The Junipers Project
Final Environmental Impact Report
SCH No. 2018041032 - Project No. 586670

Appendix J2

Private Water System Analysis

January 2021

DEXTER WILSON ENGINEERING, INC.

WATER • WASTEWATER • RECYCLED WATER

CONSULTING ENGINEERS

PRIVATE WATER SYSTEM ANALYSIS
FOR THE JUNIPERS PROJECT
IN THE CITY OF SAN DIEGO
PROJECT NO. 586670

May 14, 2019

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PRIVATE WATER SYSTEM ANALYSIS
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IN THE CITY OF SAN DIEGO
PROJECT NO. 586670

May 14, 2019

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

Job No. 509-100

DEXTER S. WILSON, P.E.
ANDREW M. OVEN, P.E.
STEPHEN M. NIELSEN, P.E.
NATALIE J. FRASCHETTI, P.E.
STEVEN J. HENDERSON, P.E.

May 14, 2019 509-100

Hunsaker & Associates San Diego, Inc.
9707 Waples Street
San Diego, CA 92121

Attention: Troy Burns, Principal

Subject: Private Water System Analysis for The Junipers Project in the City of San Diego

Introduction

This report provides a private water system analysis for The Junipers project. The project is located in Rancho Penasquitos in the north-central portion of the City of San Diego. It is situated west of Interstate 15 and north of Carmel Mountain Road. Figure 1 provides a vicinity map for the project.

The project encompasses a gross area of approximately 112.3 acres and proposes redevelopment of the Carmel Highlands Golf Course with 536 residential units. The site includes a recreation center. Pad elevations for the buildings within the project range from 670 feet to 704 feet.

The Junipers project will receive water service from the City of San Diego. The water system to which The Junipers project will connect is the Penasquitos 920 Zone system.

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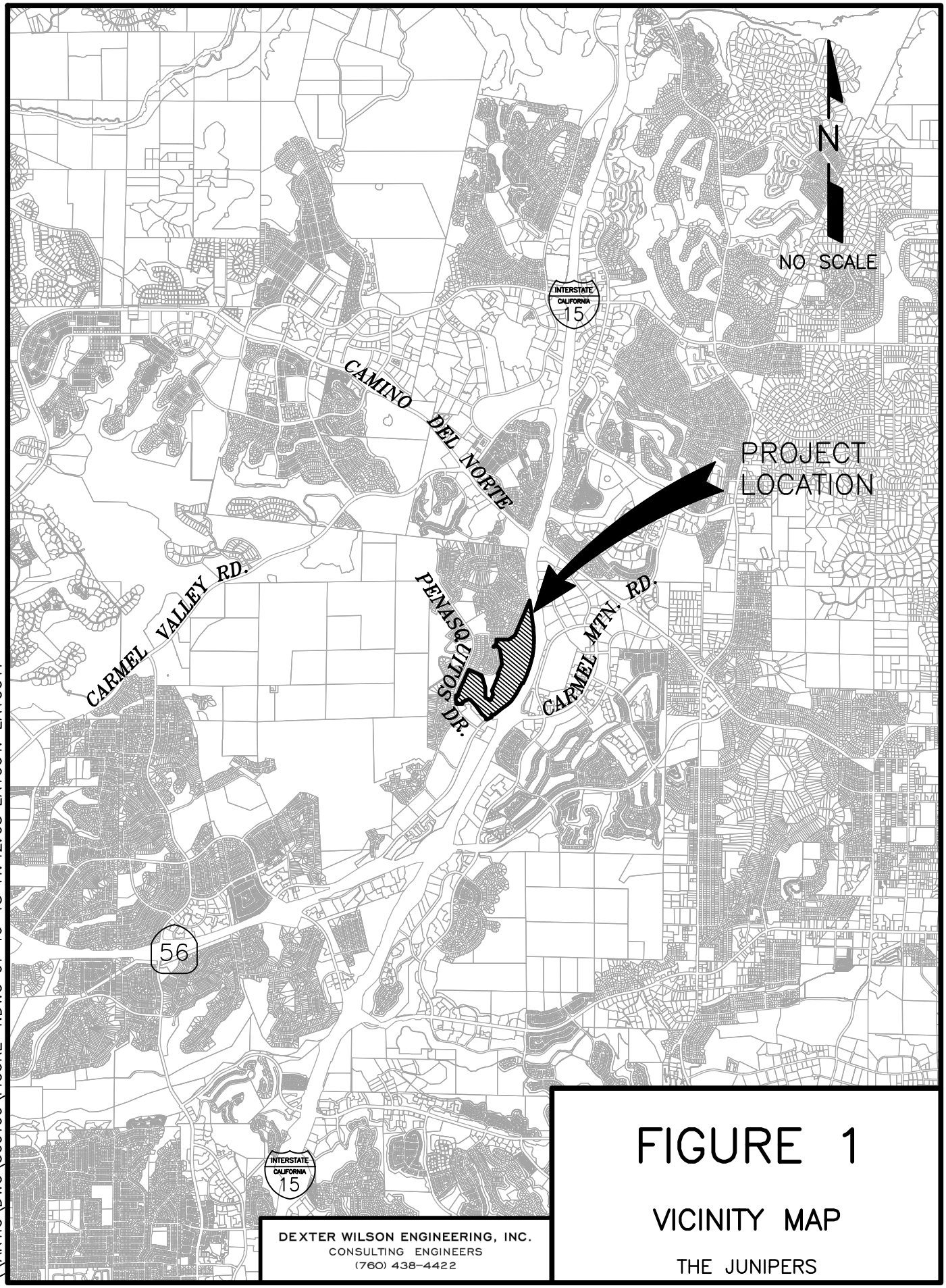

\\ARTIC\DWG\509100\FIGURE-1.DWG 01-16-18 11:42:08 LAYOUT: LAYOUT1

FIGURE 1

VICINITY MAP

THE JUNIPERS

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CONSULTING ENGINEERS
(760) 438-4422

The purpose of this letter report is to present the sizing and configuration of the private domestic water system and the private fire protection system to provide service to The Junipers project.

Private Water System Design Criteria

Water service within The Junipers project will consist of two separate systems; one will be for private domestic water service and the other will be for private fire protection service. The domestic water system will include a service lateral to each unit that supplies domestic and fire sprinkler demands. The domestic water system is sized in accordance with the California Plumbing Code 2016.

The fire protection component of the water system is designed based on the required fire flow for the project as stipulated by the City of San Diego Fire Department and the City of San Diego Water Department Facility Design Guidelines, Chapter 2, Water Demands and Service Criteria. The Fire Department generally requires that any single fire hydrant be capable of delivering 1,500 gpm flow at a minimum residual pressure of 20 psi. The Water Department Design Guidelines recommend fire flows of 2,000 gpm for single family residential development, 2,500 gpm for duplex residential development, and 3,000 gpm for apartment development.

The private fire protection system is designed to provide a minimum residual pressure greater than 20 psi at any location within the private fire protection water system under the fire hydrant flow demand.

Water Demands

To evaluate the proposed impact of the proposed project redevelopment on the surrounding water system, a comparison of historical demands versus projected demands is provided. Table 1 summarizes the estimated water demands for the golf course water use versus the projected water demand for the current project.

TABLE 1 THE JUNIPERS WATER DEMAND PROJECTIONS			
Description	**Quantity**	**Unit Demand Factor**	**Average Water Demand, gpd**
Existing/Historical			
Golf Course	89.8 Net/ac	4,000 gpd/ac	359,200
Proposed			
Residential	536 Units/112.3 ac[1]	525 gpd/unit	281,400
Water Demand Increase (Decrease)			**(77,800)**

[1] Net acres is estimated to be 80 percent of gross acres.

As shown, the proposed development would reduce water demands by an estimated 77,800 gpd.

Existing Water System

The Junipers project will obtain water service from the City of San Diego's public water system. The Junipers project will connect to the Penasquitos 920 Pressure Zone system. In the vicinity of the project, there is a 920 Zone Reservoir south and west of the intersection of Penasquitos Drive and Del Diablo Way. There is a 20-inch water line in Del Diablo Way that continues as a 20-inch line south in Penasquitos Drive until a reservoir tie-in point between Del Diablo Way and Del Diablo Drive. Following the reservoir tie-in point, the water line continues as a 16-inch line until the Penasquitos Drive and Cuca Street intersection where it decreases to 12-inches. An 8-inch lateral currently extends from the 20-inch water line in Del Diablo Way and stubs into the northwest end of the project site.

There is also an existing 24-inch transmission line in the northeast portion of the project along the project boundary. This line does not provide service to the project, but must be protected in place and remain accessible to the City with the design of the project. The project proposes to provide an access easement through the project to this line.

The maximum operating hydraulic grade line in the system that will serve the project is 920 feet which results in a maximum static water pressure range on the project of 93 psi to 108 psi. Pressure regulators are recommended to limit building service pressures to 80 psi in accordance with the California Plumbing Code.

Private Domestic Water System

Water service to The Junipers project will be provided by installing two public water service laterals from the existing 920 Zone water system. One of the connections will be to the 16-inch public water line in Penasquitos Drive and the other connection will be to an existing 10-inch line in Del Diablo Street. The sizing of the public water system lateral, domestic meters, and the private domestic water system distribution piping is presented in the following sections.

Master Meter Sizing. Two master domestic water meters will provide service to The Junipers project. The master meter sizes were determined based on the total number of Water Fixture Units (WFUs) that will be served by the meters. Irrigation internal to the project will be supplied by a separate irrigation meter to be sized by the landscape designer. Therefore, no allowance for irrigation demand will be included in the meter sizing.

The Junipers project architectural plans were used to determine the total WFUs for the project. As the architectural plans did not yet address the Recreation Center or the proposed apartment units, an estimate of 20 WFUs was used for these units. Appendix A presents the summary of the Water Fixture Counts for The Junipers project. The total WFUs for The Junipers project is 14,844.5 WFUs.

Using Chart A-2 in the California Plumbing Code a graph was created to extrapolate the water demand associated with 14,844.5 WFUs. Chart A-2 only provides flows for 3,000 WFUs or less; thus, to determine the peak flow for 14,844.5 WFUs a straight line was drawn from the end of the existing curve to extrapolate the project's peak water demand. This resulted in a peak demand of 1,600 gallons per minute (gpm). Therefore, to adhere to the City of San Diego's meter sizing guidelines one 8-inch turbine type meter is required for The Junipers project. The City of San Diego provides two smaller sized meters in parallel for redundancy. Therefore, for The Junipers project two 6-inch turbine type meters will be provided. Each 6-inch meter will be followed by a 6-inch reduced pressure principle backflow preventer. Appendix B provides the water fixture unit extrapolation graph and the City of San Diego's allowable flow rates for domestic water meters.

Domestic Water System Pipe Sizing. The private domestic water system distribution piping for The Junipers project has been sized in accordance with the Uniform Plumbing Code and the Installation Standard for PVC Cold Water Building Supply and Yard Piping (IAPMO IS 8-2006). The Installation Standard requires that the maximum pipeline velocity be limited to eight feet per second (8 fps). To comply with this requirement, the maximum flowrate and WFUs for different pipe sizes was calculated based on Chart A-2 from the California Plumbing Code 2016. The WFUs per pipe size summarized in Table 2 are used to size the piping within The Junipers project by determining the total number of WFUs that any line would serve.

TABLE 2 SIZE OF PRIVATE DOMESTIC SYSTEM PIPING BASED ON NUMBER OF WATER FIXTURE UNITS SERVED	
Number of Water Fixture Units	**Minimum System Pipe Size[1]**
0 – 14	¾ -inch
15 – 29	1-inch
30 – 53	1 ¼-inch
54 – 105	1 ½-inch
106 – 270	2-inch
271 – 500	2 ½-inch
501 – 780	3-inch
781 - 1,920	4-inch
1,921 - 3,575	5-inch
3,576 - 6,175	6-inch
6,176 – 13,986	8-inch

[1] Based on velocity of 8 fps

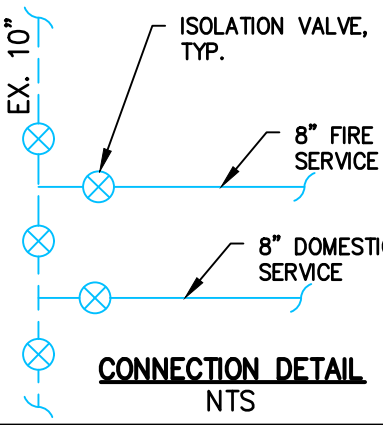
Figure 2 presents a graphic of the recommended private domestic water line sizes throughout the project. Although not shown on Figure 2, it is anticipated that each unit will be sub-metered and that a 1-inch service will be provided to each unit to supply domestic and fire sprinkler requirements. The service size is to be confirmed by the plumbing designer for the project.

The domestic water line sizes shown on Figure 2 comply with the California Plumbing Code 2016 and will supply adequate flow and pressure to each individual dwelling unit within The Junipers project. The line sizes may be increased for uniformity or ease of construction.

Pressure Regulating. The pressure will be regulated to 80 psi by individual pressure regulators. These individual pressure regulators will be located on the domestic water building supply lines.

LEGEND

- PROJECT BOUNDARY
- EXISTING 920 ZONE WATER LINE
- PROPOSED PRIVATE WATER LINE
- PROPOSED PUBLIC WATER LINE
- M — PROPOSED WATER METER
- PROPOSED BACKFLOW PREVENTOR



CONNECTION DETAIL
NTS

EXISTING 24" TRANSMISSION LINE (DEVELOPMENT TO PROVIDE 25' MIN ACCESS EASEMENT TO EXISTING LINE)

EXISTING 8" FIRE SERVICE TO BE ABANDONED

8" PUBLIC LATERAL

920 ZONE RESERVOIR

SEE DETAIL ABOVE

EXISTING GAS MAIN

8" PROPOSED PUBLIC LATERAL

SEE DETAIL BELOW

6"M 6"BF

MADRIGAL ST.

ANDORRA WAY

DEL DIABLO WAY

DEL DIABLO LN.

DEL DIABLO ST.

PENASQUITOS DR.

JANAL WAY

CARMEL MOUNTAIN ROAD

INTERSTATE 15

EX.24"

EX.20"

EX.16"

EX.10"

EX.6"

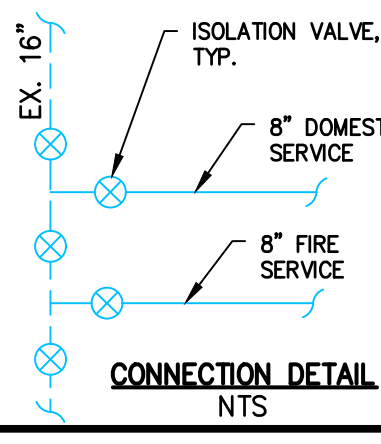
EX8"

4" 6" 8"

2"

N

0 400 FEET



CONNECTION DETAIL
NTS

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FIGURE 2

PROPOSED DOMESTIC WATER SYSTEM

THE JUNIPERS

Private Fire Protection System Pipe Sizing

All fire hydrants within The Junipers project will be connected to a private fire protection water system. The private fire protection system for The Junipers project will have two connections. The connections will be made adjacent to the domestic connections in Del Diablo Street and Penasquitos Drive.

In order to establish the required fire protection system pipe sizing, a water system computer model was generated for the project's fire protection system piping. The private fire protection system is designed to deliver the required fire hydrant flow to the onsite fire hydrants. For fire hydrant flow, minimum residual pressure in the onsite system must be greater than 20 psi.

Model Development. Analysis using the KYPIPE computer software program developed by the University of Kentucky determined residual pressures throughout the fire protection system. This computer software utilizes the Hazen-Williams equation for determining headloss in pipes. The Hazen-Williams "C" value used for all pipe sizes in the analysis is 120.

Fitting and Valve Losses. To simulate minor losses through pipe fittings and valves, equivalent lengths of piping were added to the straight pipe lengths and included in the hydraulic model. Appendix C provides the equivalent length reference table utilized for the determination of minor losses within the computer modeling analysis.

Backflow Assembly Losses. The pressure losses through the reduced pressure principle detector check assembly devices were modeled as minor losses using a "k" value large enough to result in the expected pressure loss through these devices. Appendix C presents a candidate reduced pressure principle detector check assembly backflow preventer device. The manufacturer's literature includes charts which show pressure loss through the backflow preventer as a function of flow. These charts were used to approximate the pressure losses which were reflected in the computer modeling and show up as minor losses calculated in feet.

Hydraulic Grade Line Available. The private fire protection system was modeled with an estimated hydraulic grade line (HGL) of 905 feet at the water main connection points. This hydraulic grade line assumes that the working pressure at the project's connection points is 15 feet lower than the zone's maximum hydraulic grade line of 920 feet.

Fire Protection System Analysis. Figure 3 presents the recommended fire protection system. Appendix D presents the computer modeling results for the private fire protection system. Exhibit A at the back of this report shows the model's corresponding Node and Pipe Diagram. The fire flow requirement used for single family residential areas is 2,000 gpm, for duplexes the fire flow used is 2,500 gpm, and for apartments the fire flow analyzed is 3,000 gpm.

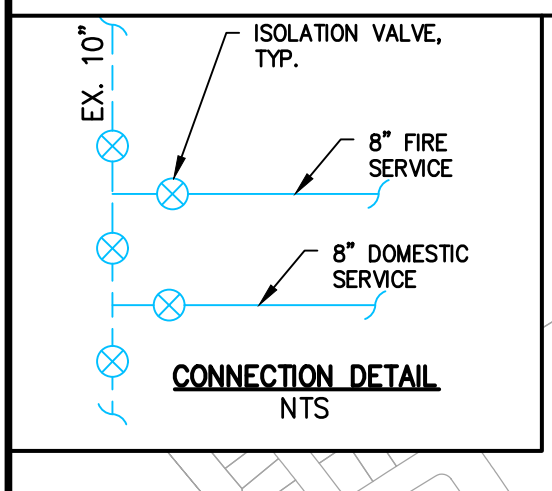
Four fire flow scenarios were modeled. The first scenario analyzes a 2,000 gpm fire flow at a single computer model node. The second scenario analyzes a 2,500 gpm fire flow split between computer model nodes. The last two scenarios include a 3,000 gpm fire flow split between computer model nodes at two different locations within the project.

Under each scenario, the fire flow requirement is being met with greater than 20 psi residual pressure at all locations within the project. Minimum residual pressures are greater than 30 psi under all fire flow scenarios.

The private fire protection system will be connected to the end of the existing 8-inch stub near the northwest corner of the project site and to the existing 16-inch water line in Penasquitos Drive as shown in Figure 3. Each of the two connections includes an 8-inch lateral and an 8-inch reduced pressure principle detector check assembly in accordance with the City of San Diego Public Utilities Department requirements.

LEGEND

- PROJECT BOUNDARY
- EXISTING 920 ZONE WATER LINE
- PROPOSED PUBLIC WATER LINE
- PROPOSED PRIVATE FIRE PROTECTION LINE
- PROPOSED BACKFLOW PREVENTOR
- PROPOSED PRIVATE FIRE HYDRANT



CONNECTION DETAIL
NTS

EXISTING 24" TRANSMISSION LINE (DEVELOPMENT TO PROVIDE 25' MIN ACCESS EASEMENT TO EXISTING LINE)

EXISTING 8" FIRE SERVICE TO BE ABANDONED

EX.20

EX.20"

EX8"

SEE DETAIL ABOVE

8"BF

920 ZONE RESERVOIR

EX.20"

EX.6"

8" PROPOSED PUBLIC LATERAL

EX.16"

EX.10"

EX.10"

EXISTING GAS MAIN

EX.16"

SEE DETAIL BELOW

8" PROPOSED PUBLIC LATERAL

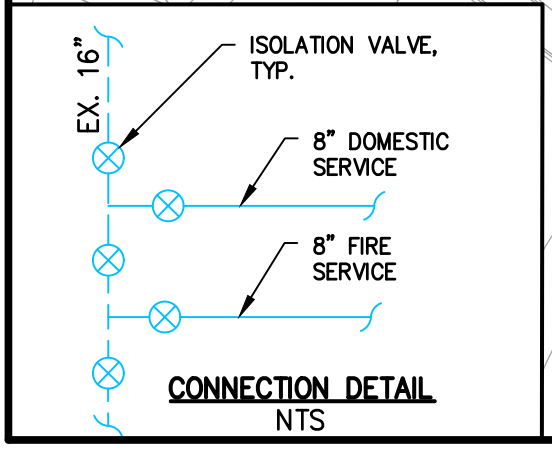
8"BF

8"

EX.24"

N

0 400 FEET



CONNECTION DETAIL
NTS

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FIGURE 3

PROPOSED PRIVATE FIRE SYSTEM

THE JUNIPERS

Project Phasing

The Junipers project is proposing to develop the property in one phase. Final engineering design will consist of one set of drawings for the entire backbone system. Once the project is graded and backbone system improvements and utility relocations are completed, development of units and occupancies are anticipated to occur over the course of several years based on market conditions.

Conclusion and Recommendations

The following recommendations and conclusions are presented based upon the private water system analyses performed for The Junipers project.

1. Water service to the project will be provided by the City of San Diego Penasquitos 920 Pressure Zone public water system.

2. Pad elevations within the project range from 670 feet to 704 feet resulting in a range of maximum static water pressures of 93 psi to 108 psi. Because working pressure is greater than 80 psi, individual pressure regulators must be installed on each building supply to limit service pressures to 80 psi in accordance with the California Plumbing Code 2016.

3. Domestic service (including fire sprinklers) and fire protection to the project shall be supplied by two independent private water systems.

4. Private domestic service for The Junipers project will be supplied by two 6-inch domestic water turbine type meters.

5. Each 6-inch domestic meter will be followed by a 6-inch reduced pressure principle backflow preventer.

6. Figure 2 presented in this report provides the recommended distribution pipe sizes for the private domestic water system. Additionally, each unit is anticipated to be sub-metered and have a 1-inch service to meet domestic and fire sprinkler demands. The sizing of the service to each unit is to be confirmed by the plumbing designer for the project.

7. The fire flow available to the project site meets the fire flow planning requirement for the proposed buildings.

8. Private fire protection service for The Junipers project will be supplied by two 8-inch fire service lateral connections to the existing 920 Pressure Zone public system. Internal to the project the private fire protection system will consist of 8-inch piping.

9. Each 8-inch private fire protection system connection to the public main shall include an 8-inch reduced pressure principle detector check assembly backflow preventer in accordance with the City of San Diego Public Utilities Department requirements.

10. Figure 3 in this report provides a layout of The Junipers project showing the recommended private fire protection system pipeline sizes throughout the project.

11. The public water system shall be designed and constructed in accordance with the guidelines, standards, and approved materials of the City of San Diego.

12. This report presents the sizing and a general schematic layout of the proposed private domestic and private fire protection water systems. The design engineer for these systems should incorporate valves, fittings, and appurtenances as needed for proper installation and long-term operation of the private water systems.

13. If PVC pipe is used for the private water lines within the project, we recommend pipes 4-inch through 12-inch diameter to be AWWA C900, DR-18 (Class 235) for both the private domestic water system and the private fire protection system piping. Pipes smaller than 4-inch in diameter should be solvent welded Schedule 40 PVC; as an alternative, copper piping may be used.

Troy Burns
May 14, 2019
Junipers Project

Thank you for the opportunity to assist you with the water system planning for this project. If you have any questions regarding the information presented in this report, please do not hesitate to call.

Dexter Wilson Engineering, Inc.

Stephen M. Nielsen, P.E.

Attachments

SMN:FF:pjs

APPENDIX A

JUNIPERS PROJECT
WATER FIXTURE DATA

Project Name The Junipers
Water System Analysis

Job Number 509-100
Date 4/23/2018

Water Fixture Units:

The basis for the Water Fixture Units is the 2016 California Plumbing Code.

	3-Plex			Duplex			SF1 Plan			SF2 Plan		
DESCRIPTION	QUANTITY	FIXTURE UNITS EACH	TOTAL FIXTURE UNITS	QUANTITY	FIXTURE UNITS EACH	TOTAL FIXTURE UNITS	QUANTITY	FIXTURE UNITS EACH	TOTAL FIXTURE UNITS	QUANTITY	FIXTURE UNITS EACH	TOTAL FIXTURE UNITS
CLOTHES WASHER	3	4	12	2	4	8	1	4	4	1	4	4
TUB/SHOWER	3	4	12	2	4	8	2	4	8	2	4	8
SHOWER	5	2	10	3	2	6	1	2	2	2	2	4
KITCHEN SINK	3	1.5	4.5	2	1.5	3	1	1.5	1.5	1	1.5	1.5
BAR SINK	0	2	0	0	2	0	0	2	0	1	2	2
WASHUP FAUCET	0	2	0	0	2	0	0	2	0	0	2	0
DISHWASHER	3	1.5	4.5	2	1.5	3	1	1.5	1.5	1	1.5	1.5
LAUNDRY SINK	0	1.5	0	0	1.5	0	0	1.5	0	0	1.5	0
SERVICE SINK	0	3	0	0	3	0	0	3	0	0	3	0
LAVATORY	9	1	9	8	1	8	4	1	4	5	1	5
URINAL	0	4	0	0	4	0	0	4	0	0	4	0
WATER CLOSET (1.6 GPF FT, private)	6	2.5	15	6	2.5	15	3	2.5	7.5	4	2.5	10
DRINKING FOUNTAIN	0	0.5	0	0	0.5	0	0	0.5	0	0	0.5	0
HOSE BIBB	1	2.5	2.5	1	2.5	2.5	1	2.5	2.5	1	2.5	2.5
EACH ADDTL HB	5	1	5	3	1	3	1	1	1	1	1	1
POOL EQUIPMENT	0	30	0	0	30	0	0	30	0	0	30	0
TOTAL			74.5			56.5			32			39.5

TOTAL WFUs

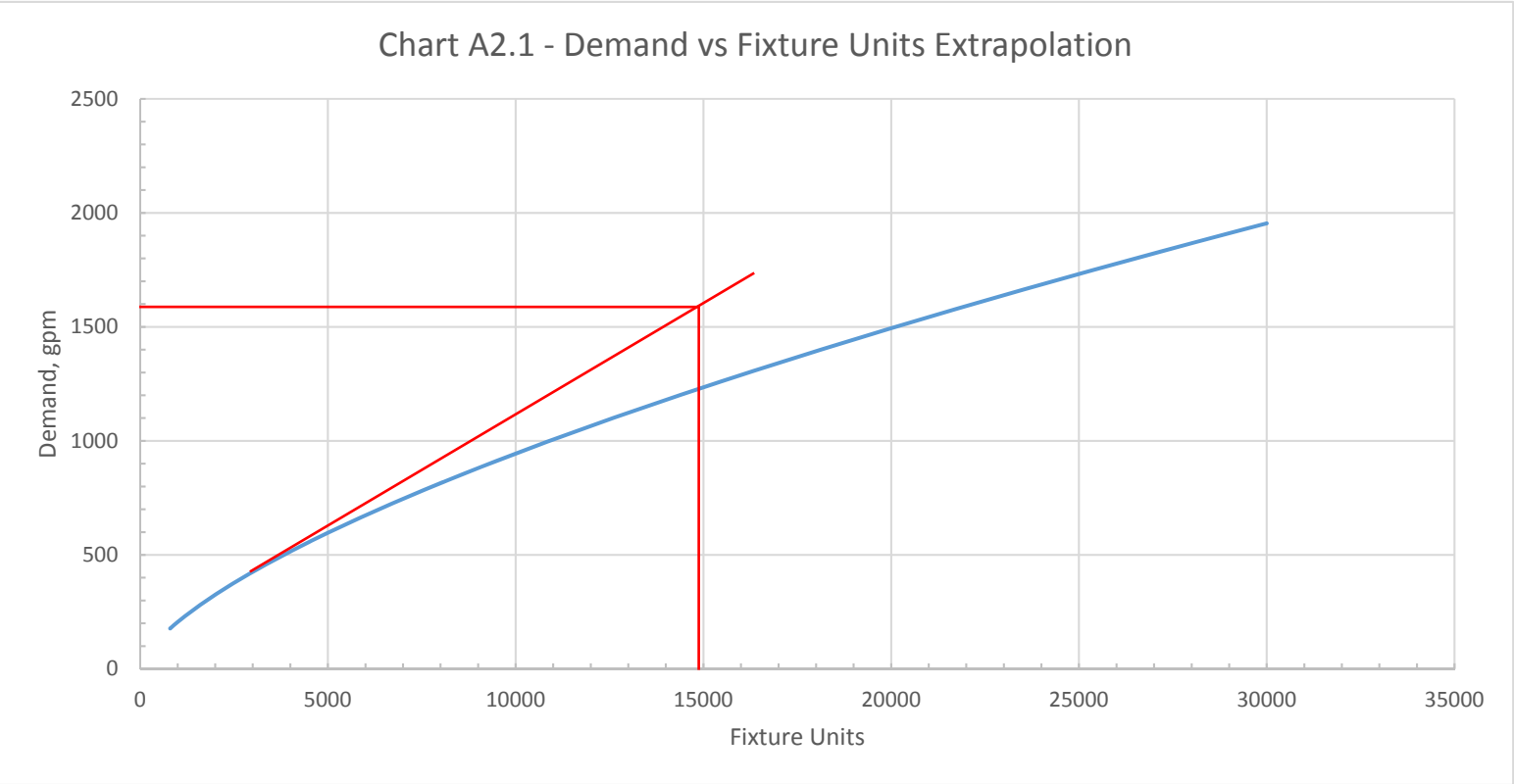
Bldg Type	Quantity	WFU/Bldg	WFU
3-Plex	62	74.5	4,619
Duplex	69	56.5	3,899
SF1	65	32	2,080
SF2	66	39.5	2,607.0
Apartment[1]	81	20	1,620.0
Rec. Center[1]	1	20	20.0
TOTAL			**14,844.5**

1. 20 WFUs assumed.

APPENDIX B

WATER FIXTURE UNIT
EXTRAPOLATION GRAPH AND
CITY OF SAN DIEGO
ALLOWABLE DOMESTIC METER CAPACITIES

FU	Demand, gpm
14844.5	1600



Graph data and line fit are based on Chart A2.1 from the 2016 CPC.

2015 AWWA Standards for Water Meter Capacities

Meter Size	Max Capacity per AWWA (gpm)	80% of Max Capacity (gpm)
Compound Type Meters - AWWA C702-15		
3	350	280
4	600	480
6	1,350	1,080
8	1,600	1,280
Turbine Type Meters - AWWA C701-15		
3	435	348
4	750	600
6	1,600	1,280
8	2,800	2,240
10	4,200	3,360
12	5,300	4,240
16	7,800	6,240
20	12,000	9,600

APPENDIX C

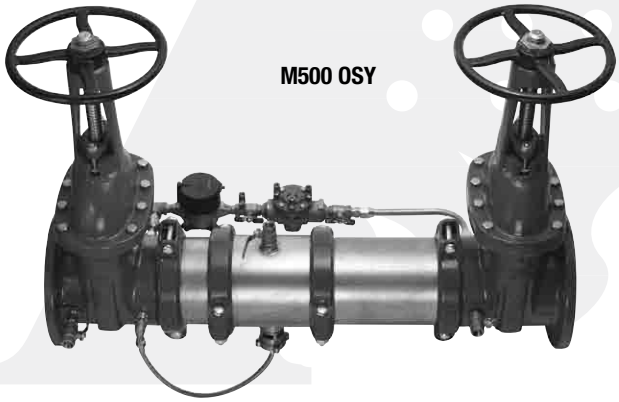
MINOR LOSS TABLES AND MANUFACTURER'S LITERATURE FOR A REDUCED PRESSURE PRINCIPLE DETECTOR CHECK ASSEMBLY BACKFLOW PREVENTER

Pipe No.	Gate Valve, Open	Check Valve	Standard tee, Branch	Standard tee, Through	90° Elbow, std.	45° Elbow	Pipe Length (ft)	Pipe Size, in	Equivalent Length of Additional Pipe Elements	Total Length (ft)	Pipe No.
105 (Bkflw)							20	8	0	20	105 (Bkflw)
109	2			2	2		880	8	79	959	109
113	3		2	2		2	345	8	149.5	494.5	113
117	3			3			557	8	55.5	612.5	117
121	2			4			633	8	65	698	121
125	1			1		1	211	8	28.5	239.5	125
129	1		1	1			215	8	62.5	277.5	129
133	1			1		1	563	8	28.5	591.5	133
137			1				312	8	44	356	137
141	3			4			654	8	69.5	723.5	141
145	1		1	1			510	8	62.5	572.5	145
149	1			3			354	8	46.5	400.5	149
153			1	3		1	617	8	96	713	153
157	1		1	1		3	423	8	92.5	515.5	157
161	1		1	1		2	365	8	82.5	447.5	161
165	3			3		1	729	8	65.5	794.5	165
169	1			2			297	8	32.5	329.5	169
173	2		1	2		2	837	8	101	938	173
177	1			2			295	8	32.5	327.5	177
181	1		1	2		1	568	8	86.5	654.5	181
185	1			2			297	8	32.5	329.5	185
189	2		1	2		2	794	8	101	895	189
193	1			2			265	8	32.5	297.5	193
197	1		1	2		1	535	8	86.5	621.5	197
201				1			185	8	14	199	201
205			1				250	8	44	294	205
209	2			2		4	515	8	77	592	209
213	1			2			172	8	32.5	204.5	213
217	1		1	1			303	8	62.5	365.5	217
225	2			3			477	8	51	528	225
250	2			2	1	5	638	8	108	746	250
301	3			3		5	679	8	105.5	784.5	301
305	2			3	1		697	8	72	769	305
309	1			2			183	8	32.5	215.5	309
313			1	2		4	776	8	112	888	313
317	2		1	2		2	370	8	101	471	317
321				1			187	8	14	201	321
325	1			1		1	166	8	28.5	194.5	325
327	1		1	1		2	386	8	82.5	468.5	327
329	3			2	1	1	673	8	72.5	745.5	329
333 (Bkflw)							20	8	0	20	333 (Bkflw)

Maxim™ Series M500, M500N, M500Z

Reduced Pressure Detector Assemblies

Sizes: 2½" – 10" (65 – 250mm)



M500 OSY

M500N OSY

Features

- Extremely Compact Design
- 70% Lighter than Traditional Designs
- 304 (Schedule 40) Stainless Steel Housing & Sleeve
- Groove Fittings Allow Integral Pipeline Adjustment
- Patented Link Check Provides Lowest Pressure Loss
- Unmatched Ease of Serviceability
  Available with Grooved Butterfly Valve Shutoffs
- Available for Horizontal or N Pattern Installations
- Replaceable Check Disc Rubber

The Maxim M500, M500N, M500Z Reduced Pressure Detector Assemblies provide protection to the potable water system from contamination in accordance with national plumbing codes. The Maxim M500, M500N, M500Z are normally used in health hazard applications to protect against backsiphonage, backpressure and the fouling of either check valve. The Maxim M500, M500N, M500Z are used to monitor unauthorized use of water from the fire protection system.

Specifications

The Reduced Pressure Detector Assemblies shall consist of two independent Link Check modules, a differential pressure relief valve located between and below the two modules, two drip tight shutoff valves, and required test cocks. Link Check modules and relief valve shall be contained within a sleeve accessible single housing constructed from 304 (Schedule 40) stainless steel pipe with groove end connections. Link Checks shall have reversible elastomer discs and in operation produce drip tight closure against the reverse flow of liquid caused by backpressure or backsiphonage. The bypass assembly consists of a meter registering either gallon or cubic measurements, a Reduced Pressure Zone Assembly and required test cocks. Assembly shall be Maxim M500, M500N, M500Z as manufactured by the Ames Company.

Job Name _____ Contractor _____

Job Location _____ Approval _____

Engineer _____ Contractor's P.O. No. _____

Approval _____ Representative _____

Ames product specifications in U.S. customary units and metric are approximate and are provided for reference only. For precise measurements, please contact Ames Technical Service. Ames reserves the right to change or modify product design, construction, specifications, or materials without prior notice and without incurring any obligation to make such changes and modifications on Ames products previously or subsequently sold.

Configurations

- Horizontal
- “Z” pattern horizontal
- “N” pattern horizontal

Materials

- Housing & Sleeve: 304 (Schedule 40) Stainless Steel
- Elastomers: EPDM, Silicone and Buna ‘N’
- Link Checks: Noryl®, Stainless Steel
- Check Discs: Reversible Silicone or EPDMr
- Test Cocks: Bronze Body Nickel Plated
- Pins & Fasteners: 300 Series Stainless Steel
- Springs: Stainless Steel

Available Models

OSY - UL/FM outside stem and yoke resilient seated gate valves

BFG - UL/FM grooved gear operated butterfly valves w/tamper switch

*OSY FxG - Flanged inlet gate connection and grooved outlet gate connection

*OSY GxF - Grooved inlet gate connection and flanged outlet gate connection

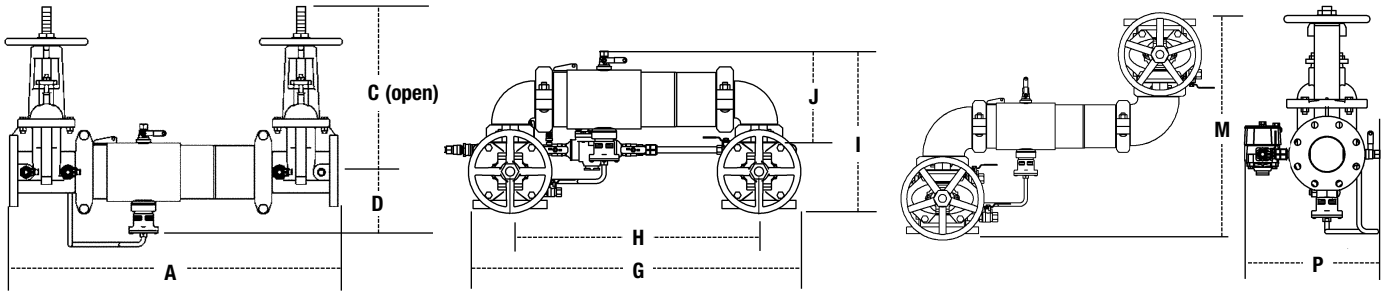
*OSY GxG - Grooved inlet gate connection and grooved outlet gate connection

Available with grooved NRS gate valves - consult factory*
Post indicator plate and operating nut available - consult factory*
*Consult factory for dimensions

Pressure — Temperature

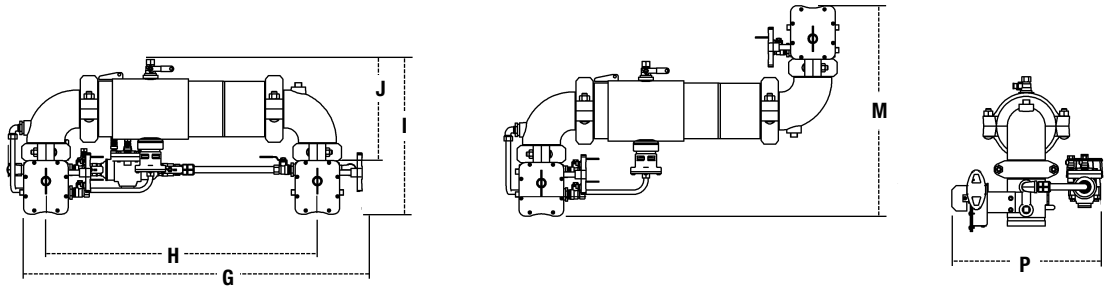
Temperature Range: 33°F – 110°F (5°C – 43°C)
Maximum Working Pressure: 175psi (12.06 bar)

Dimensions — Weights



M500, M500N

SIZE (DN)		DIMENSIONS																		WEIGHT			
		A		C (OSY)		D		H		I		P		M		G		J		M500		M500N	
in.	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*lbs.*	*kgs.*	*lbs.*	*kgs.*
2 1/2	65	31	787	16 3/8	416	6 1/2	165	22	559	15 9/16	395	13 3/8	340	18 1/16	461	29 1/2	749	8 13/16	223	142	64	150	68
3	80	31 11/16	805	18 7/8	479	6 11/16	170	22 3/4	578	16 1/4	413	14 11/16	372	19 9/16	497	30 1/2	775	9 3/16	233	162	73	175	79
4	100	40 1/2	1029	22 3/4	578	8	203	30 3/4	781	19 11/16	500	15 5/16	389	21 3/4	552	39 3/4	1010	11	280	236	107	259	117
6	150	48 3/16	1224	30 1/8	765	9 1/2	241	38	965	23 3/16	605	19 1/2	495	28 5/16	719	49	1245	14 3/4	360	407	185	447	203
8	200	55	1397	37 3/4	959	10 1/2	267	45 5/8	1159	27 3/16	690	21 5/8	549	36 3/8	924	59 1/8	1502	16 3/4	425	581	264	657	298
10	250	57 1/2	1461	45 3/4	1162	11 3/16	284	50	1270	32 1/2	825	24 5/16	617	44 5/8	1133	66	1676	17 5/16	440	798	362	968	439



M500NBFG, M500ZBFG

SIZE (DN)		DIMENSIONS												WEIGHT	
		H		I		P		M		G		J			
in.	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*lbs.*	*kgs.*
2 1/2	65	23 1/2	597	15 11/16	398	11 13/16	300	22 13/16	580	31 15/16	811	9 1/2	242	81	37
3	80	24 1/2	622	16 5/16	415	12 1/8	308	23 5/8	600	33 5/16	846	10 1/16	255	84	38
4	100	32 3/4	832	18 5/16	466	13 15/16	454	24 15/16	633	42	1067	12	305	159	72.1
6	150	40	1016	21 3/4	553	16 7/16	418	28 1/4	718	50 13/16	1291	15 3/16	386	268	121.5

Noryl® is a registered trademark of SABIC Innovative Plastics™.

Approvals

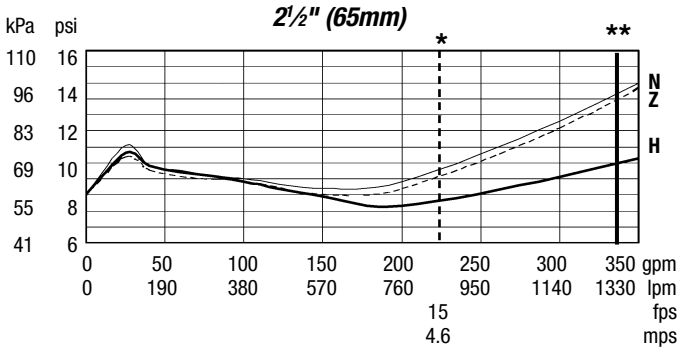
1047 28S6 B64.4

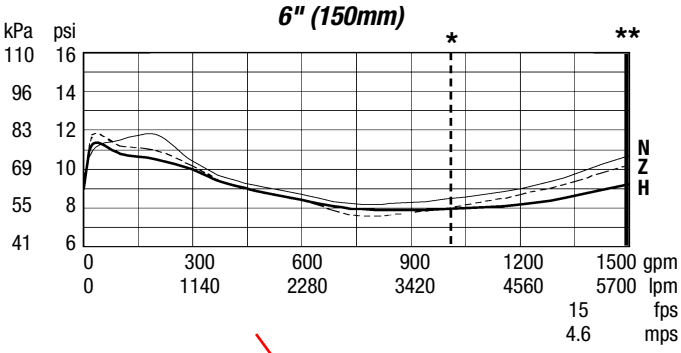
For additional approval information please contact the factory or visit our website at www.amesfirewater.com

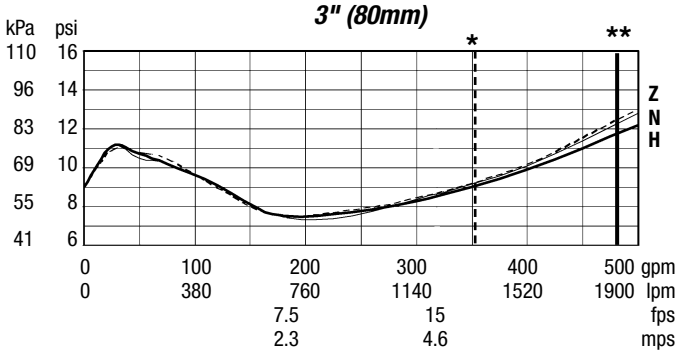
Capacity

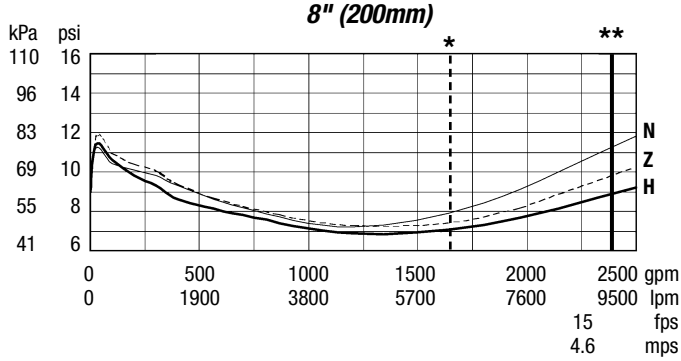
UL/FM Certified Flow Characteristics
Flow characteristics collected using butterfly shutoff valves.
See literature S-MAXIM-400/500 for gate valve flow characteristics
* = Rated flow ** = UL Tested

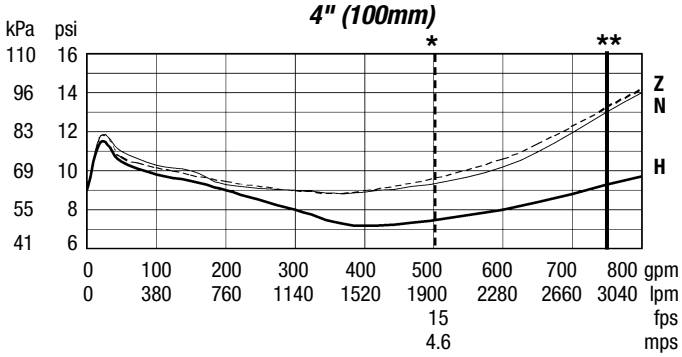
——Horizontal —— N-Pattern - - - - -Z-Pattern

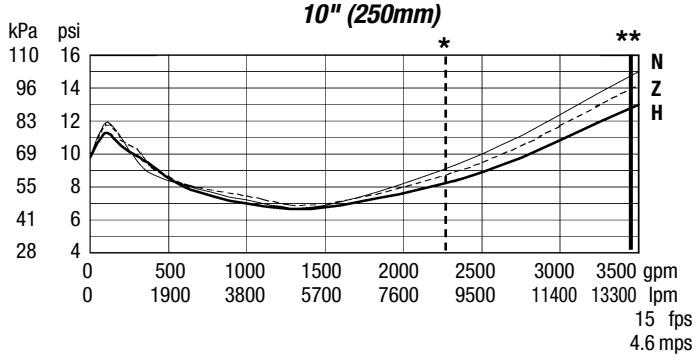












IMPORTANT: *INQUIRE WITH GOVERNING AUTHORITIES FOR LOCAL INSTALLATION REQUIREMENTS*

For additional information, visit our web site at: www.amesfirewater.com

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A Watts Water Technologies Company

USA: Backflow- Sacramento, CA • Tel: (916) 928-0123 • Fax: (916) 928-9333
Control Valves- Houston, TX • Tel: (713) 943-0688 • Fax: (713) 944-9445
Canada: Burlington, ON • Tel: (905) 332-4090 • Fax: (905) 332-7068

ES-A-M500/M500N/M500Z 0649

APPENDIX D

COMPUTER RUNS

PRIVATE FIRE PROTECTION SYSTEM ANALYSIS

NODE AND PIPE DIAGRAM REFERENCE:

Exhibit A at the back of this report.

CONDITIONS MODELED:

1. Fire flow of 2,000 gpm at Node 120.

2. Fire flow of 2,500 gpm split between Nodes 308 and 312.

3. Fire flow of 3,000 gpm split between Nodes 188 and 192.

4. Fire flow of 3,000 gpm split between Nodes 176 and 180.

FLOWRATE IS EXPRESSED IN GPM AND PRESSURE IN PSIG

A SUMMARY OF THE ORIGINAL DATA FOLLOWS

PIPE NO.	NODE NOS.		LENGTH (FEET)	DIAMETER (INCHES)	ROUGHNESS	MINOR LOSS K	FIXED GRADE
101	0	100	190.0	8.0	120.0	.00	905.00
102	0	328	40.0	8.0	120.0	.00	905.00
105	100	104	20.0	8.0	120.0	15.90	
THERE IS A CHECK VALVE IN LINE NUMBER105							
109	104	108	960.0	8.0	120.0	.00	
113	108	112	490.0	8.0	120.0	.00	
117	112	116	610.0	8.0	120.0	.00	
121	116	120	700.0	8.0	120.0	.00	
129	120	128	280.0	8.0	120.0	.00	
133	128	132	590.0	8.0	120.0	.00	
141	132	136	720.0	8.0	120.0	.00	
145	112	136	570.0	8.0	120.0	.00	
149	136	140	400.0	8.0	120.0	.00	
153	108	140	710.0	8.0	120.0	.00	
157	140	144	520.0	8.0	120.0	.00	
161	108	148	450.0	8.0	120.0	.00	
165	144	148	790.0	8.0	120.0	.00	
169	148	152	330.0	8.0	120.0	.00	
173	152	156	940.0	8.0	120.0	.00	
177	152	160	330.0	8.0	120.0	.00	
181	156	160	650.0	8.0	120.0	.00	
185	160	164	330.0	8.0	120.0	.00	
189	164	168	900.0	8.0	120.0	.00	
193	164	172	300.0	8.0	120.0	.00	
197	168	172	620.0	8.0	120.0	.00	
201	176	172	200.0	8.0	120.0	.00	
205	176	180	290.0	8.0	120.0	.00	
209	184	180	590.0	8.0	120.0	.00	
213	188	176	200.0	8.0	120.0	.00	
217	188	184	370.0	8.0	120.0	.00	
225	192	188	530.0	8.0	120.0	.00	
250	300	192	750.0	8.0	120.0	.00	
301	304	300	780.0	8.0	120.0	.00	
305	304	308	770.0	8.0	120.0	.00	
309	308	312	220.0	8.0	120.0	.00	
313	316	312	890.0	8.0	120.0	.00	
317	316	308	470.0	8.0	120.0	.00	
321	304	316	200.0	8.0	120.0	.00	
325	320	304	190.0	8.0	120.0	.00	
327	320	300	470.0	8.0	120.0	.00	
329	324	320	750.0	8.0	120.0	.00	
333	328	324	20.0	8.0	120.0	61.00	
THERE IS A CHECK VALVE IN LINE NUMBER333							

JUNCTION NUMBER	DEMAND	ELEVATION	CONNECTING PIPES
100	.00	724.00	101 105
104	.00	724.00	105 109
108	.00	687.00	109 113 153 161
112	.00	689.00	113 117 145
116	.00	688.00	117 121
120	2000.00	694.00	121 129
128	.00	692.00	129 133
132	.00	686.00	133 141
136	.00	680.00	141 145 149
140	.00	677.00	149 153 157
144	.00	672.00	157 165
148	.00	682.00	161 165 169
152	.00	684.00	169 173 177
156	.00	681.00	173 181
160	.00	687.00	177 181 185
164	.00	692.00	185 189 193
168	.00	694.00	189 197
172	.00	701.00	193 197 201
176	.00	705.00	201 205 213
180	.00	703.00	205 209
184	.00	700.00	209 217
188	.00	702.00	213 217 225
192	.00	685.00	225 250
300	.00	676.00	250 301 327
304	.00	676.00	301 305 321 325
308	.00	684.00	305 309 317
312	.00	687.00	309 313
316	.00	679.00	313 317 321
320	.00	672.00	325 327 329
324	.00	680.00	329 333
328	.00	680.00	102 333

OUTPUT SELECTION: ALL RESULTS ARE OUTPUT EACH PERIOD
5 VALUES ARE OUTPUT FOR MAXIMUM AND MINIMUM PRESSURES

THIS SYSTEM HAS 41 PIPES WITH 31 JUNCTIONS , 9 LOOPS AND 2 FGNS

THE RESULTS ARE OBTAINED AFTER 4 TRIALS WITH AN ACCURACY = .00313

The Junipers
Fire Flow Analysis
2000 gpm Fire Flow at Node 120

PIPE NO.	NODE NOS.		FLOWRATE	HEAD LOSS	PUMP HEAD	MINOR LOSS	VELOCITY	HL/1000
101	0	100	1306.65	6.61	.00	.00	8.34	34.77
102	0	328	693.35	.43	.00	.00	4.43	10.75
105	100	104	1306.65	.70	.00	17.17	8.34	34.77
109	104	108	1306.65	33.38	.00	.00	8.34	34.77
113	108	112	1071.91	11.81	.00	.00	6.84	24.09
117	112	116	1052.32	14.20	.00	.00	6.72	23.29
121	116	120	1052.32	16.30	.00	.00	6.72	23.29
129	120	128	-947.68	-5.37	.00	.00	-6.05	-19.18
133	128	132	-947.68	-11.32	.00	.00	-6.05	-19.18
141	132	136	-947.68	-13.81	.00	.00	-6.05	-19.18
145	112	136	19.59	.01	.00	.00	.13	.01
149	136	140	-928.09	-7.38	.00	.00	-5.92	-18.45
153	108	140	517.01	4.43	.00	.00	3.30	6.24
157	140	144	-411.09	-2.12	.00	.00	-2.62	-4.08
161	108	148	-282.26	-.92	.00	.00	-1.80	-2.04
165	144	148	-411.09	-3.23	.00	.00	-2.62	-4.08
169	148	152	-693.35	-3.55	.00	.00	-4.43	-10.75
173	152	156	-207.75	-1.08	.00	.00	-1.33	-1.15
177	152	160	-485.60	-1.83	.00	.00	-3.10	-5.56
181	156	160	-207.75	-.75	.00	.00	-1.33	-1.15
185	160	164	-693.35	-3.55	.00	.00	-4.43	-10.75
189	164	168	-203.83	-1.00	.00	.00	-1.30	-1.11
193	164	172	-489.52	-1.69	.00	.00	-3.12	-5.64
197	168	172	-203.83	-.69	.00	.00	-1.30	-1.11
201	176	172	693.35	2.15	.00	.00	4.43	10.75
205	176	180	-187.90	-.28	.00	.00	-1.20	-.96
209	184	180	187.90	.57	.00	.00	1.20	.96
213	188	176	505.45	1.20	.00	.00	3.23	5.99
217	188	184	187.90	.35	.00	.00	1.20	.96
225	192	188	693.35	5.70	.00	.00	4.43	10.75
250	300	192	693.35	8.06	.00	.00	4.43	10.75
301	304	300	279.71	1.56	.00	.00	1.79	2.00
305	304	308	.87	.00	.00	.00	.01	.00
309	308	312	-3.29	.00	.00	.00	-.02	.00
313	316	312	3.29	.00	.00	.00	.02	.00
317	316	308	-4.17	.00	.00	.00	-.03	.00
321	304	316	-.87	.00	.00	.00	-.01	.00
325	320	304	279.71	.38	.00	.00	1.79	2.00
327	320	300	413.64	1.94	.00	.00	2.64	4.13
329	324	320	693.35	8.06	.00	.00	4.43	10.75
333	328	324	693.35	.22	.00	18.55	4.43	10.75

JUNCTION NUMBER	DEMAND	GRADE LINE	ELEVATION	PRESSURE
100	.00	898.39	724.00	75.57
104	.00	880.53	724.00	67.83
108	.00	847.15	687.00	69.40
112	.00	835.34	689.00	63.42
116	.00	821.14	688.00	57.69
120	2000.00	804.84	694.00	48.03
128	.00	810.21	692.00	51.22
132	.00	821.53	686.00	58.73

136	.00	835.34	680.00	67.31
140	.00	842.72	677.00	71.81
144	.00	844.84	672.00	74.90
148	.00	848.07	682.00	71.96
152	.00	851.62	684.00	72.63
156	.00	852.70	681.00	74.40
160	.00	853.45	687.00	72.13
164	.00	857.00	692.00	71.50
168	.00	858.00	694.00	71.07
172	.00	858.69	701.00	68.33
176	.00	860.84	705.00	67.53
180	.00	861.12	703.00	68.52
184	.00	861.68	700.00	70.06
188	.00	862.04	702.00	69.35
192	.00	867.74	685.00	79.19
300	.00	875.80	676.00	86.58
304	.00	877.36	676.00	87.26
308	.00	877.36	684.00	83.79
312	.00	877.36	687.00	82.49
316	.00	877.36	679.00	85.96
320	.00	877.74	672.00	89.16
324	.00	885.81	680.00	89.18
328	.00	904.57	680.00	97.31

MAXIMUM PRESSURES

328	.00	904.57	680.00	97.31
324	.00	885.81	680.00	89.18
320	.00	877.74	672.00	89.16
304	.00	877.36	676.00	87.26
300	.00	875.80	676.00	86.58

MINIMUM PRESSURES

120	2000.00	804.84	694.00	48.03
128	.00	810.21	692.00	51.22
116	.00	821.14	688.00	57.69
132	.00	821.53	686.00	58.73
112	.00	835.34	689.00	63.42

THE NET SYSTEM DEMAND = 2000.00

SUMMARY OF INFLOWS(+) AND OUTFLOWS(-) FROM FIXED GRADE NODES

PIPE NUMBER	FLOWRATE
101	1306.65
102	693.35

THE NET FLOW INTO THE SYSTEM FROM FIXED GRADE NODES = 2000.00
THE NET FLOW OUT OF THE SYSTEM INTO FIXED GRADE NODES = .00

A SUMMARY OF CONDITIONS SPECIFIED FOR THE NEXT SIMULATION FOLLOWS

THE FOLLOWING SPECIFIC DEMAND CHANGES ARE MADE :

JUNCTION NUMBER	DEMAND
120	.00

308	1250.00
312	1250.00

THE FOLLOWING CHANGES IN PIPE DATA ARE SPECIFIED

PIPE NO.	NODE NOS.	LENGTH	DIAMETER	ROUGHNESS	MINOR LOSS K	FIXED GRADE
105	100 104	20.0	8.0	120.0	52.00	.00
THERE IS A CHECK VALVE IN LINE NUMBER105						
333	328 324	20.0	8.0	120.0	9.00	.00
THERE IS A CHECK VALVE IN LINE NUMBER333						

THE RESULTS ARE OBTAINED AFTER 5 TRIALS WITH AN ACCURACY = .00287

The Junipers
Fire Flow Analysis
2500 GPM Fire Flow split between Nodes 308 and 312

PIPE NO.	NODE NOS.		FLOWRATE	HEAD LOSS	PUMP HEAD	MINOR LOSS	VELOCITY	HL/1000
101	0	100	742.21	2.32	.00	.00	4.74	12.20
102	0	328	1757.79	2.41	.00	.00	11.22	60.22
105	100	104	742.21	.24	.00	18.12	4.74	12.20
109	104	108	742.21	11.71	.00	.00	4.74	12.20
113	108	112	108.38	.17	.00	.00	.69	.35
117	112	116	32.61	.02	.00	.00	.21	.04
121	116	120	32.61	.03	.00	.00	.21	.04
129	120	128	32.61	.01	.00	.00	.21	.04
133	128	132	32.61	.02	.00	.00	.21	.04
141	132	136	32.61	.03	.00	.00	.21	.04
145	112	136	75.77	.10	.00	.00	.48	.18
149	136	140	108.38	.14	.00	.00	.69	.35
153	108	140	142.69	.41	.00	.00	.91	.58
157	140	144	251.07	.85	.00	.00	1.60	1.64
161	108	148	491.15	2.56	.00	.00	3.13	5.68
165	144	148	251.07	1.29	.00	.00	1.60	1.64
169	148	152	742.21	4.03	.00	.00	4.74	12.20
173	152	156	222.39	1.23	.00	.00	1.42	1.31
177	152	160	519.82	2.08	.00	.00	3.32	6.31
181	156	160	222.39	.85	.00	.00	1.42	1.31
185	160	164	742.21	4.03	.00	.00	4.74	12.20
189	164	168	218.19	1.14	.00	.00	1.39	1.26
193	164	172	524.02	1.92	.00	.00	3.34	6.40
197	168	172	218.19	.78	.00	.00	1.39	1.26
201	176	172	-742.21	-2.44	.00	.00	-4.74	-12.20
205	176	180	201.15	.32	.00	.00	1.28	1.09
209	184	180	-201.15	-.64	.00	.00	-1.28	-1.09
213	188	176	-541.07	-1.36	.00	.00	-3.45	-6.79
217	188	184	-201.15	-.40	.00	.00	-1.28	-1.09
225	192	188	-742.21	-6.46	.00	.00	-4.74	-12.20
250	300	192	-742.21	-9.15	.00	.00	-4.74	-12.20
301	304	300	-794.10	-10.78	.00	.00	-5.07	-13.82
305	304	308	996.04	16.19	.00	.00	6.36	21.03
309	308	312	583.64	1.72	.00	.00	3.73	7.82
313	316	312	666.36	8.89	.00	.00	4.25	9.99
317	316	308	837.60	7.17	.00	.00	5.35	15.26
321	304	316	1503.96	9.02	.00	.00	9.60	45.11
325	320	304	1705.90	10.82	.00	.00	10.89	56.97
327	320	300	51.89	.04	.00	.00	.33	.09
329	324	320	1757.79	45.17	.00	.00	11.22	60.22
333	328	324	1757.79	1.20	.00	17.59	11.22	60.22

JUNCTION NUMBER	DEMAND	GRADE LINE	ELEVATION	PRESSURE
100	.00	902.68	724.00	77.43
104	.00	884.32	724.00	69.47
108	.00	872.61	687.00	80.43
112	.00	872.44	689.00	79.49
116	.00	872.42	688.00	79.91
120	.00	872.39	694.00	77.30
128	.00	872.38	692.00	78.17
132	.00	872.37	686.00	80.76

136	.00	872.34	680.00	83.35
140	.00	872.20	677.00	84.59
144	.00	871.35	672.00	86.39
148	.00	870.06	682.00	81.49
152	.00	866.03	684.00	78.88
156	.00	864.80	681.00	79.65
160	.00	863.95	687.00	76.68
164	.00	859.92	692.00	72.77
168	.00	858.79	694.00	71.41
172	.00	858.00	701.00	68.03
176	.00	855.56	705.00	65.24
180	.00	855.25	703.00	65.97
184	.00	854.61	700.00	67.00
188	.00	854.21	702.00	65.96
192	.00	847.74	685.00	70.52
300	.00	838.59	676.00	70.46
304	.00	827.81	676.00	65.78
308	1250.00	811.61	684.00	55.30
312	1250.00	809.89	687.00	53.25
316	.00	818.79	679.00	60.57
320	.00	838.63	672.00	72.21
324	.00	883.80	680.00	88.31
328	.00	902.59	680.00	96.46

MAXIMUM PRESSURES

328	.00	902.59	680.00	96.46
324	.00	883.80	680.00	88.31
144	.00	871.35	672.00	86.39
140	.00	872.20	677.00	84.59
136	.00	872.34	680.00	83.35

MINIMUM PRESSURES

312	1250.00	809.89	687.00	53.25
308	1250.00	811.61	684.00	55.30
316	.00	818.79	679.00	60.57
176	.00	855.56	705.00	65.24
304	.00	827.81	676.00	65.78

THE NET SYSTEM DEMAND = 2500.00

SUMMARY OF INFLOWS(+) AND OUTFLOWS(-) FROM FIXED GRADE NODES

PIPE NUMBER	FLOWRATE
101	742.21
102	1757.79

THE NET FLOW INTO THE SYSTEM FROM FIXED GRADE NODES = 2500.00
THE NET FLOW OUT OF THE SYSTEM INTO FIXED GRADE NODES = .00

A SUMMARY OF CONDITIONS SPECIFIED FOR THE NEXT SIMULATION FOLLOWS

THE FOLLOWING SPECIFIC DEMAND CHANGES ARE MADE :

JUNCTION NUMBER	DEMAND
120	.00

```
       188            1500.00
       192            1500.00

 THE FOLLOWING CHANGES IN PIPE DATA ARE SPECIFIED


    PIPE NO. NODE NOS. LENGTH  DIAMETER  ROUGHNESS  MINOR LOSS K  FIXED GRADE
    105     100  104       20.0      8.0      120.0        14.70          .00
  THERE IS A CHECK VALVE IN LINE NUMBER105
    333     328  324       20.0      8.0      120.0        10.00          .00
  THERE IS A CHECK VALVE IN LINE NUMBER333


 THE RESULTS ARE OBTAINED AFTER  4 TRIALS WITH AN ACCURACY =  .00218
```

The Junipers
Fire Flow Analysis
3000 GPM Fire Flow split between Nodes 188 and 192

PIPE NO.	NODE NOS.		FLOWRATE	HEAD LOSS	PUMP HEAD	MINOR LOSS	VELOCITY	HL/1000
101	0	100	1332.39	6.85	.00	.00	8.50	36.05
102	0	328	1667.61	2.19	.00	.00	10.64	54.63
105	100	104	1332.39	.72	.00	16.50	8.50	36.05
109	104	108	1332.39	34.61	.00	.00	8.50	36.05
113	108	112	194.12	.50	.00	.00	1.24	1.02
117	112	116	56.98	.06	.00	.00	.36	.11
121	116	120	56.98	.07	.00	.00	.36	.11
129	120	128	56.98	.03	.00	.00	.36	.11
133	128	132	56.98	.06	.00	.00	.36	.11
141	132	136	56.98	.08	.00	.00	.36	.11
145	112	136	137.15	.30	.00	.00	.88	.53
149	136	140	194.12	.41	.00	.00	1.24	1.02
153	108	140	256.50	1.21	.00	.00	1.64	1.70
157	140	144	450.62	2.52	.00	.00	2.88	4.84
161	108	148	881.76	7.55	.00	.00	5.63	16.78
165	144	148	450.62	3.82	.00	.00	2.88	4.84
169	148	152	1332.39	11.90	.00	.00	8.50	36.05
173	152	156	399.23	3.64	.00	.00	2.55	3.87
177	152	160	933.15	6.15	.00	.00	5.96	18.64
181	156	160	399.23	2.51	.00	.00	2.55	3.87
185	160	164	1332.39	11.90	.00	.00	8.50	36.05
189	164	168	391.68	3.36	.00	.00	2.50	3.73
193	164	172	940.70	5.68	.00	.00	6.00	18.92
197	168	172	391.68	2.32	.00	.00	2.50	3.73
201	176	172	-1332.39	-7.21	.00	.00	-8.50	-36.05
205	176	180	361.09	.93	.00	.00	2.30	3.21
209	184	180	-361.09	-1.90	.00	.00	-2.30	-3.21
213	188	176	-971.30	-4.01	.00	.00	-6.20	-20.07
217	188	184	-361.09	-1.19	.00	.00	-2.30	-3.21
225	192	188	167.61	.41	.00	.00	1.07	.78
250	300	192	1667.61	40.97	.00	.00	10.64	54.63
301	304	300	672.78	7.93	.00	.00	4.29	10.17
305	304	308	.00	.00	.00	.00	.00	.00
309	308	312	.00	.00	.00	.00	.00	.00
313	316	312	.00	.00	.00	.00	.00	.00
317	316	308	.00	.00	.00	.00	.00	.00
321	304	316	.00	.00	.00	.00	.00	.00
325	320	304	672.78	1.93	.00	.00	4.29	10.17
327	320	300	994.84	9.86	.00	.00	6.35	20.99
329	324	320	1667.61	40.97	.00	.00	10.64	54.63
333	328	324	1667.61	1.09	.00	17.59	10.64	54.63

JUNCTION NUMBER	DEMAND	GRADE LINE	ELEVATION	PRESSURE
100	.00	898.15	724.00	75.47
104	.00	880.93	724.00	68.00
108	.00	846.32	687.00	69.04
112	.00	845.82	689.00	67.96
116	.00	845.76	688.00	68.36
120	.00	845.68	694.00	65.73
128	.00	845.65	692.00	66.58
132	.00	845.59	686.00	69.16

136	.00	845.52	680.00	71.72
140	.00	845.11	677.00	72.85
144	.00	842.59	672.00	73.92
148	.00	838.77	682.00	67.93
152	.00	826.87	684.00	61.91
156	.00	823.23	681.00	61.63
160	.00	820.72	687.00	57.95
164	.00	808.82	692.00	50.62
168	.00	805.46	694.00	48.30
172	.00	803.15	701.00	44.26
176	.00	795.94	705.00	39.41
180	.00	795.01	703.00	39.87
184	.00	793.11	700.00	40.35
188	1500.00	791.92	702.00	38.97
192	1500.00	792.33	685.00	46.51
300	.00	833.30	676.00	68.16
304	.00	841.23	676.00	71.60
308	.00	841.23	684.00	68.13
312	.00	841.23	687.00	66.83
316	.00	841.23	679.00	70.30
320	.00	843.17	672.00	74.17
324	.00	884.13	680.00	88.46
328	.00	902.82	680.00	96.55

MAXIMUM PRESSURES

328	.00	902.82	680.00	96.55
324	.00	884.13	680.00	88.46
100	.00	898.15	724.00	75.47
320	.00	843.17	672.00	74.17
144	.00	842.59	672.00	73.92

MINIMUM PRESSURES

188	1500.00	791.92	702.00	38.97
176	.00	795.94	705.00	39.41
180	.00	795.01	703.00	39.87
184	.00	793.11	700.00	40.35
172	.00	803.15	701.00	44.26

THE NET SYSTEM DEMAND = 3000.00

SUMMARY OF INFLOWS(+) AND OUTFLOWS(-) FROM FIXED GRADE NODES

PIPE NUMBER	FLOWRATE
101	1332.39
102	1667.61

THE NET FLOW INTO THE SYSTEM FROM FIXED GRADE NODES = 3000.00
THE NET FLOW OUT OF THE SYSTEM INTO FIXED GRADE NODES = .00

A SUMMARY OF CONDITIONS SPECIFIED FOR THE NEXT SIMULATION FOLLOWS

THE FOLLOWING SPECIFIC DEMAND CHANGES ARE MADE :

JUNCTION NUMBER	DEMAND
120	.00

176	1500.00
180	1500.00

THE FOLLOWING CHANGES IN PIPE DATA ARE SPECIFIED

PIPE NO.	NODE NOS.	LENGTH	DIAMETER	ROUGHNESS	MINOR LOSS K	FIXED GRADE
105	100 104	20.0	8.0	120.0	12.30	.00

THERE IS A CHECK VALVE IN LINE NUMBER105

333	328 324	20.0	8.0	120.0	11.50	.00

THERE IS A CHECK VALVE IN LINE NUMBER333

THE RESULTS ARE OBTAINED AFTER 3 TRIALS WITH AN ACCURACY = .00013

The Junipers
Fire Flow Analysis
3000 GPM Fire Flow split between Nodes 176 and 180

PIPE NO.	NODE NOS.		FLOWRATE	HEAD LOSS	PUMP HEAD	MINOR LOSS	VELOCITY	HL/1000
101	0	100	1465.23	8.17	.00	.00	9.35	42.99
102	0	328	1534.77	1.87	.00	.00	9.80	46.84
105	100	104	1465.23	.86	.00	16.70	9.35	42.99
109	104	108	1465.23	41.27	.00	.00	9.35	42.99
113	108	112	213.48	.59	.00	.00	1.36	1.21
117	112	116	62.66	.08	.00	.00	.40	.13
121	116	120	62.66	.09	.00	.00	.40	.13
129	120	128	62.66	.04	.00	.00	.40	.13
133	128	132	62.66	.07	.00	.00	.40	.13
141	132	136	62.66	.09	.00	.00	.40	.13
145	112	136	150.82	.36	.00	.00	.96	.64
149	136	140	213.48	.49	.00	.00	1.36	1.21
153	108	140	282.08	1.44	.00	.00	1.80	2.03
157	140	144	495.55	3.00	.00	.00	3.16	5.77
161	108	148	969.68	9.01	.00	.00	6.19	20.01
165	144	148	495.55	4.56	.00	.00	3.16	5.77
169	148	152	1465.23	14.19	.00	.00	9.35	42.99
173	152	156	439.04	4.34	.00	.00	2.80	4.61
177	152	160	1026.19	7.33	.00	.00	6.55	22.23
181	156	160	439.04	3.00	.00	.00	2.80	4.61
185	160	164	1465.23	14.19	.00	.00	9.35	42.99
189	164	168	430.73	4.01	.00	.00	2.75	4.45
193	164	172	1034.50	6.77	.00	.00	6.60	22.56
197	168	172	430.73	2.76	.00	.00	2.75	4.45
201	176	172	-1465.23	-8.60	.00	.00	-9.35	-42.99
205	176	180	878.82	4.84	.00	.00	5.61	16.68
209	184	180	621.18	5.18	.00	.00	3.96	8.77
213	188	176	913.59	3.58	.00	.00	5.83	17.92
217	188	184	621.18	3.25	.00	.00	3.96	8.77
225	192	188	1534.77	24.83	.00	.00	9.80	46.84
250	300	192	1534.77	35.13	.00	.00	9.80	46.84
301	304	300	619.16	6.80	.00	.00	3.95	8.72
305	304	308	.00	.00	.00	.00	.00	.00
309	308	312	.00	.00	.00	.00	.00	.00
313	316	312	.00	.00	.00	.00	.00	.00
317	316	308	.00	.00	.00	.00	.00	.00
321	304	316	.00	.00	.00	.00	.00	.00
325	320	304	619.16	1.66	.00	.00	3.95	8.72
327	320	300	915.61	8.46	.00	.00	5.84	18.00
329	324	320	1534.77	35.13	.00	.00	9.80	46.84
333	328	324	1534.77	.94	.00	17.13	9.80	46.84

JUNCTION NUMBER	DEMAND	GRADE LINE	ELEVATION	PRESSURE
100	.00	896.83	724.00	74.89
104	.00	879.27	724.00	67.28
108	.00	838.01	687.00	65.44
112	.00	837.41	689.00	64.31
116	.00	837.33	688.00	64.71
120	.00	837.25	694.00	62.07
128	.00	837.21	692.00	62.92
132	.00	837.14	686.00	65.49

136	.00	837.05	680.00	68.05
140	.00	836.56	677.00	69.14
144	.00	833.56	672.00	70.01
148	.00	829.00	682.00	63.70
152	.00	814.81	684.00	56.69
156	.00	810.48	681.00	56.11
160	.00	807.48	687.00	52.21
164	.00	793.29	692.00	43.89
168	.00	789.29	694.00	41.29
172	.00	786.53	701.00	37.06
176	1500.00	777.93	705.00	31.60
180	1500.00	773.09	703.00	30.37
184	.00	778.27	700.00	33.92
188	.00	781.51	702.00	34.46
192	.00	806.34	685.00	52.58
300	.00	841.47	676.00	71.70
304	.00	848.27	676.00	74.65
308	.00	848.27	684.00	71.18
312	.00	848.27	687.00	69.88
316	.00	848.27	679.00	73.35
320	.00	849.93	672.00	77.10
324	.00	885.06	680.00	88.86
328	.00	903.13	680.00	96.69

MAXIMUM PRESSURES

328	.00	903.13	680.00	96.69
324	.00	885.06	680.00	88.86
320	.00	849.93	672.00	77.10
100	.00	896.83	724.00	74.89
304	.00	848.27	676.00	74.65

MINIMUM PRESSURES

180	1500.00	773.09	703.00	30.37
176	1500.00	777.93	705.00	31.60
184	.00	778.27	700.00	33.92
188	.00	781.51	702.00	34.46
172	.00	786.53	701.00	37.06

THE NET SYSTEM DEMAND = 3000.00

SUMMARY OF INFLOWS(+) AND OUTFLOWS(-) FROM FIXED GRADE NODES

PIPE NUMBER	FLOWRATE
101	1465.23
102	1534.77

THE NET FLOW INTO THE SYSTEM FROM FIXED GRADE NODES = 3000.00
THE NET FLOW OUT OF THE SYSTEM INTO FIXED GRADE NODES = .00

LEGEND

- PROJECT BOUNDARY
- EXISTING 920 ZONE WATER LINE
- PROPOSED PUBLIC WATER LINE
- PROPOSED PRIVATE FIRE PROTECTION LINE
- PROPOSED PRIVATE DOMESTIC LINE
- PROPOSED BACKFLOW PREVENTOR
- 4 — COMPUTER MODEL NODE NUMBER
- 105 — COMPUTER MODEL PIPE NUMBER

CONNECTION DETAIL
NTS

EXISTING 24" TRANSMISSION LINE (DEVELOPMENT TO PROVIDE 25' MIN ACCESS EASEMENT TO EXISTING LINE)

ACCESS EASEMENT TO EXISTING WATER LINE

EXISTING 8" FIRE SERVICE TO BE ABANDONED

920 ZONE RESERVOIR

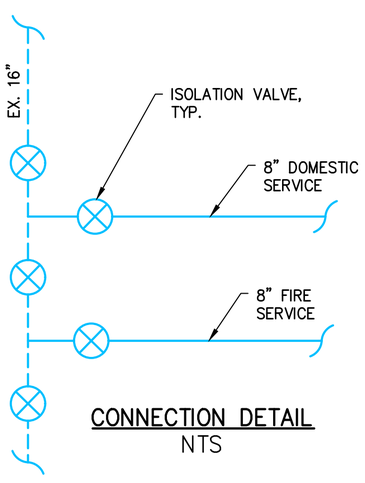
SEE DETAIL ABOVE

SEE DETAIL BELOW

EXISTING GAS MAIN

MADRIGAL ST.
ANDORRA WAY
DEL DIABLO WAY
DEL DIABLO LN.
DEL DIABLO ST.
PENASQUITOS DR.
JANAL WAY
CARMEL MOUNTAIN ROAD
INTERSTATE 15
PVT. DRWY "A"
PVT. DRWY "B"
PVT. DRWY "C"
PVT. DRWY "E"
PVT. DRWY "F"
PVT. DRWY "G"
PVT. DRWY "H"
PVT. DRWY "I"
PVT. DRWY "J"
PVT. DRWY "K"
PVT. DRWY "L"
PVT. DRWY "M"
PVT. DRWY "N"
PVT. DRWY "O"
PVT. DRWY "P"
PVT. DRWY "Q"
PVT. DRWY "R"
PVT. DRWY "S"
PVT. DRWY "T"
PVT. DRWY "U"

NOTE:
FOR PRIVATE DOMESTIC WATER LINE SIZING, SEE FIGURE 2



CONNECTION DETAIL
NTS

N

0 200 FEET

DEXTER WILSON ENGINEERING, INC.
CONSULTING ENGINEERS
2234 FARADAY AVENUE
CARLSBAD, CA 92008
(760) 438-4422

EXHIBIT A

NODE AND PIPE DIAGRAM

THE JUNIPERS