CITY OF SCOTTSDALE

Water and Wastewater Study
Combined

PRELIMINARY WATER BASIS OF DESIGN REPORT

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 scan **DATE** 5/26/2020

DR 2019-1120

Solitude

Southeast of Happy Valley Road and Pima Road
Scottsdale, Arizona

Prepared for:

Sonora West Development INC.
8937 East Bell Road
Suite 100
Scottsdale, Arizona 85260

Registered Professional Engineer (Civil)
CERTIFICATE NO.
63454
ZACHARY J. HILL
DATE SIGNED 02/05/20
ARIZONA U.S.A.

Prepared by:

Kimley-Horn and Associates
1001 West Southern Avenue, Suite 131
Mesa, Arizona 85210
291203001
February 2020

17-ZN-2019
5/8/2020

PRELIMINARY
WATER BASIS OF DESIGN REPORT

SOLITUDE

SOUTHEAST OF HAPPY VALLEY ROAD AND PIMA ROAD

SCOTTSDALE, ARIZONA

FEBRUARY 2020

Prepared By:

Kimley»Horn

17-ZN-2019
5/8/2020

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INTRODUCTION

SITE LOCATION

This Preliminary Water Basis of Design Report (WaterBOD) has been prepared for the proposed Solitude single family development located southeast of Happy Valley Road and Pima Road in Scottsdale, Arizona (development). The development is bound to the West by the 91st Street alignment, to the north by Happy Valley Road, to the south by undeveloped land, and to the west by the 92nd Street alignment. The development is located within Section 7 of Township 4 North, Range 5 East of the Gila and Salt River Base and Meridian, Maricopa County, Arizona. Refer to **Figure 1** for the Vicinity Map.

PROJECT SIZE AND TYPE

The development is a proposed 17-unit single family residential subdivision. The proposed buildings are one-story units. The development is approximately 20 acres.

PURPOSE AND OBJECTIVES

This report presents the basis of design criteria that will be used for engineering design of the proposed development. This report establishes a preliminary water service plan for the development of the site.

- Demonstrate compliance with the City's Design Standards & Polices Manual (DSPM).
- Identify a preliminary water system layout for the proposed development.
- Determination of the water demand generated by the development.
- Modeling and Analysis of the proposed water system, including Fire service.

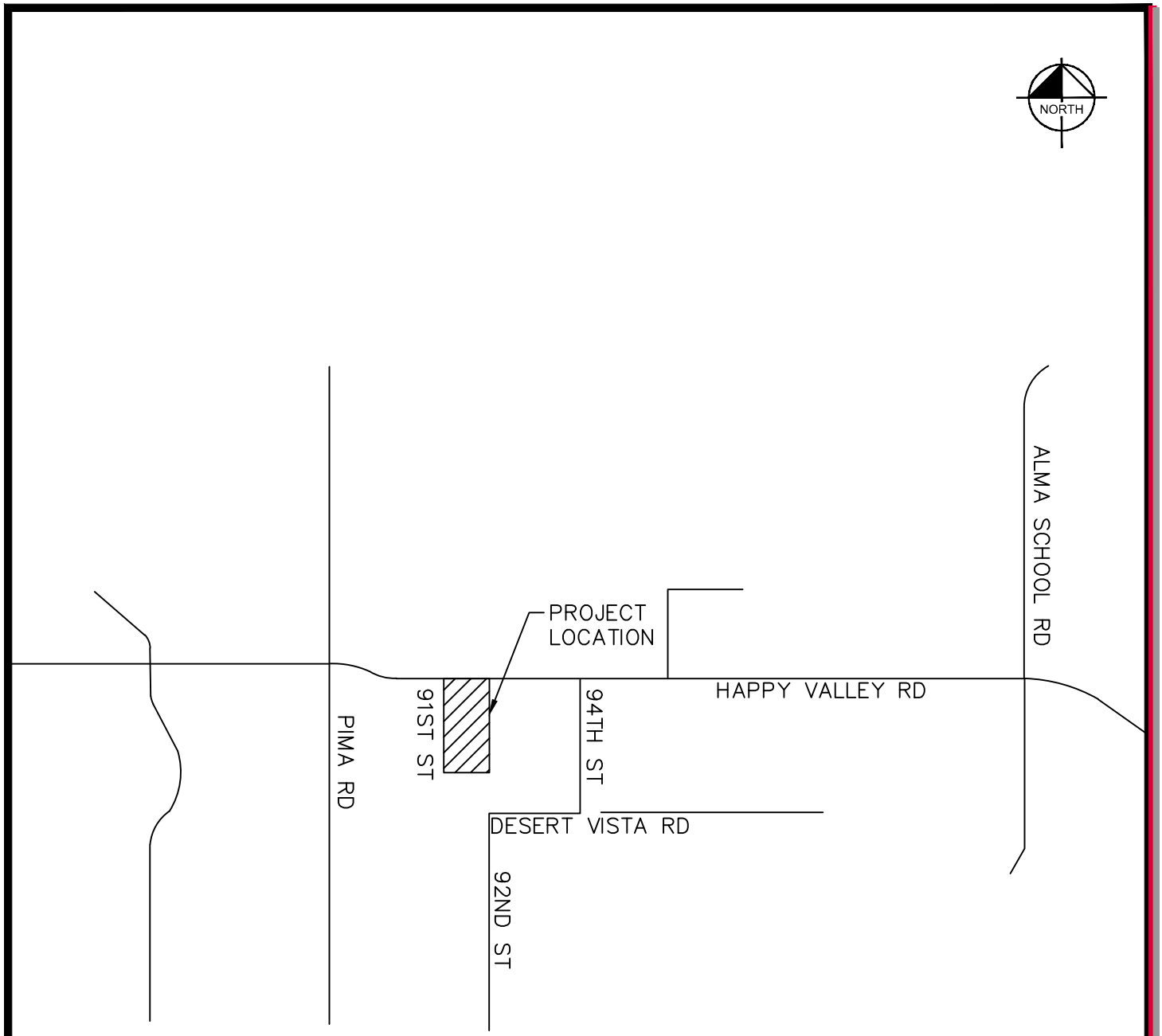


FIGURE 1
VICINITY MAP

Kimley»Horn

17-ZN-2019
5/8/2020

K:\EAV_Civil\291203001 - HV92\Reports\WaterBOD\Figures\V-MAP.dwg Sep 24, 2019 dan.recker
XREFS:

WATER SYSTEM DESCRIPTION

EXISTING WATER SYSTEM

The existing site is primarily undeveloped natural desert with one existing house to be removed. The site slopes to the southwest and across the site. Existing grade elevations on the site range from approximately 2125-2080. The development falls entirely within pressure zone 8. Based on a review of the City Quarter Section Maps, there is an existing 12-inch water line in Happy Valley Road, an existing 12-water line in the 92nd Street alignment an existing 6-inch water line in the Whispering Wind alignment, and an existing 6-inch water line in the 91st Street alignment.

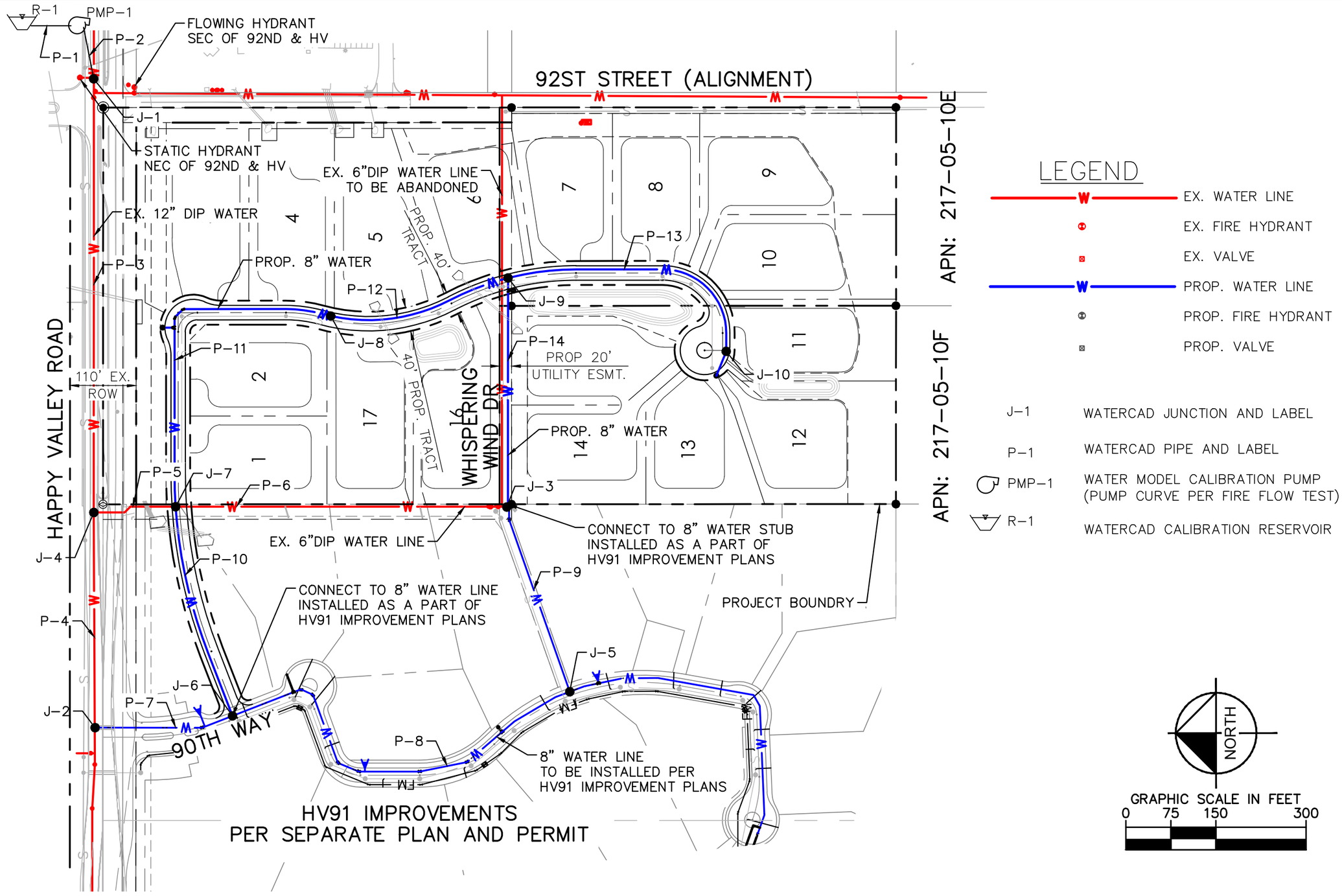
PROPOSED WATER SYSTEM

Directly to the west of the site is the HV91 development (CoS Plan Check #310-19), which is currently under construction. HV91 provide an 8-inch water stub at the eastern boundary along the Whispering Wind alignment. HV91 will be served by an 8-inch D.I.P. public water line which connects to the existing 12-inch water line in Happy Valley Road and the existing 6-inch water line in the 91st Street alignment.

The proposed solitude development consists of 17 single family residential units. The development will be served by a proposed 8"-D.I.P. public water line within private roadway tracts and/or easements within the development.

The proposed water system will be served by two connections into the HV91 system. The first connection is into the 8-inch stub provided at the Whispering Wind alignment, the second connection will be at the 8-inch line in 90th Way. Refer to **Figure 2** for the proposed water layout.

The existing 6-inch water line in the Whispering Wind Drive alignment will be abandoned.



LEGEND

- EX. WATER LINE
- EX. FIRE HYDRANT
- EX. VALVE
- PROP. WATER LINE
- PROP. FIRE HYDRANT
- PROP. VALVE

J-1	WATERCAD JUNCTION AND LABEL
P-1	WATERCAD PIPE AND LABEL
PMP-1	WATER MODEL CALIBRATION PUMP (PUMP CURVE PER FIRE FLOW TEST)
R-1	WATERCAD CALIBRATION RESERVOIR

NORTH

GRAPHIC SCALE IN FEET
0 75 150 300

NO.	REVISION	DATE

Kimley»Horn

1001 West Southern Avenue, Suite 131
Mesa, Arizona 85210 (480) 207-2666

SCALE (H): 1"=150'
SCALE (V): NONE
DESIGNED BY: TAF
DRAWN BY: DJR
CHECKED BY: JMB
DATE: FEB 2020

SOLITUDE
FINAL WATER BOD
FIGURE 2 - WATER SYSTEM LAYOUT
SCOTTSDALE, ARIZONA

PROJECT NO.
291903001

DRAWING NAME

17-ZN-2019
1 OF 1
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BASIS OF DESIGN

DESIGN CRITERIA

The design criteria for the development is based on the City of Scottsdale Design Standards and Policies Manual (DS&PM). Average daily demands for the proposed use and peaking factors were used to determine the proposed peak flows generated on site. See **Table 1** below for a summary of the design criteria used.

Table 1. Water Design Criteria

WATER DESIGN CRITERIA		
Water Demands		
Land Use	**Average Daily Flow (gpm)**	
Prop. Development (<2 DU/ac Residential)	0.69	per unit
Water Design Criteria		
Peaking Factors		
Maximum Day	2.0	
Peak Hour	3.5	
Fire Flow		
Single Family Residential*	875	GPM
Pressure Requirements		
Residual @ Highest Finished Floor Elevation	50-120	PSI
Fire Flow @ Hydrant Tee or Riser	30	PSI

***Fire Flow requirement for one-story residential property, up to 4,800 sq-ft, Per IFC Table B105.1 with 50% reduction for interior fire sprinkler system.**

The proposed development generates a peak demand of approximately 41.1 gpm. See **Table 2** below for a summary of the existing and proposed flows generated on site.

Table 2. Water Demand Calculations

Water Demand Calculations					
Use	**Units/ Rooms (#)**	**Unit Demand (gpm)**	**Average Daily Demand (gpm)**	**Max Day Demand (gpd)**	**Peak Hour Demand (gpm)**
HV91	17	0.69	11.7	23.5	41.1
Solitude	17	0.69	11.7	23.5	41.1
Total	**34**	**1.38**	**23.4**	**47**	**82.2**

WATER SYSTEM ANALYSIS

The WaterCAD v8i water system modeling software distributed by Haestad Methods, Inc. was used to model the proposed water network. A fire hydrant flow test was performed to determine the residual and static pressures of the existing network. The test was performed on Happy Valley Road at the southeast corner of 92nd Street. Refer to **Appendix A – Fire Hydrant Flow Test** Results.

The proposed water distribution system is modeled under four design scenarios. Average Day, Max Day, Peak Hour, and Max Day plus Fire Flow. Domestic demands based on the calculated demands from **Table 2** were placed on the corresponding WaterCAD design Nodes. See **Table 3** below for WaterCAD Junction Demands.

Table 3. WaterCAD Node Summary

WaterCAD Node	Existing/Proposed Ground Elevation	WaterCAD Elevation	Units	Average Day Demand (gpm)	Max Day Demand (gpm)	Peak Hour Demand (gpm)	Fire Flow Demand (gpm)
J-1	2,131	2,131	0	0	0	0	875
J-2	2,099	2,099	0	0	0	0	875
J-3	2,097	2,097	0	0	0	0	875
J-4	2,107	2,107	0	0	0	0	875
J-5*	2,089.5	2,089.5	17	11.7	23.5	41.1	875
J-6	2,097	2,097	0	0	0	0	875
J-7	2,112	2,112	4	2.8	5.5	9.7	875
J-8	2,109	2,109	3	2.1	4.1	7.3	875
J-9	2,107.5	2,107.5	5	3.5	6.9	12.1	875
J-10	2,100	2,100	5	3.5	6.9	12.1	875
			34	**23.5**	**46.9**	**82.1**	

*17- unit demand at node J-5 represents the demand from HV91

Demands are placed at the highest finished floor of the proposed building (in this case, single-story), with an additional 23-feet of head (~10 PSI) to account for losses through the service, meter and PRV. For the Average Day, Max Day and Peak hour, the minimum residual pressure in the system should be maintained between above 50 PSI at the highest finished floor and below 120 PSI in the system. For the Fire Flow scenario, the required fire flow is applied to all nodes independently. In the Fire Flow scenario, the minimum residual pressure in the network should be maintained above 30 PSI at the hydrant tee and 15 psi at the highest finished floor.

ANALYSIS RESULTS

Results from the water model indicated the proposed system is able to provide the required domestic and fire flows at or above the minimum required pressures. On-site water pressure in the three modeled scenarios are approximately 80-95 psi at the highest finished floor of the proposed development. While the available Fire Flow in the Max Day is above 1,500 gpm at a residual pressure of 30 psi at hydrants and 15 psi at the highest finished floor. **See Appendix B – WaterCAD Output** complete analysis results.

Appendix A – Fire Hydrant Flow Test Results

17-ZN-2019
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ALLIANCE FIRE PROTECTION CO.

Phone: (480) 966-9178 Fax: (480) 967-9191
2114 East Cedar Street • Tempe, Arizona 85281
E-mail Address: afpc@afpc.com

AZ Lic. C-16 58130
AZ Lic. L-16 74007
NV Lic. C-41a 30135

FIRE HYDRANT FLOW TEST

Name: Kimley-Horn
92nd St & Happy Valley
Scottsdale Arizona

Date: 11/14/17
Time: 8:00 AM
Report #
Tech: AFPC

Static Hydrant: NEC 92nd & Happy Valley
Elevation: 2131
Dist. Between Hydrants: 50 fet
Diameter of Main: 12"

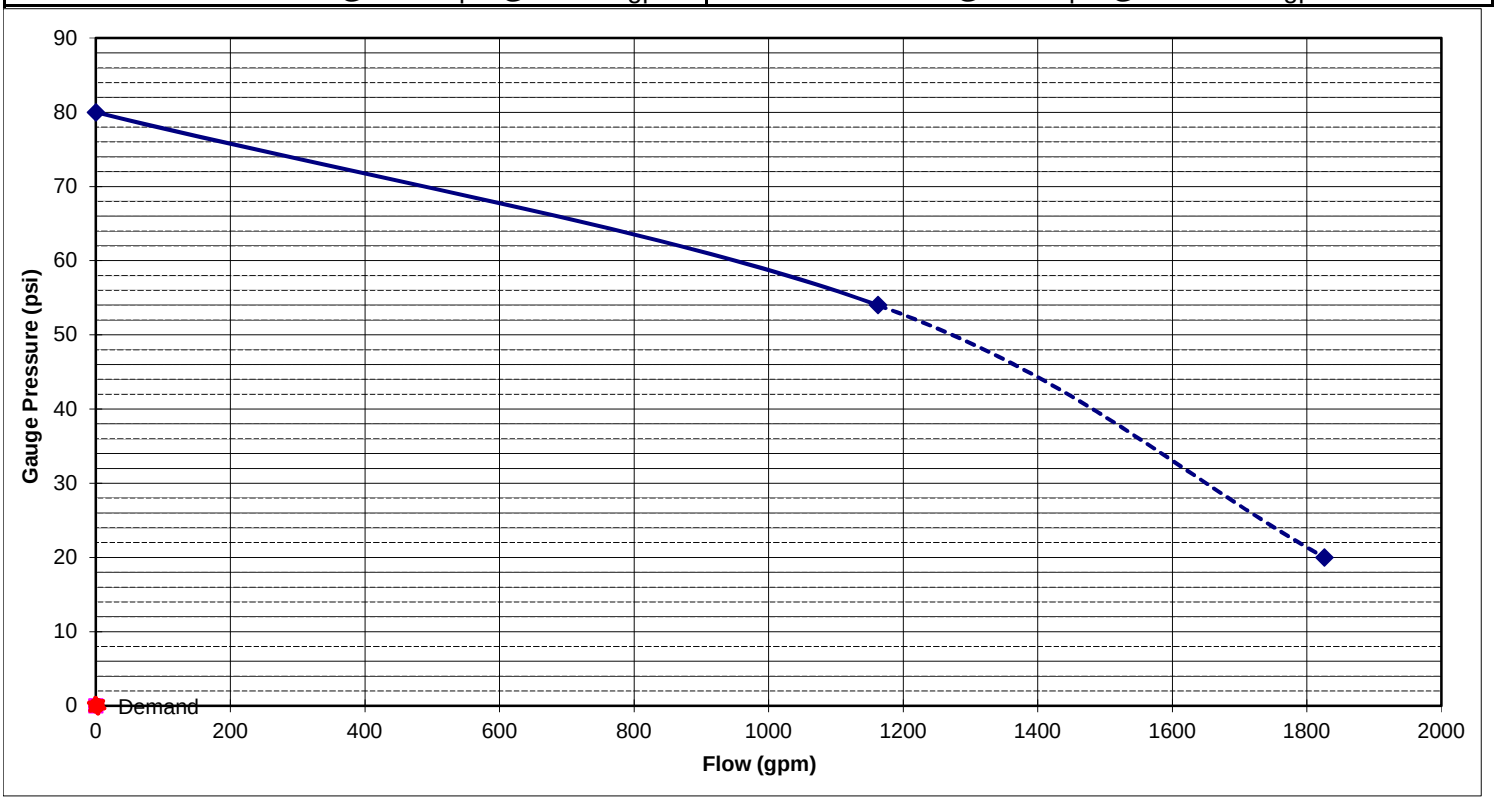
Static Pressure:	A	80.0	B	
Residual Pressure:	A	54.0	B	

Pump Present: NO
Tank Present: NO
Req. GPM: Req. PSI:

Flowing Hydrant: SEC 92nd & Happy Valley
Elevation: 2131
Type of Supply: CITY MAIN

Hydrant:	A	A	B	B
Outlet Diameter:	2.5			
Pitot Reading:	48.0			
Coeff:	0.90			
Discharge GPM:	1163	0	0	0

Flow A				Flow B			
Static pressure of	80	psi @	0 gpm	Static pressure of	0	psi @	0 gpm
Residual pressure of	54	psi @	1163 gpm	Residual pressure of	0	psi @	0 gpm
Available flow @	20	psi @	1826 gpm	Available flow @	20	psi @	gpm



Comments:

NOTES:

1. Flowing hydrant is assumed to be on a circulating main or downstream of the pressure test hydrant on a dead-end system.
2. Flow analysis assumes a gravity flow system with no distribution pumps and having no demand, other than the test
3. The distance between hydrants, elevations & main diameters are for information only.

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Appendix B – WaterCAD Output

- *Pump Supply Curve*
- *Average Day*
- *Max Day*
- *Peak Hour*
- *Max Day + Fire Flow*

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Pump Definition Detailed Report: Fire Flow "1"

Active Scenario: Average Day

Element Details

ID	55	Notes	
Label	Fire Flow "1"		

Pump Definition Type

Pump Definition Type	Standard (3 Point)	Design Head	125.00 ft
Shutoff Flow	0.0 gpm	Maximum Operating Flow	1,826.0 gpm
Shutoff Head	185.00 ft	Maximum Operating Head	46.00 ft
Design Flow	1,163.0 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	0.0 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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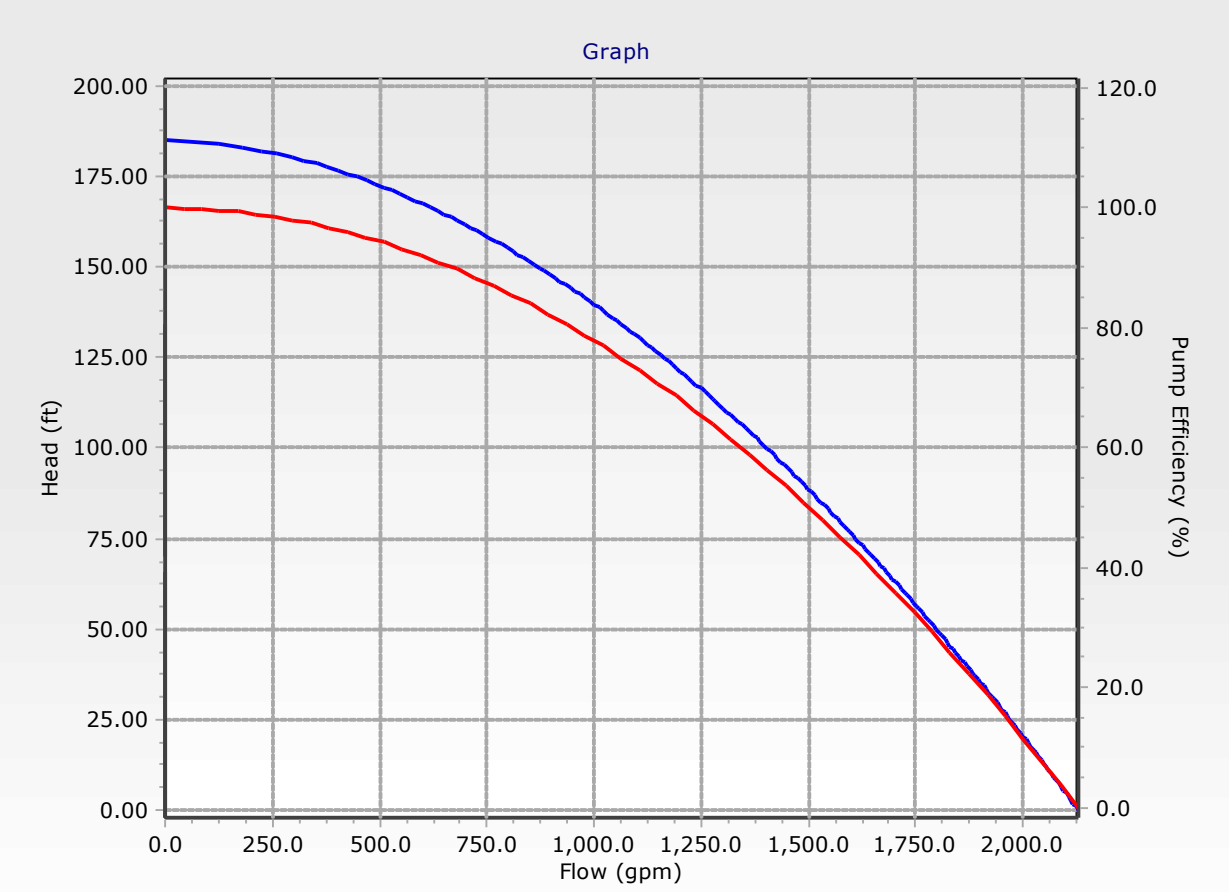
Pump Definition Detailed Report: Fire Flow "1"

Active Scenario: Average Day



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FlexTable: Junction Table

Active Scenario: Average Day

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	2,131.00	0.0	2,315.96	80
J-2	2,099.00	0.0	2,315.96	94
J-3	2,097.00	0.0	2,315.95	95
J-4	2,107.00	0.0	2,315.96	90
J-5	2,089.50	11.7	2,315.95	98
J-6	2,097.00	0.0	2,315.96	95
J-7	2,112.00	2.8	2,315.95	88
J-8	2,109.00	2.1	2,315.95	90
J-9	2,107.50	3.5	2,315.95	90
J-10	2,100.00	3.5	2,315.95	93

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5/8/2020

FlexTable: Pipe Table

Active Scenario: Average Day

Label	Length (ft)	Start Node	Stop Node	Diameter (in)	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)
P-1	1	R-1	PMP-1	48.0	130.0	23.5	0.00	0.000
P-2	1	PMP-1	J-1	48.0	130.0	23.5	0.00	0.000
P-3	667	J-1	J-4	12.0	130.0	23.5	0.07	0.000
P-4	385	J-4	J-2	12.0	130.0	13.0	0.04	0.000
P-5	118	J-4	J-7	6.0	130.0	10.4	0.12	0.000
P-6	556	J-7	J-3	6.0	130.0	4.2	0.05	0.000
P-7	219	J-6	J-2	8.0	130.0	-13.0	0.08	0.000
P-8	679	J-6	J-5	8.0	130.0	8.9	0.06	0.000
P-9	334	J-5	J-3	8.0	130.0	-2.8	0.02	0.000
P-10	371	J-7	J-6	8.0	130.0	-4.1	0.03	0.000
P-11	579	J-8	J-7	8.0	130.0	-7.6	0.05	0.000
P-12	302	J-8	J-9	8.0	130.0	5.6	0.04	0.000
P-13	463	J-9	J-10	8.0	130.0	3.5	0.02	0.000
P-14	371	J-9	J-3	8.0	130.0	-1.3	0.01	0.000

FlexTable: Pump Table

Active Scenario: Average Day

Label	Elevation (ft)	Hydraulic Grade (Suction) (ft)	Hydraulic Grade (Discharge) (ft)	Flow (Design) (gpm)	Head (Design) (ft)	Flow (Total) (gpm)	Pump Head (ft)
PMP-1	2,131.00	2,131.00	2,315.96	1,163.0	125.00	23.5	184.96

FlexTable: Junction Table

Active Scenario: Max Day

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	2,131.00	0.0	2,315.85	80
J-2	2,099.00	0.0	2,315.84	94
J-3	2,097.00	0.0	2,315.83	95
J-4	2,107.00	0.0	2,315.84	90
J-5	2,089.50	23.5	2,315.83	98
J-6	2,097.00	0.0	2,315.84	95
J-7	2,112.00	5.5	2,315.84	88
J-8	2,109.00	4.1	2,315.83	89
J-9	2,107.50	6.9	2,315.83	90
J-10	2,100.00	6.9	2,315.83	93

FlexTable: Pipe Table

Active Scenario: Max Day

Label	Length (ft)	Start Node	Stop Node	Diameter (in)	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)
P-1	1	R-1	PMP-1	48.0	130.0	46.9	0.01	0.000
P-2	1	PMP-1	J-1	48.0	130.0	46.9	0.01	0.000
P-3	667	J-1	J-4	12.0	130.0	46.9	0.13	0.000
P-4	385	J-4	J-2	12.0	130.0	26.1	0.07	0.000
P-5	118	J-4	J-7	6.0	130.0	20.9	0.24	0.000
P-6	556	J-7	J-3	6.0	130.0	8.3	0.09	0.000
P-7	219	J-6	J-2	8.0	130.0	-26.1	0.17	0.000
P-8	679	J-6	J-5	8.0	130.0	17.8	0.11	0.000
P-9	334	J-5	J-3	8.0	130.0	-5.6	0.04	0.000
P-10	371	J-7	J-6	8.0	130.0	-8.2	0.05	0.000
P-11	579	J-8	J-7	8.0	130.0	-15.3	0.10	0.000
P-12	302	J-8	J-9	8.0	130.0	11.1	0.07	0.000
P-13	463	J-9	J-10	8.0	130.0	6.9	0.04	0.000
P-14	371	J-9	J-3	8.0	130.0	-2.7	0.02	0.000

FlexTable: Pump Table

Active Scenario: Max Day

Label	Elevation (ft)	Hydraulic Grade (Suction) (ft)	Hydraulic Grade (Discharge) (ft)	Flow (Design) (gpm)	Head (Design) (ft)	Flow (Total) (gpm)	Pump Head (ft)
PMP-1	2,131.00	2,131.00	2,315.85	1,163.0	125.00	46.9	184.85

FlexTable: Junction Table

Active Scenario: Peak Hour

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	2,131.00	0.0	2,315.57	80
J-2	2,099.00	0.0	2,315.55	94
J-3	2,097.00	0.0	2,315.52	95
J-4	2,107.00	0.0	2,315.55	90
J-5	2,089.50	41.1	2,315.52	98
J-6	2,097.00	0.0	2,315.54	95
J-7	2,112.00	9.7	2,315.53	88
J-8	2,109.00	7.2	2,315.52	89
J-9	2,107.50	12.1	2,315.52	90
J-10	2,100.00	12.1	2,315.51	93

FlexTable: Pipe Table

Active Scenario: Peak Hour

Label	Length (ft)	Start Node	Stop Node	Diameter (in)	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)
P-1	1	R-1	PMP-1	48.0	130.0	82.1	0.01	0.000
P-2	1	PMP-1	J-1	48.0	130.0	82.1	0.01	0.000
P-3	667	J-1	J-4	12.0	130.0	82.1	0.23	0.000
P-4	385	J-4	J-2	12.0	130.0	45.6	0.13	0.000
P-5	118	J-4	J-7	6.0	130.0	36.5	0.41	0.000
P-6	556	J-7	J-3	6.0	130.0	14.5	0.17	0.000
P-7	219	J-6	J-2	8.0	130.0	-45.6	0.29	0.000
P-8	679	J-6	J-5	8.0	130.0	31.2	0.20	0.000
P-9	334	J-5	J-3	8.0	130.0	-9.9	0.06	0.000
P-10	371	J-7	J-6	8.0	130.0	-14.4	0.09	0.000
P-11	579	J-8	J-7	8.0	130.0	-26.7	0.17	0.000
P-12	302	J-8	J-9	8.0	130.0	19.5	0.12	0.000
P-13	463	J-9	J-10	8.0	130.0	12.1	0.08	0.000
P-14	371	J-9	J-3	8.0	130.0	-4.7	0.03	0.000

FlexTable: Pump Table

Active Scenario: Peak Hour

Label	Elevation (ft)	Hydraulic Grade (Suction) (ft)	Hydraulic Grade (Discharge) (ft)	Flow (Design) (gpm)	Head (Design) (ft)	Flow (Total) (gpm)	Pump Head (ft)
PMP-1	2,131.00	2,131.00	2,315.57	1,163.0	125.00	82.1	184.57

Fire Flow Node FlexTable: Fire Flow Report

Active Scenario: Max Day + Fire Flow

Label	Elevation (ft)	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Pressure (Calculated Residual) (psi)	Junction w/ Minimum Pressure (System)
J-1	2,131.00	875.0	1,857.4	15	J-7
J-2	2,099.00	875.0	1,857.6	25	J-1
J-3	2,097.00	875.0	1,857.6	20	J-1
J-4	2,107.00	875.0	1,857.6	23	J-1
J-6	2,097.00	875.0	1,857.6	24	J-1
J-7	2,112.00	875.0	1,857.6	17	J-1
J-8	2,109.00	875.0	1,842.4	15	J-1
J-9	2,107.50	875.0	1,847.1	15	J-1
J-10	2,100.00	875.0	1,748.5	15	J-1
J-5	2,089.50	875.0	1,857.6	23	J-1