849	473'-0½	**Pf** 20.739
57	36'-0½			80.601		PO(18'-8½)	74'-10½	**Pe** 0.009
44	36'-0			101.348		3PO(18'-8½)	547'-11	**Pv**
• • • • • Route 11 • • • • •								
RN	2.7050	121.17	6.76	120		0.036163	473'-0½	**Pf** 19.815
56	36'-3			79.563		PO(18'-8½)	74'-10½	**Pe** 0.006
43	36'-2½			99.385		3PO(18'-8½)	547'-11	**Pv**
• • • • • Route 12 • • • • •								
CM	4.3100	304.39	6.69	120		0.020563	10'-0	**Pf** 0.206
67	35'-7½	137.03		81.848		Flow (q) from Route 2		**Pe** 0.090
129	35'-5			82.144			10'-0	**Pv**
RN	2.7050	146.53	8.18	120		0.051403	473'-1	**Pf** 28.166
129	35'-5			82.144		PO(18'-8½)	74'-10½	**Pe** 0.015
47	35'-4½			110.325		3PO(18'-8½)	547'-11½	**Pv**
• • • • • Route 13 • • • • •								
CM	4.3100	157.85	3.47	120		0.006103	10'-0	**Pf** 0.061
129	35'-5	146.53		82.144		Flow (q) from Route 12		**Pe** 0.090
130	35'-2½			82.296			10'-0	**Pv**
RN	2.7050	157.85	8.81	120		0.058988	473'-1	**Pf** 32.323
130	35'-2½			82.296		PO(18'-8½)	74'-10½	**Pe** 0.017
48	35'-2			114.636		3PO(18'-8½)	547'-11½	**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

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

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
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
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 Summary

Job Number: NC-1403
Report Description: ESFR (NE System 4)

Job

Job Number: NC-1403	Designer: DB
Job Name: Town Center 22	State Certification/License Number:
Address 1: NE Town Center Blvd. Lee's Summit MO 64064	AHJ: Lee's Summit
Address 2:	Job Site/Building:
Address 3:	Drawing Name: Town Center 22 draw

System

Most Demanding Sprinkler Data: 16.8 K-Factor 121.15 at 52.000

Hose Allowance At Source: 0.00

Additional Hose Supplies

Node	Flow(gpm)
Hydrant At Node 4790	250.00

Total Hose Streams: 250.00

System Flow Demand	Total Water Required (Including Hose Allowance)
1707.92	1707.92

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 32.06 between nodes 33 and 32

Maximum Velocity Under Ground	
8.46 between nodes 53 and 52	

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
20665.71 gal	

Remote Area(s)

Occupancy	Job Suffix
ESFR	

Pressure	Area of Application
50.000	NA

Number Of Sprinklers Calculated	Number Of Nozzles Calculated	Coverage Per Sprinkler
12	0	100.00 ft²

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi) @ Flow (gpm)	Available (psi) @ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
16	Water Supply		82.000	50.000 @ 1900.00	55.726 @ 1707.92	43.835	11.891
72	Pump		147.000	130.000 @ 1500.00	171.177 @ 1457.92	159.286	11.891

Pumps: Static = Churn (Pressure @ Zero Flow)

Contractor

	Contractor Number	Contact Name	Contact Title
	1	Derek Bisoglio	Design

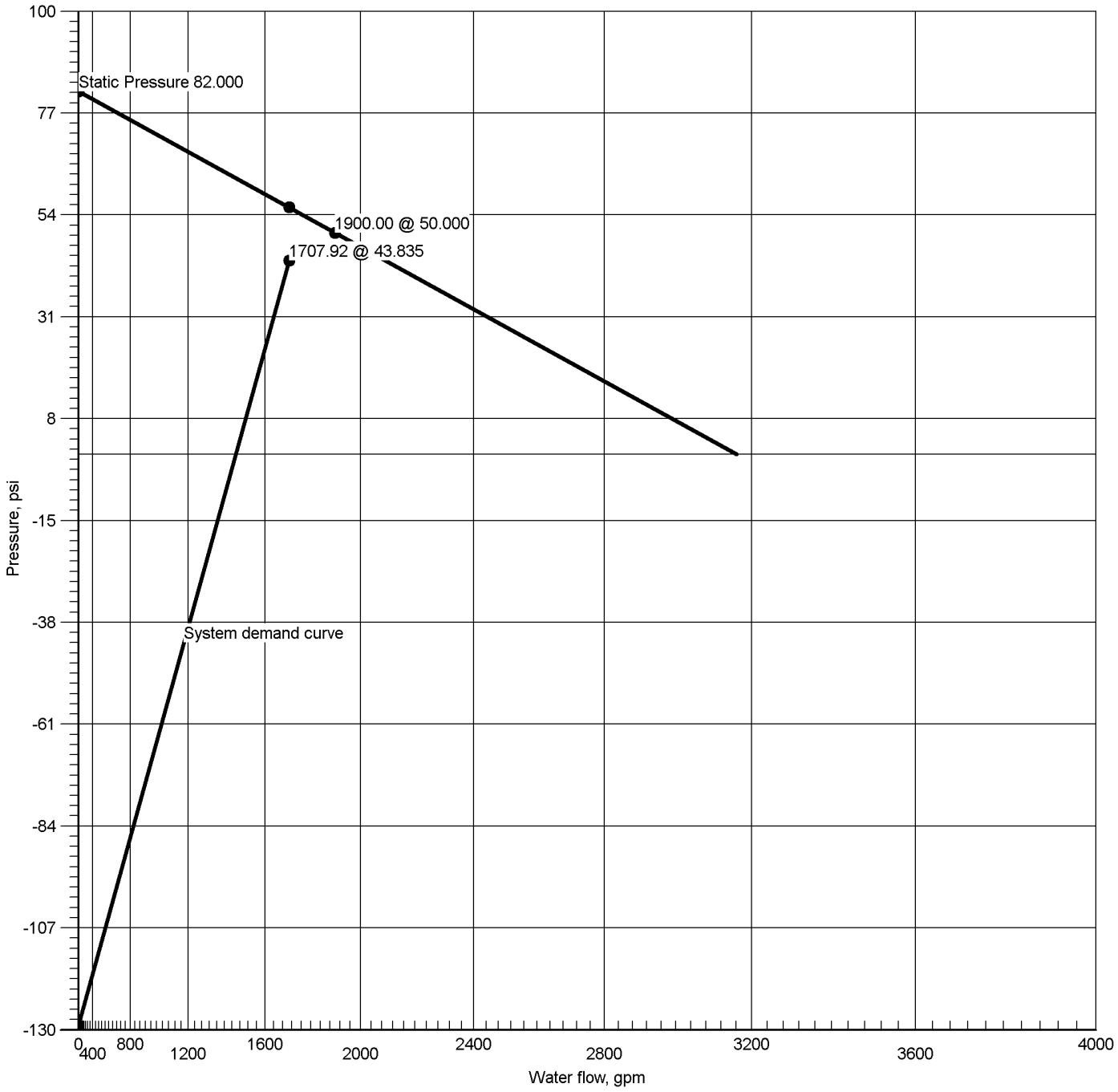
Name of Contractor:	Phone	Extension
Alliance Fire Protection	816-679-8021	

Address 1	FAX
130 w 9th Ave. Suite 100	

Address 2	E-mail
North Kansas City, MO 64116	dbisoglio@afpsprink.com

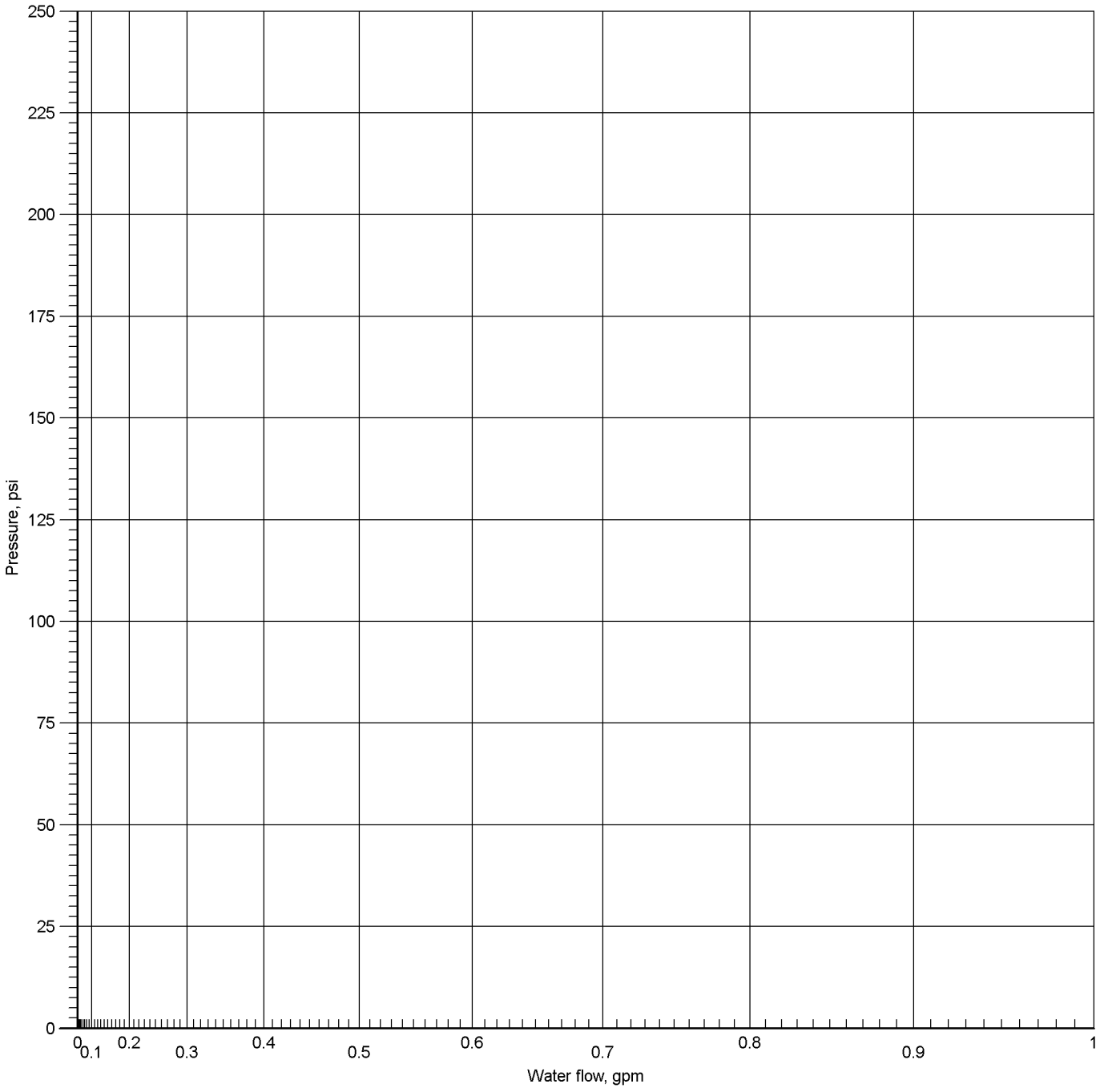
Address 3	Web-Site

Water Supply at Node 16



Hydraulic Graph
Water Supply at Node 16
Static: Pressure
82.000
Residual: Pressure
50.000 @ 1900.00
Available Pressure at System Demand
55.726 @ 1707.92
Required Pressure at System Demand
43.835 @ 1707.92
Required Pressure at System Demand (Including Hose Allowance at Source)
43.835 @ 1707.92

BOR 1 at Node 11



Hydraulic Graph
BOR 1 at Node 11

Static: Pressure
220.512

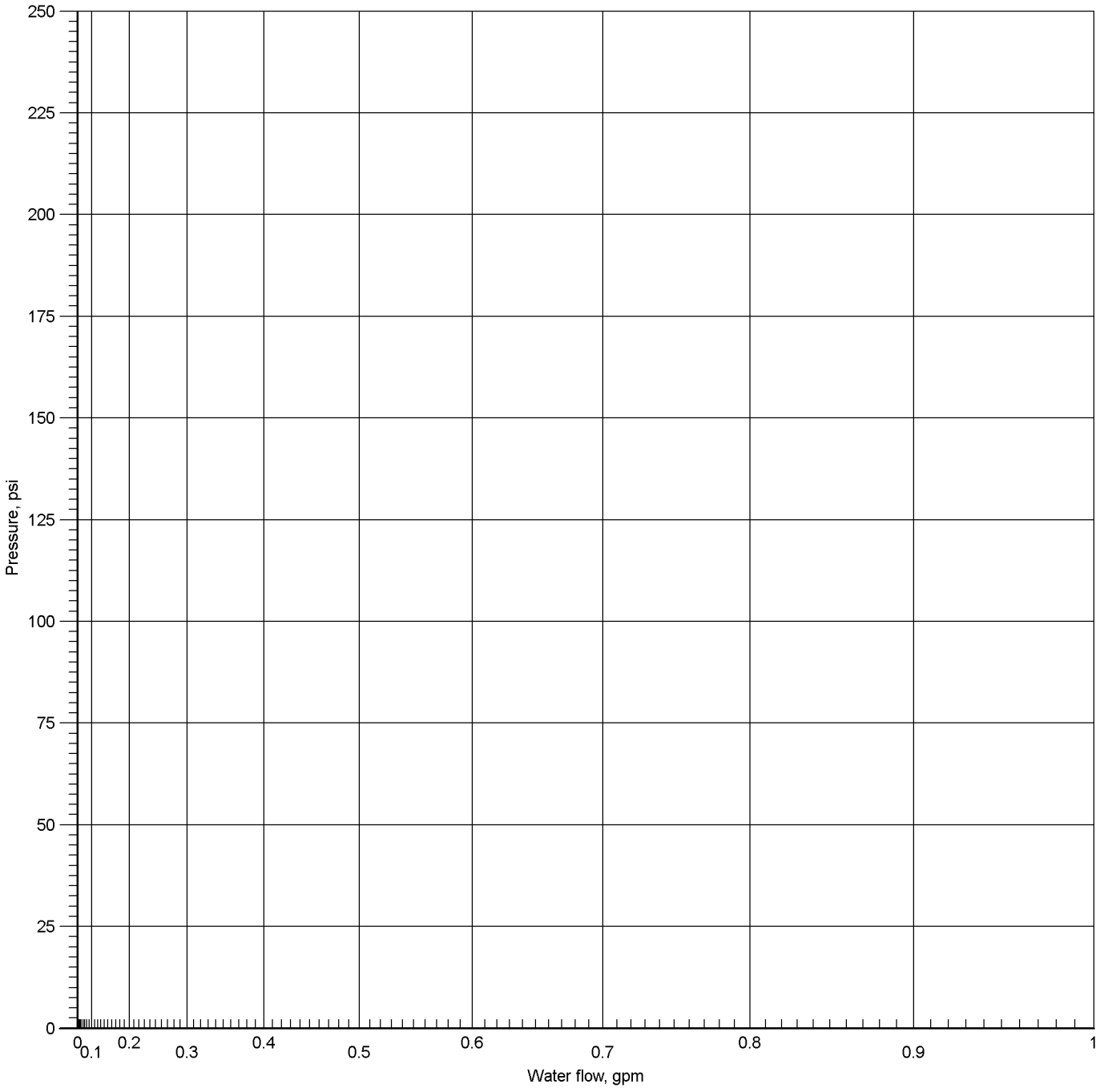
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
142.495 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 2 at Node 70



Hydraulic Graph
BOR 2 at Node 70

Static: Pressure
220.381

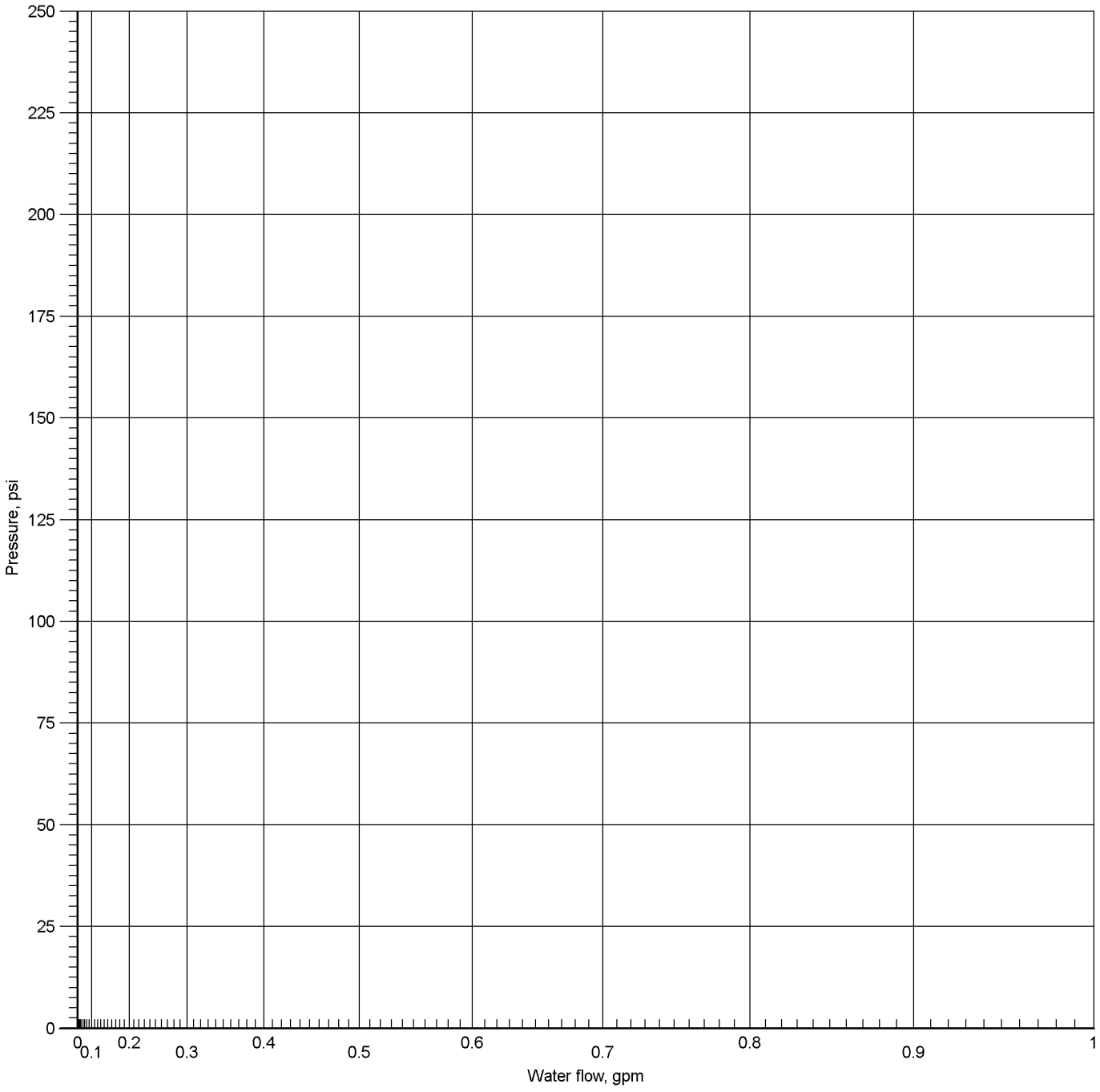
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
143.670 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 3 at Node 51



Hydraulic Graph
BOR 3 at Node 51

Static: Pressure
221.054

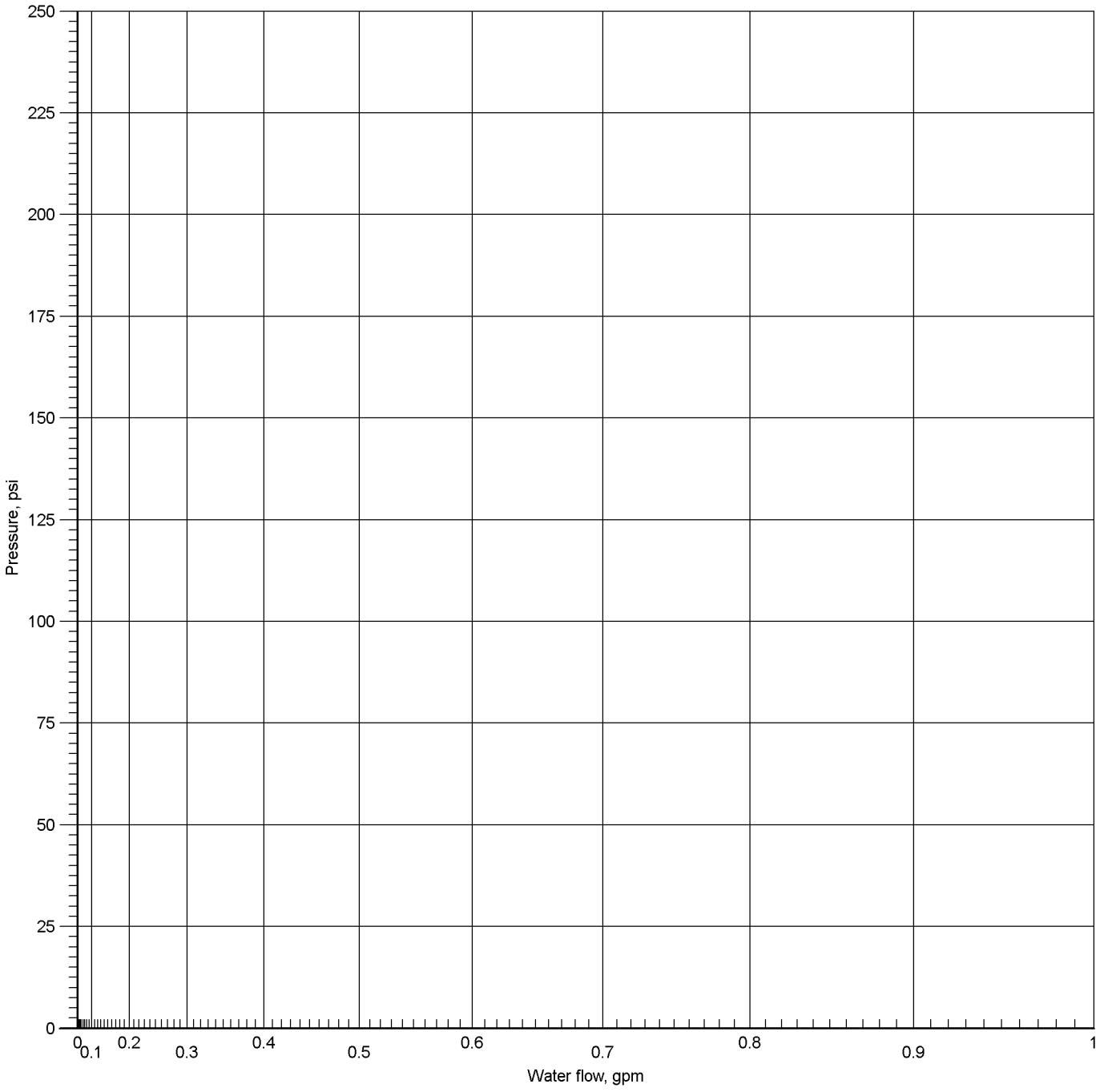
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
144.446 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 6 at Node 117



Hydraulic Graph
BOR 6 at Node 117

Static: Pressure
221.054

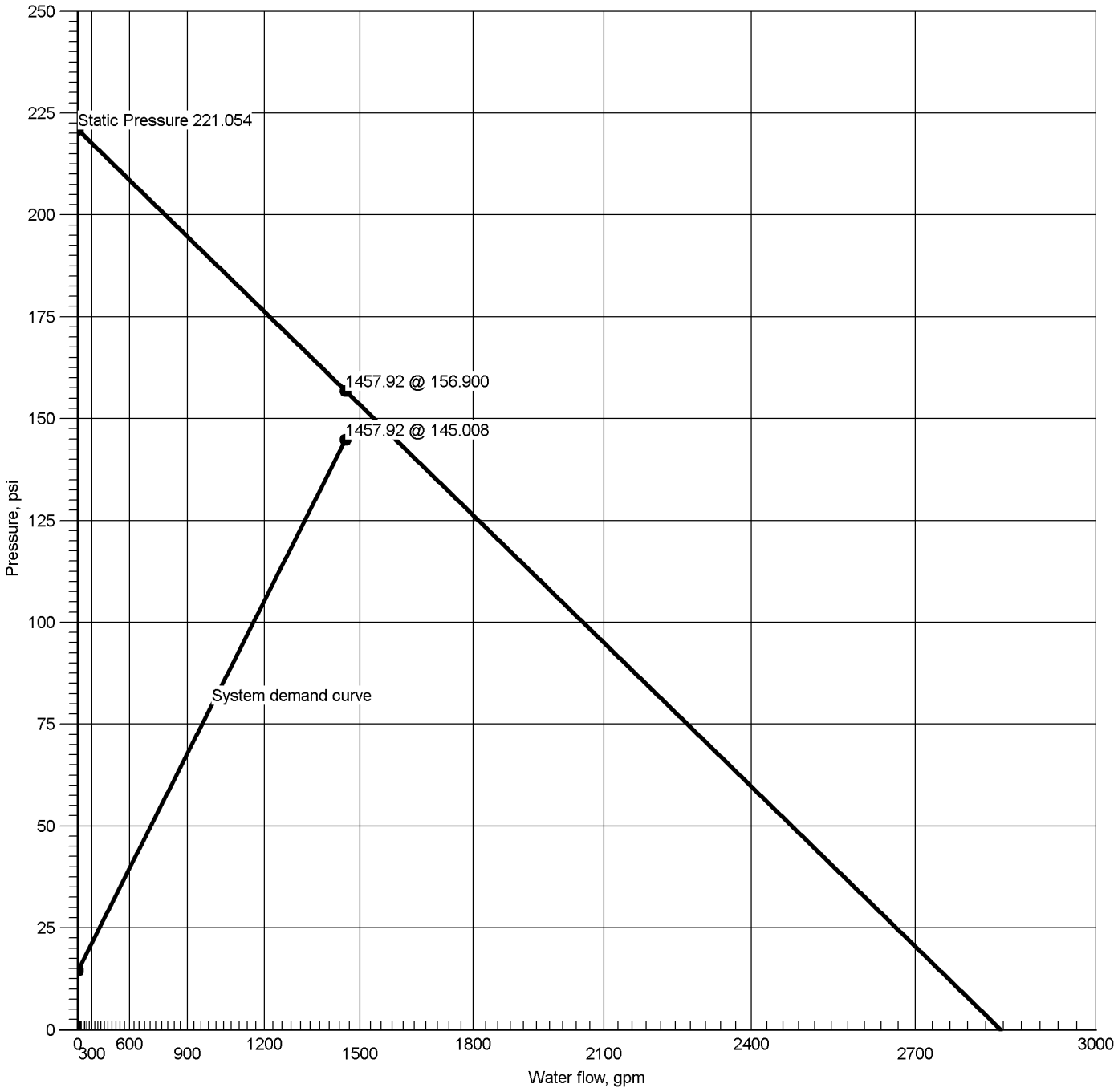
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
147.400 @ 0.00

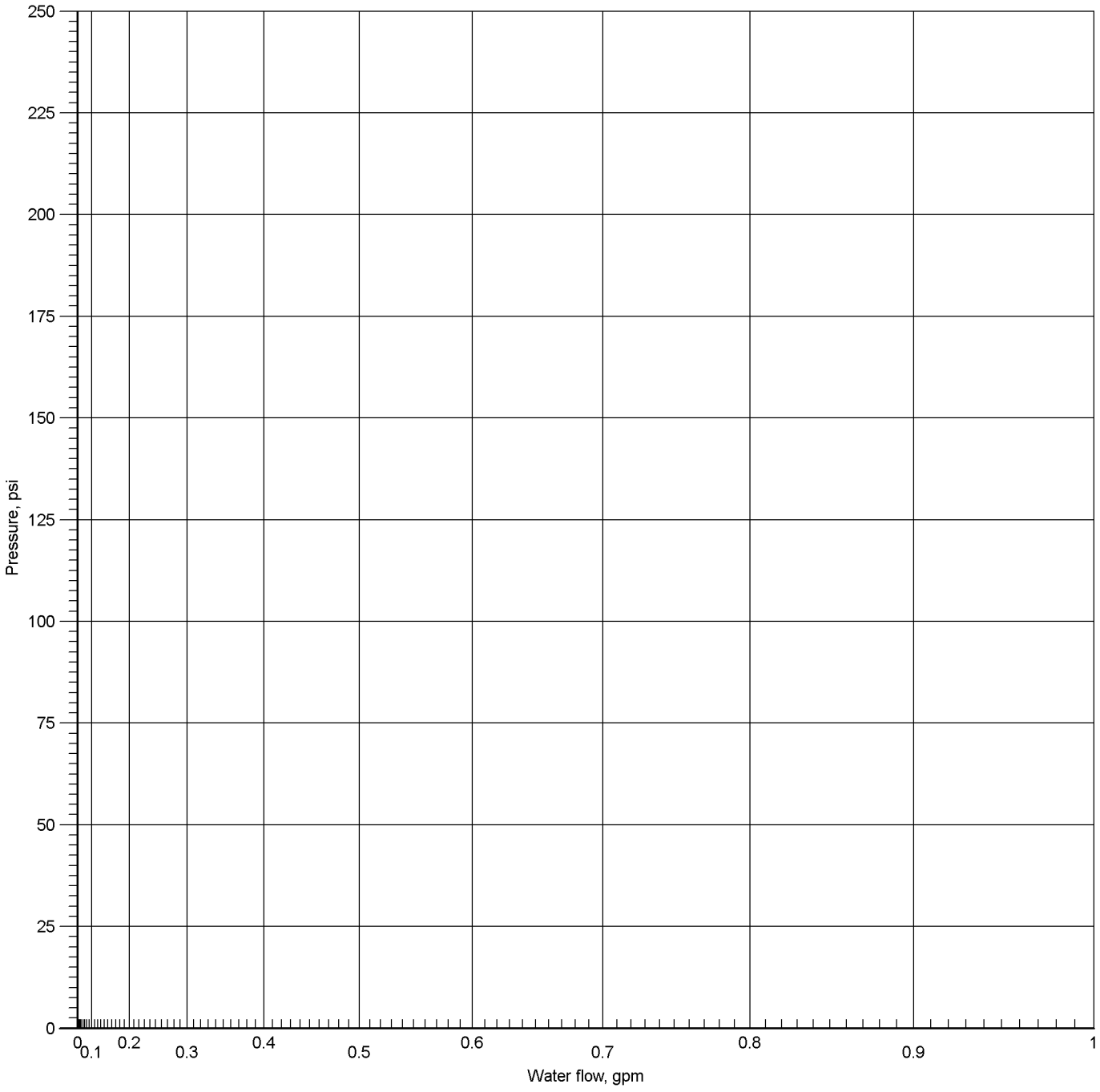
Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 4 at Node 35



Hydraulic Graph	BOR 4 at Node 35
Static: Pressure	221.054
Residual: Pressure	N/A
Available Pressure at System Demand	156.900 @ 1457.92
Required Pressure at System Demand	145.008 @ 1457.92
Required Pressure at System Demand (Including Hose Allowance at Source)	N/A

BOR 5 at Node 86



Hydraulic Graph
BOR 5 at Node 86

Static: Pressure
221.054

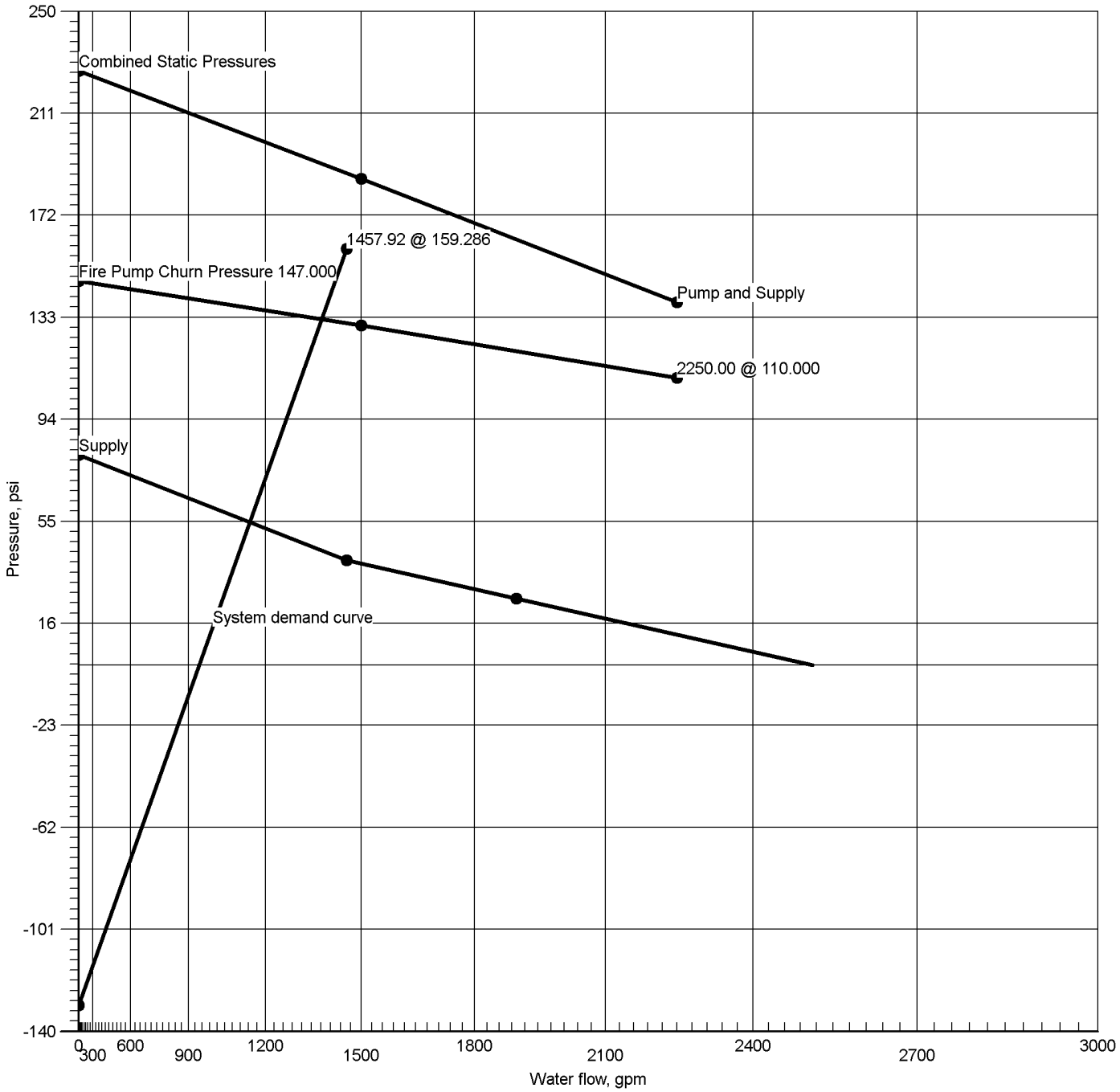
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
146.069 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

Pump at Node 72



Hydraulic Graph	Static + Churn Pressure	Fire Pump Rating
Pump at Node 72	227.555	130.000 @ 1500.00
Static: Pressure	**Fire Pump Churn Pressure**	
227.555	147.000	
Residual: Pressure		
130.962 @ 1457.92		
Available Pressure at System Demand		
171.177 @ 1457.92		
Required Pressure at System Demand		
159.286 @ 1457.92		

Summary Of Outflowing Devices

Job Number: NC-1403
Report Description: ESFR (NE System 4)

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Sprinkler	**501**	**121.15**	**121.15**	**16.8**	**52.000**			
Sprinkler	502	121.51	121.15	16.8	52.313			
Sprinkler	503	121.15	121.15	16.8	52.003			
Sprinkler	504	121.63	121.15	16.8	52.416			
Sprinkler	505	121.19	121.15	16.8	52.033			
Sprinkler	506	121.55	121.15	16.8	52.346			
Sprinkler	507	121.19	121.15	16.8	52.036			
Sprinkler	508	121.67	121.15	16.8	52.450			
Sprinkler	509	121.51	121.15	16.8	52.312			
Sprinkler	510	121.87	121.15	16.8	52.624			
Sprinkler	511	121.51	121.15	16.8	52.315			
Sprinkler	512	122.00	121.15	16.8	52.733			
Hydrant	4790	250.00	250.00	0	30.638			

Most Demanding Sprinkler Data

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
16	-4'-0	S, E(27'-2)	43.835	1707.92	
501	37'-4	Spr(-52.000)	52.000	121.15	
502	37'-4	Spr(-52.313)	52.313	121.51	
503	37'-4	Spr(-52.003)	52.003	121.15	
504	37'-4	Spr(-52.416)	52.416	121.63	
505	37'-6½	Spr(-52.033)	52.033	121.19	
506	37'-6½	Spr(-52.346)	52.346	121.55	
507	37'-6½	Spr(-52.036)	52.036	121.19	
508	37'-6½	Spr(-52.450)	52.450	121.67	
509	37'-9	Spr(-52.312)	52.312	121.51	
510	37'-9	Spr(-52.624)	52.624	121.87	
511	37'-9	Spr(-52.315)	52.315	121.51	
512	37'-9	Spr(-52.733)	52.733	122.00	
4790	0'-0	Hyd	30.638	250.00	
14	2'-10	T(41'-1½)	27.631		
15	-4'-0	T(59'-4½)	32.323		
25	35'-2½	PO(18'-8½)	99.880		
26	35'-5	PO(18'-8½)	99.915		
27	35'-7½	PO(18'-8½)	100.279		
28	35'-10	PO(18'-8½)	101.151		
29	36'-0½	PO(18'-8½)	102.420		
30	36'-3	PO(18'-8½)	104.154		
31	36'-5½	PO(18'-8½)	106.428		
32	36'-8	PO(18'-8½)	109.333		
33	36'-8½	E(13'-11)	115.276		
34	35'-1½	E(17'-7)	130.777		
35	3'-11½	BV(14'-1), BOR 4	145.008		
36	35'-2	PO(18'-8½)	72.443		
37	35'-4½	PO(18'-8½)	72.498		
38	35'-7	PO(18'-8½)	72.930		
39	35'-9½	PO(18'-8½)	73.950		
40	36'-0	PO(18'-8½)	74.611		
41	36'-2½	PO(18'-8½)	74.975		
42	36'-5	PO(18'-8½)	75.108		
52	3'-0	PO(41'-1½), C(41'-1½)	147.400		
53	1'-11	BV(20'-4½)	150.930		
71	-0'-10½		159.286		
72	-0'-10½	P2(-130.872)	159.286		
73	-0'-8	P1	28.324		
135	36'-7½	PO(18'-8½)	75.082		
149	-4'-0	E(22'-1)	32.422		

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •								
CM	2.7050	112.11	6.26	120		0.031319	10'-0	Pf 0.313
501	37'-4	121.15	16.8	52.000		Sprinkler		Pe -0.000
502	37'-4			52.313			10'-0	Pv
CM	2.7050	233.62	13.04	120		0.121823	345'-4	Pf 46.628
502	37'-4	121.51	16.8	52.313		Sprinkler,	37'-5	Pe 0.939
25	35'-2½			99.880		2PO(18'-8½)	382'-9	Pv
CM	4.3100	233.62	5.14	120		0.012603	10'-0	Pf 0.126
25	35'-2½			99.880				Pe -0.090
26	35'-5			99.915			10'-0	Pv
CM	4.3100	467.24	10.27	120		0.045436	10'-0	Pf 0.454
26	35'-5	233.62		99.915		Flow (q) from Route 3		Pe -0.090
27	35'-7½			100.279			10'-0	Pv
CM	4.3100	701.10	15.42	120		0.096258	10'-0	Pf 0.962
27	35'-7½	233.86		100.279		Flow (q) from Route 5		Pe -0.090
28	35'-10			101.151			10'-0	Pv
CM	4.3100	844.91	18.58	120		0.135941	10'-0	Pf 1.359
28	35'-10	143.82		101.151		Flow (q) from Route 9		Pe -0.090
29	36'-0½			102.420			10'-0	Pv
CM	4.3100	990.45	21.78	120		0.182407	10'-0	Pf 1.824
29	36'-0½	145.54		102.420		Flow (q) from Route 10		Pe -0.090
30	36'-3			104.154			10'-0	Pv
CM	4.3100	1139.83	25.07	120		0.236538	10'-0	Pf 2.365
30	36'-3	149.37		104.154		Flow (q) from Route 11		Pe -0.090
31	36'-5½			106.428			10'-0	Pv
CM	4.3100	1295.03	28.48	120		0.299548	10'-0	Pf 2.995
31	36'-5½	155.20		106.428		Flow (q) from Route 2		Pe -0.090
32	36'-8			109.333			10'-0	Pv
CM	4.3100	1457.92	32.06	120		0.372954	2'-0½	Pf 5.962
32	36'-8	162.89		109.333		Flow (q) from Route 12	13'-11	Pe -0.019
33	36'-8½			115.276		E(13'-11)	16'-0	Pv
CM	6.3570	1457.92	14.74	120		0.056198	193'-4	Pf 14.822
33	36'-8½			115.276			70'-5	Pe 0.679
34	35'-1½			130.777		4E(17'-7)	263'-9	Pv
FR	8.2490	1457.92	8.75	120		0.015801	31'-2	Pf 0.715
34	35'-1½			130.777			14'-1	Pe 13.516
35	3'-11½			145.008		f(-0.000), BV(14'-1), BOR 4	45'-3	Pv
CM	8.2490	1457.92	8.75	120		0.015801	2'-0	Pf 1.980
35	3'-11½			145.008			123'-4	Pe 0.411
52	3'-0			147.400		2PO(41'-1½), C(41'-1½)	125'-4	Pv
UG	8.3900	1457.92	8.46	140		0.010939	91'-11	Pf 3.066
52	3'-0			147.400			188'-3½	Pe 0.464
53	1'-11			150.930		sCV(76'-4), 3E(30'-6½), BV(20'-4½)	280'-3	Pv
DY	8.2490	1457.92	8.75	120		0.015801	2'-8	Pf 7.140
53	1'-11			150.930			164'-5	Pe 1.216
71	-0'-10½			159.286		2E(21'-1½), T(41'-1½), PRV(-4.500), 2BV(14'-1), sCV(52'-10)	167'-1	Pv
DY	6.0650	1457.92	16.19	120		0.070660	0'-0	Pf 0.000
71	-0'-10½			159.286				Pe -0.000
72	-0'-10½			159.286			0'-0	Pv
Pump			**Velocity**					
72		1457.92		159.286		Rating: 130.000 @ 1500.00		
73		Q=1457.92	8.75	28.324		Fire Pump Churn Pressure: 147.000		
FR	8.2490	1457.92	8.75	120		0.015801	6'-5½	Pf 0.826
73	-0'-8			28.324			45'-9½	Pe -1.518
14	2'-10			27.631		GV(4'-8½), T(41'-1½)	52'-3	Pv
UG	8.3900	1457.92	8.46	140		0.010939	68'-2	Pf 1.729
14	2'-10			27.631			89'-11	Pe 2.962
15	-4'-0			32.323		E(30'-6½), T(59'-4½)	158'-1	Pv
CM	7.9800	666.10	4.27	150		0.002885	2122'-8½	Pf 11.512
15	-4'-0			32.323			134'-3½	Pe
16	-4'-0			43.835		6EE(13'-7), BFP(-5.000), T(52'-10)	2257'-0½	Pv
		0.00				Hose Allowance At Source		
16		1707.92						

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 2 • • • • •								
CM	2.7050	9.04	0.50	120		0.000297	8'-9	Pf 0.003
501	37'-4	121.15	16.8	52.000		Sprinkler		Pe 0.000
503	37'-4			52.003			8'-9	Pv
CM	2.7050	130.19	7.27	120		0.041302	10'-0	Pf 0.413
503	37'-4	121.15	16.8	52.003		Sprinkler		Pe 0.000
504	37'-4			52.416			10'-0	Pv
CM	2.7050	251.82	14.06	120		0.139964	98'-11½	Pf 19.088
504	37'-4	121.63	16.8	52.416		Sprinkler,	37'-5	Pe 0.940
36	35'-2			72.443		2PO(18'-8½)	136'-4½	Pv
CM	4.3100	251.82	5.54	120		0.014480	10'-0	Pf 0.145
36	35'-2			72.443				Pe -0.090
37	35'-4½			72.498			10'-0	Pv
CM	4.3100	503.79	11.08	120		0.052229	10'-0	Pf 0.523
37	35'-4½	251.97		72.498		Flow (q) from Route 4		Pe -0.090
38	35'-7			72.930			10'-0	Pv
CM	4.3100	756.82	16.64	120		0.110889	10'-0	Pf 1.110
38	35'-7	253.03		72.930		Flow (q) from Route 6		Pe -0.090
39	35'-9½			73.950			10'-0	Pv
CM	4.3100	613.01	13.48	120		0.075086	10'-0	Pf 0.751
39	35'-9½			73.950				Pe -0.090
40	36'-0			74.611			10'-0	Pv
CM	4.3100	467.46	10.28	120		0.045476	10'-0	Pf 0.455
40	36'-0			74.611				Pe -0.090
41	36'-2½			74.975			10'-0	Pv
CM	4.3100	318.09	6.99	120		0.022308	10'-0	Pf 0.223
41	36'-2½			74.975				Pe -0.090
42	36'-5			75.108			10'-0	Pv
RN	2.7050	155.20	8.66	120		0.057169	473'-0	Pf 31.321
42	36'-5			75.108		PO(18'-8½)	74'-10½	Pe -0.001
31	36'-5½			106.428		3PO(18'-8½)	547'-10½	Pv
• • • • • Route 3 • • • • •								
CM	2.7050	112.07	6.26	120		0.031303	10'-0	Pf 0.313
505	37'-6½	121.19	16.8	52.033		Sprinkler		Pe -0.000
506	37'-6½			52.346			10'-0	Pv
CM	2.7050	233.62	13.04	120		0.121830	345'-4	Pf 46.630
506	37'-6½	121.55	16.8	52.346		Sprinkler,	37'-5	Pe 0.939
26	35'-5			99.915		2PO(18'-8½)	382'-9	Pv
• • • • • Route 4 • • • • •								
CM	2.7050	9.11	0.51	120		0.000301	8'-9	Pf 0.003
505	37'-6½	121.19	16.8	52.033		Sprinkler		Pe 0.000
507	37'-6½			52.036			8'-9	Pv
CM	2.7050	130.30	7.27	120		0.041366	10'-0	Pf 0.414
507	37'-6½	121.19	16.8	52.036		Sprinkler		Pe 0.000
508	37'-6½			52.450			10'-0	Pv
CM	2.7050	251.97	14.07	120		0.140116	98'-11½	Pf 19.108
508	37'-6½	121.67	16.8	52.450		Sprinkler,	37'-5	Pe 0.940
37	35'-4½			72.498		2PO(18'-8½)	136'-4½	Pv
• • • • • Route 5 • • • • •								
CM	2.7050	111.98	6.25	120		0.031257	10'-0	Pf 0.313
509	37'-9	121.51	16.8	52.312		Sprinkler		Pe -0.000
510	37'-9			52.624			10'-0	Pv
CM	2.7050	233.86	13.06	120		0.122055	345'-4	Pf 46.716
510	37'-9	121.87	16.8	52.624		Sprinkler,	37'-5	Pe 0.939
27	35'-7½			100.279		2PO(18'-8½)	382'-9	Pv
• • • • • Route 6 • • • • •								
CM	2.7050	9.52	0.53	120		0.000327	8'-9	Pf 0.003
509	37'-9	121.51	16.8	52.312		Sprinkler		Pe 0.000
511	37'-9			52.315			8'-9	Pv
CM	2.7050	131.04	7.32	120		0.041800	10'-0	Pf 0.418
511	37'-9	121.51	16.8	52.315		Sprinkler		Pe 0.000
512	37'-9			52.733			10'-0	Pv
CM	2.7050	253.03	14.13	120		0.141214	98'-11½	Pf 19.258
512	37'-9	122.00	16.8	52.733		Sprinkler,	37'-5	Pe 0.940
38	35'-7			72.930		2PO(18'-8½)	136'-4½	Pv
• • • • • Route 7 • • • • •								

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
FR	6.2800	250.00	2.59	140	0.001718	4'-0	Pf 0.045
4790	0'-0	250.00		30.638	Hydrant,	22'-1	Pe 1.739
149	-4'-0			32.422	E(22'-1)	26'-1	Pv
UG	8.3900	250.00	1.45	140	0.000419	22'-5	Pf 0.034
149	-4'-0			32.422		59'-4½	Pe
150	-4'-0			32.456	T(59'-4½)	81'-9½	Pv
CM	7.9800	1041.81	6.68	150	0.006600	885'-0½	Pf 11.379
150	-4'-0	791.81		32.456	Flow (q) from Route 8	81'-6	Pe
16	-4'-0			43.835	4EE(13'-7), BFP(-5.000), S, E(27'-2)	966'-6½	Pv
• • • • • Route 8 • • • • •							
CM	7.9800	791.81	5.08	150	0.003973	33'-6	Pf 0.133
15	-4'-0	666.10		32.323	Flow (q) from Route 1		Pe
150	-4'-0			32.456		33'-6	Pv
• • • • • Route 9 • • • • •							
RN	2.7050	143.82	8.03	120	0.049652	473'-0	Pf 27.203
39	35'-9½			73.950	PO(18'-8½)	74'-10½	Pe -0.001
28	35'-10			101.151	3PO(18'-8½)	547'-10½	Pv
• • • • • Route 10 • • • • •							
RN	2.7050	145.54	8.13	120	0.050761	473'-0	Pf 27.811
40	36'-0			74.611	PO(18'-8½)	74'-10½	Pe -0.001
29	36'-0½			102.420	3PO(18'-8½)	547'-10½	Pv
• • • • • Route 11 • • • • •							
RN	2.7050	149.37	8.34	120	0.053260	473'-0	Pf 29.180
41	36'-2½			74.975	PO(18'-8½)	74'-10½	Pe -0.001
30	36'-3			104.154	3PO(18'-8½)	547'-10½	Pv
• • • • • Route 12 • • • • •							
CM	4.3100	162.89	3.58	120	0.006468	10'-0	Pf 0.065
42	36'-5	155.20		75.108	Flow (q) from Route 2		Pe -0.090
135	36'-7½			75.082		10'-0	Pv
RN	2.7050	162.89	9.09	120	0.062517	473'-0	Pf 34.251
135	36'-7½			75.082	PO(18'-8½)	74'-10½	Pe -0.001
32	36'-8			109.333	3PO(18'-8½)	547'-10½	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

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

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
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
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 Summary

Job Number: NC-1403
Report Description: ESFR (E System 5)

Job

Job Number: NC-1403	Designer: DB
Job Name: Town Center 22	State Certification/License Number:
Address 1: NE Town Center Blvd. Lee's Summit MO 64064	AHJ: Lee's Summit
Address 2:	Job Site/Building:
Address 3:	Drawing Name: Town Center 22 draw

System

Most Demanding Sprinkler Data: 22.4 K-Factor 141.67 at 40.000

Hose Allowance At Source: 0.00

Additional Hose Supplies

Node	Flow(gpm)
Hydrant At Node 4790	250.00

Total Hose Streams: 250.00

System Flow Demand	Total Water Required (Including Hose Allowance)
1954.71	1954.71

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 38.37 between nodes 84 and 83

Maximum Velocity Under Ground	
9.89 between nodes 53 and 52	

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
20665.71 gal	

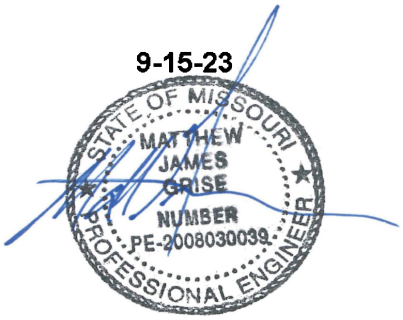
Remote Area(s)

Occupancy	Job Suffix
ESFR	

Pressure	Area of Application
50.000	NA

Number Of Sprinklers Calculated	Number Of Nozzles Calculated	Coverage Per Sprinkler
12	0	100.00 ft²

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area



Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi) @ Flow (gpm)	Available (psi) @ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
16	Water Supply		82.000	50.000 @ 1900.00	48.274 @ 1954.71	38.158	10.116
72	Pump		147.000	130.000 @ 1500.00	155.361 @ 1704.71	145.245	10.116

Pumps: Static = Churn (Pressure @ Zero Flow)

Contractor

	Contractor Number	Contact Name	Contact Title
	1	Derek Bisoglio	Design

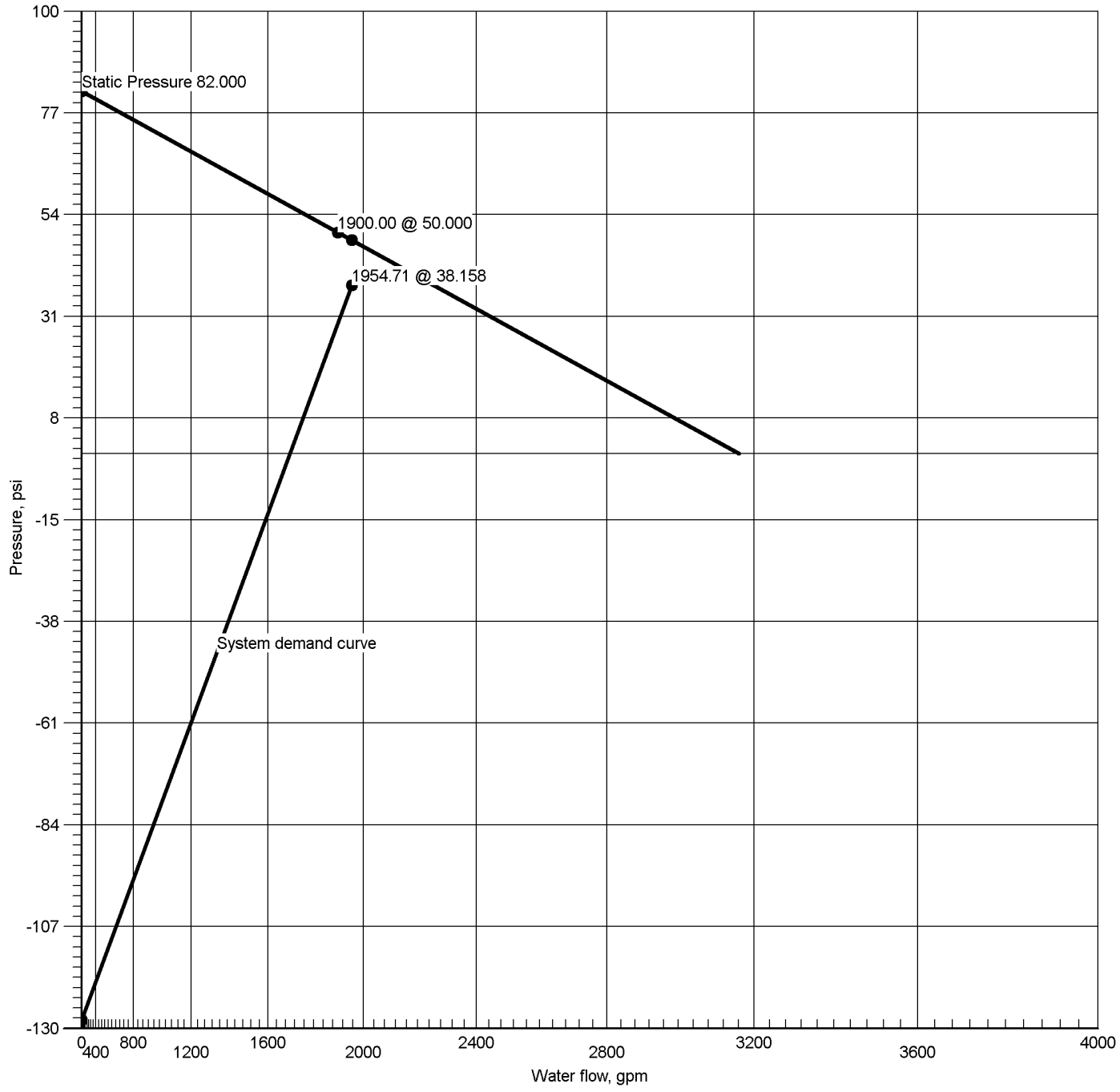
Name of Contractor:	Phone	Extension
Alliance Fire Protection	816-679-8021	

Address 1	FAX
130 w 9th Ave. Suite 100	

Address 2	E-mail
North Kansas City, MO 64116	dbisoglio@afpsprink.com

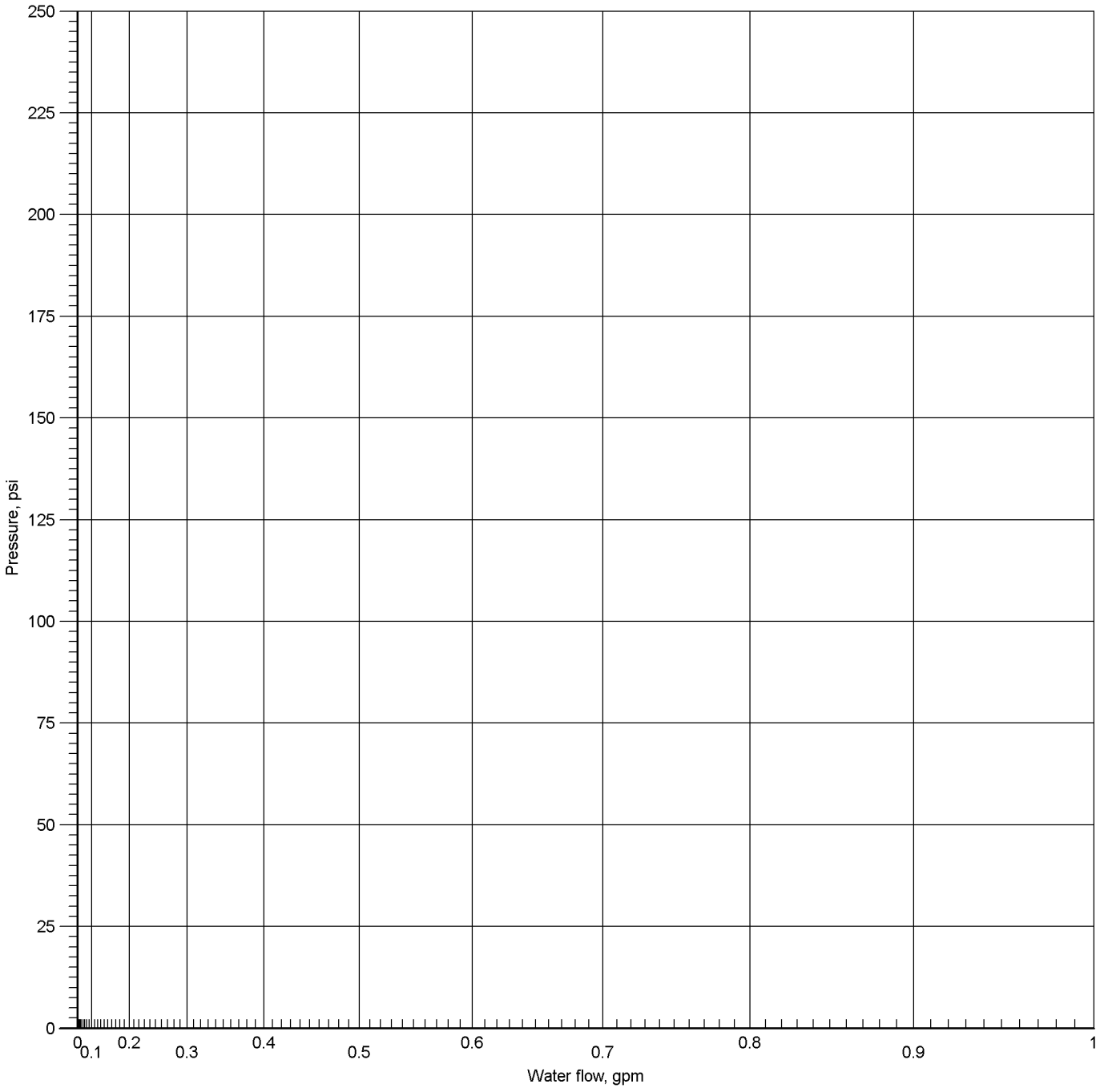
Address 3	Web-Site

Water Supply at Node 16



Hydraulic Graph	Water Supply at Node 16
Static: Pressure	82.000
Residual: Pressure	50.000 @ 1900.00
Available Pressure at System Demand	48.274 @ 1954.71
Required Pressure at System Demand	38.158 @ 1954.71
Required Pressure at System Demand (Including Hose Allowance at Source)	38.158 @ 1954.71

BOR 1 at Node 11



Hydraulic Graph
BOR 1 at Node 11

Static: Pressure
220.512

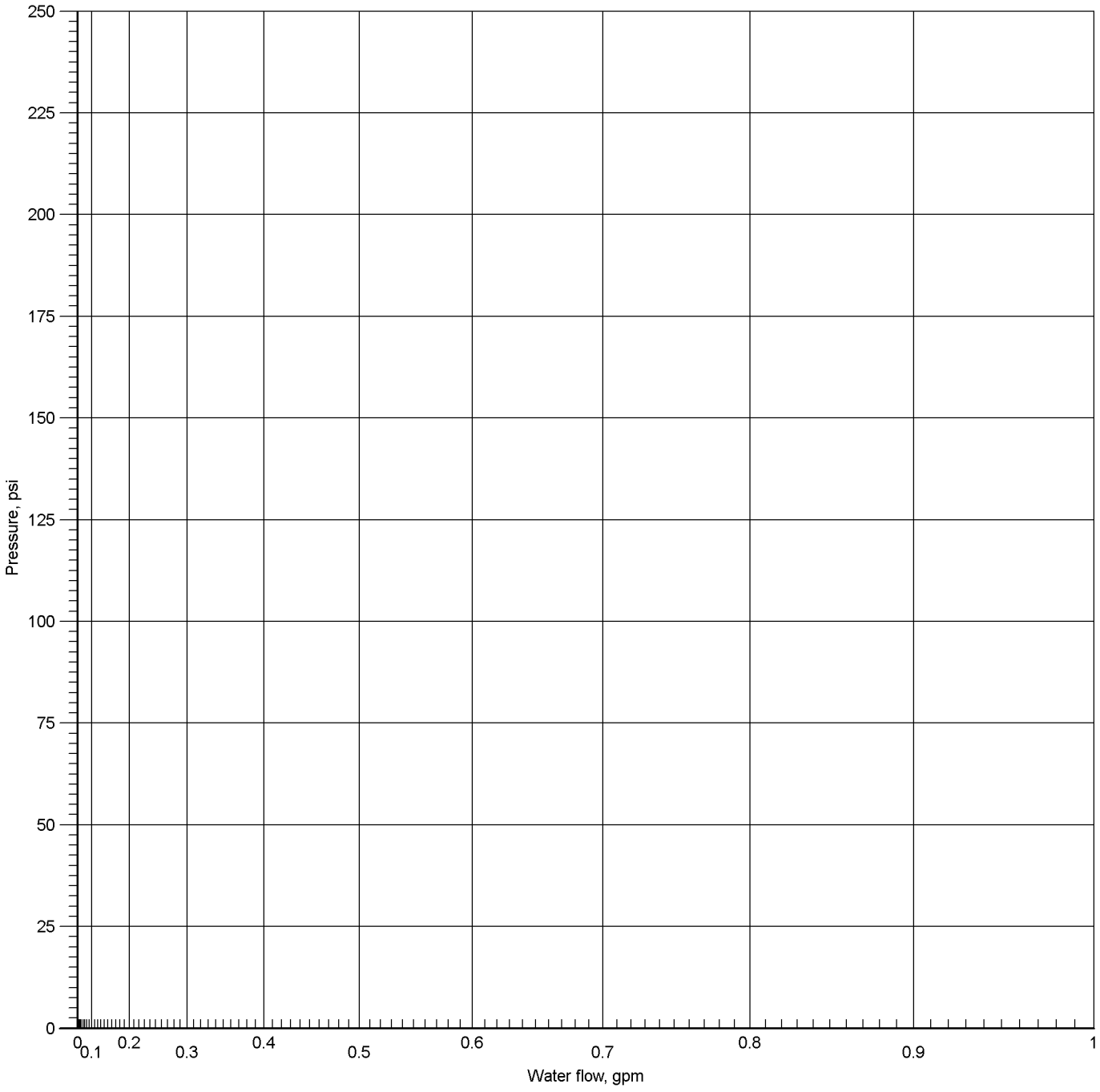
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
126.540 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 2 at Node 70



Hydraulic Graph
BOR 2 at Node 70

Static: Pressure
220.381

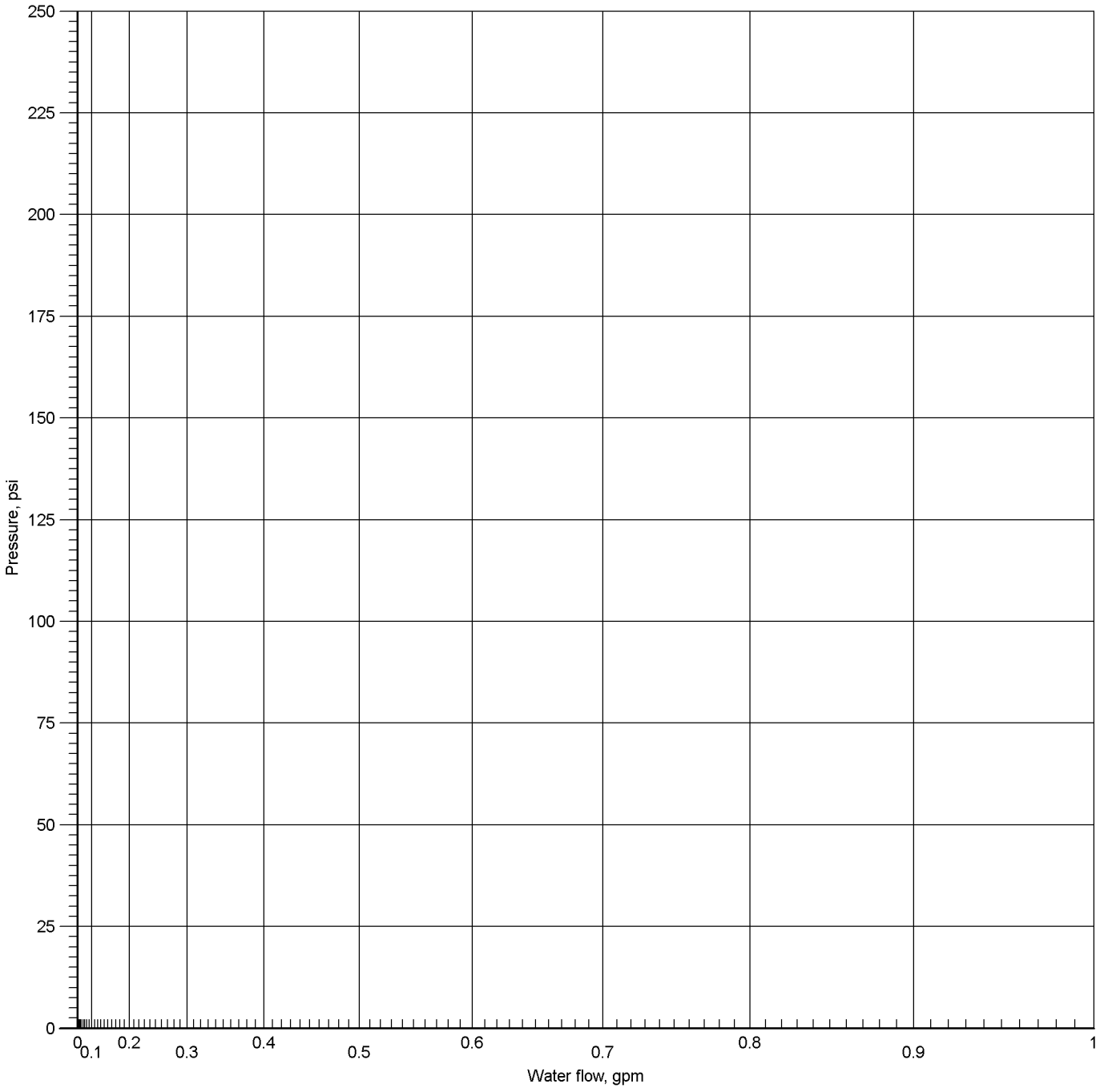
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
127.715 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 3 at Node 51



Hydraulic Graph
BOR 3 at Node 51

Static: Pressure
221.054

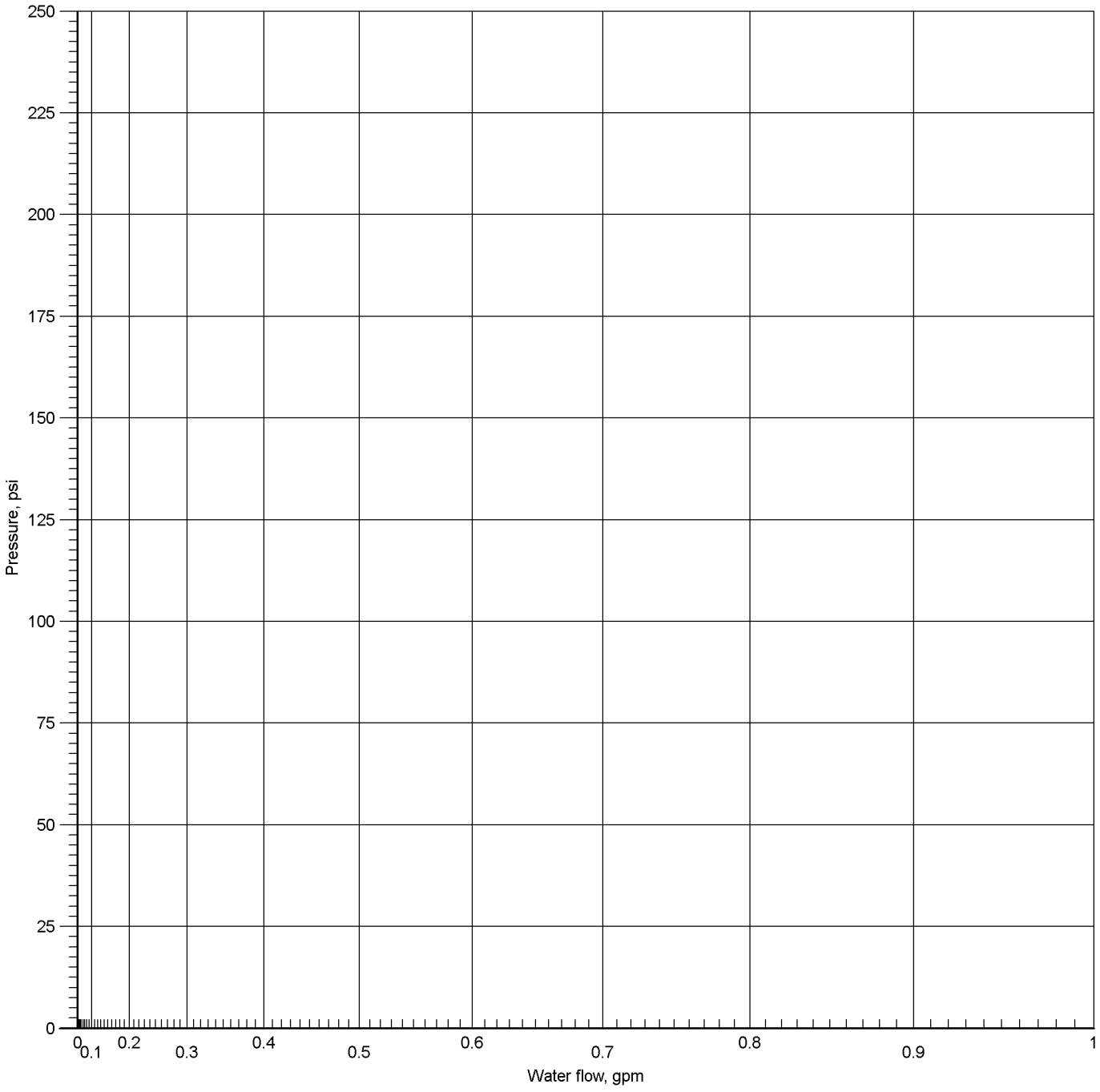
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
128.491 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 6 at Node 117



Hydraulic Graph
BOR 6 at Node 117

Static: Pressure
221.054

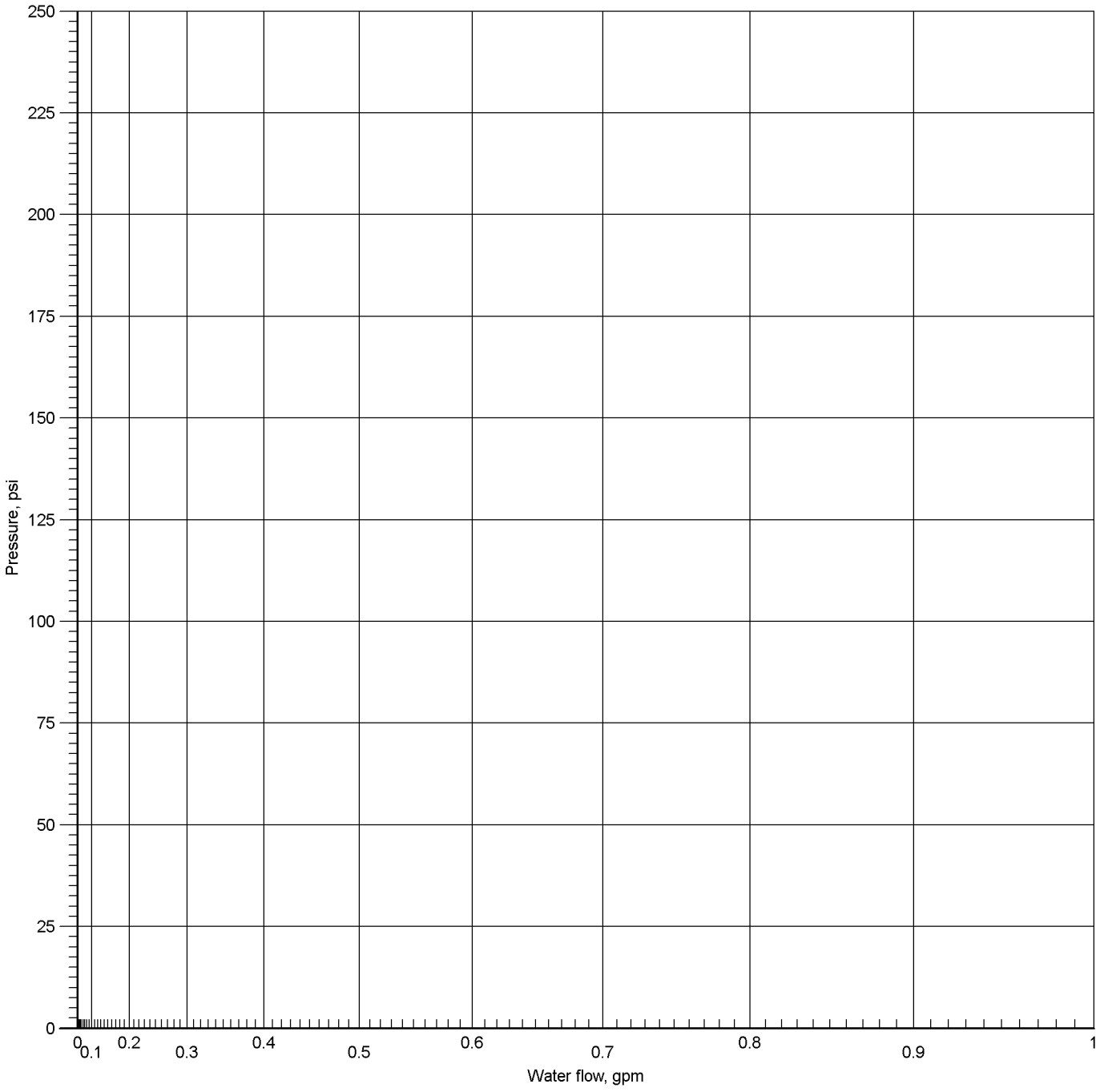
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
131.445 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 4 at Node 35



Hydraulic Graph
BOR 4 at Node 35

Static: Pressure
221.054

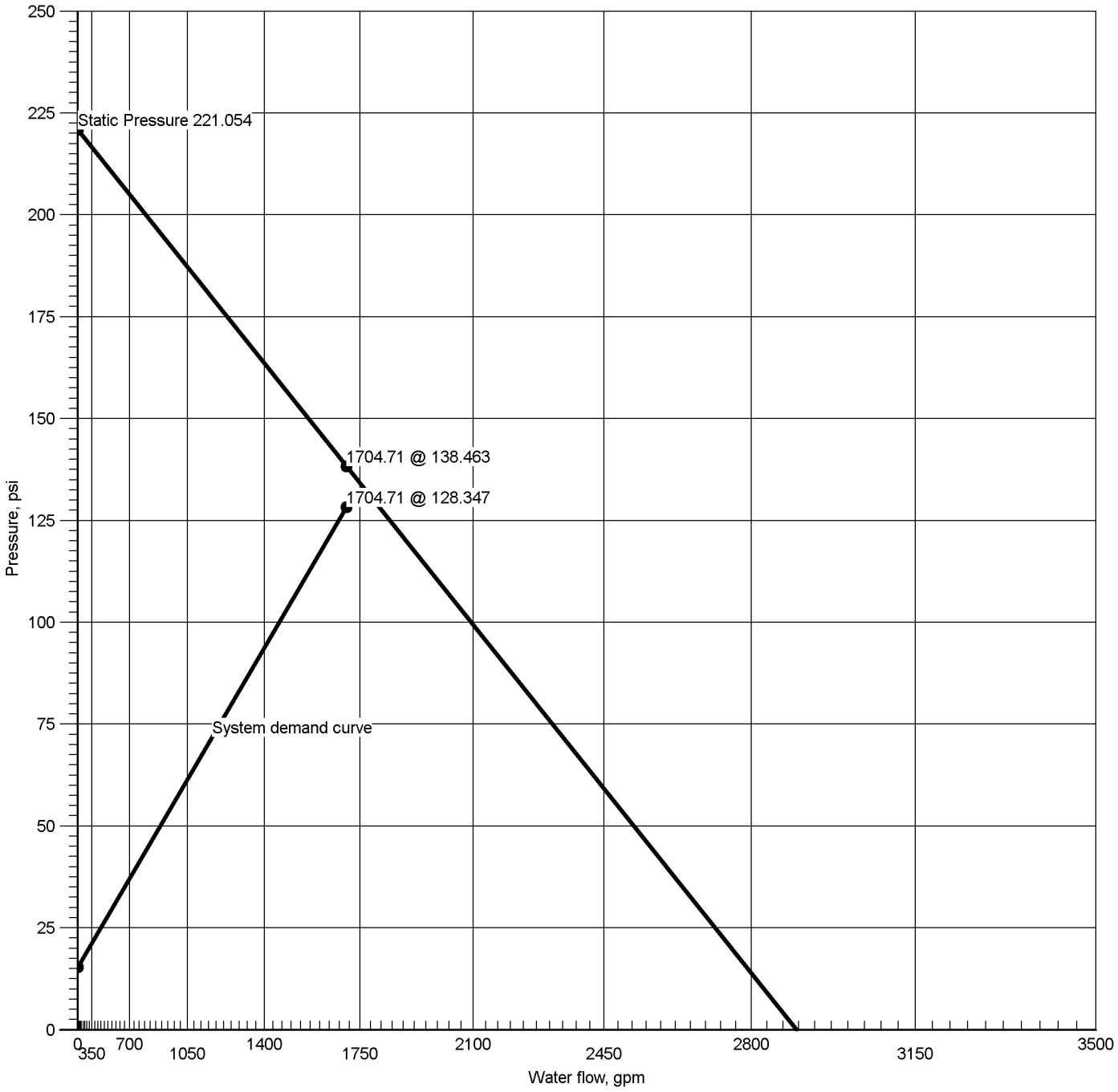
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
128.607 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 5 at Node 86



Hydraulic Graph
BOR 5 at Node 86

Static: Pressure
221.054

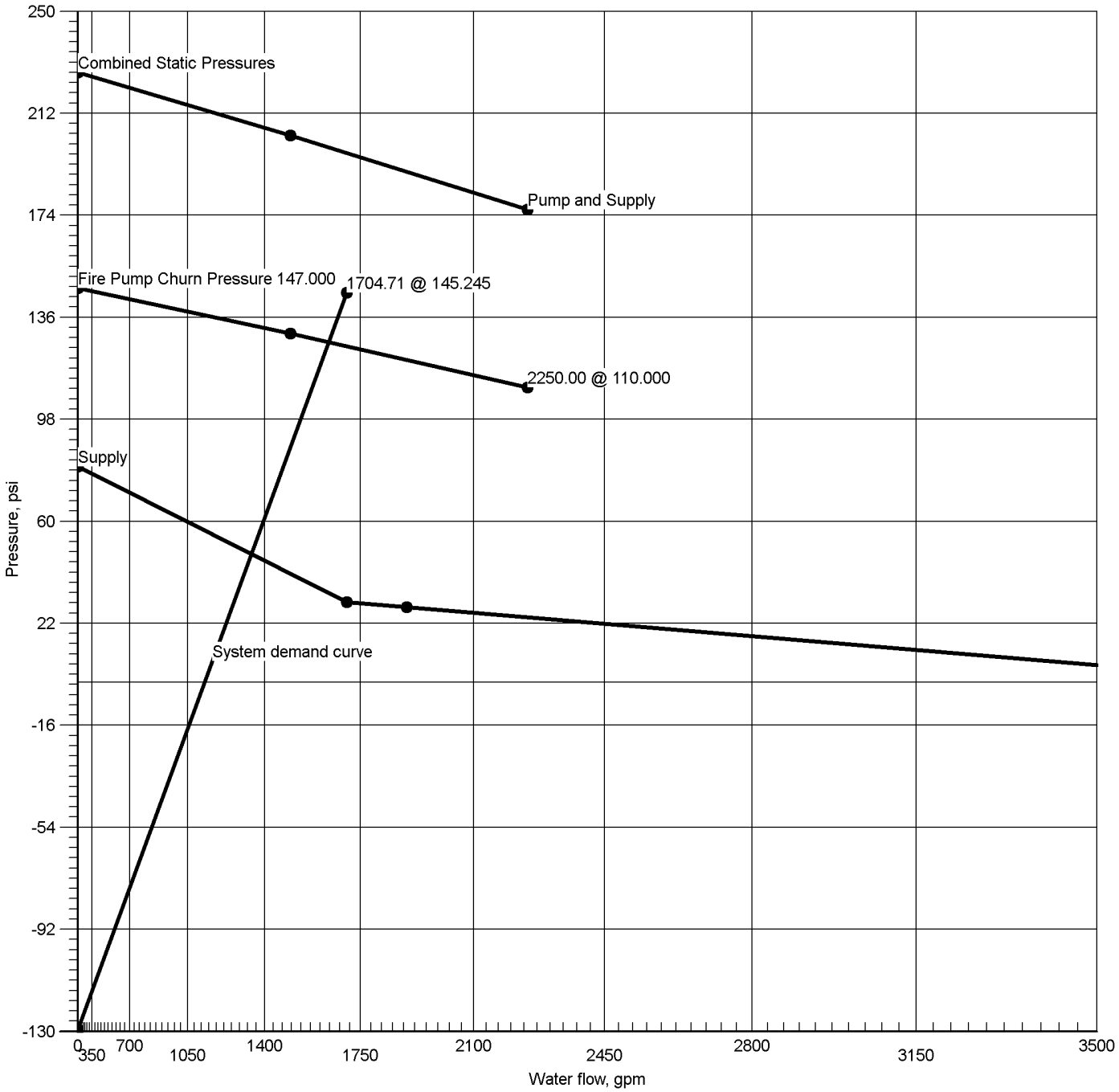
Residual: Pressure
N/A

Available Pressure at System Demand
138.463 @ 1704.71

Required Pressure at System Demand
128.347 @ 1704.71

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

Pump at Node 72



Hydraulic Graph	Static + Churn Pressure	Fire Pump Rating
Pump at Node 72	227.555	130.000 @ 1500.00
Static: Pressure	**Fire Pump Churn Pressure**	
227.555	147.000	
Residual: Pressure		
125.310 @ 1704.71		
Available Pressure at System Demand		
155.361 @ 1704.71		
Required Pressure at System Demand		
145.245 @ 1704.71		

Summary Of Outflowing Devices

Job Number: NC-1403
Report Description: ESFR (E System 5)

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Sprinkler	**401**	**141.67**	**141.67**	**22.4**	**40.000**			
Sprinkler	402	141.89	141.67	22.4	40.126			
Sprinkler	403	141.67	141.67	22.4	40.002			
Sprinkler	404	142.00	141.67	22.4	40.185			
Sprinkler	405	141.74	141.67	22.4	40.038			
Sprinkler	406	141.96	141.67	22.4	40.166			
Sprinkler	407	141.74	141.67	22.4	40.039			
Sprinkler	408	142.06	141.67	22.4	40.219			
Sprinkler	409	142.36	141.67	22.4	40.389			
Sprinkler	410	142.59	141.67	22.4	40.522			
Sprinkler	411	142.36	141.67	22.4	40.391			
Sprinkler	412	142.67	141.67	22.4	40.567			
Hydrant	4790	250.00	250.00	0	23.157			

Most Demanding Sprinkler Data

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
16	-4'-0	S, E(27'-2)	38.158	1954.71	
401	39'-2½	Spr(-40.000)	40.000	141.67	
402	39'-2½	Spr(-40.126)	40.126	141.89	
403	39'-2½	Spr(-40.002)	40.002	141.67	
404	39'-2½	Spr(-40.185)	40.185	142.00	
405	39'-5½	Spr(-40.038)	40.038	141.74	
406	39'-5½	Spr(-40.166)	40.166	141.96	
407	39'-5½	Spr(-40.039)	40.039	141.74	
408	39'-5½	Spr(-40.219)	40.219	142.06	
409	39'-8	Spr(-40.389)	40.389	142.36	
410	39'-8	Spr(-40.522)	40.522	142.59	
411	39'-8	Spr(-40.391)	40.391	142.36	
412	39'-8	Spr(-40.567)	40.567	142.67	
4790	0'-0	Hyd	23.157	250.00	
14	2'-10	T(41'-1½)	19.520		
15	-4'-0	T(59'-4½)	24.792		
52	3'-0	PO(41'-1½), C(41'-1½)	131.445		
53	1'-11	BV(20'-4½)	136.003		
71	-0'-10½		145.245		
72	-0'-10½	P2(-125.220)	145.245		
73	-0'-8	P1	19.935		
76	36'-10½	PO(22'-6)	63.013		
77	36'-10½	PO(22'-6)	63.376		
78	36'-11	PO(22'-6)	64.302		
79	36'-11½	PO(22'-6)	66.030		
80	36'-11½	PO(22'-6)	68.339		
81	37'-0	PO(22'-6)	71.351		
82	37'-0	PO(22'-6)	75.232		
83	37'-0½	E(13'-11)	83.082		
84	36'-7		104.216		
85	35'-1½	E(17'-7)	113.876		
86	3'-11½	BV(14'-1), BOR 5	128.347		
87	36'-10½	PO(22'-6)	51.842		
88	36'-10½	PO(22'-6)	51.883		
89	36'-11	PO(22'-6)	52.283		
90	36'-11½	PO(22'-6)	53.333		
91	36'-11½	PO(22'-6)	53.991		
124	36'-10	PO(22'-6)	62.969		
125	37'-0	PO(22'-6)	54.325		
126	37'-0½	PO(22'-6)	54.418		
134	36'-10	PO(22'-6)	51.910		
149	-4'-0	E(22'-1)	24.941		

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •								
CM	3.3340	127.46	4.68	120		0.014348	8'-9	Pf 0.126
401	39'-2½	141.67	22.4	40.000		Sprinkler		Pe -0.000
402	39'-2½			40.126			8'-9	Pv
CM	3.3340	269.36	9.90	120		0.057268	336'-9	Pf 21.862
402	39'-2½	141.89	22.4	40.126		Sprinkler,	44'-11½	Pe 1.026
76	36'-10½			63.013		2PO(22'-6)	381'-9	Pv
CM	4.3100	420.41	9.24	120		0.037371	10'-0	Pf 0.374
76	36'-10½	151.05		63.013		Flow (q) from Route 8		Pe -0.011
77	36'-10½			63.376			10'-0	Pv
CM	4.3100	691.30	15.20	120		0.093786	10'-0	Pf 0.938
77	36'-10½	270.90		63.376		Flow (q) from Route 3		Pe -0.011
78	36'-11			64.302			10'-0	Pv
CM	4.3100	965.34	21.23	120		0.173944	10'-0	Pf 1.739
78	36'-11	274.04		64.302		Flow (q) from Route 5		Pe -0.011
79	36'-11½			66.030			10'-0	Pv
CM	4.3100	1127.86	24.80	120		0.231962	10'-0	Pf 2.320
79	36'-11½	162.51		66.030		Flow (q) from Route 9		Pe -0.011
80	36'-11½			68.339			10'-0	Pv
CM	4.3100	1301.54	28.62	120		0.302338	10'-0	Pf 3.023
80	36'-11½	173.68		68.339		Flow (q) from Route 2		Pe -0.011
81	37'-0			71.351			10'-0	Pv
CM	4.3100	1492.14	32.81	120		0.389312	10'-0	Pf 3.893
81	37'-0	190.61		71.351		Flow (q) from Route 11		Pe -0.011
82	37'-0			75.232			10'-0	Pv
CM	4.3100	1704.71	37.49	120		0.498085	1'-10	Pf 7.852
82	37'-0	212.57		75.232		Flow (q) from Route 10	13'-11	Pe -0.002
83	37'-0½			83.082		E(13'-11)	15'-9	Pv
CM	4.2600	1704.71	38.37	120		0.527209	26'-6½	Pf 20.944
83	37'-0½			83.082			13'-2	Pe 0.190
84	36'-7			104.216		E(13'-2)	39'-8½	Pv
CM	6.3570	1704.71	17.23	120		0.075053	85'-0½	Pf 9.026
84	36'-7			104.216			35'-2½	Pe 0.634
85	35'-1½			113.876		2E(17'-7)	120'-3	Pv
FR	8.2490	1704.71	10.23	120		0.021102	31'-2	Pf 0.955
85	35'-1½			113.876			14'-1	Pe 13.516
86	3'-11½			128.347		f(-0.000), BV(14'-1), BOR 5	45'-3	Pv
CM	8.2490	1704.71	10.23	120		0.021102	4'-0	Pf 2.687
86	3'-11½			128.347			123'-4	Pe 0.411
52	3'-0			131.445		2PO(41'-1½), C(41'-1½)	127'-4	Pv
UG	8.3900	1704.71	9.89	140		0.014609	91'-11	Pf 4.094
52	3'-0			131.445			188'-3½	Pe 0.464
53	1'-11			136.003		sCV(76'-4), 3E(30'-6½), BV(20'-4½)	280'-3	Pv
DY	8.2490	1704.71	10.23	120		0.021102	2'-8	Pf 8.026
53	1'-11			136.003			164'-5	Pe 1.216
71	-0'-10½			145.245		2E(21'-1½), T(41'-1½), PRV(-4.500), 2BV(14'-1), sCV(52'-10)	167'-1	Pv
DY	6.0650	1704.71	18.93	120		0.094367	0'-0	Pf 0.000
71	-0'-10½			145.245				Pe -0.000
72	-0'-10½			145.245			0'-0	Pv
Pump			**Velocity**					
72		1704.71		145.245		Rating: 130.000 @ 1500.00		
73		Q=1704.71	10.23	19.935		Fire Pump Churn Pressure: 147.000		
FR	8.2490	1704.71	10.23	120		0.021102	6'-5½	Pf 1.103
73	-0'-8			19.935			45'-9½	Pe -1.518
14	2'-10			19.520		GV(4'-8½), T(41'-1½)	52'-3	Pv
UG	8.3900	1704.71	9.89	140		0.014609	68'-2	Pf 2.310
14	2'-10			19.520			89'-11	Pe 2.962
15	-4'-0			24.792		E(30'-6½), T(59'-4½)	158'-1	Pv
CM	7.9800	762.74	4.89	150		0.003707	2122'-8½	Pf 13.367
15	-4'-0			24.792			134'-3½	Pe
16	-4'-0			38.158		6EE(13'-7), BFP(-5.000), T(52'-10)	2257'-0½	Pv
		0.00				Hose Allowance At Source		
16		1954.71						

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 2 • • • • •								
CM	3.3340	14.21	0.52	120		0.000248	10'-0	Pf 0.002
401	39'-2½	141.67	22.4	40.000		Sprinkler		Pe 0.000
403	39'-2½			40.002			10'-0	Pv
CM	3.3340	155.88	5.73	120		0.020820	8'-9	Pf 0.182
403	39'-2½	141.67	22.4	40.002		Sprinkler		Pe 0.000
404	39'-2½			40.185			8'-9	Pv
CM	3.3340	297.88	10.95	120		0.068989	109'-1½	Pf 10.632
404	39'-2½	142.00	22.4	40.185		Sprinkler,	44'-11½	Pe 1.025
87	36'-10½			51.842		2PO(22'-6)	154'-1½	Pv
CM	4.3100	146.83	3.23	120		0.005338	10'-0	Pf 0.053
87	36'-10½			51.842				Pe -0.012
88	36'-10½			51.883			10'-0	Pv
CM	4.3100	443.43	9.75	120		0.041245	10'-0	Pf 0.412
88	36'-10½	296.60		51.883		Flow (q) from Route 4		Pe -0.012
89	36'-11			52.283			10'-0	Pv
CM	4.3100	739.37	16.26	120		0.106205	10'-0	Pf 1.062
89	36'-11	295.94		52.283		Flow (q) from Route 6		Pe -0.012
90	36'-11½			53.333			10'-0	Pv
CM	4.3100	576.86	12.69	120		0.067100	10'-0	Pf 0.671
90	36'-11½			53.333				Pe -0.012
91	36'-11½			53.991			10'-0	Pv
RN	3.3340	173.68	6.38	120		0.025430	474'-0½	Pf 14.342
91	36'-11½			53.991		PO(22'-6)	89'-11½	Pe 0.005
80	36'-11½			68.339		3PO(22'-6)	564'-0	Pv
• • • • • Route 3 • • • • •								
CM	3.3340	128.93	4.74	120		0.014655	8'-9	Pf 0.128
405	39'-5½	141.74	22.4	40.038		Sprinkler		Pe 0.000
406	39'-5½			40.166			8'-9	Pv
CM	3.3340	270.90	9.96	120		0.057876	336'-11½	Pf 22.104
406	39'-5½	141.96	22.4	40.166		Sprinkler,	44'-11½	Pe 1.106
77	36'-10½			63.376		2PO(22'-6)	381'-11	Pv
• • • • • Route 4 • • • • •								
CM	3.3340	12.80	0.47	120		0.000204	10'-0	Pf 0.002
405	39'-5½	141.74	22.4	40.038		Sprinkler		Pe -0.000
407	39'-5½			40.039			10'-0	Pv
CM	3.3340	154.54	5.68	120		0.020490	8'-9	Pf 0.179
407	39'-5½	141.74	22.4	40.039		Sprinkler		Pe -0.000
408	39'-5½			40.219			8'-9	Pv
CM	3.3340	296.60	10.90	120		0.068442	109'-4	Pf 10.560
408	39'-5½	142.06	22.4	40.219		Sprinkler,	44'-11½	Pe 1.104
88	36'-10½			51.883		2PO(22'-6)	154'-3½	Pv
• • • • • Route 5 • • • • •								
CM	3.3340	131.45	4.83	120		0.015188	8'-9	Pf 0.133
409	39'-8	142.36	22.4	40.389		Sprinkler		Pe 0.000
410	39'-8			40.522			8'-9	Pv
CM	3.3340	274.04	10.07	120		0.059124	337'-1½	Pf 22.592
410	39'-8	142.59	22.4	40.522		Sprinkler,	44'-11½	Pe 1.188
78	36'-11			64.302		2PO(22'-6)	382'-1½	Pv
• • • • • Route 6 • • • • •								
CM	3.3340	10.91	0.40	120		0.000152	10'-0	Pf 0.002
409	39'-8	142.36	22.4	40.389		Sprinkler		Pe -0.000
411	39'-8			40.391			10'-0	Pv
CM	3.3340	153.27	5.63	120		0.020180	8'-9	Pf 0.177
411	39'-8	142.36	22.4	40.391		Sprinkler		Pe -0.000
412	39'-8			40.567			8'-9	Pv
CM	3.3340	295.94	10.88	120		0.068163	109'-6	Pf 10.530
412	39'-8	142.67	22.4	40.567		Sprinkler,	44'-11½	Pe 1.185
89	36'-11			52.283		2PO(22'-6)	154'-6	Pv
• • • • • Route 7 • • • • •								
FR	6.2800	250.00	2.59	140		0.001718	4'-0	Pf 0.045
4790	0'-0	250.00		23.157		Hydrant,	22'-1	Pe 1.739
149	-4'-0			24.941		E(22'-1)	26'-1	Pv
UG	8.3900	250.00	1.45	140		0.000419	22'-5	Pf 0.034
149	-4'-0			24.941			59'-4½	Pe
150	-4'-0			24.975		T(59'-4½)	81'-9½	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
CM	7.9800	1191.97	7.65	150	0.008467	885'-0½	Pf 13.183
150	-4'-0	941.97		24.975	Flow (q) from Route 13	81'-6	Pe
16	-4'-0			38.158	4EE(13'-7), BFP(-5.000), S, E(27'-2)	966'-6½	Pv
• • • • • Route 8 • • • • •							
CM	4.3100	151.05	3.32	120	0.005625	10'-0	Pf 0.056
124	36'-10	151.05		62.969	Flow (q) from Route 12		Pe -0.011
76	36'-10½			63.013		10'-0	Pv
• • • • • Route 9 • • • • •							
RN	3.3340	162.51	5.97	120	0.022488	474'-6	Pf 12.694
90	36'-11½			53.333	PO(22'-6)	89'-11½	Pe 0.004
79	36'-11½			66.030	3PO(22'-6)	564'-5½	Pv
• • • • • Route 10 • • • • •							
CM	4.3100	403.18	8.87	120	0.034587	10'-0	Pf 0.346
91	36'-11½	173.68		53.991	Flow (q) from Route 2		Pe -0.012
125	37'-0			54.325		10'-0	Pv
CM	4.3100	212.57	4.67	120	0.010583	10'-0	Pf 0.106
125	37'-0			54.325			Pe -0.012
126	37'-0½			54.418		10'-0	Pv
RN	3.3340	212.57	7.81	120	0.036956	473'-1	Pf 20.807
126	37'-0½			54.418	PO(22'-6)	89'-11½	Pe 0.007
82	37'-0			75.232	3PO(22'-6)	563'-0½	Pv
• • • • • Route 11 • • • • •							
RN	3.3340	190.61	7.00	120	0.030204	473'-6½	Pf 17.020
125	37'-0			54.325	PO(22'-6)	89'-11½	Pe 0.006
81	37'-0			71.351	3PO(22'-6)	563'-6	Pv
• • • • • Route 12 • • • • •							
CM	4.3100	151.05	3.32	120	0.005625	10'-0	Pf 0.056
87	36'-10½	146.83		51.842	Flow (q) from Route 2		Pe 0.012
134	36'-10			51.910		10'-0	Pv
RN	3.3340	151.05	5.55	120	0.019642	473'-0½	Pf 11.058
134	36'-10			51.910	PO(22'-6)	89'-11½	Pe 0.000
124	36'-10			62.969	3PO(22'-6)	563'-0	Pv
• • • • • Route 13 • • • • •							
CM	7.9800	941.97	6.04	150	0.005478	33'-6	Pf 0.183
15	-4'-0	762.74		24.792	Flow (q) from Route 1		Pe
150	-4'-0			24.975		33'-6	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

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

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
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
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 Summary

Job Number: NC-1403
Report Description: ESFR (SE System 6)

Job

Job Number: NC-1403	Designer: DB
Job Name: Town Center 22	State Certification/License Number:
Address 1: NE Town Center Blvd. Lee's Summit MO 64064	AHJ: Lee's Summit
Address 2:	Job Site/Building:
Address 3:	Drawing Name: Town Center 22 draw

System

Most Demanding Sprinkler Data: 16.8 K-Factor 121.15 at 52.000

Hose Allowance At Source: 0.00

Additional Hose Supplies

Node	Flow(gpm)

Total Hose Streams: 250.00

System Flow Demand	Total Water Required (Including Hose Allowance)
1918.49	1918.49

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 37.56 between nodes 100 and 99

Maximum Velocity Under Ground	
9.68 between nodes 53 and 117	

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
20665.71 gal	

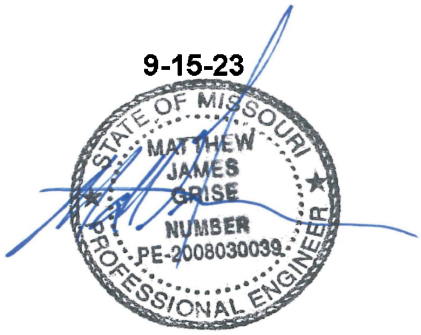
Remote Area(s)

Occupancy	Job Suffix
ESFR	

Pressure	Area of Application
50.000	NA

Number Of Sprinklers Calculated	Number Of Nozzles Calculated	Coverage Per Sprinkler
12	0	100.00 ft²

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area



Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@ Flow (gpm)	Available (psi)	@ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
16	Water Supply		82.000	50.000	1900.00	49.421	1918.49	41.170	8.251
72	Pump		147.000	130.000	1500.00	157.810	1668.49	149.559	8.251

Pumps: Static = Churn (Pressure @ Zero Flow)

Contractor

	Contractor Number	Contact Name	Contact Title
	1	Derek Bisoglio	Design

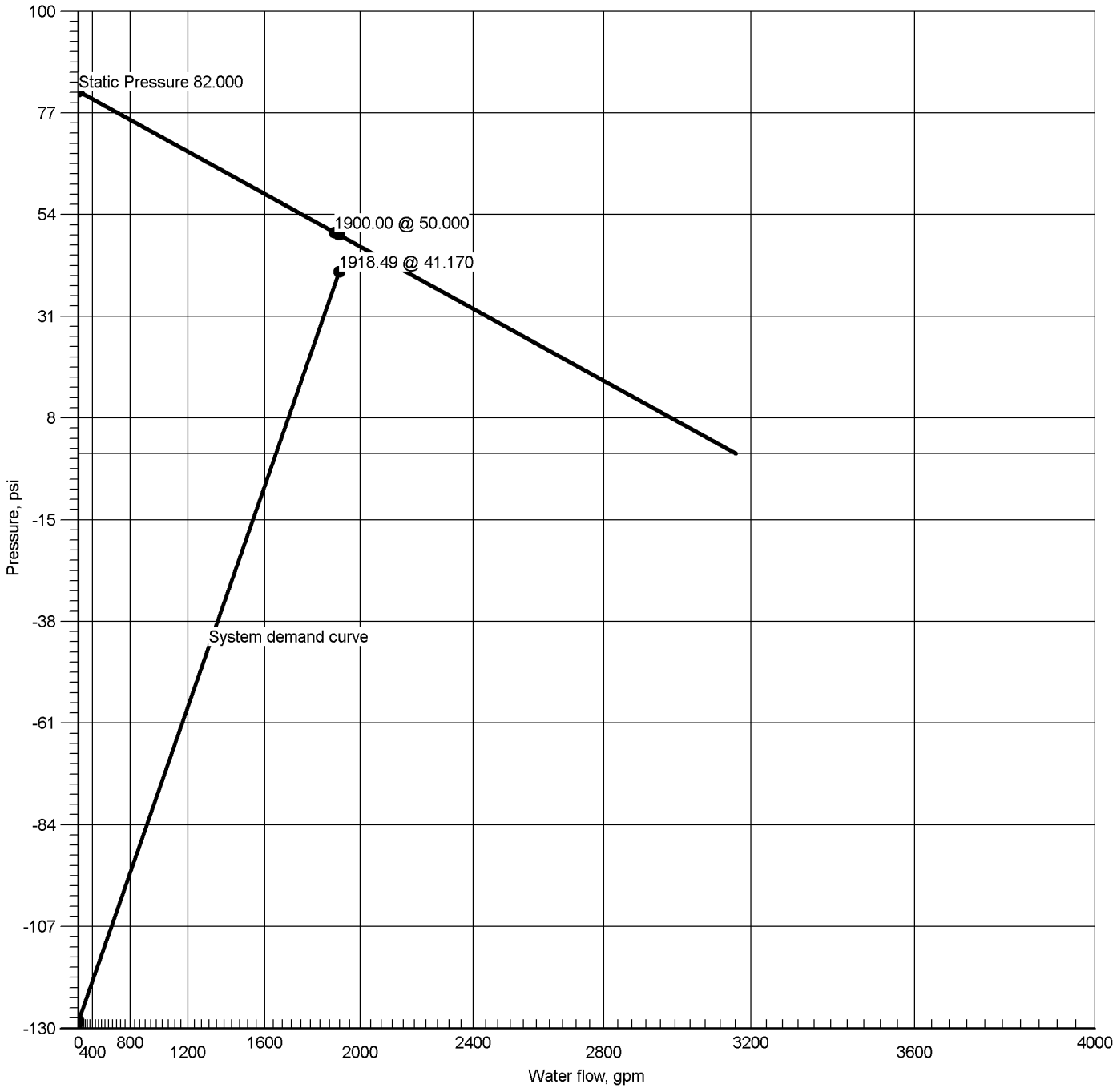
Name of Contractor:	Phone	Extension
Alliance Fire Protection	816-679-8021	

Address 1	FAX
130 w 9th Ave. Suite 100	

Address 2	E-mail
North Kansas City, MO 64116	dbisoglio@afpsprink.com

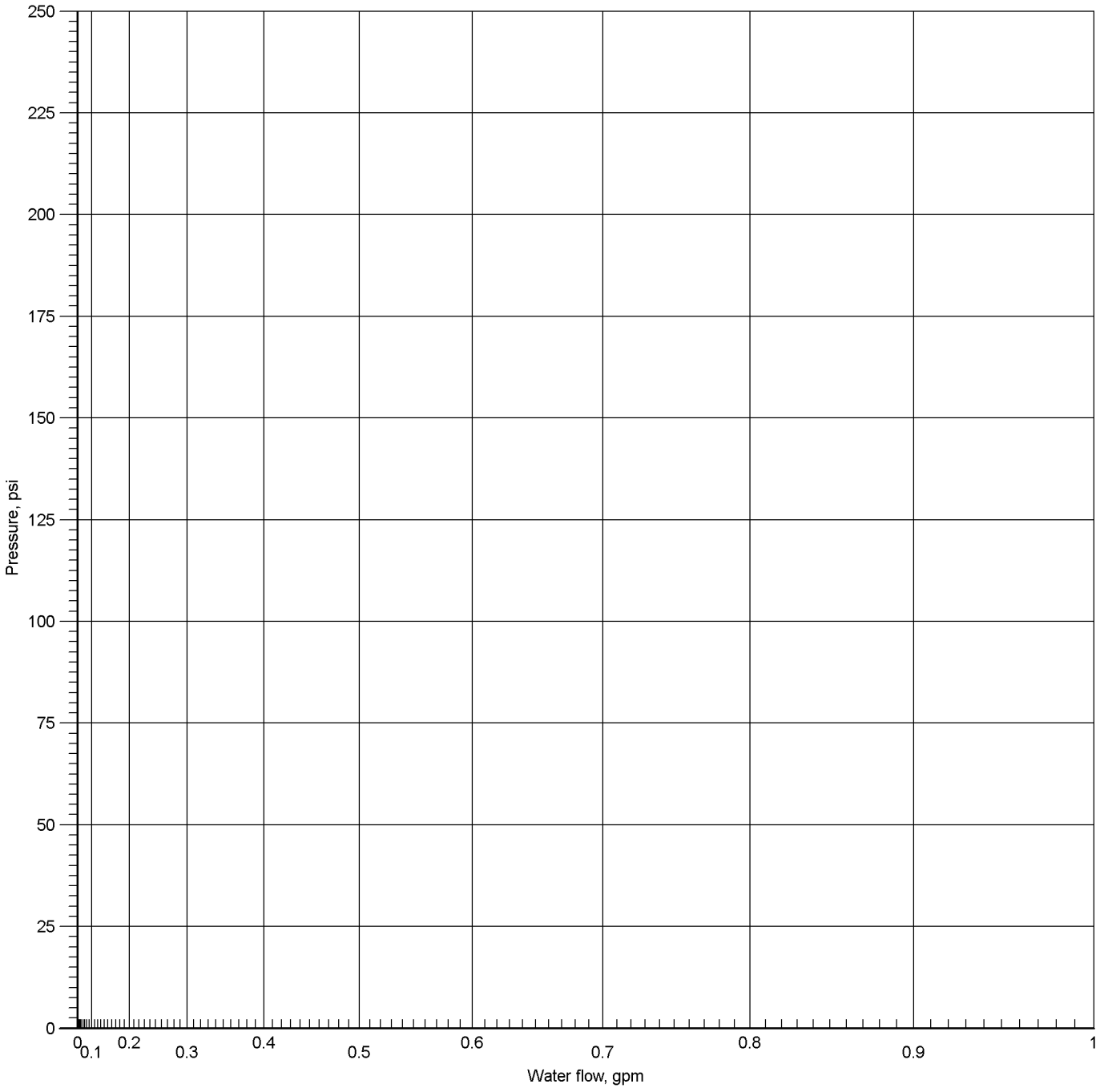
Address 3	Web-Site

Water Supply at Node 16



Hydraulic Graph	Water Supply at Node 16
Static: Pressure	82.000
Residual: Pressure	50.000 @ 1900.00
Available Pressure at System Demand	49.421 @ 1918.49
Required Pressure at System Demand	41.170 @ 1918.49
Required Pressure at System Demand (Including Hose Allowance at Source)	41.170 @ 1918.49

BOR 1 at Node 11



Hydraulic Graph
BOR 1 at Node 11

Static: Pressure
220.512

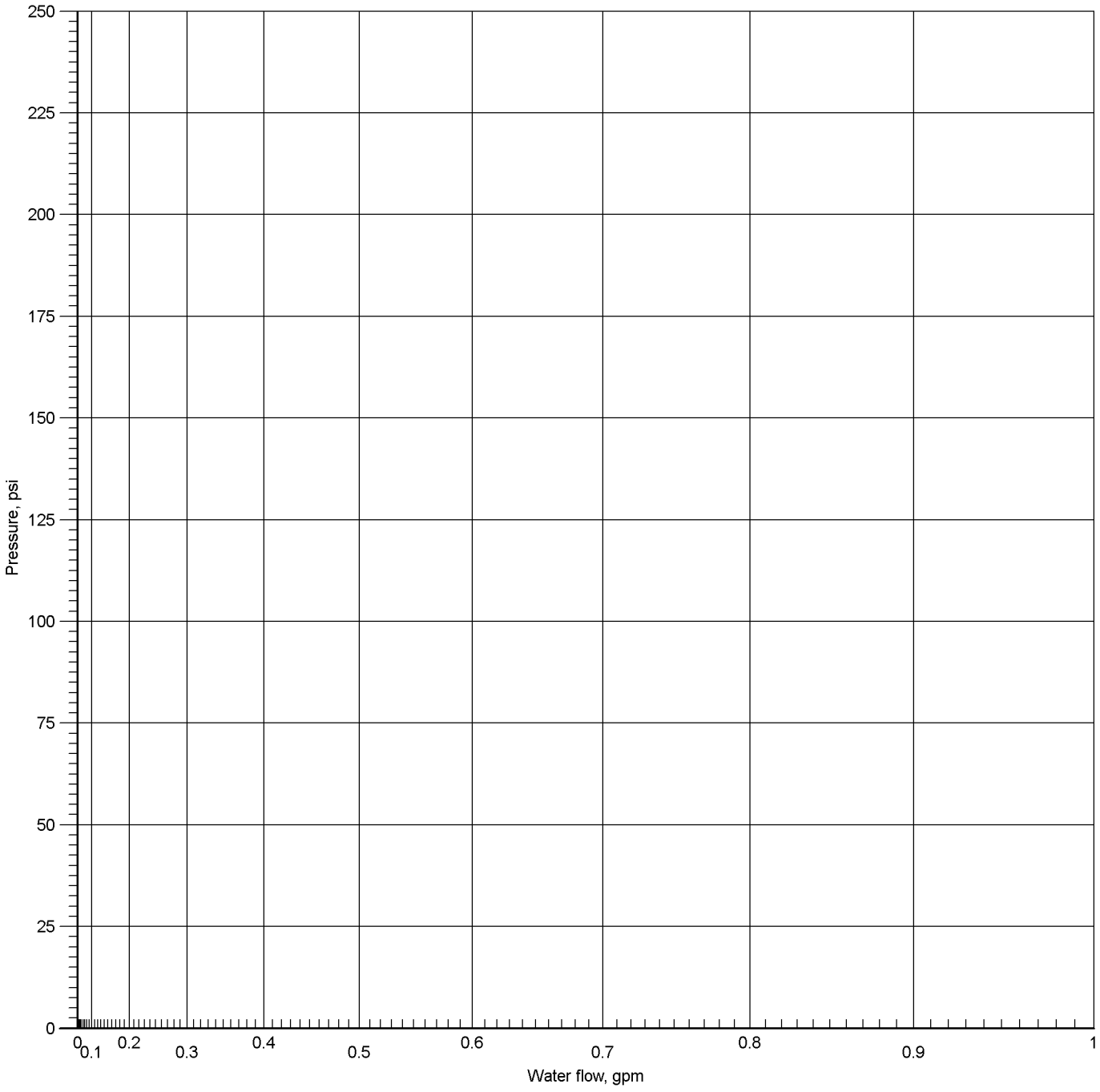
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
131.151 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 2 at Node 70



Hydraulic Graph
BOR 2 at Node 70

Static: Pressure
220.381

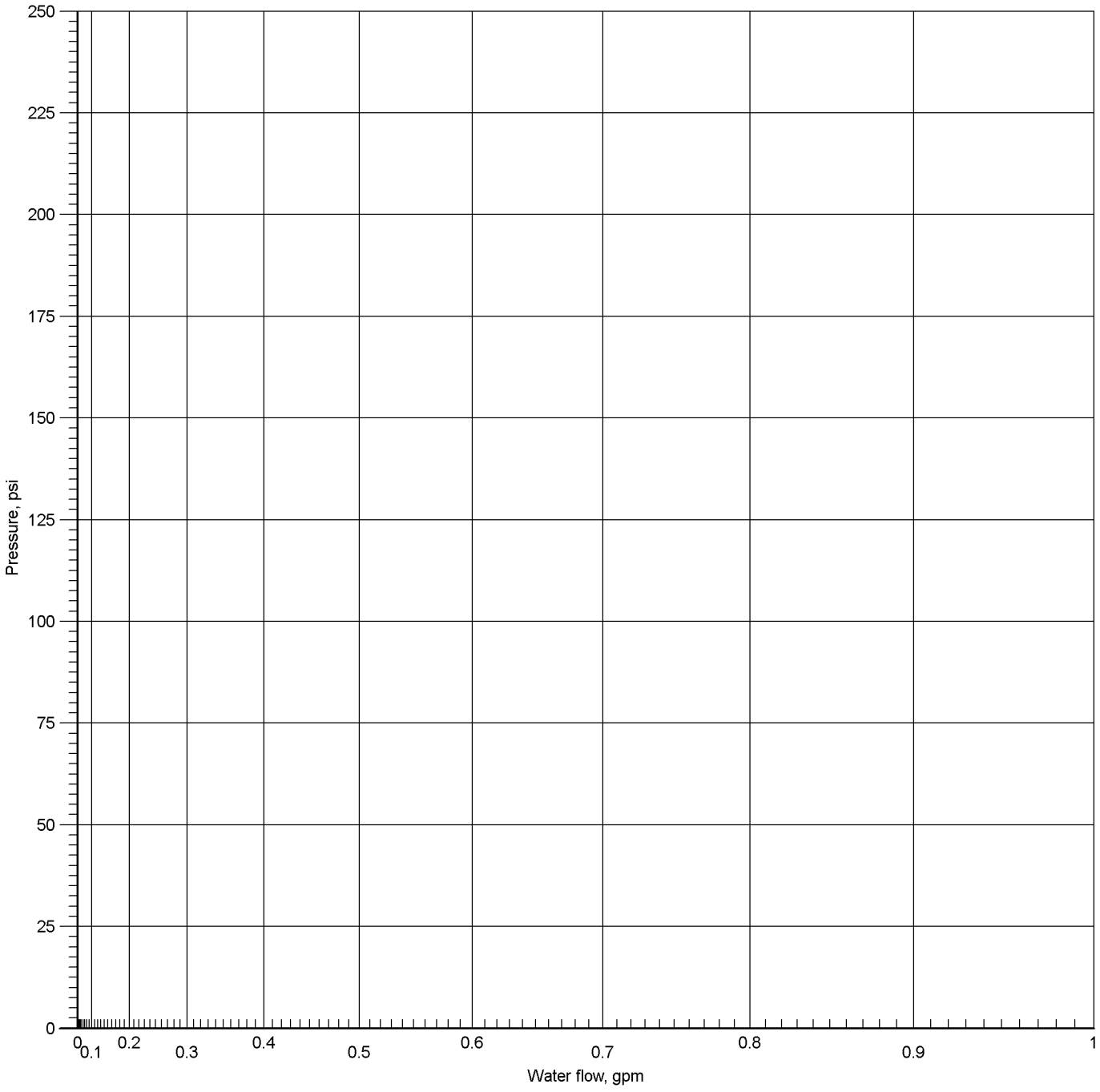
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
132.326 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 3 at Node 51



Hydraulic Graph
BOR 3 at Node 51

Static: Pressure
221.054

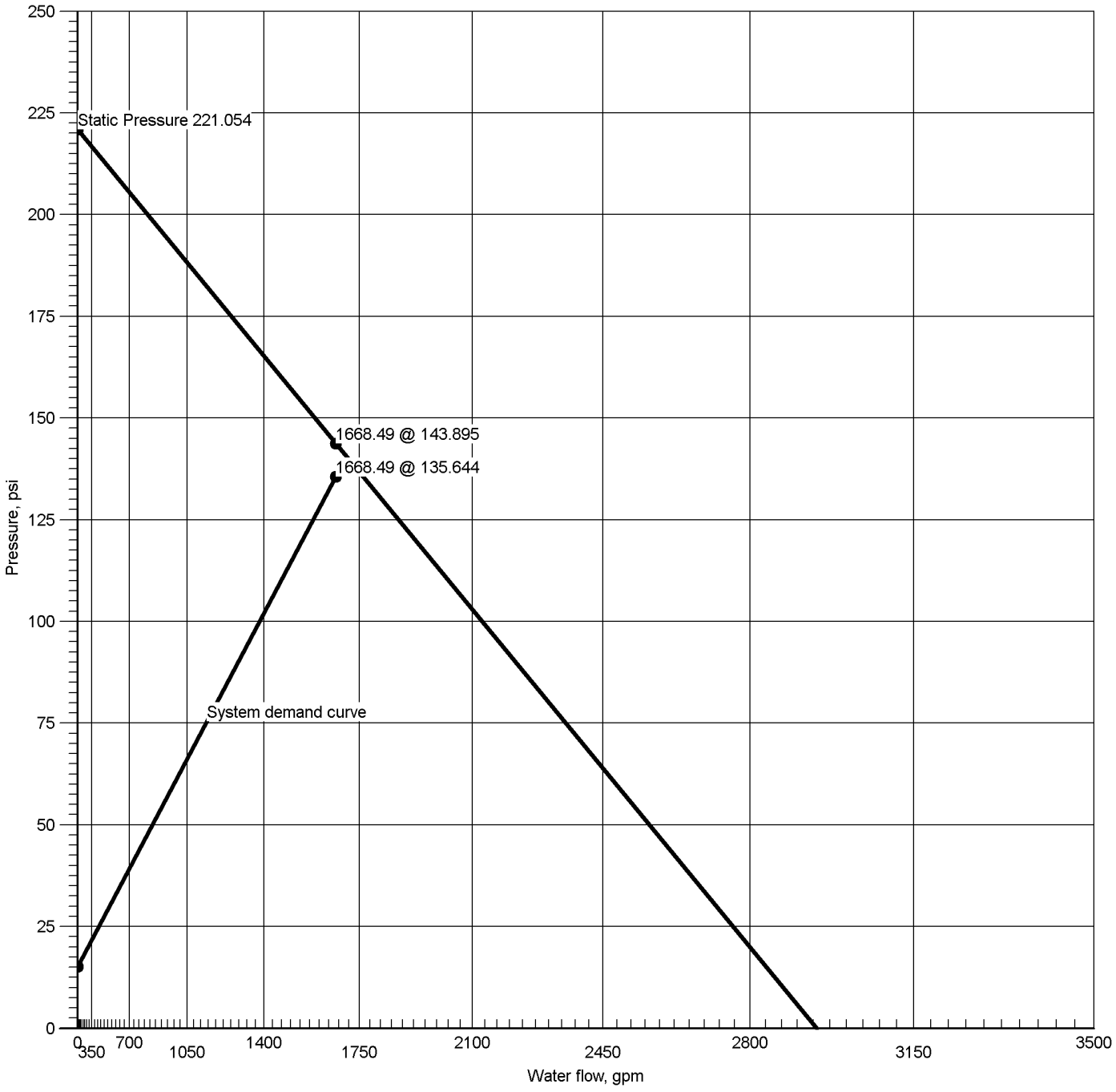
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
133.101 @ 0.00

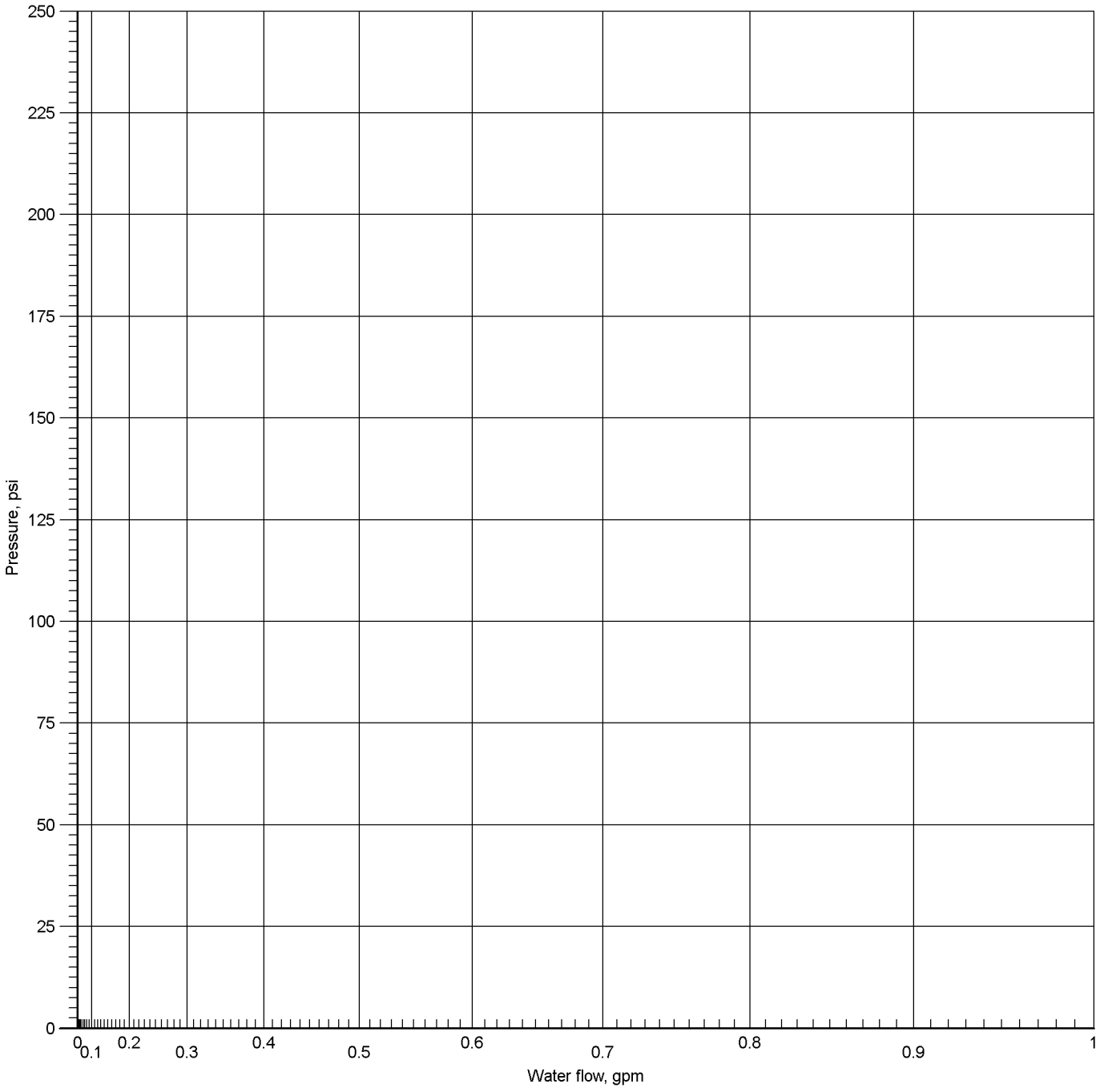
Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 6 at Node 117



Hydraulic Graph	BOR 6 at Node 117
Static: Pressure	221.054
Residual: Pressure	N/A
Available Pressure at System Demand	143.895 @ 1668.49
Required Pressure at System Demand	135.644 @ 1668.49
Required Pressure at System Demand (Including Hose Allowance at Source)	N/A

BOR 4 at Node 35



Hydraulic Graph
BOR 4 at Node 35

Static: Pressure
221.054

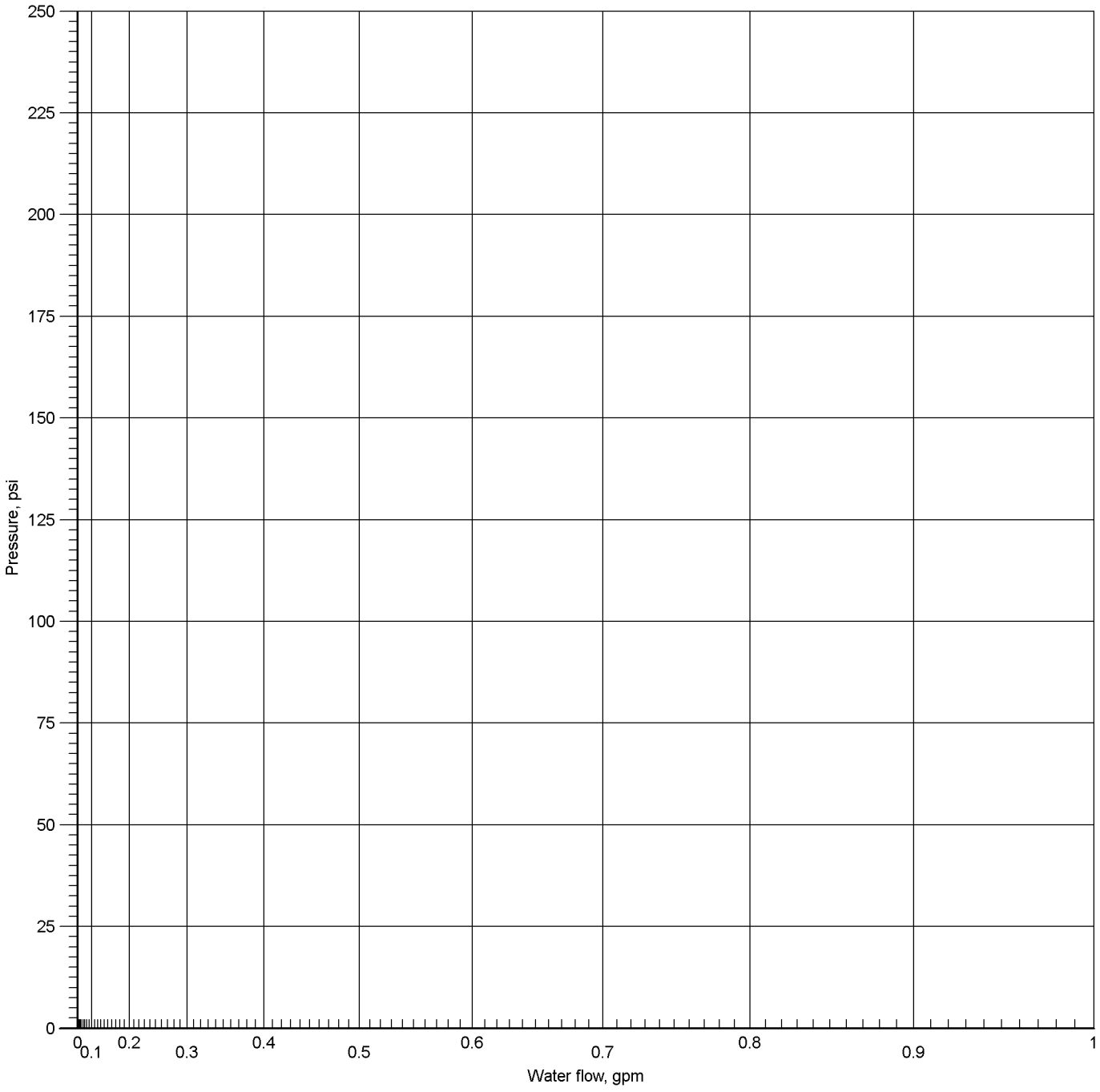
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
133.217 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

BOR 5 at Node 86



Hydraulic Graph
BOR 5 at Node 86

Static: Pressure
221.054

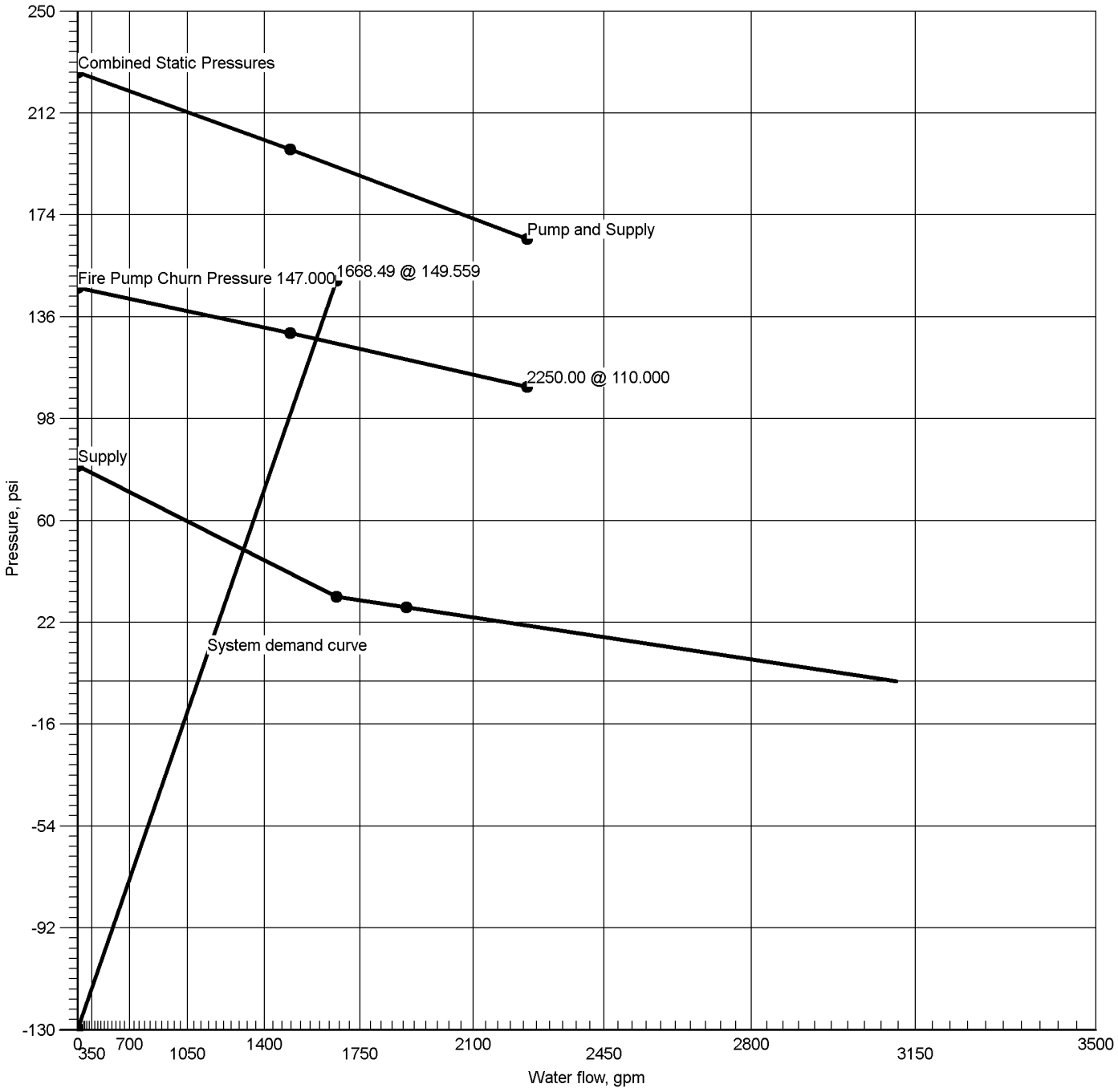
Residual: Pressure
N/A

Available Pressure at System Demand
N/A

Required Pressure at System Demand
132.957 @ 0.00

Required Pressure at System Demand (Including Hose Allowance at Source)
N/A

Pump at Node 72



Hydraulic Graph	Static + Churn Pressure	Fire Pump Rating
Pump at Node 72	227.555	130.000 @ 1500.00
Static: Pressure	**Fire Pump Churn Pressure**	
227.555	147.000	
Residual: Pressure		
126.194 @ 1668.49		
Available Pressure at System Demand		
157.810 @ 1668.49		
Required Pressure at System Demand		
149.559 @ 1668.49		

Summary Of Outflowing Devices

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Sprinkler	**601**	**121.15**	**121.15**	**16.8**	**52.000**			
Sprinkler	602	121.54	121.15	16.8	52.339			
Sprinkler	603	121.15	121.15	16.8	52.001			
Sprinkler	604	121.59	121.15	16.8	52.385			
Sprinkler	605	121.74	121.15	16.8	52.515			
Sprinkler	606	122.14	121.15	16.8	52.856			
Sprinkler	607	121.75	121.15	16.8	52.515			
Sprinkler	608	122.20	121.15	16.8	52.905			
Sprinkler	609	173.62	141.67	22.4	60.078			
Sprinkler	610	173.63	141.67	22.4	60.081			
Sprinkler	611	174.06	141.67	22.4	60.382			
Sprinkler	612	173.93	141.67	22.4	60.290			
Hydrant	4790	250.00	250.00	0	26.446			

Most Demanding Sprinkler Data

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
16	-4'-0	S, E(27'-2)	41.170	1918.49	
601	38'-10	Spr(-52.000)	52.000	121.15	
602	38'-10	Spr(-52.339)	52.339	121.54	
603	38'-10	Spr(-52.001)	52.001	121.15	
604	38'-10	Spr(-52.385)	52.385	121.59	
605	38'-7½	Spr(-52.515)	52.515	121.74	
606	38'-7½	Spr(-52.856)	52.856	122.14	
607	38'-7½	Spr(-52.515)	52.515	121.75	
608	38'-7½	Spr(-52.905)	52.905	122.20	
609	39'-0½	Spr(-60.078)	60.078	173.62	
610	39'-0½	Spr(-60.081)	60.081	173.63	
611	39'-0½	Spr(-60.382)	60.382	174.06	
612	39'-0½	Spr(-60.290)	60.290	173.93	
4790	0'-0	Hyd	26.446	250.00	
14	2'-10	T(41'-1½)	22.907		
15	-4'-0	T(59'-4½)	28.089		
53	1'-11	BV(20'-4½)	140.454		
71	-0'-10½		149.559		
72	-0'-10½	P2(-126.103)	149.559		
73	-0'-8	P1	23.365		
92	36'-8	PO(18'-8½)	97.004		
93	36'-5½	PO(18'-8½)	97.864		
94	36'-2½	PO(18'-8½)	99.385		
95	36'-0	PO(18'-8½)	101.317		
96	35'-9½	PO(18'-8½)	103.718		
97	35'-7	PO(18'-8½)	106.660		
98	35'-4½	PO(18'-8½)	110.227		
99	35'-2	PO(18'-8½)	114.526		
100	35'-2		115.372		
114	35'-1½	E(17'-7)	121.210		
117	3'-11½	BV(14'-1), BOR 6	135.644		
118	36'-8	PO(18'-8½)	76.779		
119	36'-5½	PO(18'-8½)	77.543		
121	36'-3	PO(18'-8½)	78.937		
122	36'-10½	PO(22'-6)	96.610		
123	36'-10½	PO(22'-6)	76.449		
136	35'-5	PO(18'-8½)	81.562		
137	35'-2½	PO(18'-8½)	81.714		
138	36'-0½	PO(18'-8½)	79.995		
139	35'-10	PO(18'-8½)	80.756		
140	35'-7½	PO(18'-8½)	81.262		
149	-4'-0	E(22'-1)	28.230		

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •								
CM	2.7050	117.03	6.53	120		0.033913	10'-0	Pf 0.339
601	38'-10	121.15	16.8	52.000		Sprinkler		Pe 0.000
602	38'-10			52.339			10'-0	Pv
CM	2.7050	238.57	13.32	120		0.126649	307'-10	Pf 43.726
602	38'-10	121.54	16.8	52.339		Sprinkler,	37'-5	Pe 0.939
92	36'-8			97.004		2PO(18'-8½)	345'-3	Pv
CM	4.2600	602.70	13.57	120		0.077023	10'-0	Pf 0.770
92	36'-8	364.13		97.004		Flow (q) from Route 5		Pe 0.090
93	36'-5½			97.864			10'-0	Pv
CM	4.2600	842.29	18.96	120		0.143064	10'-0	Pf 1.430
93	36'-5½	239.58		97.864		Flow (q) from Route 3		Pe 0.090
94	36'-2½			99.385			10'-0	Pv
CM	4.2600	965.54	21.73	120		0.184184	10'-0	Pf 1.841
94	36'-2½	123.25		99.385		Flow (q) from Route 2		Pe 0.090
95	36'-0			101.317			10'-0	Pv
CM	4.2600	1091.61	24.57	120		0.231129	10'-0	Pf 2.311
95	36'-0	126.07		101.317		Flow (q) from Route 13		Pe 0.090
96	35'-9½			103.718			10'-0	Pv
CM	4.2600	1222.83	27.53	120		0.285140	10'-0	Pf 2.851
96	35'-9½	131.22		103.718		Flow (q) from Route 12		Pe 0.090
97	35'-7			106.660			10'-0	Pv
CM	4.2600	1361.40	30.64	120		0.347780	10'-0	Pf 3.477
97	35'-7	138.57		106.660		Flow (q) from Route 11		Pe 0.090
98	35'-4½			110.227			10'-0	Pv
CM	4.2600	1509.35	33.97	120		0.420908	10'-0	Pf 4.208
98	35'-4½	147.94		110.227		Flow (q) from Route 10		Pe 0.090
99	35'-2			114.526			10'-0	Pv
CM	4.2600	1668.49	37.56	120		0.506674	1'-7½	Pf 0.831
99	35'-2	159.15		114.526		Flow (q) from Route 9		Pe 0.015
100	35'-2			115.372			1'-7½	Pv
CM	6.3570	1668.49	16.87	120		0.072130	27'-11½	Pf 5.827
100	35'-2			115.372			52'-9½	Pe 0.012
114	35'-1½			121.210		3E(17'-7)	80'-9½	Pv
FR	8.2490	1668.49	10.02	120		0.020281	31'-2	Pf 0.918
114	35'-1½			121.210			14'-1	Pe 13.516
117	3'-11½			135.644		f(-0.000), BV(14'-1), BOR 6	45'-3	Pv
UG	8.2490	1668.49	10.02	120		0.020281	91'-11	Pf 3.935
117	3'-11½			135.644			188'-3½	Pe 0.875
53	1'-11			140.454		sCV(76'-4), 3E(30'-6½), BV(20'-4½)	280'-3	Pv
DY	8.2490	1668.49	10.02	120		0.020281	2'-8	Pf 7.889
53	1'-11			140.454			164'-5	Pe 1.216
71	-0'-10½			149.559		2E(21'-1½), T(41'-1½), PRV(-4.500), 2BV(14'-1), sCV(52'-10)	167'-1	Pv
DY	6.0650	1668.49	18.53	120		0.090692	0'-0	Pf 0.000
71	-0'-10½			149.559				Pe -0.000
72	-0'-10½			149.559			0'-0	Pv
Pump			**Velocity**					
72		1668.49		149.559		Rating: 130.000 @ 1500.00		
73		Q=1668.49	10.02	23.365		Fire Pump Churn Pressure: 147.000		
FR	8.2490	1668.49	10.02	120		0.020281	6'-5½	Pf 1.060
73	-0'-8			23.365			45'-9½	Pe -1.518
14	2'-10			22.907		GV(4'-8½), T(41'-1½)	52'-3	Pv
UG	8.3900	1668.49	9.68	140		0.014040	68'-2	Pf 2.220
14	2'-10			22.907			89'-11	Pe 2.962
15	-4'-0			28.089		E(30'-6½), T(59'-4½)	158'-1	Pv
CM	7.9800	748.56	4.80	150		0.003580	2122'-8½	Pf 13.081
15	-4'-0			28.089			134'-3½	Pe
16	-4'-0			41.170		6EE(13'-7), BFP(-5.000), T(52'-10)	2257'-0½	Pv
		0.00				Hose Allowance At Source		
16		1918.49						
• • • • • Route 2 • • • • •								

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
CM	2.7050	4.11	0.23	120	0.000069	8'-9	Pf 0.001
601	38'-10	121.15	16.8	52.000	Sprinkler		Pe -0.000
603	38'-10			52.001		8'-9	Pv
CM	2.7050	125.26	6.99	120	0.038455	10'-0	Pf 0.385
603	38'-10	121.15	16.8	52.001	Sprinkler		Pe -0.000
604	38'-10			52.385		10'-0	Pv
CM	2.7050	246.85	13.78	120	0.134901	136'-5	Pf 23.455
604	38'-10	121.59	16.8	52.385	Sprinkler,	37'-5	Pe 0.939
118	36'-8			76.779	2PO(18'-8½)	173'-10½	Pv
CM	4.3100	577.96	12.71	120	0.067339	10'-0	Pf 0.673
118	36'-8	331.11		76.779	Flow (q) from Route 6		Pe 0.090
119	36'-5½			77.543		10'-0	Pv
CM	4.3100	826.21	18.17	120	0.130425	10'-0	Pf 1.304
119	36'-5½	248.24		77.543	Flow (q) from Route 4		Pe 0.090
121	36'-3			78.937		10'-0	Pv
RN	2.7050	123.25	6.88	120	0.037322	473'-0	Pf 20.447
121	36'-3			78.937	PO(18'-8½)	74'-10½	Pe 0.001
94	36'-2½			99.385	3PO(18'-8½)	547'-10½	Pv
• • • • • Route 3 • • • • •							
CM	2.7050	117.45	6.56	120	0.034135	10'-0	Pf 0.341
605	38'-7½	121.74	16.8	52.515	Sprinkler		Pe 0.000
606	38'-7½			52.856		10'-0	Pv
CM	2.7050	239.58	13.38	120	0.127643	307'-10	Pf 44.069
606	38'-7½	122.14	16.8	52.856	Sprinkler,	37'-5	Pe 0.939
93	36'-5½			97.864	2PO(18'-8½)	345'-3	Pv
• • • • • Route 4 • • • • •							
CM	2.7050	4.30	0.24	120	0.000075	8'-9	Pf 0.001
605	38'-7½	121.74	16.8	52.515	Sprinkler		Pe -0.000
607	38'-7½			52.515		8'-9	Pv
CM	2.7050	126.05	7.04	120	0.038902	10'-0	Pf 0.389
607	38'-7½	121.75	16.8	52.515	Sprinkler		Pe -0.000
608	38'-7½			52.905		10'-0	Pv
CM	2.7050	248.24	13.86	120	0.136306	136'-5	Pf 23.700
608	38'-7½	122.20	16.8	52.905	Sprinkler,	37'-5	Pe 0.939
119	36'-5½			77.543	2PO(18'-8½)	173'-10½	Pv
• • • • • Route 5 • • • • •							
CM	3.3340	16.44	0.60	120	0.000325	8'-9	Pf 0.003
609	39'-0½	173.62	22.4	60.078	Sprinkler		Pe 0.000
610	39'-0½			60.081		8'-9	Pv
CM	3.3340	190.07	6.99	120	0.030046	10'-0	Pf 0.300
610	39'-0½	173.63	22.4	60.081	Sprinkler		Pe 0.000
611	39'-0½			60.382		10'-0	Pv
CM	3.3340	364.13	13.38	120	0.100030	307'-10	Pf 35.290
611	39'-0½	174.06	22.4	60.382	Sprinkler,	44'-11½	Pe 0.939
122	36'-10½			96.610	2PO(22'-6)	352'-9½	Pv
CM	4.2600	364.13	8.20	120	0.030321	10'-0	Pf 0.303
122	36'-10½			96.610			Pe 0.090
92	36'-8			97.004		10'-0	Pv
• • • • • Route 6 • • • • •							
CM	3.3340	157.18	5.78	120	0.021142	10'-0	Pf 0.211
609	39'-0½	173.62	22.4	60.078	Sprinkler		Pe -0.000
612	39'-0½			60.290		10'-0	Pv
CM	3.3340	331.11	12.17	120	0.083899	136'-5	Pf 15.220
612	39'-0½	173.93	22.4	60.290	Sprinkler,	44'-11½	Pe 0.939
123	36'-10½			76.449	2PO(22'-6)	181'-5	Pv
CM	4.3100	331.11	7.28	120	0.024027	10'-0	Pf 0.240
123	36'-10½			76.449			Pe 0.090
118	36'-8			76.779		10'-0	Pv
• • • • • Route 7 • • • • •							
FR	6.2800	250.00	2.59	140	0.001718	4'-0	Pf 0.045
4790	0'-0	250.00		26.446	Hydrant,	22'-1	Pe 1.739
149	-4'-0			28.230	E(22'-1)	26'-1	Pv
UG	8.3900	250.00	1.45	140	0.000419	22'-5	Pf 0.034
149	-4'-0			28.230		59'-4½	Pe
150	-4'-0			28.265	T(59'-4½)	81'-9½	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
CM	7.9800	1169.94	7.50	150	0.008179	885'-0½	Pf 12.906
150	-4'-0	919.94		28.265	Flow (q) from Route 8	81'-6	Pe
16	-4'-0			41.170	4EE(13'-7), BFP(-5.000), S, E(27'-2)	966'-6½	Pv
• • • • • Route 8 • • • • •							
CM	7.9800	919.94	5.90	150	0.005243	33'-6	Pf 0.176
15	-4'-0	748.56		28.089	Flow (q) from Route 1		Pe
150	-4'-0			28.265		33'-6	Pv
• • • • • Route 9 • • • • •							
CM	4.3100	159.15	3.50	120	0.006196	10'-0	Pf 0.062
136	35'-5			81.562			Pe 0.090
137	35'-2½			81.714		10'-0	Pv
RN	2.7050	159.15	8.88	120	0.059887	473'-0	Pf 32.810
137	35'-2½			81.714	PO(18'-8½)	74'-10½	Pe 0.002
99	35'-2			114.526	3PO(18'-8½)	547'-10½	Pv
• • • • • Route 10 • • • • •							
CM	4.3100	702.95	15.46	120	0.096731	10'-0	Pf 0.967
121	36'-3	123.25		78.937	Flow (q) from Route 2		Pe 0.090
138	36'-0½			79.995		10'-0	Pv
CM	4.3100	576.88	12.69	120	0.067106	10'-0	Pf 0.671
138	36'-0½			79.995			Pe 0.090
139	35'-10			80.756		10'-0	Pv
CM	4.3100	445.66	9.80	120	0.041630	10'-0	Pf 0.416
139	35'-10			80.756			Pe 0.090
140	35'-7½			81.262		10'-0	Pv
CM	4.3100	307.09	6.75	120	0.020902	10'-0	Pf 0.209
140	35'-7½			81.262			Pe 0.090
136	35'-5			81.562		10'-0	Pv
RN	2.7050	147.94	8.26	120	0.052319	473'-0	Pf 28.664
136	35'-5			81.562	PO(18'-8½)	74'-10½	Pe 0.001
98	35'-4½			110.227	3PO(18'-8½)	547'-10½	Pv
• • • • • Route 11 • • • • •							
RN	2.7050	138.57	7.74	120	0.046354	473'-0	Pf 25.396
140	35'-7½			81.262	PO(18'-8½)	74'-10½	Pe 0.001
97	35'-7			106.660	3PO(18'-8½)	547'-10½	Pv
• • • • • Route 12 • • • • •							
RN	2.7050	131.22	7.33	120	0.041910	473'-0	Pf 22.961
139	35'-10			80.756	PO(18'-8½)	74'-10½	Pe 0.001
96	35'-9½			103.718	3PO(18'-8½)	547'-10½	Pv
• • • • • Route 13 • • • • •							
RN	2.7050	126.07	7.04	120	0.038917	473'-0	Pf 21.322
138	36'-0½			79.995	PO(18'-8½)	74'-10½	Pe 0.001
95	36'-0			101.317	3PO(18'-8½)	547'-10½	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

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

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
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
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