

PRELIMINARY WATER ANALYSIS REPORT

FOR

THE PROPOSED RESIDENTIAL DEVELOPMENT

at

1341 WALLER ST SE
SALEM, OREGON

July 20, 2022

PREPARED BY:

7 OAKS ENGINEERING, INC.
Kimberly Johnson, P.E.
345 Westfield St. #107
Silverton, Or. 97381



OVERVIEW

This Preliminary Water Analysis Report is to comply with the City of Salem's Fire Department request to demonstrate the feasibility of the future residential development at 1341 Waller Street SE in Salem with respect to complying with the fire flow demand.

Per the email from Laurel Christian on June 28, 2022, "based off the type of construction provided and the area per floor referenced it looks like the total area I have to use is 7437 square feet. With the reduction allowed for fire sprinklers, the building will be required to have a minimum fire flow of 1,500 gpm for 2 hours. The fire sprinkler system would need to be designed based on the actual main installed and psi provided."

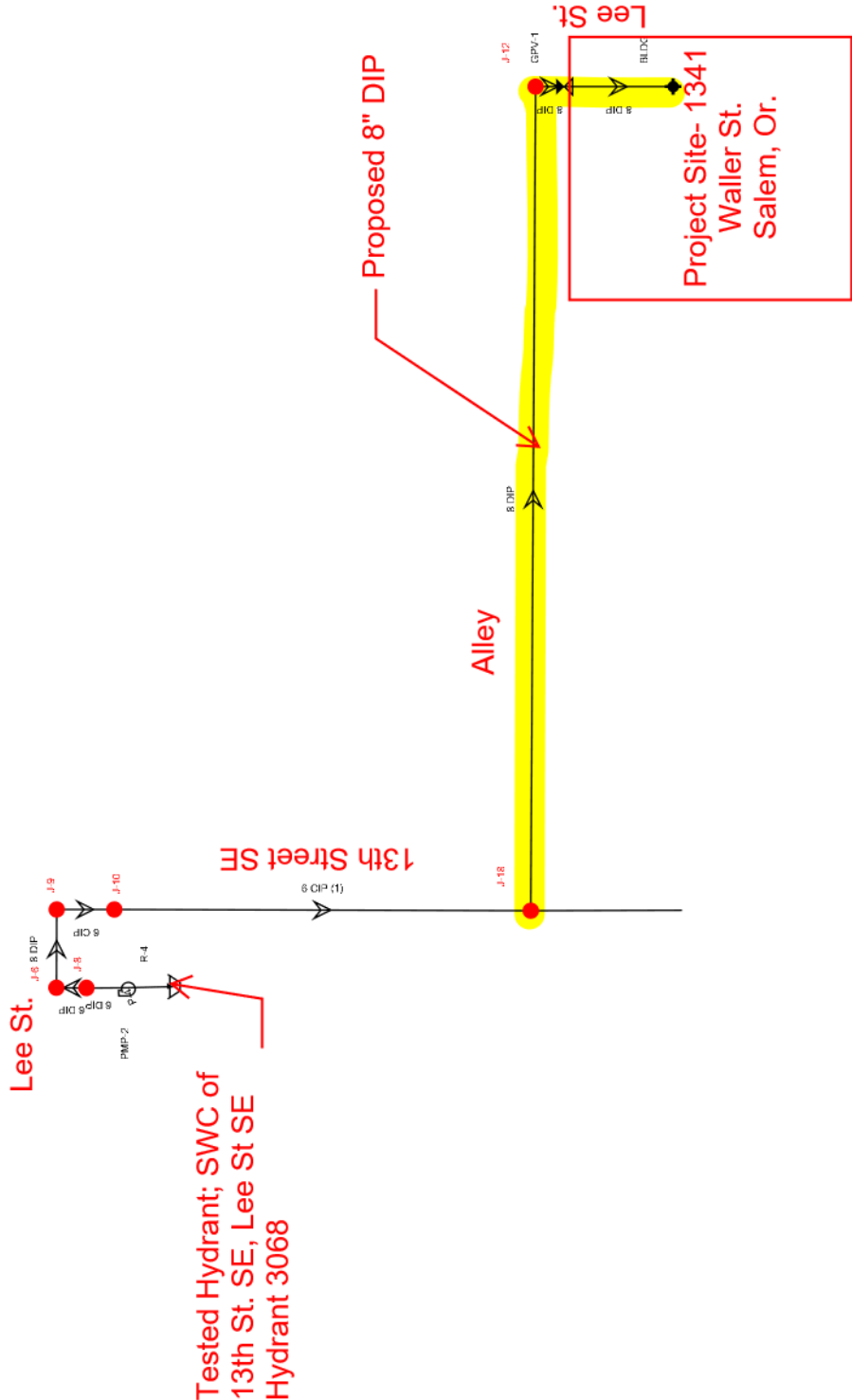
Bentley WaterCAD Software was used to model the existing and proposed underground fire line. Two scenarios were run to demonstrate feasibility;

1. The first scenario is extending an 8" water main, connecting to the existing 6" water main in 13th Street, and extending east down the existing alleyway just north of the proposed 1341 Waller Street property. An 8" fire service will be provided to the proposed development.
2. The second scenario is extending a 6" water main, connecting to the existing 6" water main in 13th Street, and extending east down the existing alleyway just north of the proposed 1341 Waller Street property. A 6" fire service will be provided to the proposed development.

A fire flow test was ordered and conducted on 7/1/2022, at fire hydrant number 3068, at the SW corner of 13th St SE & Lee St SE. The fire flow test has been included for reference herein.

SCENARIO 1- 8" WATER MAIN EXTENSION

Scenario: fire flow runs



Fire Flow Node FlexTable: Fire Flow Results Table

Label	Zone	Satisfies Fire Flow Constraints?	Fire Flow Status		Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Junction w/ Minimum Pressure (System)
J-1	<None>	True	Passed		1,500	1,630	1,500	BLDG
J-6	<None>	True	Passed		1,500	2,438	1,500	BLDG
J-8	<None>	True	Passed		1,500	2,695	1,500	BLDG
J-9	<None>	True	Passed		1,500	2,375	1,500	BLDG
J-10	<None>	True	Passed		1,500	2,294	1,500	BLDG
J-12	<None>	True	Passed		1,500	1,718	1,500	BLDG
BLDG	<None>	True	Passed		1,500	1,534	1,500	J-12
J-18	<None>	True	Passed		1,500	1,876	1,500	BLDG
Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Zone Lower Limit) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (System Lower Limit) (psi)	Pressure (Calculated System Lower Limit) (psi)	
1,630	20	20	20	31	BLDG	(N/A)	31	BLDG
2,438	20	21	20	20	BLDG	(N/A)	20	BLDG
2,695	20	21	20	20	BLDG	(N/A)	20	BLDG
2,375	20	21	20	20	BLDG	(N/A)	20	BLDG
2,294	20	21	20	20	BLDG	(N/A)	20	BLDG
1,718	20	21	20	20	BLDG	(N/A)	20	BLDG
1,534	20	20	20	30	J-12	(N/A)	30	J-12
1,876	20	21	20	20	BLDG	(N/A)	20	BLDG
Is Fire Flow Run Balanced?								
True								
True								
True								
True								
True								
True								
True								

Hydraulic Summary			
Time Analysis Type	Steady State	Simulation Start Date	1/1/2000
Friction Method	Hazen-Williams	Hydraulic Time Step	1.000
Accuracy	0.001	Duration	24,000
Trials	40	Calculation Type	Fire Flow

Scenario Summary	
ID	83
Label	fire flow runs
Notes	
Active Topology	Base Active Topology
User Data Extensions	Base User Data Extensions
Physical	Base Physical
Demand	Base Demand
Initial Settings	Base Initial Settings
Operational	Base Operational
Age	Base Age
Constituent	Base Constituent
Trace	Base Trace
Fire Flow	Fire Flow
Energy Cost	Base Energy Cost
Pressure Dependent Demand	Base Pressure Dependent Demand
Transient	Base Transient
Failure History	Base Failure History
SCADA	Base SCADA
Steady State / EPS Solver Calculation Options	Base Calculation Options
Transient Solver Calculation Options	Base Calculation Options

Time (hours)	BLDG - fire flow runs - Hydraulic Grade (ft)	BLDG - fire flow runs - Demand (gpm)	BLDG - fire flow runs - Pressure (psi)	BLDG - fire flow runs - Pressure (psi)
0.00	208.23	1,534	20	20

FLEXTABLE: PIPE TABLE

	ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Has Check Valve?	Minor Loss Coefficient (Local)	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Has User Defined Length?	Length (User Defined) (ft)
43: 6 CIP	43	6 CIP	21	J-9	J-10	6.0	Cast iron	130.0	☐	0.000	1,534	17.41	0.164	☐	0
47: 8 DIP	47	8 DIP	28	J-9	J-6	8.0	Ductile Iron	130.0	☐	0.800	-1,534	9.79	0.082	☐	0
49: 8 DIP	49	8 DIP	10	J-12	GPV-1	8.0	Ductile Iron	130.0	☐	0.800	1,534	9.79	0.154	☐	0
52: 8 DIP	52	8 DIP	40	GPV-1	BLDG	8.0	Ductile Iron	130.0	☐	0.000	1,534	9.79	0.040	☐	0
54: 8 DIP	54	8 DIP	300	J-18	J-12	8.0	Ductile Iron	130.0	☐	1.280	1,534	9.79	0.047	☐	0
71: 6 DIP	71	6 DIP	15	PMP-2	J-8	150.0	Ductile Iron	130.0	☐	0.000	(N/A)	(N/A)	(N/A)	☐	0
80: 6 DIP	80	6 DIP	11	J-8	J-6	6.0	Ductile Iron	130.0	☐	1.280	1,534	17.41	0.716	☐	0
87: 6 CIP (1)	87	6 CIP (1)	151	J-10	J-18	6.0	Cast iron	130.0	☐	0.000	1,534	17.41	0.164	☐	0
88: 6 CIP (2)	88	6 CIP (2)	155	J-18	J-1	6.0	Cast iron	130.0	☐	0.000	(N/A)	(N/A)	(N/A)	☐	0
91: P-4	91	P-4	17	R-4	PMP-2	150.0	Ductile Iron	130.0	☐	0.000	(N/A)	(N/A)	(N/A)	☒	5

FLEXTABLE: JUNCTION TABLE

	ID	Label	Elevation (ft)	Zone	Demand Collection	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
31: J-1	31	J-1	160.00	<None>	<Collection:	(N/A)	(N/A)	(N/A)
39: J-6	39	J-6	159.00	<None>	<Collection:	(N/A)	(N/A)	(N/A)
42: J-8	42	J-8	159.00	<None>	<Collection:	(N/A)	(N/A)	(N/A)
44: J-9	44	J-9	159.00	<None>	<Collection:	(N/A)	(N/A)	(N/A)
45: J-10	45	J-10	159.00	<None>	<Collection:	(N/A)	(N/A)	(N/A)
50: J-12	50	J-12	160.00	<None>	<Collection:	(N/A)	(N/A)	(N/A)
86: J-18	86	J-18	159.47	<None>	<Collection:	(N/A)	(N/A)	(N/A)

FLEXTABLE: HYDRANT TABLE

	ID	Label	Hydrant Status	Include Hydrant Lateral Loss?	Emitter Coefficient (gpm/psi^n)	Length (Hydrant Lateral) (ft)	Elevation (ft)	Zone	Demand Collection	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
72: BLDG	72	BLDG	Closed	☐	0.000	20	162.00	<None>	<Collection:	1,534	208.23	20

FLEXTABLE: GPV TABLE

	ID	Label	Elevation (ft)	Diameter (Valve) (in)	Minor Loss Coefficient (Local)	General Purpose Valve Headloss Curve	Flow (gpm)	Hydraulic Grade (From) (ft)	Hydraulic Grade (To) (ft)	Headloss (ft)
75: GPV-1	75	GPV-1	161.00	8.0	0.000	Backflow	1,534	228.45	209.82	18.63

PROPERTIES: PUMP (EX. HYDRANT-FLOW TEST)

Properties - Pump - PMP-2 (69)

PMP-2

  50%

<Show All>

Property Search

▼

<General>

ID

69

Label

PMP-2

Notes

GIS-IDs

<Collection: 0 items>

Hyperlinks

<Collection: 0 items>

Downstream Pipe

6 DIP

▼

<Geometry>

X (ft)

2,454.93

Y (ft)

7,440.48

▼

Active Topology

Is Active?

True

▼

Initial Settings

Relative Speed Factor (Initial)

1.000

Status (Initial)

On

▼

Operational

Controls

<Collection>

▼

Physical

Elevation (ft)

159.00

Installation Year

0

Zone

<None>

DMA Status

Boundary Candidate

Pump Definition

Ex. Fire Hydrant

Pump Station

<None>

Is Variable Speed Pump?

False

▼

Pump Data

Head (Shutoff) (ft)

163.81

Head (Design) (ft)

152.27

Flow (Design) (gpm)

780

Head (Maximum Operating) (ft)

46.14

Flow (Maximum Operating) (gpm)

2,734

Flow (Maximum Extended) (gpm)

(N/A)

▼

Transient (Operational)

Pump Type (Transient)

Constant Speed - Four-Quadrant Characteristic

▼

Water Quality

Age (Initial) (hours)

0.000

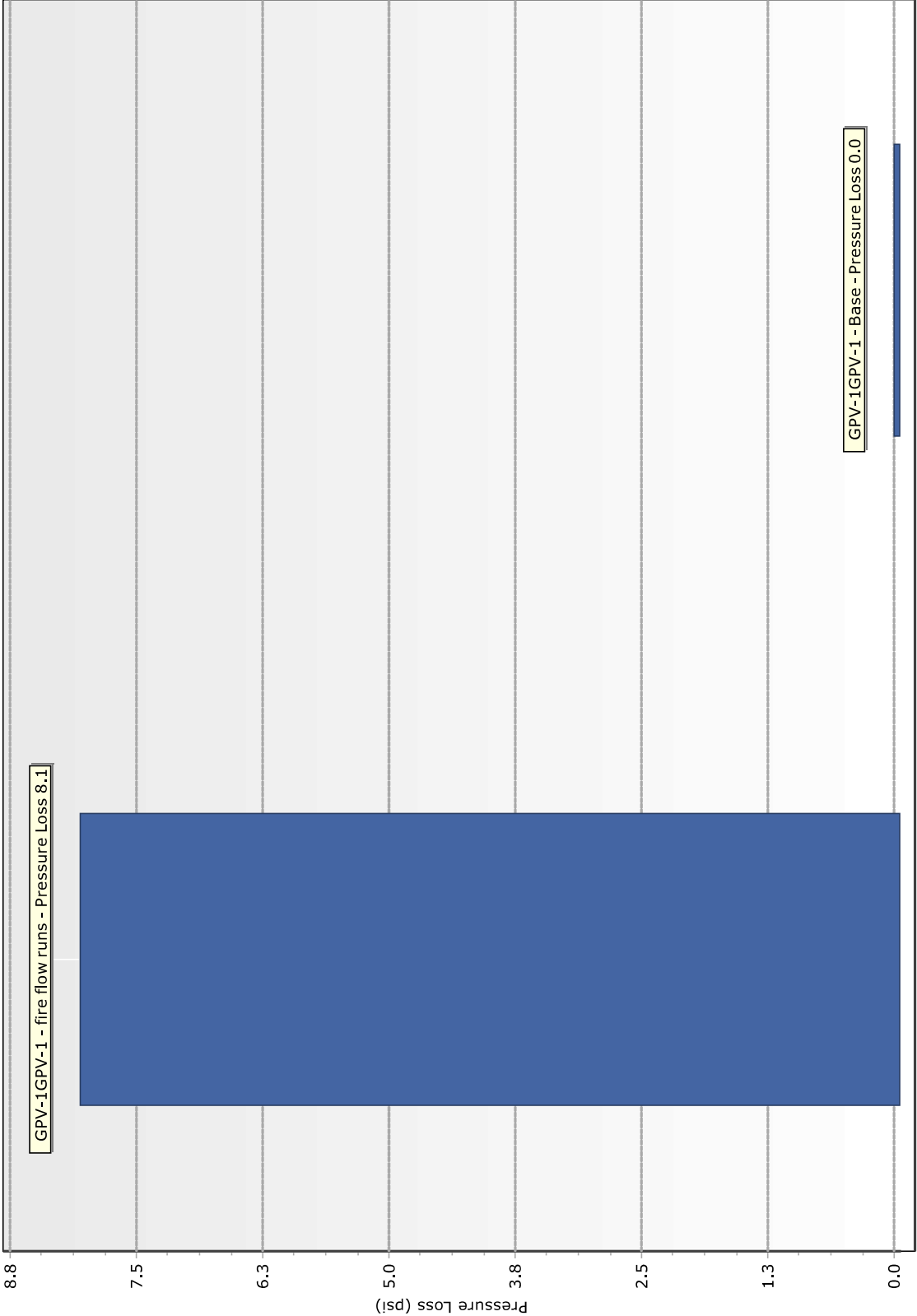
Concentration (Initial) (mg/L)

0.0

Trace (Initial) (%)

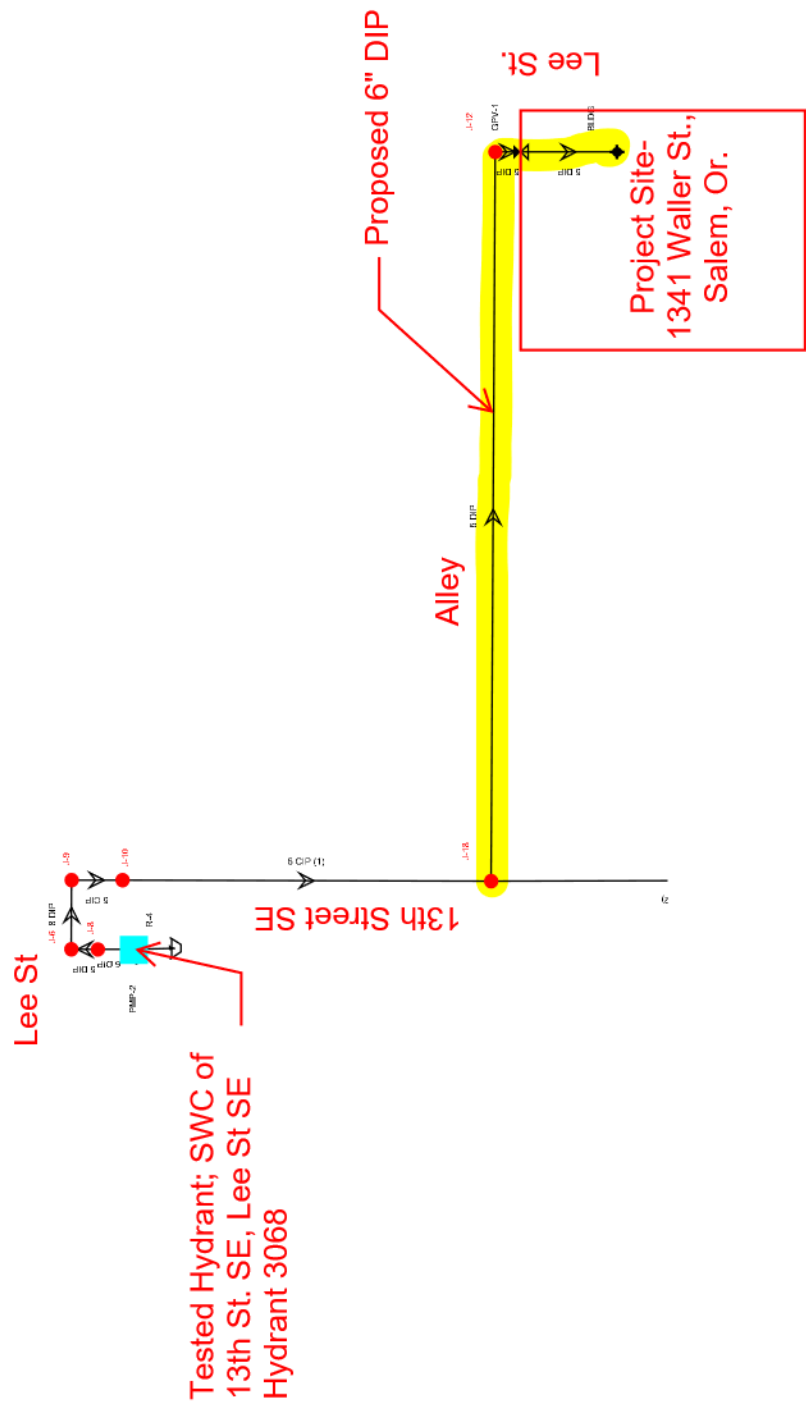
0.0

Graph - 1



SCENARIO 2- 6" WATER MAIN EXTENSION

Scenario: fire flow runs



Fire Flow Node FlexTable: Fire Flow Results Table

Label	Zone	Satisfies Fire Flow Constraints?	Fire Flow Status			Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Junction w/ Minimum Pressure (System)
J-1	<None>	True	Passed		1,500	1,630	1,500		
J-6	<None>	True	Passed		1,500	2,438	1,500		
J-8	<None>	True	Passed		1,500	2,694	1,500		
J-9	<None>	True	Passed		1,500	2,375	1,500		
J-10	<None>	True	Passed		1,500	2,294	1,500		
J-12	<None>	False	Zone Pressure Failed		1,500	1,411	1,500		
BLDG	<None>	False	Residual Pressure Failed		1,500	1,234	1,500		
J-18	<None>	True	Passed		1,500	1,876	1,500		
Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Zone Lower Limit) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (System Lower Limit) (psi)	Pressure (Calculated System Lower Limit) (psi)		
1,630	20	20	20	31	BLDG	(N/A)	31	BLDG	
2,438	20	21	20	20	BLDG	(N/A)	20	BLDG	
2,694	20	21	20	20	BLDG	(N/A)	20	BLDG	
2,375	20	21	20	20	BLDG	(N/A)	20	BLDG	
2,294	20	21	20	20	BLDG	(N/A)	20	BLDG	
1,411	20	21	20	20	BLDG	(N/A)	20	BLDG	
1,234	20	20	20	32	J-12	(N/A)	32	J-12	
1,876	20	21	20	20	BLDG	(N/A)	20	BLDG	
Is Fire Flow Run Balanced?									
True									
True									
True									
True									
True									
True									
True									
True									

Hydraulic Model Properties

Title

Engineer

Company

Date 7/19/2022

Notes

Time (hours)	0.00	BLDG - fire flow runs - Fire Flow (Needed) (gpm)	1,500	BLDG - fire flow runs - Fire Flow (Needed) (gpm)	1,500	BLDG - fire flow runs - Fire Flow (Needed) (gpm)	1,500	BLDG - fire flow runs - Fire Flow (Needed) (gpm)	1,500
BLDG - fire flow runs - Fire Flow (Needed) (gpm)		BLDG - fire flow runs - Hydraulic Grade (ft)		BLDG - fire flow runs - Demand (gpm)		BLDG - fire flow runs - Pressure (psi)		BLDG - fire flow runs - Fire Flow (Available) (gpm)	
1,500		322.81		0		70		1,234	
BLDG - fire flow runs - Flow (Total Available) (gpm)		BLDG - fire flow runs - Flow (Total Needed) (gpm)		BLDG - fire flow runs - Pressure (Calculated Residual @ Total Flow Needed) (psi)		BLDG - fire flow runs - Pressure (Calculated Residual) (psi)		BLDG - fire flow runs - Pressure (Calculated System Lower Limit) (psi)	
1,234		1,500		1		20		32	
BLDG - fire flow runs - Pressure (Calculated Zone Lower Limit) (psi)		BLDG - fire flow runs - Velocity of Maximum Pipe (ft/s)							
32		14.01							

Network Inventory

Pipe	10	-Shut Down After Time Delay	0
Lateral	0	-Variable Speed/Torque	0
Junction	7	-Pump Start - Variable Speed/Torque	0
Hydrant	1	Customer Meter	0
Tank	0	Pump Station	0
Reservoir	1	Variable Speed Pump Battery	0

00260-No Loop 6 DIP.wtg
7/19/2022

Bentley Systems, Inc. Haestad Methods Solution Center
76 Watertown Road, Suite 2D Thomaston, CT 06787 USA +1-203-755-1666

WaterCAD
[10.03.05.05]
Page 1 of 3

Network Inventory			
Tap	0	SCADA Element	0
Pump	1	PRV	0
-Constant Power	0	PSV	0
-Custom Extended	0	PBV	0
-Design Point (1 Point)	0	FCV	0
-Multiple Point	0	TCV	0
-Standard (3 Point)	1	GPV	1
-Standard Extended	0	Isolation Valve	0
-Constant Speed - Four-Quadrant Characteristics	1	Spot Elevation	0
-Constant Speed - Pump Definition	0		

Scenario Summary

ID	83
Label	fire flow runs
Notes	
Active Topology	Base Active Topology
User Data Extensions	Base User Data Extensions
Physical	Base Physical
Demand	Base Demand
Initial Settings	Base Initial Settings
Operational	Base Operational
Age	Base Age
Constituent	Base Constituent
Trace	Base Trace
Fire Flow	Fire Flow
Energy Cost	Base Energy Cost
Pressure Dependent Demand	Base Pressure Dependent Demand
Transient	Base Transient
Failure History	Base Failure History
SCADA	Base SCADA
Steady State / EPS Solver Calculation Options	Base Calculation Options
Transient Solver Calculation Options	Base Calculation Options

Hydraulic Summary			
Time Analysis Type	Steady State	Simulation Start Date	1/1/2000
Friction Method	Hazen-Williams	Hydraulic Time Step	1.000
Accuracy	0.001	Duration	24.000
Trials	40	Calculation Type	Fire Flow

FLEXTABLE: PIPE TABLE

	ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Has Check Valve?	Minor Loss Coefficient (Local)	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Has User Defined Length?	Length (User Defined) (ft)
43: 6 CIP	43	6 CIP	21	J-9	J-10	6.0	Cast iron	130.0	☐	0.000	1,234	14.01	0.110	☐	0
47: 8 DIP	47	8 DIP	28	J-9	J-6	8.0	Ductile Iron	130.0	☐	0.800	-1,234	7.88	0.054	☐	0
49: 6 DIP	49	6 DIP	10	J-12	GPV-1	6.0	Ductile Iron	130.0	☐	0.800	1,234	14.01	0.342	☐	0
52: 6 DIP	52	6 DIP	40	GPV-1	BLDG	6.0	Ductile Iron	130.0	☐	0.000	1,234	14.01	0.110	☐	0
54: 6 DIP	54	6 DIP	300	J-18	J-12	6.0	Ductile Iron	130.0	☐	1.280	1,234	14.01	0.123	☐	0
71: 6 DIP	71	6 DIP	15	PMP-2	J-8	150.0	Ductile Iron	130.0	☐	0.000	(N/A)	(N/A)	(N/A)	☐	0
80: 6 DIP	80	6 DIP	11	J-8	J-6	6.0	Ductile Iron	130.0	☐	1.280	1,234	14.01	0.467	☐	0
87: 6 CIP (1)	87	6 CIP (1)	151	J-10	J-18	6.0	Cast iron	130.0	☐	0.000	1,234	14.01	0.110	☐	0
88: 6 CIP (2)	88	6 CIP (2)	155	J-18	J-1	6.0	Cast iron	130.0	☐	0.000	(N/A)	(N/A)	(N/A)	☐	0
91: P-4	91	P-4	17	R-4	PMP-2	150.0	Ductile Iron	130.0	☐	0.000	(N/A)	(N/A)	(N/A)	☒	5

FLEXTABLE: JUNCTION TABLE

	ID	Label	Elevation (ft)	Zone	Demand Collection	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
31: J-1	31	J-1	160.00	<None>	<Collection:	(N/A)	(N/A)	(N/A)
39: J-6	39	J-6	159.00	<None>	<Collection:	(N/A)	(N/A)	(N/A)
42: J-8	42	J-8	159.00	<None>	<Collection:	(N/A)	(N/A)	(N/A)
44: J-9	44	J-9	159.00	<None>	<Collection:	(N/A)	(N/A)	(N/A)
45: J-10	45	J-10	159.00	<None>	<Collection:	(N/A)	(N/A)	(N/A)
50: J-12	50	J-12	160.00	<None>	<Collection:	(N/A)	(N/A)	(N/A)
86: J-18	86	J-18	159.47	<None>	<Collection:	(N/A)	(N/A)	(N/A)

FLEXTABLE: HYDRANT TABLE

	ID	Label	Hydrant Status	Include Hydrant Lateral Loss?	Emitter Coefficient (gpm/psi^n)	Length (Hydrant Lateral) (ft)	Elevation (ft)	Zone	Demand Collection	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
72: BLDG	72	BLDG	Closed	☐	0.000	20	162.00	<None>	<Collection:	1,234	208.23	20

FLEXTABLE: GPV TABLE

	ID	Label	Elevation (ft)	Diameter (Valve) (in)	Minor Loss Coefficient (Local)	General Purpose Valve Headloss Curve	Flow (gpm)	Hydraulic Grade (From) (ft)	Hydraulic Grade (To) (ft)	Headloss (ft)
75: GPV-1	75	GPV-1	161.00	8.0	0.000	Backflow	1,234	229.91	212.56	17.35

PROPERTIES: PUMP (EX. HYDRANT-FLOW TEST)

Properties - Pump - PMP-2 (69)

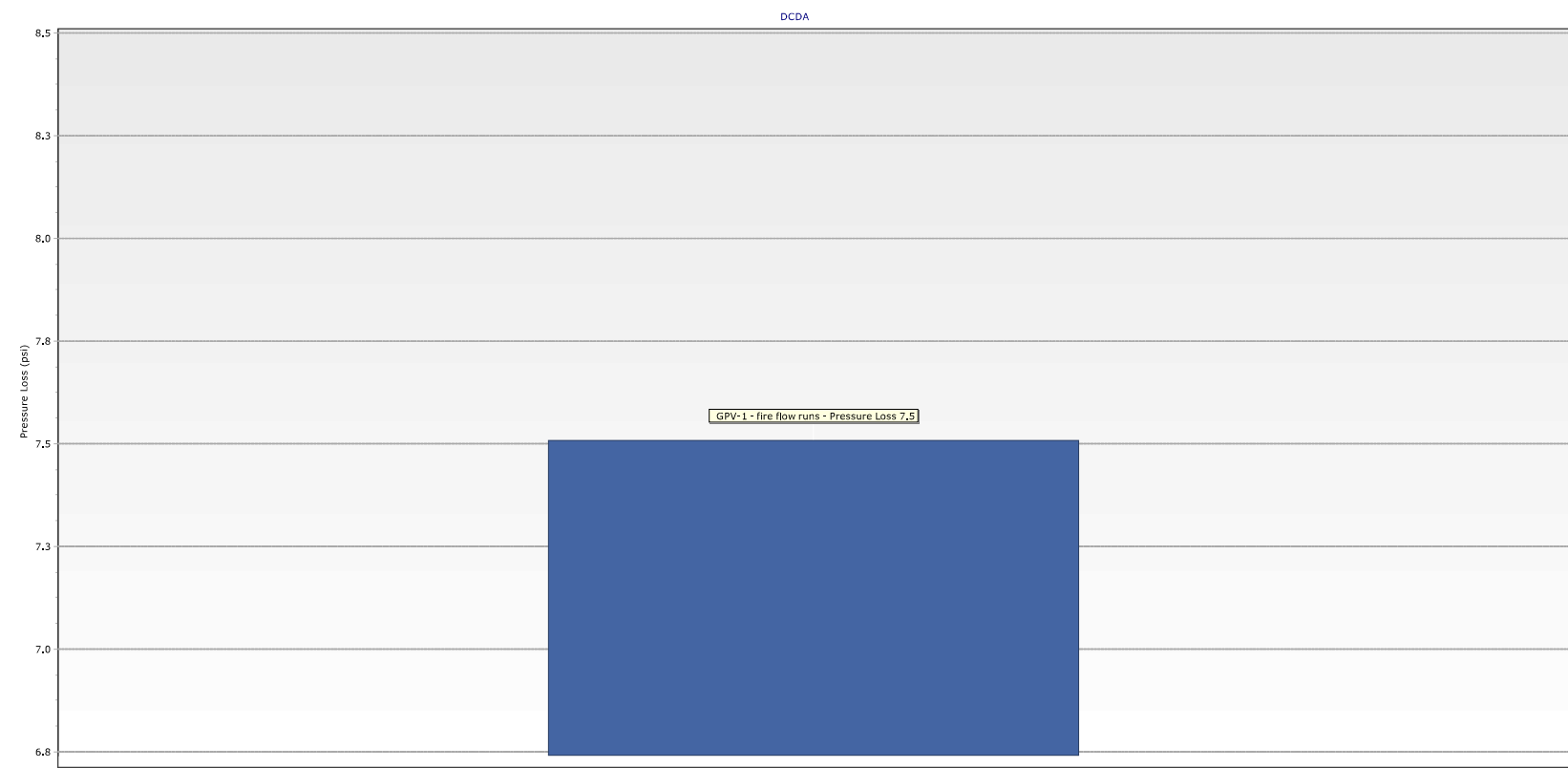
PMP-2

Fire Flow (Predefined)

Property Search

<General>	
ID	69
Label	PMP-2
Notes	
GIS-IDs	<Collection: 0 items>
Hyperlinks	<Collection: 0 items>
Downstream Pipe	6 DIP
<Geometry>	
X (ft)	2,454.93
Y (ft)	7,440.48
Active Topology	
Is Active?	True
Initial Settings	
Relative Speed Factor (Initial)	1.000
Status (Initial)	On
Operational	
Controls	<Collection>
Physical	
Elevation (ft)	159.00
Installation Year	0
Zone	<None>
DMA Status	Boundary Candidate
Pump Definition	Ex. Fire Hydrant
Pump Station	<None>
Is Variable Speed Pump?	False
Pump Data	
Head (Shutoff) (ft)	163.81
Head (Design) (ft)	152.27
Flow (Design) (gpm)	780
Head (Maximum Operating) (ft)	46.14
Flow (Maximum Operating) (gpm)	2,734
Flow (Maximum Extended) (gpm)	(N/A)
Water Quality	
Age (Initial) (hours)	0.000
Concentration (Initial) (mg/L)	0.0
Trace (Initial) (%)	0.0

DCDA
PRESSURE LOSS GRAPH



FIRE FLOW TEST

Public Works Department

Permits: (503) 588-6211
Inspections: (503) 589-2021
Fax: (503) 588-6025

**City Hall**

555 Liberty St SE
Room 325
Salem, OR 97301-3503

WATER PERMIT - Multi Family - Fire Flow

Location of Work: 901 13TH ST SE**Permit Number:** 22-113525-WA**Date Issued:** 7/1/2022**Applicant:**

RONALD PED
1220 20TH ST SE
SALEM OR 97302

Contractor:**Engineer:**

Associated Permits Included:

- Fire Flow Test and Report

Terms and Conditions:

1.

Special Conditions:

Jurisdiction: Salem

Map #: 45-470

Fire Flow Test and Report:

Hydrant Number: 3068

Test Location (static and residual): Nearest hydrant

Hydrant Location: SW corner of 13th St SE & Lee St SE

Public Works Department

Permits: (503) 588-6211
 Inspections: (503) 589-2021
 Fax: (503) 588-6025

**City Hall**

555 Liberty St SE
 Room 325
 Salem, OR 97301-3503

WATER PERMIT - Multi Family - Fire Flow**Location of Work: 901 13TH ST SE****Permit Number: 22-113525-WA****Date Issued: 7/1/2022**Flow Tested Hydrant No.: 3068Map No.: 45-470Hydrant Location: 901 13th St SELocation-Static and Residual Pressure Measurement: 3066

Orifice		Pressure (Lbs./Sq. In.)			Observed Discharge (GPM)
Diameter (In.)	Coefficient	Static	Residual	Pitot	
1 <u>2 1/2</u>		<u>71</u>	<u>66</u>	<u>25</u>	<u>780</u>
2 <u>2 1/2</u>		<u>71</u>	<u>66</u>	<u>25</u>	<u>780</u>
3					<u>1560 TBA</u>

Main Line Diameter: 8 Inch Looped System? Yes No (circle one) Flow Formula:

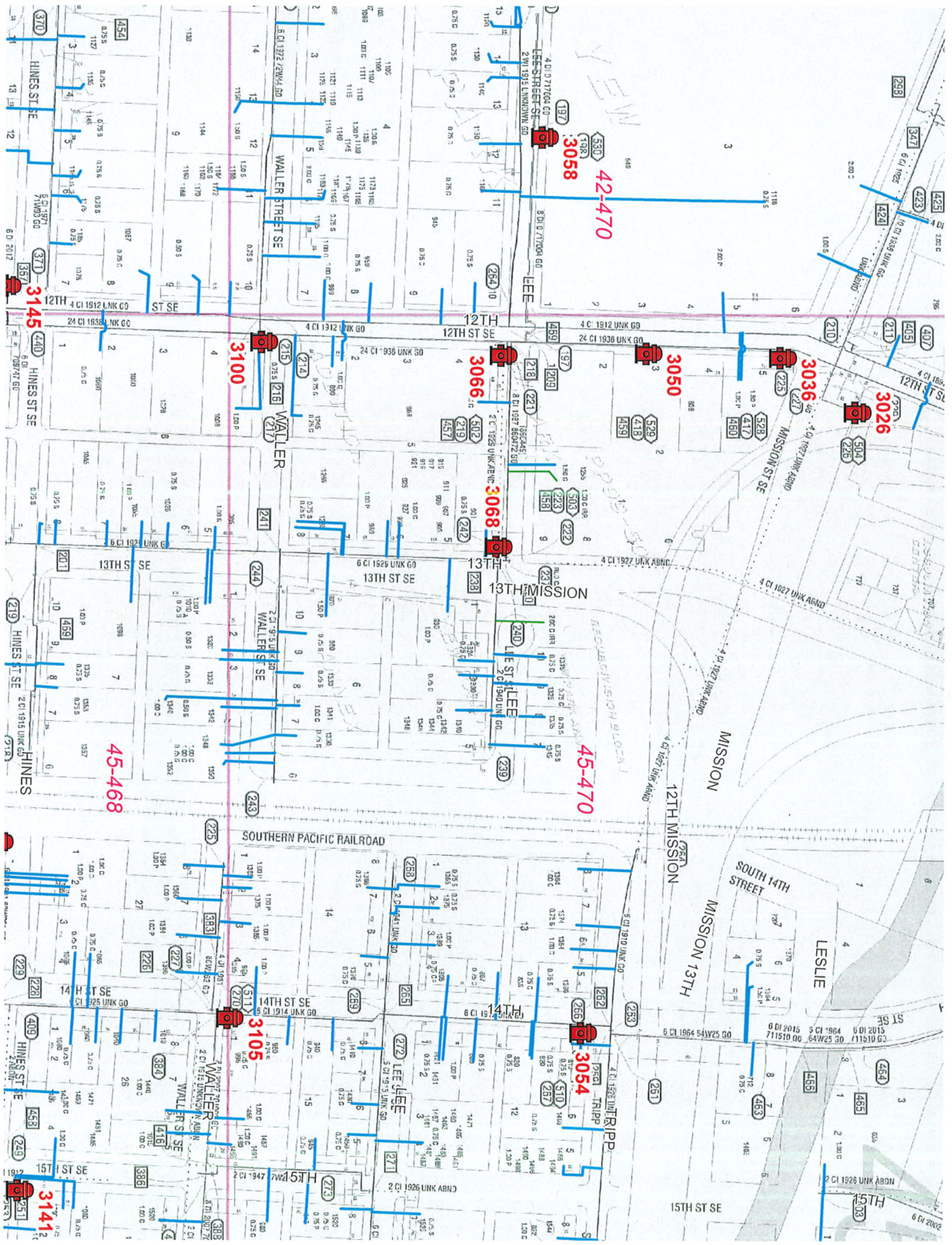
$$\text{Observed Discharge (GPM)} = 29.82 CD^2 \sqrt{P}$$

Where: C = Orifice Coefficient, D = Orifice Diameter, and P = Pitot Pressure

NOTES: STATIC PRESSURE indicates the normal pressure in the main. RESIDUAL PRESSURE indicates pressure in the main during flow at hydrant outlet. PITOT PRESSURE indicates measured velocity head of stream at hydrant outlet. OBSERVED DISCHARGE is the flow computed from the noted pressures. ORIFICE is the diameter of the hydrant opening tested.

DISCLAIMER: This flow test was taken to determine the ability of the water distribution system to deliver water for fire control purposes. The test information is provided solely for fire insurance rating or grading purposes. No representation or warranties of any kind are extended or implied.

 Person Performing Test: [Signature] Date: 7 / 12 / 22 Time: 1330



42-470

3058

3100

3066

3068

45-470

45-468

3105

3054

3141

3026

3036

3050

3064

3058

3054

3058

3054

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3054

3058

3054

CONCLUSION:

In conclusion, the first scenario modeled with the 8" water main extension is preliminarily determined feasible. However, the second scenario modeled with the 6" water main extension is determined infeasible.

Below is a summary of the two scenarios findings:

SCENARIO 1- 8" WATER MAIN EXTENSION

Label	Satisfies Fire Flow Constraints?	Fire Flow Status	Fire Flow Needed (GPM)	Fire Flow Available (GPM)	Pressure Calculated Residual (PSI)	Pressure Calculated Zone Lower Limit (PSI)
J-1	Yes	Passed	1,500	1,630	20	31
J-6	Yes	Passed	1,500	2,438	21	20
J-8	Yes	Passed	1,500	2,695	21	20
J-9	Yes	Passed	1,500	2,375	21	20
J-10	Yes	Passed	1,500	2,294	21	20
J-12	Yes	Passed	1,500	1,718	21	20
BLDG	Yes	Passed	1,500	1,534	20	30
J-18	Yes	Passed	1,500	1,876	21	20

SCENARIO 2- 6" WATER MAIN EXTENSION

Label	Satisfies Fire Flow Constraints?	Fire Flow Status	Fire Flow Needed (GPM)	Fire Flow Available (GPM)	Pressure Calculated Residual (PSI)	Pressure Calculated Zone Lower Limit (PSI)
J-1	Yes	Passed	1,500	1,630	20	31
J-6	Yes	Passed	1,500	2,438	21	20
J-8	Yes	Passed	1,500	2,694	21	20
J-9	Yes	Passed	1,500	2,375	21	20
J-10	Yes	Passed	1,500	2,294	21	20
J-12	No	Zone Pressure Failed	1,500	1,411	21	20
BLDG	No	Residual Pressure Failed	1,500	1,234	20	32
J-18	Yes	Passed	1,500	1,876	21	20

Therefore, in conclusion, a minimum 8" water main extension will be required for the proposed development in order to adequately deliver a minimum 1,500 GPM at 20 PSI.