CITY OF SCOTTSDALE

Water and Wastewater Study
Combined

Water and Wastewater Basis of Design Report

Estates at Jenan

PRELIMINARY Basis of Design Report

- ☐ ACCEPTED
- ☐ ACCEPTED AS NOTED
- ☑ REVISE AND RESUBMIT

CITY OF SCOTTSDALE
SCOTTSDALE WATER
9379 E San Salvador Dr.
Scottsdale, AZ 85258

Disclaimer: If accepted; the preliminary approval is granted under the condition that a final basis of design report will also be submitted for city review and approval (typically during the DR or PP case). The final report shall incorporate further water or sewer design and analysis requirements as defined in the city design standards and policy manual and address those items noted in the preliminary review comments (both separate and included herein). The final report shall be submitted and approved prior to the plan review submission.
For questions or clarifications contact the Water Resources Planning and Engineering Department at 480-312-5685.

BY rsacks **DATE** 2/3/2020

Prepared for:

Camelot Homes, Inc.
6607 North Scottsdale Rd
Scottsdale, AZ 85250

Prepared by:

Kimley-Horn & Associates, Inc.
7740 North 16th Street, Suite 300
Phoenix, AZ 85020

Kimley»Horn

291104074
October 2019

Kimley»Horn

Contents

Appendices

2-ZN-2020
1/28/2020

1.0 INTRODUCTION

Kimley-Horn and Associates, Inc. has prepared this water and wastewater basis of design report for the proposed residential development south of East Jenan Drive between North Scottsdale Road and North 74th Place in Scottsdale, Arizona. This report will demonstrate that the proposed project conforms to the City of Scottsdale design requirements.

Estates at Jenan, the "project", encompasses approximately 5.7 acres and contains a total of 10 single family residential lots. The project lies within a portion of the Northwest Quarter of Section 23, Township 3 North, Range 4 East of the Gila and Salt River Base and Meridian in Maricopa County, Arizona. More specifically, the project is bounded by private properties to the east, East Jenan Drive to the north, an existing development to the south, Cholla Estates, and an existing development and North Scottsdale United Methodist Church to the west. The site slopes from the northwest to the southeast at approximately 0.94%. Refer to **Figure 1** in **Appendix A** for the project Vicinity Map.

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2.0 DOMESTIC WATER ANALYSIS

2.1 INTRODUCTION

The intent of this section is to calculate the project's water demands, determine the available system capacity and proposed hydraulics of the planned water system while meeting the requirements of the City of Scottsdale and the 2015 International Fire Code (IFC). As a result of this analysis, it will be determined if the potable water infrastructure is capable of satisfying the projected fire flow and domestic water demands for the project per the City of Scottsdale Design Standards & Policies Manual (**Reference 1**) and the 2015 International Fire Code (**Reference 2**) for fire prevention. According to the City of Scottsdale Fire Department, the 2015 International Fire Code (IFC) with City of Scottsdale Amendments is currently the governing code with respect to fire protection requirements. The IFC evaluates the building construction type, occupancy descriptions, and square footage in order to set minimum fire flow requirements with regards to a particular development.

2.2 EXISTING WATER DISTRIBUTION SYSTEM

There is an existing 8-inch Asbestos-Cement Pipe (ACP) water main in East Jenan Drive along the north boundary of the Site. This existing water main tees into a twelve-inch Ductile Iron Pipe (DIP) main in Scottsdale Road west of the Site and reduces, and tees, into a 6-inch ACP main in North 74th Place. These water mains belong to the City of Scottsdale.

2.3 PROPOSED WATER DISTRIBUTION SYSTEM

A proposed 8-inch water line will tap into the existing 8-inch main in East Jenan Drive. This proposed 8-inch water line will extend south and west within the private residential roadway alignment. The proposed 8-inch water main will serve proposed on-site fire hydrants, as well as, providing individual services to residential lots 4-10. Residential lots 1-3 will tap directly into the existing 8-inch main in East Jenan Drive. Refer to **Figure 2** in **Appendix A** for the proposed water system layout.

2.4 WATER DEMANDS

Per Figure 6-1.2 of the City of Scottsdale Design Standards & Policies Manual, **Reference 1**, the average day demand (ADD) for residential land use (<2 du/acre) is 0.69 gallons per minute per unit (gpm/du). Maximum Day Demand (MDD) is calculated as 2.0 times the ADD and Peak Hour Demand (PHD) is calculated as 3.5 times the ADD. Refer to **Table 1** below for a summary of domestic water demands.

Table 1: Domestic Water Demands

Land Use	# DUs	Demand[1] (GPM/DU)	ADD (GPM)	MDD[2] (GPM)	PHD[3] (GPM)
Residential (<2 du/acre)	10	0.69	6.9	13.8	24.2

Notes:

1. For residential (<2 DU/ac) land use, average day demand is 0.69 gpm/du.
2. Maximum day demand defined as 2 times the average day demand.
3. Peak hour demand defined as 3.5 times the average day demand.

Per Table B105.1(1) of the 2015 IFC, the required fire flow for single family residential dwellings is 1,000 gpm for a 1-hour duration.

Per DS & PM, see installing fittings into AC pipe

2.5 DESIGN PARAMETERS

The following design criteria will be utilized for this project:

Table 1 Design Parameters

Design Criteria	ADD	PHD	MDD + Fire Flow
Minimum Pressure (psi)	50	50	20
Maximum Pressure (psi)	100	100	100
Maximum Velocity (ft/sec)	5	5	10

The Site will connect to the existing City of Scottsdale water system in East Jenan Drive (see **Figure 2**). The connection will require tees to be cut into the existing 8-inch water main with isolation valves per the DSPM. The existing 8-inch water main has sufficient valves located to isolate the waterline during construction (see QS 30-45). All waterlines will be 8" DIP Class 350, with 3-foot of minimum cover. The end of the proposed cul-de-sacs will have a fire hydrant to allow for flushing the waterline. If needed, dip sections under the proposed storm drain will be realigned per MAG STD DTL 404. All waterlines will be located within water/sewer facility easements.

2.6 HYDRAULIC MODEL AND RESULTS

The water system modeling program WaterCAD, developed by Bentley Systems, is used to model the water system servicing the proposed development. This program used the fluid mechanic headloss theory known as the Hazen-Williams method. This is the typical method used to evaluate water distribution systems. Through the use of WaterCAD, the proposed water distribution system was modeled. Existing, residual, and static water pressures were obtained from a fire hydrant flow test performed on two existing fire hydrants (one flow and one static) along East Jenan Drive and 74th Place. A copy of the fire hydrant flow test is provided in **Appendix B** for reference. The pressures from the flow test were modeled using a reservoir and pump to simulate the existing water supply conditions. A schematic of the WaterCAD layout can be seen in **Figure 3** of **Appendix A.**

Four separate water scenarios were modeled with the added demands from the proposed development to demonstrate that the system is adequately designed. The four scenarios modeled include:

- Average Day Demand
- Maximum Day Demand
- Peak Hour Demand
- Maximum Day Demand + Fire Flow

The system was analyzed to ensure that a minimum pressure of 50 psi can be maintained for Average Day, Maximum Day, and Peak Hour Demands and 30 psi for Maximum day plus Fire Flow Demand.

Based on the fire hydrant flow tests performed and the results of the WaterCAD analysis, the proposed water system is capable of providing the required flows at pressures ranging from 59 psi – 61 psi during

the Average Day, Maximum Day, and Peak Hour Demand scenarios. For the Maximum Day plus Fire Flow Demand, the minimum pressure provided was calculated to be 59 psi. Refer to **Appendix C** for the WaterCAD results.

2.7 CONCLUSION

Based on the results presented in this report, the existing water infrastructure has the capability to support the proposed development while conforming to the City of Scottsdale's design criteria. An 8-inch water main is proposed onsite which will connect to an existing 8-inch water main in East Jenan Drive.

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3.0 WASTEWATER COLLECTION SYSTEM

3.1 INTRODUCTION

The intent of this section is to calculate the project's wastewater demands, determine the available system capacity and proposed hydraulics of the planned wastewater system while meeting the requirements of the City of Scottsdale. As a result of this analysis, it will be determined that the wastewater infrastructure is capable of satisfying the projected wastewater demands for the project per the City of Scottsdale Design Standards & Policies Manual (**Reference 1**).

3.2 SYSTEM LAYOUT

There is an existing 12" sanitary sewer main in Jenan Drive that flows to the west towards Scottsdale Road. A new 8" sewer main is proposed on site that will connect to the existing 12" sewer main in Jenan Drive serving seven of the ten proposed single-family residential lots. Three saddle tap connections to a 4" service line will be required on the existing 12" sanitary sewer main in Jenan Drive to service the remaining single-family residential lots. The elevation drops across the site from north to south and west to east. Refer to **Figure 2** in **Appendix A** for the wastewater layout.

All 8" sewer lines will be PVC SDR 35 at a minimum slope of 0.52%. Sewer Manhole sections and cones will be precast concrete as detailed in the MAG Standard Detail No. 420, without the manhole steps and/or cast in anchors for steps. Manholes shall be 4 feet in diameter, and for depths less than 10 feet, manholes shall be 5 feet in diameter for all depths greater than 10 foot.

3.2 SYSTEM ANALYSIS AND RESULTS

To determine the capacity of the proposed onsite wastewater collection system, design flows were calculated and analyzed with minimum pipe design slopes. Design flows are calculated based on the criteria in Section 7-1.403 of **Reference 1**. For residential developments, the design flow is 100 gallons per capita per day (gpcd) with a peaking factor of 4. Residential densities are assumed to be 2.5 persons per dwelling unit. Average Day Flow (ADF) and Peak Day Flow (PDF) are summarized in Table 2 below:

Table 2: Wastewater Design Flows

# DUs	Density (persons/DU)	Design flow (gpcpd)	ADF (GPD)	Peaking Factor	PDF (GPD)	PDF (GPM)
10	2.5	100	2,500	4.0	10,000	6.9

Sanitary sewer lines will be designed to maintain a full flow velocity between 2.5 ft/sec–10 ft/sec with a maximum depth to diameter ratio (d/D) of 0.65 in the ultimate peak flow condition. To achieve the velocity requirements, the minimum slope of 0.52% and maximum slope of 8.33% will be utilized. Using the peak flow calculated in **Table 2** and the minimum design slope, an 8" sewer main has the capacity to convey the proposed design flows with a flow depth of 0.70" and a d/D ratio of 0.09. Sewer pipe capacity calculations can be seen in **Appendix D**.

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4.0 CONCLUSION

This project proposes to connect to the existing City of Scottsdale water main located in Jenan Drive for the proposed development. The onsite water system as outlined by this analysis appears adequate and sufficient to meet the required domestic and fire flow demands for the development while satisfying the City of Scottsdale design criteria.

This project proposes a new 8” sanitary sewer main to serve the proposed development which will connect to the existing 12” sanitary sewer main in Jenan Drive. Based on the analysis in this report, an 8” sewer main has the capacity to convey the proposed design flow for the development.

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5.0 REFERENCES

1. City of Scottsdale, *Design Standards and Policies Manual.* 2018.

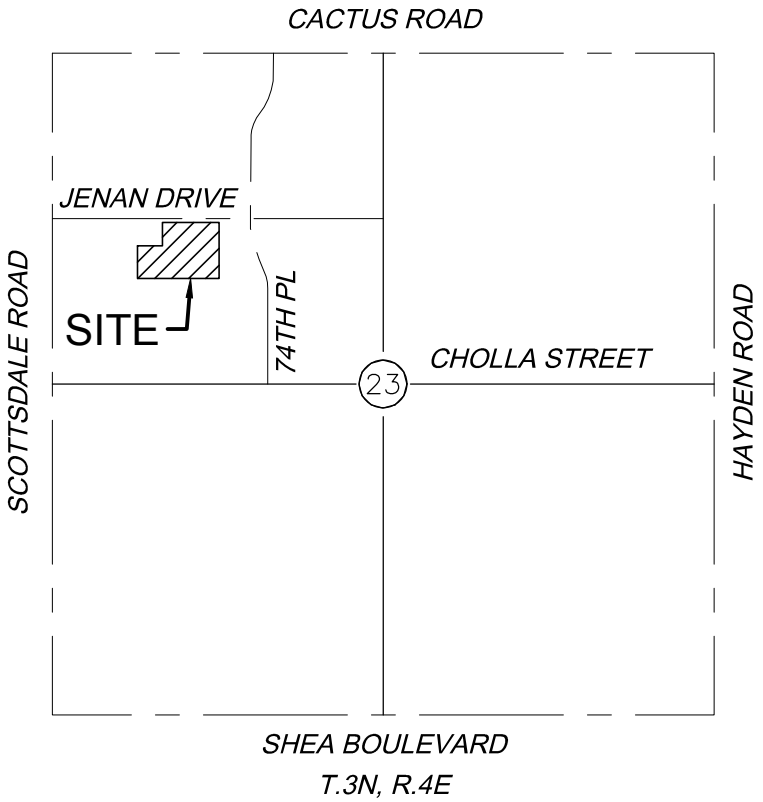
2. International Code Council, *2015 International Fire* Code. May 2014.

Appendix A – Figures

Figure 1 – Vicinity Map

Figure 2 – Water and Wastewater Layout

Figure 3 – WaterCAD Layout



PROJECT NO. 291104074 DRAWING NAME 1 OF 1		**ESTATES AT JENAN** FIGURE 1 VICINITY MAP	SCALE (H): NTS SCALE (V): NTS DESIGNED BY: JPW DRAWN BY: JPW CHECKED BY: CLB DATE: 10/22/19	Kimley»Horn 7740 North 16th Street, Suite 300 Phoenix, Arizona 85020 (602) 944-5500	NO.	REVISION	DATE

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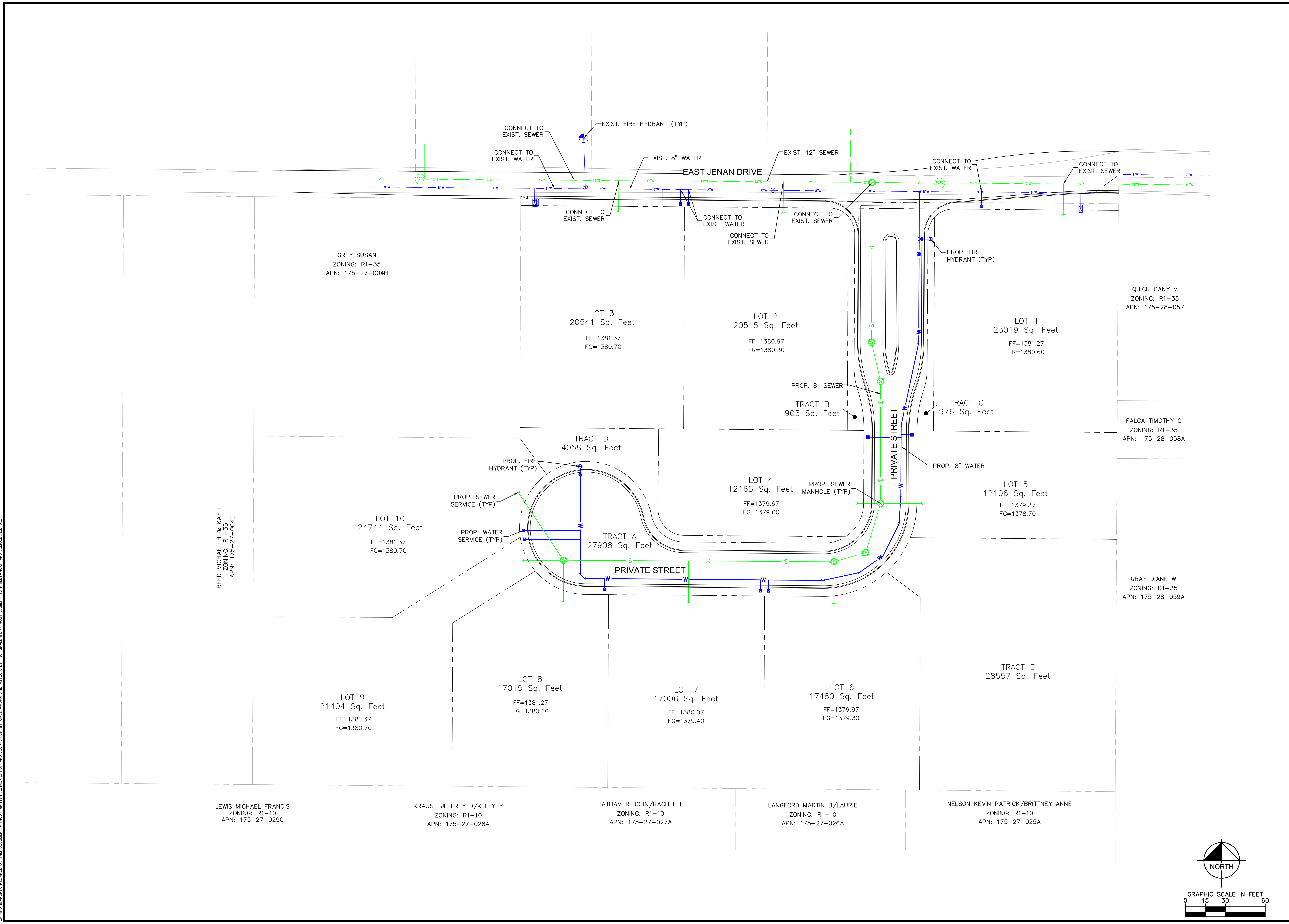
~~1/28/2020~~



NO.	REVISION	BY	DATE	APPR.

Kimley»Horn

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7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

SCALE (H): 1"=30'
SCALE (V): NONE

DESIGNED BY: JRT
DRAWN BY: JRT
CHECKED BY: CLB

DATE: 11/07/2019

ESTATES AT JENAN
SCOTTSDALE, ARIZONA
FIGURE 2
WATER & WASTEWATER LAYOUT

CURTIS LELAND BROWN
31101

PROJECT NO.
291104074

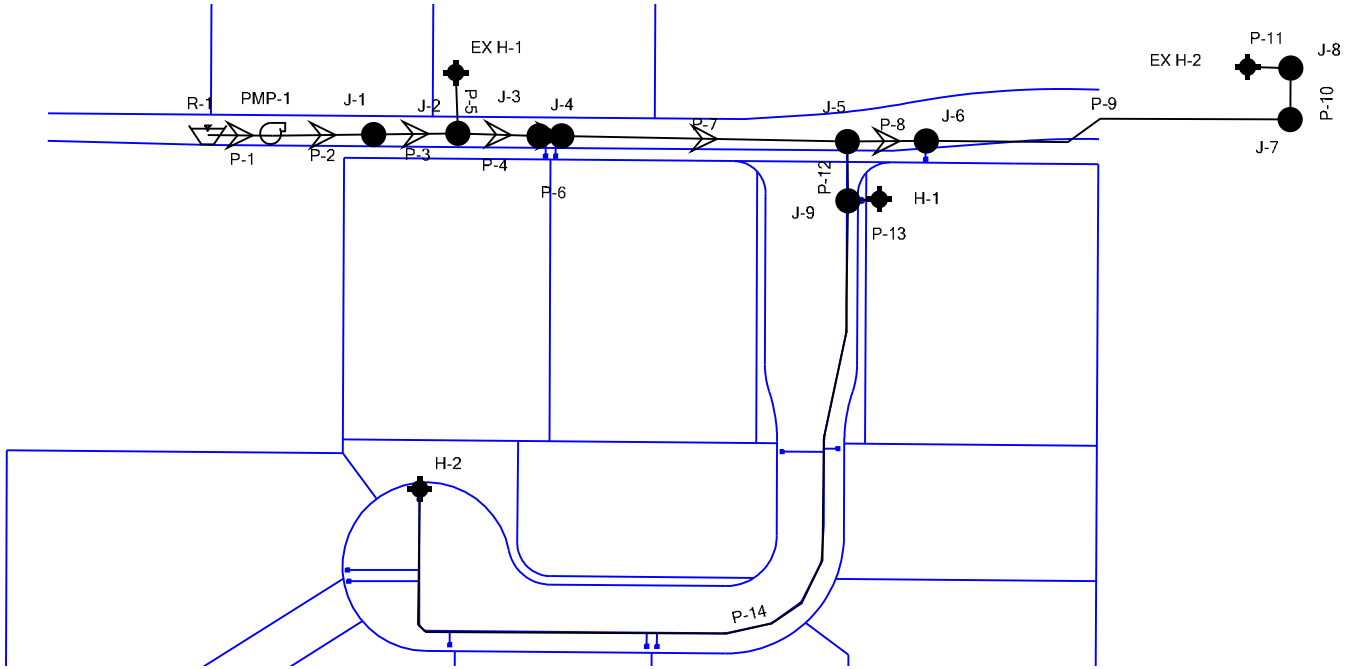
DRAWING NAME
UTILITY LAYOUT

1 OF 1

30-45
2-ZN-2020
1/28/2020

Scenario: Maximum Day + Fire Flow

Active Scenario: Maximum Day + Fire Flow



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Appendix B – Fire Hydrant Flow Test Results

Flow Test Summary

Project Name:	EJFT 18097
Project Address:	7315 E Jenan Dr, Scottsdale, AZ 85260
Date of Flow Test:	2018-05-11
Time of Flow Test:	7:08 AM
Data Reliable Until:	2018-11-11
Conducted By:	Austin Gourley & Eder Cueva (EJ Flow Tests) 602.999.7637
Witnessed By:	Jared Berry (City of Scottsdale) 602.541.4942
City Forces Contacted:	City of Scottsdale (602.541.4942)
Permit Number:	C55298

Need to submit current hydrant flow test

Raw Flow Test Data

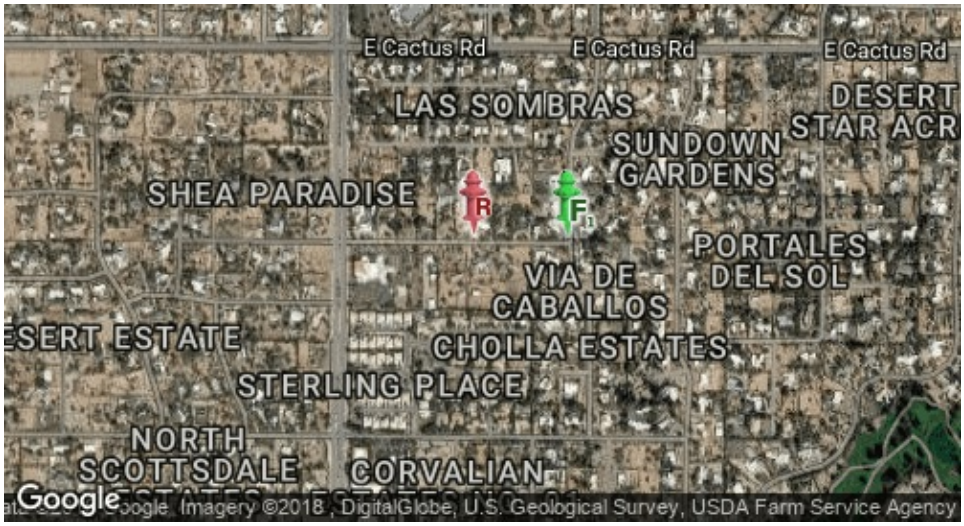
Static Pressure:	66.0 PSI
Residual Pressure:	52.0 PSI
Flowing GPM:	1,839
GPM @ 20 PSI:	3,495

Data with a 10 % Safety Factor

Static Pressure:	59.4 PSI
Residual Pressure:	45.4 PSI
Flowing GPM:	1,839
GPM @ 20 PSI:	3,215

Hydrant F_1

Pitot Pressure (1):	30	PSI
Coefficient of Discharge (1):	0.9	
Hydrant Orifice Diameter (1):	2.5	inches
Pitot Pressure (2):	30	PSI
Coefficient of Discharge (2):	0.9	
Hydrant Orifice Diameter (2):	2.5	inches



Static-Residual Hydrant

Flow Hydrant

Distance Between F_1 and R
638 ft (measured linearly)

Static-Residual Elevation
1380 ft (above sea level)

Flow Hydrant (F_1) Elevation
1379 ft (above sea level)

Elevation & distance values are approximate

EJ Flow Tests, LLC
21505 North 78th Ave. | Suite 130 | Peoria, Arizona 85382 | (602) 999-7637 | www.ejengineering.com
John L. Echeverri | NICET Level IV 078493 SME | C-16 FP Contractor ROC 271705 AZ | NFPA CFPS 1915

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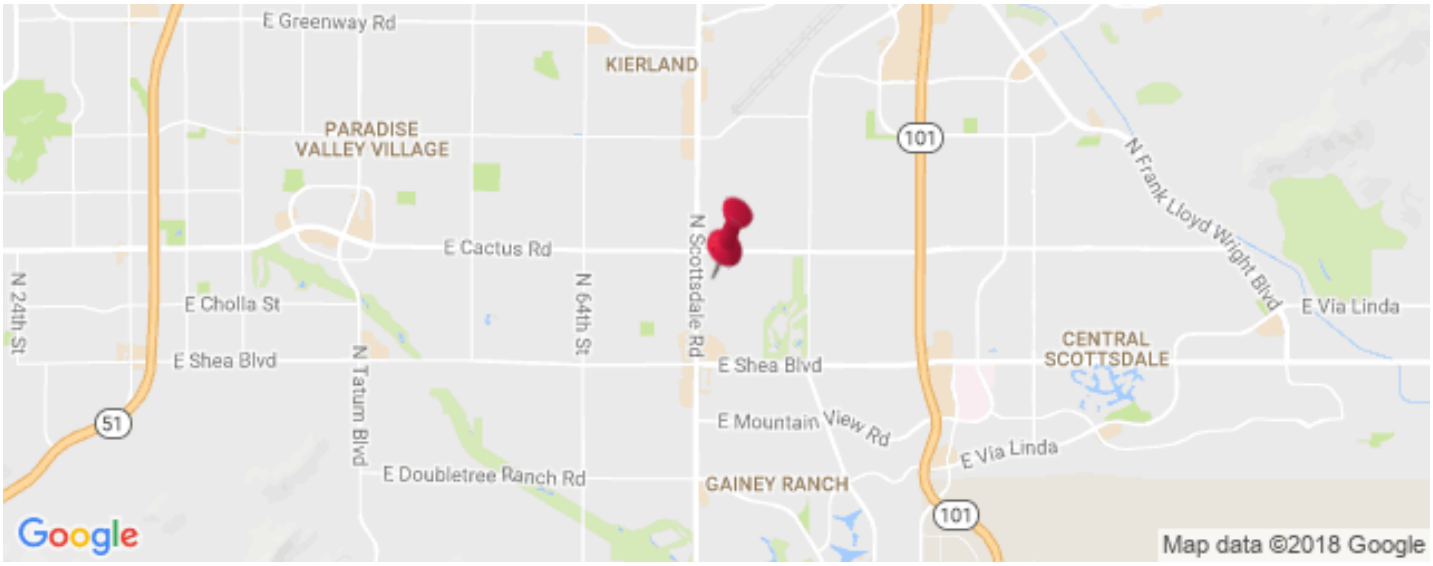
Flow Test Summary

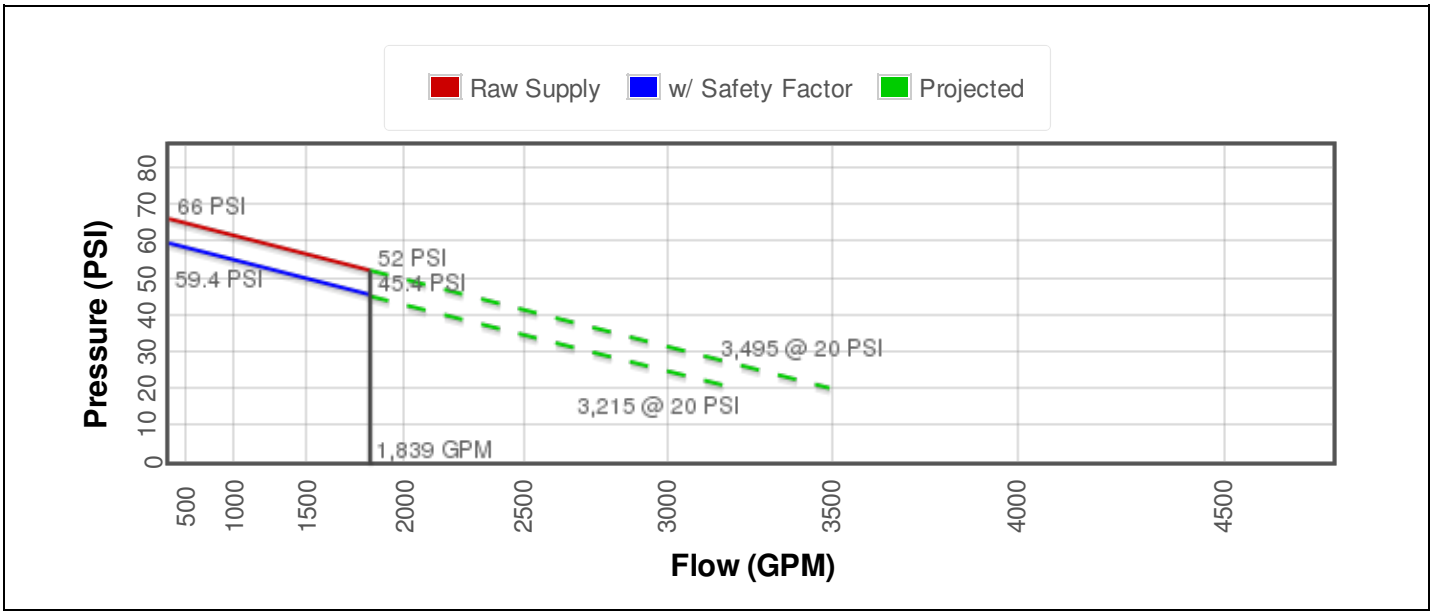
Static-Residual Hydrant

Flow Hydrant (only hydrant F1 shown for clarity)

Approximate Project Site



Water Supply Curve $N^{1.85}$ Graph



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John L. Echeverri | NICET Level IV 078493 SME | C-16 FP Contractor ROC 271705 AZ | NFPA CFPS 1915

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Pump Definition Detailed Report: Flow Test Results

Element Details

ID	74	Notes	
Label	Flow Test Results		

Pump Definition Type

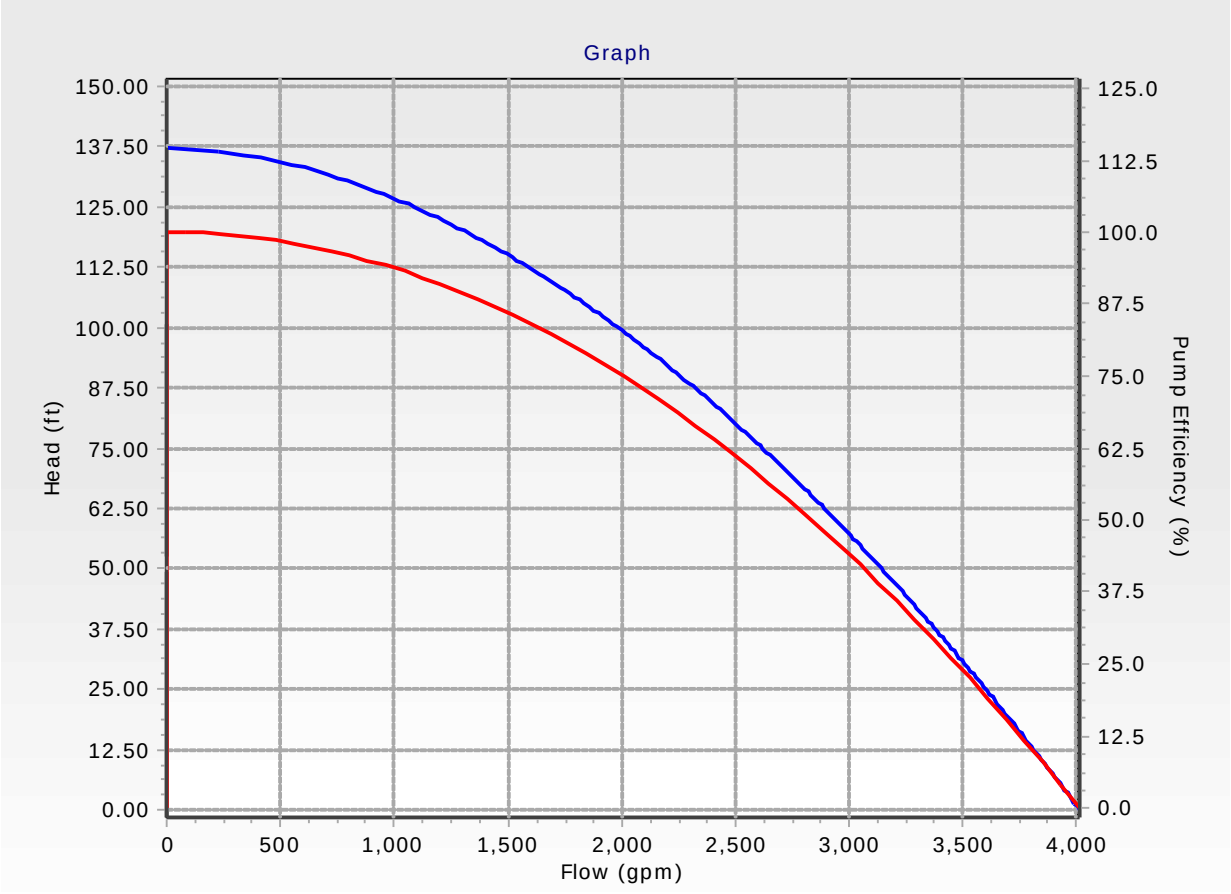
Pump Definition Type	Standard (3 Point)	Design Head	104.87 ft
Shutoff Flow	0 gpm	Maximum Operating Flow	3,215 gpm
Shutoff Head	137.21 ft	Maximum Operating Head	46.20 ft
Design Flow	1,839 gpm		

Pump Efficiency Type

Pump Efficiency Type	Best Efficiency Point	Motor Efficiency	100.0 %
BEP Efficiency	100.0 %	Is Variable Speed Drive?	False
BEP Flow	0 gpm		

Transient (Physical)

Inertia (Pump and Motor)	0.000 lb·ft²	Specific Speed	SI=25, US=1280
Speed (Full)	0 rpm	Reverse Spin Allowed?	True



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Appendix C – WaterCAD Results

Average Day Demand

Maximum Day Demand

Peak Hour Demand

Maximum Day + Fire Flow Demand

2-ZN-2020
1/28/2020

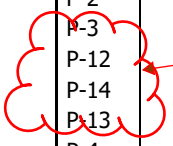
Jenan Water Model

Active Scenario: Average Day Demand

Average Day Demand

Pipe Table - Time: 0.00 hours

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)
P-1	39	R-1	PMP-1	48.0	Ductile Iron	130.0	2	0.00	0.000
P-9	364	J-6	J-7	8.0	Ductile Iron	130.0	0	0.00	0.000
P-10	30	J-7	J-8	8.0	Ductile Iron	130.0	0	0.00	0.000
P-5	36	EX H-1	J-2	8.0	Ductile Iron	130.0	0	0.00	0.000
P-11	15	EX H-2	J-8	8.0	Ductile Iron	130.0	0	0.00	0.000
P-2	60	PMP-1	J-1	48.0	Ductile Iron	130.0	2	0.00	0.000
P-3	50	J-1	J-2	48.0	Ductile Iron	130.0	2	0.00	0.000
P-12	35	J-5	J-9	6.0	Ductile Iron	130.0	0	0.00	0.000
P-14	558	J-9	H-2	6.0	Ductile Iron	130.0	0	0.00	0.000
P-13	19	H-1	J-9	6.0	Ductile Iron	130.0	0	0.00	0.000
P-4	48	J-2	J-3	8.0	Ductile Iron	130.0	2	0.01	0.000
P-6	14	J-3	J-4	8.0	Ductile Iron	130.0	1	0.01	0.000



Both P-12 and P-14 are 8" lines not 6" as shown in all tables.

Junction Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
34	J-2	1,380.07	0	1,518.45	60
36	J-6	1,379.09	1	1,518.45	60
38	J-7	1,378.54	0	1,518.45	61
40	J-8	1,378.54	0	1,518.45	61
92	J-1	1,380.36	0	1,518.45	60
95	J-9	1,380.00	0	1,518.45	60
101	J-4	1,379.55	1	1,518.45	60
104	J-3	1,379.60	1	1,518.45	60

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Jenan Water Model

Active Scenario: Average Day Demand

Hydrant Table - Time: 0.00 hours

ID	Label	Length (Hydrant Lateral) (ft)	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
60	EX H-1	20	1,381.24	0	1,518.45	59
61	EX H-2	20	1,379.04	0	1,518.45	60
97	H-2	20	1,380.00	0	1,518.45	60
99	H-1	20	1,380.00	0	1,518.45	60

Reservoir Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Zone	Flow (Out net) (gpm)	Hydraulic Grade (ft)
30	R-1	1,381.24	<None>	2	1,381.24

Pump Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Pump Definition	Status (Initial)	Hydraulic Grade (Suction) (ft)	Hydraulic Grade (Discharge) (ft)	Flow (Total) (gpm)	Pump Head (ft)
67	PMP-1	1,381.24	Flow Test Results	On	1,381.24	1,518.45	2	137.21

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1/28/2020

Jenan Water Model
Active Scenario: Average Day Demand
Maximum Day + Fire Flow

Pipe Table - Time: 0.00 hours

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)
P-1	39	R-1	PMP-1	48.0	Ductile Iron	130.0	7	0.00	0.000
P-9	364	J-6	J-7	8.0	Ductile Iron	130.0	0	0.00	0.000
P-10	30	J-7	J-8	8.0	Ductile Iron	130.0	0	0.00	0.000
P-5	36	EX H-1	J-2	8.0	Ductile Iron	130.0	0	0.00	0.000
P-11	15	EX H-2	J-8	8.0	Ductile Iron	130.0	0	0.00	0.000
P-2	60	PMP-1	J-1	48.0	Ductile Iron	130.0	7	0.00	0.000
P-3	50	J-1	J-2	48.0	Ductile Iron	130.0	7	0.00	0.000
P-12	35	J-5	J-9	6.0	Ductile Iron	130.0	0	0.00	0.000
P-14	558	J-9	H-2	6.0	Ductile Iron	130.0	0	0.00	0.000
P-13	19	H-1	J-9	6.0	Ductile Iron	130.0	0	0.00	0.000
P-4	48	J-2	J-3	8.0	Ductile Iron	130.0	7	0.04	0.000
P-6	14	J-3	J-4	8.0	Ductile Iron	130.0	7	0.04	0.000

Junction Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
34	J-2	1,380.07	0	1,518.45	60
36	J-6	1,379.09	7	1,518.45	60
38	J-7	1,378.54	0	1,518.45	61
40	J-8	1,378.54	0	1,518.45	61
92	J-1	1,380.36	0	1,518.45	60
95	J-9	1,380.00	0	1,518.45	60
101	J-4	1,379.55	0	1,518.45	60
104	J-3	1,379.60	0	1,518.45	60

2-ZN-2020
1/28/2020

Jenan Water Model

Active Scenario: Average Day Demand

Hydrant Table - Time: 0.00 hours

ID	Label	Length (Hydrant Lateral) (ft)	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
60	EX H-1	20	1,381.24	0	1,518.45	59
61	EX H-2	20	1,379.04	0	1,518.45	60
97	H-2	20	1,380.00	0	1,518.45	60
99	H-1	20	1,380.00	0	1,518.45	60

Reservoir Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Zone	Flow (Out net) (gpm)	Hydraulic Grade (ft)
30	R-1	1,381.24	<None>	7	1,381.24

Pump Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Pump Definition	Status (Initial)	Hydraulic Grade (Suction) (ft)	Hydraulic Grade (Discharge) (ft)	Flow (Total) (gpm)	Pump Head (ft)
67	PMP-1	1,381.24	Flow Test Results	On	1,381.24	1,518.45	7	137.21

2-ZN-2020
1/28/2020

Jenan Water Model
Active Scenario: Average Day Demand
Maximum Day Demand

Pipe Table - Time: 0.00 hours

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)
P-1	39	R-1	PMP-1	48.0	Ductile Iron	130.0	7	0.00	0.000
P-9	364	J-6	J-7	8.0	Ductile Iron	130.0	0	0.00	0.000
P-10	30	J-7	J-8	8.0	Ductile Iron	130.0	0	0.00	0.000
P-5	36	EX H-1	J-2	8.0	Ductile Iron	130.0	0	0.00	0.000
P-11	15	EX H-2	J-8	8.0	Ductile Iron	130.0	0	0.00	0.000
P-2	60	PMP-1	J-1	48.0	Ductile Iron	130.0	7	0.00	0.000
P-3	50	J-1	J-2	48.0	Ductile Iron	130.0	7	0.00	0.000
P-12	35	J-5	J-9	6.0	Ductile Iron	130.0	0	0.00	0.000
P-14	558	J-9	H-2	6.0	Ductile Iron	130.0	0	0.00	0.000
P-13	19	H-1	J-9	6.0	Ductile Iron	130.0	0	0.00	0.000
P-4	48	J-2	J-3	8.0	Ductile Iron	130.0	7	0.04	0.000
P-6	14	J-3	J-4	8.0	Ductile Iron	130.0	7	0.04	0.000

Junction Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
34	J-2	1,380.07	0	1,518.45	60
36	J-6	1,379.09	7	1,518.45	60
38	J-7	1,378.54	0	1,518.45	61
40	J-8	1,378.54	0	1,518.45	61
92	J-1	1,380.36	0	1,518.45	60
95	J-9	1,380.00	0	1,518.45	60
101	J-4	1,379.55	0	1,518.45	60
104	J-3	1,379.60	0	1,518.45	60

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Jenan Water Model

Active Scenario: Average Day Demand

Hydrant Table - Time: 0.00 hours

ID	Label	Length (Hydrant Lateral) (ft)	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
60	EX H-1	20	1,381.24	0	1,518.45	59
61	EX H-2	20	1,379.04	0	1,518.45	60
97	H-2	20	1,380.00	0	1,518.45	60
99	H-1	20	1,380.00	0	1,518.45	60

Reservoir Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Zone	Flow (Out net) (gpm)	Hydraulic Grade (ft)
30	R-1	1,381.24	<None>	7	1,381.24

Pump Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Pump Definition	Status (Initial)	Hydraulic Grade (Suction) (ft)	Hydraulic Grade (Discharge) (ft)	Flow (Total) (gpm)	Pump Head (ft)
67	PMP-1	1,381.24	Flow Test Results	On	1,381.24	1,518.45	7	137.21

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Jenan Water Model
Active Scenario: Average Day Demand
Peak Hour Demand

Pipe Table - Time: 0.00 hours

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)
P-1	39	R-1	PMP-1	48.0	Ductile Iron	130.0	12	0.00	0.000
P-9	364	J-6	J-7	8.0	Ductile Iron	130.0	0	0.00	0.000
P-10	30	J-7	J-8	8.0	Ductile Iron	130.0	0	0.00	0.000
P-5	36	EX H-1	J-2	8.0	Ductile Iron	130.0	0	0.00	0.000
P-11	15	EX H-2	J-8	8.0	Ductile Iron	130.0	0	0.00	0.000
P-2	60	PMP-1	J-1	48.0	Ductile Iron	130.0	12	0.00	0.000
P-3	50	J-1	J-2	48.0	Ductile Iron	130.0	12	0.00	0.000
P-12	35	J-5	J-9	6.0	Ductile Iron	130.0	0	0.00	0.000
P-14	558	J-9	H-2	6.0	Ductile Iron	130.0	0	0.00	0.000
P-13	19	H-1	J-9	6.0	Ductile Iron	130.0	0	0.00	0.000
P-4	48	J-2	J-3	8.0	Ductile Iron	130.0	12	0.08	0.000
P-6	14	J-3	J-4	8.0	Ductile Iron	130.0	12	0.08	0.000

Junction Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
34	J-2	1,380.07	0	1,518.45	60
36	J-6	1,379.09	12	1,518.45	60
38	J-7	1,378.54	0	1,518.45	61
40	J-8	1,378.54	0	1,518.45	61
92	J-1	1,380.36	0	1,518.45	60
95	J-9	1,380.00	0	1,518.45	60
101	J-4	1,379.55	0	1,518.45	60
104	J-3	1,379.60	0	1,518.45	60

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Jenan Water Model

Active Scenario: Average Day Demand

Hydrant Table - Time: 0.00 hours

ID	Label	Length (Hydrant Lateral) (ft)	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
60	EX H-1	20	1,381.24	0	1,518.45	59
61	EX H-2	20	1,379.04	0	1,518.45	60
97	H-2	20	1,380.00	0	1,518.45	60
99	H-1	20	1,380.00	0	1,518.45	60

Reservoir Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Zone	Flow (Out net) (gpm)	Hydraulic Grade (ft)
30	R-1	1,381.24	<None>	12	1,381.24

Pump Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Pump Definition	Status (Initial)	Hydraulic Grade (Suction) (ft)	Hydraulic Grade (Discharge) (ft)	Flow (Total) (gpm)	Pump Head (ft)
67	PMP-1	1,381.24	Flow Test Results	On	1,381.24	1,518.45	12	137.21

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Fire Flow Node FlexTable: Fire Flow Report

Active Scenario: Maximum Day + Fire Flow

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Calculated Residual) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (Calculated System Lower Limit) (psi)	Junction w/ Minimum Pressure (System)	Velocity of Maximum Pipe (ft/s)
EX H-1	1,000	1,500	1,000	1,500	49	50	J-1	50	J-1	9.57
EX H-2	1,000	1,500	1,000	1,500	39	40	J-8	40	J-8	9.62
H-2	1,000	1,275	1,000	1,275	20	48	J-9	48	J-9	14.47
H-1	1,000	1,500	1,000	1,500	43	44	H-2	44	H-2	17.02
J-2	1,000	1,500	1,000	1,500	50	50	EX H-1	50	EX H-1	0.27
J-6	1,000	1,500	1,007	1,507	46	46	EX H-2	46	EX H-2	9.62
J-7	1,000	1,500	1,000	1,500	40	40	EX H-2	40	EX H-2	9.62
J-8	1,000	1,500	1,000	1,500	40	39	EX H-2	39	EX H-2	9.62
J-1	1,000	1,500	1,000	1,500	50	50	EX H-1	50	EX H-1	0.27
J-9	1,000	1,500	1,000	1,500	44	44	H-2	44	H-2	17.02
J-4	1,000	1,500	1,000	1,500	49	49	H-2	49	H-2	9.62
J-3	1,000	1,500	1,000	1,500	50	49	H-2	49	H-2	9.62
J-5	1,000	1,500	1,000	1,500	47	46	J-9	46	J-9	9.62

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Appendix D – Sewer Capacity Calculations

Worksheet for 8" Full Flow Capacity

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00520	ft/ft ← minimum slope
Normal Depth	8.00	in
Diameter	8.00	in
Discharge	563169.09	gal/day ← full flow capacity

Results

Discharge	563169.09	gal/day
Normal Depth	8.00	in
Flow Area	0.35	ft²
Wetted Perimeter	2.09	ft
Hydraulic Radius	2.00	in
Top Width	0.00	ft
Critical Depth	0.44	ft
Percent Full	100.0	%
Critical Slope	0.00857	ft/ft
Velocity	2.50	ft/s ← minimum velocity met
Velocity Head	0.10	ft
Specific Energy	0.76	ft
Froude Number	0.00	
Maximum Discharge	0.94	ft³/s
Discharge Full	0.87	ft³/s
Slope Full	0.00520	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%

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Worksheet for 8" Full Flow Capacity

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	8.00	in
Critical Depth	0.44	ft
Channel Slope	0.00520	ft/ft
Critical Slope	0.00857	ft/ft

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Worksheet for 8" Sewer Capacity

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.013
Channel Slope	0.005 ft/ft
Diameter	8.0 in
Discharge	6.95 gpm

Results	
Normal Depth	0.7 in
Flow Area	0.0 ft²
Wetted Perimeter	0.4 ft
Hydraulic Radius	0.5 in
Top Width	0.39 ft
Critical Depth	0.7 in
Percent Full	9.3 %
Critical Slope	0.008 ft/ft
Velocity	0.95 ft/s
Velocity Head	0.01 ft
Specific Energy	0.08 ft
Froude Number	0.815
Maximum Discharge	420.70 gpm
Discharge Full	391.09 gpm
Slope Full	0.000 ft/ft
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	11.2 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.7 in
Critical Depth	0.7 in
Channel Slope	0.005 ft/ft
Critical Slope	0.008 ft/ft

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Water and Wastewater Basis of Design Report

Estates at Jenan

Prepared for:

Camelot Homes, Inc.
6607 North Scottsdale Road, Suite H-100
Scottsdale, AZ 85250

Prepared by:

Kimley-Horn & Associates, Inc.
7740 North 16th Street, Suite 300
Phoenix, AZ 85020

Kimley»Horn

291104074
October 2019

2-ZN-2020
1/28/2020

Kimley»Horn

Contents

Appendices

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1.0 INTRODUCTION

Kimley-Horn and Associates, Inc. has prepared this water and wastewater basis of design report for the proposed residential development south of East Jenan Drive between North Scottsdale Road and North 74th Place in Scottsdale, Arizona. This report will demonstrate that the proposed project conforms to the City of Scottsdale design requirements.

Estates at Jenan, the "project", encompasses approximately 5.7 acres and contains a total of 10 single family residential lots. The project lies within a portion of the Northwest Quarter of Section 23, Township 3 North, Range 4 East of the Gila and Salt River Base and Meridian in Maricopa County, Arizona. More specifically, the project is bounded by private properties to the east, East Jenan Drive to the north, an existing development to the south, Cholla Estates, and an existing development and North Scottsdale United Methodist Church to the west. The site slopes from the northwest to the southeast at approximately 0.94%. Refer to **Figure 1** in **Appendix A** for the project Vicinity Map.

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2.0 DOMESTIC WATER ANALYSIS

2.1 INTRODUCTION

The intent of this section is to calculate the project's water demands, determine the available system capacity and proposed hydraulics of the planned water system while meeting the requirements of the City of Scottsdale and the 2015 International Fire Code (IFC). As a result of this analysis, it will be determined if the potable water infrastructure is capable of satisfying the projected fire flow and domestic water demands for the project per the City of Scottsdale Design Standards & Policies Manual (**Reference 1**) and the 2015 International Fire Code (**Reference 2**) for fire prevention. According to the City of Scottsdale Fire Department, the 2015 International Fire Code (IFC) with City of Scottsdale Amendments is currently the governing code with respect to fire protection requirements. The IFC evaluates the building construction type, occupancy descriptions, and square footage in order to set minimum fire flow requirements with regards to a particular development.

2.2 EXISTING WATER DISTRIBUTION SYSTEM

There is an existing 8-inch Asbestos-Cement Pipe (ACP) water main in East Jenan Drive along the north boundary of the Site. This existing water main tees into a twelve-inch Ductile Iron Pipe (DIP) main in Scottsdale Road west of the Site and reduces, and tees, into a 6-inch ACP main in North 74th Place. These water mains belong to the City of Scottsdale.

2.3 PROPOSED WATER DISTRIBUTION SYSTEM

A proposed 8-inch water line will tap into the existing 8-inch main in East Jenan Drive. This proposed 8-inch water line will extend south and west within the private residential roadway alignment. The proposed 8-inch water main will serve proposed on-site fire hydrants, as well as, providing individual services to residential lots 4-10. Residential lots 1-3 will tap directly into the existing 8-inch main in East Jenan Drive. Refer to **Figure 2** in **Appendix A** for the proposed water system layout.

2.4 WATER DEMANDS

Per Figure 6-1.2 of the City of Scottsdale Design Standards & Policies Manual, **Reference 1**, the average day demand (ADD) for residential land use (<2 du/acre) is 0.69 gallons per minute per unit (gpm/du). Maximum Day Demand (MDD) is calculated as 2.0 times the ADD and Peak Hour Demand (PHD) is calculated as 3.5 times the ADD. Refer to **Table 1** below for a summary of domestic water demands.

Table 1: Domestic Water Demands

Land Use	# DUs	Demand[1] (GPM/DU)	ADD (GPM)	MDD[2] (GPM)	PHD[3] (GPM)
Residential (<2 du/acre)	10	0.69	6.9	13.8	24.2

Notes:

1. For residential (<2 DU/ac) land use, average day demand is 0.69 gpm/du.
2. Maximum day demand defined as 2 times the average day demand.
3. Peak hour demand defined as 3.5 times the average day demand.

Per Table B105.1(1) of the 2015 IFC, the required fire flow for single family residential dwellings is 1,000 gpm for a 1-hour duration.

2.5 DESIGN PARAMETERS

The following design criteria will be utilized for this project:

Table 1 Design Parameters

Design Criteria	ADD	PHD	MDD + Fire Flow
Minimum Pressure (psi)	50	50	20
Maximum Pressure (psi)	100	100	100
Maximum Velocity (ft/sec)	5	5	10

The Site will connect to the existing City of Scottsdale water system in East Jenan Drive (see **Figure 2**). The connection will require tees to be cut into the existing 8-inch water main with isolation valves per the DSPM. The existing 8-inch water main has sufficient valves located to isolate the waterline during construction (see QS 30-45). All waterlines will be 8" DIP Class 350, with 3-foot of minimum cover. The end of the proposed cul-de-sacs will have a fire hydrant to allow for flushing the waterline. If needed, dip sections under the proposed storm drain will be realigned per MAG STD DTL 404. All waterlines will be located within water/sewer facility easements.

2.6 HYDRAULIC MODEL AND RESULTS

The water system modeling program WaterCAD, developed by Bentley Systems, is used to model the water system servicing the proposed development. This program used the fluid mechanic headloss theory known as the Hazen-Williams method. This is the typical method used to evaluate water distribution systems. Through the use of WaterCAD, the proposed water distribution system was modeled. Existing, residual, and static water pressures were obtained from a fire hydrant flow test performed on two existing fire hydrants (one flow and one static) along East Jenan Drive and 74th Place. A copy of the fire hydrant flow test is provided in **Appendix B** for reference. The pressures from the flow test were modeled using a reservoir and pump to simulate the existing water supply conditions. A schematic of the WaterCAD layout can be seen in **Figure 3** of **Appendix A.**

Four separate water scenarios were modeled with the added demands from the proposed development to demonstrate that the system is adequately designed. The four scenarios modeled include:

- Average Day Demand
- Maximum Day Demand
- Peak Hour Demand
- Maximum Day Demand + Fire Flow

The system was analyzed to ensure that a minimum pressure of 50 psi can be maintained for Average Day, Maximum Day, and Peak Hour Demands and 30 psi for Maximum day plus Fire Flow Demand.

Based on the fire hydrant flow tests performed and the results of the WaterCAD analysis, the proposed water system is capable of providing the required flows at pressures ranging from 59 psi – 61 psi during

the Average Day, Maximum Day, and Peak Hour Demand scenarios. For the Maximum Day plus Fire Flow Demand, the minimum pressure provided was calculated to be 59 psi. Refer to **Appendix C** for the WaterCAD results.

2.7 CONCLUSION

Based on the results presented in this report, the existing water infrastructure has the capability to support the proposed development while conforming to the City of Scottsdale's design criteria. An 8-inch water main is proposed onsite which will connect to an existing 8-inch water main in East Jenan Drive.

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3.0 WASTEWATER COLLECTION SYSTEM

3.1 INTRODUCTION

The intent of this section is to calculate the project's wastewater demands, determine the available system capacity and proposed hydraulics of the planned wastewater system while meeting the requirements of the City of Scottsdale. As a result of this analysis, it will be determined that the wastewater infrastructure is capable of satisfying the projected wastewater demands for the project per the City of Scottsdale Design Standards & Policies Manual (**Reference 1**).

3.2 SYSTEM LAYOUT

There is an existing 12" sanitary sewer main in Jenan Drive that flows to the west towards Scottsdale Road. A new 8" sewer main is proposed on site that will connect to the existing 12" sewer main in Jenan Drive serving seven of the ten proposed single-family residential lots. Three saddle tap connections to a 4" service line will be required on the existing 12" sanitary sewer main in Jenan Drive to service the remaining single-family residential lots. The elevation drops across the site from north to south and west to east. Refer to **Figure 2** in **Appendix A** for the wastewater layout.

All 8" sewer lines will be PVC SDR 35 at a minimum slope of 0.52%. Sewer Manhole sections and cones will be precast concrete as detailed in the MAG Standard Detail No. 420, without the manhole steps and/or cast in anchors for steps. Manholes shall be 4 feet in diameter, and for depths less than 10 feet, manholes shall be 5 feet in diameter for all depths greater than 10 foot.

3.2 SYSTEM ANALYSIS AND RESULTS

To determine the capacity of the proposed onsite wastewater collection system, design flows were calculated and analyzed with minimum pipe design slopes. Design flows are calculated based on the criteria in Section 7-1.403 of **Reference 1**. For residential developments, the design flow is 100 gallons per capita per day (gpcd) with a peaking factor of 4. Residential densities are assumed to be 2.5 persons per dwelling unit. Average Day Flow (ADF) and Peak Day Flow (PDF) are summarized in Table 2 below:

Table 2: Wastewater Design Flows

# DUs	Density (persons/DU)	Design flow (gpcpd)	ADF (GPD)	Peaking Factor	PDF (GPD)	PDF (GPM)
10	2.5	100	2,500	4.0	10,000	6.9

Sanitary sewer lines will be designed to maintain a full flow velocity between 2.5 ft/sec–10 ft/sec with a maximum depth to diameter ratio (d/D) of 0.65 in the ultimate peak flow condition. To achieve the velocity requirements, the minimum slope of 0.52% and maximum slope of 8.33% will be utilized. Using the peak flow calculated in **Table 2** and the minimum design slope, an 8" sewer main has the capacity to convey the proposed design flows with a flow depth of 0.70" and a d/D ratio of 0.09. Sewer pipe capacity calculations can be seen in **Appendix D**.

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4.0 CONCLUSION

This project proposes to connect to the existing City of Scottsdale water main located in Jenan Drive for the proposed development. The onsite water system as outlined by this analysis appears adequate and sufficient to meet the required domestic and fire flow demands for the development while satisfying the City of Scottsdale design criteria.

This project proposes a new 8” sanitary sewer main to serve the proposed development which will connect to the existing 12” sanitary sewer main in Jenan Drive. Based on the analysis in this report, an 8” sewer main has the capacity to convey the proposed design flow for the development.

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5.0 REFERENCES

1. City of Scottsdale, *Design Standards and Policies Manual.* 2018.

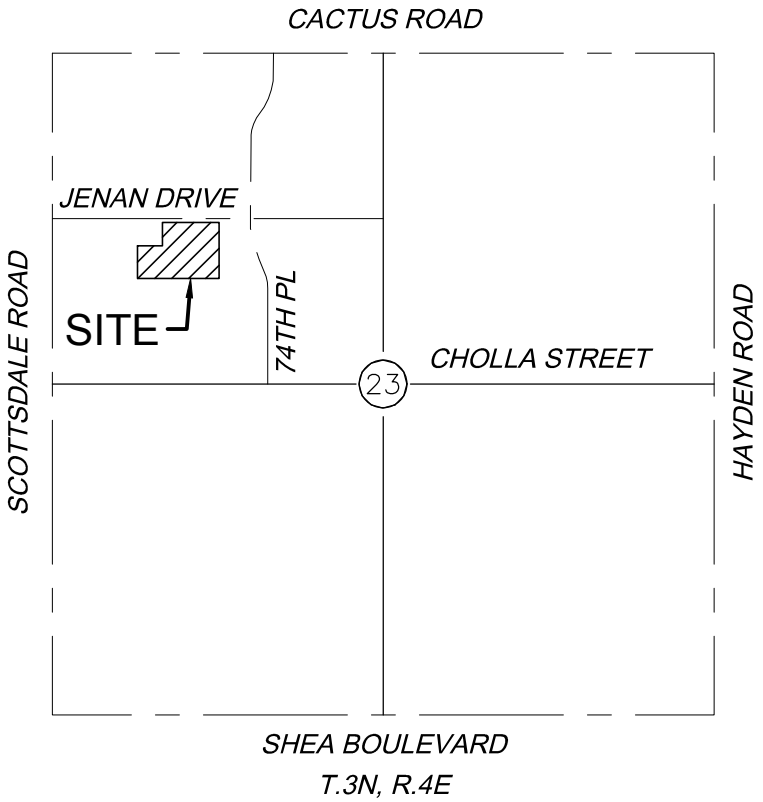
2. International Code Council, *2015 International Fire* Code. May 2014.

Appendix A – Figures

Figure 1 – Vicinity Map

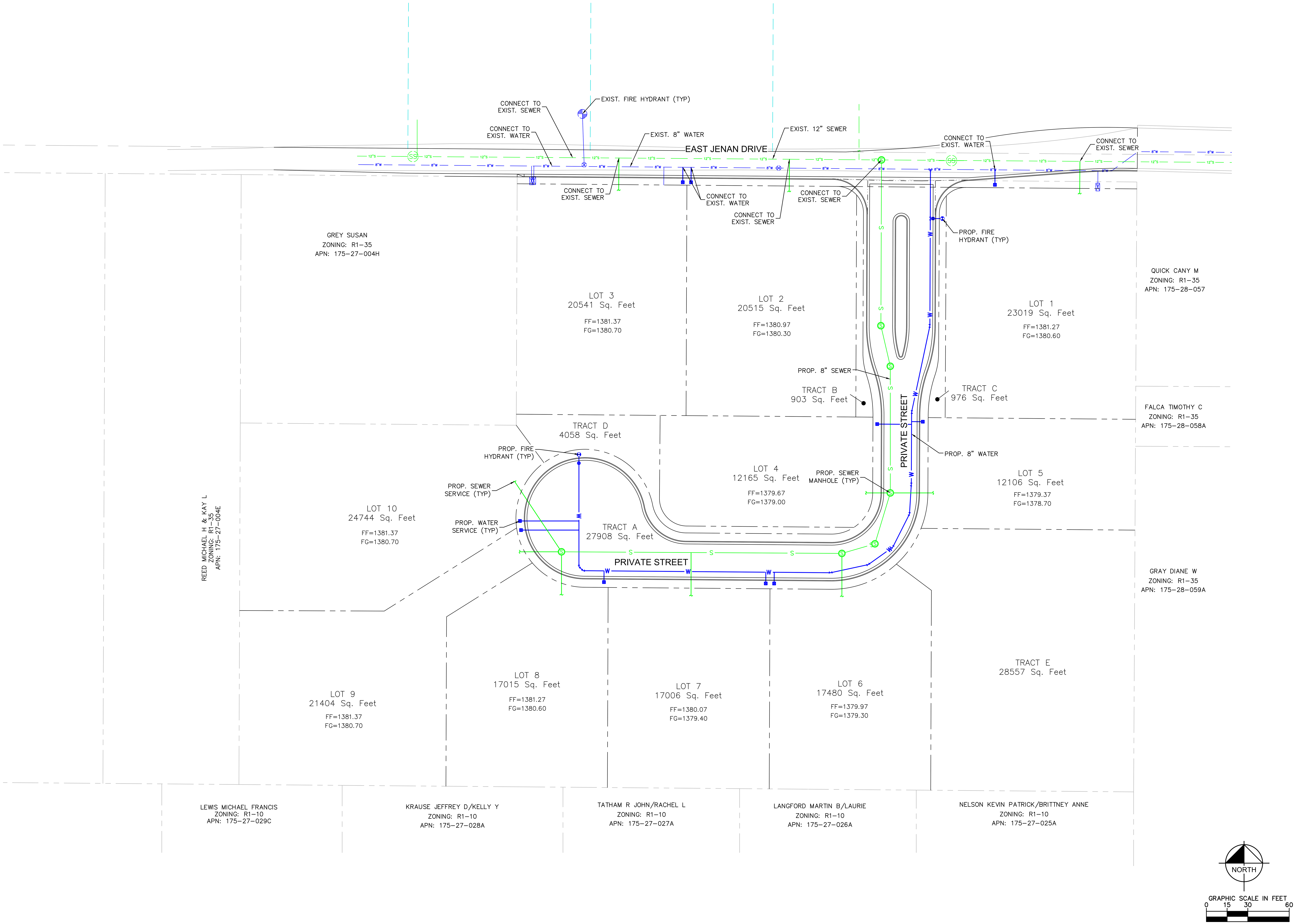
Figure 2 – Water and Wastewater Layout

Figure 3 – WaterCAD Layout



PROJECT NO. 291104074 DRAWING NAME 1 OF 1		**ESTATES AT JENAN** FIGURE 1 VICINITY MAP	SCALE (H): NTS SCALE (V): NTS DESIGNED BY: JPW DRAWN BY: JPW CHECKED BY: CLB DATE: 10/22/19	Kimley»Horn 7740 North 16th Street, Suite 300 Phoenix, Arizona 85020 (602) 944-5500	NO.	REVISION	DATE

2-ZN-2020
~~1/28/2020~~



NO. | REVISION | BY | DATE | APPR.

Kimley»Horn

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7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

SCALE (H): 1"=30'
SCALE (V): NONE
DESIGNED BY: JRT
DRAWN BY: JRT
CHECKED BY: CLB
DATE: 11/07/2019

ESTATES AT JENAN
SCOTTSDALE, ARIZONA
FIGURE 2
WATER & WASTEWATER LAYOUT

PROJECT NO.
291104074

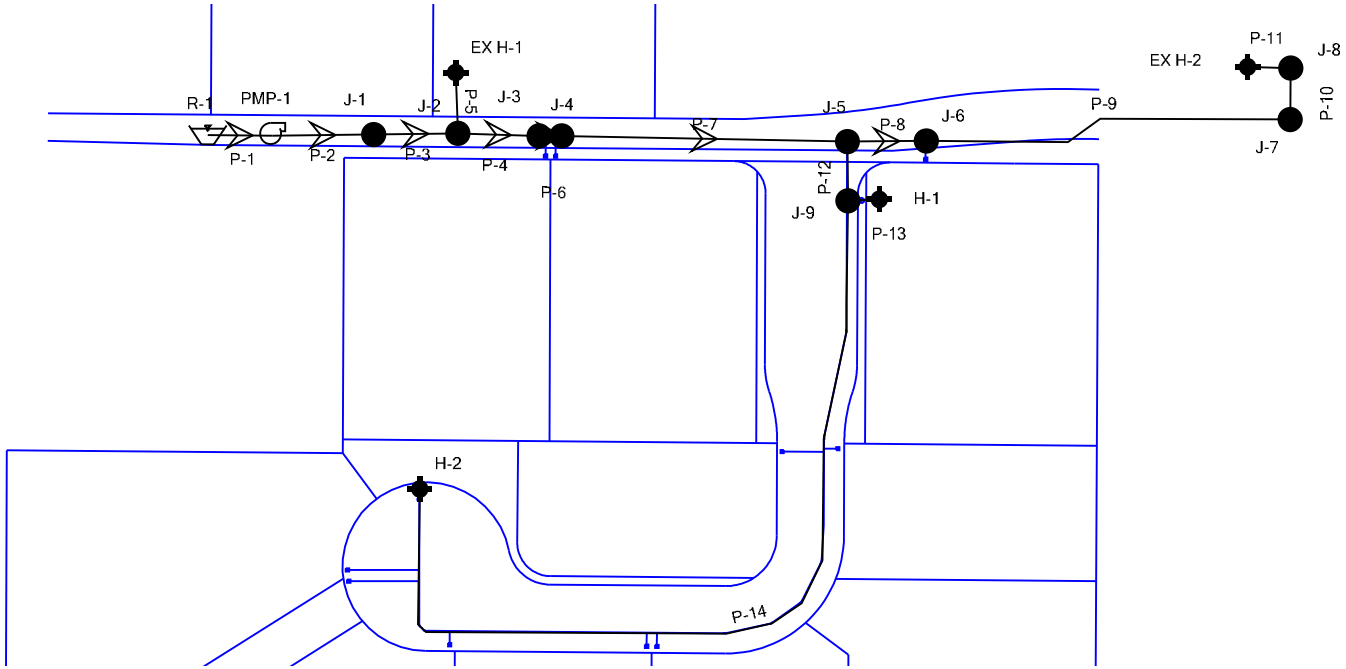
DRAWING NAME
UTILITY LAYOUT

1 OF 1

30-45
2-ZN-2020
1/28/2020

Scenario: Maximum Day + Fire Flow

Active Scenario: Maximum Day + Fire Flow



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1/28/2020

Appendix B – Fire Hydrant Flow Test Results

Flow Test Summary

Project Name:	EJFT 18097
Project Address:	7315 E Jenan Dr, Scottsdale, AZ 85260
Date of Flow Test:	2018-05-11
Time of Flow Test:	7:08 AM
Data Reliable Until:	2018-11-11
Conducted By:	Austin Gourley & Eder Cueva (EJ Flow Tests) 602.999.7637
Witnessed By:	Jared Berry (City of Scottsdale) 602.541.4942
City Forces Contacted:	City of Scottsdale (602.541.4942)
Permit Number:	C55298

Raw Flow Test Data

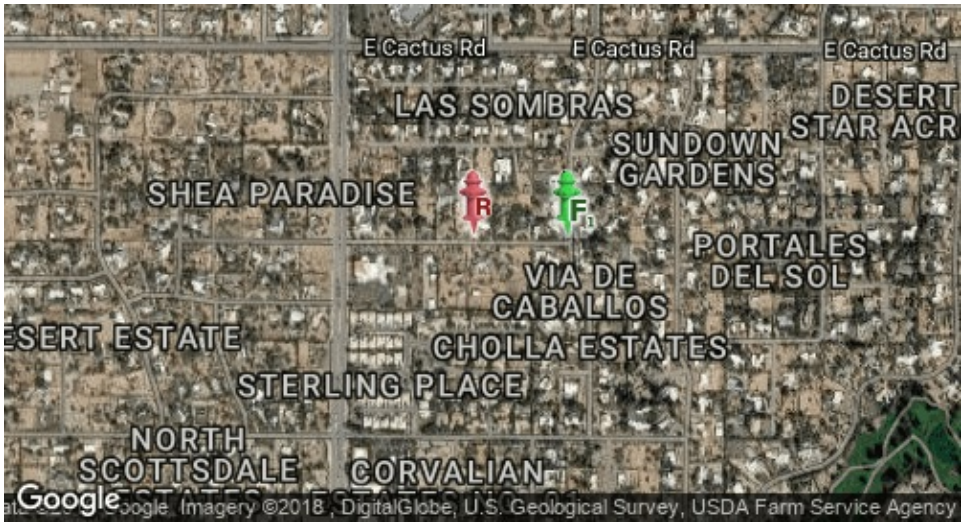
Static Pressure:	66.0 PSI
Residual Pressure:	52.0 PSI
Flowing GPM:	1,839
GPM @ 20 PSI:	3,495

Data with a 10 % Safety Factor

Static Pressure:	59.4 PSI
Residual Pressure:	45.4 PSI
Flowing GPM:	1,839
GPM @ 20 PSI:	3,215

Hydrant F_1

Pitot Pressure (1):	30	PSI
Coefficient of Discharge (1):	0.9	
Hydrant Orifice Diameter (1):	2.5	inches
Pitot Pressure (2):	30	PSI
Coefficient of Discharge (2):	0.9	
Hydrant Orifice Diameter (2):	2.5	inches



Static-Residual Hydrant

Flow Hydrant

Distance Between F_1 and R
638 ft (measured linearly)

Static-Residual Elevation
1380 ft (above sea level)

Flow Hydrant (F_1) Elevation
1379 ft (above sea level)

Elevation & distance values are approximate

EJ Flow Tests, LLC
21505 North 78th Ave. | Suite 130 | Peoria, Arizona 85382 | (602) 999-7637 | www.ejengineering.com
John L. Echeverri | NICET Level IV 078493 SME | C-16 FP Contractor ROC 271705 AZ | NFPA CFPS 1915

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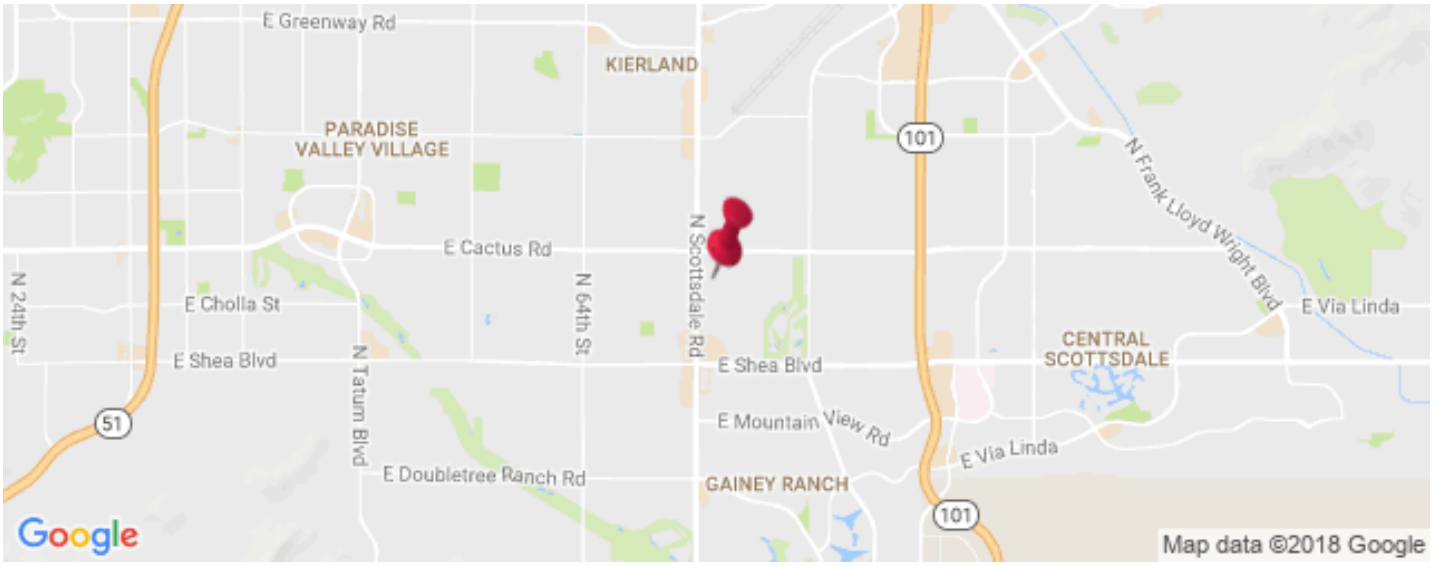
Flow Test Summary

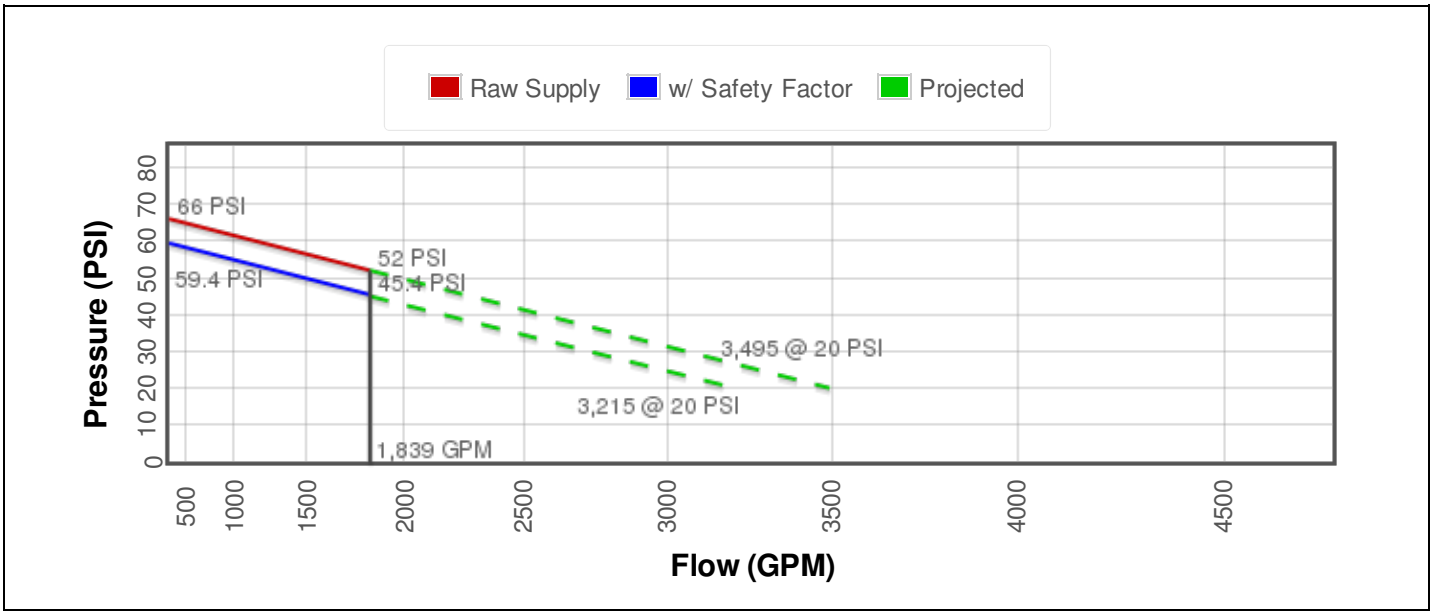
Static-Residual Hydrant

Flow Hydrant (only hydrant F1 shown for clarity)

Approximate Project Site



Water Supply Curve $N^{1.85}$ Graph



EJ Flow Tests, LLC
21505 North 78th Ave. | Suite 130 | Peoria, Arizona 85382 | (602) 999-7637 | www.ejengineering.com
John L. Echeverri | NICET Level IV 078493 SME | C-16 FP Contractor ROC 271705 AZ | NFPA CFPS 1915

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Pump Definition Detailed Report: Flow Test Results

Element Details

ID	74	Notes	
Label	Flow Test Results		

Pump Definition Type

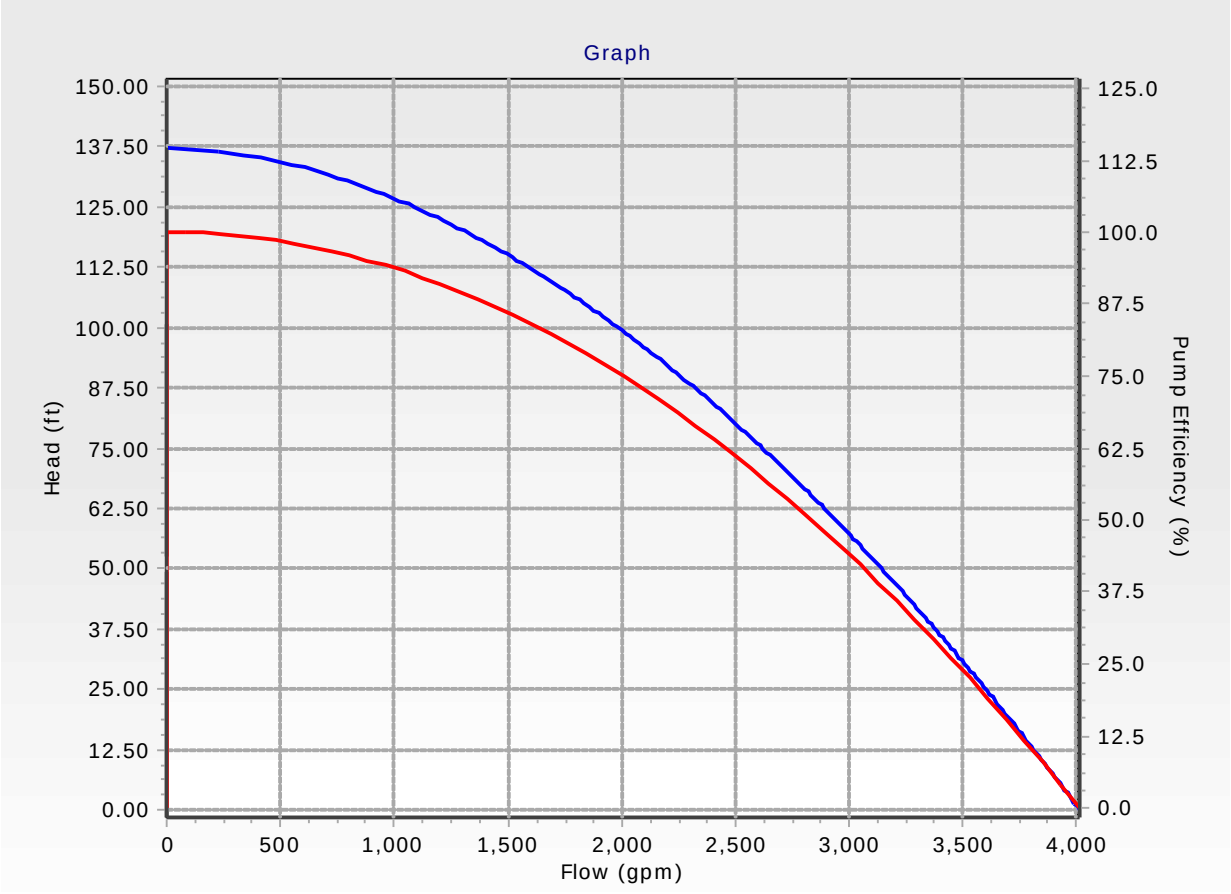
Pump Definition Type	Standard (3 Point)	Design Head	104.87 ft
Shutoff Flow	0 gpm	Maximum Operating Flow	3,215 gpm
Shutoff Head	137.21 ft	Maximum Operating Head	46.20 ft
Design Flow	1,839 gpm		

Pump Efficiency Type

Pump Efficiency Type	Best Efficiency Point	Motor Efficiency	100.0 %
BEP Efficiency	100.0 %	Is Variable Speed Drive?	False
BEP Flow	0 gpm		

Transient (Physical)

Inertia (Pump and Motor)	0.000 lb·ft²	Specific Speed	SI=25, US=1280
Speed (Full)	0 rpm	Reverse Spin Allowed?	True



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Appendix C – WaterCAD Results

Average Day Demand

Maximum Day Demand

Peak Hour Demand

Maximum Day + Fire Flow Demand

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Jenan Water Model
Active Scenario: Average Day Demand
Average Day Demand
Pipe Table - Time: 0.00 hours

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)
P-1	39	R-1	PMP-1	48.0	Ductile Iron	130.0	2	0.00	0.000
P-9	364	J-6	J-7	8.0	Ductile Iron	130.0	0	0.00	0.000
P-10	30	J-7	J-8	8.0	Ductile Iron	130.0	0	0.00	0.000
P-5	36	EX H-1	J-2	8.0	Ductile Iron	130.0	0	0.00	0.000
P-11	15	EX H-2	J-8	8.0	Ductile Iron	130.0	0	0.00	0.000
P-2	60	PMP-1	J-1	48.0	Ductile Iron	130.0	2	0.00	0.000
P-3	50	J-1	J-2	48.0	Ductile Iron	130.0	2	0.00	0.000
P-12	35	J-5	J-9	6.0	Ductile Iron	130.0	0	0.00	0.000
P-14	558	J-9	H-2	6.0	Ductile Iron	130.0	0	0.00	0.000
P-13	19	H-1	J-9	6.0	Ductile Iron	130.0	0	0.00	0.000
P-4	48	J-2	J-3	8.0	Ductile Iron	130.0	2	0.01	0.000
P-6	14	J-3	J-4	8.0	Ductile Iron	130.0	1	0.01	0.000

Junction Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
34	J-2	1,380.07	0	1,518.45	60
36	J-6	1,379.09	1	1,518.45	60
38	J-7	1,378.54	0	1,518.45	61
40	J-8	1,378.54	0	1,518.45	61
92	J-1	1,380.36	0	1,518.45	60
95	J-9	1,380.00	0	1,518.45	60
101	J-4	1,379.55	1	1,518.45	60
104	J-3	1,379.60	1	1,518.45	60

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Jenan Water Model

Active Scenario: Average Day Demand

Hydrant Table - Time: 0.00 hours

ID	Label	Length (Hydrant Lateral) (ft)	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
60	EX H-1	20	1,381.24	0	1,518.45	59
61	EX H-2	20	1,379.04	0	1,518.45	60
97	H-2	20	1,380.00	0	1,518.45	60
99	H-1	20	1,380.00	0	1,518.45	60

Reservoir Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Zone	Flow (Out net) (gpm)	Hydraulic Grade (ft)
30	R-1	1,381.24	<None>	2	1,381.24

Pump Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Pump Definition	Status (Initial)	Hydraulic Grade (Suction) (ft)	Hydraulic Grade (Discharge) (ft)	Flow (Total) (gpm)	Pump Head (ft)
67	PMP-1	1,381.24	Flow Test Results	On	1,381.24	1,518.45	2	137.21

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Jenan Water Model
Active Scenario: Average Day Demand
Maximum Day + Fire Flow

Pipe Table - Time: 0.00 hours

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)
P-1	39	R-1	PMP-1	48.0	Ductile Iron	130.0	7	0.00	0.000
P-9	364	J-6	J-7	8.0	Ductile Iron	130.0	0	0.00	0.000
P-10	30	J-7	J-8	8.0	Ductile Iron	130.0	0	0.00	0.000
P-5	36	EX H-1	J-2	8.0	Ductile Iron	130.0	0	0.00	0.000
P-11	15	EX H-2	J-8	8.0	Ductile Iron	130.0	0	0.00	0.000
P-2	60	PMP-1	J-1	48.0	Ductile Iron	130.0	7	0.00	0.000
P-3	50	J-1	J-2	48.0	Ductile Iron	130.0	7	0.00	0.000
P-12	35	J-5	J-9	6.0	Ductile Iron	130.0	0	0.00	0.000
P-14	558	J-9	H-2	6.0	Ductile Iron	130.0	0	0.00	0.000
P-13	19	H-1	J-9	6.0	Ductile Iron	130.0	0	0.00	0.000
P-4	48	J-2	J-3	8.0	Ductile Iron	130.0	7	0.04	0.000
P-6	14	J-3	J-4	8.0	Ductile Iron	130.0	7	0.04	0.000

Junction Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
34	J-2	1,380.07	0	1,518.45	60
36	J-6	1,379.09	7	1,518.45	60
38	J-7	1,378.54	0	1,518.45	61
40	J-8	1,378.54	0	1,518.45	61
92	J-1	1,380.36	0	1,518.45	60
95	J-9	1,380.00	0	1,518.45	60
101	J-4	1,379.55	0	1,518.45	60
104	J-3	1,379.60	0	1,518.45	60

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Jenan Water Model

Active Scenario: Average Day Demand

Hydrant Table - Time: 0.00 hours

ID	Label	Length (Hydrant Lateral) (ft)	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
60	EX H-1	20	1,381.24	0	1,518.45	59
61	EX H-2	20	1,379.04	0	1,518.45	60
97	H-2	20	1,380.00	0	1,518.45	60
99	H-1	20	1,380.00	0	1,518.45	60

Reservoir Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Zone	Flow (Out net) (gpm)	Hydraulic Grade (ft)
30	R-1	1,381.24	<None>	7	1,381.24

Pump Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Pump Definition	Status (Initial)	Hydraulic Grade (Suction) (ft)	Hydraulic Grade (Discharge) (ft)	Flow (Total) (gpm)	Pump Head (ft)
67	PMP-1	1,381.24	Flow Test Results	On	1,381.24	1,518.45	7	137.21

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Jenan Water Model
Active Scenario: Average Day Demand
Maximum Day Demand

Pipe Table - Time: 0.00 hours

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)
P-1	39	R-1	PMP-1	48.0	Ductile Iron	130.0	7	0.00	0.000
P-9	364	J-6	J-7	8.0	Ductile Iron	130.0	0	0.00	0.000
P-10	30	J-7	J-8	8.0	Ductile Iron	130.0	0	0.00	0.000
P-5	36	EX H-1	J-2	8.0	Ductile Iron	130.0	0	0.00	0.000
P-11	15	EX H-2	J-8	8.0	Ductile Iron	130.0	0	0.00	0.000
P-2	60	PMP-1	J-1	48.0	Ductile Iron	130.0	7	0.00	0.000
P-3	50	J-1	J-2	48.0	Ductile Iron	130.0	7	0.00	0.000
P-12	35	J-5	J-9	6.0	Ductile Iron	130.0	0	0.00	0.000
P-14	558	J-9	H-2	6.0	Ductile Iron	130.0	0	0.00	0.000
P-13	19	H-1	J-9	6.0	Ductile Iron	130.0	0	0.00	0.000
P-4	48	J-2	J-3	8.0	Ductile Iron	130.0	7	0.04	0.000
P-6	14	J-3	J-4	8.0	Ductile Iron	130.0	7	0.04	0.000

Junction Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
34	J-2	1,380.07	0	1,518.45	60
36	J-6	1,379.09	7	1,518.45	60
38	J-7	1,378.54	0	1,518.45	61
40	J-8	1,378.54	0	1,518.45	61
92	J-1	1,380.36	0	1,518.45	60
95	J-9	1,380.00	0	1,518.45	60
101	J-4	1,379.55	0	1,518.45	60
104	J-3	1,379.60	0	1,518.45	60

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Jenan Water Model

Active Scenario: Average Day Demand

Hydrant Table - Time: 0.00 hours

ID	Label	Length (Hydrant Lateral) (ft)	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
60	EX H-1	20	1,381.24	0	1,518.45	59
61	EX H-2	20	1,379.04	0	1,518.45	60
97	H-2	20	1,380.00	0	1,518.45	60
99	H-1	20	1,380.00	0	1,518.45	60

Reservoir Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Zone	Flow (Out net) (gpm)	Hydraulic Grade (ft)
30	R-1	1,381.24	<None>	7	1,381.24

Pump Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Pump Definition	Status (Initial)	Hydraulic Grade (Suction) (ft)	Hydraulic Grade (Discharge) (ft)	Flow (Total) (gpm)	Pump Head (ft)
67	PMP-1	1,381.24	Flow Test Results	On	1,381.24	1,518.45	7	137.21

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Jenan Water Model
Active Scenario: Average Day Demand
Peak Hour Demand

Pipe Table - Time: 0.00 hours

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)
P-1	39	R-1	PMP-1	48.0	Ductile Iron	130.0	12	0.00	0.000
P-9	364	J-6	J-7	8.0	Ductile Iron	130.0	0	0.00	0.000
P-10	30	J-7	J-8	8.0	Ductile Iron	130.0	0	0.00	0.000
P-5	36	EX H-1	J-2	8.0	Ductile Iron	130.0	0	0.00	0.000
P-11	15	EX H-2	J-8	8.0	Ductile Iron	130.0	0	0.00	0.000
P-2	60	PMP-1	J-1	48.0	Ductile Iron	130.0	12	0.00	0.000
P-3	50	J-1	J-2	48.0	Ductile Iron	130.0	12	0.00	0.000
P-12	35	J-5	J-9	6.0	Ductile Iron	130.0	0	0.00	0.000
P-14	558	J-9	H-2	6.0	Ductile Iron	130.0	0	0.00	0.000
P-13	19	H-1	J-9	6.0	Ductile Iron	130.0	0	0.00	0.000
P-4	48	J-2	J-3	8.0	Ductile Iron	130.0	12	0.08	0.000
P-6	14	J-3	J-4	8.0	Ductile Iron	130.0	12	0.08	0.000

Junction Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
34	J-2	1,380.07	0	1,518.45	60
36	J-6	1,379.09	12	1,518.45	60
38	J-7	1,378.54	0	1,518.45	61
40	J-8	1,378.54	0	1,518.45	61
92	J-1	1,380.36	0	1,518.45	60
95	J-9	1,380.00	0	1,518.45	60
101	J-4	1,379.55	0	1,518.45	60
104	J-3	1,379.60	0	1,518.45	60

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Jenan Water Model

Active Scenario: Average Day Demand

Hydrant Table - Time: 0.00 hours

ID	Label	Length (Hydrant Lateral) (ft)	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
60	EX H-1	20	1,381.24	0	1,518.45	59
61	EX H-2	20	1,379.04	0	1,518.45	60
97	H-2	20	1,380.00	0	1,518.45	60
99	H-1	20	1,380.00	0	1,518.45	60

Reservoir Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Zone	Flow (Out net) (gpm)	Hydraulic Grade (ft)
30	R-1	1,381.24	<None>	12	1,381.24

Pump Table - Time: 0.00 hours

ID	Label	Elevation (ft)	Pump Definition	Status (Initial)	Hydraulic Grade (Suction) (ft)	Hydraulic Grade (Discharge) (ft)	Flow (Total) (gpm)	Pump Head (ft)
67	PMP-1	1,381.24	Flow Test Results	On	1,381.24	1,518.45	12	137.21

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Fire Flow Node FlexTable: Fire Flow Report

Active Scenario: Maximum Day + Fire Flow

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Calculated Residual) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (Calculated System Lower Limit) (psi)	Junction w/ Minimum Pressure (System)	Velocity of Maximum Pipe (ft/s)
EX H-1	1,000	1,500	1,000	1,500	49	50	J-1	50	J-1	9.57
EX H-2	1,000	1,500	1,000	1,500	39	40	J-8	40	J-8	9.62
H-2	1,000	1,275	1,000	1,275	20	48	J-9	48	J-9	14.47
H-1	1,000	1,500	1,000	1,500	43	44	H-2	44	H-2	17.02
J-2	1,000	1,500	1,000	1,500	50	50	EX H-1	50	EX H-1	0.27
J-6	1,000	1,500	1,007	1,507	46	46	EX H-2	46	EX H-2	9.62
J-7	1,000	1,500	1,000	1,500	40	40	EX H-2	40	EX H-2	9.62
J-8	1,000	1,500	1,000	1,500	40	39	EX H-2	39	EX H-2	9.62
J-1	1,000	1,500	1,000	1,500	50	50	EX H-1	50	EX H-1	0.27
J-9	1,000	1,500	1,000	1,500	44	44	H-2	44	H-2	17.02
J-4	1,000	1,500	1,000	1,500	49	49	H-2	49	H-2	9.62
J-3	1,000	1,500	1,000	1,500	50	49	H-2	49	H-2	9.62
J-5	1,000	1,500	1,000	1,500	47	46	J-9	46	J-9	9.62

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Appendix D – Sewer Capacity Calculations

Worksheet for 8" Full Flow Capacity

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00520	ft/ft ← minimum slope
Normal Depth	8.00	in
Diameter	8.00	in
Discharge	563169.09	gal/day ← full flow capacity

Results

Discharge	563169.09	gal/day
Normal Depth	8.00	in
Flow Area	0.35	ft²
Wetted Perimeter	2.09	ft
Hydraulic Radius	2.00	in
Top Width	0.00	ft
Critical Depth	0.44	ft
Percent Full	100.0	%
Critical Slope	0.00857	ft/ft
Velocity	2.50	ft/s ← minimum velocity met
Velocity Head	0.10	ft
Specific Energy	0.76	ft
Froude Number	0.00	
Maximum Discharge	0.94	ft³/s
Discharge Full	0.87	ft³/s
Slope Full	0.00520	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%

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Worksheet for 8" Full Flow Capacity

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	8.00	in
Critical Depth	0.44	ft
Channel Slope	0.00520	ft/ft
Critical Slope	0.00857	ft/ft

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Worksheet for 8" Sewer Capacity

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.013
Channel Slope	0.005 ft/ft
Diameter	8.0 in
Discharge	6.95 gpm

Results	
Normal Depth	0.7 in
Flow Area	0.0 ft²
Wetted Perimeter	0.4 ft
Hydraulic Radius	0.5 in
Top Width	0.39 ft
Critical Depth	0.7 in
Percent Full	9.3 %
Critical Slope	0.008 ft/ft
Velocity	0.95 ft/s
Velocity Head	0.01 ft
Specific Energy	0.08 ft
Froude Number	0.815
Maximum Discharge	420.70 gpm
Discharge Full	391.09 gpm
Slope Full	0.000 ft/ft
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	11.2 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.7 in
Critical Depth	0.7 in
Channel Slope	0.005 ft/ft
Critical Slope	0.008 ft/ft

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