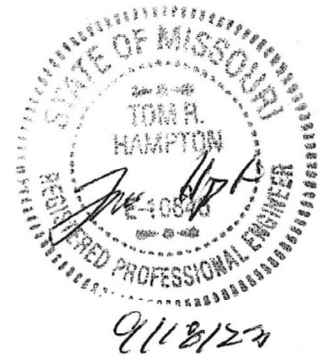




## Hydraulic Calculations by HydraCALC

PERFORMANCE FIRE SYSTEMS  
11425 W 59TH STREET SOUTH  
SAND SPRINGS, OK 74063  
(918) 630-7344

Job Name : Lakeview Storage  
Drawing : FP 4 of 5  
Location : Lee's Summit, Missouri  
Remote Area : 2  
Contract : LS-01-23  
Data File : Lakeview Storage - Fire Submit Area 2.WXF

---

**HYDRAULIC CALCULATIONS**  
**for**

**JOB NAME** Lakeview Storage  
**Location** Lee's Summit, Missouri  
**Drawing #** FP 4 of 5  
**Contract #** LS-01-23  
**Date** 9/10/2023

**DESIGN**

**Remote area #** 2  
**Remote area location** LEVEL 2 - AREA 2  
**Occupancy classification** ORDINARY HAZARD GROUP II  
**Density** 0.2 - Gpm/SqFt  
**Area of application** 1557 - SqFt  
**Coverage/sprinkler** VARIES - SqFt  
**Type of sprinkler calculated** STANDARD RESPONSE AND SR EC  
**# Sprinklers calculated** 12  
**In-rack demand** N/A - GPM  
**Hose streams** 250 - GPM  
**Total water required (including hose streams)** 667.229 - GPM @ 73.4098 - Psi  
**Type of system** WET  
**Volume of system (dry or pre-action)** N/A - Gal

**WATER SUPPLY INFORMATION**

**Test date** 8/17/2023  
**Location** NE PORT DRIVE  
**Source of info** CITY OF LEES SUMMIT

**CONTRACTOR INFO** PERFORMANCE FIRE SYSTEMS  
**Address** 11425 W 59TH STREET SOUTH / SAND SPRINGS, OK 74063  
**Phone #** (918) 630-7344  
**Name of designer** XSTREAM FIRE SYSTEMS  
**Authority having jurisdiction** LOCAL  
**NOTES:**

text1(35) - invisible

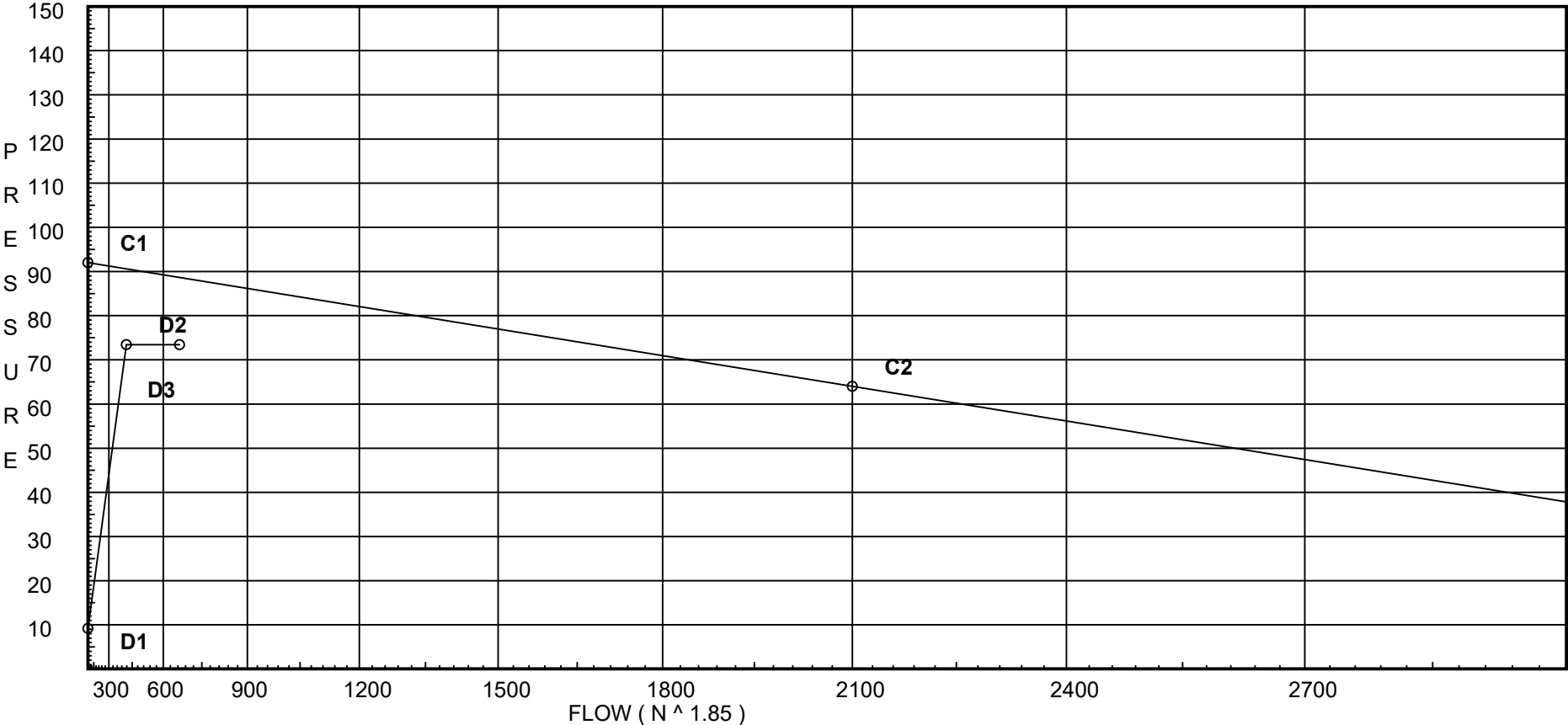
# Water Supply Curve

PERFORMANCE FIRE SYSTEMS  
Lakeview Storage

Page 2  
Date 9/10/2023

City Water Supply:  
C1 - Static Pressure : 92  
C2 - Residual Pressure: 64  
C2 - Residual Flow : 2100

Demand:  
D1 - Elevation : 9.186  
D2 - System Flow : 417.229  
D2 - System Pressure : 73.410  
Hose ( Demand ) : 250  
D3 - System Demand : 667.229  
Safety Margin : 15.233



# Fittings Used Summary

PERFORMANCE FIRE SYSTEMS  
Lakeview Storage

Page 3  
Date 9/10/2023

## 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  |
|---------|----------------------------|----------------------------------------------|-----|---|-------|-------|-----|-------|----|-------|-----|-----|----|----|-----|-----|----|----|----|-----|-----|
| Bvca    | B Fly Vic 705              |                                              |     |   |       |       | 6   | 6     | 7  |       | 8   | 12  | 14 | 16 | 18  | 19  |    |    |    |     |     |
| 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  |
| Fsp     | Flow Switch Potter VSR     | Fitting generates a Fixed Loss Based on Flow |     |   |       |       |     |       |    |       |     |     |    |    |     |     |    |    |    |     |     |
| 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  |
| S       | NFPA 13 Swing Check        | 0                                            | 0   | 5 | 7     | 9     | 11  | 14    | 16 | 19    | 22  | 27  | 32 | 45 | 55  | 65  |    |    |    |     |     |
| 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 |
| V       | 90' Ell Firelock #001      | 0                                            | 0   | 0 | 0     | 0     | 3.5 | 4.3   | 5  | 0     | 6.8 | 8.5 | 10 | 13 | 4.5 | 5.1 | 0  | 0  | 0  | 0   | 0   |
| X       | 90'Tee-BranchFirelock002   | 0                                            | 0   | 0 | 0     | 0     | 8.5 | 10.8  | 13 | 0     | 16  | 21  | 25 | 33 | 9.3 | 11  | 0  | 0  | 0  | 0   | 0   |
| Zfb     | Febco 850                  | 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.

# Flow Summary - NFPA

PERFORMANCE FIRE SYSTEMS  
Lakeview Storage

Page 4  
Date 9/10/2023

## SUPPLY ANALYSIS

| <i>Node at Source</i> | <i>Static Pressure</i> | <i>Residual Pressure</i> | <i>Flow</i> | <i>Available Pressure</i> | <i>Total Demand</i> | <i>Required Pressure</i> |
|-----------------------|------------------------|--------------------------|-------------|---------------------------|---------------------|--------------------------|
| TEST                  | 92.0                   | 64                       | 2100.0      | 88.643                    | 667.23              | 73.41                    |

## NODE ANALYSIS

| <i>Node Tag</i> | <i>Elevation</i> | <i>Node Type</i> | <i>Pressure at Node</i> | <i>Discharge at Node</i> | <i>Notes</i> |       |
|-----------------|------------------|------------------|-------------------------|--------------------------|--------------|-------|
| 200             | 21.21            | 5.6              | 18.89                   | 24.34                    | 0.2          | 121.7 |
| 201             | 21.21            | 5.6              | 18.99                   | 24.4                     | 0.2          | 121.7 |
| 202             | 21.21            | 5.6              | 19.8                    | 24.92                    | 0.2          | 121.7 |
| 203             | 21.21            |                  | 24.53                   |                          |              |       |
| 204             | 21.21            |                  | 26.54                   |                          |              |       |
| 205             | 21.21            |                  | 31.68                   |                          |              |       |
| 206             | 21.21            |                  | 32.38                   |                          |              |       |
| 207             | 21.21            |                  | 33.41                   |                          |              |       |
| 208             | 21.21            |                  | 34.65                   |                          |              |       |
| 209             | 21.21            |                  | 35.74                   |                          |              |       |
| 210             | 21.21            |                  | 36.73                   |                          |              |       |
| 211             | 21.21            |                  | 37.65                   |                          |              |       |
| 212             | 21.21            |                  | 38.53                   |                          |              |       |
| 213             | 21.21            |                  | 39.38                   |                          |              |       |
| 214             | 21.21            |                  | 40.22                   |                          |              |       |
| 215             | 21.21            |                  | 41.04                   |                          |              |       |
| 216             | 21.21            |                  | 41.85                   |                          |              |       |
| 217             | 21.21            |                  | 42.61                   |                          |              |       |
| 218             | 21.21            |                  | 43.32                   |                          |              |       |
| 219             | 21.21            |                  | 43.94                   |                          |              |       |
| 220             | 21.21            |                  | 44.46                   |                          |              |       |
| 221             | 21.21            |                  | 44.82                   |                          |              |       |
| 222             | 21.21            |                  | 45.47                   |                          |              |       |
| 223             | 21.21            |                  | 45.64                   |                          |              |       |
| 224             | 21.21            |                  | 45.66                   |                          |              |       |
| 225             | 21.21            |                  | 46.9                    |                          |              |       |
| 226             | 21.21            |                  | 49.02                   |                          |              |       |
| 227             | 21.21            |                  | 50.92                   |                          |              |       |
| 228             | 21.21            |                  | 52.44                   |                          |              |       |
| 229             | 21.21            |                  | 52.44                   |                          |              |       |
| 230             | 21.21            |                  | 52.47                   |                          |              |       |
| TR2             | 10.5             |                  | 60.46                   |                          |              |       |
| BR2             | 2.5              |                  | 68.46                   |                          |              |       |
| UG1             | -4.0             |                  | 71.51                   |                          |              |       |
| TEST            | 0.0              |                  | 73.41                   | 250.0                    |              |       |
| 232             | 21.21            | 5.6              | 18.99                   | 24.4                     | 0.1          | 130   |
| 233             | 21.21            | 5.6              | 20.04                   | 25.07                    | 0.2          | 121.7 |
| 234             | 21.21            |                  | 32.06                   |                          |              |       |
| 235             | 21.21            |                  | 32.54                   |                          |              |       |
| 236             | 21.21            |                  | 32.94                   |                          |              |       |
| 237             | 21.21            |                  | 33.94                   |                          |              |       |
| 238             | 21.21            |                  | 34.18                   |                          |              |       |

# Flow Summary - NFPA

PERFORMANCE FIRE SYSTEMS  
Lakeview Storage

Page 5  
Date 9/10/2023

## NODE ANALYSIS (cont.)

| <i>Node Tag</i> | <i>Elevation</i> | <i>Node Type</i> | <i>Pressure<br/>at Node</i> | <i>Discharge<br/>at Node</i> | <i>Notes</i> |     |
|-----------------|------------------|------------------|-----------------------------|------------------------------|--------------|-----|
| 239             | 21.21            |                  | 34.65                       |                              |              |     |
| 240             | 21.21            |                  | 35.37                       |                              |              |     |
| 241             | 21.21            |                  | 36.13                       |                              |              |     |
| 242             | 21.21            |                  | 36.92                       |                              |              |     |
| 243             | 21.21            |                  | 37.73                       |                              |              |     |
| 244             | 21.21            |                  | 38.56                       |                              |              |     |
| 245             | 21.21            |                  | 39.39                       |                              |              |     |
| 246             | 21.21            |                  | 40.23                       |                              |              |     |
| 247             | 21.21            |                  | 41.07                       |                              |              |     |
| 248             | 21.21            |                  | 41.92                       |                              |              |     |
| 249             | 21.21            |                  | 42.79                       |                              |              |     |
| 250             | 21.21            |                  | 43.67                       |                              |              |     |
| 251             | 21.21            |                  | 44.59                       |                              |              |     |
| 252             | 21.21            |                  | 45.55                       |                              |              |     |
| 253             | 21.21            |                  | 46.57                       |                              |              |     |
| 254             | 21.21            |                  | 47.67                       |                              |              |     |
| 255             | 21.21            |                  | 49.1                        |                              |              |     |
| 256             | 21.21            |                  | 23.69                       |                              |              |     |
| 257             | 21.21            | 11.2             | 21.96                       | 52.49                        | 0.2          | 256 |
| 258             | 21.21            | 11.2             | 21.83                       | 52.33                        | 0.2          | 256 |
| 259             | 21.21            | 11.2             | 21.85                       | 52.35                        | 0.2          | 256 |
| 260             | 21.21            | 5.6              | 22.13                       | 26.34                        | 0.1          | 130 |
| 261             | 21.21            | 11.2             | 22.92                       | 53.62                        | 0.2          | 256 |
| 262             | 21.21            |                  | 31.79                       |                              |              |     |
| 263             | 21.21            | 5.6              | 25.86                       | 28.47                        | 0.2          | 130 |
| 264             | 21.21            | 5.6              | 25.9                        | 28.5                         | 0.2          | 130 |

# Final Calculations : Hazen-Williams

PERFORMANCE FIRE SYSTEMS  
Lakeview Storage

Page 6  
Date 9/10/2023

| Node1<br>to<br>Node2 | Elev1<br>Elev2 | K<br>Fact | Qa<br>Qt | Nom<br>Act | Fitting<br>or<br>Equiv | Len    | Pipe<br>Ftngs<br>Total | CFact<br>Pf/Ft | Pt<br>Pe<br>Pf | ***** | Notes | ***** |
|----------------------|----------------|-----------|----------|------------|------------------------|--------|------------------------|----------------|----------------|-------|-------|-------|
| 200<br>to<br>201     | 21.21<br>21.21 | 5.60      | 11.39    | 1.25       |                        |        | 10.000                 | 120            | 18.891<br>0.0  |       |       |       |
|                      |                |           | 11.39    | 1.442      |                        |        | 10.000                 | 0.0098         | 0.098          | Vel = | 2.24  |       |
| 201<br>to<br>202     | 21.21<br>21.21 | 5.60      | 24.40    | 1.25       |                        |        | 10.000                 | 120            | 18.989<br>0.0  |       |       |       |
|                      |                |           | 35.79    | 1.442      |                        |        | 10.000                 | 0.0811         | 0.811          | Vel = | 7.03  |       |
| 202<br>to<br>203     | 21.21<br>21.21 | 5.60      | 24.92    | 1.25       | T                      | 7.432  | 14.500<br>7.432        | 120            | 19.800<br>0.0  |       |       |       |
|                      |                |           | 60.71    | 1.442      |                        |        | 21.932                 | 0.2155         | 4.727          | Vel = | 11.93 |       |
| 203<br>to<br>204     | 21.21<br>21.21 |           | 91.28    | 2          |                        |        | 12.170                 | 120            | 24.527<br>0.0  |       |       |       |
|                      |                |           | 151.99   | 2.157      |                        |        | 12.170                 | 0.1657         | 2.016          | Vel = | 13.34 |       |
| 204<br>to<br>205     | 21.21<br>21.21 |           | 21.41    | 2          | 2E                     | 12.307 | 12.000<br>12.307       | 120            | 26.543<br>0.0  |       |       |       |
|                      |                |           | 173.4    | 2.157      |                        |        | 24.307                 | 0.2114         | 5.138          | Vel = | 15.22 |       |
| 205<br>to<br>206     | 21.21<br>21.21 |           | -16.58   | 2          |                        |        | 4.000                  | 120            | 31.681<br>0.0  |       |       |       |
|                      |                |           | 156.82   | 2.157      |                        |        | 4.000                  | 0.1755         | 0.702          | Vel = | 13.77 |       |
| 206<br>to<br>207     | 21.21<br>21.21 |           | -14.66   | 2          |                        |        | 7.000                  | 120            | 32.383<br>0.0  |       |       |       |
|                      |                |           | 142.16   | 2.157      |                        |        | 7.000                  | 0.1463         | 1.024          | Vel = | 12.48 |       |
| 207<br>to<br>208     | 21.21<br>21.21 |           | -11.98   | 2          |                        |        | 10.000                 | 120            | 33.407<br>0.0  |       |       |       |
|                      |                |           | 130.18   | 2.157      |                        |        | 10.000                 | 0.1244         | 1.244          | Vel = | 11.43 |       |
| 208<br>to<br>209     | 21.21<br>21.21 |           | -8.90    | 2          |                        |        | 10.000                 | 120            | 34.651<br>0.0  |       |       |       |
|                      |                |           | 121.28   | 2.157      |                        |        | 10.000                 | 0.1091         | 1.091          | Vel = | 10.65 |       |
| 209<br>to<br>210     | 21.21<br>21.21 |           | -6.38    | 2          |                        |        | 10.000                 | 120            | 35.742<br>0.0  |       |       |       |
|                      |                |           | 114.9    | 2.157      |                        |        | 10.000                 | 0.0987         | 0.987          | Vel = | 10.09 |       |
| 210<br>to<br>211     | 21.21<br>21.21 |           | -4.34    | 2          |                        |        | 10.000                 | 120            | 36.729<br>0.0  |       |       |       |
|                      |                |           | 110.56   | 2.157      |                        |        | 10.000                 | 0.0920         | 0.920          | Vel = | 9.71  |       |
| 211<br>to<br>212     | 21.21<br>21.21 |           | -2.76    | 2          |                        |        | 10.000                 | 120            | 37.649<br>0.0  |       |       |       |
|                      |                |           | 107.8    | 2.157      |                        |        | 10.000                 | 0.0877         | 0.877          | Vel = | 9.46  |       |
| 212<br>to<br>213     | 21.21<br>21.21 |           | -1.62    | 2          |                        |        | 10.000                 | 120            | 38.526<br>0.0  |       |       |       |
|                      |                |           | 106.18   | 2.157      |                        |        | 10.000                 | 0.0853         | 0.853          | Vel = | 9.32  |       |
| 213<br>to<br>214     | 21.21<br>21.21 |           | -0.96    | 2          |                        |        | 10.000                 | 120            | 39.379<br>0.0  |       |       |       |
|                      |                |           | 105.22   | 2.157      |                        |        | 10.000                 | 0.0839         | 0.839          | Vel = | 9.24  |       |
| 214<br>to<br>215     | 21.21<br>21.21 |           | -0.93    | 2          |                        |        | 10.000                 | 120            | 40.218<br>0.0  |       |       |       |
|                      |                |           | 104.29   | 2.157      |                        |        | 10.000                 | 0.0825         | 0.825          | Vel = | 9.16  |       |
| 215<br>to<br>216     | 21.21<br>21.21 |           | -1.56    | 2          |                        |        | 10.000                 | 120            | 41.043<br>0.0  |       |       |       |
|                      |                |           | 102.73   | 2.157      |                        |        | 10.000                 | 0.0803         | 0.803          | Vel = | 9.02  |       |

# Final Calculations : Hazen-Williams

PERFORMANCE FIRE SYSTEMS  
Lakeview Storage

Page 7  
Date 9/10/2023

| Node1<br>to<br>Node2 | Elev1<br>Elev2 | K<br>Fact | Qa<br>Qt         | Nom<br>Act    | Fitting<br>or<br>Eqiv | Len                     | Pipe<br>Ftngs<br>Total     | CFact<br>Pf/Ft | Pt<br>Pe<br>Pf           | ***** | Notes             | ***** |
|----------------------|----------------|-----------|------------------|---------------|-----------------------|-------------------------|----------------------------|----------------|--------------------------|-------|-------------------|-------|
| 216<br>to<br>217     | 21.21<br>21.21 |           | -2.68<br>100.05  | 2<br>2.157    |                       |                         | 10.000<br>10.000           | 120<br>0.0764  | 41.846<br>0.0<br>0.764   |       |                   |       |
|                      |                |           |                  |               |                       |                         |                            |                |                          | Vel = | 8.78              |       |
| 217<br>to<br>218     | 21.21<br>21.21 |           | -4.18<br>95.87   | 2<br>2.157    |                       |                         | 10.000<br>10.000           | 120<br>0.0706  | 42.610<br>0.0<br>0.706   |       |                   |       |
|                      |                |           |                  |               |                       |                         |                            |                |                          | Vel = | 8.42              |       |
| 218<br>to<br>219     | 21.21<br>21.21 |           | -6.11<br>89.76   | 2<br>2.157    |                       |                         | 10.000<br>10.000           | 120<br>0.0625  | 43.316<br>0.0<br>0.625   |       |                   |       |
|                      |                |           |                  |               |                       |                         |                            |                |                          | Vel = | 7.88              |       |
| 219<br>to<br>220     | 21.21<br>21.21 |           | -8.44<br>81.32   | 2<br>2.157    |                       |                         | 10.000<br>10.000           | 120<br>0.0521  | 43.941<br>0.0<br>0.521   |       |                   |       |
|                      |                |           |                  |               |                       |                         |                            |                |                          | Vel = | 7.14              |       |
| 220<br>to<br>221     | 21.21<br>21.21 |           | -11.17<br>70.15  | 2<br>2.157    |                       |                         | 9.000<br>9.000             | 120<br>0.0396  | 44.462<br>0.0<br>0.356   |       |                   |       |
|                      |                |           |                  |               |                       |                         |                            |                |                          | Vel = | 6.16              |       |
| 221<br>to<br>222     | 21.21<br>21.21 |           | -13.91<br>56.24  | 2<br>2.157    | 2E                    | 12.307                  | 12.500<br>12.307<br>24.807 | 120<br>0.0264  | 44.818<br>0.0<br>0.654   |       |                   |       |
|                      |                |           |                  |               |                       |                         |                            |                |                          | Vel = | 4.94              |       |
| 222<br>to<br>223     | 21.21<br>21.21 |           | -16.44<br>39.8   | 2<br>2.157    |                       |                         | 12.000<br>12.000           | 120<br>0.0138  | 45.472<br>0.0<br>0.166   |       |                   |       |
|                      |                |           |                  |               |                       |                         |                            |                |                          | Vel = | 3.49              |       |
| 223<br>to<br>224     | 21.21<br>21.21 |           | -22.60<br>17.2   | 2<br>2.157    |                       |                         | 8.000<br>8.000             | 120<br>0.0030  | 45.638<br>0.0<br>0.024   |       |                   |       |
|                      |                |           |                  |               |                       |                         |                            |                |                          | Vel = | 1.51              |       |
| 224<br>to<br>225     | 21.21<br>21.21 |           | 0.0<br>17.2      | 1.25<br>1.442 | 3T                    | 22.296                  | 37.000<br>22.296<br>59.296 | 120<br>0.0209  | 45.662<br>0.0<br>1.239   |       |                   |       |
|                      |                |           |                  |               |                       |                         |                            |                |                          | Vel = | 3.38              |       |
| 225<br>to<br>226     | 21.21<br>21.21 |           | 22.60<br>39.8    | 1.25<br>1.442 |                       |                         | 21.500<br>21.500           | 120<br>0.0987  | 46.901<br>0.0<br>2.122   |       |                   |       |
|                      |                |           |                  |               |                       |                         |                            |                |                          | Vel = | 7.82              |       |
| 226<br>to<br>227     | 21.21<br>21.21 |           | -3.95<br>35.85   | 1.25<br>1.442 | 2T                    | 14.864                  | 8.500<br>14.864<br>23.364  | 120<br>0.0814  | 49.023<br>0.0<br>1.901   |       |                   |       |
|                      |                |           |                  |               |                       |                         |                            |                |                          | Vel = | 7.04              |       |
| 227<br>to<br>228     | 21.21<br>21.21 |           | -19.70<br>16.15  | 1.25<br>1.442 | 3T                    | 22.296                  | 59.000<br>22.296<br>81.296 | 120<br>0.0186  | 50.924<br>0.0<br>1.512   |       |                   |       |
|                      |                |           |                  |               |                       |                         |                            |                |                          | Vel = | 3.17              |       |
| 228<br>to<br>229     | 21.21<br>21.21 |           | 0.0<br>16.15     | 3<br>3.26     |                       |                         | 10.000<br>10.000           | 120<br>0.0004  | 52.436<br>0.0<br>0.004   |       |                   |       |
|                      |                |           |                  |               |                       |                         |                            |                |                          | Vel = | 0.62              |       |
| 229<br>to<br>230     | 21.21<br>21.21 |           | 19.70<br>35.85   | 3<br>3.26     | X                     | 17.471                  | 0.960<br>17.471<br>18.431  | 120<br>0.0015  | 52.440<br>0.0<br>0.028   |       |                   |       |
|                      |                |           |                  |               |                       |                         |                            |                |                          | Vel = | 1.38              |       |
| 230<br>to<br>TR2     | 21.21<br>10.5  |           | 381.38<br>417.23 | 4<br>4.26     | 5V                    | 44.768                  | 41.090<br>44.768<br>85.858 | 120<br>0.0390  | 52.468<br>4.638<br>3.350 |       |                   |       |
|                      |                |           |                  |               |                       |                         |                            |                |                          | Vel = | 9.39              |       |
| TR2<br>to<br>BR2     | 10.5<br>2.5    |           | 0.0<br>417.23    | 4<br>4.26     | X<br>Bvca<br>Fsp      | 21.067<br>10.534<br>0.0 | 8.000<br>31.601<br>39.601  | 120<br>0.0390  | 60.456<br>6.465<br>1.544 |       | ** Fixed Loss = 3 |       |
|                      |                |           |                  |               |                       |                         |                            |                |                          | Vel = | 9.39              |       |



# Final Calculations : Hazen-Williams

PERFORMANCE FIRE SYSTEMS  
Lakeview Storage

Page 8  
Date 9/10/2023

| Node1<br>to<br>Node2 | Elev1<br>Elev2 | K<br>Fact | Qa<br>Qt         | Nom<br>Act    | Fitting<br>or<br>Equiv<br>Len | Pipe<br>Ftngs<br>Total             | CFact<br>Pf/Ft | Pt<br>Pe<br>Pf           | ***** | Notes                                | ***** |
|----------------------|----------------|-----------|------------------|---------------|-------------------------------|------------------------------------|----------------|--------------------------|-------|--------------------------------------|-------|
| BR2<br>to<br>UG1     | 2.5<br>-4      |           | 0.0<br>417.23    | 6<br>6.357    | X                             | 31.433<br>31.433<br>40.893         | 120<br>0.0056  | 68.465<br>2.815<br>0.227 |       |                                      |       |
| UG1<br>to<br>TEST    | -4<br>0        |           | 0.0<br>417.23    | 6<br>6.09     | 2E<br>Zfb<br>2G<br>S          | 43.166<br>0.0<br>9.25<br>49.333    | 150<br>0.0045  | 71.507<br>1.007<br>0.896 |       | * * Fixed Loss = 2.739<br>Vel = 4.60 |       |
| TEST                 |                |           | 250.00<br>667.23 |               |                               |                                    |                | 73.410                   |       | Qa = 250.00<br>K Factor = 77.87      |       |
| 200<br>to<br>232     | 21.21<br>21.21 |           | 12.95<br>12.95   | 1.25<br>1.442 |                               | 8.000<br>8.000                     | 120<br>0.0124  | 18.891<br>0.0<br>0.099   |       | Vel = 2.54                           |       |
| 232<br>to<br>233     | 21.21<br>21.21 | 5.60      | 24.40            | 1.25          |                               | 12.000                             | 120            | 18.990<br>0.0            |       | Vel = 7.34                           |       |
| 233<br>to<br>234     | 21.21<br>21.21 | 5.60      | 25.08            | 1.25          | T                             | 7.432<br>45.500<br>7.432<br>52.932 | 120            | 20.044<br>0.0            |       | Vel = 12.26                          |       |
| 234<br>to<br>235     | 21.21<br>21.21 |           | 145.84           | 3             |                               | 12.170                             | 120            | 32.056<br>0.0            |       | Vel = 8.01                           |       |
| 235<br>to<br>236     | 21.21<br>21.21 |           | 208.27           | 3.26          |                               | 12.170                             | 0.0397         | 0.483                    |       | Vel = 9.37                           |       |
| 236<br>to<br>237     | 21.21<br>21.21 |           | 35.56            | 3             |                               | 7.500                              | 120            | 32.539<br>0.0            |       | Vel = 9.37                           |       |
| 237<br>to<br>238     | 21.21<br>21.21 |           | 243.83           | 3.26          | 2V                            | 13.44<br>5.500<br>13.440<br>18.940 | 120            | 32.938<br>0.0            |       | Vel = 9.37                           |       |
| 238<br>to<br>239     | 21.21<br>21.21 |           | 16.58            | 3             |                               | 4.000                              | 120            | 33.944<br>0.0            |       | Vel = 10.01                          |       |
| 239<br>to<br>240     | 21.21<br>21.21 |           | 260.41           | 3.26          |                               | 4.000                              | 0.0600         | 0.240                    |       | Vel = 10.57                          |       |
| 240<br>to<br>241     | 21.21<br>21.21 |           | 14.65            | 3             |                               | 7.000                              | 120            | 34.184<br>0.0            |       | Vel = 11.03                          |       |
| 241<br>to<br>242     | 21.21<br>21.21 |           | 275.06           | 3.26          |                               | 7.000                              | 0.0664         | 0.465                    |       | Vel = 11.38                          |       |
| 242<br>to<br>243     | 21.21<br>21.21 |           | 11.99            | 3             |                               | 10.000                             | 120            | 34.649<br>0.0            |       | Vel = 11.62                          |       |
| 243<br>to<br>244     | 21.21<br>21.21 |           | 287.05           | 3.26          |                               | 10.000                             | 0.0719         | 0.719                    |       | Vel = 11.79                          |       |
|                      |                |           | 8.90             | 3             |                               | 10.000                             | 120            | 35.368<br>0.0            |       | Vel = 11.89                          |       |
|                      |                |           | 295.95           | 3.26          |                               | 10.000                             | 0.0760         | 0.760                    |       |                                      |       |
|                      |                |           | 6.37             | 3             |                               | 10.000                             | 120            | 36.128<br>0.0            |       |                                      |       |
|                      |                |           | 302.32           | 3.26          |                               | 10.000                             | 0.0791         | 0.791                    |       |                                      |       |
|                      |                |           | 4.35             | 3             |                               | 10.000                             | 120            | 36.919<br>0.0            |       |                                      |       |
|                      |                |           | 306.67           | 3.26          |                               | 10.000                             | 0.0812         | 0.812                    |       |                                      |       |
|                      |                |           | 2.76             | 3             |                               | 10.000                             | 120            | 37.731<br>0.0            |       |                                      |       |
|                      |                |           | 309.43           | 3.26          |                               | 10.000                             | 0.0826         | 0.826                    |       |                                      |       |

# Final Calculations : Hazen-Williams

PERFORMANCE FIRE SYSTEMS  
Lakeview Storage

Page 9  
Date 9/10/2023

| Node1<br>to<br>Node2 | Elev1<br>Elev2 | K<br>Fact | Qa<br>Qt         | Nom<br>Act | Fitting<br>or<br>Equiv<br>Len | Pipe<br>Ftngs<br>Total     | CFact<br>Pf/Ft | Pt<br>Pe<br>Pf          | ***** | Notes            | ***** |
|----------------------|----------------|-----------|------------------|------------|-------------------------------|----------------------------|----------------|-------------------------|-------|------------------|-------|
| 244<br>to<br>245     | 21.21<br>21.21 |           | 1.62<br>311.05   | 3<br>3.26  |                               | 10.000<br>10.000           | 120<br>0.0833  | 38.557<br>0.0<br>0.833  |       |                  |       |
| 245<br>to<br>246     | 21.21<br>21.21 |           | 0.95<br>312.0    | 3<br>3.26  |                               | 10.000<br>10.000           | 120<br>0.0839  | 39.390<br>0.0<br>0.839  |       | Vel = 11.96      |       |
| 246<br>to<br>247     | 21.21<br>21.21 |           | 0.94<br>312.94   | 3<br>3.26  |                               | 10.000<br>10.000           | 120<br>0.0843  | 40.229<br>0.0<br>0.843  |       | Vel = 11.99      |       |
| 247<br>to<br>248     | 21.21<br>21.21 |           | 1.56<br>314.5    | 3<br>3.26  |                               | 10.000<br>10.000           | 120<br>0.0851  | 41.072<br>0.0<br>0.851  |       | Vel = 12.03      |       |
| 248<br>to<br>249     | 21.21<br>21.21 |           | 2.68<br>317.18   | 3<br>3.26  |                               | 10.000<br>10.000           | 120<br>0.0864  | 41.923<br>0.0<br>0.864  |       | Vel = 12.09      |       |
| 249<br>to<br>250     | 21.21<br>21.21 |           | 4.18<br>321.36   | 3<br>3.26  |                               | 10.000<br>10.000           | 120<br>0.0886  | 42.787<br>0.0<br>0.886  |       | Vel = 12.19      |       |
| 250<br>to<br>251     | 21.21<br>21.21 |           | 6.11<br>327.47   | 3<br>3.26  |                               | 10.000<br>10.000           | 120<br>0.0917  | 43.673<br>0.0<br>0.917  |       | Vel = 12.35      |       |
| 251<br>to<br>252     | 21.21<br>21.21 |           | 8.44<br>335.91   | 3<br>3.26  |                               | 10.000<br>10.000           | 120<br>0.0961  | 44.590<br>0.0<br>0.961  |       | Vel = 12.59      |       |
| 252<br>to<br>253     | 21.21<br>21.21 |           | 11.17<br>347.08  | 3<br>3.26  |                               | 10.000<br>10.000           | 120<br>0.1021  | 45.551<br>0.0<br>1.021  |       | Vel = 12.91      |       |
| 253<br>to<br>254     | 21.21<br>21.21 |           | 13.91<br>360.99  | 3<br>3.26  |                               | 10.000<br>10.000           | 120<br>0.1098  | 46.572<br>0.0<br>1.098  |       | Vel = 13.34      |       |
| 254<br>to<br>255     | 21.21<br>21.21 |           | 16.43<br>377.42  | 3<br>3.26  |                               | 12.000<br>12.000           | 120<br>0.1192  | 47.670<br>0.0<br>1.431  |       | Vel = 13.88      |       |
| 255<br>to<br>230     | 21.21<br>21.21 |           | 3.96<br>381.38   | 3<br>3.26  | T 20.159                      | 7.540<br>20.159<br>27.699  | 120<br>0.1216  | 49.101<br>0.0<br>3.367  |       | Vel = 14.51      |       |
| 230                  |                |           | 0.0<br>381.38    |            |                               |                            |                | 52.468                  |       | K Factor = 52.65 |       |
| 203<br>to<br>256     | 21.21<br>21.21 |           | -91.28<br>-91.28 | 2<br>2.157 |                               | 13.000<br>13.000           | 120<br>-0.0645 | 24.527<br>0.0<br>-0.838 |       | Vel = 8.01       |       |
| 256<br>to<br>257     | 21.21<br>21.21 |           | 0.0<br>-91.28    | 2<br>2.157 | T 12.307                      | 14.500<br>12.307<br>26.807 | 120<br>-0.0645 | 23.689<br>0.0<br>-1.729 |       | Vel = 8.01       |       |
| 257<br>to<br>258     | 21.21<br>21.21 | 11.20     | 52.49<br>-38.79  | 2<br>2.157 |                               | 10.000<br>10.000           | 120<br>-0.0132 | 21.960<br>0.0<br>-0.132 |       | Vel = 3.41       |       |
| 258<br>to<br>259     | 21.21<br>21.21 | 11.20     | 52.33<br>13.54   | 2<br>2.157 |                               | 10.000<br>10.000           | 120<br>0.0019  | 21.828<br>0.0<br>0.019  |       | Vel = 1.19       |       |

# Final Calculations : Hazen-Williams

PERFORMANCE FIRE SYSTEMS  
Lakeview Storage

Page 10  
Date 9/10/2023

| Node1<br>to<br>Node2 | Elev1<br>Elev2 | K<br>Fact | Qa<br>Qt         | Nom<br>Act    | Fitting<br>or<br>Equiv | Len    | Pipe<br>Ftngs<br>Total       | CFact<br>Pf/Ft | Pt<br>Pe<br>Pf          | ***** | Notes            | ***** |
|----------------------|----------------|-----------|------------------|---------------|------------------------|--------|------------------------------|----------------|-------------------------|-------|------------------|-------|
| 259<br>to<br>260     | 21.21<br>21.21 | 11.20     | 52.35<br>65.89   | 2<br>2.157    |                        |        | 8.000<br>8.000               | 120<br>0.0352  | 21.847<br>0.0<br>0.282  |       | Vel = 5.79       |       |
| 260<br>to<br>261     | 21.21<br>21.21 | 5.60      | 26.34<br>92.23   | 2<br>2.157    |                        |        | 12.000<br>12.000             | 120<br>0.0658  | 22.129<br>0.0<br>0.789  |       | Vel = 8.10       |       |
| 261<br>to<br>262     | 21.21<br>21.21 | 11.20     | 53.61<br>145.84  | 2<br>2.157    | T                      | 12.307 | 45.500<br>12.307<br>57.807   | 120<br>0.1535  | 22.918<br>0.0<br>8.871  |       | Vel = 12.80      |       |
| 262<br>to<br>234     | 21.21<br>21.21 |           | 0.0<br>145.84    | 3<br>3.26     |                        |        | 13.000<br>13.000             | 120<br>0.0205  | 31.789<br>0.0<br>0.267  |       | Vel = 5.61       |       |
| 234                  |                |           | 0.0<br>145.84    |               |                        |        |                              |                | 32.056                  |       | K Factor = 25.76 |       |
| 204<br>to<br>263     | 21.21<br>21.21 |           | -21.42<br>-21.42 | 1.25<br>1.442 | T                      | 7.432  | 14.500<br>7.432<br>21.932    | 120<br>-0.0314 | 26.543<br>0.0<br>-0.688 |       | Vel = 4.21       |       |
| 263<br>to<br>264     | 21.21<br>21.21 | 5.60      | 28.48<br>7.06    | 1.25<br>1.442 |                        |        | 10.000<br>10.000             | 120<br>0.0040  | 25.855<br>0.0<br>0.040  |       | Vel = 1.39       |       |
| 264<br>to<br>235     | 21.21<br>21.21 | 5.60      | 28.50<br>35.56   | 1.25<br>1.442 | T                      | 7.432  | 75.500<br>7.432<br>82.932    | 120<br>0.0801  | 25.895<br>0.0<br>6.644  |       | Vel = 6.99       |       |
| 235                  |                |           | 0.0<br>35.56     |               |                        |        |                              |                | 32.539                  |       | K Factor = 6.23  |       |
| 205<br>to<br>237     | 21.21<br>21.21 |           | 16.58<br>16.58   | 1.25<br>1.442 | 2T                     | 14.864 | 101.000<br>14.864<br>115.864 | 120<br>0.0195  | 31.681<br>0.0<br>2.263  |       | Vel = 3.26       |       |
| 237                  |                |           | 0.0<br>16.58     |               |                        |        |                              |                | 33.944                  |       | K Factor = 2.85  |       |
| 206<br>to<br>238     | 21.21<br>21.21 |           | 14.66<br>14.66   | 1.25<br>1.442 | 2T                     | 14.864 | 101.000<br>14.864<br>115.864 | 120<br>0.0155  | 32.383<br>0.0<br>1.801  |       | Vel = 2.88       |       |
| 238                  |                |           | 0.0<br>14.66     |               |                        |        |                              |                | 34.184                  |       | K Factor = 2.51  |       |
| 207<br>to<br>239     | 21.21<br>21.21 |           | 11.98<br>11.98   | 1.25<br>1.442 | 2T                     | 14.864 | 101.000<br>14.864<br>115.864 | 120<br>0.0107  | 33.407<br>0.0<br>1.242  |       | Vel = 2.35       |       |
| 239                  |                |           | 0.0<br>11.98     |               |                        |        |                              |                | 34.649                  |       | K Factor = 2.04  |       |
| 208<br>to<br>240     | 21.21<br>21.21 |           | 8.90<br>8.9      | 1.25<br>1.442 | 2T                     | 14.864 | 101.000<br>14.864<br>115.864 | 120<br>0.0062  | 34.651<br>0.0<br>0.717  |       | Vel = 1.75       |       |
| 240                  |                |           | 0.0<br>8.90      |               |                        |        |                              |                | 35.368                  |       | K Factor = 1.50  |       |
| 209<br>to<br>241     | 21.21<br>21.21 |           | 6.37<br>6.37     | 1.25<br>1.442 | 2T                     | 14.864 | 101.000<br>14.864<br>115.864 | 120<br>0.0033  | 35.742<br>0.0<br>0.386  |       | Vel = 1.25       |       |

# Final Calculations : Hazen-Williams

PERFORMANCE FIRE SYSTEMS  
Lakeview Storage

Page 11  
Date 9/10/2023

| Node1<br>to<br>Node2 | Elev1<br>Elev2 | K<br>Fact | Qa<br>Qt    | Nom<br>Act | Fitting<br>or<br>Equiv<br>Len | Pipe<br>Ftngs<br>Total | CFact<br>Pf/Ft | Pt<br>Pe<br>Pf | ***** | Notes           | ***** |
|----------------------|----------------|-----------|-------------|------------|-------------------------------|------------------------|----------------|----------------|-------|-----------------|-------|
| 241                  |                |           | 0.0<br>6.37 |            |                               |                        |                | 36.128         |       | K Factor = 1.06 |       |
| 210<br>to<br>242     | 21.21<br>21.21 |           | 4.34        | 1.25       | 2T 14.864                     | 101.000<br>14.864      | 120            | 36.729<br>0.0  |       |                 |       |
|                      |                |           | 4.34        | 1.442      |                               | 115.864                | 0.0016         | 0.190          |       | Vel = 0.85      |       |
| 242                  |                |           | 0.0<br>4.34 |            |                               |                        |                | 36.919         |       | K Factor = 0.71 |       |
| 211<br>to<br>243     | 21.21<br>21.21 |           | 2.76        | 1.25       | 2T 14.864                     | 101.000<br>14.864      | 120            | 37.649<br>0.0  |       |                 |       |
|                      |                |           | 2.76        | 1.442      |                               | 115.864                | 0.0007         | 0.082          |       | Vel = 0.54      |       |
| 243                  |                |           | 0.0<br>2.76 |            |                               |                        |                | 37.731         |       | K Factor = 0.45 |       |
| 212<br>to<br>244     | 21.21<br>21.21 |           | 1.62        | 1.25       | 2T 14.864                     | 101.000<br>14.864      | 120            | 38.526<br>0.0  |       |                 |       |
|                      |                |           | 1.62        | 1.442      |                               | 115.864                | 0.0003         | 0.031          |       | Vel = 0.32      |       |
| 244                  |                |           | 0.0<br>1.62 |            |                               |                        |                | 38.557         |       | K Factor = 0.26 |       |
| 213<br>to<br>245     | 21.21<br>21.21 |           | 0.95        | 1.25       | 2T 14.864                     | 101.000<br>14.864      | 120            | 39.379<br>0.0  |       |                 |       |
|                      |                |           | 0.95        | 1.442      |                               | 115.864                | 0.0001         | 0.011          |       | Vel = 0.19      |       |
| 245                  |                |           | 0.0<br>0.95 |            |                               |                        |                | 39.390         |       | K Factor = 0.15 |       |
| 214<br>to<br>246     | 21.21<br>21.21 |           | 0.93        | 1.25       | 2T 14.864                     | 101.000<br>14.864      | 120            | 40.218<br>0.0  |       |                 |       |
|                      |                |           | 0.93        | 1.442      |                               | 115.864                | 0.0001         | 0.011          |       | Vel = 0.18      |       |
| 246                  |                |           | 0.0<br>0.93 |            |                               |                        |                | 40.229         |       | K Factor = 0.15 |       |
| 215<br>to<br>247     | 21.21<br>21.21 |           | 1.57        | 1.25       | 2T 14.864                     | 101.000<br>14.864      | 120            | 41.043<br>0.0  |       |                 |       |
|                      |                |           | 1.57        | 1.442      |                               | 115.864                | 0.0003         | 0.029          |       | Vel = 0.31      |       |
| 247                  |                |           | 0.0<br>1.57 |            |                               |                        |                | 41.072         |       | K Factor = 0.24 |       |
| 216<br>to<br>248     | 21.21<br>21.21 |           | 2.67        | 1.25       | 2T 14.864                     | 101.000<br>14.864      | 120            | 41.846<br>0.0  |       |                 |       |
|                      |                |           | 2.67        | 1.442      |                               | 115.864                | 0.0007         | 0.077          |       | Vel = 0.52      |       |
| 248                  |                |           | 0.0<br>2.67 |            |                               |                        |                | 41.923         |       | K Factor = 0.41 |       |
| 217<br>to<br>249     | 21.21<br>21.21 |           | 4.19        | 1.25       | 2T 14.864                     | 101.000<br>14.864      | 120            | 42.610<br>0.0  |       |                 |       |
|                      |                |           | 4.19        | 1.442      |                               | 115.864                | 0.0015         | 0.177          |       | Vel = 0.82      |       |
| 249                  |                |           | 0.0<br>4.19 |            |                               |                        |                | 42.787         |       | K Factor = 0.64 |       |
| 218<br>to<br>250     | 21.21<br>21.21 |           | 6.11        | 1.25       | 2T 14.864                     | 101.000<br>14.864      | 120            | 43.316<br>0.0  |       |                 |       |
|                      |                |           | 6.11        | 1.442      |                               | 115.864                | 0.0031         | 0.357          |       | Vel = 1.20      |       |
| 250                  |                |           | 0.0<br>6.11 |            |                               |                        |                | 43.673         |       | K Factor = 0.92 |       |

# Final Calculations : Hazen-Williams

PERFORMANCE FIRE SYSTEMS  
Lakeview Storage

Page 12  
Date 9/10/2023

| Node1<br>to<br>Node2 | Elev1<br>Elev2 | K<br>Fact | Qa<br>Qt       | Nom<br>Act    | Fitting<br>or<br>Equiv<br>Len | Pipe<br>Ftngs<br>Total       | CFact<br>Pf/Ft | Pt<br>Pe<br>Pf         | ***** | Notes           | ***** |
|----------------------|----------------|-----------|----------------|---------------|-------------------------------|------------------------------|----------------|------------------------|-------|-----------------|-------|
| 219<br>to<br>251     | 21.21<br>21.21 |           | 8.44<br>8.44   | 1.25<br>1.442 | 2T<br>14.864                  | 101.000<br>14.864<br>115.864 | 120<br>0.0056  | 43.941<br>0.0<br>0.649 |       | Vel = 1.66      |       |
| 251                  |                |           | 0.0<br>8.44    |               |                               |                              |                | 44.590                 |       | K Factor = 1.26 |       |
| 220<br>to<br>252     | 21.21<br>21.21 |           | 11.17<br>11.17 | 1.25<br>1.442 | 2T<br>14.864                  | 101.000<br>14.864<br>115.864 | 120<br>0.0094  | 44.462<br>0.0<br>1.089 |       | Vel = 2.19      |       |
| 252                  |                |           | 0.0<br>11.17   |               |                               |                              |                | 45.551                 |       | K Factor = 1.66 |       |
| 221<br>to<br>253     | 21.21<br>21.21 |           | 13.91<br>13.91 | 1.25<br>1.442 | 2T<br>2E<br>7.432             | 102.000<br>22.296<br>124.296 | 120<br>0.0141  | 44.818<br>0.0<br>1.754 |       | Vel = 2.73      |       |
| 253                  |                |           | 0.0<br>13.91   |               |                               |                              |                | 46.572                 |       | K Factor = 2.04 |       |
| 222<br>to<br>254     | 21.21<br>21.21 |           | 16.44<br>16.44 | 1.25<br>1.442 | 2T<br>14.864                  | 99.500<br>14.864<br>114.364  | 120<br>0.0192  | 45.472<br>0.0<br>2.198 |       | Vel = 3.23      |       |
| 254                  |                |           | 0.0<br>16.44   |               |                               |                              |                | 47.670                 |       | K Factor = 2.38 |       |
| 223<br>to<br>225     | 21.21<br>21.21 |           | 22.61<br>22.61 | 1.25<br>1.442 | T<br>7.432                    | 29.000<br>7.432<br>36.432    | 120<br>0.0347  | 45.638<br>0.0<br>1.263 |       | Vel = 4.44      |       |
| 225                  |                |           | 0.0<br>22.61   |               |                               |                              |                | 46.901                 |       | K Factor = 3.30 |       |
| 226<br>to<br>255     | 21.21<br>21.21 |           | 3.95<br>3.95   | 1.25<br>1.442 | T<br>7.432                    | 49.000<br>7.432<br>56.432    | 120<br>0.0014  | 49.023<br>0.0<br>0.078 |       | Vel = 0.78      |       |
| 255                  |                |           | 0.0<br>3.95    |               |                               |                              |                | 49.101                 |       | K Factor = 0.56 |       |
| 227<br>to<br>229     | 21.21<br>21.21 |           | 19.70<br>19.7  | 1.25<br>1.442 | T<br>7.432                    | 49.000<br>7.432<br>56.432    | 120<br>0.0269  | 50.924<br>0.0<br>1.516 |       | Vel = 3.87      |       |
| 229                  |                |           | 0.0<br>19.70   |               |                               |                              |                | 52.440                 |       | K Factor = 2.72 |       |