CALCULATION SUMMARY

Project Name : Johnsonville Elementary School Phase 2

Project Location: 18495 NC-27

Contract No. : 173-NC22

City: Cameron, NC 28326

Design Areas

Design Area Name	Calc. Mode (Model)	Occupancy	Area of Application	Total Water	Pressure @ Source	Min. Density	Min. Pressure	Min. Flow	Calculated Heads	Hose Streams	Margin To Source
			(ft²)	(gpm)	(psi)	(gpm/ft²)	(psi)	(gpm)	#	(gpm)	(psi)
1	Demand (HW)	Light Hazard	1340	340.7	Required 45.1	0.1	12.8	40.1	6	100	33.1

HYDRAULIC CALCULATIONS
for

Job Information

Project Name : Johnsonville Elementary School Phase 2

Contract No. : 173-NC22

City: Cameron, NC 28326

Project Location: 18495 NC-27

Date: 10/14/2022

Contractor Information

Name of Contractor: A & B Fire Services Inc.

Address: 113 North Ln.

City: Bluefield, WV 24605

Phone Number: 540-521-5776

E-mail: croseberry@aandbfire.com

Name of Designer: C.J. Roseberry

Authority Having Jurisdiction: Harnett Co.

Design

Remote Area Name	1
Remote Area Location	Classroom 8 / 7
Occupancy Classification	Light Hazard
Density (gpm/ft²)	0.1
Area of Application (ft²)	1340
Coverage per Sprinkler (ft²)	400
Number of Calculated Sprinklers	6
In-Rack Demand (gpm)	0
Special Heads	
Hose Streams (gpm)	100
Total Water Required (incl. Hose Streams) (gpm)	340.7
Required Pressure at Source (psi)	45.1
Type of System	Wet
Volume - Entire System (gal)	3836.9 gal

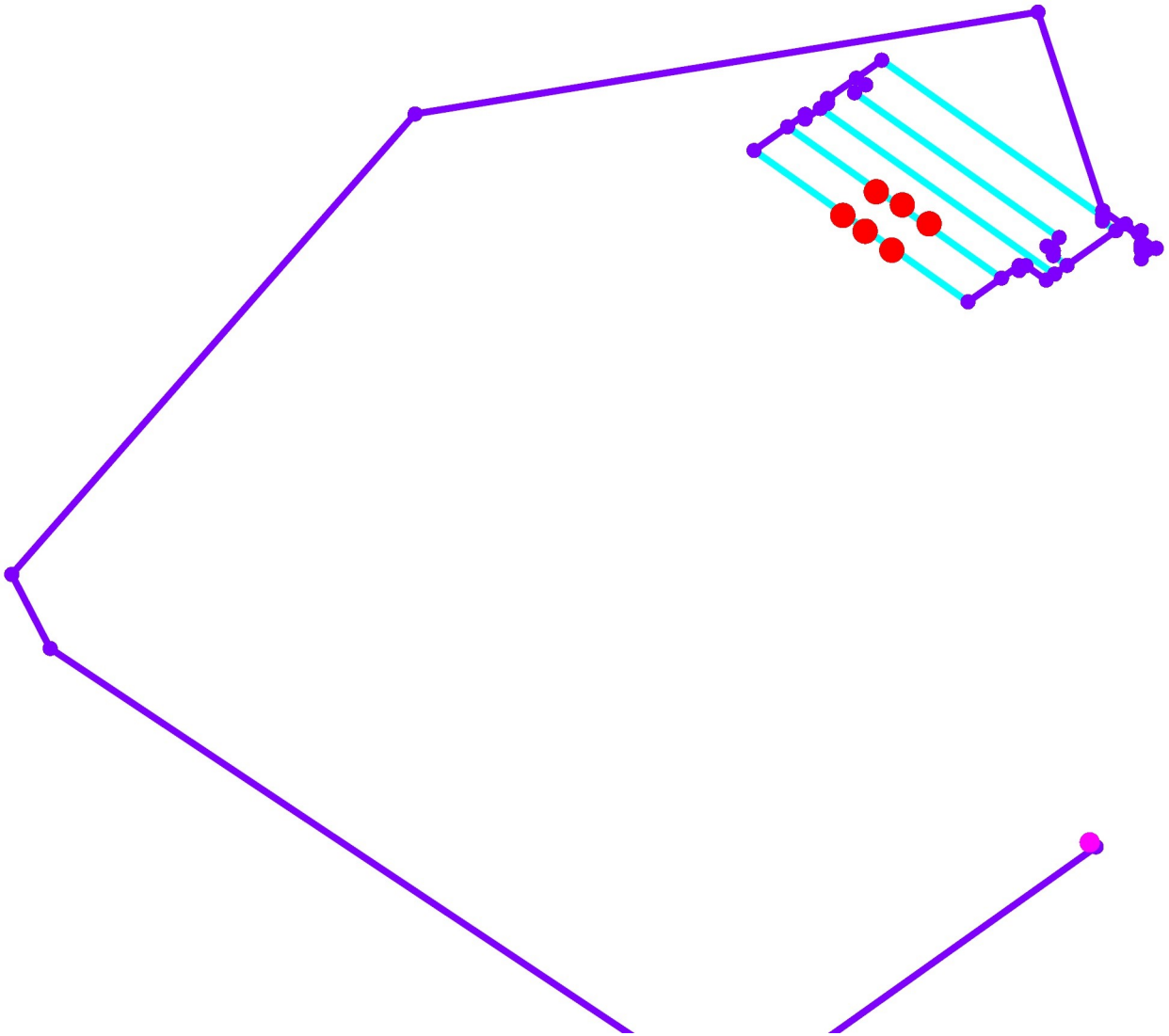
Water Supply Information

Date	09/27/2022
Location	Fire Hydrant 996G
Source	W1

Notes

Node Labels: Off
Pipe Labels: Off

Diagram for Design Area : 1
(Optimized Hydraulic Simplified)



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Hydraulic Analysis for : 1

Calculation Info

Calculation Mode	Demand
Hydraulic Model	Hazen-Williams
Fluid Name	Water @ 60F (15.6C)
Fluid Weight, (lb/ft³)	N/A for Hazen-Williams calculation.
Fluid Dynamic Viscosity, (lb·s/ft²)	N/A for Hazen-Williams calculation.

Water Supply Parameters

Supply 1 : W1

Flow (gpm)	Pressure (psi)
0	80
860	70

Supply Analysis

Node at Source	Static Pressure (psi)	Residual Pressure (psi)	Flow (gpm)	Available Pressure (psi)	Total Demand (gpm)	Required Pressure (psi)
W1	80	70	860	78.2	340.7	45.1

Hoses

Inside Hose Flow / Standpipe Demand (gpm)	
Outside Hose Flow (gpm)	
Additional Outside Hose Flow (gpm)	100
Other (custom defined) Hose Flow (gpm)	
Total Hose Flow (gpm)	100

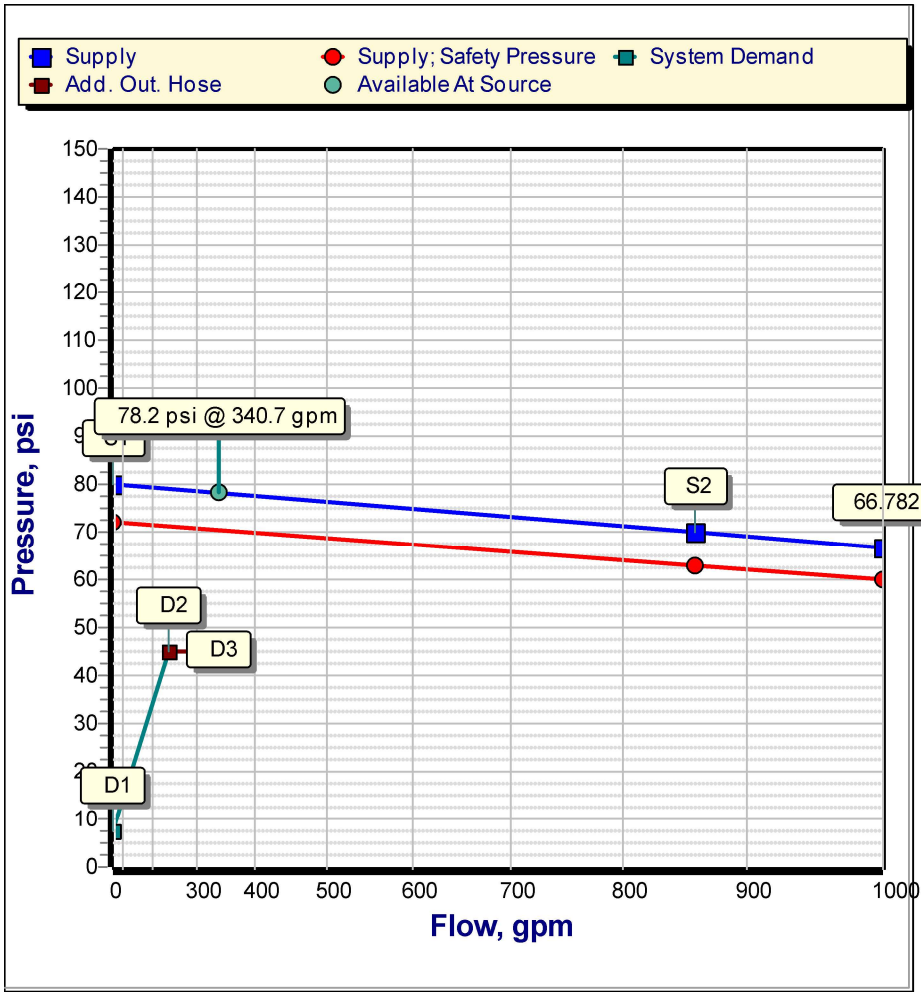
Sprinklers

Ovehead Sprinkler Flow (gpm)	240.7
InRack Sprinkler Flow (gpm)	0
Other (custom defined) Sprinkler Flow (gpm)	0
Total Sprinkler Flow (gpm)	240.7

Other

Required Margin of Safety (%)	10
W1 - Pressure (psi)	45.1
W1 - Flow (gpm)	240.7
Demand w/o System Pump(s)	N/A

Hydraulic Analysis for : 1



Hydraulic Analysis for : 1

Graph Labels

Label	Description	Values	
		Flow (gpm)	Pressure (psi)
S1	Supply point #1 - Static	0	80
S2	Supply point #2 - Residual	860	70
D1	Elevation Pressure	0	7.7
D2	System Demand	240.7	45.1
D3	System Demand + Add.Out.Hose	340.7	45.1

Curve Intersections & Safety Margins

Curve Name	Intersection		Safety Margin	
	Pressure (psi)	Flow (gpm)	Pressure (psi)	@ Flow (gpm)
Supply	78.2	339.1	33.1	340.7
Supply; Safety Pressure	70.6	318.7	25.3	340.7

Open Heads

Head Ref.	Head Type	Coverage	K-Factor	Required			Calculated		
				Density	Flow	Pressure	Density	Flow	Pressure
		(ft²)	(gpm/psi½)	(gpm/ft²)	(gpm)	(psi)	(gpm/ft²)	(gpm)	(psi)
S1	Overhead Sprinkler	400	11.2	0.1	40	12.8	0.1	40.1	12.8
S2	Overhead Sprinkler	400	11.2	0.1	40	12.8	0.1	40.1	12.8
S3	Overhead Sprinkler	400	11.2	0.1	40	12.8	0.1	40.2	12.9
S4	Overhead Sprinkler	400	11.2	0.1	40	12.8	0.1	40.1	12.8
S5	Overhead Sprinkler	400	11.2	0.1	40	12.8	0.1	40.1	12.8
S6	Overhead Sprinkler	400	11.2	0.1	40	12.8	0.101	40.2	12.9

Node Data

Node# Type	Hgroup Fitting	K-Fact. Stat. Pres.	Elev Coverage	X Y
		gpm/psi½ psi	ft ft²	ft ft
S2 Overhead Sprinkler	HEAD	11.2	14.25 400	6756.54 488.9
S1 Overhead Sprinkler	HEAD	11.2	14.25 400	6756.54 500.9
S5 Overhead Sprinkler	HEAD	11.2	14.25 400	6776.54 488.9
S4 Overhead Sprinkler	HEAD	11.2	14.25 400	6774.54 500.9
S3 Overhead Sprinkler	HEAD	11.2	14.25 400	6756.54 474.51
S6 Overhead Sprinkler	HEAD	11.2	14.25 400	6776.54 474.51
136 Node	NODE us.Tee		14.25	6757.38 488.9
135 Node	NODE us.Tee		14.25	6757.38 500.9
150 Node	NODE us.Tee		14.25	6775.38 488.9
149 Node	NODE us.Tee		14.25	6775.38 500.9
001 Node	NODE us.Tee		14.25	6757.38 474.51
151 Node	NODE us.Tee		14.25	6775.38 474.51
127 Node	NODE us.Tee		14.25	6757.38 549.42
126 Node	NODE us.Tee		14.25	6775.38 549.42
118 Node	NODE us.Tee		14.25	6812.31 549.42
117 Node	NODE us.Tee		14.25	6825.98 549.42
005 Node	NODE us.Tee		14.25	6757.38 434.42
009 Node	NODE us.Tee		14.25	6775.38 434.42
122 Node	NODE us.Tee		11.67	6792.98 549.42
053 Node	NODE us.Tee		11.67	6792.98 423.49
054 Node	NODE us.Tee		11.67	6799.69 423.49
057 Node	NODE us.Tee		11.67	6825.98 423.49
073-O Node	NODE		4.49	6832.76 416.66
073-I Node	NODE		3.69	6832.76 416.66
074-O Node	NODE		2.92	6832.76 416.66

Node Data

Node# Type	Hgroup Fitting	K-Fact. Stat. Pres.	Elev Coverage	X Y
		gpm/psi½ psi	ft ft²	ft ft
074-I Node	NODE		2.54	6832.76 416.66
075 Node	NODE		1.08	6832.76 416.66
079 Node	NODE us.Tee		-3.42	6898.73 538.18
086-O Node	NODE		-3.42	6406.78 235.51
086-I Node	NODE		-3.42	6406.78 231.35
W1 Supply	SUPPLY		-3.42	6597.2 208.85

PIPE INFORMATION

Node 1 Node 2	Elev 1 Elev 2	K-Factor 1 K-Factor 2	Flow added (q) Total flow (Q)	Nominal ID Actual ID	Fittings quantity x (name) = length	L F T	C Factor Pf per ft	total (Pt) elev (Pe) frict (Pf)	NOTES
	(ft)	(gpm/psi½)	(gpm)	(in)	(ft)	(ft)	(psi)	(psi)	
Path No: 1									
S2	14.25	11.2	40.1	1	1x(us.Tee-Br)=5	24	120	12.8	Flex-48"
136	14.25		40.1	1.049		5	0.4696	0	
						29		13.6	
136	14.25		-6.9	2		14.39	120	26.4	
001	14.25		33.2	2.157		0	0.0099	0	
						14.39		0.1	
001	14.25		40.2	2	1x(us.Tee-Br)=12.31	40.09	120	26.6	
005	14.25		73.4	2.157		12.31	0.043	0	
						52.4		2.3	
005	14.25		0	4		18	120	28.8	
009	14.25		73.4	4.26		0	0.0016	0	
						18		0.0	
009	14.25		73.2	4	2x(us.Tee-Br)=52.67	31.11	120	28.8	
053	11.67		146.6	4.26	2x(us.90)=26.33	79	0.0056	1.1	
						110.11		0.6	
053	11.67		33.2	4		6.71	120	30.6	
054	11.67		179.8	4.26		0	0.0082	0	
						6.71		0.1	
054	11.67		26.7	4		26.29	120	30.6	
057	11.67		206.4	4.26		0	0.0106	0	
						26.29		0.3	
057	11.67		34.3	4	2x(us.90)=26.33	20.79	120	30.9	
073-O	4.49		240.7	4.26	1x(us.Tee-Br)=26.33	52.67	0.0141	3.1	
						73.46		1	
073-O	4.49		0	4		0.8		35.1	CV-1 FR
073-I	3.69		240.7	0		0	0.7197	0.3	Check
						0.8		0.6	***
073-I	3.69		0	4		0.77	120	36	
074-O	2.92		240.7	4.26		0	0.0141	0.3	
						0.77		0.0	
074-O	2.92		0	4		0.38		36.3	BFV-N
074-I	2.54		240.7	0		0	0.4271	0.2	***
						0.38		0.2	
074-I	2.54		0	4		1.46	120	36.7	
075	1.08		240.7	4.26		0	0.0141	0.6	
						1.46		0.0	
075	1.08		0	6	1x(us.Tee-Br)=51.84	150.64	140	37.3	
079	-3.42		240.7	6.4	1x(us.45)=12.1	112.32	0.0015	1.9	
					2x(us.90)=48.39	262.96		0.4	
079	-3.42		0	8	3x(us.45)=47.55	904.76	140	39.6	
086-O	-3.42		240.7	8.55	1x(elbow.22.5)=7.93	87.18	0.0004	0	
					1x(us.90)=31.7	991.94		0.4	
086-O	-3.42		0	8		4.17		40	Ames3000SS
086-I	-3.42		240.7	0		0	1.1935	0	***
						4.17		5	
086-I	-3.42		0	8	1x(us.90)=31.7	220.28	140	45	
W1	-3.42		240.7	8.55	1x(us.Tee-Br)=61.64	93.34	0.0004	0	
						313.62		0.1	
W1								**45.1**	

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PIPE INFORMATION

Node 1 Node 2	Elev 1 Elev 2	K-Factor 1 K-Factor 2	Flow added (q) Total flow (Q)	Nominal ID Actual ID	Fittings quantity x (name) = length	L F T	C Factor Pf per ft	total (Pt) elev (Pe) frict (Pf)	NOTES
	(ft)	(gpm/psi½)	(gpm)	(in)	(ft)	(ft)	(psi)	(psi)	
Path No: 2									
S1	14.25	11.2	40.1	1	1x(us.Tee-Br)=5	24	120	12.8	Flex-48"
135	14.25		40.1	1.049		5	0.4697	0	
						29		13.6	
135	14.25		6.9	2	1x(us.Tee-Br)=12.31	48.52	120	26.4	
127	14.25		47	2.157		12.31	0.0188	0	
						60.83		1.1	
127	14.25		0	3		18	120	27.6	
126	14.25		47	3.26		0	0.0025	0	
						18		0.0	
126	14.25		47.2	3	2x(us.90)=18.82	20.18	120	27.6	
122	11.67		94.2	3.26		18.82	0.0091	1.1	
						39		0.4	
122	11.67		-33.2	3	2x(us.90)=18.82	21.92	120	29.1	
118	14.25		61	3.26		18.82	0.0041	-1.1	
						40.73		0.2	
118	14.25		-26.7	3	1x(us.Tee-Br)=20.16	13.67	120	28.1	
117	14.25		34.3	3.26		20.16	0.0014	0	
						33.83		0.0	
117	14.25		0	2	1x(us.Tee-Br)=12.31	128.51	120	28.2	
057	11.67		34.3	2.157	2x(us.90)=12.31	24.61	0.0105	1.1	
						153.12		1.6	
057								**30.9**	
Path No: 3									
S5	14.25	11.2	40.1	1	1x(us.Tee-Br)=5	24	120	12.8	Flex-48"
150	14.25		40.1	1.049		5	0.4702	0	
						29		13.6	
150	14.25		-7.1	2		14.39	120	26.5	
151	14.25		33	2.157		0	0.0098	0	
						14.39		0.1	
151	14.25		40.2	2	1x(us.Tee-Br)=12.31	40.09	120	26.6	
009	14.25		73.2	2.157		12.31	0.0429	0	
						52.4		2.2	
009								**28.8**	
Path No: 4									
S4	14.25	11.2	40.1	1	1x(us.Tee-Br)=5	24	120	12.8	Flex-48"
149	14.25		40.1	1.049		5	0.4704	0	
						29		13.6	
149	14.25		7.1	2	1x(us.Tee-Br)=12.31	48.52	120	26.5	
126	14.25		47.2	2.157		12.31	0.019	0	
						60.83		1.2	
126								**27.6**	

PIPE INFORMATION

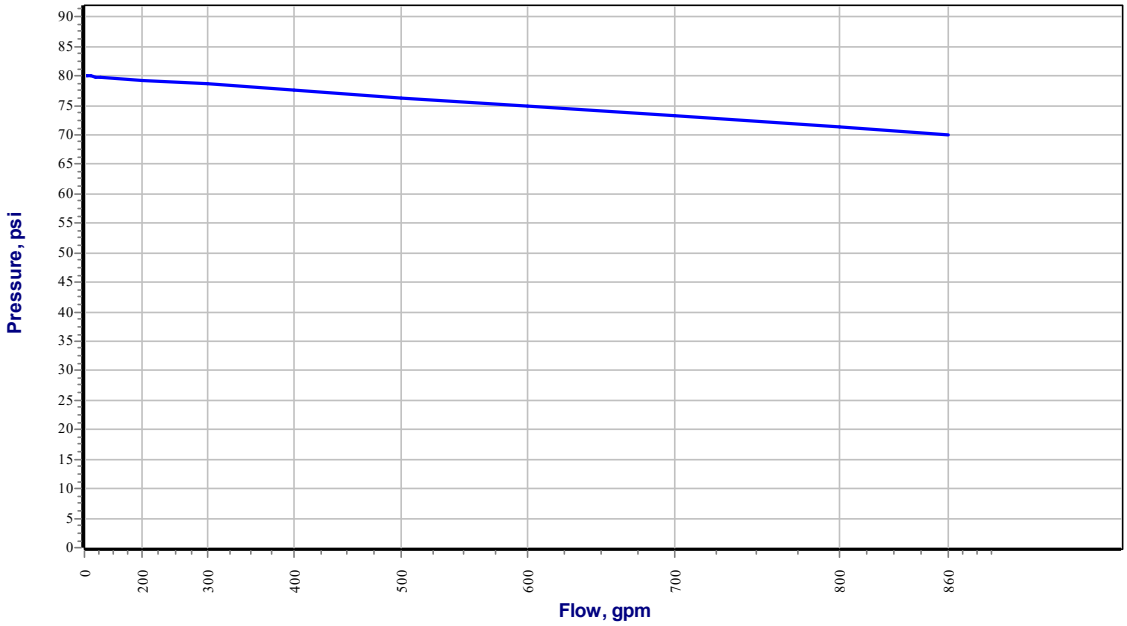
Node 1 Node 2	Elev 1 Elev 2	K-Factor 1 K-Factor 2	Flow added (q) Total flow (Q)	Nominal ID Actual ID	Fittings quantity x (name) = length	L F T	C Factor Pf per ft	total (Pt) elev (Pe) frict (Pf)	NOTES
	(ft)	(gpm/psi½)	(gpm)	(in)	(ft)	(ft)	(psi)	(psi)	
Path No: 5									
S3	14.25	11.2	40.2	1	1x(us.Tee-Br)=5	24	120	12.9	Flex-48"
001	14.25		40.2	1.049		5	0.4721	0	
						29		13.7	
001								**26.6**	
Path No: 6									
S6	14.25	11.2	40.2	1	1x(us.Tee-Br)=5	24	120	12.9	Flex-48"
151	14.25		40.2	1.049		5	0.4726	0	
						29		13.7	
151								**26.6**	
Path No: 7									
136	14.25		0	2		12	120	26.4	
135	14.25		6.9	2.157		0	0.0005	0	
						12		0	
135								**26.4**	
Path No: 8									
122	11.67		0	2	2x(us.Tee-Br)=24.61	125.93	120	29.1	
053	11.67		33.2	2.157		24.61	0.0099	0	
						150.54		1.5	
053								**30.6**	
Path No: 9									
118	14.25		0	2	3x(us.Tee-Br)=36.92	141.14	120	28.1	
054	11.67		26.7	2.157	5x(us.90)=30.77	67.69	0.0066	1.1	
						208.82		1.4	
054								**30.6**	
Path No: 10									
150	14.25		0	2		12	120	26.5	
149	14.25		7.1	2.157		0	0.0006	0	
						12		0	
149								**26.5**	

* Pressures are balanced to a high degree of accuracy. Values may vary by 0.1 psi due to display rounding.

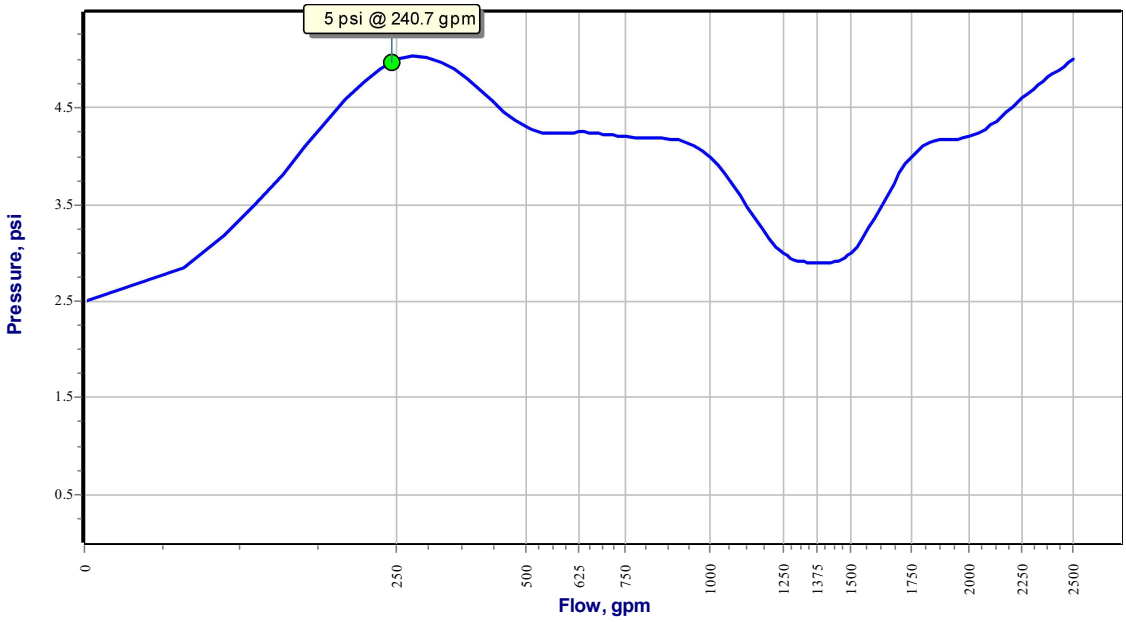
* Maximum Velocity of 14.93 ft/s occurs in the following pipe(s): (151-S6)

*** Device pressure loss (gain in the case of pumps) is calculated from the device's curve. If the device curve is printed with this report, it will appear below. The length of the device as shown in the table above comes from the CAD drawing. The friction loss per unit of length is calculated based upon the length and the curve-based loss/gain value. Internal ID and C Factor values are irrelevant as the device is not represented as an addition to any pipe, but is an individual item whose loss/gain is based solely on the curve data.

Pressure vs. Flow Function
Design Area: 1; Supply Ref.: W1; Supply Name:W1



Pressure Loss Function
Design Area: 1; BFP Ref.: 349 (Ames3000SS, Size = 8); Inlet Node: 086-I; Outlet Node: 086-O



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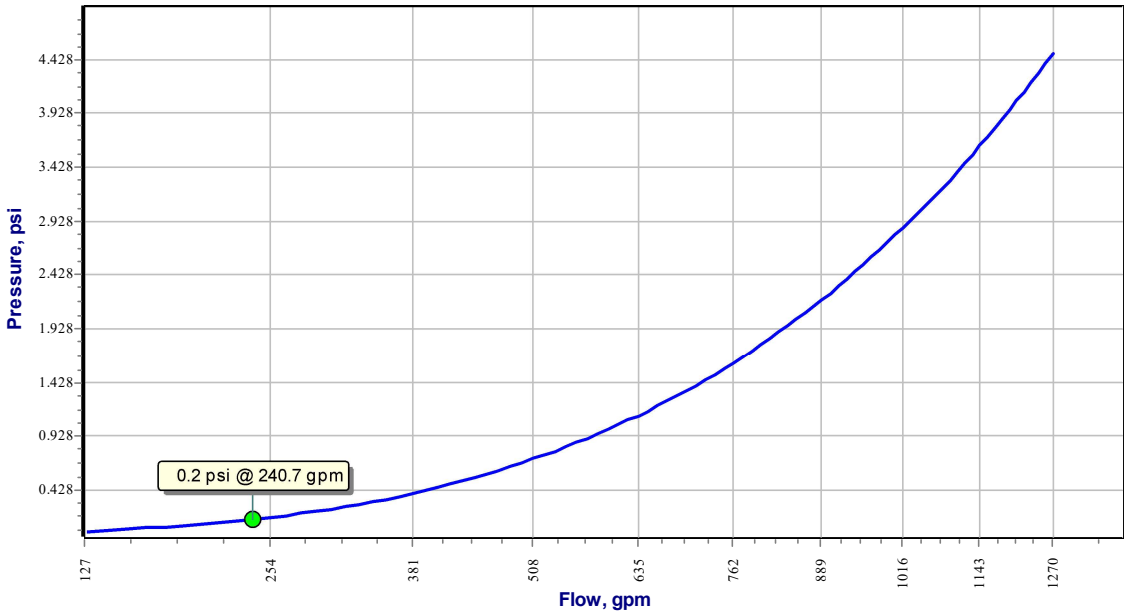
Pressure Loss Function
Design Area: 1; Valve Ref.: 347 (BFV-N, Size = 4); Inlet Node: 074-I; Outlet Node: 074-O



Pressure Loss Function
Design Area: 1; Valve Ref.: 348 (CV-1 FR Check, Size = 4); Inlet Node: 073-I; Outlet Node: 073-O