



... Fire Protection by Computer Design

Dean and Allyn, Inc.
116 Lewiston Rd
Gray, ME 04039
(207) 657-5646

Job Name : Unum
Drawing : FP-05
Location : 2211 Congress St. Portland, ME 04122
Remote Area : 2
Contract : C171470
Data File : Unum Area 2.WXF

HYDRAULIC CALCULATIONS
for

Project name: Unum HO 2 Restack and Consolidation
Location: 2211 Congress St. Portland, ME 04122
Drawing no: FP-05
Date: 11/29/17

Design

Remote area number: 2
Remote area location: 2nd Floor Monumental Stair 2.2.E.923
Occupancy classification: Light Hazard
Density: .1 - Gpm/SqFt
Area of application: 1518 - SqFt
Coverage per sprinkler: 225 - SqFt
Type of sprinklers calculated: Reliable Model F1FR56 Upright
No. of sprinklers calculated: 18
In-rack demand: N/A - GPM
Hose streams: 100 - GPM
Total water required (including hose streams): 274.23 - GPM @ 48.8443 - Psi
Type of system: Wet
Volume of dry or preaction system: N/A - Gal

Water supply information

Date: Sept. 2012
Location: Unum Hyd. #6 Congress St. and Johnson Rd.
Source: Hydrant Flow Data

Name of contractor: Dean and Allyn, Inc.
Address: 116 Lewiston Rd / Your Street Address 2 / Gray, ME 04039
Phone number: (207) 657-5646
Name of designer: ZJG
Authority having jurisdiction: State of Maine Fire Dept.
Notes: (Include peaking information or gridded systems here.)

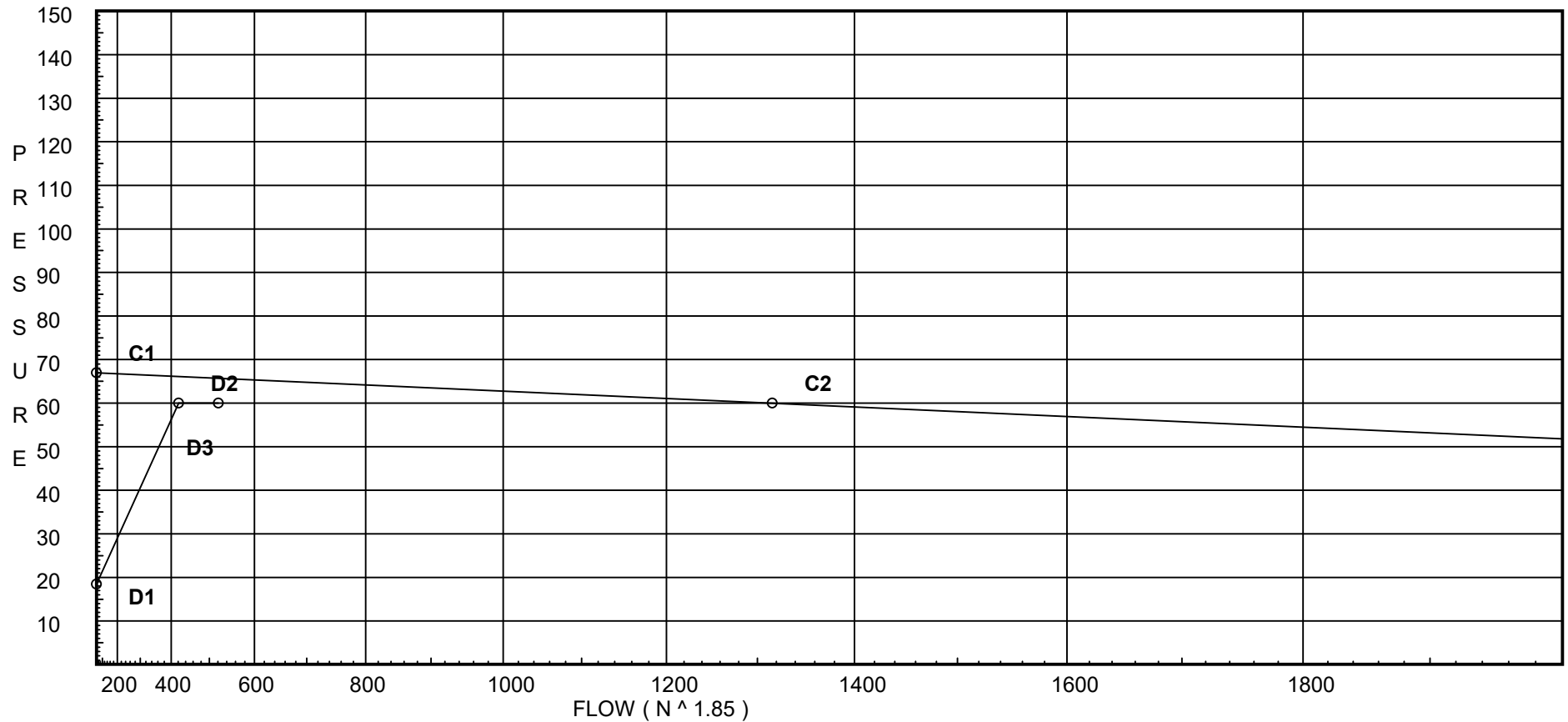
Water Supply Curve C

Dean and Allyn, Inc.
Unum

Page 2
Date 11-28-2017

City Water Supply:
C1 - Static Pressure : 67
C2 - Residual Pressure: 60
C2 - Residual Flow : 1316

Demand:
D1 - Elevation : 18.425
D2 - System Flow : 421.231
D2 - System Pressure : 60.030
Hose (Demand) : 100
D3 - System Demand : 521.231
Safety Margin : 5.708



Fittings Used Summary

Dean and Allyn, Inc.
Unum

Page 3
Date 11-28-2017

Fitting Legend

| Abbrev. | Name | 1/2 | 3/4 | 1 | 1 1/4 | 1 1/2 | 2 | 2 1/2 | 3 | 3 1/2 | 4 | 5 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 24 | |
|---------|----------------------------|-----|-----|-----|-------|-------|------|-------|------|-------|----|-----|----|----|----|----|----|----|----|-----|-----|--|
| A | Alarm Rel E1 & E3 | | | | | | | 7.7 | 21.5 | | 17 | | 27 | 29 | | | | | | | | |
| 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 | |
| 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 | |
| G | NFPA 13 Gate Valve | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 10 | 11 | 13 | |
| I | 90' Grvd-Vic Elbow #10 | 0 | 0 | 2 | 3 | 4 | 3.5 | 6 | 5 | 8 | 7 | 8.5 | 10 | 13 | 17 | 20 | 23 | 25 | 33 | 36 | 40 | |
| J | 90'Tee-Branch Grv Vic #20 | 0 | 0 | 4.5 | 6 | 8 | 8.5 | 10.8 | 13 | 17 | 16 | 21 | 25 | 33 | 41 | 50 | 65 | 78 | 88 | 98 | 120 | |
| 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 | |
| Y | Mechanical Tee | 2 | 4 | 5 | 6 | 8 | 10.5 | 12.5 | 15.5 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

Unit 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

Dean and Allyn, Inc.
Unum

Page 4
Date 11-28-2017

| Node No. | Elevation | K-Fact | Pt Actual | Pn | Flow Actual | Density | Area | Press Req. |
|----------|-----------|--------|-----------|----|-------------|---------|------|------------|
| 1 | 39.333 | 5.6 | 11.0 | na | 18.58 | 0.1 | 126 | 7.0 |
| 3 | 44.542 | 5.6 | 10.66 | na | 18.29 | 0.1 | 153 | 7.0 |
| 4 | 40.042 | | 13.73 | na | | | | |
| 6 | 44.542 | 5.6 | 18.14 | na | 23.85 | 0.1 | 91 | 7.0 |
| 8 | 44.542 | 5.6 | 22.28 | na | 26.43 | 0.1 | 150 | 7.0 |
| 2 | 40.042 | | 13.42 | na | | | | |
| 5 | 40.042 | | 14.45 | na | | | | |
| 7 | 40.042 | | 20.9 | na | | | | |
| 9 | 40.042 | | 25.21 | na | | | | |
| 11 | 39.333 | 5.6 | 15.69 | na | 22.18 | 0.1 | 99 | 7.0 |
| 12 | 40.042 | | 19.16 | na | | | | |
| 16 | 44.542 | 5.6 | 20.22 | na | 25.18 | 0.1 | 182 | 7.0 |
| 18 | 44.542 | 5.6 | 22.34 | na | 26.47 | 0.1 | 134 | 7.0 |
| 13 | 40.042 | | 19.63 | na | | | | |
| 14 | 40.042 | | 21.81 | na | | | | |
| 15 | 40.042 | | 22.44 | na | | | | |
| 17 | 40.042 | | 23.06 | na | | | | |
| 19 | 40.042 | | 25.28 | na | | | | |
| 20 | 40.042 | | 29.65 | na | | | | |
| 22 | 39.333 | 5.6 | 8.98 | na | 16.78 | 0.1 | 104 | 7.0 |
| 24 | 39.333 | 5.6 | 9.43 | na | 17.2 | 0.1 | 104 | 7.0 |
| 26 | 39.333 | 5.6 | 13.94 | na | 20.91 | 0.1 | 176 | 7.0 |
| 27 | 40.042 | | 17.02 | na | | | | |
| 31 | 44.542 | 5.6 | 19.98 | na | 25.03 | 0.1 | 155 | 7.0 |
| 23 | 40.042 | | 10.93 | na | | | | |
| 25 | 40.042 | | 11.49 | na | | | | |
| 28 | 40.042 | | 17.44 | na | | | | |
| 29 | 40.042 | | 18.66 | na | | | | |
| 30 | 40.042 | | 20.1 | na | | | | |
| 32 | 40.042 | | 22.82 | na | | | | |
| 35 | 44.542 | 5.6 | 15.28 | na | 21.89 | 0.1 | 162 | 15.277 |
| 37 | 44.542 | 5.6 | 17.57 | na | 23.47 | 0.1 | 59 | 15.277 |
| 39 | 44.542 | 5.6 | 19.4 | na | 24.66 | 0.1 | 59 | 15.277 |
| 41 | 44.542 | 5.6 | 23.47 | na | 27.13 | 0.1 | 64 | 15.277 |
| 43 | 44.542 | 5.6 | 24.1 | na | 27.49 | 0.1 | 100 | 15.277 |
| 36 | 42.042 | | 17.05 | na | | | | |
| 38 | 42.042 | | 19.09 | na | | | | |
| 40 | 42.042 | | 20.96 | na | | | | |
| 42 | 42.042 | | 25.13 | na | | | | |
| 44 | 42.042 | | 26.24 | na | | | | |
| 45 | 40.042 | | 28.46 | na | | | | |
| 48 | 44.542 | 5.6 | 24.19 | na | 27.54 | 0.1 | 59 | 15.277 |
| 50 | 44.542 | 5.6 | 25.27 | na | 28.15 | 0.1 | 59 | 15.277 |
| 49 | 42.042 | | 26.33 | na | | | | |
| 51 | 42.042 | | 27.45 | na | | | | |
| 52 | 40.042 | | 29.06 | na | | | | |
| 53 | 40.042 | | 30.88 | na | | | | |
| 33 | 40.042 | | 29.18 | na | | | | |
| 34 | 40.042 | | 29.27 | na | | | | |
| 46 | 40.042 | | 29.42 | na | | | | |
| 10 | 40.042 | | 29.98 | na | | | | |
| 21 | 40.042 | | 30.05 | na | | | | |
| 47 | 40.042 | | 30.23 | na | | | | |
| 54 | 40.042 | | 31.05 | na | | | | |
| 55 | 13.25 | | 43.65 | na | | | | |
| 56 | 13.25 | | 44.9 | na | | | | |
| 57 | 13.25 | | 46.82 | na | | | | |
| 58 | 13.25 | | 48.16 | na | | | | |
| 59 | 13.25 | | 49.93 | na | | | | |
| 60 | 12.792 | | 50.54 | na | | | | |
| 61 | 12.792 | | 50.69 | na | | | | |
| 62 | 12.792 | | 50.98 | na | | | | |

Flow Summary - Standard

Dean and Allyn, Inc.
Unum

Page 5
Date 11-28-2017

| Node No. | Elevation | K-Fact | Pt Actual | Pn | Flow Actual | Density | Area | Press Req. |
|----------|-----------|--------|-----------|----|-------------|---------|------|------------|
| TR | 3.208 | | 55.41 | na | | | | |
| BR | 3.208 | | 57.31 | na | | | | |
| MAN | -6.0 | | 62.66 | na | | | | |
| UG | -6.0 | | 62.81 | na | | | | |
| UG1 | -6.0 | | 62.89 | na | | | | |
| UG2 | -6.0 | | 63.06 | na | | | | |
| UG3 | 14.0 | | 54.58 | na | | | | |
| TEST | 2.0 | | 60.03 | na | 100.0 | | | |

The maximum velocity is 19.64 and it occurs in the pipe between nodes 45 and 46

Final Calculations - Hazen-Williams - 2007

Dean and Allyn, Inc.
Unum

Page 6
Date 11-28-2017

| Hyd. Ref. Point | Qa Qt | Dia. "C" Pf/Ft | Fitting or Eqv. | Ln. | Pipe Ftng's Total | Pt Pe Pf | Pt Pv Pn | ***** | Notes | ***** |
|-----------------------|----------|----------------------|-----------------------|-----|-------------------------|----------------|----------------|-------|------------------|-------|
| 1 | 18.58 | 1.049 | | 0.0 | 24.000 | 11.004 | | | | |
| to | | 120.0 | | 0.0 | 0.0 | -0.307 | | | K Factor = 5.60 | |
| 2 | 18.58 | 0.1135 | | 0.0 | 24.000 | 2.724 | | | Vel = 6.90 | |
| | 0.0 | | | | | | | | | |
| | 18.58 | | | | | | 13.421 | | K Factor = 5.07 | |
| 3 | 18.29 | 1.049 | E | 2.0 | 8.125 | 10.665 | | | K Factor = 5.60 | |
| to | | 120.0 | | 0.0 | 2.000 | 1.949 | | | | |
| 4 | 18.29 | 0.1102 | | 0.0 | 10.125 | 1.116 | | | Vel = 6.79 | |
| 4 | 0.0 | 1.049 | E | 2.0 | 4.500 | 13.730 | | | | |
| to | | 120.0 | | 0.0 | 2.000 | 0.0 | | | | |
| 5 | 18.29 | 0.1103 | | 0.0 | 6.500 | 0.717 | | | Vel = 6.79 | |
| | 0.0 | | | | | | | | | |
| | 18.29 | | | | | | 14.447 | | K Factor = 4.81 | |
| 6 | 23.85 | 1.049 | | 0.0 | 4.500 | 18.141 | | | K Factor = 5.60 | |
| to | | 120.0 | | 0.0 | 0.0 | 1.949 | | | | |
| 7 | 23.85 | 0.1802 | | 0.0 | 4.500 | 0.811 | | | Vel = 8.85 | |
| | 0.0 | | | | | | | | | |
| | 23.85 | | | | | | 20.901 | | K Factor = 5.22 | |
| 8 | 26.43 | 1.049 | | 0.0 | 4.500 | 22.277 | | | K Factor = 5.60 | |
| to | | 120.0 | | 0.0 | 0.0 | 1.949 | | | | |
| 9 | 26.43 | 0.2180 | | 0.0 | 4.500 | 0.981 | | | Vel = 9.81 | |
| | 0.0 | | | | | | | | | |
| | 26.43 | | | | | | 25.207 | | K Factor = 5.26 | |
| 2 | 18.58 | 1.049 | T | 5.0 | 4.042 | 13.421 | | | | |
| to | | 120.0 | | 0.0 | 5.000 | 0.0 | | | | |
| 5 | 18.58 | 0.1135 | | 0.0 | 9.042 | 1.026 | | | Vel = 6.90 | |
| 5 | 18.28 | 1.049 | T | 5.0 | 11.000 | 14.447 | | | | |
| to | | 120.0 | | 0.0 | 5.000 | 0.0 | | | | |
| 7 | 36.86 | 0.4034 | | 0.0 | 16.000 | 6.454 | | | Vel = 13.68 | |
| 7 | 23.86 | 1.38 | T | 6.0 | 10.125 | 20.901 | | | | |
| to | | 120.0 | | 0.0 | 6.000 | 0.0 | | | | |
| 9 | 60.72 | 0.2670 | | 0.0 | 16.125 | 4.306 | | | Vel = 13.02 | |
| 9 | 26.43 | 1.61 | T | 8.0 | 11.417 | 25.207 | | | | |
| to | | 120.0 | | 0.0 | 8.000 | 0.0 | | | | |
| 10 | 87.15 | 0.2460 | | 0.0 | 19.417 | 4.776 | | | Vel = 13.73 | |
| | 0.0 | | | | | | | | | |
| | 87.15 | | | | | | 29.983 | | K Factor = 15.92 | |
| 11 | 22.18 | 1.049 | | 0.0 | 24.000 | 15.687 | | | K Factor = 5.60 | |
| to | | 120.0 | | 0.0 | 0.0 | -0.307 | | | | |
| 12 | 22.18 | 0.1576 | | 0.0 | 24.000 | 3.782 | | | Vel = 8.23 | |
| 12 | 0.0 | 1.049 | E | 2.0 | 1.000 | 19.162 | | | | |
| to | | 120.0 | | 0.0 | 2.000 | 0.0 | | | | |
| 13 | 22.18 | 0.1577 | | 0.0 | 3.000 | 0.473 | | | Vel = 8.23 | |
| | 0.0 | | | | | | | | | |
| | 22.18 | | | | | | 19.635 | | K Factor = 5.01 | |
| 16 | 25.18 | 1.049 | | 0.0 | 4.500 | 20.217 | | | K Factor = 5.60 | |
| to | | 120.0 | | 0.0 | 0.0 | 1.949 | | | | |
| 17 | 25.18 | 0.1991 | | 0.0 | 4.500 | 0.896 | | | Vel = 9.35 | |

Final Calculations - Hazen-Williams

Dean and Allyn, Inc.
Unum

Page 7
Date 11-28-2017

| Hyd. Ref. Point | Qa Qt | Dia. "C" Pf/Ft | Fitting or Eqv. | Ln. | Pipe Ftng's Total | Pt Pe Pf | Pt Pv Pn | ***** | Notes | ***** |
|-----------------------|--------------|----------------------|-----------------------|------------|-------------------------|------------------|----------------|-------|------------------|-------|
| | 0.0 25.18 | | | | | | 23.062 | | K Factor = 5.24 | |
| 18 to 19 | 26.47 | 1.049 120.0 | | 0.0 0.0 | 4.500 0.0 | 22.343 1.949 | | | K Factor = 5.60 | |
| | 26.47 | 0.2187 | | 0.0 | 4.500 | 0.984 | | | Vel = 9.83 | |
| | 0.0 26.47 | | | | | | 25.276 | | K Factor = 5.27 | |
| 13 to 14 | 22.18 | 1.049 120.0 | E | 2.0 0.0 | 11.833 2.000 | 19.635 0.0 | | | | |
| | 22.18 | 0.1576 | | 0.0 | 13.833 | 2.180 | | | Vel = 8.23 | |
| 14 to 15 | 0.0 | 1.049 120.0 | E | 2.0 0.0 | 1.958 2.000 | 21.815 0.0 | | | | |
| | 22.18 | 0.1574 | | 0.0 | 3.958 | 0.623 | | | Vel = 8.23 | |
| 15 to 17 | 0.0 | 1.049 120.0 | E | 2.0 0.0 | 1.958 2.000 | 22.438 0.0 | | | | |
| | 22.18 | 0.1577 | | 0.0 | 3.958 | 0.624 | | | Vel = 8.23 | |
| 17 to 19 | 25.18 | 1.38 120.0 | E | 3.0 0.0 | 10.125 3.000 | 23.062 0.0 | | | | |
| | 47.36 | 0.1687 | | 0.0 | 13.125 | 2.214 | | | Vel = 10.16 | |
| 19 to 20 | 26.47 | 1.38 120.0 | | 0.0 0.0 | 11.417 0.0 | 25.276 0.0 | | | | |
| | 73.83 | 0.3834 | | 0.0 | 11.417 | 4.377 | | | Vel = 15.84 | |
| 20 to 21 | 0.0 | 1.61 120.0 | | 0.0 0.0 | 2.167 0.0 | 29.653 0.0 | | | | |
| | 73.83 | 0.1809 | | 0.0 | 2.167 | 0.392 | | | Vel = 11.64 | |
| | 0.0 73.83 | | | | | | 30.045 | | K Factor = 13.47 | |
| 22 to 23 | 16.78 | 1.049 120.0 | | 0.0 0.0 | 24.000 0.0 | 8.976 -0.307 | | | K Factor = 5.60 | |
| | 16.78 | 0.0940 | | 0.0 | 24.000 | 2.257 | | | Vel = 6.23 | |
| | 0.0 16.78 | | | | | | 10.926 | | K Factor = 5.08 | |
| 24 to 25 | 17.20 | 1.049 120.0 | | 0.0 0.0 | 24.000 0.0 | 9.434 -0.307 | | | K Factor = 5.60 | |
| | 17.2 | 0.0985 | | 0.0 | 24.000 | 2.363 | | | Vel = 6.39 | |
| | 0.0 17.20 | | | | | | 11.490 | | K Factor = 5.07 | |
| 26 to 27 | 20.91 | 1.049 120.0 | | 0.0 0.0 | 24.000 0.0 | 13.938 -0.307 | | | K Factor = 5.60 | |
| | 20.91 | 0.1413 | | 0.0 | 24.000 | 3.390 | | | Vel = 7.76 | |
| 27 to 28 | 0.0 | 1.049 120.0 | E | 2.0 0.0 | 1.000 2.000 | 17.021 0.0 | | | | |
| | 20.91 | 0.1413 | | 0.0 | 3.000 | 0.424 | | | Vel = 7.76 | |
| | 0.0 20.91 | | | | | | 17.445 | | K Factor = 5.01 | |
| 31 to 32 | 25.03 | 1.049 120.0 | | 0.0 0.0 | 4.500 0.0 | 19.981 1.949 | | | K Factor = 5.60 | |
| | 25.03 | 0.1971 | | 0.0 | 4.500 | 0.887 | | | Vel = 9.29 | |

Final Calculations - Hazen-Williams

Dean and Allyn, Inc.
Unum

Page 8
Date 11-28-2017

| Hyd. Ref. Point | Qa Qt | Dia. "C" Pf/Ft | Fitting or Eqv. | Ln. | Pipe Ftng's Total | Pt Pe Pf | Pt Pv Pn | ***** | Notes | ***** |
|-----------------------|----------------|--------------------------|-----------------------|-------------------|---------------------------|--------------------------|----------------|-------|------------|-------|
| | 0.0 25.03 | | | | | | | | | |
| | | | | | | 22.817 | | | K Factor = | 5.24 |
| 23 to 25 | 16.78 16.78 | 1.049 120.0 0.0940 | E | 2.0 0.0 0.0 | 4.000 2.000 6.000 | 10.926 0.0 0.564 | | | Vel = | 6.23 |
| 25 to 28 | 17.20 33.98 | 1.049 120.0 0.3469 | E | 2.0 0.0 0.0 | 15.167 2.000 17.167 | 11.490 0.0 5.955 | | | Vel = | 12.61 |
| 28 to 29 | 20.90 54.88 | 1.38 120.0 0.2215 | E | 3.0 0.0 0.0 | 2.500 3.000 5.500 | 17.445 0.0 1.218 | | | Vel = | 11.77 |
| 29 to 30 | 0.0 54.88 | 1.38 120.0 0.2215 | E | 3.0 0.0 0.0 | 3.500 3.000 6.500 | 18.663 0.0 1.440 | | | Vel = | 11.77 |
| 30 to 32 | 0.0 54.88 | 1.38 120.0 0.2216 | T | 6.0 0.0 0.0 | 6.250 6.000 12.250 | 20.103 0.0 2.714 | | | Vel = | 11.77 |
| 32 to 33 | 25.04 79.92 | 1.38 120.0 0.4439 | T | 6.0 0.0 0.0 | 8.333 6.000 14.333 | 22.817 0.0 6.363 | | | Vel = | 17.14 |
| | 0.0 79.92 | | | | | | | | | |
| | | | | | | 29.180 | | | K Factor = | 14.79 |
| 35 to 36 | 21.89 21.89 | 1.049 120.0 0.1538 | E | 2.0 0.0 0.0 | 2.500 2.000 4.500 | 15.277 1.083 0.692 | | | K Factor = | 5.60 |
| | | | | | | | | | Vel = | 8.13 |
| | 0.0 21.89 | | | | | | | | | |
| | | | | | | 17.052 | | | K Factor = | 5.30 |
| 37 to 38 | 23.47 23.47 | 1.049 120.0 0.1748 | | 0.0 0.0 0.0 | 2.500 0.0 2.500 | 17.569 1.083 0.437 | | | K Factor = | 5.60 |
| | | | | | | | | | Vel = | 8.71 |
| | 0.0 23.47 | | | | | | | | | |
| | | | | | | 19.089 | | | K Factor = | 5.37 |
| 39 to 40 | 24.66 24.66 | 1.049 120.0 0.1920 | | 0.0 0.0 0.0 | 2.500 0.0 2.500 | 19.395 1.083 0.480 | | | K Factor = | 5.60 |
| | | | | | | | | | Vel = | 9.15 |
| | 0.0 24.66 | | | | | | | | | |
| | | | | | | 20.958 | | | K Factor = | 5.39 |
| 41 to 42 | 27.13 27.13 | 1.049 120.0 0.2284 | | 0.0 0.0 0.0 | 2.500 0.0 2.500 | 23.475 1.083 0.571 | | | K Factor = | 5.60 |
| | | | | | | | | | Vel = | 10.07 |
| | 0.0 27.13 | | | | | | | | | |
| | | | | | | 25.129 | | | K Factor = | 5.41 |
| 43 to 44 | 27.49 27.49 | 1.049 120.0 0.2344 | E | 2.0 0.0 0.0 | 2.500 2.000 4.500 | 24.102 1.083 1.055 | | | K Factor = | 5.60 |
| | | | | | | | | | Vel = | 10.21 |
| | 0.0 27.49 | | | | | | | | | |
| | | | | | | 26.240 | | | K Factor = | 5.37 |

Final Calculations - Hazen-Williams

Dean and Allyn, Inc.
Unum

Page 9
Date 11-28-2017

| Hyd. Ref. Point | Qa Qt | Dia. "C" Pf/Ft | Fitting or Eqv. | Ln. | Pipe Ftng's Total | Pt Pe Pf | Pt Pv Pn | ***** | Notes | ***** |
|-----------------------|---------------|----------------------|-----------------------|------------|-------------------------|-----------------|----------------|------------|-------|-------|
| 36 to 38 | 21.89 | 1.049 120.0 | E T | 2.0 5.0 | 6.250 7.000 | 17.052 0.0 | | | | |
| | | 0.1537 | | 0.0 | 13.250 | 2.037 | | Vel = | 8.13 | |
| 38 to 40 | 23.47 | 1.38 120.0 | T | 6.0 0.0 | 6.000 6.000 | 19.089 0.0 | | | | |
| | 45.36 | 0.1558 | | 0.0 | 12.000 | 1.869 | | Vel = | 9.73 | |
| 40 to 42 | 24.66 | 1.38 120.0 | T | 6.0 0.0 | 6.000 6.000 | 20.958 0.0 | | | | |
| | 70.02 | 0.3476 | | 0.0 | 12.000 | 4.171 | | Vel = | 15.02 | |
| 42 to 45 | 27.14 | 1.61 120.0 | T | 8.0 0.0 | 0.208 8.000 | 25.129 0.866 | | | | |
| | 97.16 | 0.3008 | | 0.0 | 8.208 | 2.469 | | Vel = | 15.31 | |
| | 0.0 97.16 | | | | | | 28.464 | K Factor = | 18.21 | |
| 44 to 45 | 27.49 | 1.049 120.0 | | 0.0 0.0 | 5.792 0.0 | 26.240 0.866 | | | | |
| | 27.49 | 0.2345 | | 0.0 | 5.792 | 1.358 | | Vel = | 10.21 | |
| 45 to 46 | 97.16 | 1.61 120.0 | | 0.0 0.0 | 2.000 0.0 | 28.464 0.0 | | | | |
| | 124.65 | 0.4770 | | 0.0 | 2.000 | 0.954 | | Vel = | 19.64 | |
| | 0.0 124.65 | | | | | | 29.418 | K Factor = | 22.98 | |
| 48 to 49 | 27.54 | 1.049 120.0 | E | 2.0 0.0 | 2.500 2.000 | 24.185 1.083 | | K Factor = | 5.60 | |
| | 27.54 | 0.2351 | | 0.0 | 4.500 | 1.058 | | Vel = | 10.22 | |
| | 0.0 27.54 | | | | | | 26.326 | K Factor = | 5.37 | |
| 50 to 51 | 28.15 | 1.049 120.0 | E | 2.0 0.0 | 2.500 2.000 | 25.268 1.083 | | K Factor = | 5.60 | |
| | 28.15 | 0.2449 | | 0.0 | 4.500 | 1.102 | | Vel = | 10.45 | |
| | 0.0 28.15 | | | | | | 27.453 | K Factor = | 5.37 | |
| 49 to 52 | 27.54 | 1.049 120.0 | T | 5.0 0.0 | 2.958 5.000 | 26.326 0.866 | | | | |
| | 27.54 | 0.2352 | | 0.0 | 7.958 | 1.872 | | Vel = | 10.22 | |
| | 0.0 27.54 | | | | | | 29.064 | K Factor = | 5.11 | |
| 51 to 52 | 28.15 | 1.049 120.0 | | 0.0 0.0 | 3.042 0.0 | 27.453 0.866 | | | | |
| | 28.15 | 0.2449 | | 0.0 | 3.042 | 0.745 | | Vel = | 10.45 | |
| 52 to 53 | 27.54 | 1.38 120.0 | T | 6.0 0.0 | 2.000 6.000 | 29.064 0.0 | | | | |
| | 55.69 | 0.2276 | | 0.0 | 8.000 | 1.821 | | Vel = | 11.95 | |
| 53 to 54 | 0.0 | 2.067 120.0 | | 0.0 0.0 | 5.354 0.0 | 30.885 0.0 | | | | |
| | 55.69 | 0.0318 | | 0.0 | 5.354 | 0.170 | | Vel = | 5.32 | |
| | 0.0 | | | | | | | | | |

Final Calculations - Hazen-Williams

Dean and Allyn, Inc.
Unum

Page 10
Date 11-28-2017

| Hyd. Ref. Point | Qa Qt | Dia. "C" Pf/Ft | Fitting or Eqv. Ln. | Pipe Ftng's Total | Pt Pe Pf | Pt Pv Pn | ***** | Notes | ***** |
|-----------------|---------------|----------------|----------------------|-------------------|------------------|----------|-------|------------------|-------|
| | 55.69 | | | | | 31.055 | | K Factor = 9.99 | |
| 33 to 34 | 79.92 | 3.26 120.0 | I 6.72 | 6.250 6.720 | 29.180 0.0 | | | | |
| | 79.92 | 0.0067 | | 12.970 | 0.087 | | | Vel = 3.07 | |
| 34 to 46 | 0.0 | 3.26 120.0 | Y 20.831 | 1.510 20.831 | 29.267 0.0 | | | | |
| | 79.92 | 0.0068 | | 22.341 | 0.151 | | | Vel = 3.07 | |
| 46 to 47 | 124.64 | 3.26 120.0 | J 17.471 | 3.698 17.471 | 29.418 0.0 | | | | |
| | 204.56 | 0.0384 | | 21.169 | 0.813 | | | Vel = 7.86 | |
| | 0.0 204.56 | | | | | 30.231 | | K Factor = 37.20 | |
| 10 to 21 | 87.15 | 4.26 120.0 | J 21.067 | 7.792 21.067 | 29.983 0.0 | | | | |
| | 87.15 | 0.0021 | | 28.859 | 0.062 | | | Vel = 1.96 | |
| 21 to 47 | 73.83 | 4.26 120.0 | J 21.067 | 6.667 21.067 | 30.045 0.0 | | | | |
| | 160.98 | 0.0067 | | 27.734 | 0.186 | | | Vel = 3.62 | |
| 47 to 54 | 204.56 | 4.26 120.0 | J 21.067 | 5.917 21.067 | 30.231 0.0 | | | | |
| | 365.54 | 0.0305 | | 26.984 | 0.824 | | | Vel = 8.23 | |
| 54 to 55 | 55.69 | 4.26 120.0 | G 2.633 E 13.167 | 9.167 15.800 | 31.055 11.604 | | | | |
| | 421.23 | 0.0397 | | 24.967 | 0.991 | | | Vel = 9.48 | |
| | 0.0 421.23 | | | | | 43.650 | | K Factor = 63.76 | |
| 55 to 56 | 421.23 | 5.295 120.0 | I 10.737 J 26.526 | 53.583 37.263 | 43.650 0.0 | | | | |
| | 421.23 | 0.0138 | | 90.846 | 1.250 | | | Vel = 6.14 | |
| 56 to 57 | 0.0 | 5.295 120.0 | I 10.737 | 128.583 10.737 | 44.900 0.0 | | | | |
| | 421.23 | 0.0138 | | 139.320 | 1.918 | | | Vel = 6.14 | |
| 57 to 58 | 0.0 | 5.295 120.0 | I 10.737 | 86.708 10.737 | 46.818 0.0 | | | | |
| | 421.23 | 0.0138 | | 97.445 | 1.341 | | | Vel = 6.14 | |
| 58 to 59 | 0.0 | 5.295 120.0 | I 10.737 | 117.625 10.737 | 48.159 0.0 | | | | |
| | 421.23 | 0.0138 | | 128.362 | 1.767 | | | Vel = 6.14 | |
| 59 to 60 | 0.0 | 5.295 120.0 | I 10.737 | 19.250 10.737 | 49.926 0.198 | | | | |
| | 421.23 | 0.0138 | | 29.987 | 0.414 | | | Vel = 6.14 | |
| 60 to 61 | 0.0 | 5.295 120.0 | I 10.737 | 0.542 10.737 | 50.538 0.0 | | | | |
| | 421.23 | 0.0137 | | 11.279 | 0.155 | | | Vel = 6.14 | |
| 61 to 62 | 0.0 | 5.295 120.0 | I 10.737 | 10.208 10.737 | 50.693 0.0 | | | | |
| | 421.23 | 0.0138 | | 20.945 | 0.288 | | | Vel = 6.14 | |
| 62 to TR | 0.0 | 5.295 120.0 | I 10.737 | 9.667 10.737 | 50.981 4.151 | | | | |
| | 421.23 | 0.0138 | | 20.404 | 0.281 | | | Vel = 6.14 | |

Final Calculations - Hazen-Williams

Dean and Allyn, Inc.
Unum

Page 11
Date 11-28-2017

| Hyd. Ref. Point | Qa Qt | Dia. "C" Pf/Ft | Fitting or Eqv. Ln. | Pipe Ftng's Total | Pt Pe Pf | Pt Pv Pn | ***** | Notes | ***** |
|-----------------------|----------|----------------------|---------------------------|-------------------------|----------------|----------------|------------------|-------|-------|
| TR | 0.0 | 4.26 | G 2.633 | 9.583 | 55.413 | | | | |
| to | | 120.0 | A 22.384 | 38.184 | 0.0 | | | | |
| BR | 421.23 | 0.0397 | E 13.167 | 47.767 | 1.896 | | Vel = 9.48 | | |
| BR | 0.0 | 4.26 | J 21.067 | 8.021 | 57.309 | | | | |
| to | | 120.0 | Eq 5.267 | 26.334 | 3.988 | | | | |
| MAN | 421.23 | 0.0397 | 0.0 | 34.355 | 1.364 | | Vel = 9.48 | | |
| MAN | 0.0 | 6.16 | E 20.084 | 9.208 | 62.661 | | | | |
| to | | 140.0 | 0.0 | 20.084 | 0.0 | | | | |
| UG | 421.23 | 0.0050 | 0.0 | 29.292 | 0.145 | | Vel = 4.53 | | |
| UG | 0.0 | 6.16 | F 10.042 | 7.000 | 62.806 | | | | |
| to | | 140.0 | 0.0 | 10.042 | 0.0 | | | | |
| UG1 | 421.23 | 0.0049 | 0.0 | 17.042 | 0.084 | | Vel = 4.53 | | |
| UG1 | 0.0 | 6.16 | E 20.084 | 14.458 | 62.890 | | | | |
| to | | 140.0 | 0.0 | 20.084 | 0.0 | | | | |
| UG2 | 421.23 | 0.0050 | 0.0 | 34.542 | 0.172 | | Vel = 4.53 | | |
| UG2 | 0.0 | 8.27 | F 14.234 | 136.292 | 63.062 | | | | |
| to | | 140.0 | 0.0 | 14.234 | -8.662 | | | | |
| UG3 | 421.23 | 0.0012 | 0.0 | 150.526 | 0.177 | | Vel = 2.52 | | |
| UG3 | 0.0 | 8.27 | T 55.354 | 161.542 | 54.577 | | | | |
| to | | 140.0 | 0.0 | 55.354 | 5.197 | | | | |
| TEST | 421.23 | 0.0012 | 0.0 | 216.896 | 0.256 | | Vel = 2.52 | | |
| | 100.00 | | | | | | Qa = 100.00 | | |
| | 521.23 | | | | 60.030 | | K Factor = 67.27 | | |