FINAL UTILITY REPORT

FOR

E-470 RV Storage
Aurora, Colorado

Prepared for:

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Prepared by:

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Project #: 096648001

Prepared: July 1, 2020

Kimley»Horn

TABLE OF CONTENTS

CERTIFICATION

ENGINEER'S STATEMENT

This Final Utility Report for RV Storage - Aurora was prepared by me (or under my supervision) in accordance with the provisions of City of Aurora Criteria, and was designed to comply with the provisions thereof. I understand that the City of Aurora does not, and will not, assume liability for facilities designed by others.

_____

By: Stephen Litsas, P.E.
Licensed Professional Engineer
State of Colorado PE No. 56598

GENERAL LOCATION AND DESCRIPTION

The purpose of this Final Utility Report is to outline the proposed water and sanitary sewer design for the 470 Storage development (the Project) located southwest of E. Jewell Avenue and E-470 within the City of Aurora, Colorado. The information provided in this Report has been prepared in accordance with the City of Aurora Capital Improvement Plans and meets all requirements of the Public Utility Improvements Rules & Regulations Regarding Standards and Specifications.

LOCATION

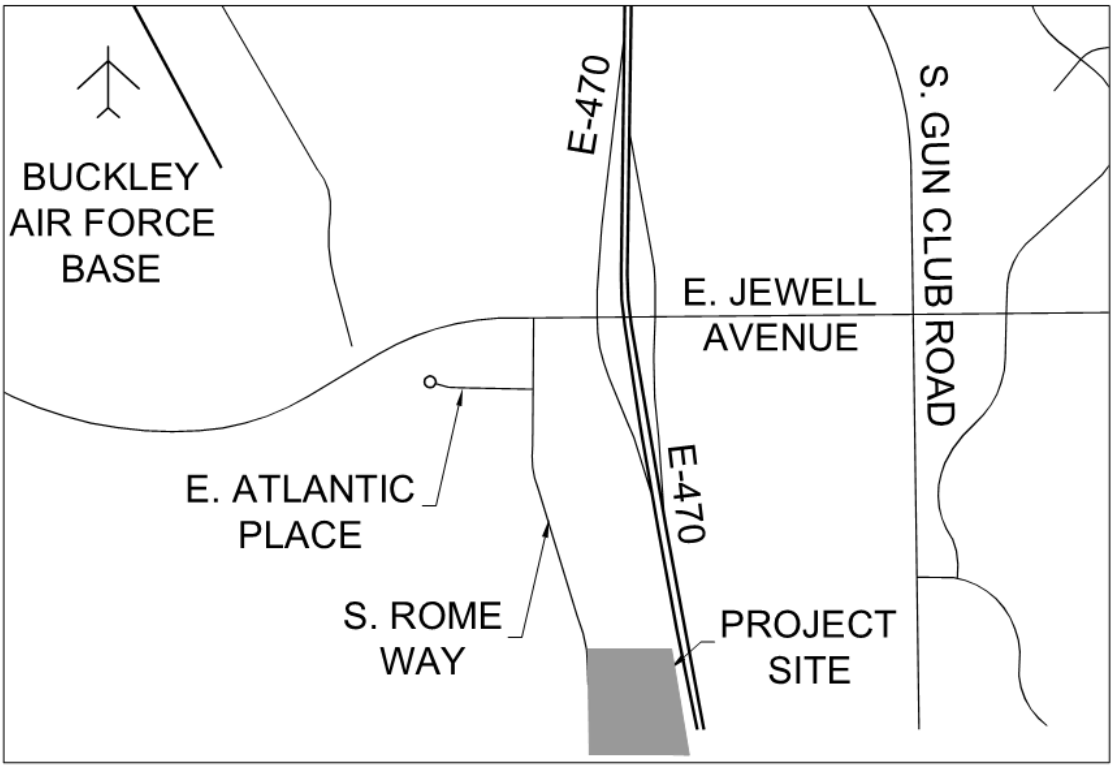
The Site is located in the South 1/2 of Section 25, Township 4 South, Range 66 West of the 6th Principal Meridian, City of Aurora, County of Arapahoe, State of Colorado.

More specifically, the Site is located at the southwest corner of E. Jewell Avenue and E-470 in Aurora, Colorado.

The site is bounded by the following.

North: Pioneer Business Park
South: Plains Conservation Land
East: E-470
West: Plains Conservation Land

VICINITY MAP



VICINITY MAP

DESCRIPTION OF PROPERTY

The 38.3 +/- acre project site is currently undeveloped and consists of primarily sparse native grass, weeds, and brush cover. The proposed site will consist of one parcel and public road right of way dedication. The site is currently zoned as Accident Potential Zone.

The existing topography generally drains from southwest to northeast. The overall site varies in elevation from a high of approximately 5758 feet to a low of approximately 5710 feet. The respective runoff flows across the property from west to northeast across the site.

There is an existing 8” water line within the improved section of S Rome Way, that stubs within the roadway just before the northern property line. There is also an existing 24” water line located in an E-470 multi-use easement approximately 1250 feet north of the Site. The Project will utilize these two existing water lines to loop a combination of 8” and 12” PVC water lines that will service six (6) fire hydrants internal to the site spaced along the perimeter of the development. In addition, two- 12” stubs will be provided south of the Site for future developments.

An existing 36” sanitary sewer main within the improved section of S Rome Way, that stubs within the roadway just before the northern property line, will be extended to the site to provide service to the proposed dump station, wash stations, and 400 SF office building.

This Final Utility Report covers the water demands and sanitary sewer flows anticipated for the development of the Site. This Report demonstrates that the proposed water and sanitary sewer infrastructure for this Project will be sufficient to serve the above-mentioned development. Water and sanitary sewer mainlines will be owned and maintained by City of Aurora (COA) and fire protection will be provided by Aurora Fire Department. These utilities will be within the South Rome Way right-of-way (ROW) and will be publicly maintained. Easements will be provided for utilities outside the public ROW as required by COA.

WATER DISTRIBUTION SYSTEM

EXISTING WATER SYSTEM

Aurora Water operates and maintains the existing water system that currently stubs in S Rome Way, near the northern boundary. The existing 8” main is located in Zone 4 and was found to have a with a static pressure of 48.4 psi in 2020 at the hydrant directly adjacent to the proposed tie-in location northwest of the development site. The 24” line was found to have a static pressure of 64 psi in 2018.

WATER LAYOUT

An overall utility plan is included in **Appendix A**. In accordance with COA design criteria, the water mains follow the proposed roadway for public improvements. Water main lines located within the public roadway will be 8-inch PVC pipes. The project will connect to 2 (two) existing water mains. The first connection is an 8” water main in South Rome Way and the second is a 24” water main located in the E-470 multi-use easement. A looped water system is proposed internal to the site to provide sufficient spacing for the seven (7) proposed fire hydrants (six internal to the site and one along S Rome Way). All water lines shall have a minimum vertical separation of 24-inches and 10-feet horizontally from other wet utilities. The future 8-inch and 12-inch water mains and fire hydrant placements have been shown on the Overall Utility Model and included in the water system analysis to demonstrate appropriate pressure requirements. All water mains and hydrants upon approval, will be owned, operated, and maintained by COA.

WATER DEMAND

The peak and average water demands analyzed to meet the maximum day plus fire flow demand (as determined by ISO criteria) with a residual pressure of no less than 20 psi at any point in the distribution system. The demand is solely based off fire demand.

The required fire flow is 1500 gpm per IFC Table B105.1(2).

Fire Demand Location	Fire Flow (gpm)	No. of Hydrants	Max. Pipe Velocity (fps)
Fire	1500	7	5.89

It is assumed that the existing system will provide adequate pressures to the fire hydrants. The water demand calculations are included in **Appendix B** of this Report.

WATER SYSTEM DISTRIBUTION MODELING

The proposed water system was modeled using Bentley WaterCAD Connect to assess hydraulics of the water distribution system. The proposed water system is modeled with the assumption of a full build out condition for the Project using the Hazen-Williams Formula. The water system was evaluated under five scenarios based on City of Aurora Standards and Specifications criteria. The five scenarios are as follows: Static pressure and four (4) fire flow scenarios 1,500 gpm fire flow for some of the hydrants onsite. These fire flow scenarios are provided to give a detailed look at the system under specific fire scenarios. Also included is an overall fire flow report that models the 1,500 gpm fire flow for each hydrant in the system sequentially.

AVAILABLE PRESSURE AND FLOW

A water reservoir was used to simulate available pressure in the area adjacent to the Project. The City of Aurora provided existing hydrant pressures adjacent to the site to assist in calibrating the water model. This information is included in Appendix D for reference. Based on the location of the Project and the Existing Pressures provided by COA (included in Appendix D for reference), the project is within Zone 4. The Existing Hydraulic Grade Line Schematic shows that the site is serviced by an 8” water main located north of the site. In the Water Model, the static pressure was converted to a hydraulic grade line of 5841.51 ft. The 24” static pressure was converted to a hydraulic grade line of 5842.20 ft. Refer to **Appendix B** for more information.

SUMMARY OF WATER MODELING RESULTS

Based on the results acquired from the water model, the proposed system will adequately serve the project area per COA requirements. It was determined that an 8-inch water main will be required through the public roadway improvements and for the East-West connections within the site, while a 12-inch main will be required internal to the site for the North-South mains to support expansion of the site to the south in future phases. A summary of each water model scenario is included in **Appendix B** of this Report. Below is a summary of the COA requirement and the water model results for each scenario.

1. *Static Condition* – COA requires that the pressure is not to fall below 20 psi at any time. A maximum was assumed to be 100 psi. As shown in the water model output in **Appendix B**, the minimum system static pressure is 40 psi with a maximum static pressure of 51 psi.

2. *Velocities* – COA requires pipe velocities to not exceed 10 fps during maximum day plus fire flows for 12-inch water lines. As shown in the water model output in **Appendix B,** the minimum system pressure is 37 psi. The maximum velocity is 5.89 fps within the system.

SANITARY SEWER SYSTEM

EXISTING SANITARY SEWER SYSTEM

The City of Aurora operates and maintains the existing sanitary sewer system that the Project utilizes. An existing 8-inch sewer is located within S Rome Way just to the north of the proposed development.

SANITARY SEWER LAYOUT

An overall utility plan is included in **Appendix A**. In accordance with the COA design criteria, the sanitary sewer main follows the roadway infrastructure. The project will extend the sewer an additional 60 LF to the tie into the project site. This proposed extension will be owned, operated and maintained by COA.

The sanitary sewer lateral to the site will be an 8-inch PVC. The line within the site will be privately owned, operated and maintained.

SANITARY SEWER DEMANDS

Sanitary sewer demands for the Project were determined making a few key assumptions:

An RV has a tank of 40 gallons and it takes 1 minute to empty the tank at the dump station.

The maximum load on the system will be when an RV is utilizing all three dump stations at the same time. The maximum load is assumed to be 120 gallons over a course of 1 minute. This results in a flow rate of 0.089 cfs. An 8” sanitary sewer main will be used to connect the dump station to the existing 36” sanitary sewer main.

Per the COA criteria, a sewer main must be able to convey all wastewater with a maximum 75% flow depth. In addition, service lines require a minimum of 2 feet per second velocity once per day. A Bentley FlowMaster V8i analysis demonstrates an 8-inch sanitary sewer main at slope of 0.75% and carrying the assumed average daily flow of 0.089 CFS will be 18% full and have a velocity of 2.20 fps. The maximum peaking factor of 4 was used to prove sufficient capacity for the sanitary sewer. The 8” sanitary sewer will be constructed at a constant 0.75% slope. The sanitary sewer calculations are provided in **Appendix C** for reference.

SANITARY SEWER DESIGN

The project sewer mains were designed to meet all Aurora Standards and Specifications set forth in Section 5 – Utility Design Criteria and Construction Plans. For the purposes of this report, a slope of 0.75% was used to achieve the minimum slope required. The sanitary sewer main is to be constructed at a minimum 0.75% slope or greater. Based on criteria found in Section 500, the proposed Project development can be adequately conveyed with an 8-inch PVC sanitary sewer main for the total max daily peak value. All sanitary sewer calculations are provided in **Appendix C**.

CONCLUSION

COMPLIANCE WITH STANDARDS

Proposed water main and sanitary sewer for the Project have been designed in accordance with applicable Aurora Water Standards and Specifications. The results from the water and sanitary sewer analysis detailed in this report show that a 8-inch water main and 8-inch sanitary sewer main in the public roadways can adequately support the Project.

WATER SYSTEM

The calculations within this Report demonstrate the following results:

1. The proposed site will be served by connections to an existing 8-inch water main in S Rome Way and an existing 24-inch main within the E-470 multi-use easement.
2. All static water pressures are less than 100 psi and greater than 30 psi.
3. All junctions meet the COA minimum pressure requirement of 20 psi during fire flow demands.
4. The maximum velocity will not exceed 10 fps throughout the system in any of the scenarios.
5. No pressure reduction valves (PRVs) will be required for this project. Flows for the system work for the appropriate pressure.

SANITARY SEWER

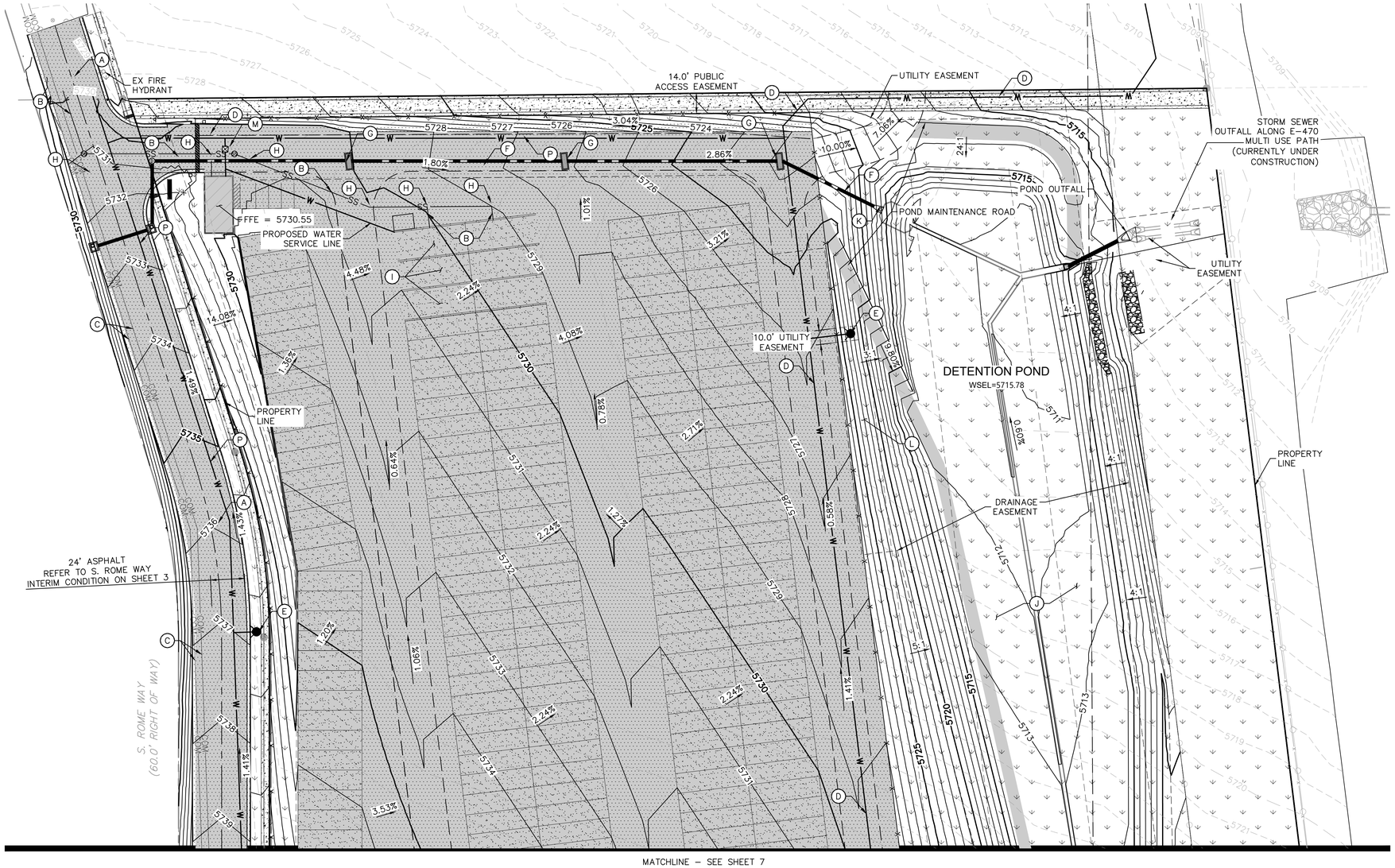
The calculations within this Report demonstrate the following results:

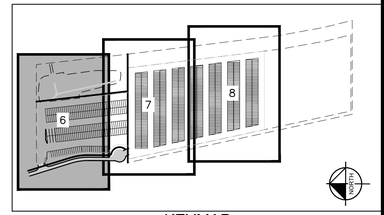
1. An 8-inch main is adequate for serving the entire Project site at a minimum slope of 0.75%.
2. A minimum velocity for the 8-inch main exceeds the minimum velocity of 2.0 fps at the total max daily peak volume (MDP).
3. The 8-inch main system operates at less than 50% capacity at the MDP. The MDP includes the demand from the proposed developments, future developments, and the existing school site

REFERENCES

1. Water, Sanitary Sewer and Storm Drainage Infrastructure, Aurora Water, 2020 Edition

APPENDIX A – SITE DRAWINGS





KEYMAP
N.T.S

LEGEND

- EXISTING R.O.W. LINE
- PROPOSED SITE PROPERTY LINE
- HIGH POINT
- W — PROPOSED WATER LINE
- SS — PROPOSED SSWR LINE
- E — PROPOSED ELECTRIC LINE
- COM — PROPOSED COMMUNICATION LINE
- DRAINAGE PAN
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- 5747 — PROPOSED CONTOUR
- 5747 — EXISTING CONTOUR
- PROPOSED STORM DRAINAGE INLET
- PROPOSED STORM OUTLET
- PROPOSED FIRE HYDRANT
- FIRE LANE

SITE KEYNOTES

(A) PROPOSED UNDERGROUND ELECTRICAL SERVICE, EXACT ROUTING BY PROVIDER
(B) PROPOSED 8" PVC SANITARY SEWER SERVICE @ 1% (MIN) SLOPE
(C) 2-4" CONDUIT; (1) FOR COMCAST, (1) FOR QUEST
(D) PROPOSED 12" C-900 PVC WATER MAIN
(E) PROPOSED FIRE HYDRANT
(F) PROPOSED PRIVATE STORM LINE
(G) PROPOSED TRIPLE DENVER TYPE 16 VALLEY INLET
(H) PROPOSED SANITARY SEWER MANHOLE
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Denver, Colorado 80237 (303) 228-2300

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DRAWN BY: NER
CHECKED BY: SAL
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AURORA, COLORADO
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GRADING & UTILITY PLAN

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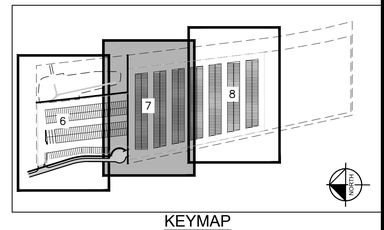

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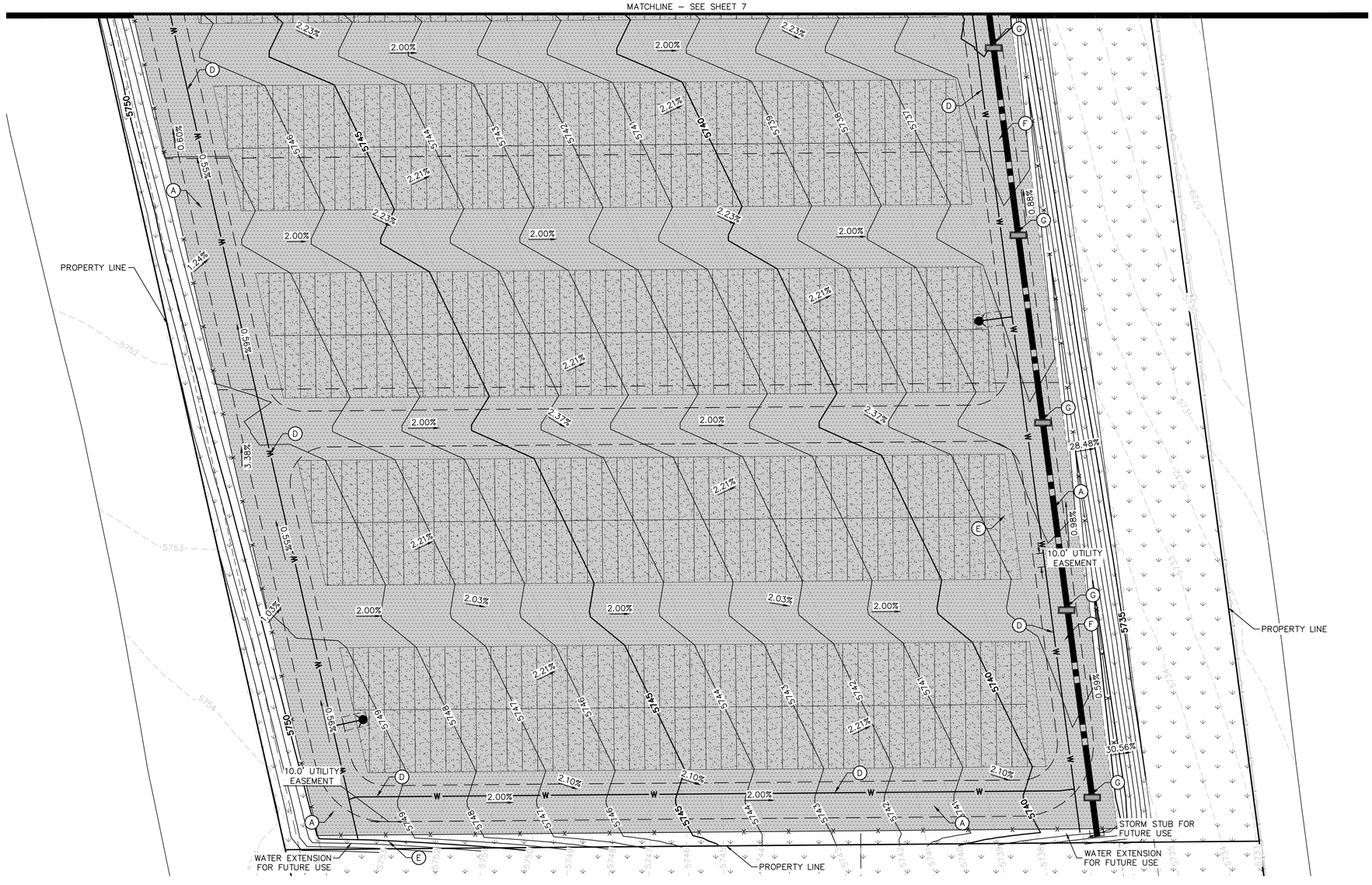

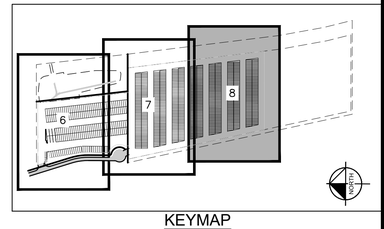

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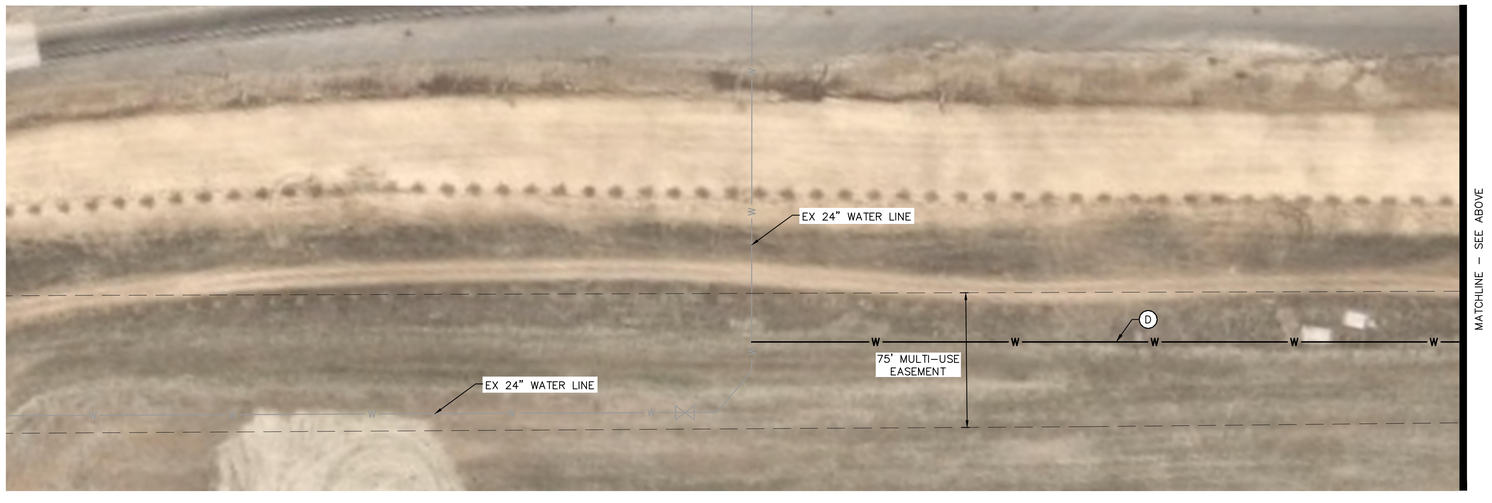

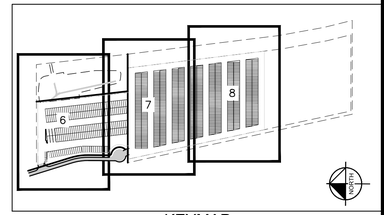

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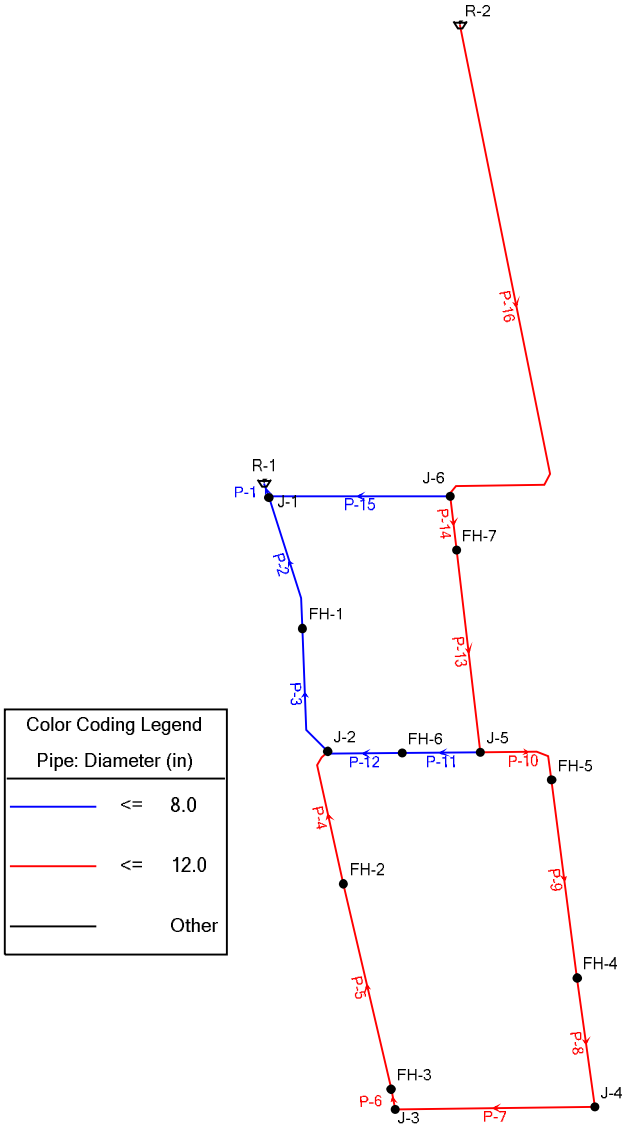
APPENDIX B – WATER SYSTEM COMPUTATIONS

E-470 RV Storage
Pipe Schematic



E-470 RV Storage
Active Scenario: Static Condition
FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
FH-1	5,737.01	0	5,841.69	45
FH-2	5,745.76	0	5,841.80	42
FH-3	5,749.44	0	5,841.81	40
FH-4	5,736.74	0	5,841.82	45
FH-5	5,729.57	0	5,841.83	49
FH-6	5,738.06	0	5,841.81	45
FH-7	5,725.92	0	5,841.86	50
J-1	5,730.53	0	5,841.57	48
J-2	5,739.53	0	5,841.80	44
J-3	5,749.55	0	5,841.81	40
J-4	5,739.33	0	5,841.82	44
J-5	5,731.60	0	5,841.83	48
J-6	5,723.06	0	5,841.86	51

E-470 RV Storage
Active Scenario: Static Condition
FlexTable: Pipe Table

Label	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Length (Scaled) (ft)	Flow (Absolute) (gpm)	Velocity (ft/s)	Headloss (ft)
P-1	R-1	J-1	8.0	PVC	130.0	40	270	1.73	0.06
P-2	J-1	FH-1	8.0	PVC	130.0	357	111	0.71	0.11
P-3	FH-1	J-2	8.0	PVC	130.0	346	111	0.71	0.11
P-4	J-2	FH-2	12.0	PVC	130.0	365	58	0.17	0.01
P-5	FH-2	FH-3	12.0	PVC	130.0	554	58	0.17	0.01
P-6	FH-3	J-3	12.0	PVC	130.0	54	58	0.17	0.00
P-7	J-3	J-4	12.0	PVC	130.0	524	58	0.17	0.01
P-8	J-4	FH-4	12.0	PVC	130.0	342	58	0.17	0.00
P-9	FH-4	FH-5	12.0	PVC	130.0	525	58	0.17	0.01
P-10	FH-5	J-5	12.0	PVC	130.0	242	58	0.17	0.00
P-11	J-5	FH-6	8.0	PVC	130.0	206	53	0.34	0.02
P-12	FH-6	J-2	8.0	PVC	130.0	198	53	0.34	0.02
P-13	J-5	FH-7	12.0	PVC	130.0	535	111	0.32	0.02
P-14	FH-7	J-6	12.0	PVC	130.0	142	111	0.32	0.01
P-15	J-1	J-6	8.0	PVC	130.0	477	159	1.02	0.29
P-16	R-2	J-6	12.0	PVC	130.0	1,501	270	0.77	0.34

E-470 RV Storage
Active Scenario: Fire Flow - 1,500 gpm
Fire Flow Node FlexTable: Fire Flow Report

Label	Fire Flow (Available) (gpm)	Pressure (Calculated Residual) (psi)	Velocity of Maximum Pipe (ft/s)	Pipe w/ Maximum Velocity	Pressure (Calculated System Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)
FH-1	1,501	43	5.89	P-1	39	J-3
FH-2	1,501	39	5.11	P-1	38	J-3
FH-3	1,501	37	5.02	P-1	37	J-3
FH-4	1,501	43	4.90	P-1	38	J-3
FH-5	1,501	47	4.87	P-1	38	J-3
FH-6	1,501	42	5.00	P-11	38	J-3
FH-7	1,501	49	4.47	P-1	39	J-3

E-470 RV Storage
Active Scenario: Fire Demand - FH-7
FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
FH-1	5,737.01	0	5,840.36	45
FH-2	5,745.76	0	5,839.54	41
FH-3	5,749.44	0	5,839.48	39
FH-4	5,736.74	0	5,839.39	44
FH-5	5,729.57	0	5,839.34	47
FH-6	5,738.06	0	5,839.45	44
FH-7	5,725.92	1,500	5,839.15	49
J-1	5,730.53	0	5,841.14	48
J-2	5,739.53	0	5,839.57	43
J-3	5,749.55	0	5,839.47	39
J-4	5,739.33	0	5,839.43	43
J-5	5,731.60	0	5,839.32	47
J-6	5,723.06	0	5,839.68	50

E-470 RV Storage
Active Scenario: Fire Demand - FH-7
FlexTable: Pipe Table

Label	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Length (Scaled) (ft)	Flow (Absolute) (gpm)	Velocity (ft/s)	Headloss (ft)
P-1	R-1	J-1	8.0	PVC	130.0	40	699	4.46	0.37
P-2	J-1	FH-1	8.0	PVC	130.0	357	318	2.03	0.78
P-3	FH-1	J-2	8.0	PVC	130.0	346	318	2.03	0.78
P-4	J-2	FH-2	12.0	PVC	130.0	365	167	0.47	0.04
P-5	FH-2	FH-3	12.0	PVC	130.0	554	167	0.47	0.05
P-6	FH-3	J-3	12.0	PVC	130.0	54	167	0.47	0.01
P-7	J-3	J-4	12.0	PVC	130.0	524	167	0.47	0.05
P-8	J-4	FH-4	12.0	PVC	130.0	342	167	0.47	0.03
P-9	FH-4	FH-5	12.0	PVC	130.0	525	167	0.47	0.05
P-10	FH-5	J-5	12.0	PVC	130.0	242	167	0.47	0.03
P-11	J-5	FH-6	8.0	PVC	130.0	206	151	0.96	0.13
P-12	FH-6	J-2	8.0	PVC	130.0	198	151	0.96	0.13
P-13	J-5	FH-7	12.0	PVC	130.0	535	318	0.90	0.17
P-14	FH-7	J-6	12.0	PVC	130.0	142	1,182	3.35	0.53
P-15	J-1	J-6	8.0	PVC	130.0	477	381	2.43	1.46
P-16	R-2	J-6	12.0	PVC	130.0	1,501	801	2.27	2.52

E-470 RV Storage
Active Scenario: Fire Demand - FH-6
FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
FH-1	5,737.01	0	5,839.41	44
FH-2	5,745.76	0	5,837.83	40
FH-3	5,749.44	0	5,837.93	38
FH-4	5,736.74	0	5,838.11	44
FH-5	5,729.57	0	5,838.21	47
FH-6	5,738.06	1,500	5,835.38	42
FH-7	5,725.92	0	5,839.71	49
J-1	5,730.53	0	5,841.06	48
J-2	5,739.53	0	5,837.75	42
J-3	5,749.55	0	5,837.95	38
J-4	5,739.33	0	5,838.05	43
J-5	5,731.60	0	5,838.26	46
J-6	5,723.06	0	5,840.12	51

E-470 RV Storage
Active Scenario: Fire Demand - FH-6
FlexTable: Pipe Table

Label	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Length (Scaled) (ft)	Flow (Absolute) (gpm)	Velocity (ft/s)	Headloss (ft)
P-1	R-1	J-1	8.0	PVC	130.0	40	777	4.96	0.45
P-2	J-1	FH-1	8.0	PVC	130.0	357	476	3.04	1.65
P-3	FH-1	J-2	8.0	PVC	130.0	346	476	3.04	1.65
P-4	J-2	FH-2	12.0	PVC	130.0	365	241	0.68	0.08
P-5	FH-2	FH-3	12.0	PVC	130.0	554	241	0.68	0.10
P-6	FH-3	J-3	12.0	PVC	130.0	54	241	0.68	0.02
P-7	J-3	J-4	12.0	PVC	130.0	524	241	0.68	0.10
P-8	J-4	FH-4	12.0	PVC	130.0	342	241	0.68	0.07
P-9	FH-4	FH-5	12.0	PVC	130.0	525	241	0.68	0.10
P-10	FH-5	J-5	12.0	PVC	130.0	242	241	0.68	0.05
P-11	J-5	FH-6	8.0	PVC	130.0	206	783	5.00	2.88
P-12	FH-6	J-2	8.0	PVC	130.0	198	717	4.58	2.37
P-13	J-5	FH-7	12.0	PVC	130.0	535	1,024	2.90	1.45
P-14	FH-7	J-6	12.0	PVC	130.0	142	1,024	2.90	0.40
P-15	J-1	J-6	8.0	PVC	130.0	477	301	1.92	0.94
P-16	R-2	J-6	12.0	PVC	130.0	1,501	723	2.05	2.08

E-470 RV Storage
Active Scenario: Fire Demand - FH-3
FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
FH-1	5,737.01	0	5,839.27	44
FH-2	5,745.76	0	5,836.79	39
FH-3	5,749.44	1,500	5,835.87	37
FH-4	5,736.74	0	5,837.25	43
FH-5	5,729.57	0	5,837.97	47
FH-6	5,738.06	0	5,837.93	43
FH-7	5,725.92	0	5,839.77	49
J-1	5,730.53	0	5,841.05	48
J-2	5,739.53	0	5,837.49	42
J-3	5,749.55	0	5,836.03	37
J-4	5,739.33	0	5,836.75	42
J-5	5,731.60	0	5,838.38	46
J-6	5,723.06	0	5,840.16	51

E-470 RV Storage
Active Scenario: Fire Demand - FH-3
FlexTable: Pipe Table

Label	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Length (Scaled) (ft)	Flow (Absolute) (gpm)	Velocity (ft/s)	Headloss (ft)
P-1	R-1	J-1	8.0	PVC	130.0	40	786	5.02	0.46
P-2	J-1	FH-1	8.0	PVC	130.0	357	496	3.16	1.78
P-3	FH-1	J-2	8.0	PVC	130.0	346	496	3.16	1.78
P-4	J-2	FH-2	12.0	PVC	130.0	365	788	2.23	0.69
P-5	FH-2	FH-3	12.0	PVC	130.0	554	788	2.23	0.92
P-6	FH-3	J-3	12.0	PVC	130.0	54	712	2.02	0.15
P-7	J-3	J-4	12.0	PVC	130.0	524	712	2.02	0.72
P-8	J-4	FH-4	12.0	PVC	130.0	342	712	2.02	0.49
P-9	FH-4	FH-5	12.0	PVC	130.0	525	712	2.02	0.72
P-10	FH-5	J-5	12.0	PVC	130.0	242	712	2.02	0.41
P-11	J-5	FH-6	8.0	PVC	130.0	206	292	1.86	0.45
P-12	FH-6	J-2	8.0	PVC	130.0	198	292	1.86	0.44
P-13	J-5	FH-7	12.0	PVC	130.0	535	1,004	2.85	1.40
P-14	FH-7	J-6	12.0	PVC	130.0	142	1,004	2.85	0.39
P-15	J-1	J-6	8.0	PVC	130.0	477	291	1.85	0.88
P-16	R-2	J-6	12.0	PVC	130.0	1,501	714	2.02	2.04

E-470 RV Storage
Active Scenario: Fire Demand - FH-4
FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
FH-1	5,737.01	0	5,839.54	44
FH-2	5,745.76	0	5,837.64	40
FH-3	5,749.44	0	5,837.15	38
FH-4	5,736.74	1,500	5,836.26	43
FH-5	5,729.57	0	5,837.46	47
FH-6	5,738.06	0	5,838.08	43
FH-7	5,725.92	0	5,839.65	49
J-1	5,730.53	0	5,841.07	48
J-2	5,739.53	0	5,838.01	43
J-3	5,749.55	0	5,837.05	38
J-4	5,739.33	0	5,836.58	42
J-5	5,731.60	0	5,838.15	46
J-6	5,723.06	0	5,840.06	51

E-470 RV Storage
Active Scenario: Fire Demand - FH-4
FlexTable: Pipe Table

Label	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Length (Scaled) (ft)	Flow (Absolute) (gpm)	Velocity (ft/s)	Headloss (ft)
P-1	R-1	J-1	8.0	PVC	130.0	40	768	4.90	0.44
P-2	J-1	FH-1	8.0	PVC	130.0	357	457	2.91	1.53
P-3	FH-1	J-2	8.0	PVC	130.0	346	457	2.91	1.53
P-4	J-2	FH-2	12.0	PVC	130.0	365	563	1.60	0.37
P-5	FH-2	FH-3	12.0	PVC	130.0	554	563	1.60	0.49
P-6	FH-3	J-3	12.0	PVC	130.0	54	563	1.60	0.10
P-7	J-3	J-4	12.0	PVC	130.0	524	563	1.60	0.47
P-8	J-4	FH-4	12.0	PVC	130.0	342	563	1.60	0.32
P-9	FH-4	FH-5	12.0	PVC	130.0	525	937	2.66	1.20
P-10	FH-5	J-5	12.0	PVC	130.0	242	937	2.66	0.68
P-11	J-5	FH-6	8.0	PVC	130.0	206	107	0.68	0.07
P-12	FH-6	J-2	8.0	PVC	130.0	198	107	0.68	0.07
P-13	J-5	FH-7	12.0	PVC	130.0	535	1,043	2.96	1.50
P-14	FH-7	J-6	12.0	PVC	130.0	142	1,043	2.96	0.42
P-15	J-1	J-6	8.0	PVC	130.0	477	311	1.99	1.00
P-16	R-2	J-6	12.0	PVC	130.0	1,501	732	2.08	2.14

APPENDIX C – SANITARY SEWER COMPUTATIONS

Average Daily Flow

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.00750	ft/ft
Diameter	0.67	ft
Discharge	0.09	ft³/s

Results

Normal Depth	0.12	ft
Flow Area	0.04	ft²
Wetted Perimeter	0.57	ft
Hydraulic Radius	0.07	ft
Top Width	0.51	ft
Critical Depth	0.14	ft
Percent Full	17.2	%
Critical Slope	0.00386	ft/ft
Velocity	2.20	ft/s
Velocity Head	0.08	ft
Specific Energy	0.19	ft
Froude Number	1.37	
Maximum Discharge	1.48	ft³/s
Discharge Full	1.38	ft³/s
Slope Full	0.00003	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	17.21	%
Downstream Velocity	Infinity	ft/s

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.12	ft
Critical Depth	0.14	ft
Channel Slope	0.00750	ft/ft
Critical Slope	0.00386	ft/ft

Max Daily Flow

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.05000	ft/ft
Diameter	0.67	ft
Discharge	0.36	ft^3/s

Results

Normal Depth	0.14	ft
Flow Area	0.06	ft^2
Wetted Perimeter	0.64	ft
Hydraulic Radius	0.09	ft
Top Width	0.55	ft
Critical Depth	0.28	ft
Percent Full	21.4	%
Critical Slope	0.00391	ft/ft
Velocity	6.46	ft/s
Velocity Head	0.65	ft
Specific Energy	0.79	ft
Froude Number	3.59	
Maximum Discharge	3.83	ft^3/s
Discharge Full	3.56	ft^3/s
Slope Full	0.00050	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	21.35	%
Downstream Velocity	Infinity	ft/s

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.14	ft
Critical Depth	0.28	ft
Channel Slope	0.05000	ft/ft
Critical Slope	0.00391	ft/ft

APPENDIX D – REFERENCE DOCUMENTS

Aurora Water

Water Administration
15151 E. Alameda Parkway, Ste. 3600
Aurora, Colorado 80012
303.739.7370

			SITE:	S Rome Way		
			HYDRANT:	Listed		
			SCENARIO:	**2017 Summer Day**		
			DATE:	6/24/2020		
Hydraulic Zone	***Hydrant***	***Fire-Flow Demand (gpm)***	***Static Pressure***	***Fire-Flow Demand (MGD)***	***Residual Pressure***	***Available Flow at Hydrant @ 20 psi (gpm)***
4	***13S-04***	***2,500.00***	***72.5***	***3.6***	***55.2***	***4,739.05***
4	***13S-28***	***2,500.00***	***58.1***	***3.6***	***13.2***	***2,280.04***
4	***13S-29***	***2,500.00***	***56.5***	***3.6***	***12.7***	***2,257.75***
4	***14S-01***	***1,500.00***	***48.4***	***2.16***	***22.4***	***1,576.50***

The City of Aurora performs fireflow simulations on the City's Water Distribution Model, using InfoWater software by Innovyze, Inc. The model developed from pipes and node elevations from the City's GIS system, design drawings for pumps and tanks, and diurnal demand patterns from SCADA and historical use records. Comparing the model's performance with SCADA data validates the model. Fireflow simulations are performed under a maximum day demand scenario. These pressures may differ slightly than actual pressures measured in the field.

Meyer, Bryan

From: Francis, Edward <efrancis@auroragov.org>
Sent: Tuesday, October 17, 2017 12:31 PM
To: Meyer, Bryan
Cc: Kijowski, Kelsey (Palmer)
Subject: RE: Water Pressures - 470 Storage

Bryan,
The static pressure in the 24" where it crosses E-470 is approx. 64psi.

Eddie