MASTER UTILITY REPORT

FOR

1450 S. ABILENE STREET

Located:
1450 South Abilene Street,
Aurora, CO 80012

Prepared: September 23rd, 2021
Revised: December 21st, 2021

Prepared for:

MAA
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HKS Project No. 210424

APPROVED FOR ONE YEAR FROM THIS DATE

_____

_____ _____
CITY ENGINEER DATE

_____ _____
WATER DEPARTMENT DATE

TABLE OF CONTENTS

I. INTRODUCTION

A. Site Location

The proposed development of 1450 S. Abilene St. is located in the Northwest Quarter of Section 19, Township 4 South, Range 66 West of the 6th Principal Meridian, City and County of Aurora, State of Colorado. The Site is bounded by a multi-use commercial building to the North, single-family homes along East Arkansas Drive to the East, East Florida Avenue to the South, and South Abilene Street to West. A vicinity map is included with this report in Appendix A.

B. Site Description

The Site encompasses approximately 4.41 acres of developed land. There is currently an existing building containing a fitness center along with internal roadways/fire lanes, parking areas, & landscaping.

The site generally flows South to North and West to East. Slopes range from approximately 0.5% to 10% throughout the site with a maximum of 23 feet of vertical elevation change across the site. Existing vegetation is predominately landscaped grass and a tree covered swale. The soil for this site is a combination of Hydrological Soil Group A and B.

C. Existing Facilities

Sanitary: The City of Aurora owns and operates the sanitary sewer facilities within the vicinity of the Site. Sanitary facility locations within the proximity of the site are based on field survey and utility maps provided by the City of Aurora. A copy of the City's Utility Locate Map is included in Appendix B.

According to the City's Utility Locate Map and survey data, two existing 8" sanitary mains exist in East Florida Avenue with both heading South through commercial development towards East Jewell Avenue. One connection to the existing 8" sanitary main in East Florida Avenue that the site will connect to, flows East into an existing manhole near the intersection of East Florida Avenue and East Arkansas Drive. The main then routes South where it services existing commercial development including a condominium complex and shops. The second connection will occur in East Florida Avenue where it will flow East towards an existing manhole and also head south through an internal private roadway that services a hotel. These existing facilities are in place to serve the existing adjacent sites and residential development in accordance with previous studies and analyses. These existing utilities can be seen in the City's Utility Locate Map found in Appendix B. Internally to the Site; the existing sanitary sewer main is to be abandoned. Services for the existing building will be abandoned and removed at the time of the proposed building construction.

Water: Aurora Water owns and operates the existing water facilities surrounding the Site. Water facilities are located within the proximity of the site based on field survey data. An existing internal loop with multiple hydrant branches exists on site. The removal of a portion of this site along with relocating existing hydrants will take place during development. An exhibit showing existing water infrastructure is included in Appendix B.

D. Proposed Project Description

The project proposes development of the Site into multi-family residential units with an attached parking garage structure and pool. Other Site improvements will include paved drives/walks, curb & gutter, utilities, water quality/stormwater detention and landscaping.

II. PROPOSED SANITARY SEWER SYSTEM

A. Layout and Connection(s) to the Aurora Sanitary Sewer System

The sanitary service for the Site will be constructed through two 8-inch services that will connect to the sanitary sewer mains that exist within East Florida Avenue. The proposed 8-inch mains will split the building into two sanitary basins due to the existing topography of the Site and a building step. The Western portion of the building for the purpose of this report will be Basin 1 and the Eastern Portion of the building will be Basin 2. Proposed Sanitary mains will route the sewer to both the Southwest and Southeast of the Site. All proposed sanitary mains will be placed either in Aurora Public Right of Way or Easements dedicated to the city.

An additional service is being proposed to remove snowmelt and any excess water in the garage. These flows will be picked up by drains in the garage, routed through a sand-oil separator, and released into the public sanitary infrastructure. Peak flows have not been calculated for this service as it is to capture snowmelt only. There are no dwelling units or facilities in the garage.

Sanitary flows will be conveyed via the 8-inch services to collect wastewater effluent from the proposed building within the site. The Western portion of the building (Basin 1) will connect to the existing 8” main via a proposed manhole. The Eastern portion of the building (Basin 2) will connect to the existing sanitary main via a 50’ +/- main extension. The proposed sanitary sewer mains and sanitary service connections are shown on the Overall Utility Plan included in Appendix C.

The 8” sanitary service lines will each be constructed at a minimum slope of 1.00%. The 8-inch mainlines will be constructed at a minimum slope of 0.40%, the maximum slope will be 10%, per Aurora Water’s Water, Sanitary Sewer & Storm Drainage Infrastructure Standards & Specifications. A minimum of 10-feet horizontal clearance will be required from water lines and trees. A minimum of 5-feet horizontal clearance will be maintained from storm lines, with 10-feet clearance being maintained where possible. 8-inch mains have been calculated to have a capacity of 0.934 CFS at the minimum slope provided which is higher than the maximum proposed flows across the site.

B. Average and Peak Flow Calculations

The Water, Sanitary Sewer & Storm Drainage Infrastructure Standards & Specifications – Section 5.03: Sanitary Sewer System Design Criteria was used to determine necessary calculations related to sanitary sewer flows (See Appendix D) Per the City Standards, the average sewage flow at mean velocity shall be two (2) feet per second or greater while never exceeding ten (10) feet per second The maximum allowable slope shall not exceed 10%.

The following equations were used to calculate the Average Day Demand and Peak Flow Demand for the Site:

Aurora Water's: Water, Sanitary Sewer & Storm Drainage Infrastructure Standards & Specifications – Section 5

Criteria

AF = UNITS*POPULATION*68 GPD
PF = $5 \div p^{.167}$
INFILTRATION = AF × 0.1
PEAK FLOW = ((PF*AF)+INFILTRATION)

Using the information above and assuming 2.77 capita per unit, the projected peak flow from the Site to Building Basin 1 is 0.142 CFS and the peak flow from the Site to Building Basin 2 is 0.168 CFS. See Appendix D.

C. Conclusions

Existing peak flow in the existing offsite sanitary infrastructure is currently unknown. Aurora has documented the need to update their CIP to include future improvements to the sewer capacity in the future for this area. Furthermore, the addition of less than 0.15 CFS to existing infrastructure should be acceptable as currently configured. This addition makes up less than 15% of the capacity of the sanitary sewer in basin 1 and less than 16% of the capacity of the sanitary sewer that basin 2 is connected to. See calculations in Appendix D.

III. PROPOSED WATER SYSTEM

A. Layout and Connection(s) to the Aurora Potable Water System

The Site proposes to remove an internal loop from the existing 8" DIP water main on site. The 8" DIP Line on the Eastern side of the site running North-South will remain. The relocation of an existing hydrant will occur to allow for a revised drive aisle. The addition of a 3" Domestic Service will also be added to this loop while an existing hydrant on the Northern part of this run will remain. The existing connections for this water line are to the South in East Florida Avenue. An additional hydrant will be run off a section of the loop that will remain on the North side of the site. A layout of the proposed water main, service and overall utility plan is included in Appendix D.

B. Potable Water Demand (Peak and Average)

The design of the potable water distribution system was based on the design criteria given in section 5.02.3 of the Water, Sanitary Sewer & Storm Drainage Infrastructure Standards & Specifications published by Aurora Water. The potable water demand assumes 101 gallons/capita/day with an assumed average capita per unit of 2.77. The maximum day

peaking factor and max hour factor of 2.8 and 4.5 were utilized respectively. The total number of dwelling units for the proposed Site is 259. The total average daily demand and total maximum daily demand for the Site is 50.3 GPM and 140.9 GPM respectively. Domestic water demand calculations can be found in Appendix E. Table 1 represents the potable water demand for all buildings:

Aurora Water's Standards and Specifications Section 5.02.3 Design Criteria

5.02.3 Domestic Water Demand per Zoning Classification

Residential

Zoning	People per Unit	Average Day Per Capita Flow (gpd)
Residential	2.77	101

Non-Residential

Zoning	Average Day (gpd/acre)	Max Day (gpd/acre)	Max Hour (gpd/acre)
Commercial	1,500	4,200	6,750
Industrial (including schools)	1,200	3,360	5,400
Parks	1,800	5,040	N/A

Average Day Demand = (DU)*(101GPD)*(2.77persons)
Max Day Demand = (2.8)*Average Day Demand
Max Hour Demand = (4.5)*Max Day Demand

C. Fire Flow Demand

A water model was created with multiple scenarios to account for differing demands and fire flows. The Max daily demand with fire flow used three hydrants to accommodate for 4000 GPM total, with all 3 operating at 1500 GPM. These flows were coupled with the Maximum Daily Demand for the building. Scenarios were laid out to sufficiently cover the whole Site in the event of a fire.

Per the 2018 IFC, the calculated fire flow for the apartment building is 6000 GPM. A 50% reduction is allowed for buildings that are sprinklered, the garage is not sprinklered so the total fire flow required for the building is 4000 GPM. Fire flow calculations can be found in Appendix E.

D. Available Pressure and Capacity

The Aurora Water standards state that system must be analyzed to meet the maximum day plus fire flow demand with a residual pressure of no less than 20 psi at any point in the water distribution system.

The City of Aurora provided HGL Elevations and pressure zones for this site. Using this provided information, average day and maximum day demand pressures resulted in a

range of 102 psi and 107 psi, with fire scenario pressures between 100 psi and 106 psi. Water velocities in all pipes for all scenarios range between 0.11 feet per second (ft/s) and 9.57 feet per second (ft/s). The two hydrant laterals, when in use exceed the maximum 10 ft/s but only during a fire flow event. These 6 inch ductile iron fire hydrant laterals reach a maximum velocity of 17.02 ft/s. Velocities in the 8-inch water line exceed the maximum criteria in Aurora Water Specifications, however Aurora Water has reviewed and approved a variance for this condition. See Appendix E for calculations.

E. Network Model of System

The system was modeled using three reservoirs set at the 5850 feet. The water model elevations for proposed water appurtenances are based on the proposed grading conditions for the Site. The WaterCAD model utilized a steady-state analysis to calculate pressures, velocities, and head losses of the model. A table of these values for each scenario can be seen in Appendix E.

V. CRITERIA AND DESCRIPTION

The principal design criteria used for this study was Section 5 of Aurora Water's: Water, Sanitary Sewer & Storm Drainage Infrastructure Standards & Specifications.

VI. CONCLUSIONS

The Site is proposed to be developed into a multi-family residential building with a variety of unit types (totaling 259 dwelling units).

As previously mentioned, the peak flows were determined for this site to be 0.142 CFS for the Western portion of the building and 0.168 CFS for the Eastern portion of the building. Aurora has stated that these peak flow calculations will be used to size their line in their revised CIP plans and report.

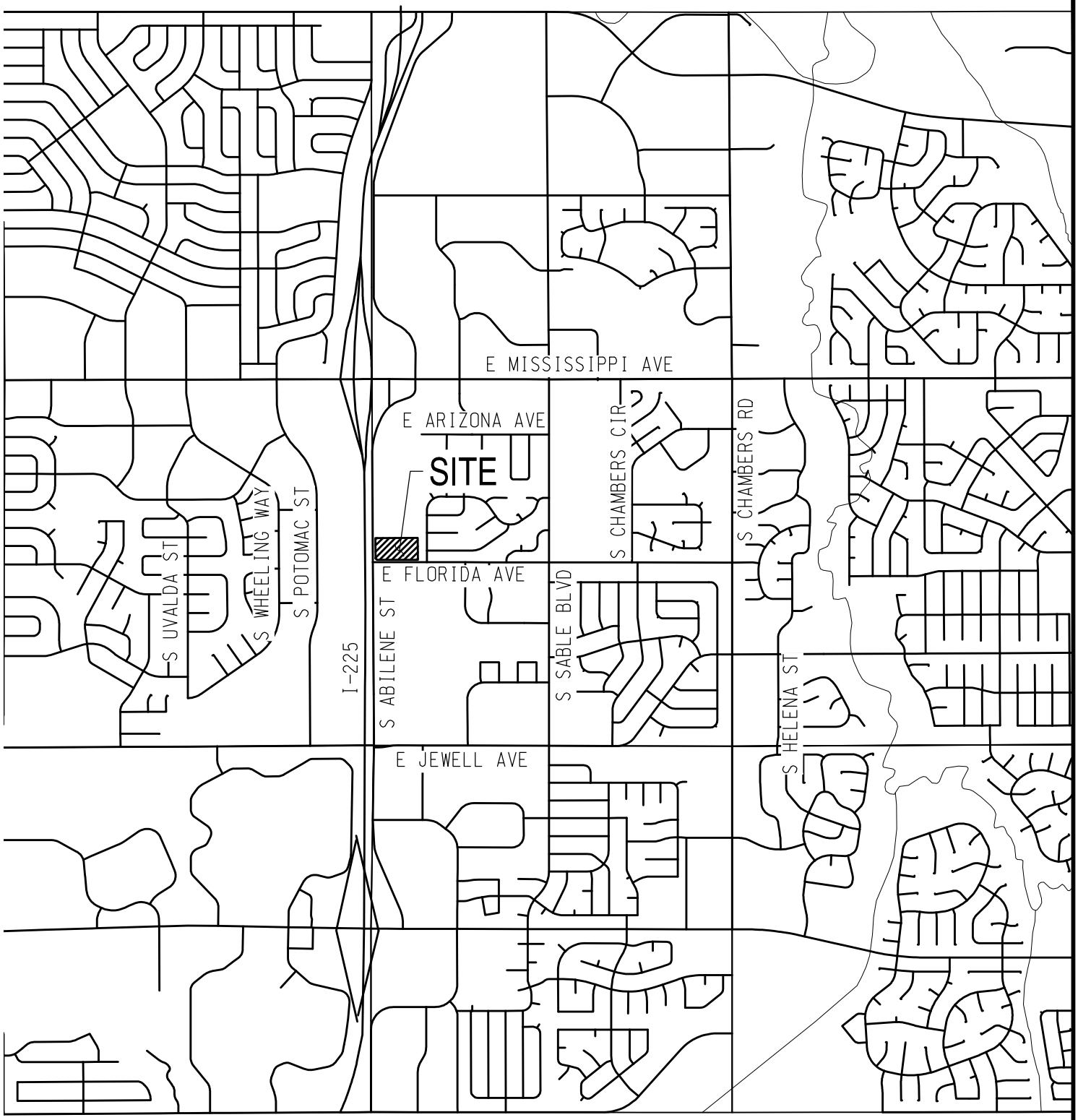
The water system is designed to provide a minimum of 20 psi residual pressure for fire flow, 4000 GPM for the hydrant laterals and up to 599.7 GPM during the maximum hour demand. The existing infrastructure being tied into has capacity per the estimated flows using Aurora Water's criteria.

References

1. Aurora Water. "Water. Sanitary Sewer & Storm Drainage Infrastructure Standards & Specifications." 2020.

2. International Code Council. "International Fire Code." 2018.

APPENDIX A - Vicinity Map



VICINITY MAP

SCALE: 1"=2000'

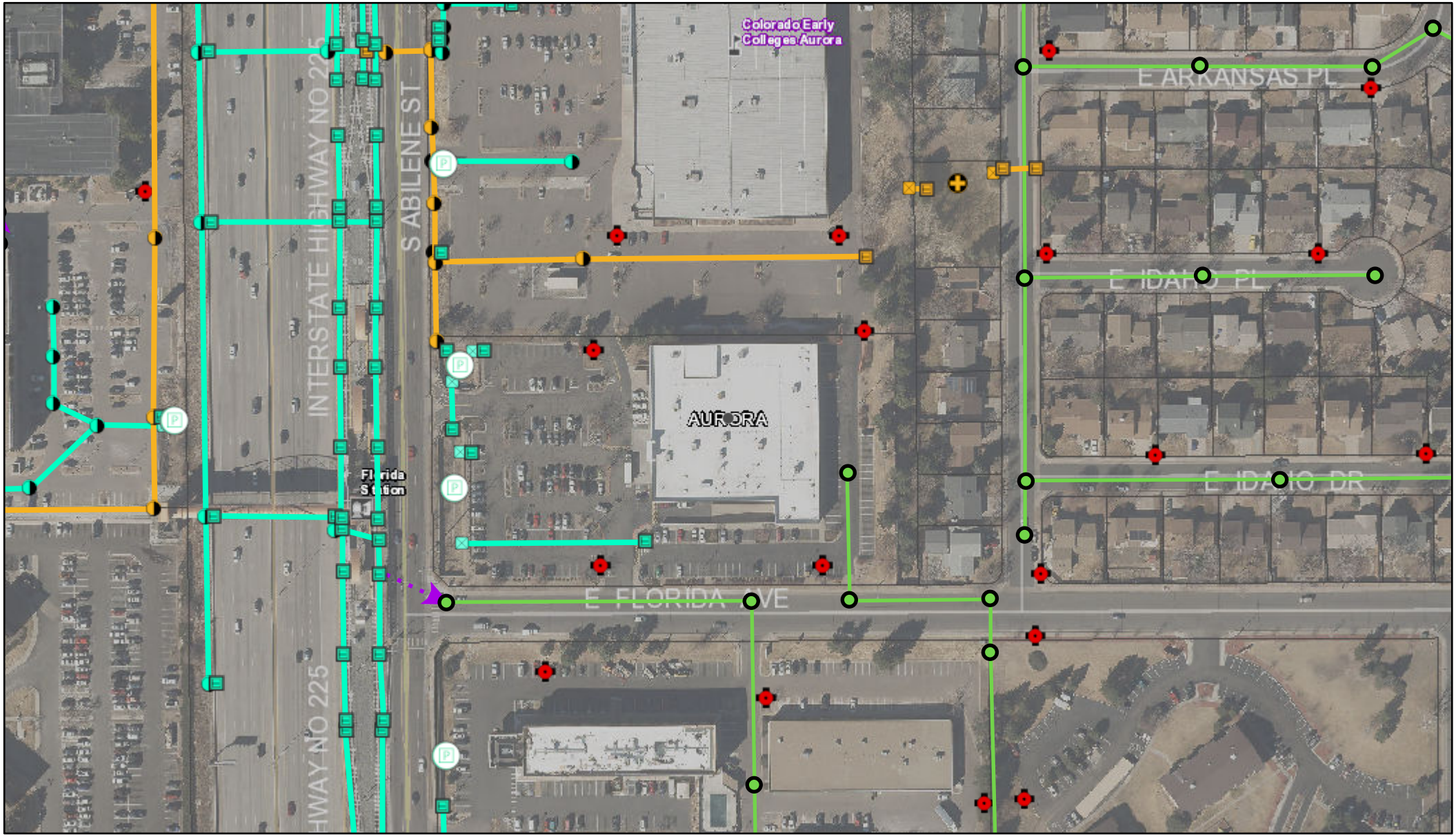
2000 0 2000 4000

SCALE: 1" = 2000'

Plotted: THU 09/23/21 3:02:27P By: James Rambone Filepath: k:\210424\engineering\xref\vicinity map.dwg Layout: layout2

APPENDIX B – City Utility Locate Maps

Waste Water and Storm Water Assets



4/15/2021, 3:05:29 PM

1:2,000

0 0.01 0.03 0.06 mi

0 0.03 0.06 0.11 km

Ponds
- Ponds City
- Ponds Other Owner

Storm Inlets
- Inlet Aurora
- Inlet Private or Other Owner

Storm Outlets
- Aurora Storm Outlet
- Private or Other Owner Storm Outlet

Storm Manholes
- Storm Manhole Aurora
- Storm Manhole Private or Other Owner

Wastewater Manholes
- Manhole

Storm Mains
- Aurora Storm Main
- Private or Other Owner Storm Main

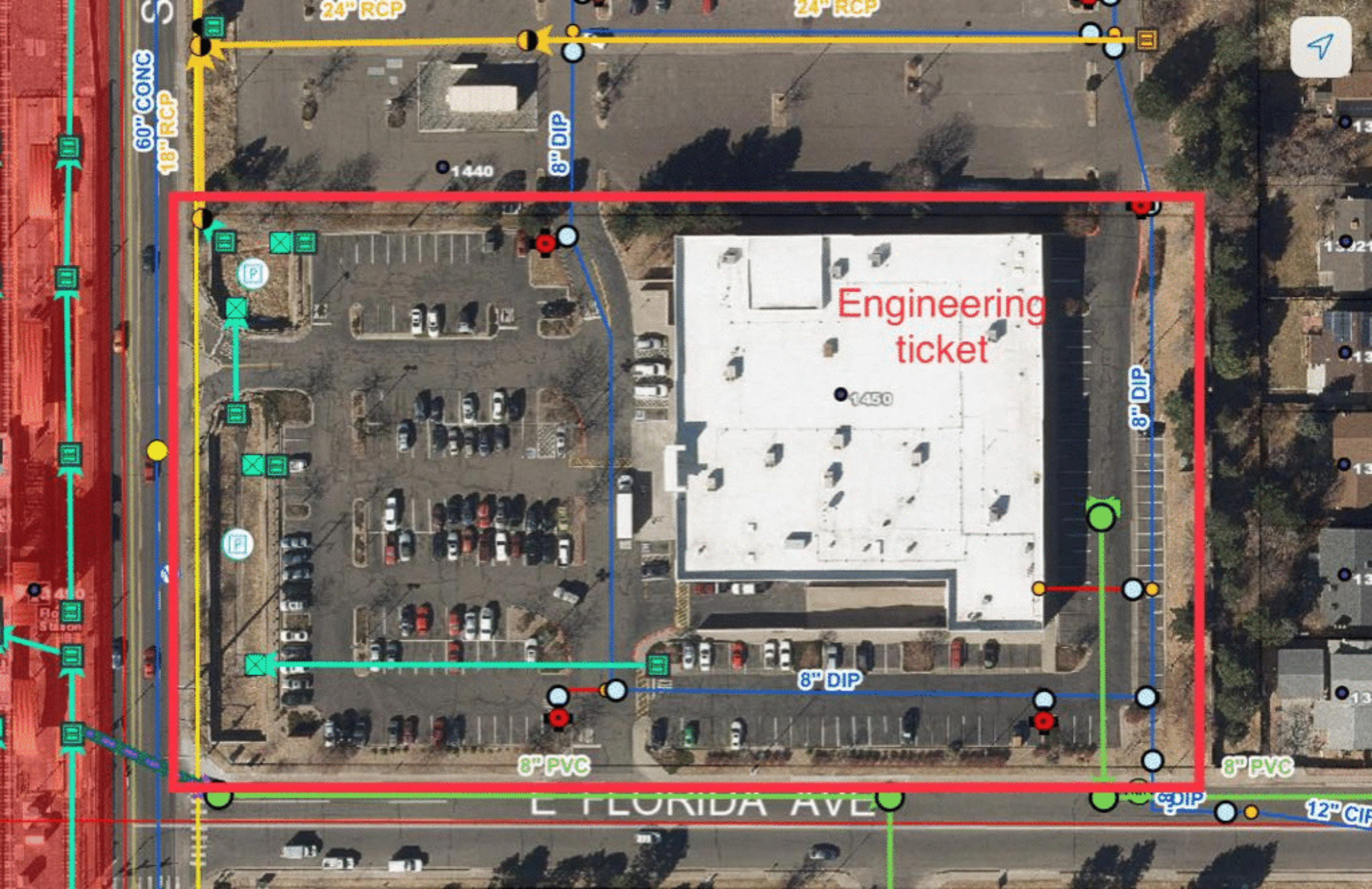
Wastewater Mains
- Wastewater Main
- Other

Fire Hydrants

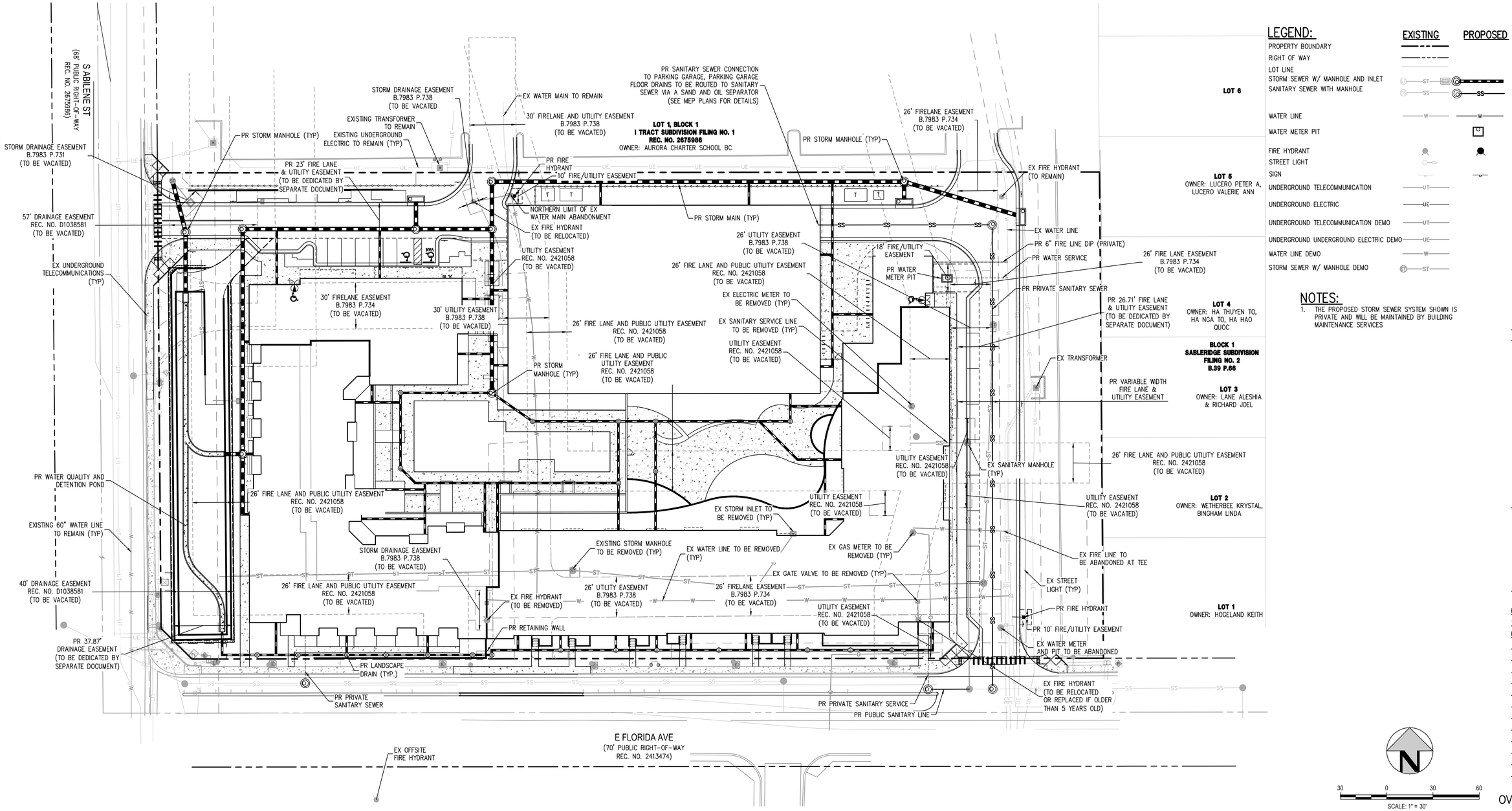
Storm Fittings
- Tee Fitting

City of Aurora

City of Aurora - GIS Editing Group |


24" RCP
24" RCP
60" CONC
18" RCP
8" DIP
1440
Engineering
ticket
1450
8" DIP
8" DIP
8" PVC
8" PVC
8" DIP
12" CIP
E FLORIDA AVE

APPENDIX C – Overall Utility Plan



LEGEND:

	EXISTING	PROPOSED
PROPERTY BOUNDARY		
RIGHT OF WAY		
LOT LINE		
STORM SEWER W/ MANHOLE AND INLET	ST ST	
SANITARY SEWER WITH MANHOLE	SS SS	SS
WATER LINE	W	W
WATER METER PIT		
FIRE HYDRANT		
STREET LIGHT		
SIGN		
UNDERGROUND TELECOMMUNICATION	UT	
UNDERGROUND ELECTRIC	UE	
UNDERGROUND TELECOMMUNICATION DEMO	UT	
UNDERGROUND UNDERGROUND ELECTRIC DEMO	UE	
WATER LINE DEMO	W	
STORM SEWER W/ MANHOLE DEMO	ST	ST

NOTES:

1. THE PROPOSED STORM SEWER SYSTEM SHOWN IS PRIVATE AND WILL BE MAINTAINED BY BUILDING MAINTENANCE SERVICES

N

30 0 30 60

SCALE: 1" = 30'

HKS HARRIS KOCHER SMITH
1120 Lincoln Street, Suite 1000
Denver, Colorado 80203
P: 303.623.4300 F: 303.623.4311
HarrisKocherSmith.com

MAA ABILENE MULTIFAMILY | SITE PLAN

1450 S ABILENE ST
AURORA, COLORADO

APPLICANT:
MAA Communities

5040 Addison Cir #200
Addison, TX 75001
Bart French

NOT FOR CONSTRUCTION

DATE:
09/29/21 SITE PLAN 01
11/19/21 SITE PLAN 02
01/07/22 SITE PLAN 03

SHEET TITLE:
OVERALL UTILITY PLAN

4 OF 18

CHECKED BY: CR, JC
DRAWN BY: CR, JR

APPENDIX D – Sanitary Sewer Calculations

HARRIS KOCHER SMITH
DENVER • DALLAS/FORT WORTH

Approximate Proposed Sanitary Peak Flows Table

Area ID	Development	Area	SF	Units	Density	Population per Unit	Commercial Flow Factors	Non-Residential Flow Factors	Ave Flow	Peak Factor	Infiltration (cfs)	Projected Peak Flow (cfs)
		(Acres)			(Units/Ac.)	(Table 5.03.9)	(Table 5.03.9)	(Table 5.03.9)	= Units x Population x 68 GPCD	= 5 ÷ P^.167	= AF × .1	= ((PF × Ave Flow) + Infiltration)
Basin 1	MF (Residential)	2.205	-	119	54.0	2.77	-	-	0.03	4.00	0.003	0.142
Basin 2	MF (Residential)	2.205	-	140	63.5	2.77	-	-	0.04	4.00	0.004	0.168
											TOTAL =	**0.31**

APPENDIX E – Water Calculations

FIRE FLOW CALCULATIONS

Project Name	1450 S. Abilene St
Last Edited	1/6/2022
Edited By	HGT

Site Area (ac) =	4.41
Zoning =	MU-C

Code Used For Analysis: 2018 IFC

Building A	Sprinkled?	Yes	No				
Description	Type	Area (sf)	Area (sf)	Area Percentage	Full GPM req	Sprinkled req	Apply Perc
Garage	IA	-	122,000	31.16%	6,000.00	6,000.00	1,869.58
	IB						
	IIA						
Residential	IIIA	269,531	-	68.84%	6,000.00	3,000.00	2,065.00
	IV						
	V-A						
	IIB						
	IIIB						
	V-B						
Total		391,531					**3,934.58**

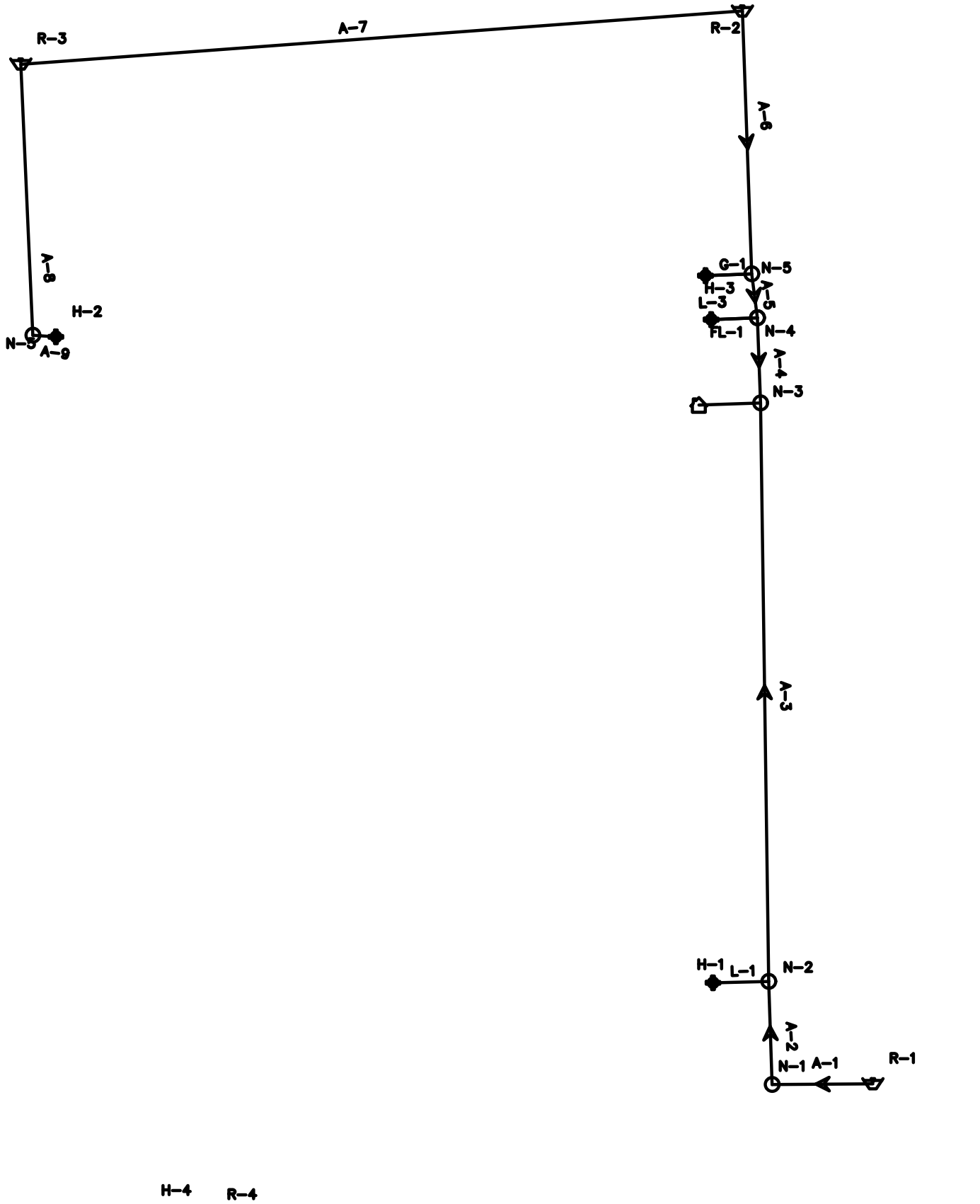
TOTAL UNADJUSTED FIRE FLOW (gpm)=	**6,000**
50% REDUCTION W/ SPRINKLE (gpm)=	**3,935**
TOTAL HYDRANTS REQUIRED PER IFC APPENDIX C=	**4**

Abilene Apartments
Project #210424
Date: 09/13/2021

BUILDING NUMBER	# OF UNITS	AVG. DEMAND (GPCD)	AVG DAILY DEMAND (GPD)	AVG DAILY DEMAND (GPM)	MAX DAILY DEMAND (PF=2.8) (GPM)	MAX HOUR DEMAND (PF=4.5) (GPM)	SPRINKLER FIRE FLOWS (GPM)	FIRE JUNCTION NUMBER
BUILDING A-1	259	101	68536.58	47.6	133.3	599.7	1750.0	Bldg-A1
TOTAL	259	101	68536.58	47.59	133.3	599.7		

Total DU = 259
Area = 4.41
DU/Acre = 59

Residential:
Avg day demand = (DU * 101GPD/person * 2.77 persons) (GPD)
Avg day demand = Avg day/1440min/day (GPM)
Max Day = Avg Day * 2.8 (GPM)
Max Hr = Max Day * 4.5 (GPM)
Avg day demand = (101GPCD*# OF UNITS*PERSON PER UNIT) (GPD)



ABILENE - WATERCAD LAYOUT

SCALE: 1"=60'

Scenario: Average Daily Demand
Current Time Step: 0.000 h
FlexTable: Pipe Table

Label	Length (Scaled) (ft)	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)
A-1	44	8.0	Ductile Iron	130.0	21	0.13	0.000
A-2	45	8.0	Ductile Iron	130.0	21	0.13	0.000
A-3	255	8.0	Ductile Iron	130.0	21	0.13	0.000
A-4	38	8.0	Ductile Iron	130.0	-30	0.19	0.000
A-5	25	8.0	Ductile Iron	130.0	-30	0.19	0.000
A-6	116	8.0	Ductile Iron	130.0	-30	0.19	0.000
A-7	304	6.0	Ductile Iron	130.0	0	0.00	0.000
A-8	120	8.0	Ductile Iron	130.0	0	0.00	0.000
A-9	10	6.0	Ductile Iron	130.0	0	0.00	0.000
A-10	23	6.0	Ductile Iron	130.0	0	0.00	0.000
L-1	25	6.0	Ductile Iron	130.0	0	0.00	0.000
L-3	20	6.0	Ductile Iron	130.0	0	0.00	0.000

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Scenario: Average Daily Demand
Current Time Step: 0.000 h
FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)
G-1	5,603.54	0	107
N-1	5,614.19	0	102
N-2	5,615.14	0	102
N-3	5,605.93	50	106
N-4	5,603.54	0	107
N-5	5,601.60	0	107

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Scenario: Maximum Daily Demand
Current Time Step: 0.000 h
FlexTable: Pipe Table

Label	Length (Scaled) (ft)	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)
A-1	44	8.0	Ductile Iron	130.0	58	0.37	0.000
A-2	45	8.0	Ductile Iron	130.0	58	0.37	0.000
A-3	255	8.0	Ductile Iron	130.0	58	0.37	0.000
A-4	38	8.0	Ductile Iron	130.0	-83	0.53	0.000
A-5	25	8.0	Ductile Iron	130.0	-83	0.53	0.000
A-6	116	8.0	Ductile Iron	130.0	-83	0.53	0.000
A-7	304	6.0	Ductile Iron	130.0	0	0.00	0.000
A-8	120	8.0	Ductile Iron	130.0	0	0.00	0.000
A-9	10	6.0	Ductile Iron	130.0	0	0.00	0.000
A-10	23	6.0	Ductile Iron	130.0	0	0.00	0.000
L-1	25	6.0	Ductile Iron	130.0	0	0.00	0.000
L-3	20	6.0	Ductile Iron	130.0	0	0.00	0.000

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Scenario: Maximum Daily Demand
Current Time Step: 0.000 h
FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)
G-1	5,603.54	0	107
N-1	5,614.19	0	102
N-2	5,615.14	0	102
N-3	5,605.93	141	106
N-4	5,603.54	0	107
N-5	5,601.60	0	107

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Scenario: Maximum Hour Demand
Current Time Step: 0.000 h
FlexTable: Pipe Table

Label	Length (Scaled) (ft)	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)
A-1	44	8.0	Ductile Iron	130.0	261	1.67	0.002
A-2	45	8.0	Ductile Iron	130.0	261	1.67	0.002
A-3	255	8.0	Ductile Iron	130.0	261	1.67	0.002
A-4	38	8.0	Ductile Iron	130.0	-373	2.38	0.003
A-5	25	8.0	Ductile Iron	130.0	-373	2.38	0.003
A-6	116	8.0	Ductile Iron	130.0	-373	2.38	0.003
A-7	304	6.0	Ductile Iron	130.0	1	0.01	0.000
A-8	120	8.0	Ductile Iron	130.0	0	0.00	0.000
A-9	10	6.0	Ductile Iron	130.0	0	0.00	0.000
A-10	23	6.0	Ductile Iron	130.0	0	0.00	0.000
L-1	25	6.0	Ductile Iron	130.0	0	0.00	0.000
L-3	20	6.0	Ductile Iron	130.0	0	0.00	0.000

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Scenario: Maximum Hour Demand
Current Time Step: 0.000 h
FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)
G-1	5,603.54	0	106
N-1	5,614.19	0	102
N-2	5,615.14	0	102
N-3	5,605.93	634	105
N-4	5,603.54	0	106
N-5	5,601.60	0	107

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Scenario: Maximum Hourly Demand w/ Fire Flow
Current Time Step: 0.000 h
FlexTable: Pipe Table

Label	Length (Scaled) (ft)	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)
A-1	44	8.0	Ductile Iron	130.0	1,392	8.88	0.034
A-2	45	8.0	Ductile Iron	130.0	1,392	8.88	0.034
A-3	255	8.0	Ductile Iron	130.0	-108	0.69	0.000
A-4	38	8.0	Ductile Iron	130.0	-742	4.74	0.011
A-5	25	8.0	Ductile Iron	130.0	-742	4.74	0.011
A-6	116	8.0	Ductile Iron	130.0	-1,042	6.65	0.020
A-7	304	6.0	Ductile Iron	130.0	4	0.04	0.000
A-8	120	8.0	Ductile Iron	130.0	1,500	9.57	0.039
A-9	10	6.0	Ductile Iron	130.0	1,500	17.02	0.157
A-10	23	6.0	Ductile Iron	130.0	1,500	17.02	0.157
L-1	25	6.0	Ductile Iron	130.0	-1,500	17.02	0.157
L-3	20	6.0	Ductile Iron	130.0	0	0.00	0.000

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Scenario: Maximum Hourly Demand w/ Fire Flow
Current Time Step: 0.000 h
FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)
G-1	5,603.54	300	106
N-1	5,614.19	0	101
N-2	5,615.14	0	100
N-3	5,605.93	634	104
N-4	5,603.54	0	106
N-5	5,601.60	0	105

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Scenario: Maximum Hourly Demand w/ Fire Flow
Current Time Step: 0.000 h
FlexTable: Hydrant Table

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)
H-2	5,602.25	1,500	104
H-1	5,615.04	1,500	99
H-9	5,603.17	0	106
H-4	5,615.00	1,500	100

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