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)
2	Demand (HW)	OH1	773	381.2	Required 42.6	0.15	10.3	18	7	250	35.2

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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	2
Remote Area Location	Mechanical Platform
Occupancy Classification	OH1
Density (gpm/ft²)	0.15
Area of Application (ft²)	773
Coverage per Sprinkler (ft²)	120
Number of Calculated Sprinklers	7
In-Rack Demand (gpm)	0
Special Heads	
Hose Streams (gpm)	250
Total Water Required (incl. Hose Streams) (gpm)	381.2
Required Pressure at Source (psi)	42.6
Type of System	Wet
Volume - Entire System (gal)	3866.6 gal

Water Supply Information

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

Notes

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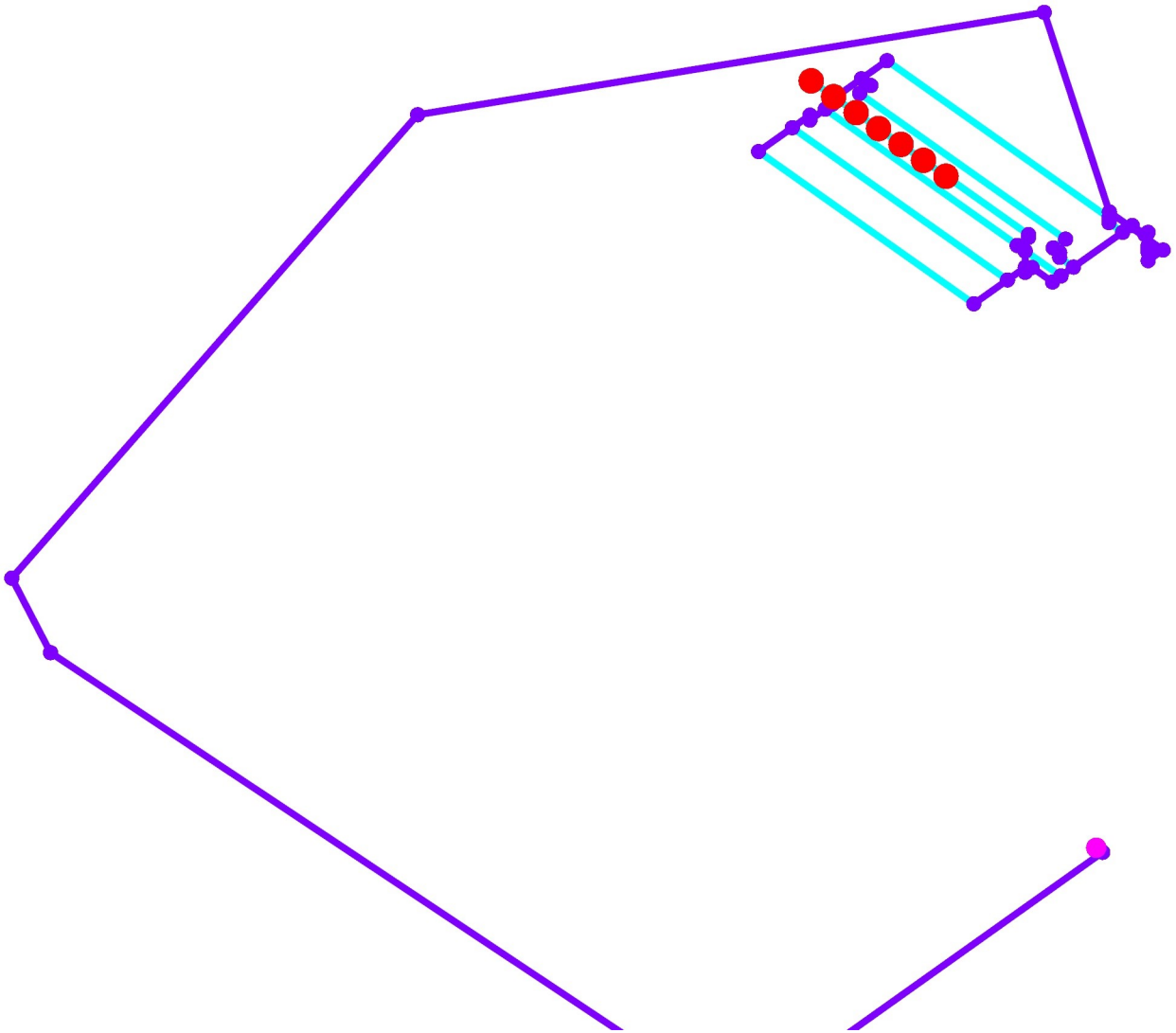
Node Labels: Off
Pipe Labels: Off

Diagram for Design Area : 2
(Optimized Hydraulic Simplified)



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Hydraulic Analysis for : 2

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	77.8	381.2	42.6

Hoses

Inside Hose Flow / Standpipe Demand (gpm)	
Outside Hose Flow (gpm)	
Additional Outside Hose Flow (gpm)	250
Other (custom defined) Hose Flow (gpm)	
Total Hose Flow (gpm)	250

Sprinklers

Ovehead Sprinkler Flow (gpm)	131.2
InRack Sprinkler Flow (gpm)	0
Other (custom defined) Sprinkler Flow (gpm)	0
Total Sprinkler Flow (gpm)	131.2

Other

Required Margin of Safety (%)	10
W1 - Pressure (psi)	42.6
W1 - Flow (gpm)	131.2
Demand w/o System Pump(s)	N/A

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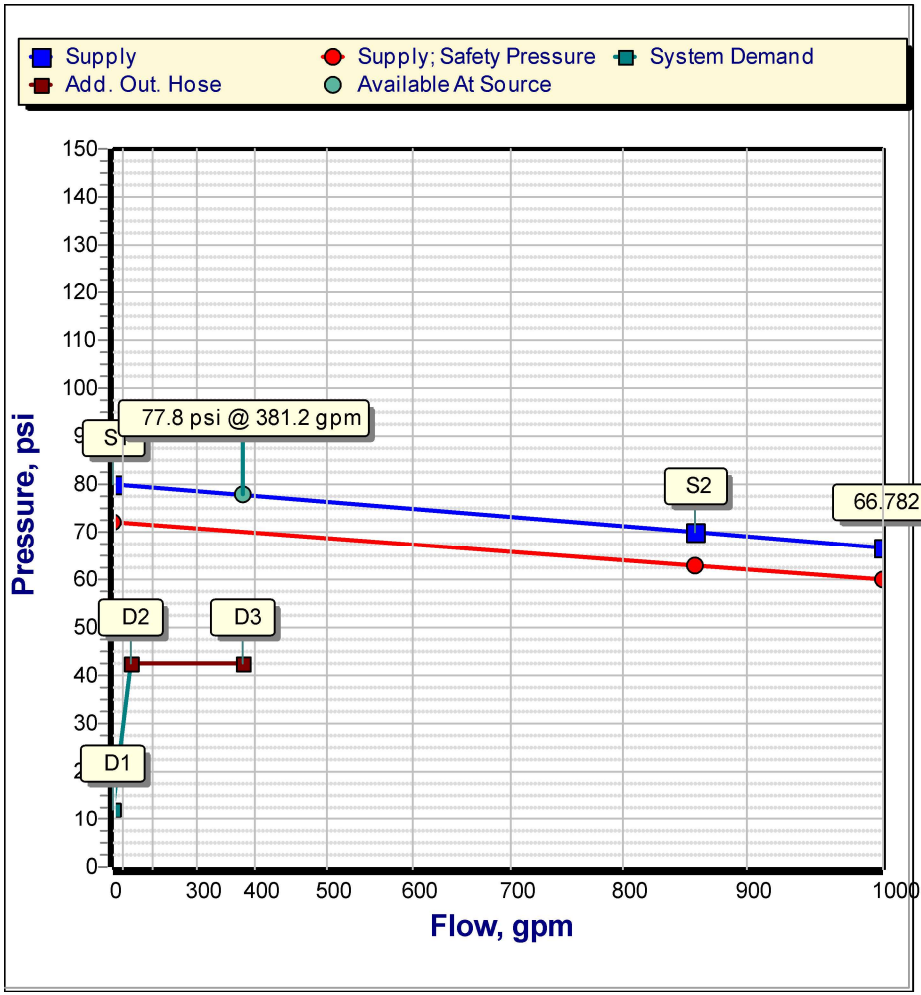
Hydraulic Analysis for : 2



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Hydraulic Analysis for : 2

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	12.1
D2	System Demand	131.2	42.6
D3	System Demand + Add.Out.Hose	381.2	42.6

Curve Intersections & Safety Margins

Curve Name	Intersection		Safety Margin	
	Pressure (psi)	Flow (gpm)	Pressure (psi)	@ Flow (gpm)
Supply	79.3	201.1	35.2	381.2
Supply; Safety Pressure	71.5	188	27.4	381.2

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)
M1	Overhead Sprinkler	120	5.6	0.15	18	10.3	0.15	18	10.3
M2	Overhead Sprinkler	120	5.6	0.15	18	10.3	0.15	18	10.4
M3	Overhead Sprinkler	120	5.6	0.15	18	10.3	0.151	18.2	10.5
M4	Overhead Sprinkler	120	5.6	0.15	18	10.3	0.153	18.4	10.8
M5	Overhead Sprinkler	120	5.6	0.15	18	10.3	0.157	18.8	11.3
M6	Overhead Sprinkler	120	5.6	0.15	18	10.3	0.162	19.5	12.1
M7	Overhead Sprinkler	120	5.6	0.15	18	10.3	0.17	20.3	13.2

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Node Data

Node# Type	Hgroup Fitting	K-Fact. Stat. Pres.	Elev Coverage	X Y
		gpm/psi½ psi	ft ft²	ft ft
M1 Overhead Sprinkler	HEAD	5.6	24.5 120	6790.87 554.8
M2 Overhead Sprinkler	HEAD	5.6	24.5 120	6790.87 542.8
M3 Overhead Sprinkler	HEAD	5.6	24.5 120	6790.87 530.8
M4 Overhead Sprinkler	HEAD	5.6	24.5 120	6790.87 518.8
M5 Overhead Sprinkler	HEAD	5.6	24.5 120	6790.87 506.8
M6 Overhead Sprinkler	HEAD	5.6	24.5 120	6790.87 494.8
M7 Overhead Sprinkler	HEAD	5.6	24.5 120	6790.87 482.8
015 Node	NODE us.90		23	6784.81 434.42
016 Node	NODE us.Tee		14.25	6784.81 434.42
009 Node	NODE us.Tee		14.25	6775.38 434.42
005 Node	NODE us.Tee		14.25	6757.38 434.42
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
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
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

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Node Data

Node# Type	Hgroup Fitting	K-Fact. Stat. Pres.	Elev Coverage	X Y
		gpm/psi½ psi	ft ft²	ft ft
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

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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: 1									
M1	24.5	5.6	18	2		12	120	10.3	
M2	24.5	5.6	18	2.157		0	0.0032	0	
						12		0.0	
M2	24.5	5.6	18	2		12	120	10.4	
M3	24.5	5.6	36	2.157		0	0.0115	0	
						12		0.1	
M3	24.5	5.6	18.2	2		12	120	10.5	
M4	24.5	5.6	54.2	2.157		0	0.0245	0	
						12		0.3	
M4	24.5	5.6	18.4	2		12	120	10.8	
M5	24.5	5.6	72.6	2.157		0	0.0422	0	
						12		0.5	
M5	24.5	5.6	18.8	2		12	120	11.3	
M6	24.5	5.6	91.4	2.157		0	0.0646	0	
						12		0.8	
M6	24.5	5.6	19.5	2		12	120	12.1	
M7	24.5	5.6	110.9	2.157		0	0.0924	0	
						12		1.1	
M7	24.5	5.6	20.3	2	2x(us.90)=12.31	55.94	120	13.2	
015	23		131.2	2.157	2x(us.Tee-Br)=24.61	36.92	0.1263	0.6	
						92.86		11.7	
015	23		0	4		8.75	120	25.6	
016	14.25		131.2	4.26		0	0.0046	3.8	
						8.75		0.0	
016	14.25		-21.1	4	1x(us.Tee-Br)=26.33	21.68	120	29.4	
053	11.67		110.1	4.26	2x(us.90)=26.33	52.67	0.0033	1.1	
						74.35		0.2	
053	11.67		5.7	4		6.71	120	30.8	
054	11.67		115.8	4.26		0	0.0036	0	
						6.71		0.0	
054	11.67		5.3	4		26.29	120	30.8	
057	11.67		121.1	4.26		0	0.004	0	
						26.29		0.1	
057	11.67		10.1	4	2x(us.90)=26.33	20.79	120	30.9	
073-O	4.49		131.2	4.26	1x(us.Tee-Br)=26.33	52.67	0.0046	3.1	
						73.46		0.3	
073-O	4.49		0	4		0.8		34.3	CV-1 FR
073-I	3.69		131.2	0		0	0.4323	0.3	Check
						0.8		0.3	***
073-I	3.69		0	4		0.77	120	35	
074-O	2.92		131.2	4.26		0	0.0046	0.3	
						0.77		0	
074-O	2.92		0	4		0.38		35.4	BFV-N
074-I	2.54		131.2	0		0	0.139	0.2	***
						0.38		0.1	
074-I	2.54		0	4		1.46	120	35.6	
075	1.08		131.2	4.26		0	0.0046	0.6	
						1.46		0	

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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: 1									
075	1.08		0	6	1x(us.Tee-Br)=51.84	150.64	140	36.2	
079	-3.42		131.2	6.4	1x(us.45)=12.1	112.32	0.0005	1.9	
					2x(us.90)=48.39	262.96		0.1	
079	-3.42		0	8	3x(us.45)=47.55	904.76	140	38.3	
086-O	-3.42		131.2	8.55	1x(elbow.22.5)=7.93	87.18	0.0001	0	
					1x(us.90)=31.7	991.94		0.1	
086-O	-3.42		0	8		4.17		38.4	Ames3000SS
086-I	-3.42		131.2	0		0	1.0002	0	***
						4.17		4.2	
086-I	-3.42		0	8	1x(us.90)=31.7	220.28	140	42.6	
W1	-3.42		131.2	8.55	1x(us.Tee-Br)=61.64	93.34	0.0001	0	
						313.62		0.0	
W1								**42.6**	
Path No: 2									
016	14.25		0	4	1x(us.Tee-Br)=26.33	9.43	120	29.4	
009	14.25		21.1	4.26		26.33	0.0002	0	
						35.77		0	
009	14.25		-10.4	4	1x(us.Tee-Br)=26.33	18	120	29.4	
005	14.25		10.7	4.26		26.33	0.0000	0	
						44.33		0	
005	14.25		0	2	1x(us.Tee-Br)=12.31	115	120	29.4	
127	14.25		10.7	2.157		12.31	0.0012	0	
						127.3		0.2	
127	14.25		0	3		18	120	29.6	
126	14.25		10.7	3.26		0	0.0002	0	
						18		0	
126	14.25		10.4	3	2x(us.90)=18.82	20.18	120	29.6	
122	11.67		21.1	3.26		18.82	0.0006	1.1	
						39		0.0	
122	11.67		-5.7	3	2x(us.90)=18.82	21.92	120	30.7	
118	14.25		15.4	3.26		18.82	0.0003	-1.1	
						40.73		0.0	
118	14.25		-5.3	3	1x(us.Tee-Br)=20.16	13.67	120	29.6	
117	14.25		10.1	3.26		20.16	0.0001	0	
						33.83		0	
117	14.25		0	2	1x(us.Tee-Br)=12.31	128.51	120	29.6	
057	11.67		10.1	2.157	2x(us.90)=12.31	24.61	0.0011	1.1	
						153.12		0.2	
057								**30.9**	
Path No: 3									
009	14.25		0	2	2x(us.Tee-Br)=24.61	115	120	29.4	
126	14.25		10.4	2.157		24.61	0.0012	0	
						139.61		0.2	
126								**29.6**	

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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: 4									
122	11.67		0	2	2x(us.Tee-Br)=24.61	125.93	120	30.7	
053	11.67		5.7	2.157		24.61	0.0004	0	
						150.54		0.1	
053								**30.8**	
Path No: 5									
118	14.25		0	2	3x(us.Tee-Br)=36.92	141.14	120	29.6	
054	11.67		5.3	2.157	5x(us.90)=30.77	67.69	0.0003	1.1	
						208.82		0.1	
054								**30.8**	

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

* Maximum Velocity of 11.52 ft/s occurs in the following pipe(s): (015-M7)

*** 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.

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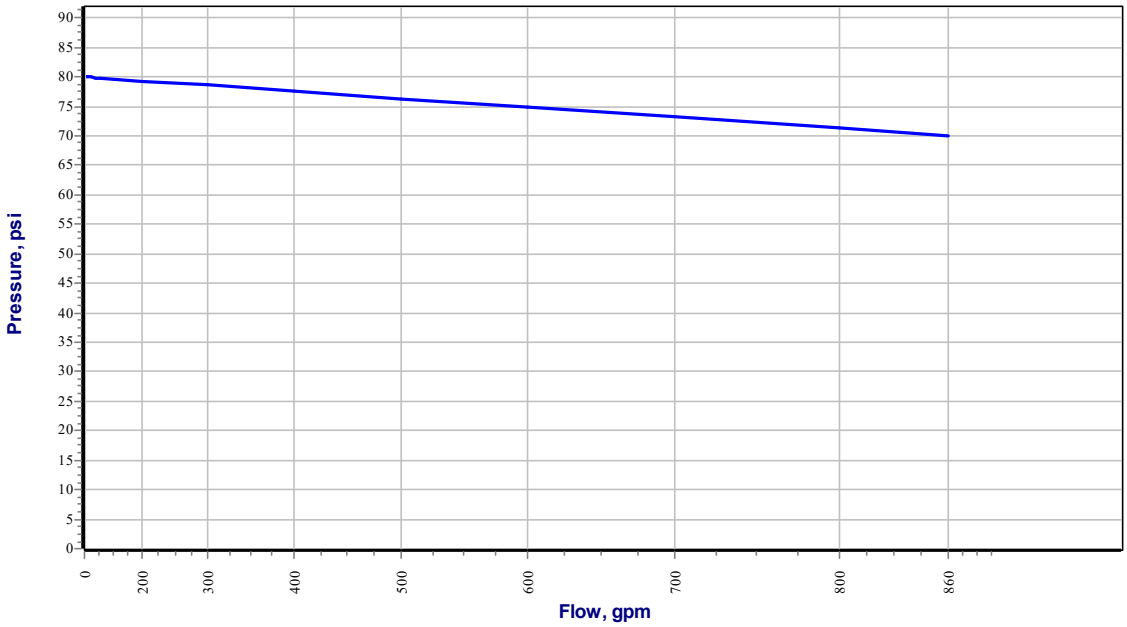
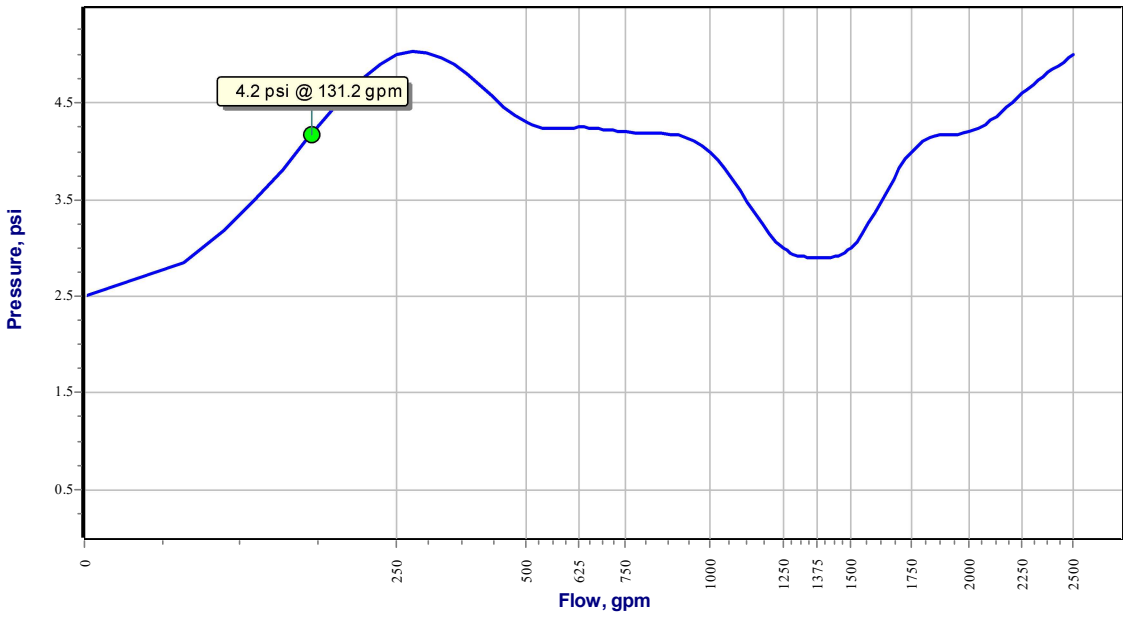
Pressure vs. Flow Function
Design Area: 2; Supply Ref.: W1; Supply Name:W1



Pressure Loss Function
Design Area: 2; BFP Ref.: 349 (Ames3000SS, Size = 8); Inlet Node: 086-I; Outlet Node: 086-O



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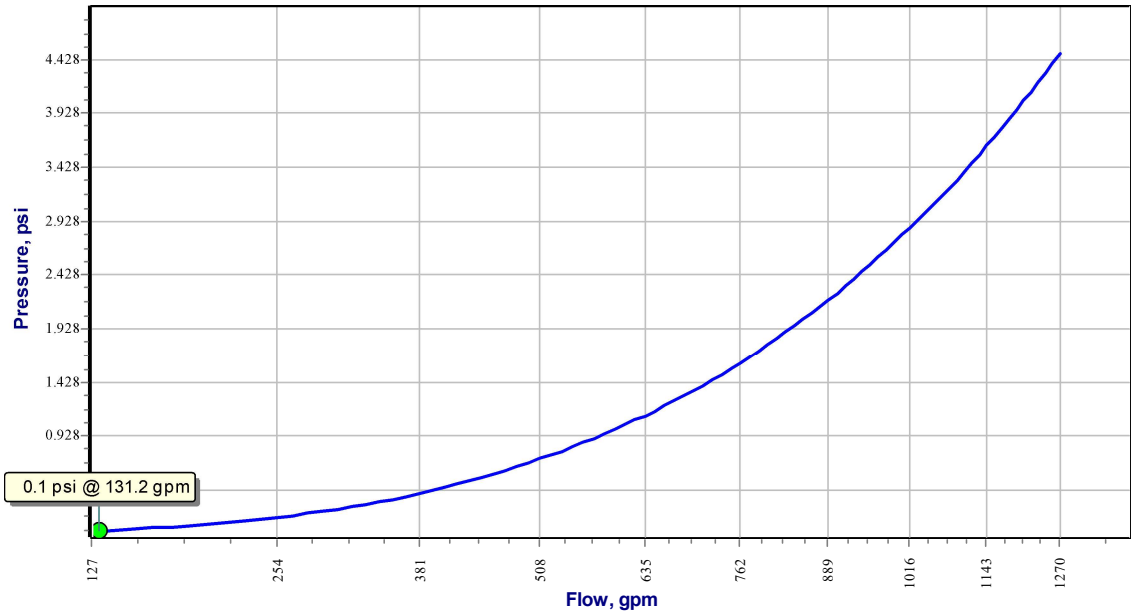
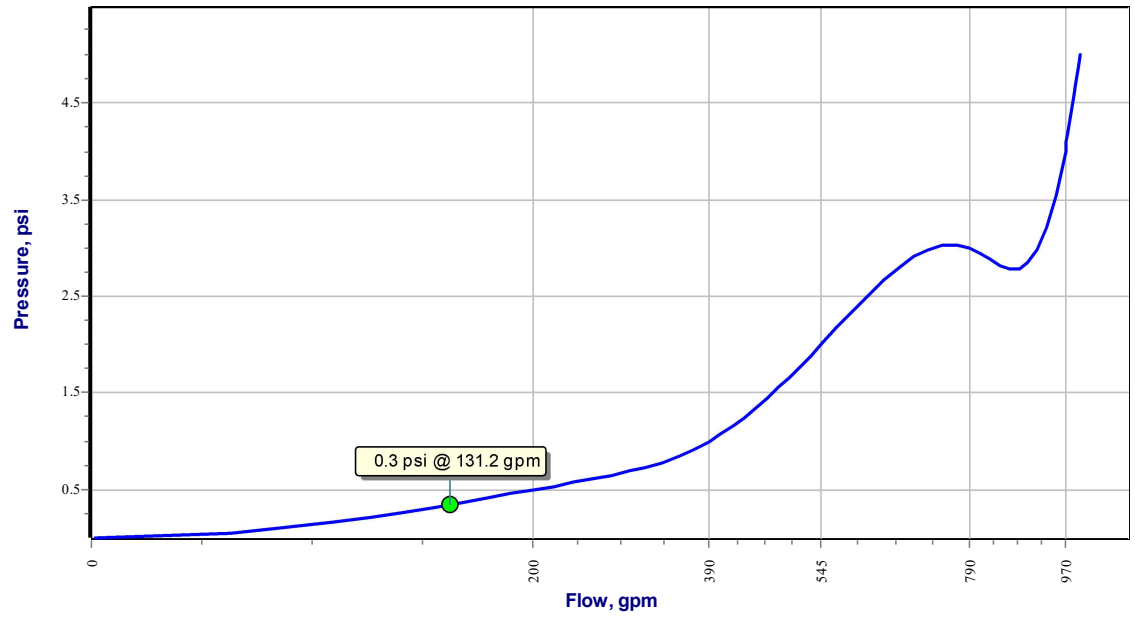
Pressure Loss Function
Design Area: 2; Valve Ref.: 347 (BFV-N, Size = 4); Inlet Node: 074-I; Outlet Node: 074-O



Pressure Loss Function
Design Area: 2; Valve Ref.: 348 (CV-1 FR Check, Size = 4); Inlet Node: 073-I; Outlet Node: 073-O



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