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**WATER SYSTEM ANALYSIS
FOR THE
VIEWPOINT OLD TOWN PROJECT
IN THE CITY OF SAN DIEGO**

March 6, 2023

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FOR THE
VIEWPOINT OLD TOWN PROJECT
IN THE CITY OF SAN DIEGO**

March 6, 2023



**Prepared by:
Dexter Wilson Engineering, Inc.
2234 Faraday Avenue
Carlsbad, CA 92008
(760) 438-4422**

Job No. 574-023

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DEXTER WILSON ENGINEERING, INC.

DEXTER S. WILSON, P.E.
ANDREW M. OVEN, P.E.
NATALIE J. FRASCHETTI, P.E.
STEVEN J. HENDERSON, P.E.
FERNANDO FREGOSO, P.E.
KATHLEEN L. HEITT, P.E.

March 6, 2023

574-023

Pasco Laret Suiter & Associates
1911 San Diego Avenue, Suite 100
San Diego, CA 92110

Attention: Chase Blood, P.E., Senior Project Manager

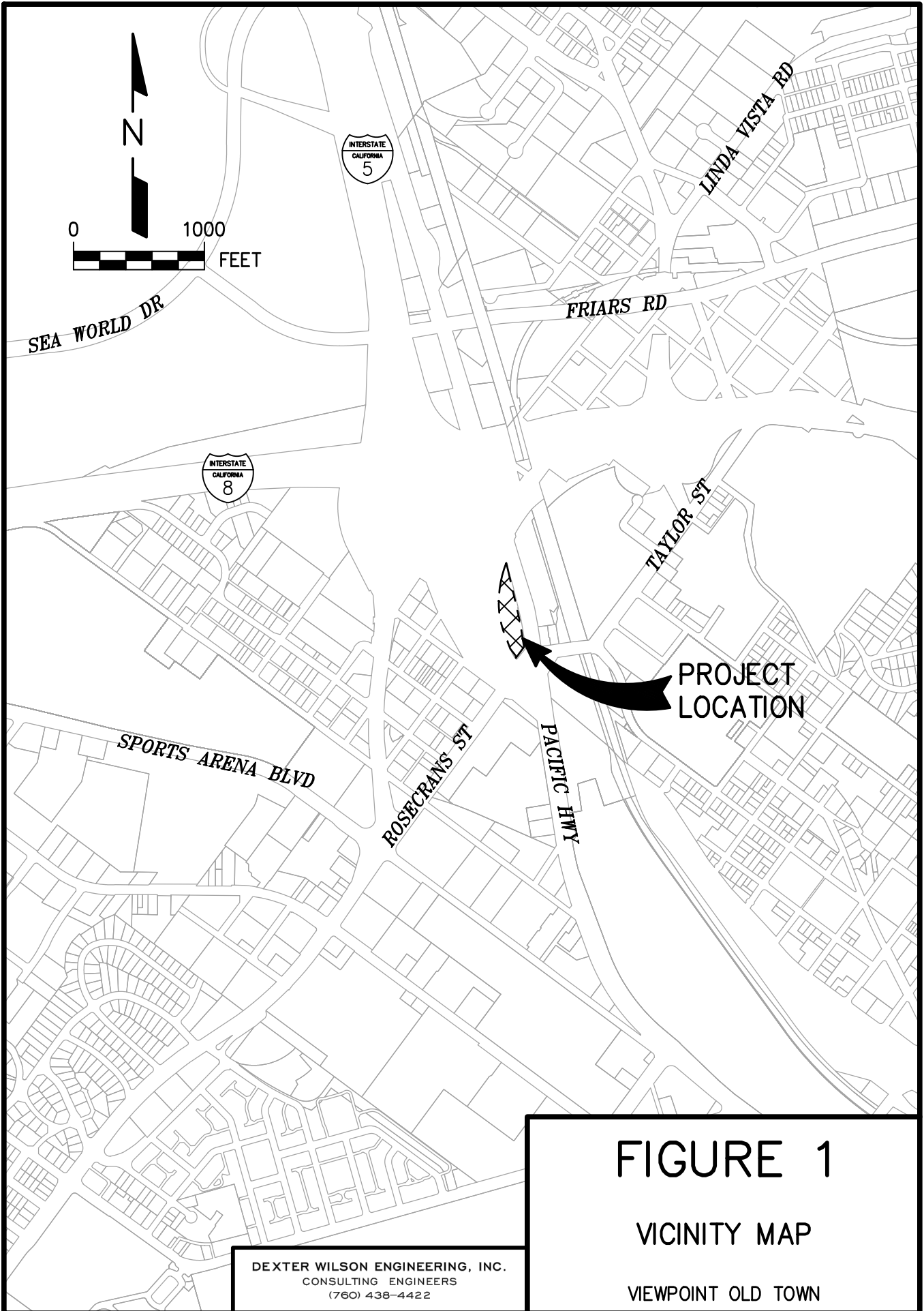
Subject: Water System Analysis for the Viewpoint Old Town Project in the City of San Diego

Introduction

This report provides a public water system analysis for the Viewpoint Old Town project in the City of San Diego. The project site is located northwest of the Pacific Highway and Rosecrans Street intersection and southeast of the Interstate 5 and Interstate 8 interchange. Figure 1 provides a location map for the project.

The project encompasses approximately 1.67 acres and the land use is mixed commercial residential. The project proposes to redevelop the site into a 221 unit apartment complex of multi-family units. The pad elevation of the site is 10 feet.

\\ARTIC\DWG\574023\REPORT\VPOT_FIGURE-1_VM.DWG 8/30/2022 11:33:54 AM LAYOUT:8x11 USER:Matthew



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FIGURE 1
VICINITY MAP
VIEWPOINT OLD TOWN

Purpose of Study

The purpose of this study is to evaluate the ability of the existing public water system to provide adequate domestic and fire protection service to the Viewpoint Old Town project. This report is prepared based on the San Diego Public Utilities Department, Water Facility Design Guidelines (Water Facility Design Guidelines).

Study Area

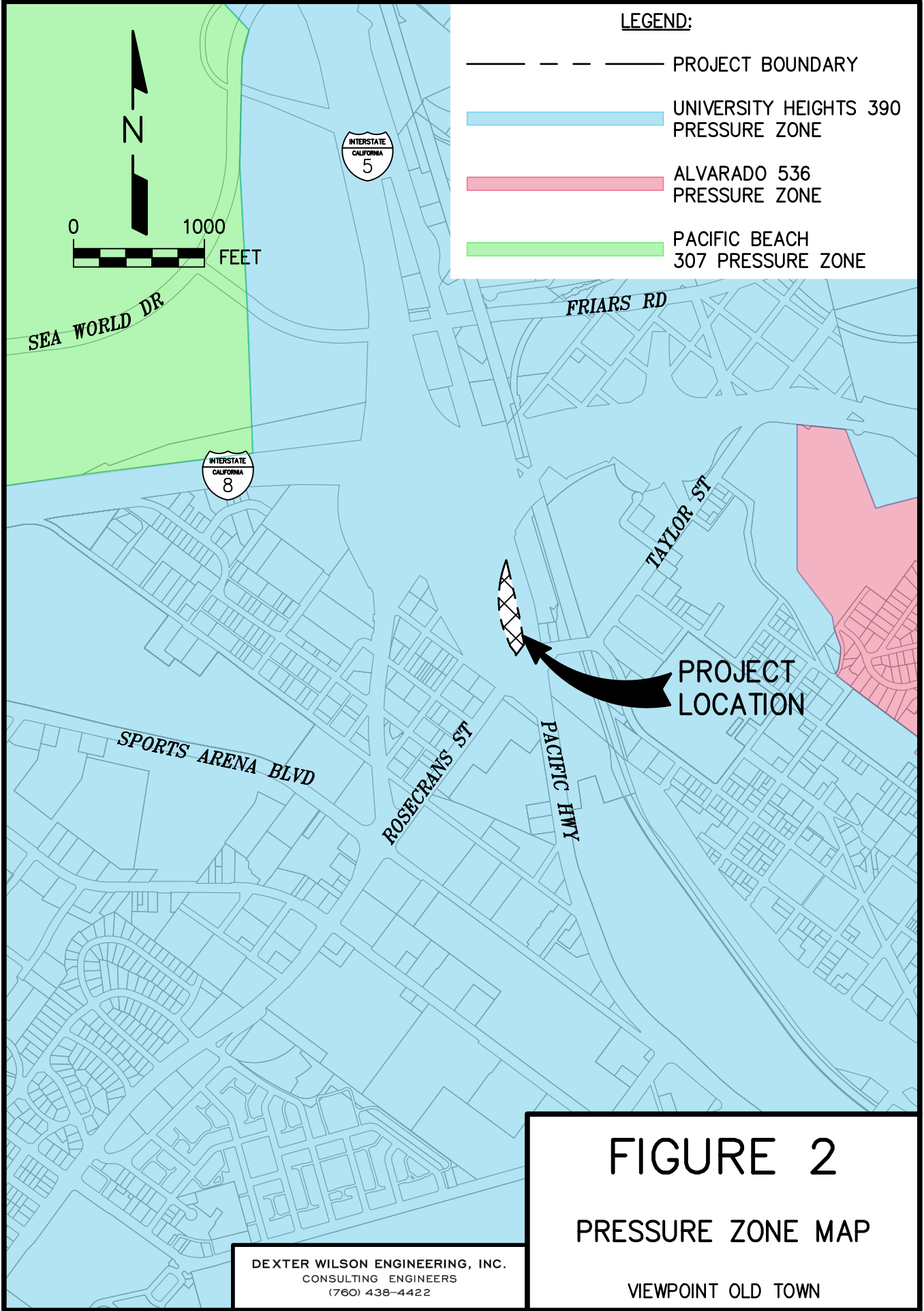
The study area for this report is the existing public water facilities in the vicinity of the Viewpoint Old Town project. These water facilities are within the University Heights 390 Pressure Zone. Figure 2 presents a map of pressure zones near the project.

Water System Design Criteria

The design criteria utilized in the analysis of the Viewpoint Old Town project water system are in consideration of the Water Facility Design Guidelines. The design criteria include a minimum static pressure of 65 pounds per square inch (psi) and maximum static pressure of 120 psi. Domestic residual pressures with all pipes in service must be a minimum of 40 psi and pressure loss at any location must not exceed 25 psi below static pressure. With one source out of service, domestic pressures may fall more than 25 psi below static pressure, but domestic pressure at all locations shall be greater than 40 psi.

For fire flow scenarios, a minimum residual pressure of 20 psi is required in the area of the fire hydrant flow during maximum day demands. Velocities in distribution mains under maximum day demand plus fire flow must be less than 15 feet per second (fps).

\\ARTIC\DWG\574023\REPORT\VPOT_WTR_FIGURE-2_PZMAP.DWG 9/8/2022 10:45:11 AM LAYOUT:8x11 USER:Matthew



LEGEND:

- — — — — PROJECT BOUNDARY
- UNIVERSITY HEIGHTS 390 PRESSURE ZONE
- ALVARADO 536 PRESSURE ZONE
- PACIFIC BEACH 307 PRESSURE ZONE

FIGURE 2

PRESSURE ZONE MAP

VIEWPOINT OLD TOWN

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Viewpoint Old Town Project Water Demand

Table 1 summarizes the water duty factors used for the land uses proposed for the project as well as the planning fire flow rates by land use category. Residential water duty factors are based on a unit demand of 150 gpd per person.

TABLE 1 WATER DUTY FACTORS				
Land Use	Density DU/AC	Persons/ DU	Average Water Duty Factor	Fire Flow Requirement, gpm
Multi-Family Residential	132	1.8	270 gpd/DU	3,000

Table 2 presents the project water demand for the Viewpoint Old Town project. As shown, the projected average daily water demand is 59,670 gpd (0.06 mgd or 41.4 gpm).

TABLE 2 VIEWPOINT OLD TOWN PROJECT AVERAGE DAILY WATER DEMAND			
Land Use	Quantity	Duty Factor	Average Water Demand, gpd
Multi-Family Residential	221 DUs	270 gpd/DU	59,670
TOTAL	221 DUs	—	59,670 gpd

To convert average day demands to maximum daily demands and peak hour demands, Figures 2-2 and 2-1 from the Water Facility Design Guidelines were used, respectively. Using the peaking curves on Figure 2-2 for the “MS residential zoning (14 – 218 dwelling unit/acre)”, the maximum day peak factor is approximately 1.15, thus the projected maximum day demand for the project is 0.07 mgd (47.7 gpm). Using the peaking curves on

Figure 2-1 for the “MS residential zoning (14 – 218 dwelling unit/acre)”, the peak hour factor is 1.69. In accordance with page 2-3 of the Water Facility Design Guidelines, an additional factor of 1.5 is applied for a combined peak factor of 2.54 over average day, thus the projected peak hour demand for the project is 0.15 mgd (105.3 gpm). Appendix A presents the peaking factor curves showing how the peaking factors were derived.

Existing Water System

The existing water facilities in the vicinity of the Viewpoint Old Town project include the western portion of the University Heights 390 Pressure Zone near the 307 Pacific Beach Pressure Zone to the north. The project will receive service solely from the University Heights 390 Pressure Zone. Figure 3 presents the existing water system that will serve the Viewpoint Old Town project.

There are two existing 24-inch diameter pipelines in Rosecrans Street. One of the 24-inch diameter mains is the Alvarado Pipeline that runs through the 390 Pressure Zone. The second 24-inch diameter main is an offshoot of the Pacific Beach Pipeline that serves as a distribution main to the area in this section of the University Heights 390 Pressure Zone. An 8-inch loop extends from the Pacific Beach Pipeline 24-inch offshoot, along the project’s frontage in Pacific Highway.

Proposed Water Service to the Viewpoint Old Town Project

The proposed pad elevation for the Viewpoint Old Town project is 10 feet. This results in a static pressure of 164 psi based on the zone hydraulic grade line of 390 feet. However, a fire hydrant test received for this project reports the HGL in the area is 300 feet. This would equate to a static pressure of 125 psi. This exceeds the maximum static pressure criteria of 120 psi, however there is no lower pressure zone near the project can connect to in the vicinity. In accordance with the Uniform Plumbing Code, a pressure regulator will be installed to limit the pressure onsite to a maximum of 80 psi.

\\ARTIC\DWG\574023\REPORT\VPOT_WTR_FIGURE-3_EXPRO.DWG 3/3/2023 5:36:28 PM LAYOUT: 11x17 USER: Karam

LEGEND

- PROJECT BOUNDARY
- - - - EXISTING PUBLIC WATER FACILITIES
- PROPOSED PUBLIC WATER FACILITIES
- ⊕ EXISTING PUBLIC FIRE HYDRANT
- ⊞ PROPOSED METER
- ▣ PROPOSED BACKFLOW PREVENTER

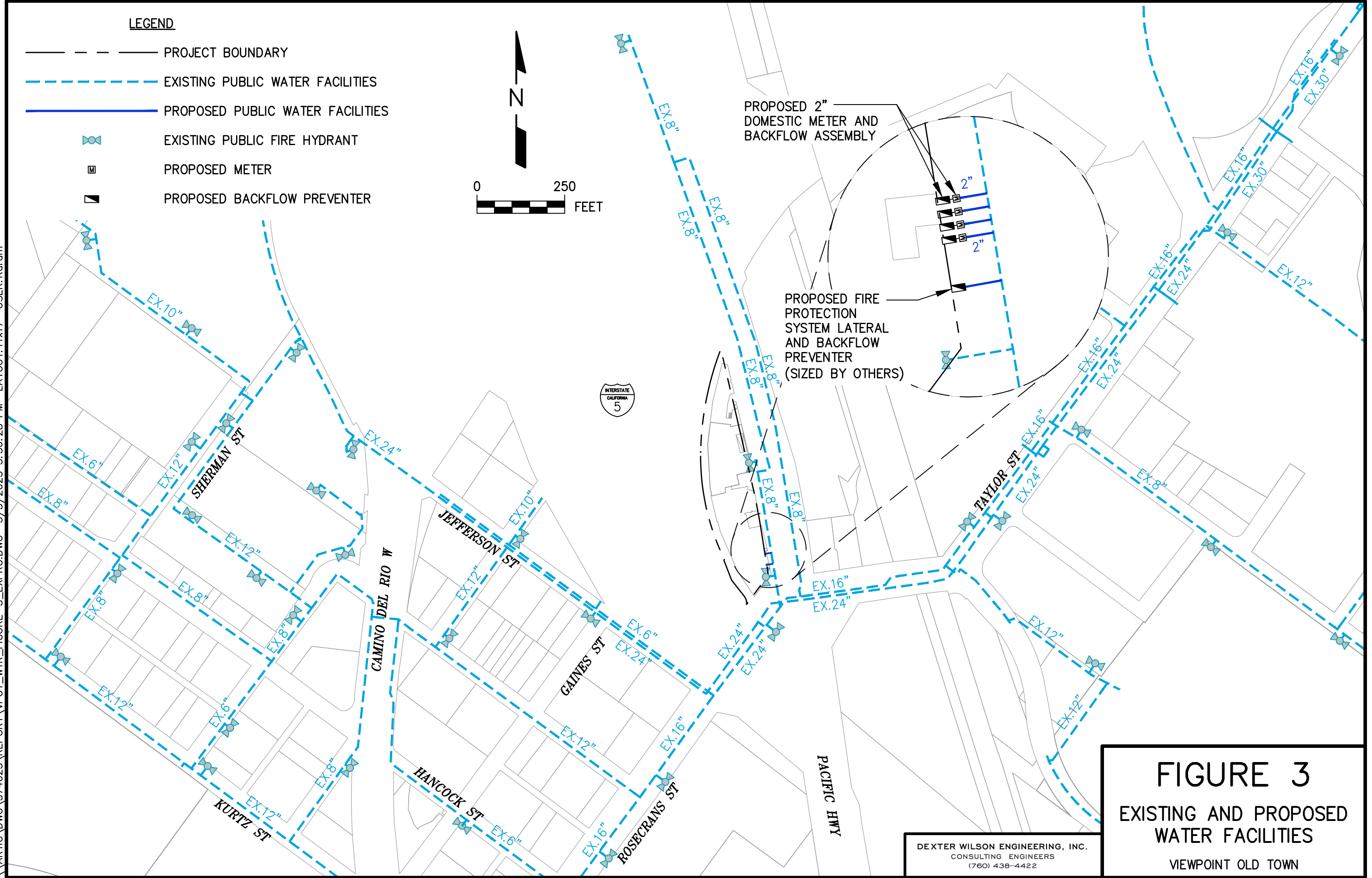
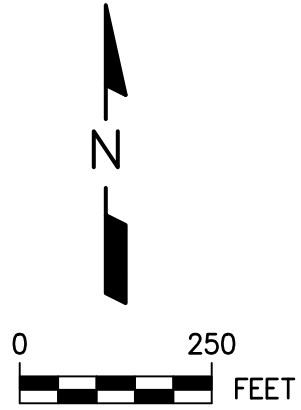


FIGURE 3
EXISTING AND PROPOSED
WATER FACILITIES
 VIEWPOINT OLD TOWN

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Architectural Plans or official Water Meter Data Cards are not available at this stage of development. The Developer has provided a preliminary Water Fixture Unit (WFU) count to estimate the necessary meter size. The preliminary WFU count is 3,699 WFUs. Using Chart A 103.1 (1) of the California Plumbing Code, the corresponding flow rate is extrapolated to be 501 gpm. Meter sizing in the City of San Diego uses 80% of the maximum capacity of the 2015 AWWA Standards for Water Meter Capacities. This suggests that the required meter will be a 6-inch meter, with a capacity of 1,080 gpm.

Due to space considerations, the project is proposing to use four 2-inch meters, each with a capacity of 128 gpm for a total of 512 gpm, rather than a single larger meter. The backflow preventers and the domestic laterals to each meter are also recommended to be 2-inches to correspond with the meters. These recommendations will be confirmed when the project plumbing plans are completed.

There are no proposed onsite fire hydrants for the Viewpoint Old Town project. The private fire protection system will be sized by the fire sprinkler designer.

Water System Computer Model

A public water system hydraulic analysis was prepared for the Viewpoint Old Town project to confirm that adequate flow and pressure can be provided by the public water system. The critical analysis presented in this report will be to deliver peak hour demand with one source out of service and maximum day demands plus fire flow needs.

The University of Kentucky KYPIPE computer program was used to conduct a hydraulic model of the existing and proposed water system within the study area. This computer program utilizes the Hazen-Williams equation for determining head loss in pipes; the Hazen-Williams “C” value used for all pipes is 120.

For computer modeling, a fire hydrant flow test was requested from the City, available in Appendix C. Appendix C also presents the calculation of the available hydraulic gradeline utilized in each of the model scenarios. The hydraulic gradeline in the area of the project is approximately 300 feet.

Water System Analysis and Results

Results of the computer model hydraulic analysis are provided in Appendix D; Exhibit A provides the corresponding computer model Node and Pipe Diagram. The system was modeled under average day demand, maximum day demand, peak hour demand, and maximum day demand plus fire flow scenario as discussed further below.

Maximum Day and Peak Hour Pressure Results and Discussion

The hydraulic model confirms the ability of the 390 Pressure Zone to deliver adequate domestic service to Viewpoint Old Town during average day demand through peak hour demand. Residual pressures exceed the minimum requirement of 40 psi. Additionally, the pressure loss at any location is less than 25 psi below static pressure with once source closed. The minimum pressure during peak hour demand with one source closed is 122 psi.

Maximum Day Plus Fire Flow Results and Discussion. The results of the computer analysis indicate that the existing public water system is capable of providing adequate service to the project under a maximum day demand plus 3,000 gpm fire flow conditions with a residual pressure of 20 psi to the nearest hydrant. The minimum residual pressure during maximum day demand plus 3,000 gpm fire flow is 61 psi. The only pipe segment to exceed the City's 15 fps velocity criteria is the 30 feet of 8-inch pipe that goes to the fire hydrant nearest the site. At a flow of 3,000 gpm the velocity in this line is 19.2 fps. The City will need to review and approve this exceedance of their criteria.

Conclusions and Recommendations

The following conclusions and recommendations are summarized based on the water system analysis prepared for the Viewpoint Old Town project.

1. The Viewpoint Old Town project consists of 221 multi-family residential units across 1.67 acres.

2. The project will obtain water service from the University Heights 390 Pressure Zone. Based on a pad elevation of 10 feet, the resulting static pressure is 164 psi. A fire hydrant test for this project provides the HGL is 300 feet, resulting in a static pressure of 125 psi. The City will need to review and accept this exceedance of their maximum static pressure criteria. A pressure regulator that limits the pressure below 80 psi will be required to abide with the Uniform Plumbing Code.
3. Figure 2 provides the layout of the existing public water system that will serve the Viewpoint Old Town project. There are two 24-inch diameter pipeline in the vicinity of the project and an 8-inch loop extension fronts the project in Pacific Highway. The project will make a connection to this 8-inch loop for domestic service.
4. There are 1,524 fixtures currently estimated for the project, corresponding to an estimated 3,699 WFUs. Chart A 103.1 (1) of the California Plumbing Code equates this to a flow rate of 501 gpm. The recommended meter size is a 6-inch meter, with a capacity of 1,080 gpm. The project is proposing to use four 2-inch meters in lieu of the single 6-inch meter. This recommendation will be confirmed when plumbing plans are completed.
5. Residual pressures during maximum day demand and peak hour demand exceed 40 psi (with one source out of service) in accordance with the City's Water Facility Design Guidelines. Additionally, residual pressures drop less than 25 psi from static at all lots (with one source out of service) in accordance with the Water Facility Design Guidelines.
6. The existing public water system can deliver 3,000 gpm fire flow under maximum day demand conditions to the project with a residual pressure above 20 psi. There is 30 feet of 8-inch pipe that exceeds the City's 15 fps velocity criteria. This exceedance will have to be reviewed and approved by the City.

Chase Blood
March 6, 2023
Viewpoint Old Town Water System Analysis

We appreciate the opportunity to have provided you with this analysis. If you have any questions regarding the information or conclusions and recommendations presented in this report, please do not hesitate to contact me.

Dexter Wilson Engineering, Inc.



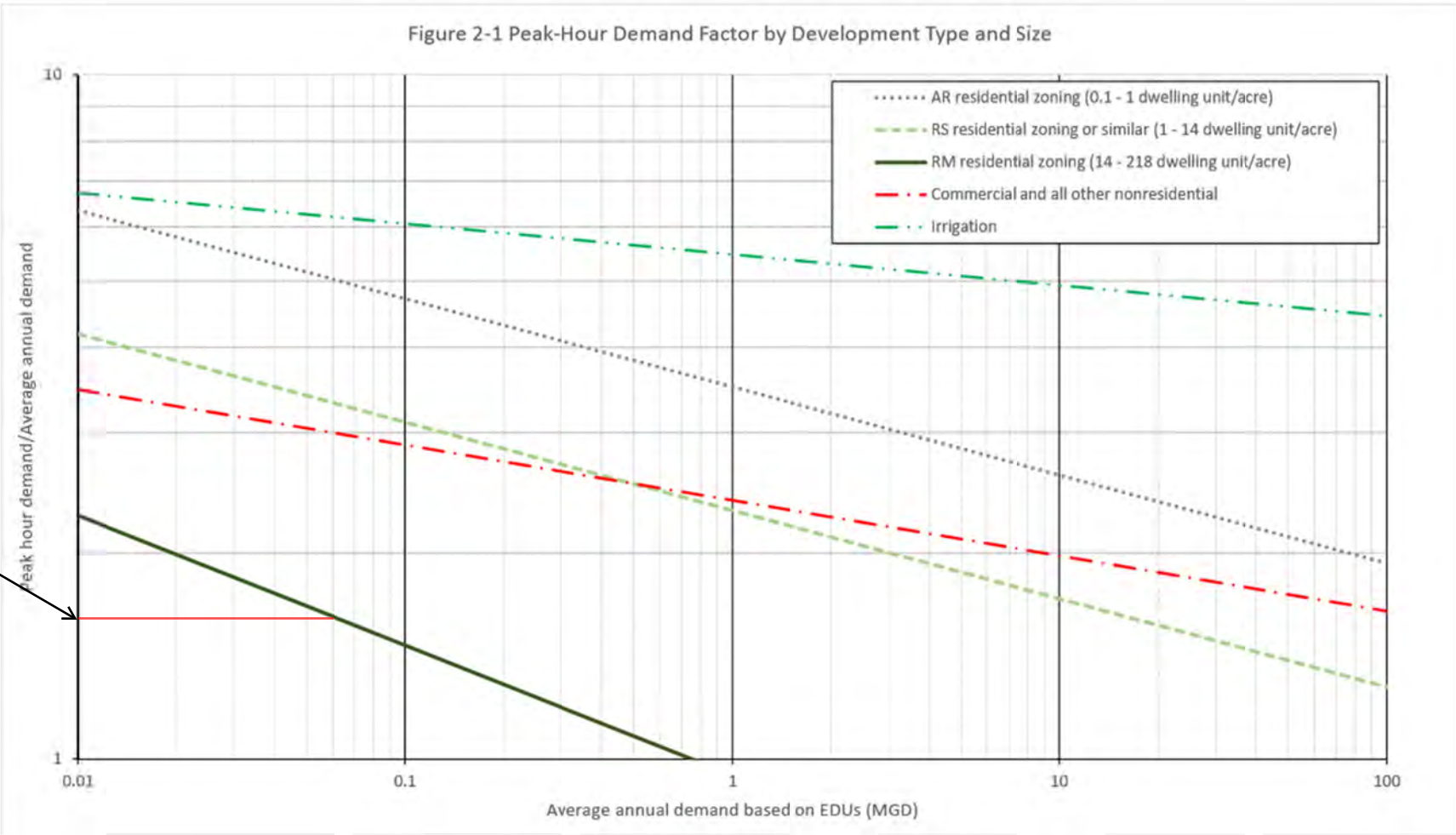
Kathleen L. Heitt, P.E.

KH:ru

Attachments

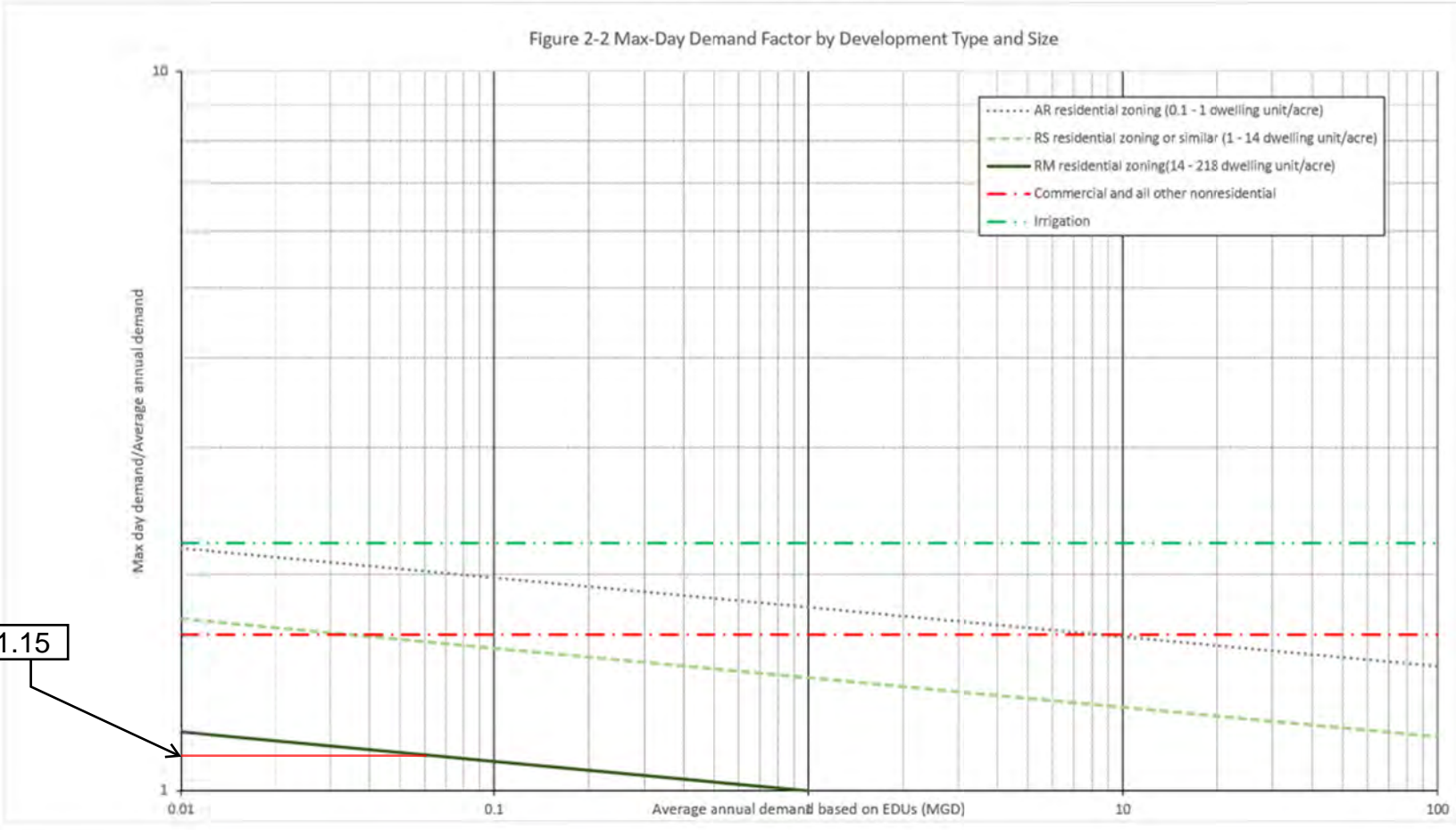
APPENDIX A

WATER DEMAND PEAKING FACTOR CHARTS



1.69





1.15



APPENDIX B

METER SIZING

Project Name Viewpoint Old Town

Job Number 574-023

Date 9/9/2022

Water Fixture Units

The basis for the Water Fixture Units is "Private" per the City of San Diego Water Meter Data Card (08-11) and 2019 Californ

DESCRIPTION	Studio			1 Bedroom			2 Bedroom		
	FIXTURE		TOTAL	FIXTURE		TOTAL	FIXTURE		TOTAL
	QUANTITY	UNITS	FIXTURE	QUANTITY	UNITS	FIXTURE	QUANTITY	UNITS	FIXTURE
	EACH		UNITS	EACH		UNITS	EACH		UNITS
CLOTHES WASHER	1	4	4	1	4	4	1	4	4
LAUNDRY SINK		1.5	0		1.5	0		1.5	0
TUB/SHOWER	1	4	4	1	4	4	2	4	8
SHOWER		2	0		2	0		2	0
KITCHEN SINK	1	1.5	1.5	1	1.5	1.5	1	1.5	1.5
DISHWASHER	1	1.5	1.5	1	1.5	1.5	1	1.5	1.5
LAVATORY	1	1	1	1	1	1	2	1	2
WATER CLOSET (1.6 GPF)	1	2.5	2.5	1	2.5	2.5	2	2.5	5
HOSE BIBB		2.5	0		2.5	0		2.5	0
EACH ADDTL HB		1	0		1	0		1	0
OTHER			0			0			0
TOTAL			14.5			14.5			22

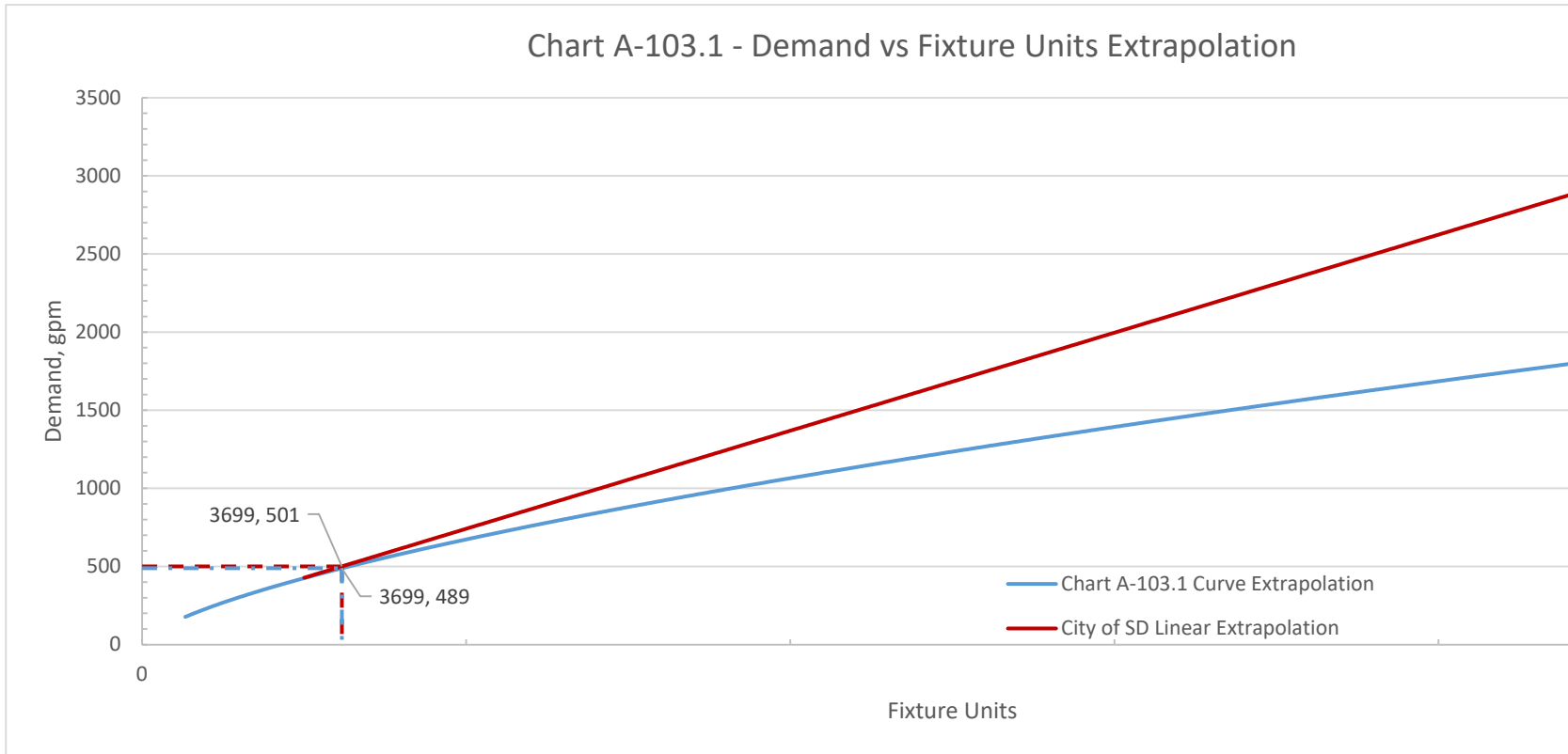
48	Units
288	Fixtures
696	WFU

113	Units
678	Fixtures
1638.5	WFU

62	Units
558	Fixtures
1364	WFU

1524	Total Fixtures
3698.5	Total WFU

WFU	Demand, gpm	Demand, gpm
3,699	501	489



Graph data and line fit are based on Chart A-103.1 from the 2016 CPC.

APPENDIX C

FIRE HYDRANT FLOW TEST DATA

Fire Hydrant Flow Test Date

7/7/22

Input Flow Test Results

Static Pressure 125.69 PSI
 Residual Pressure 110.68 PSI
 Hydrant Flow 1713.57 GPM

Actual Hydrant Elevation 9 Feet HGL Feet
 Estimated Hydrant Elevation 9 Feet HGL 299.1 Feet

Equation $\Delta H = k Q^{1.85}$

k = 3.60494E-05

Extrapolated Calculations

Q, gpm	Residual Pressure	Available HGL
0	125.7 psi	299.1 ft
41.4	125.7 psi	299.1 ft
47.7	125.7 psi	299.0 ft
100	125.6 psi	298.9 ft
105.3	125.6 psi	298.9 ft
500	124.2 psi	295.5 ft
1000	120.1 psi	286.3 ft
1578	112.8 psi	269.3 ft
2000	105.7 psi	253.0 ft
2087	104.1 psi	249.2 ft
2300	99.8 psi	239.4 ft
2500	95.5 psi	229.4 ft
2700	90.9 psi	218.8 ft
3000	83.4 psi	201.5 ft
3047.7	82.1 psi	198.6 ft
3300	75.2 psi	182.6 ft
3500	69.4 psi	169.2 ft
3700	63.3 psi	155.2 ft
3900	57.0 psi	140.5 ft
4000	53.7 psi	132.9 ft
4100	50.3 psi	125.1 ft
4300	43.4 psi	109.1 ft
4500	36.1 psi	92.4 ft
4700	28.6 psi	75.1 ft
4900	20.9 psi	57.1 ft
5100	12.8 psi	38.5 ft

Residual Pressure, psi	Available Flow, gpm
0 psi	5,405
10 psi	5,168
20 psi	4,921
30 psi	4,664
40 psi	4,394
50 psi	4,109
60 psi	3,806
70 psi	3,481
80 psi	3,128
90 psi	2,737
100 psi	2,291
110 psi	1,755
120 psi	1,014
130 psi	Residual Pressure Exceeds Static Pressure
140 psi	Residual Pressure Exceeds Static Pressure
150 psi	Residual Pressure Exceeds Static Pressure
160 psi	Residual Pressure Exceeds Static Pressure
170 psi	Residual Pressure Exceeds Static Pressure
180 psi	Residual Pressure Exceeds Static Pressure
190 psi	Residual Pressure Exceeds Static Pressure

APPENDIX D

COMPUTER MODEL OUTPUT

ONE SOURCE CLOSED

The following conditions were modeled:

1. Average Day Demand – One Source Closed
2. Maximum Day Demand – One Source Closed
3. Peak Hour Demand – One Source Closed
4. Maximum Day Demand plus 3,000 gpm Fire Flow

**Viewpoint Old Town Project
City of San Diego
Computer Hydraulic Model**

**March 6, 2023
Dexter Wilson Eng., Inc.
Job 574-023**

Date & Time: Mon Mar 06 09:34:46 2023

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SUMMARY OF ORIGINAL DATA

U N I T S S P E C I F I E D

FLOWRATE = gallons/minute
HEAD (HGL) = feet
PRESSURE = psig

P I P E L I N E D A T A

PIPE NAME	NODE NAMES #1	NODE NAMES #2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.
1	R-1	2	75.00	24.00	120.0000	0.00
3	2	4	185.00	8.00	120.0000	0.00
5	4	6	245.00	8.00	120.0000	0.00
7	6	8	40.00	8.00	120.0000	0.00
9	6	10	440.00	8.00	120.0000	0.00
11	10	12	600.00	8.00	120.0000	0.00
13	12	14	50.00	8.00	120.0000	0.00
15	14	16	620.00	8.00	120.0000	0.00
17	16	18	430.00	8.00	120.0000	0.00
19	18	20	400.00	8.00	120.0000	0.00
21	20	2	85.00	24.00	120.0000	0.00

N O D E D A T A

NODE NAME	NODE TITLE	EXTERNAL DEMAND (gpm)	JUNCTION ELEVATION (ft)	EXTERNAL GRADE (ft)
2		0.00	12.00	
4		0.00	10.00	
6		0.00	11.00	
8		0.00	11.00	
10		0.00	14.00	
12		0.00	15.00	
14		0.00	15.00	
16		0.00	14.00	
18		0.00	11.00	
20		0.00	12.00	
R-1		----	10.00	299.10

O U T P U T O P T I O N D A T A

OUTPUT SELECTION: ALL RESULTS ARE INCLUDED IN THE TABULATED OUTPUT
MAXIMUM AND MINIMUM PRESSURES = 3
MAXIMUM AND MINIMUM VELOCITIES = 3
MAXIMUM AND MINIMUM HEAD LOSS/1000 = 0

S Y S T E M C O N F I G U R A T I O N

NUMBER OF PIPES (P) = 11
NUMBER OF END NODES (J) = 10
NUMBER OF PRIMARY LOOPS (L) = 1
NUMBER OF SUPPLY NODES (F) = 1
NUMBER OF SUPPLY ZONES (Z) = 1

**Viewpoint Old Town Project
City of San Diego
Computer Hydraulic Model**

**March 6, 2023
Dexter Wilson Eng., Inc.
Job 574-023**

=====
Case: 1 = AVERAGE DAY DEMAND

Pipe 3 is CLOSED
TANK at node R-1 has a new HGL of 299.000

P I P E L I N E R E S U L T S

P I P E N A M E	N O D E N U M B E R S		F L O W R A T E gpm	H E A D L O S S ft	M I N O R L O S S ft	L I N E V E L O . ft/s	H L + M L / 1 0 0 0 ft/f	H L / 1 0 0 0 ft/f
	#1	#2						
1	R-1	2	41.40	0.00	0.00	0.03	0.00	0.00
3-XX	2	4						
5	4	6	-41.40	0.01	0.00	0.26	0.06	0.06
7	6	8	0.00	0.00	0.00	0.00	0.00	0.00
9	6	10	-41.40	0.03	0.00	0.26	0.06	0.06
11	10	12	-41.40	0.03	0.00	0.26	0.06	0.06
13	12	14	-41.40	0.00	0.00	0.26	0.06	0.06
15	14	16	-41.40	0.04	0.00	0.26	0.06	0.06
17	16	18	-41.40	0.03	0.00	0.26	0.06	0.06
19	18	20	-41.40	0.02	0.00	0.26	0.06	0.06
21	20	2	-41.40	0.00	0.00	0.03	0.00	0.00

N O D E R E S U L T S

N O D E N A M E	N O D E T I T L E	E X T E R N A L D E M A N D gpm	H Y D R A U L I C G R A D E ft	N O D E E L E V A T I O N ft	P R E S S U R E H E A D ft	N O D E P R E S S U R E psi
2		0.00	299.00	12.00	287.00	124.37
4		41.40	298.84	10.00	288.84	125.16
6		0.00	298.85	11.00	287.85	124.74
8		0.00	298.85	11.00	287.85	124.74
10		0.00	298.88	14.00	284.88	123.45
12		0.00	298.91	15.00	283.91	123.03
14		0.00	298.92	15.00	283.92	123.03
16		0.00	298.95	14.00	284.95	123.48
18		0.00	298.98	11.00	287.98	124.79
20		0.00	299.00	12.00	287.00	124.37
R-1		----	299.00	10.00	289.00	125.23

M A X I M U M A N D M I N I M U M V A L U E S

P R E S S U R E S

JUNCTION N U M B E R	M A X I M U M P R E S S U R E S psi	JUNCTION N U M B E R	M I N I M U M P R E S S U R E S psi
R-1	125.23	12	123.03
4	125.16	14	123.03
18	124.79	10	123.45

V E L O C I T I E S

P I P E N U M B E R	M A X I M U M V E L O C I T Y (ft/s)	P I P E N U M B E R	M I N I M U M V E L O C I T Y (ft/s)
5	0.26	1	0.03
9	0.26	21	0.03
11	0.26	11	0.26

**Viewpoint Old Town Project
City of San Diego
Computer Hydraulic Model**

**March 6, 2023
Dexter Wilson Eng., Inc.
Job 574-023**

S U M M A R Y O F I N F L O W S A N D O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM SUPPLY NODES
(-) OUTFLOWS FROM THE SYSTEM INTO SUPPLY NODES

NODE NAME	FLOWRATE gpm	NODE TITLE
R-1	41.40	
NET SYSTEM INFLOW = 41.40		
NET SYSTEM OUTFLOW = 0.00		
NET SYSTEM DEMAND = 41.40		

Case: 2 = MAXIMUM DAY DEMAND

TANK at node R-1 has a new HGL of 299.000

P I P E L I N E R E S U L T S

PIPE NAME	NODE NUMBERS		FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/1000 ft/f	HL/1000 ft/f
	#1	#2						
1	R-1	2	47.70	0.00	0.00	0.03	0.00	0.00
3-XX	2	4						
5	4	6	-47.70	0.02	0.00	0.30	0.08	0.08
7	6	8	0.00	0.00	0.00	0.00	0.00	0.00
9	6	10	-47.70	0.03	0.00	0.30	0.08	0.08
11	10	12	-47.70	0.05	0.00	0.30	0.08	0.08
13	12	14	-47.70	0.00	0.00	0.30	0.08	0.08
15	14	16	-47.70	0.05	0.00	0.30	0.08	0.08
17	16	18	-47.70	0.03	0.00	0.30	0.08	0.08
19	18	20	-47.70	0.03	0.00	0.30	0.08	0.08
21	20	2	-47.70	0.00	0.00	0.03	0.00	0.00

N O D E R E S U L T S

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
2		0.00	299.00	12.00	287.00	124.37
4		47.70	298.79	10.00	288.79	125.14
6		0.00	298.81	11.00	287.81	124.72
8		0.00	298.81	11.00	287.81	124.72
10		0.00	298.84	14.00	284.84	123.43
12		0.00	298.89	15.00	283.89	123.02
14		0.00	298.89	15.00	283.89	123.02
16		0.00	298.94	14.00	284.94	123.47
18		0.00	298.97	11.00	287.97	124.79
20		0.00	299.00	12.00	287.00	124.37
R-1		----	299.00	10.00	289.00	125.23

M A X I M U M A N D M I N I M U M V A L U E S

P R E S S U R E S

JUNCTION NUMBER	MAXIMUM PRESSURES psi	JUNCTION NUMBER	MINIMUM PRESSURES psi
R-1	125.23	12	123.02
4	125.14	14	123.02
18	124.79	10	123.43

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V E L O C I T I E S

PIPE NUMBER	MAXIMUM VELOCITY (ft/s)	PIPE NUMBER	MINIMUM VELOCITY (ft/s)
5	0.30	1	0.03
9	0.30	21	0.03
11	0.30	11	0.30

S U M M A R Y O F I N F L O W S A N D O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM SUPPLY NODES
(-) OUTFLOWS FROM THE SYSTEM INTO SUPPLY NODES

NODE NAME	FLOWRATE gpm	NODE TITLE
R-1	47.70	

NET SYSTEM INFLOW = 47.70
NET SYSTEM OUTFLOW = 0.00
NET SYSTEM DEMAND = 47.70

=====
Case: 3 = PEAK HOUR DEMAND

TANK at node R-1 has a new HGL of 298.000

P I P E L I N E R E S U L T S

PIPE NAME	NODE #1	NODE #2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/1000 ft/f	HL/1000 ft/f
1	R-1	2	105.30	0.00	0.00	0.07	0.00	0.00
3-XX	2	4						
5	4	6	-105.30	0.08	0.00	0.67	0.33	0.33
7	6	8	0.00	0.00	0.00	0.00	0.00	0.00
9	6	10	-105.30	0.14	0.00	0.67	0.33	0.33
11	10	12	-105.30	0.20	0.00	0.67	0.33	0.33
13	12	14	-105.30	0.02	0.00	0.67	0.33	0.33
15	14	16	-105.30	0.20	0.00	0.67	0.33	0.33
17	16	18	-105.30	0.14	0.00	0.67	0.33	0.33
19	18	20	-105.30	0.13	0.00	0.67	0.33	0.33
21	20	2	-105.30	0.00	0.00	0.07	0.00	0.00

N O D E R E S U L T S

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
2		0.00	298.00	12.00	286.00	123.93
4		105.30	297.09	10.00	287.09	124.40
6		0.00	297.17	11.00	286.17	124.01
8		0.00	297.17	11.00	286.17	124.01
10		0.00	297.31	14.00	283.31	122.77
12		0.00	297.51	15.00	282.51	122.42
14		0.00	297.52	15.00	282.52	122.43
16		0.00	297.73	14.00	283.73	122.95
18		0.00	297.87	11.00	286.87	124.31
20		0.00	298.00	12.00	286.00	123.93
R-1		----	298.00	10.00	288.00	124.80

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MAXIMUM AND MINIMUM VALUES

PRESSURES

JUNCTION NUMBER	MAXIMUM PRESSURES psi	JUNCTION NUMBER	MINIMUM PRESSURES psi
R-1	124.80	12	122.42
4	124.40	14	122.43
18	124.31	10	122.77

VELOCITIES

PIPE NUMBER	MAXIMUM VELOCITY (ft/s)	PIPE NUMBER	MINIMUM VELOCITY (ft/s)
5	0.67	1	0.07
9	0.67	21	0.07
11	0.67	11	0.67

SUMMARY OF INFLOWS AND OUTFLOWS

(+) INFLOWS INTO THE SYSTEM FROM SUPPLY NODES
(-) OUTFLOWS FROM THE SYSTEM INTO SUPPLY NODES

NODE NAME	FLOWRATE gpm	NODE TITLE
R-1	105.30	

NET SYSTEM INFLOW = 105.30
NET SYSTEM OUTFLOW = 0.00
NET SYSTEM DEMAND = 105.30

=====
Case: 4 = MAXIMUM DAY DEMAND + 3,000 GPM FIRE FLOW

Pipe 3 is OPENED
TANK at node R-1 has a new HGL of 198.000

PIPELINE RESULTS

PIPE NAME	NODE NUMBERS #1 #2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
1	R-1 2	3047.70	0.06	0.00	2.16	0.79	0.79
3	2 4	2210.82	17.04	0.00	14.11	92.08	92.08
5	4 6	2163.12	21.67	0.00	13.81	88.44	88.44
7	6 8	3000.00	6.48	0.00	19.15	162.07	162.07
9	6 10	-836.88	6.70	0.00	5.34	15.24	15.24
11	10 12	-836.88	9.14	0.00	5.34	15.24	15.24
13	12 14	-836.88	0.76	0.00	5.34	15.24	15.24
15	14 16	-836.88	9.45	0.00	5.34	15.24	15.24
17	16 18	-836.88	6.55	0.00	5.34	15.24	15.24
19	18 20	-836.88	6.09	0.00	5.34	15.24	15.24
21	20 2	-836.88	0.01	0.00	0.59	0.07	0.07

NODE RESULTS

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
2		0.00	197.94	12.00	185.94	80.57
4		47.70	180.90	10.00	170.90	74.06
6		0.00	159.24	11.00	148.24	64.24
8		3000.00	152.75	11.00	141.75	61.43

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10	0.00	165.94	14.00	151.94	65.84
12	0.00	175.08	15.00	160.08	69.37
14	0.00	175.84	15.00	160.84	69.70
16	0.00	185.29	14.00	171.29	74.23
18	0.00	191.84	11.00	180.84	78.36
20	0.00	197.93	12.00	185.93	80.57
R-1	----	198.00	10.00	188.00	81.47

M A X I M U M A N D M I N I M U M V A L U E S

P R E S S U R E S

JUNCTION NUMBER	MAXIMUM PRESSURES psi	JUNCTION NUMBER	MINIMUM PRESSURES psi
R-1	81.47	8	61.43
2	80.57	6	64.24
20	80.57	10	65.84

V E L O C I T I E S

PIPE NUMBER	MAXIMUM VELOCITY (ft/s)	PIPE NUMBER	MINIMUM VELOCITY (ft/s)
7	19.15	21	0.59
3	14.11	1	2.16
5	13.81	13	5.34

S U M M A R Y O F I N F L O W S A N D O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM SUPPLY NODES
(-) OUTFLOWS FROM THE SYSTEM INTO SUPPLY NODES

NODE NAME	FLOWRATE gpm	NODE TITLE
R-1	3047.70	

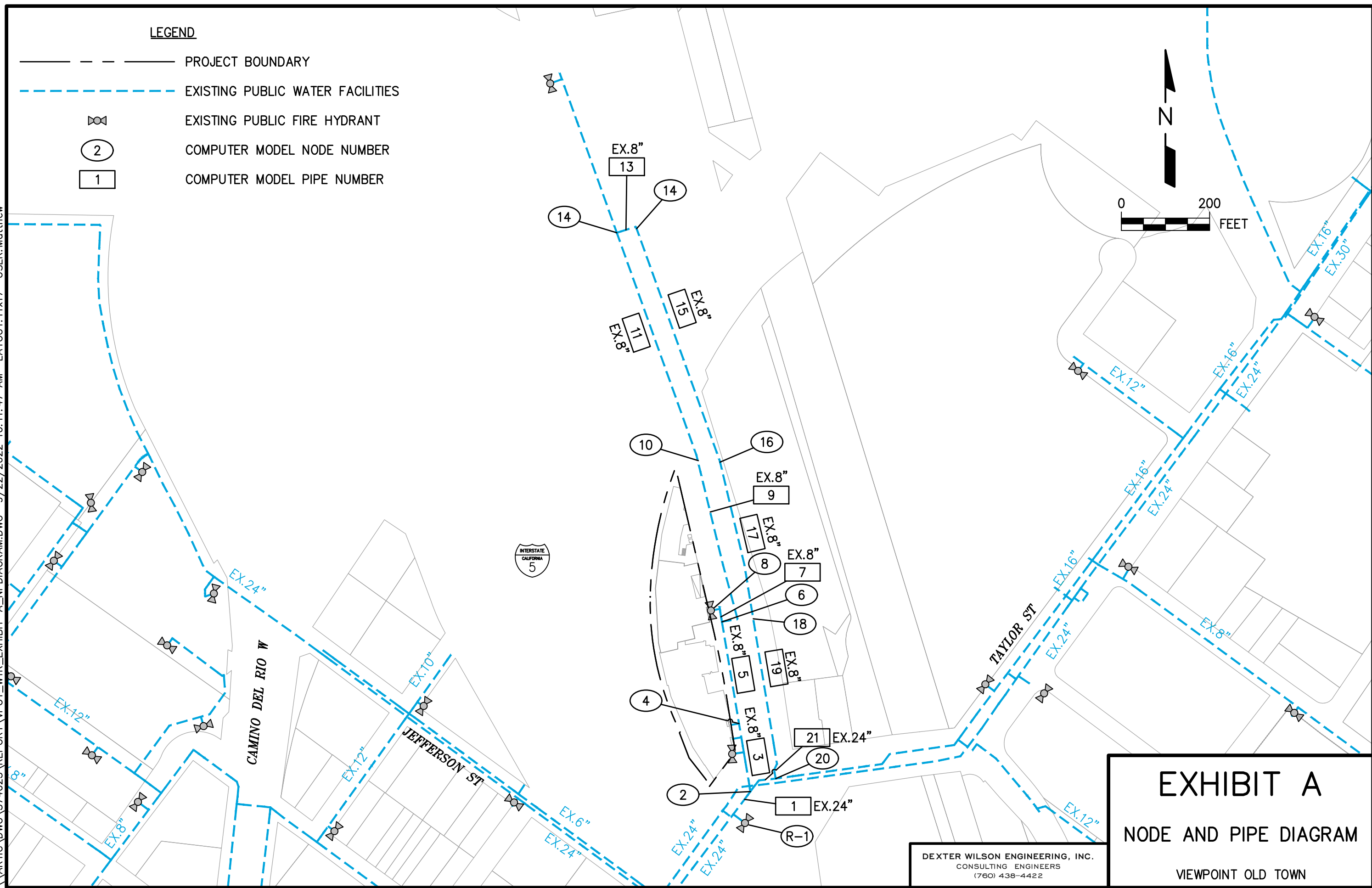
NET SYSTEM INFLOW = 3047.70
NET SYSTEM OUTFLOW = 0.00
NET SYSTEM DEMAND = 3047.70

***** HYDRAULIC ANALYSIS COMPLETED *****

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LEGEND

- — — — — PROJECT BOUNDARY
- - - - - EXISTING PUBLIC WATER FACILITIES
- ⊗ EXISTING PUBLIC FIRE HYDRANT
- ② COMPUTER MODEL NODE NUMBER
- ① COMPUTER MODEL PIPE NUMBER



DEXTER WILSON ENGINEERING, INC.
 CONSULTING ENGINEERS
 (760) 438-4422

EXHIBIT A
NODE AND PIPE DIAGRAM
 VIEWPOINT OLD TOWN