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ENGINEER | PLAN | SURVEY | MANAGE

WATER BASIS OF DESIGN REPORT
FOR
SCOTTSDALE CONDO VILLAS

SCOTTSDALE, ARIZONA

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**WATER BASIS OF DESIGN REPORT
FOR
SCOTTSDALE CONDO VILLAS**

TABLE OF CONTENTS

1.0	INTRODUCTION.....	1
1.1	Project Location	1
1.2	General Description.....	1
1.3	Purpose of Report.....	1
2.0	DESIGN CRITERIA.....	1
2.1	Design Criteria	1
3.0	WATER DEMANDS.....	2
3.1	Water Demand Calculations	2
4.0	WATER SYSTEM INFRASTRUCTURE.....	2
4.1	Existing Water System Infrastructure	2
4.2	Proposed Water System Improvements.....	3
5.0	HYDRAULIC MODEL AND RESULTS.....	3
5.1	Design Methodology	3
6.0	CONCLUSIONS.....	4
7.0	REFERENCES.....	4

APPENDICES

- A. Figures
- B. Hydrant Flow Test
- C. Hydraulic Model Results

FIGURES

1.	Vicinity Map	Appendix A
2.	Water System Improvements	Appendix A
3.	Preliminary Utility Plan.....	Appendix A

TABLES

1.	Water System Design Criteria	2
2.	Onsite Hydraulic Modeling Summary.....	4

1.0 INTRODUCTION

1.1 Project Location

Scottsdale Condo Villas (the Project) is located just north and west of the intersection of Osborn Road and Miller Road in Scottsdale, Arizona. It lies within Section 26, Township 2 North, Range 4 East of the Gila and Salt River Baseline and Meridian. The property is bounded by multi-family residential units on the north and south, Miller Road on the east, and an alley and Scottsdale Stadium on the west. Figure 1 in Appendix A provides a vicinity map for the Project.

1.2 General Description

Scottsdale Condo Villas is a proposed condominium development consisting of 24 units. The Project site currently consists of four multi-family residential buildings consisting of 21 units located on the perimeter of the lot with a courtyard in the center. These existing buildings will be demolished as part of the project. Scottsdale Condo Villas is located within the City of Scottsdale Water Service Area.

1.3 Purpose of Report

The purpose of this Water Basis of Design Report is to identify and evaluate the existing and proposed water system infrastructure for serving Scottsdale Condo Villas in accordance with the City of Scottsdale January 2010 Design Standards & Policies Manual (Scottsdale 2010). This Water Basis of Design Report discusses the existing water infrastructure within the project vicinity and identifies anticipated demands for average day, maximum day, and peak hour conditions.

2.0 DESIGN CRITERIA

2.1 Design Criteria

The proposed water distribution system design for Scottsdale Condo Villas has been prepared consistent with the City of Scottsdale January 2010 Design Standards & Policies Manual (Scottsdale 2010). A summary of the design criteria is provided in Table 1 below.

TABLE 1 WATER SYSTEM DESIGN CRITERIA			
Category		Value	Unit
Population Density			
	High Density Condominium	2.5	persons/DU
Average Day Water Demand			
	High Density Condominium	185.3	gpcu/day
Peaking Factors			
	Maximum Day	2	x Average Day
	Peak Hour	3.5	x Average Day
Average Day System Performance			
	Minimum Pressure	50	psi
	Maximum Pressure*	120	psi
	Maximum Headloss - transmission lines	8	ft/1,000 ft
	Maximum Headloss - distribution lines	10	ft/1,000 ft
Maximum Day + Fire Flow System Performance			
	Minimum Pressure	30	psi
	Fire Flow	1,500	gpm for 2 hours
<u>Notes:</u>			
*Any structure experiencing pressures greater than 80 psi shall have an individual PRV.			

3.0 WATER DEMANDS

3.1 Water Demand Calculations

Anticipated water demands for Scottsdale Condo Villas have been calculated in accordance with the design criteria listed in Table 1. The average day demand, maximum day demand, and peak hour demand are 4,447 gpd, 8,894 gpd, and 15,565 gpd, respectively.

4.0 WATER SYSTEM INFRASTRUCTURE

4.1 Existing Water System Infrastructure

Existing water infrastructure immediately adjacent to Scottsdale Condo Villas includes an 8-inch water line to the west within Scottsdale Stadium property and an 8-inch water line along Miller Road to the east.

A hydrant flow test was performed by EJ Flow Tests at the intersection of Miller Road and Osborn Road on March 16, 2015 at 8:00 AM. The flow test results showed a static pressure of 88 psi and a residual pressure of 86 psi at a flow of 1,760 gpm. Due to the minimal pressure drop observed at the residual hydrant during the flow test (only 2 psi, whereas the National Fire Protection Association Document 291 recommends an ideal pressure drop of at least 25 percent), the available flow at a pressure of 30 psi was not extrapolated from the test results. Doing so would provide an artificially high flow projection, as such calculation would not accurately account for the high head losses associated with such high flows. As such, a pump curve was developed based on the hydrant flow test results and a minimum pressure of 80 psi (equivalent to a projected flow of 3,721 gpm). Copies of the hydrant flow test results and the pump curve are included in Appendix C of this report.

4.2 Proposed Water System Improvements

As shown in Figure 2 in Appendix A, the 24 condominiums in Scottsdale Condo Villas will be served by the existing 8-inch water line in Miller Road to the east. There will not be a tie-in to the existing 8-inch water line within the Scottsdale Stadium property boundary per the direction of City of Scottsdale staff.

5.0 HYDRAULIC MODEL AND RESULTS

5.1 Design Methodology

The proposed water system infrastructure for Scottsdale Condo Villas is shown in Figure 2 in Appendix A. The water system was modeled by placing a reservoir and pump near the intersection of Miller Road and Osborn Road, at the approximate location of the hydrant flow test. A pump curve developed from the hydrant flow test results was used to establish the boundary condition for the modeled system. The hydrant flow test and associated pump curve are included in Appendix C. As discussed in Section 4.1, the pump curve was created using hydrant flow test results and was extrapolated to a flow of 3,721 gpm (projected pressure of 80 psi).

The proposed system for Scottsdale Condo Villas was modeled using WaterCAD V8i by Bentley Systems, Inc. Five scenarios were modeled: average day, maximum day, peak hour, residual fire flow during maximum day conditions, and available fire flow during maximum day conditions. A residual fire flow analysis applies a residential fire flow to each corresponding junction in the system to confirm the system's ability to meet the minimum pressure and maximum velocity requirements while providing the required fire flow during maximum day conditions. The available fire flow analysis estimates the maximum flow available at each junction while maintaining the minimum allowable residual pressure throughout the proposed system during maximum day conditions.

Detailed hydraulic model results for the proposed system are provided in Appendix D. Table 2 below summarizes the results. As shown in the table and results, pressures throughout the modeled area remained between 86 psi and 88 psi for the domestic scenarios modeled. The high pressures observed will require the installation of individual pressure reducing valves on each individual service connection (typically installed when pressures exceed 80 psi).

Velocities and head losses for the peak day scenario fall within the allowable limits established in Table 1. Furthermore, the fire flow analysis showed that the proposed system can adequately provide the 1,500 gpm of required fire flow to Scottsdale Condo Villas while maintaining a residual pressure of at least 30 psi and a maximum velocity of less than 10 feet per second.

TABLE 2 ONSITE HYDRAULIC MODELING SUMMARY						
	Average Day		Maximum Day		Peak Hour	
	Value	Location	Value	Location	Value	Location
Minimum Pressure (psi)	86	Multiple	86	Multiple	86	Multiple
Maximum Pressure (psi)	88	J-9	88	J-9	88	J-9
Maximum Velocity (fps)	0.02	P-1, P-8	0.04	P-1, P-8	0.07	P-1, P-8
Maximum Head loss (feet/1,000 feet of pipe)	0.000	P-2	0.002	P-1, P-8	0.004	P-1, P-8
Maximum Day Demand + Fire Flow - Residual Pressure Analysis						
	Value	Location	Fire Flow Location and Flow			
Minimum Residual Pressure (psi)	75	J-5	Multiple 1,500 gpm			
Maximum Velocity (fps)	9.61	P-1, P-8	Multiple 1,500 gpm			
Maximum Day Demand + Fire Flow - Available Fire Flow Analysis						
	Value	Location				
Minimum Available Fire Flow (gpm)	3,256.6	J-6				
Notes:						
1. Full model results are provided in Appendix C.						

6.0 CONCLUSIONS

This report summarizes water system improvements for serving Scottsdale Condo Villas. This report has determined that:

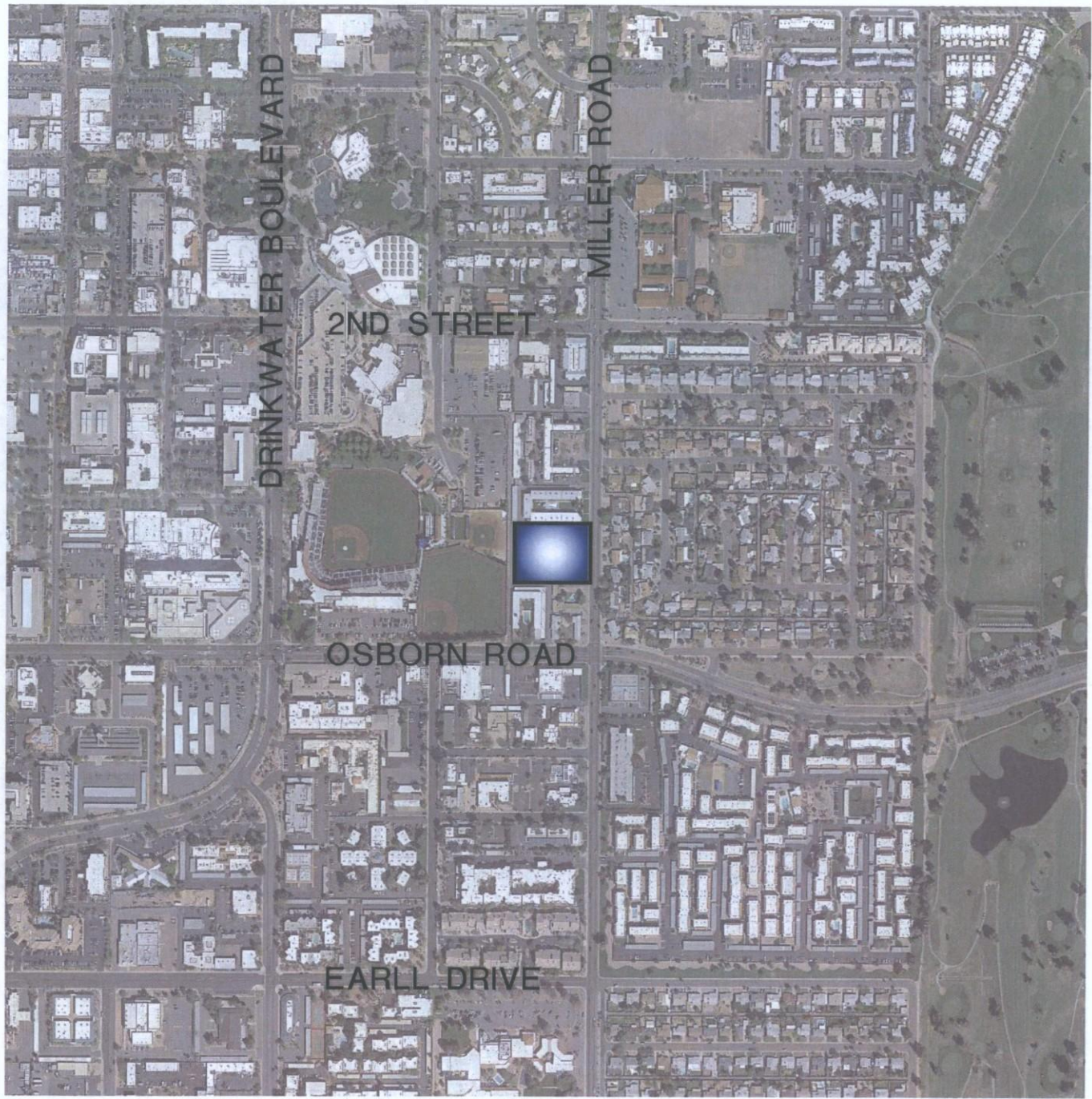
- The anticipated average day, maximum day, and peak day demands for Scottsdale Condo Villas are 4,447 gpd, 8,894 gpd, and 15,565 gpd, respectively
- The hydraulic model shows that Scottsdale Condo Villas can be adequately served by the proposed internal 8-inch water lines and the existing 8-inch water main in Miller Road.
- Hydraulic model results show that the proposed system will provide for velocities of less than 10 feet per second and head losses less than 10 feet per 1,000 feet of pipe during the domestic scenarios modeled.
- The proposed system can provide the required 1,500 gpm of fire flow while maintaining a minimum residual pressure of at least 30 psi.

7.0 REFERENCES

City of Scottsdale (2010). *Design Standards and Policy Manual*. January 2010, Scottsdale, AZ.

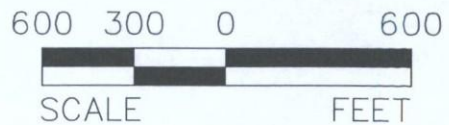
A

APPENDIX A
FIGURES



LEGEND

PROJECT LOCATION

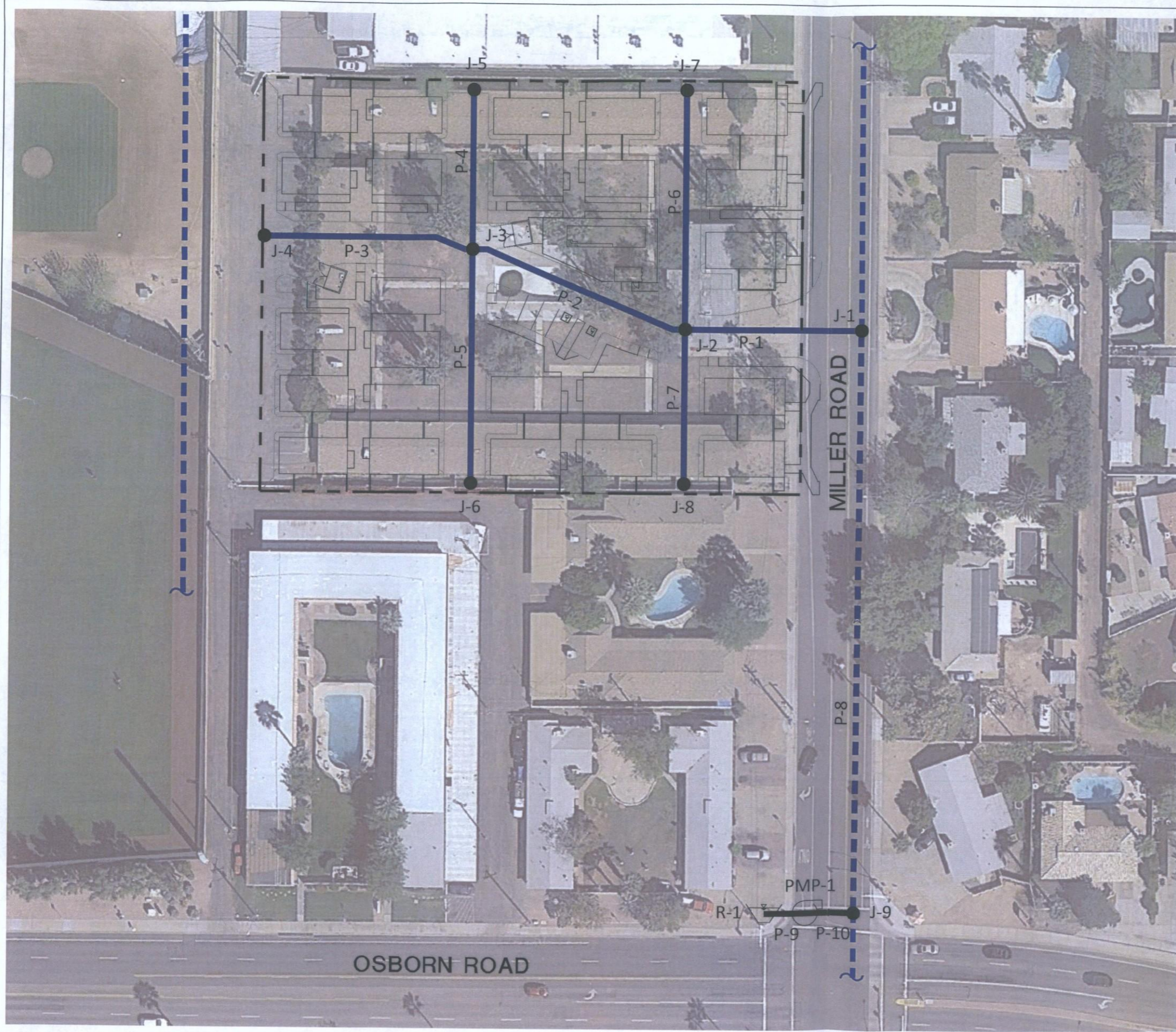


PROJ.NO.:	1454
DATE:	APR. 2015
SCALE:	1" = 600'
DRAWN BY:	JPG
CHECKED BY:	MI

SCOTTSDALE CONDO VILLAS
 3510 N MILLER RD
 SCOTTSDALE, ARIZONA

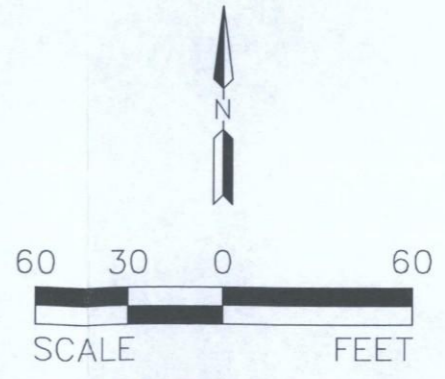
FIG 1: VICINITY MAP

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- LEGEND**
- PROPERTY BOUNDARY
 - PROPOSED WATERLINE
 - EXISTING WATERLINE
 - RESERVOIR
 - JUNCTION
 - PUMP

COLOR CODING LEGEND
 PIPE: DIAMETER (IN)
 ———— ≤ 8.0



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SCOTTSDALE CONDO VILLAS
 3510 N MILLER RD
 SCOTTSDALE, ARIZONA

FIG 2: WATER SYSTEM IMPROVEMENTS

PROJ. NO.:	1454
DATE:	APR. 2015
SCALE:	1" = 60'
DRAWN BY:	JPG
CHECKED BY:	MI

APPENDIX B
HYDRANT FLOW TEST



Flow Tests

FLOW TESTING SERVICES

Although a 25% drop in pressure wasn't achieved per NFPA-291, the total flowing GPM exceeds 1,500. Since there was such a small drop in pressure, the projected GPM @ 20 PSI is not shown for clarity.

Flow Test Summary

EJ Flow Tests Project Name: Scottsdale Condo Villas
 EJ Flow Tests Project No.: 15026
 Project Address: East Osborn Road & North Miller Road, Scottsdale, Arizona 85251
 Date of Flow Test: March 16, 2015
 Time of Flow Test: 8:00 AM
 Data is Current and Reliable Until: September 16, 2015

City of Scottsdale requires a Maximum Static Pressure of 72 PSI for use as Safety Factor.

Raw Test Data:

Static Pressure: 88.0 psi
 (measured in pounds per square inch)

Residual Pressure: 86.0 psi
 (measured in pounds per square inch)

Pitot Pressure: 27.5 psi
 (measured in pounds per square inch)

Number of Outlets Flowed: 2

Fire Hydrant Orifice Diameter: 2.5 inches
 (measured in inches)

Coefficient of Discharge: 0.9
 (0.9 smooth/round outlet, 0.8 square/sharp outlet,
 0.7 square/raised outlet)

Flowing GPM: 1,760
 (measured in gallons per minute)

Data with minimum safety factor of: 16 PSI :

Static Pressure: 72.0 psi
 (measured in pounds per square inch)

Residual Pressure: 70.0 psi
 (measured in pounds per square inch)

Main Size: Not Provided
 (measured in inches)

Approximate Distance Between Hydrants: 1,000 ft
 (measured in feet)

Approx. Static/Residual Hydrant Elevation: 1,238 ft
 (measured above sea level)

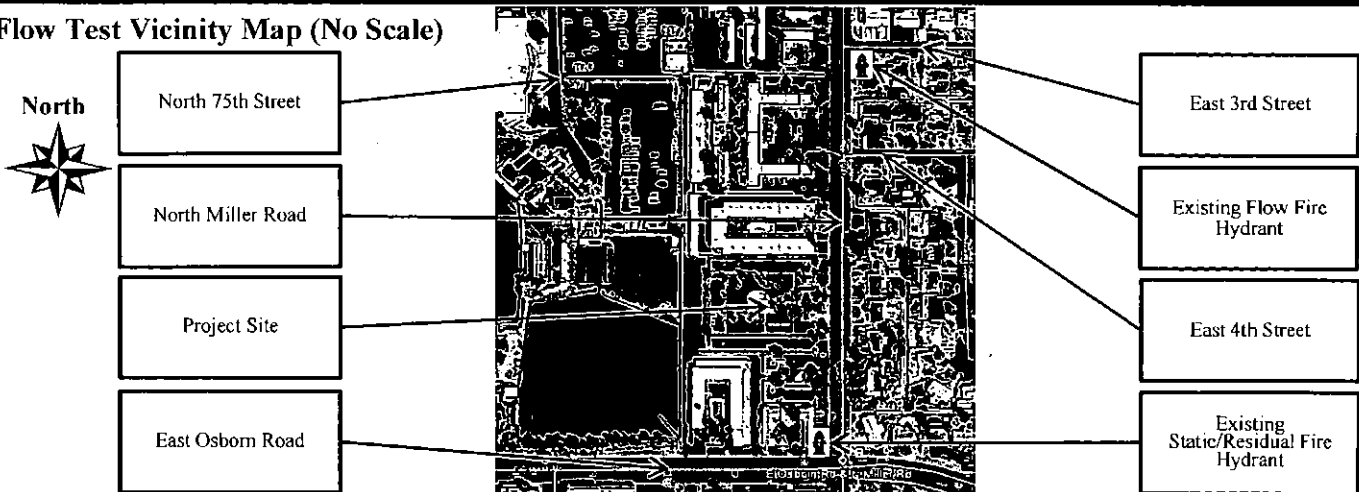
Approx. Flow Hydrant Elevation: 1,242 ft
 (measured above sea level)

Flowing GPM: 1,760
 (measured in gallons per minute)

Conducted by/Witnessed by/City Forces Contacted:

Conducted by: Cesar Reyna & Austin Gourley (EJ Flow Tests) 602.999.7637
 Witnessed by: Phil Cipolla (City of Scottsdale) 602.828.0847
 City Forces Contacted: City of Scottsdale (Permit #: C47196)

Flow Test Vicinity Map (No Scale)



E J Flow Tests, LLC

21505 North 78th Ave. • Suite 125 • Peoria, Arizona 85382 • 602.999.7637 • www.ejflowtests.com
 John L. Echeverri • NICET Level IV 078493 SME • C-16 FP Contractor ROC 271705 AZ • NFPA CFPS 1915

FLOW TEST PUMP CURVE

Scottsdale Condo Villas Flow Test - Miller Road and Osborn Road

Scottsdale, Arizona

Flow Test Date: March 16, 2015 (8:00 AM)



Fire Flow Test Results

Static Pressure at Test Hydrant (psi)	88
Residual Pressure at Test Hydrant (psi)	86
Total Discharge at Flowed Hydrants, Qf (gpm)	1,760

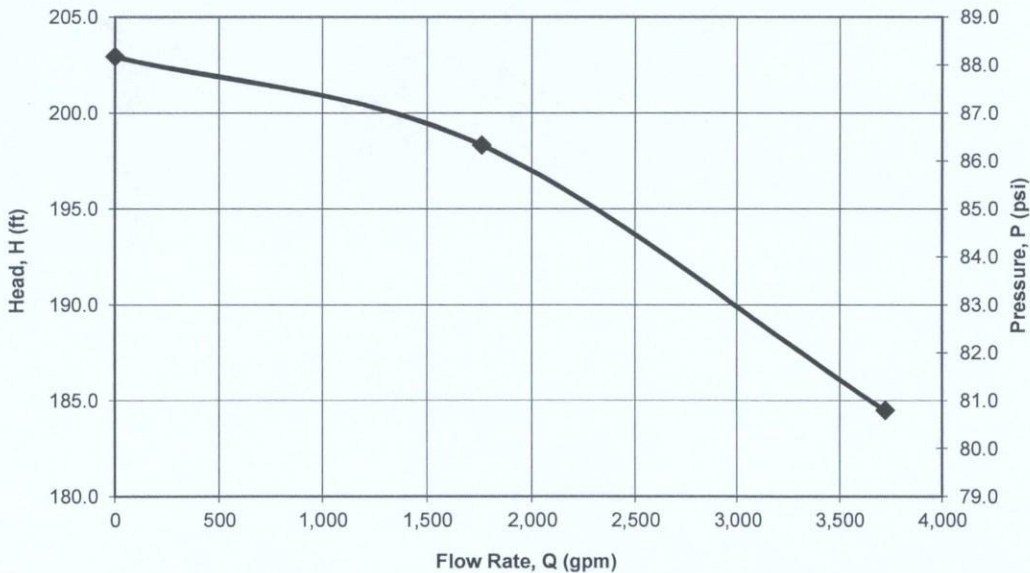
Calculations

Desired Fire Flow Residual Pressure (psi)	80.0
Pressure Drop During Test, hf (psi)	2.0
Pressure Drop During Test (%)	2%
Pressure Drop at Desired Residual Pressure, hr (psi)	8.0
Available Flow at Desired Residual Pressure, Qr (gpm)	3,721

Pump Curve

Q (gpm)	P (psi)	H (ft)
0	88.0	202.9
1,760	86.0	198.3
3,721	80.0	184.5

Pump Curve Extrapolated from Fire Flow Test Results



Note: Curve extrapolation limited to a flow of 3,721 gpm due to minimum pressure loss observed during flow test

C

APPENDIX C
HYDRAULIC MODEL RESULTS

AVERAGE DAY DEMAND

**FlexTable: Junction
Table
15-0420_Scottsdale
Condo Villas_Water
Model.wtg**

**Active Scenario:
Average Day Demand**

Current Time: 0.000 hours

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	1,240.00	0.0	1,440.90	87
J-2	1,240.00	0.4	1,440.90	87
J-3	1,241.00	0.5	1,440.90	86
J-4	1,242.00	0.6	1,440.90	86
J-5	1,243.00	0.3	1,440.90	86
J-6	1,242.00	0.5	1,440.90	86
J-7	1,242.00	0.5	1,440.90	86
J-8	1,240.00	0.3	1,440.90	87
J-9	1,238.00	0.0	1,440.90	88

FlexTable: Pipe Table
15-0420_Scottsdale
Condo Villas_Water
Model.wtg

Active Scenario:
Average Day Demand

Current Time: 0.000 hours

Label	Length (ft)	Diameter (in)	Hazen- Williams C	Flow (Absolute) (gpm)	Velocity (ft/s)	Headloss Gradient (ft/1000ft)
P-1	101	8.0	130.0	3.1	0.02	0.000
P-2	132	8.0	130.0	1.9	0.01	0.000
P-3	122	8.0	130.0	0.6	0.00	0.000
P-4	93	8.0	130.0	0.3	0.00	0.000
P-5	135	8.0	130.0	0.5	0.00	0.000
P-6	138	8.0	130.0	0.5	0.00	0.000
P-7	90	8.0	130.0	0.3	0.00	0.000
P-8	337	8.0	130.0	3.1	0.02	0.000
P-9	23	96.0	130.0	3.1	0.00	0.000
P-10	28	96.0	130.0	3.1	0.00	0.000

**FlexTable: Reservoir
Table
15-0420_Scottsdale
Condo Villas_Water
Model.wtg**

**Active Scenario:
Average Day Demand**

Current Time: 0.000 hours

Label	Elevation (ft)	Flow (Out net) (gpm)	Hydraulic Grade (ft)
R-1	1,238.00	3.1	1,238.00

FlexTable: Pump Table
15-0420_Scottsdale
Condo Villas_Water
Model.wtg

Active Scenario:
Average Day Demand

Current Time: 0.000 hours

Label	Elevation (ft)	Status (Initial)	Hydraulic Grade (Discharge) (ft)	Flow (Total) (gpm)	Pump Head (ft)
PMP-1	1,238.00	On	1,440.90	3.1	202.90

MAXIMUM DAY DEMAND

**FlexTable: Junction
Table
15-0420_Scottsdale
Condo Villas_Water
Model.wtg**

**Active Scenario:
Maximum Day Demand**

Current Time: 0.000 hours

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	1,240.00	0.0	1,440.90	87
J-2	1,240.00	0.8	1,440.90	87
J-3	1,241.00	1.0	1,440.90	86
J-4	1,242.00	1.3	1,440.90	86
J-5	1,243.00	0.5	1,440.90	86
J-6	1,242.00	1.0	1,440.90	86
J-7	1,242.00	1.0	1,440.90	86
J-8	1,240.00	0.5	1,440.90	87
J-9	1,238.00	0.0	1,440.90	88