



... Fire Protection by Computer Design

High Tech Fire Protection
PO Box 156
Minot, ME 04258
(207) 998-2551

Job Name : Zone 1A - Gymnasium Calc.
Building : Fred P Hall Elementary School
Location : First Floor Gymnasium
System : Zone 1A
Contract : 041917-1
Data File : Zone 1A - Gymnasium Calc.wxf

Hydraulic Design Information Sheet

Name - Zone 1A - Gymnasium Calc. Date - 11/28/2017
 Location - First Floor Gymnasium
 Building - Fred P Hall Elementary School System No. - Zone 1A
 Contractor - High Tech Fire Protection Contract No. - 041917-1
 Calculated By - Jeremy A Foss Drawing No. - FP-1.1
 Construction: () Combustible (X) Non-Combustible Ceiling Height - 28'-0"
 Occupancy - Educational - Gymnasium

S (X) NFPA 13 (X) Lt. Haz. Ord.Haz.Gp. () 1 () 2 () 3 () Ex.Haz.
 Y () NFPA 231 () NFPA 231C () Figure Curve

S Other

T Specific Ruling Made By Date

	Area of Sprinkler Operation - 1500	Density - .1	Area Per Sprinkler - 225	Elevation at Highest Outlet - 26.500	Hose Allowance - Inside - 0	Rack Sprinkler Allowance -	Hose Allowance - Outside - 100	System Type (X) Wet	Sprinkler/Nozzle Make Globe
M								() Dry	Model GL5615
D								() Deluge	Size 1/2"
E								() Preaction	K-Factor 5.6
S								() Other	Temp.Rat.155
I									
G									
N									

Note

Calculation Flow Required - 431 Press Required - 64 23psi Under Curve
 Summary C-Factor Used: 120 Overhead 140 Underground

W	Water Flow Test:	Pump Data:	Tank or Reservoir:
A	Date of Test - 11/09/2017		Cap. -
T	Time of Test -	Rated Cap.-	Elev.-
E	Static Press - 87	@ Press -	
R	Residual Press - 85	Elev. -	Well
S	Flow - 1403		Proof Flow
U	Elevation - -1		

P Location - Test Hydrant Located on Godfrey Street 650' from Site

P Source of Information - Portland Water District

C	Commodity	Class	Location
O	Storage Ht.	Area	Aisle W.
M	Storage Method:	%	Palletized % Rack
M	() Single Row	() Conven. Pallet	() Auto. Storage () Encap.
S	() Double Row	() Slave Pallet	() Solid Shelf () Non
T	() Mult. Row		() Open Shelf
O			
C			

R K Flue Spacing Clearance:Storage to Ceiling
 A Longitudinal Transverse

E Horizontal Barriers Provided:

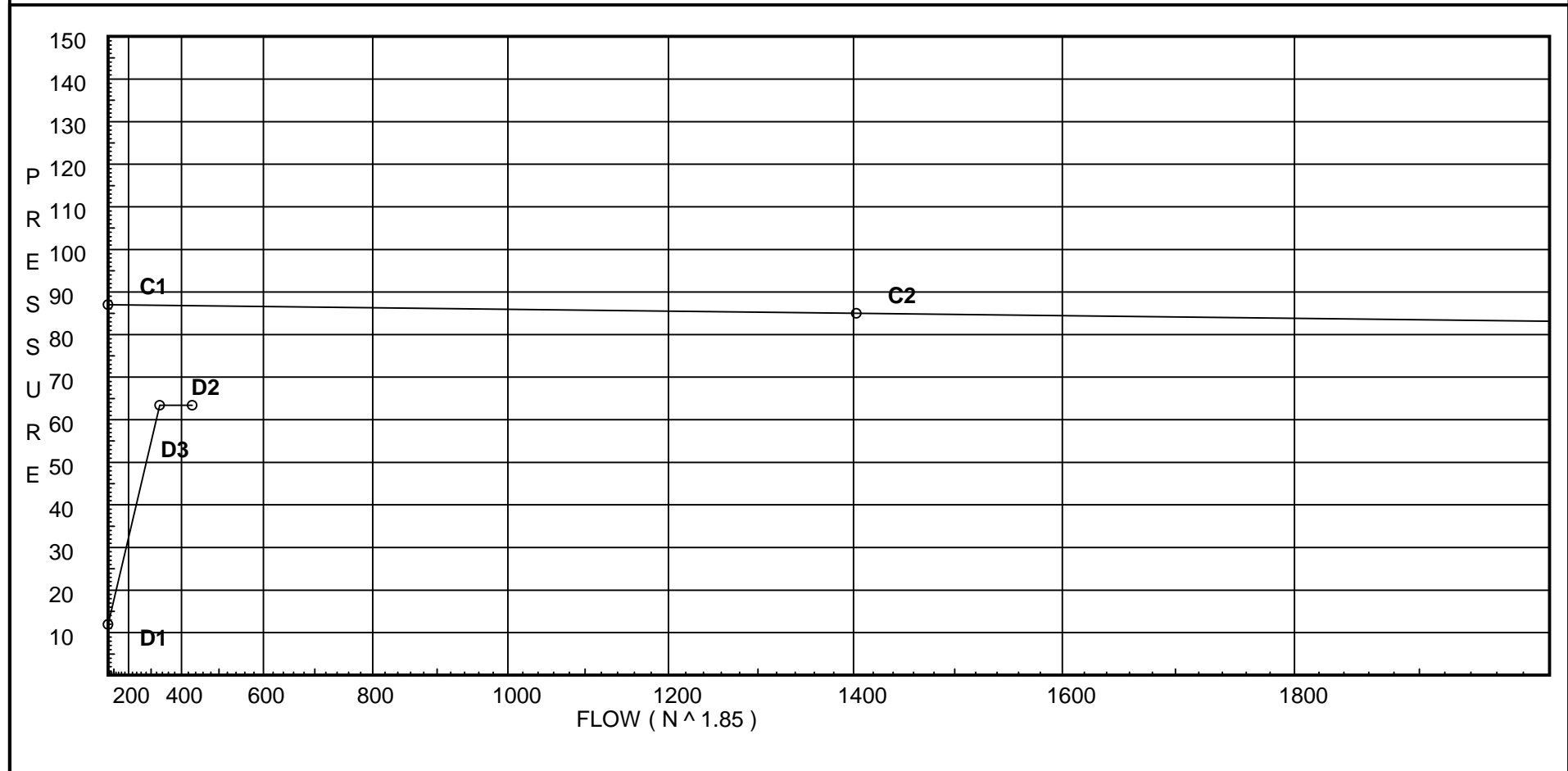
Water Supply Curve (C)

High Tech Fire Protection
Zone 1A - Gymnasium Calc.

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City Water Supply:
C1 - Static Pressure : 87
C2 - Residual Pressure: 85
C2 - Residual Flow : 1403

Demand:
D1 - Elevation : 11.910
D2 - System Flow : 330.892
D2 - System Pressure : 63.414
Hose (Demand) : 100
D3 - System Demand : 430.892
Safety Margin : 23.361



Fittings Used Summary

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Zone 1A - Gymnasium Calc.

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Fitting Legend		½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24	
Abbrev.	Name																					
A	Alarm Rel E1 & E3							7.7	21.5		17		27	29								
B	NFPA 13 Butterfly Valve	0	0	0	0	5	6	7	10	0	12	9	10	12	19	21	0	0	0	0	0	0
E	NFPA 13 90' Standard Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61	61
F	NFPA 13 45' Elbow	1	1	1	1	2	2	3	3	3	4	5	7	9	11	13	17	19	21	24	28	28
Fsp	Flow Switch Potter VSR	Fitting generates a Fixed Loss Based on Flow																				
G	NFPA 13 Gate Valve	0	0	1	1	1	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13	13
T	NFPA 13 90' Flow thru Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121	121
V	90' Ell Firelock #001	0	0	0	0	3.5	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0	0
X	90'Tee-BranchFirelock002	0	0	0	0	8.5	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0	0
Zia	Wilkins 350	Fitting generates a Fixed Loss Based on Flow																				

Units Summary

Diameter Units Inches
 Length Units Feet
 Flow Units US Gallons per Minute
 Pressure Units Pounds per Square Inch

Note: Fitting Legend provides equivalent pipe lengths for fittings types of various diameters. Equivalent lengths shown are standard for actual diameters of Sched 40 pipe and CFactors of 120 except as noted with *. The fittings marked with a * show equivalent lengths values supplied by manufacturers based on specific pipe diameters and CFactors and they require no adjustment. All values for fittings not marked with a * will be adjusted in the calculation for CFactors of other than 120 and diameters other than Sched 40 per NFPA.

Pressure / Flow Summary - STANDARD

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
DP1	1.0	5.6	16.14	na	22.5	0.1	225	7.0
801	26.5	K = K @ EQ01	17.55	na	22.5			
802	26.5	K = K @ EQ01	17.78	na	22.65			
803	26.5	K = K @ EQ01	18.62	na	23.18			
804	26.5	K = K @ EQ01	20.42	na	24.27			
805	26.5	K = K @ EQ01	17.63	na	22.55			
806	26.5	K = K @ EQ01	17.86	na	22.7			
807	26.5	K = K @ EQ01	18.7	na	23.23			
808	26.5	K = K @ EQ01	20.51	na	24.33			
809	26.5	K = K @ EQ01	17.93	na	22.74			
810	26.5	K = K @ EQ01	18.16	na	22.89			
811	26.5	K = K @ EQ01	19.02	na	23.42			
812	26.5	K = K @ EQ01	20.85	na	24.53			
813	26.5	K = K @ EQ01	23.2	na	25.87			
814	26.5	K = K @ EQ01	23.5	na	26.04			
D1	26.5		26.17	na				
D2	26.5		26.29	na				
D3	26.5		26.72	na				
D4	26.5		27.64	na				
D5	26.5		32.79	na				
D6	17.9		38.24	na				
D7	17.9		40.74	na				
D8	17.9		41.54	na				
D9	11.8		44.62	na				
TRA	11.8		47.67	na				
BRA	2.0		56.74	na				
BASE	2.0		61.02	na				
H1	-2.0		62.94	na				
H2	-2.0		63.59	na				
H3	-1.0		63.27	na				
TEST	-1.0		63.41	na	100.0			

The maximum velocity is 14.75 and it occurs in the pipe between nodes 812 and D3

Final Calculations - Hazen-Williams

High Tech Fire Protection
Zone 1A - Gymnasium Calc.

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
DP1 to EQ01	22.50 22.5	1.049 120.0 0.1618	1T	5.0 0.0 0.0	1.000 5.000 6.000	16.143 0.433 0.971			K Factor = 5.60 Vel = 8.35	
	0.0 22.50								17.547	K Factor = 5.37
801 to 802	22.50 22.5	1.61 120.0 0.0201		0.0 0.0 0.0	11.500 0.0 11.500	17.547 0.0 0.231			K Factor @ node EQ01 Vel = 3.55	
802 to 803	22.65 45.15	1.61 120.0 0.0729		0.0 0.0 0.0	11.500 0.0 11.500	17.778 0.0 0.838			K Factor @ node EQ01 Vel = 7.12	
803 to 804	23.17 68.32	1.61 120.0 0.1568		0.0 0.0 0.0	11.500 0.0 11.500	18.616 0.0 1.803			K Factor @ node EQ01 Vel = 10.77	
804 to D1	24.27 92.59	1.61 120.0 0.2752	1T	8.0 0.0 0.0	12.900 8.000 20.900	20.419 0.0 5.751			K Factor @ node EQ01 Vel = 14.59	
	0.0 92.59								26.170	K Factor = 18.10
805 to 806	22.55 22.55	1.61 120.0 0.0202		0.0 0.0 0.0	11.500 0.0 11.500	17.629 0.0 0.232			K Factor @ node EQ01 Vel = 3.55	
806 to 807	22.70 45.25	1.61 120.0 0.0732		0.0 0.0 0.0	11.500 0.0 11.500	17.861 0.0 0.842			K Factor @ node EQ01 Vel = 7.13	
807 to 808	23.23 68.48	1.61 120.0 0.1575		0.0 0.0 0.0	11.500 0.0 11.500	18.703 0.0 1.811			K Factor @ node EQ01 Vel = 10.79	
808 to D2	24.33 92.81	1.61 120.0 0.2763	1T	8.0 0.0 0.0	12.900 8.000 20.900	20.514 0.0 5.775			K Factor @ node EQ01 Vel = 14.63	
	0.0 92.81								26.289	K Factor = 18.10
809 to 810	22.74 22.74	1.61 120.0 0.0205		0.0 0.0 0.0	11.500 0.0 11.500	17.925 0.0 0.236			K Factor @ node EQ01 Vel = 3.58	
810 to 811	22.89 45.63	1.61 120.0 0.0743		0.0 0.0 0.0	11.500 0.0 11.500	18.161 0.0 0.854			K Factor @ node EQ01 Vel = 7.19	
811 to 812	23.42 69.05	1.61 120.0 0.1599		0.0 0.0 0.0	11.500 0.0 11.500	19.015 0.0 1.839			K Factor @ node EQ01 Vel = 10.88	
812 to D3	24.53 93.58	1.61 120.0 0.2807	1T	8.0 0.0 0.0	12.900 8.000 20.900	20.854 0.0 5.866			K Factor @ node EQ01 Vel = 14.75	

Final Calculations - Hazen-Williams

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Zone 1A - Gymnasium Calc.

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftnng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
	0.0 93.58					26.720		K Factor = 18.10	
813 to 814	25.87	1.61 120.0	0.0 0.0	11.500 0.0	23.196 0.0			K Factor @ node EQ01	
814 to D4	25.87	0.0261	0.0	11.500	0.300			Vel = 4.08	
	26.04	1.61 120.0	1T 0.0	8.0 8.000	35.900 0.0	23.496		K Factor @ node EQ01	
D4	51.91	0.0943	0.0	43.900	4.140			Vel = 8.18	
	0.0 51.91					27.636		K Factor = 9.87	
D1 to D2	92.59	3.068 120.0	0.0 0.0	10.000 0.0	26.170 0.0			Vel = 4.02	
D2 to D3	92.59	0.0119	0.0	10.000	0.119			Vel = 4.02	
	92.81	3.068 120.0	0.0 0.0	10.000 0.0	26.289 0.0				
D3 to D4	185.4	0.0431	0.0	10.000	0.431			Vel = 8.05	
	93.59	3.068 120.0	0.0 0.0	10.000 0.0	26.720 0.0				
D4 to D5	278.99	0.0916	0.0	10.000	0.916			Vel = 12.11	
	51.90	3.068 120.0	1V 0.0	5.0 5.000	36.000 0.0	27.636			
D5 to D6	330.89	0.1256	0.0	41.000	5.150			Vel = 14.36	
	0.0	3.068 120.0	1V 0.0	5.0 5.000	8.800 3.725	32.786			
D6 to D7	330.89	0.1257	0.0	13.800	1.734			Vel = 14.36	
	0.0	3.068 120.0	1X 0.0	13.0 13.000	6.900 0.0	38.245			
D7 to D8	330.89	0.1256	0.0	19.900	2.500			Vel = 14.36	
	0.0	4.026 120.0	1V 0.0	6.8 6.800	17.000 6.800	40.745			
D8 to D9	330.89	0.0334	0.0	23.800	0.796			Vel = 8.34	
	0.0	4.026 120.0	1V 0.0	6.8 6.800	6.200 2.642	41.541			
D9 to TRA	330.89	0.0335	0.0	13.000	0.435			Vel = 8.34	
	0.0	4.026 120.0	2X 1V	32.0 6.8	52.400 38.800	44.618			
TRA to BRA	330.89	0.0334	0.0	91.200	3.050			Vel = 8.34	
	0.0	4.026 120.0	1A 1B	17.0 12.0	9.800 45.000	47.668			* Fixed loss = 3
BRA to BASE	330.89	0.0334	1Fsp 1X	0.0 16.0	54.800	1.833		Vel = 8.34	
	0.0	4.026 120.0	1E 1Zia	10.0 0.0	5.900 10.000	56.745			* Fixed loss = 3.747
BASE to H1	330.89	0.0335	0.0	15.900	0.532			Vel = 8.34	
	0.0	8.27 140.0	2E 2F	56.936 28.468	150.000 91.730	61.024			
H1	330.89	0.0008	1G	6.326	241.730	0.183		Vel = 1.98	

Final Calculations - Hazen-Williams

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
H1 to H2	0.0 330.89	8.23 100.0 0.0014	1T	29.011 0.0 0.0	425.000 29.010 454.010	62.939 0.0 0.654		Vel = 2.00	
H2 to H3	0.0 330.89	8.23 100.0 0.0014	1T	29.011 0.0 0.0	50.000 29.010 79.010	63.593 -0.433 0.114		Vel = 2.00	
H3 to TEST	0.0 330.89	6.16 140.0 0.0032	1E 1G	20.084 4.304 0.0	20.000 24.388 44.388	63.274 0.0 0.140		Vel = 3.56	
	100.00 430.89					63.414		Qa = 100.00 K Factor = 54.11	



... Fire Protection by Computer Design

High Tech Fire Protection
PO Box 156
Minot, ME 04258
(207) 998-2551

Job Name : Zone 1BC - Classroom Calc.
Building : Fred P Hall Elementary School
Location : First Floor 2nd Grade Classroom
System : Zone 1BC
Contract : 041917-1
Data File : Zone 1BC - Classroom Calc.WXF

Hydraulic Design Information Sheet

Name - Zone 1BC - Classroom Calc. Date - 11/28/2017
 Location - First Floor 2nd Grade Classroom
 Building - Fred P Hall Elementary School System No. - Zone 1BC
 Contractor - High Tech Fire Protection Contract No. - 041917-1
 Calculated By - Jeremy A Foss Drawing No. - FP-1.2
 Construction: () Combustible (X) Non-Combustible Ceiling Height - 11'-0"
 Occupancy - Educational - Classroom

S (X) NFPA 13 (X) Lt. Haz. Ord.Haz.Gp. () 1 () 2 () 3 () Ex.Haz.
 Y () NFPA 231 () NFPA 231C () Figure Curve

S Other

T Specific Ruling Made By Date

	Area of Sprinkler Operation - 1500	Density - .1	Area Per Sprinkler - 225	Elevation at Highest Outlet - 11.5	Hose Allowance - Inside - 0	Rack Sprinkler Allowance -	Hose Allowance - Outside - 100	System Type (X) Wet	Sprinkler/Nozzle Make Globe
M								() Dry	Model GL5601
D								() Deluge	Size 1/2"
E								() Preaction	K-Factor 5.6
S								() Other	Temp.Rat.155
I									
G									
N									

Note

Calculation Flow Required - 399 Press Required - 64 23psi Under Curve
 Summary C-Factor Used: 120 Overhead 140 Underground

W	Water Flow Test:	Pump Data:	Tank or Reservoir:
A	Date of Test - 11/09/2017		Cap. -
T	Time of Test -	Rated Cap.-	Elev.-
E	Static Press - 87	@ Press -	
R	Residual Press - 85	Elev. -	Well
S	Flow - 1403		Proof Flow
U	Elevation - -1		

P Location - Test Hydrant Located on Godfrey Street 650' from Site

P Source of Information - Portland Water District

C	Commodity	Class	Location
O	Storage Ht.	Area	Aisle W.
M	Storage Method:	%	Palletized % Rack
M	() Single Row	() Conven. Pallet	() Auto. Storage () Encap.
S	() Double Row	() Slave Pallet	() Solid Shelf () Non
T	() Mult. Row		() Open Shelf
O			

R K Flue Spacing Clearance:Storage to Ceiling
 A Longitudinal Transverse

E Horizontal Barriers Provided:

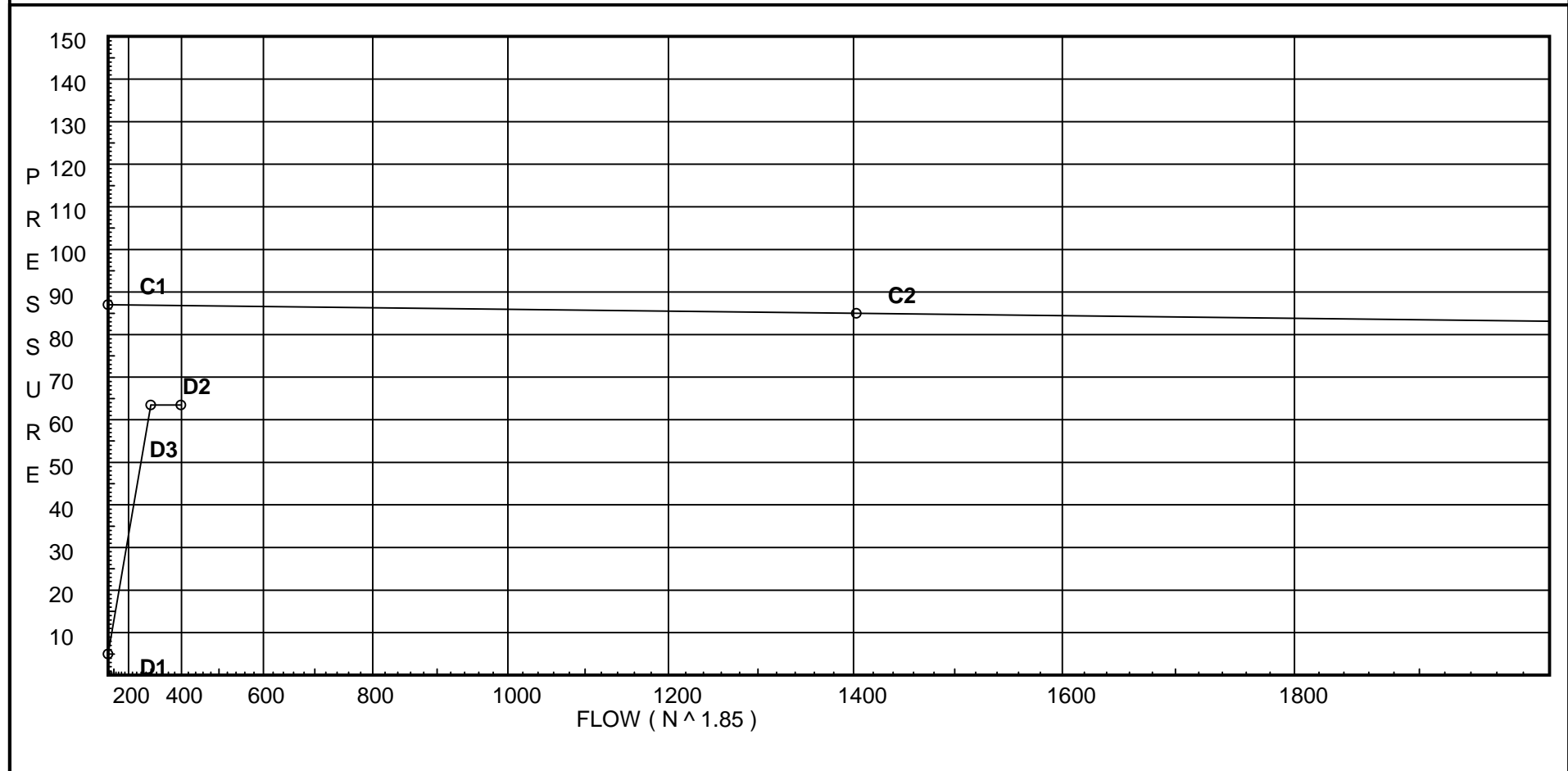
Water Supply Curve (C)

High Tech Fire Protection
Zone 1BC - Classroom Calc.

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City Water Supply:
C1 - Static Pressure : 87
C2 - Residual Pressure: 85
C2 - Residual Flow : 1403

Demand:
D1 - Elevation : 4.981
D2 - System Flow : 298.696
D2 - System Pressure : 63.479
Hose (Demand) : 100
D3 - System Demand : 398.696
Safety Margin : 23.326



Fittings Used Summary

High Tech Fire Protection
Zone 1BC - Classroom Calc.

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Fitting Legend		½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24	
Abbrev.	Name																					
A	Alarm Rel E1 & E3							7.7	21.5		17		27	29								
B	NFPA 13 Butterfly Valve	0	0	0	0	5	6	7	10	0	12	9	10	12	19	21	0	0	0	0	0	0
E	NFPA 13 90' Standard Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61	61
F	NFPA 13 45' Elbow	1	1	1	1	2	2	3	3	3	4	5	7	9	11	13	17	19	21	24	28	28
Fsp	Flow Switch Potter VSR	Fitting generates a Fixed Loss Based on Flow																				
G	NFPA 13 Gate Valve	0	0	1	1	1	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13	13
T	NFPA 13 90' Flow thru Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121	121
V	90' Ell Firelock #001	0	0	0	0	3.5	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0	0
X	90'Tee-BranchFirelock002	0	0	0	0	8.5	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0	0
Zia	Wilkins 350	Fitting generates a Fixed Loss Based on Flow																				

Units Summary

Diameter Units Inches
 Length Units Feet
 Flow Units US Gallons per Minute
 Pressure Units Pounds per Square Inch

Note: Fitting Legend provides equivalent pipe lengths for fittings types of various diameters. Equivalent lengths shown are standard for actual diameters of Sched 40 pipe and CFactors of 120 except as noted with *. The fittings marked with a * show equivalent lengths values supplied by manufacturers based on specific pipe diameters and CFactors and they require no adjustment. All values for fittings not marked with a * will be adjusted in the calculation for CFactors of other than 120 and diameters other than Sched 40 per NFPA.

Pressure / Flow Summary - STANDARD

High Tech Fire Protection
Zone 1BC - Classroom Calc.

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
DP1	-1.0	5.6	16.14	na	22.5	0.1	225	7.0
DP2	-1.0	5.6	16.14	na	22.5	0.1	225	7.0
601	11.5	K = K @ EQ01	17.0	na	22.5			
602	11.5	K = K @ EQ01	18.68	na	23.58			
C1	11.5		19.92	na				
603	11.5	K = K @ EQ01	18.31	na	23.35			
C3	11.5		18.83	na				
604	11.5	K = K @ EQ02	19.19	na	23.57			
605	11.5	K = K @ EQ02	20.28	na	24.23			
606	11.5	K = K @ EQ01	17.87	na	23.06			
607	11.5	K = K @ EQ02	20.24	na	24.2			
608	11.5	K = K @ EQ01	21.19	na	25.12			
609	10.5	K = K @ EQ01	20.11	na	24.47			
610	0.0	K = K @ EQ02	26.9	na	27.91			
611	10.5	K = K @ EQ01	23.48	na	26.44			
C4	11.5		22.36	na				
C2	11.5		22.4	na				
C5	11.5		22.84	na				
C6	11.5		23.03	na				
C7	11.5		24.28	na				
C8	10.5		25.4	na				
C9	10.5		25.51	na				
Y1	10.5		30.39	na				
612	10.5	K = K @ EQ01	30.79	na	30.28			
C10	10.5		30.81	na				
Y2	10.5		31.38	na				
Y3	10.5		31.61	na				
Y4	10.5		31.96	na				
Y5	10.5		32.19	na				
Y6	10.5		35.85	na				
Y7	10.5		36.07	na				
Y8	10.5		36.44	na				
Y9	10.5		36.66	na				
Y10	10.5		43.49	na				
Y11	18.5		40.43	na				
Y12	18.5		43.66	na				
Y13	10.5		47.54	na				
TRBC	10.5		49.44	na				
BRBC	2.0		57.6	na				
BASE	2.0		61.71	na				
H1	-2.0		63.59	na				
H2	-2.0		64.13	na				
H3	-1.0		63.8	na				
TEST	0.0		63.48	na	100.0			

The maximum velocity is 17.99 and it occurs in the pipe between nodes C9 and Y1

Final Calculations - Hazen-Williams

High Tech Fire Protection
Zone 1BC - Classroom Calc.

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
DP1 to EQ01	22.50 22.5	1.049 120.0 0.1619	3E 6.0 0.0 0.0	2.000 6.000 8.000	16.143 -0.433 1.295		K Factor = 5.60 Vel = 8.35		
	0.0 22.50					17.005	K Factor = 5.46		
DP2 to EQ02	22.50 22.5	1.049 120.0 0.1618	2E 4.0 1T 5.0 0.0	2.000 9.000 11.000	16.143 -0.433 1.780		K Factor = 5.60 Vel = 8.35		
	0.0 22.50					17.490	K Factor = 5.38		
601 to C1	22.50 22.5	1.049 120.0 0.1618	1E 2.0 0.0 0.0	16.000 2.000 18.000	17.005 0.0 2.912		K Factor @ node EQ01 Vel = 8.35		
	0.0 22.50					19.917	K Factor = 5.04		
602 to C1	23.58 23.58	1.049 120.0 0.1764	1T 5.0 0.0 0.0	2.000 5.000 7.000	18.682 0.0 1.235		K Factor @ node EQ01 Vel = 8.75		
C1 to C2	22.50 46.08	1.38 120.0 0.1603	1T 6.0 0.0 0.0	9.500 6.000 15.500	19.917 0.0 2.485		Vel = 9.88		
	0.0 46.08					22.402	K Factor = 9.74		
603 to C3	23.35 23.35	1.049 120.0 0.1733	1E 2.0 0.0 0.0	1.000 2.000 3.000	18.312 0.0 0.520		K Factor @ node EQ01 Vel = 8.67		
C3 to 604	0.0 23.35	1.61 120.0 0.0215	1V 3.5 0.0 0.0	13.000 3.500 16.500	18.832 0.0 0.354		Vel = 3.68		
604 to 605	23.56 46.91	1.61 120.0 0.0783	0.0 0.0 0.0	14.000 0.0 14.000	19.186 0.0 1.096		K Factor @ node EQ02 Vel = 7.39		
605 to C4	24.23 71.14	1.61 120.0 0.1689	1T 8.0 0.0 0.0	4.300 8.000 12.300	20.282 0.0 2.078		K Factor @ node EQ02 Vel = 11.21		
	0.0 71.14					22.360	K Factor = 15.04		
606 to 607	23.06 23.06	1.049 120.0 0.1694	0.0 0.0 0.0	14.000 0.0 14.000	17.867 0.0 2.371		K Factor @ node EQ01 Vel = 8.56		
607 to C5	24.21 47.27	1.38 120.0 0.1681	1T 6.0 0.0 0.0	9.500 6.000 15.500	20.238 0.0 2.605		K Factor @ node EQ02 Vel = 10.14		
	0.0 47.27					22.843	K Factor = 9.89		

Final Calculations - Hazen-Williams

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
608 to C6	25.12 25.12	1.049 120.0 0.1983	1T	5.0 0.0 0.0	4.300 5.000 9.300	21.187 0.0 1.844			K Factor @ node EQ01 Vel = 9.33	
	0.0 25.12						23.031		K Factor = 5.23	
609 to 610	24.47 24.47	1.049 120.0 0.1889		0.0 0.0 0.0	11.900 0.0 11.900	20.108 4.548 2.248			K Factor @ node EQ01 Vel = 9.08	
610 to C9	27.90 52.37	1.38 120.0 0.2032	1T	6.0 0.0 0.0	9.500 6.000 15.500	26.904 -4.548 3.149			K Factor @ node EQ02 Vel = 11.23	
	0.0 52.37						25.505		K Factor = 10.37	
611 to C9	26.44 26.44	1.049 120.0 0.2181	1T	5.0 0.0 0.0	4.300 5.000 9.300	23.477 0.0 2.028			K Factor @ node EQ01 Vel = 9.82	
	0.0 26.44						25.505		K Factor = 5.24	
C4 to C2	71.14 71.14	2.469 120.0 0.0210		0.0 0.0 0.0	2.000 0.0 2.000	22.360 0.0 0.042			Vel = 4.77	
C2 to C5	46.09 117.23	2.469 120.0 0.0531		0.0 0.0 0.0	8.300 0.0 8.300	22.402 0.0 0.441			Vel = 7.86	
C5 to C6	47.26 164.49	2.469 120.0 0.0989		0.0 0.0 0.0	1.900 0.0 1.900	22.843 0.0 0.188			Vel = 11.02	
C6 to C7	25.12 189.61	2.469 120.0 0.1292	1V	4.3 0.0 0.0	5.400 4.300 9.700	23.031 0.0 1.253			Vel = 12.71	
C7 to C8	0.0 189.61	2.469 120.0 0.1292	1V	4.3 0.0 0.0	1.000 4.300 5.300	24.284 0.433 0.685			Vel = 12.71	
C8 to C9	0.0 189.61	2.469 120.0 0.1287		0.0 0.0 0.0	0.800 0.0 0.800	25.402 0.0 0.103			Vel = 12.71	
C9 to Y1	78.81 268.42	2.469 120.0 0.2457	1T	12.0 0.0 0.0	7.900 12.000 19.900	25.505 0.0 4.889			Vel = 17.99	
	0.0 268.42						30.394		K Factor = 48.69	
Y1 to C10	268.42 268.42	4.026 120.0 0.0227		0.0 0.0 0.0	18.200 0.0 18.200	30.394 0.0 0.414			Vel = 6.76	
	0.0									

Final Calculations - Hazen-Williams

High Tech Fire Protection
Zone 1BC - Classroom Calc.

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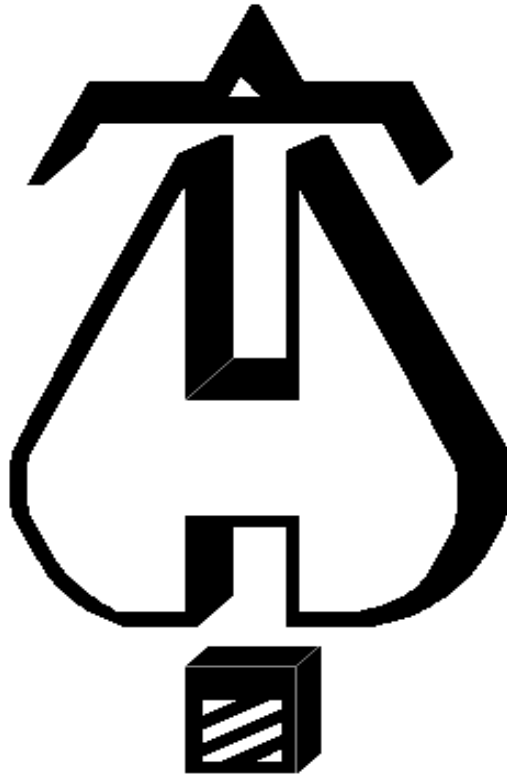
Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftnng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
	268.42					30.808			K Factor = 48.36	
612 to C10	30.28	4.026 120.0	1E 1T	10.0 20.0	11.000 30.000	30.791 0.0			K Factor @ node EQ01	
	30.28	0.0004		0.0	41.000	0.017			Vel = 0.76	
C10 to Y2	268.42	4.026 120.0	1V	6.8 0.0	13.900 6.800	30.808 0.0				
	298.7	0.0276		0.0	20.700	0.572			Vel = 7.53	
Y2 to Y3	0.0	4.026 120.0	1V	6.8 0.0	1.500 6.800	31.380 0.0				
	298.7	0.0277		0.0	8.300	0.230			Vel = 7.53	
Y3 to Y4	0.0	4.026 120.0	1V	6.8 0.0	6.000 6.800	31.610 0.0				
	298.7	0.0277		0.0	12.800	0.354			Vel = 7.53	
Y4 to Y5	0.0	4.026 120.0	1V	6.8 0.0	1.500 6.800	31.964 0.0				
	298.7	0.0277		0.0	8.300	0.230			Vel = 7.53	
Y5 to Y6	0.0	4.026 120.0	2V	13.6 0.0	118.500 13.600	32.194 0.0				
	298.7	0.0277		0.0	132.100	3.656			Vel = 7.53	
Y6 to Y7	0.0	4.026 120.0	1V	6.8 0.0	1.000 6.800	35.850 0.0				
	298.7	0.0277		0.0	7.800	0.216			Vel = 7.53	
Y7 to Y8	0.0	4.026 120.0	1V	6.8 0.0	6.700 6.800	36.066 0.0				
	298.7	0.0277		0.0	13.500	0.374			Vel = 7.53	
Y8 to Y9	0.0	4.026 120.0	1V	6.8 0.0	1.000 6.800	36.440 0.0				
	298.7	0.0276		0.0	7.800	0.215			Vel = 7.53	
Y9 to Y10	0.0	4.026 120.0	4V 2X	27.2 32.0	187.600 59.200	36.655 0.0				
	298.7	0.0277		0.0	246.800	6.831			Vel = 7.53	
Y10 to Y11	0.0	4.026 120.0	1V	6.8 0.0	8.000 6.800	43.486 -3.465				
	298.7	0.0276		0.0	14.800	0.409			Vel = 7.53	
Y11 to Y12	0.0	4.026 120.0	5V	34.0 0.0	82.800 34.000	40.430 0.0				
	298.7	0.0277		0.0	116.800	3.233			Vel = 7.53	
Y12 to Y13	0.0	4.026 120.0	1V	6.8 0.0	8.000 6.800	43.663 3.465				
	298.7	0.0276		0.0	14.800	0.409			Vel = 7.53	
Y13 to TRBC	0.0	4.026 120.0	5V	34.0 0.0	34.800 34.000	47.537 0.0				
	298.7	0.0277		0.0	68.800	1.904			Vel = 7.53	
TRBC to BRBC	0.0	4.026 120.0	1A 1B	17.0 12.0	8.500 45.000	49.441 6.681			* Fixed loss = 3	
	298.7	0.0277	1Fsp	0.0	53.500	1.481			Vel = 7.53	

Final Calculations - Hazen-Williams

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
			1X 16.0						
BRBC to BASE	0.0 298.7	4.026 120.0 0.0277	1E 10.0 1Zia 0.0 0.0	4.300 10.000 14.300	57.603 3.711 0.396		* Fixed loss = 3.711 Vel = 7.53		
BASE to H1	0.0 298.7	8.27 140.0 0.0006	2E 56.936 2F 28.468 1G 6.326	150.000 91.730 241.730	61.710 1.732 0.152		Vel = 1.78		
H1 to H2	0.0 298.7	8.23 100.0 0.0012	1T 29.011 0.0 0.0	425.000 29.010 454.010	63.594 0.0 0.541		Vel = 1.80		
H2 to H3	0.0 298.7	8.23 100.0 0.0012	1T 29.011 0.0 0.0	50.000 29.010 79.010	64.135 -0.433 0.094		Vel = 1.80		
H3 to TEST	0.0 298.7	6.16 140.0 0.0026	1E 20.084 1G 4.304 0.0	20.000 24.388 44.388	63.796 -0.433 0.116		Vel = 3.22		
	100.00 398.70				63.479		Qa = 100.00 K Factor = 50.04		



... Fire Protection by Computer Design

High Tech Fire Protection
PO Box 156
Minot, ME 04258
(207) 998-2551

Job Name : Zone 2 - Mechanical Room Calc.
Building : Fred P Hall Elementary School
Location : Second Floor Mechanical Room
System : Zone 2
Contract : 041917-1
Data File : Zone 2 - Mechanical Room Calc.wxf

Hydraulic Design Information Sheet

Name - Zone 2 - Mechanical Room Calc. Date - 11/28/2017
 Location - Second Floor Mechanical Room
 Building - Fred P Hall Elementary School System No. - Zone 2
 Contractor - High Tech Fire Protection Contract No. - 041917-1
 Calculated By - Jeremy A Foss Drawing No. - FP- 1.4
 Construction: () Combustible (X) Non-Combustible Ceiling Height - 9'-0"
 Occupancy - Mechanical

S (X) NFPA 13 () Lt. Haz. Ord.Haz.Gp. (X) 1 () 2 () 3 () Ex.Haz.
 Y () NFPA 231 () NFPA 231C () Figure Curve

S Other

T Specific Ruling Made By Date

	Area of Sprinkler Operation - 1500	System Type	Sprinkler/Nozzle
M	Density - .15	(X) Wet	Make Globe
D	Area Per Sprinkler - 130	() Dry	Model GL5615
E	Elevation at Highest Outlet - 28.2	() Deluge	Size 1/2"
S	Hose Allowance - Inside - 0	() Preaction	K-Factor 5.6
I	Rack Sprinkler Allowance -	() Other	Temp.Rat.200
G	Hose Allowance - Outside - 250		

N Note

Calculation Flow Required - 693 Press Required - 68 19psi Under Curve
 Summary C-Factor Used: 120 Overhead 140 Underground

W	Water Flow Test:	Pump Data:	Tank or Reservoir:
A	Date of Test - 11/09/2017		Cap. -
T	Time of Test -	Rated Cap.-	Elev.-
E	Static Press - 87	@ Press -	
R	Residual Press - 85	Elev. -	Well
S	Flow - 1403		Proof Flow
U	Elevation - -1		

P Location - Test Hydrant Located on Godfrey Street 650' from Site

P Source of Information - Portland Water District

C	Commodity	Class	Location
O	Storage Ht.	Area	Aisle W.
M	Storage Method:	%	Palletized % Rack
M	() Single Row	() Conven. Pallet	() Auto. Storage () Encap.
S	() Double Row	() Slave Pallet	() Solid Shelf () Non
T	() Mult. Row		() Open Shelf

R K Flue Spacing Clearance:Storage to Ceiling
 A Longitudinal Transverse

E Horizontal Barriers Provided:

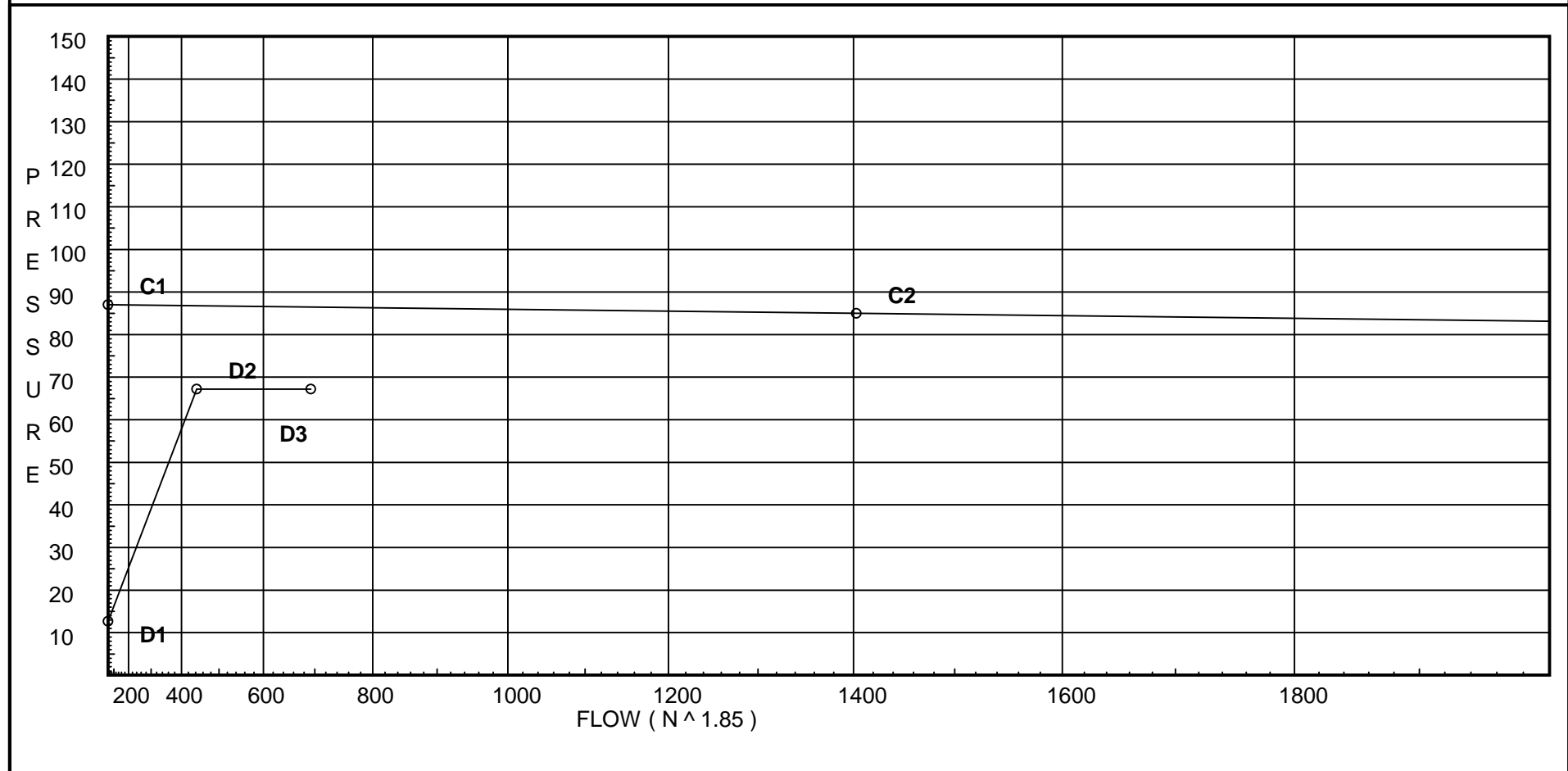
Water Supply Curve (C)

High Tech Fire Protection
Zone 2 - Mechanical Room Calc.

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City Water Supply:
C1 - Static Pressure : 87
C2 - Residual Pressure: 85
C2 - Residual Flow : 1403

Demand:
D1 - Elevation : 12.647
D2 - System Flow : 442.997
D2 - System Pressure : 67.180
Hose (Demand) : 250
D3 - System Demand : 692.997
Safety Margin : 19.277



Fittings Used Summary

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Zone 2 - Mechanical Room Calc.

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Fitting Legend		½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24	
Abbrev.	Name																					
A	Alarm Rel E1 & E3							7.7	21.5		17		27	29								
B	NFPA 13 Butterfly Valve	0	0	0	0	5	6	7	10	0	12	9	10	12	19	21	0	0	0	0	0	0
E	NFPA 13 90' Standard Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61	61
F	NFPA 13 45' Elbow	1	1	1	1	2	2	3	3	3	4	5	7	9	11	13	17	19	21	24	28	28
Fsp	Flow Switch Potter VSR	Fitting generates a Fixed Loss Based on Flow																				
G	NFPA 13 Gate Valve	0	0	1	1	1	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13	13
T	NFPA 13 90' Flow thru Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121	121
V	90' Ell Firelock #001	0	0	0	0	3.5	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0	0
X	90'Tee-BranchFirelock002	0	0	0	0	8.5	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0	0
Zia	Wilkins 350	Fitting generates a Fixed Loss Based on Flow																				

Units Summary

Diameter Units Inches
 Length Units Feet
 Flow Units US Gallons per Minute
 Pressure Units Pounds per Square Inch

Note: Fitting Legend provides equivalent pipe lengths for fittings types of various diameters. Equivalent lengths shown are standard for actual diameters of Sched 40 pipe and CFactors of 120 except as noted with *. The fittings marked with a * show equivalent lengths values supplied by manufacturers based on specific pipe diameters and CFactors and they require no adjustment. All values for fittings not marked with a * will be adjusted in the calculation for CFactors of other than 120 and diameters other than Sched 40 per NFPA.

Pressure / Flow Summary - STANDARD

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Zone 2 - Mechanical Room Calc.

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
DP1	1.0	5.6	12.13	na	19.5	0.15	130	7.0
DP2	1.0	5.6	12.13	na	19.5	0.15	130	7.0
414	28.2	K = K @ EQ01	13.5	na	19.64			
415	28.2	K = K @ EQ01	13.64	na	19.75			
416	28.2	K = K @ EQ01	14.19	na	20.14			
417	28.2	K = K @ EQ01	15.24	na	20.87			
418	28.2	K = K @ EQ01	16.56	na	21.76			
419	28.2	K = K @ EQ01	18.64	na	23.08			
408	28.2	K = K @ EQ01	13.3	na	19.5			
409	28.2	K = K @ EQ01	13.45	na	19.6			
410	28.2	K = K @ EQ02	13.12	na	19.64			
B7	28.2		13.85	na				
411	28.2	K = K @ EQ01	15.15	na	20.81			
412	28.2	K = K @ EQ01	16.43	na	21.67			
413	28.2	K = K @ EQ01	18.48	na	22.98			
401	28.2	K = K @ EQ01	27.53	na	28.05			
402	28.2	K = K @ EQ02	25.91	na	27.6			
B1	28.2		27.53	na				
403	28.2	K = K @ EQ02	25.92	na	27.61			
B2	28.2		27.55	na				
404	28.2	K = K @ EQ02	25.94	na	27.62			
B3	28.2		27.57	na				
405	28.2	K = K @ EQ02	25.77	na	27.53			
B4	28.2		27.61	na				
406	28.2	K = K @ EQ02	25.82	na	27.55			
B5	28.2		27.66	na				
407	28.2	K = K @ EQ02	25.87	na	27.58			
B6	28.2		27.71	na				
B8	28.2		28.24	na				
B9	28.2		28.55	na				
X1	28.2		31.17	na				
X2	20.2		35.48	na				
X3	20.2		40.39	na				
X4	12.2		44.71	na				
TR2	12.2		47.88	na				
BR2	2.0		58.46	na				
BASE	2.0		64.01	na				
H1	-2.0		66.05	na				
H2	-2.0		67.18	na				
H3	-1.0		66.94	na				
TEST	-1.0		67.18	na	250.0			

The maximum velocity is 19.74 and it occurs in the pipe between nodes 419 and B9

Final Calculations - Hazen-Williams

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
DP1 to EQ01	19.50 19.5	1.049 120.0 0.1243	1T	5.0 0.0 0.0	1.000 5.000 6.000	12.125 0.433 0.746			K Factor = 5.60	
	0.0 19.50						13.304		K Factor = 5.35	
DP2 to EQ02	19.50 19.5	1.049 120.0 0.1243	1E	2.0 0.0 0.0	1.000 2.000 3.000	12.125 0.433 0.373			K Factor = 5.60	
	0.0 19.50						12.931		K Factor = 5.42	
414 to 415	19.64 19.64	1.61 120.0 0.0157		0.0 0.0 0.0	9.200 0.0 9.200	13.500 0.0 0.144			K Factor @ node EQ01	Vel = 3.10
415 to 416	19.75 39.39	1.61 120.0 0.0567		0.0 0.0 0.0	9.600 0.0 9.600	13.644 0.0 0.544			K Factor @ node EQ01	Vel = 6.21
416 to 417	20.14 59.53	1.61 120.0 0.1215		0.0 0.0 0.0	8.700 0.0 8.700	14.188 0.0 1.057			K Factor @ node EQ01	Vel = 9.38
417 to 418	20.87 80.4	1.61 120.0 0.2119		0.0 0.0 0.0	6.200 0.0 6.200	15.245 0.0 1.314			K Factor @ node EQ01	Vel = 12.67
418 to 419	21.76 102.16	1.61 120.0 0.3300		0.0 0.0 0.0	6.300 0.0 6.300	16.559 0.0 2.079			K Factor @ node EQ01	Vel = 16.10
419 to B9	23.08 125.24	1.61 120.0 0.4811	1T	8.0 0.0 0.0	12.600 8.000 20.600	18.638 0.0 9.911			K Factor @ node EQ01	Vel = 19.74
	0.0 125.24						28.549		K Factor = 23.44	
408 to 409	19.50 19.5	1.61 120.0 0.0153		0.0 0.0 0.0	9.200 0.0 9.200	13.304 0.0 0.141			K Factor @ node EQ01	Vel = 3.07
409 to B7	19.60 39.1	1.61 120.0 0.0559		0.0 0.0 0.0	7.300 0.0 7.300	13.445 0.0 0.408			K Factor @ node EQ01	Vel = 6.16
	0.0 39.10						13.853		K Factor = 10.51	
410 to B7	19.64 19.64	1.049 120.0 0.1259	1T	5.0 0.0 0.0	0.800 5.000 5.800	13.123 0.0 0.730			K Factor @ node EQ02	Vel = 7.29
B7 to 411	39.11 58.75	1.61 120.0 0.1186		0.0 0.0 0.0	10.900 0.0 10.900	13.853 0.0 1.293				Vel = 9.26
411 to 412	20.80 79.55	1.61 120.0 0.2077		0.0 0.0 0.0	6.200 0.0 6.200	15.146 0.0 1.288			K Factor @ node EQ01	Vel = 12.54

Final Calculations - Hazen-Williams

High Tech Fire Protection
Zone 2 - Mechanical Room Calc.

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
412 to 413	21.68 101.23	1.61 120.0 0.3244		0.0 0.0 0.0	6.300 0.0 6.300	16.434 0.0 2.044			K Factor @ node EQ01 Vel = 15.95	
413 to B8	22.98 124.21	1.61 120.0 0.4738	1T	8.0 0.0 0.0	12.600 8.000 20.600	18.478 0.0 9.761			K Factor @ node EQ01 Vel = 19.57	
	0.0 124.21					28.239			K Factor = 23.37	
401 to B1	28.05 28.05	4.026 120.0 0.0003		0.0 0.0 0.0	9.000 0.0 9.000	27.531 0.0 0.003			K Factor @ node EQ01 Vel = 0.71	
	0.0 28.05					27.534			K Factor = 5.35	
402 to B1	27.60 27.6	1.049 120.0 0.2361	1T	5.0 0.0 0.0	1.900 5.000 6.900	25.905 0.0 1.629			K Factor @ node EQ02 Vel = 10.25	
B1 to B2	28.05 55.65	4.026 120.0 0.0013		0.0 0.0 0.0	11.000 0.0 11.000	27.534 0.0 0.014			Vel = 1.40	
	0.0 55.65					27.548			K Factor = 10.60	
403 to B2	27.61 27.61	1.049 120.0 0.2362	1T	5.0 0.0 0.0	1.900 5.000 6.900	25.918 0.0 1.630			K Factor @ node EQ02 Vel = 10.25	
B2 to B3	55.65 83.26	4.026 120.0 0.0026		0.0 0.0 0.0	9.600 0.0 9.600	27.548 0.0 0.025			Vel = 2.10	
	0.0 83.26					27.573			K Factor = 15.86	
404 to B3	27.62 27.62	1.049 120.0 0.2364	1T	5.0 0.0 0.0	1.900 5.000 6.900	25.942 0.0 1.631			K Factor @ node EQ02 Vel = 10.25	
B3 to B4	83.26 110.88	4.026 120.0 0.0044		0.0 0.0 0.0	7.700 0.0 7.700	27.573 0.0 0.034			Vel = 2.79	
	0.0 110.88					27.607			K Factor = 21.10	
405 to B4	27.53 27.53	1.049 120.0 0.2350	1T	5.0 0.0 0.0	2.800 5.000 7.800	25.774 0.0 1.833			K Factor @ node EQ02 Vel = 10.22	
B4 to B5	110.88 138.41	4.026 120.0 0.0067		0.0 0.0 0.0	7.200 0.0 7.200	27.607 0.0 0.048			Vel = 3.49	
	0.0 138.41					27.655			K Factor = 26.32	

Final Calculations - Hazen-Williams

High Tech Fire Protection
Zone 2 - Mechanical Room Calc.

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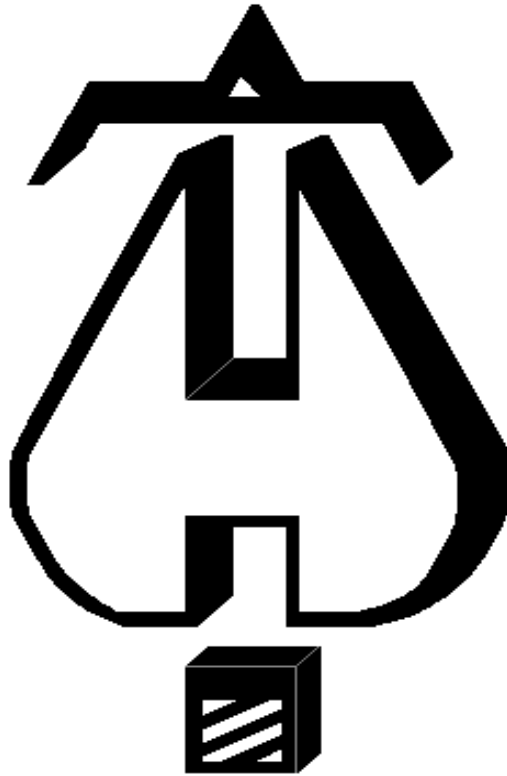
Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
406 to B5	27.55 27.55	1.049 120.0 0.2354	1T	5.0 0.0	2.800 5.000 7.800	25.819 0.0 1.836			K Factor @ node EQ02	
B5 to B6	138.41 165.96	4.026 120.0 0.0094		0.0 0.0	6.300 0.0 6.300	27.655 0.0 0.059				Vel = 10.23
	0.0 165.96					27.714			K Factor = 31.52	
407 to B6	27.58 27.58	1.049 120.0 0.2359	1T	5.0 0.0	2.800 5.000 7.800	25.874 0.0 1.840			K Factor @ node EQ02	
B6 to B8	165.97 193.55	4.026 120.0 0.0124	1X	16.0 0.0	26.300 16.000 42.300	27.714 0.0 0.525				Vel = 10.24
B8 to B9	124.21 317.76	4.026 120.0 0.0310		0.0 0.0	10.000 0.0 10.000	28.239 0.0 0.310				Vel = 4.88
B9 to X1	125.24 443.0	4.026 120.0 0.0574	5V	34.0 0.0	11.600 34.000 45.600	28.549 0.0 2.616				Vel = 8.01
	0.0 443.00					31.165			K Factor = 79.35	
X1 to X2	443.00 443.0	4.026 120.0 0.0574	1V	6.8 0.0	8.000 6.800 14.800	31.165 3.465 0.849				Vel = 11.16
X2 to X3	0.0 443.0	4.026 120.0 0.0574	1V	6.8 0.0	78.800 6.800 85.600	35.479 0.0 4.912				Vel = 11.16
X3 to X4	0.0 443.0	4.026 120.0 0.0574	1V	6.8 0.0	8.000 6.800 14.800	40.391 3.465 0.849				Vel = 11.16
X4 to TR2	0.0 443.0	4.026 120.0 0.0574	3V	20.4 0.0	34.900 20.400 55.300	44.705 0.0 3.173				Vel = 11.16
TR2 to BR2	0.0 443.0	4.026 120.0 0.0574	1A 1B 1Fsp 1X	17.0 12.0 0.0 16.0	10.200 45.000 55.200	47.878 7.418 3.167			* Fixed loss = 3	Vel = 11.16
BR2 to BASE	0.0 443.0	4.026 120.0 0.0574	1E 1Zia	10.0 0.0	7.600 10.000 17.600	58.463 4.536 1.010			* Fixed loss = 4.536	Vel = 11.16
BASE to H1	0.0 443.0	8.27 140.0 0.0013	2E 2F 1G	56.936 28.468 6.326	150.000 91.730 241.730	64.009 1.732 0.313				Vel = 2.65
H1 to H2	0.0 443.0	8.23 100.0 0.0025	1T	29.011 0.0	425.000 29.010 454.010	66.054 0.0 1.123				Vel = 2.67

Final Calculations - Hazen-Williams

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 Zone 2 - Mechanical Room Calc.

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
H2 to H3	0.0 443.0	8.23 100.0 0.0025	1T	29.011 0.0 0.0	50.000 29.010 79.010	67.177 -0.433 0.195		Vel = 2.67	
H3 to TEST	0.0 443.0	6.16 140.0 0.0054	1E 1G	20.084 4.304 0.0	20.000 24.388 44.388	66.939 0.0 0.241		Vel = 4.77	
	250.00 693.00					67.180		Qa = 250.00 K Factor = 84.55	



... Fire Protection by Computer Design

High Tech Fire Protection
PO Box 156
Minot, ME 04258
(207) 998-2551

Job Name : Zone 2 - Classroom Calc.
Building : Fred P Hall Elementary School
Location : Second Floor 3rd Grade Classroom
System : Zone 2
Contract : 041917-1
Data File : Zone 2 - Classroom Calc.wxf

Hydraulic Design Information Sheet

Name - Zone 2 - Classroom Calc. Date - 11/28/2017
 Location - Second Floor 3rd Grade Classroom
 Building - Fred P Hall Elementary School System No. - Zone 2
 Contractor - High Tech Fire Protection Contract No. - 041917-1
 Calculated By - Jeremy A Foss Drawing No. - FP- 1.5
 Construction: () Combustible (X) Non-Combustible Ceiling Height - 11'-0"
 Occupancy - Educational - Classroom

S (X) NFPA 13 (X) Lt. Haz. Ord.Haz.Gp. () 1 () 2 () 3 () Ex.Haz.
 Y () NFPA 231 () NFPA 231C () Figure Curve

S Other

T Specific Ruling Made By Date

	Area of Sprinkler Operation - 1500	System Type	Sprinkler/Nozzle
M	Density - .1	(X) Wet	Make Globe
D	Area Per Sprinkler - 225	() Dry	Model GL5601
E	Elevation at Highest Outlet - 32	() Deluge	Size 1/2"
S	Hose Allowance - Inside - 0	() Preaction	K-Factor 5.6
I	Rack Sprinkler Allowance -	() Other	Temp.Rat.155
G	Hose Allowance - Outside - 100		

N Note

Calculation Flow Required - 389 Press Required - 77 10psi Under Curve
 Summary C-Factor Used: 120 Overhead 140 Underground

W	Water Flow Test:	Pump Data:	Tank or Reservoir:
A	Date of Test - 11/09/2017		Cap. -
T	Time of Test -	Rated Cap.-	Elev.-
E	Static Press - 87	@ Press -	
R	Residual Press - 85	Elev. -	Well
S	Flow - 1403		Proof Flow
U	Elevation - -1		

P Location - Test Hydrant Located on Godfrey Street 650' from Site

P Source of Information - Portland Water District

C	Commodity	Class	Location
O	Storage Ht.	Area	Aisle W.
M	Storage Method:	%	Palletized % Rack
M	() Single Row	() Conven. Pallet	() Auto. Storage () Encap.
S	() Double Row	() Slave Pallet	() Solid Shelf () Non
T	() Mult. Row		() Open Shelf

R K Flue Spacing Clearance:Storage to Ceiling
 A Longitudinal Transverse

E Horizontal Barriers Provided:

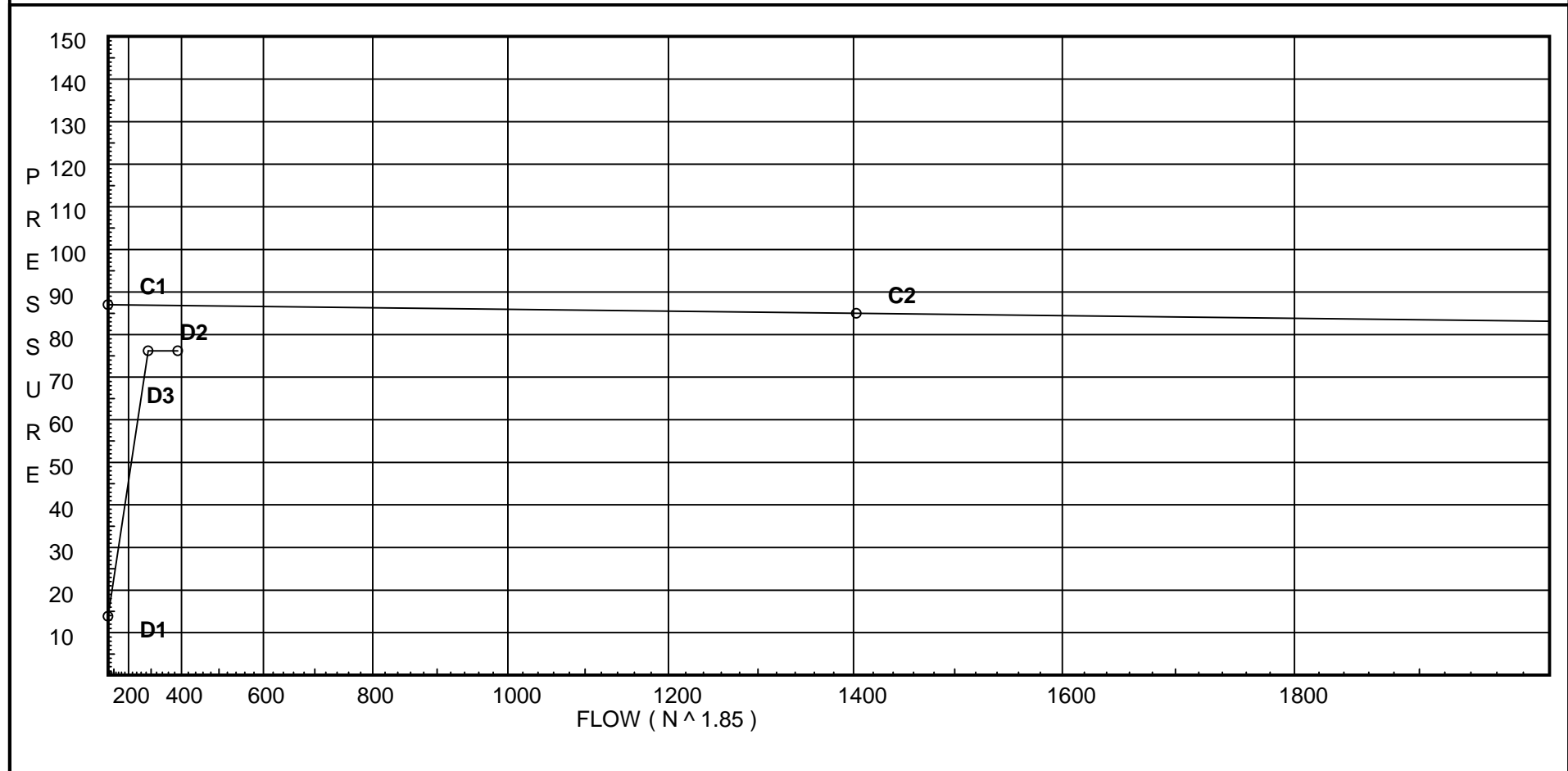
Water Supply Curve (C)

High Tech Fire Protection
Zone 2 - Classroom Calc.

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City Water Supply:
C1 - Static Pressure : 87
C2 - Residual Pressure: 85
C2 - Residual Flow : 1403

Demand:
D1 - Elevation : 13.859
D2 - System Flow : 288.972
D2 - System Pressure : 76.173
Hose (Demand) : 100
D3 - System Demand : 388.972
Safety Margin : 10.641



Fittings Used Summary

High Tech Fire Protection
Zone 2 - Classroom Calc.

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Fitting Legend		½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24	
Abbrev.	Name																					
A	Alarm Rel E1 & E3							7.7	21.5		17		27	29								
B	NFPA 13 Butterfly Valve	0	0	0	0	5	6	7	10	0	12	9	10	12	19	21	0	0	0	0	0	0
E	NFPA 13 90' Standard Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61	61
F	NFPA 13 45' Elbow	1	1	1	1	2	2	3	3	3	4	5	7	9	11	13	17	19	21	24	28	28
Fsp	Flow Switch Potter VSR	Fitting generates a Fixed Loss Based on Flow																				
G	NFPA 13 Gate Valve	0	0	1	1	1	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13	13
T	NFPA 13 90' Flow thru Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121	121
U	45' Ell Firelock #003	0	0	0	0	0	1.8	2.2	2.6	0	3.4	4.2	5	5	0	0	0	0	0	0	0	0
V	90' Ell Firelock #001	0	0	0	0	3.5	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0	0
X	90'Tee-BranchFirelock002	0	0	0	0	8.5	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0	0
Zia	Wilkins 350	Fitting generates a Fixed Loss Based on Flow																				

Units Summary

Diameter Units Inches
 Length Units Feet
 Flow Units US Gallons per Minute
 Pressure Units Pounds per Square Inch

Note: Fitting Legend provides equivalent pipe lengths for fittings types of various diameters. Equivalent lengths shown are standard for actual diameters of Sched 40 pipe and CFactors of 120 except as noted with *. The fittings marked with a * show equivalent lengths values supplied by manufacturers based on specific pipe diameters and CFactors and they require no adjustment. All values for fittings not marked with a * will be adjusted in the calculation for CFactors of other than 120 and diameters other than Sched 40 per NFPA.

Pressure / Flow Summary - STANDARD

High Tech Fire Protection
Zone 2 - Classroom Calc.

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
DP1	-1.0	5.6	16.14	na	22.5	0.1	225	7.0
DP2	-1.0	5.6	16.14	na	22.5	0.1	225	7.0
201	32.0	K = K @ EQ01	17.49	na	22.5			
202	32.0	K = K @ EQ01	17.73	na	22.65			
203	32.0	K = K @ EQ02	17.07	na	22.54			
A1	32.0		18.35	na				
204	32.0	K = K @ EQ01	19.74	na	23.9			
205	32.0	K = K @ EQ01	19.11	na	23.52			
206	32.0	K = K @ EQ01	19.41	na	23.7			
207	32.0	K = K @ EQ01	20.48	na	24.35			
208	32.0	K = K @ EQ01	22.87	na	25.73			
209	32.0	K = K @ EQ01	20.22	na	24.19			
210	32.0	K = K @ EQ01	20.54	na	24.38			
211	32.0	K = K @ EQ01	21.67	na	25.04			
212	32.0	K = K @ EQ01	24.19	na	26.46			
A2	32.0		26.7	na				
A3	32.0		27.03	na				
A4	32.0		28.57	na				
A5	32.0		33.7	na				
A6	32.0		36.72	na				
A7	31.0		37.6	na				
A8	31.0		41.25	na				
A9	30.7		41.56	na				
A10	30.7		42.97	na				
A11	31.9		42.66	na				
A12	31.9		44.02	na				
A13	28.2		46.13	na				
X1	28.2		50.08	na				
X2	20.2		53.93	na				
X3	20.2		56.16	na				
X4	12.2		60.01	na				
TR2	12.2		61.44	na				
BR2	2.0		70.3	na				
BASE	2.0		74.46	na				
H1	-2.0		76.33	na				
H2	-2.0		76.84	na				
H3	-1.0		76.5	na				
TEST	0.0		76.17	na	100.0			

The maximum velocity is 19.36 and it occurs in the pipe between nodes A4 and A5

Final Calculations - Hazen-Williams

High Tech Fire Protection
Zone 2 - Classroom Calc.

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
DP1 to EQ01	22.50 22.5	1.049 120.0 0.1618	2E 1T	4.0 5.0 0.0	2.000 9.000 11.000	16.143 -0.433 1.780			K Factor = 5.60 Vel = 8.35	
	0.0 22.50						17.490		K Factor = 5.38	
DP2 to EQ02	22.50 22.5	1.049 120.0 0.1619	3E	6.0 0.0 0.0	2.000 6.000 8.000	16.143 -0.433 1.295			K Factor = 5.60 Vel = 8.35	
	0.0 22.50						17.005		K Factor = 5.46	
201 to 202	22.50 22.5	1.61 120.0 0.0201		0.0 0.0 0.0	12.000 0.0 12.000	17.490 0.0 0.241			K Factor @ node EQ01 Vel = 3.55	
202 to A1	22.65 45.15	1.61 120.0 0.0729		0.0 0.0 0.0	8.500 0.0 8.500	17.731 0.0 0.620			K Factor @ node EQ01 Vel = 7.12	
	0.0 45.15						18.351		K Factor = 10.54	
203 to A1	22.54 22.54	1.049 120.0 0.1624	1T	5.0 0.0 0.0	2.900 5.000 7.900	17.068 0.0 1.283			K Factor @ node EQ02 Vel = 8.37	
A1 to 204	45.16 67.7	1.61 120.0 0.1541		0.0 0.0 0.0	9.000 0.0 9.000	18.351 0.0 1.387			Vel = 10.67	
204 to A2	23.90 91.6	1.61 120.0 0.2697	1T	8.0 0.0 0.0	17.800 8.000 25.800	19.738 0.0 6.959			K Factor @ node EQ01 Vel = 14.44	
	0.0 91.60						26.697		K Factor = 17.73	
205 to 206	23.52 23.52	1.61 120.0 0.0218		0.0 0.0 0.0	14.000 0.0 14.000	19.105 0.0 0.305			K Factor @ node EQ01 Vel = 3.71	
206 to 207	23.70 47.22	1.61 120.0 0.0792		0.0 0.0 0.0	13.500 0.0 13.500	19.410 0.0 1.069			K Factor @ node EQ01 Vel = 7.44	
207 to 208	24.35 71.57	1.61 120.0 0.1709		0.0 0.0 0.0	14.000 0.0 14.000	20.479 0.0 2.392			K Factor @ node EQ01 Vel = 11.28	
208 to A3	25.73 97.3	1.61 120.0 0.3016	1T	8.0 0.0 0.0	5.800 8.000 13.800	22.871 0.0 4.162			K Factor @ node EQ01 Vel = 15.33	
	0.0 97.30						27.033		K Factor = 18.71	
209 to 210	24.19 24.19	1.61 120.0 0.0230		0.0 0.0 0.0	14.000 0.0 14.000	20.219 0.0 0.322			K Factor @ node EQ01 Vel = 3.81	

Final Calculations - Hazen-Williams

High Tech Fire Protection
Zone 2 - Classroom Calc.

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
210 to 211	24.39 48.58	1.61 120.0 0.0834		0.0 0.0 0.0	13.500 0.0 13.500	20.541 0.0 1.126		K Factor @ node EQ01 Vel = 7.66		
211 to 212	25.04 73.62	1.61 120.0 0.1800		0.0 0.0 0.0	14.000 0.0 14.000	21.667 0.0 2.520		K Factor @ node EQ01 Vel = 11.60		
212 to A4	26.46 100.08	1.61 120.0 0.3178	1T	8.0 0.0 0.0	5.800 8.000 13.800	24.187 0.0 4.385		K Factor @ node EQ01 Vel = 15.77		
	0.0 100.08					28.572		K Factor = 18.72		
A2 to A3	91.60 91.6	2.469 120.0 0.0336		0.0 0.0 0.0	10.000 0.0 10.000	26.697 0.0 0.336		Vel = 6.14		
A3 to A4	97.29 188.89	2.469 120.0 0.1282		0.0 0.0 0.0	12.000 0.0 12.000	27.033 0.0 1.539		Vel = 12.66		
A4 to A5	100.08 288.97	2.469 120.0 0.2816	1T	12.0 0.0 0.0	6.200 12.000 18.200	28.572 0.0 5.125		Vel = 19.36		
A5 to A6	0.0 288.97	4.026 120.0 0.0260	1V	6.8 0.0 0.0	109.500 6.800 116.300	33.697 0.0 3.028		Vel = 7.28		
A6 to A7	0.0 288.97	4.026 120.0 0.0260	1X	16.0 0.0 0.0	1.000 16.000 17.000	36.725 0.433 0.442		Vel = 7.28		
A7 to A8	0.0 288.97	4.026 120.0 0.0260	3V 2X	20.4 32.0 0.0	87.700 52.400 140.100	37.600 0.0 3.647		Vel = 7.28		
A8 to A9	0.0 288.97	4.026 120.0 0.0261	1V	6.8 0.0 0.0	0.300 6.800 7.100	41.247 0.130 0.185		Vel = 7.28		
A9 to A10	0.0 288.97	4.026 120.0 0.0260	1U 1V	3.4 6.8 0.0	44.000 10.200 54.200	41.562 0.0 1.411		Vel = 7.28		
A10 to A11	0.0 288.97	4.026 120.0 0.0261	1V	6.8 0.0 0.0	1.200 6.800 8.000	42.973 -0.520 0.209		Vel = 7.28		
A11 to A12	0.0 288.97	4.026 120.0 0.0260	3V 1X	20.4 16.0 0.0	15.700 36.400 52.100	42.662 0.0 1.356		Vel = 7.28		
A12 to A13	0.0 288.97	4.026 120.0 0.0260	1X	16.0 0.0 0.0	3.700 16.000 19.700	44.018 1.602 0.513		Vel = 7.28		
A13 to X1	0.0 288.97	4.026 120.0 0.0260	5V 1X	34.0 16.0 0.0	101.500 50.000 151.500	46.133 0.0 3.944		Vel = 7.28		

Final Calculations - Hazen-Williams

High Tech Fire Protection
Zone 2 - Classroom Calc.

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
X1	0.0	4.026	1V	6.8	8.000	50.077				
to		120.0		0.0	6.800	3.465				
X2	288.97	0.0260		0.0	14.800	0.385		Vel = 7.28		
X2	0.0	4.026	1V	6.8	78.800	53.927				
to		120.0		0.0	6.800	0.0				
X3	288.97	0.0260		0.0	85.600	2.228		Vel = 7.28		
X3	0.0	4.026	1V	6.8	8.000	56.155				
to		120.0		0.0	6.800	3.465				
X4	288.97	0.0260		0.0	14.800	0.385		Vel = 7.28		
X4	0.0	4.026	3V	20.4	34.900	60.005				
to		120.0		0.0	20.400	0.0				
TR2	288.97	0.0260		0.0	55.300	1.440		Vel = 7.28		
TR2	0.0	4.026	1A	17.0	10.200	61.445				
to		120.0	1B	12.0	45.000	7.418		* Fixed loss = 3		
BR2	288.97	0.0260	1Fsp	0.0	55.200	1.437		Vel = 7.28		
			1X	16.0						
BR2	0.0	4.026	1E	10.0	7.600	70.300				
to		120.0	1Zia	0.0	10.000	3.700		* Fixed loss = 3.7		
BASE	288.97	0.0260		0.0	17.600	0.457		Vel = 7.28		
BASE	0.0	8.27	2E	56.936	150.000	74.457				
to		140.0	2F	28.468	91.730	1.732				
H1	288.97	0.0006	1G	6.326	241.730	0.143		Vel = 1.73		
H1	0.0	8.23	1T	29.011	425.000	76.332				
to		100.0		0.0	29.010	0.0				
H2	288.97	0.0011		0.0	454.010	0.509		Vel = 1.74		
H2	0.0	8.23	1T	29.011	50.000	76.841				
to		100.0		0.0	29.010	-0.433				
H3	288.97	0.0011		0.0	79.010	0.088		Vel = 1.74		
H3	0.0	6.16	1E	20.084	20.000	76.496				
to		140.0	1G	4.304	24.388	-0.433				
TEST	288.97	0.0025		0.0	44.388	0.110		Vel = 3.11		
	100.00							Qa = 100.00		
	388.97					76.173		K Factor = 44.57		