DEXTER WILSON ENGINEERING, INC.

WATER • WASTEWATER • RECYCLED WATER

CONSULTING ENGINEERS

WATER SYSTEM ANALYSIS
FOR THE AVION PROJECT
IN THE CITY OF SAN DIEGO
PTS No. 598173

August 27, 2018

2234 FARADAY AVENUE • CARLSBAD, CA • (760) 438-4422

WATER SYSTEM ANALYSIS
FOR THE
AVION PROJECT
IN THE CITY OF SAN DIEGO
PTS No. 598173

August 27, 2018

8-27-2018

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

Job No. 1010-005

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DEXTER WILSON ENGINEERING, INC.

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

August 27, 2018 1010-005

LENNAR
16465 Via Esprillo, Suite 150
San Diego, CA 92127

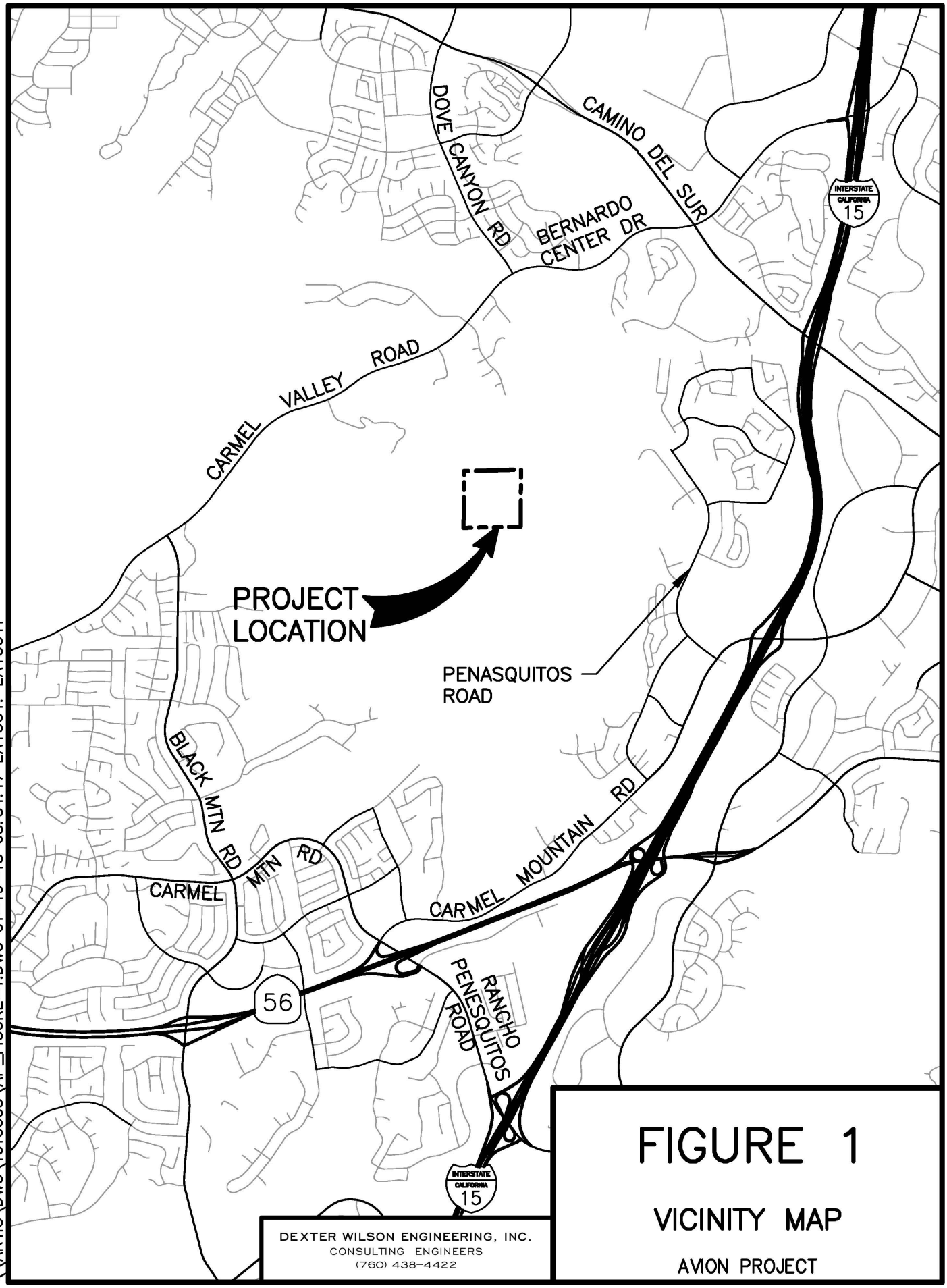
Attention: Alex L. Plishner, Vice President Forward Planning

Subject: Water System Analysis for the Avion Project in the City of San Diego

Introduction

This report provides a water system analysis for the Avion project in the City of San Diego. The project is located south of Carmel Valley Road/Bernardo Center Drive adjacent to the Black Mountain Ranch East Clusters project. The Avion project has common boundaries with and is southwest of the Heritage Bluffs project. Figure 1 provides a location map for the Avion project.

The project encompasses approximately 41.5 acres and proposes 84 single family residential dwelling units and open space. Residential pad elevations within the project range from a low of 769.3 feet to a high of 829.7 feet.



\\ARTIC\DWG\1010005\AP_FIGURE-1.DWG 01-19-18 08:34:17 LAYOUT: LAYOUT1

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FIGURE 1

VICINITY MAP

AVION PROJECT

Purpose of Study

The purpose of this study is to demonstrate the ability of the public water system to provide adequate domestic and fire protection service to the Avion project. This report will verify that the public water system in the vicinity of the Avion project complies with the City of San Diego Water Department water system design standards.

Study Area

The study area for this report is the boundary of the Avion project and the adjacent Heritage Bluffs project as well as the public water system designed to provide water service to the Heritage Bluffs project. The extent of the existing water system which was incorporated into the analysis of the Heritage Bluffs project site was based on the existing Pomerado Park 920 Zone distribution system necessary to serve the Heritage Bluffs project.

The Pomerado Park 920 Pressure Zone water mains are included in the computer model analyses for the Avion project because they provide service to the Heritage Bluffs project. As will be discussed in this study, water service to the Avion project will be connected to the public water system piping within the Heritage Bluffs project.

Water System Design Criteria

The design criteria utilized in the analysis of the Avion project water system are in accordance with the current City of San Diego Water Department Capital Improvements Program Guidelines and Standards, Book 2, Facility Design Guidelines, Chapter 2, Water Demands and Service Criteria, November 2002. The design criteria include a minimum static pressure of 65 pounds per square inch (psi) and maximum static pressure of 120 psi. Residual pressure with all pipes open must be a minimum of 40 psi and pressure loss at any location must not exceed 25 psi below static pressure. For one source out of service, residual pressures at all locations must not be less than 40 psi below static pressure.

For fire flow scenarios, minimum residual pressure must be 20 psi in the area of the fire. The 25 psi and 40 psi maximum pressure drop requirements apply for the remaining portions of the system for all pipes open and one source out of service, respectively. A key criterion is that velocities in the water mains under maximum day plus fire flow demands cannot exceed 15 feet per second.

Avion 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
Single Family Residential	<9	3.5	525 gpd/DU	2,000

Table 2 presents the projected water demand for the Avion project. As shown, the projected average daily water demand is 44,100 gpd (0.044 mgd or 30.6 gpm).

To convert average day demands to maximum daily demands and peak hour demands, Figures 2-2 and 2-1 from the Water Design Guide were used, respectively. Using the peaking curves for the "Inland Central" area, the maximum day peak factor is 2.7 and the peak hour peak factor is 6.5.

TABLE 2 AVION PROJECT ESTIMATED WATER DEMAND			
Land Use	**Quantity**	**Duty Factor**	**Average Water Demand**
SF Residential (<9 DU/AC)	84 DUs	525 gpd/DU	44,100
TOTAL			**44,100**

Thus, the projected maximum day demand for the project is 0.12 mgd (82.7 gpm) and the projected peak hour demand is 0.29 mgd (199 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 Avion project include the Pomerado Park 920 Pressure Zone pipelines needed to provide service to the adjacent Heritage Bluffs project. This existing pipeline system was the recommendation of the water study prepared for the Heritage Bluffs project entitled, *"Water System Analysis for the Heritage Bluffs Project in the City of San Diego,"* October 31, 2014, by Dexter Wilson Engineering, Inc. This system was recommended because the Rancho Bernardo 793 Pressure Zone, of which there is piping in the vicinity of the Heritage Bluffs project, does not have sufficient pressure to provide service to the Heritage Bluffs project. Since the Avion project is higher in elevation than Heritage Bluffs, the existing Rancho Bernardo 793 Pressure Zone cannot provide service to the Avion project.

The Heritage Bluffs water study anticipates service from the Pomerado Park 920 Pressure Zone for the Avion project. The Heritage Bluffs project includes two 12-inch 920 Pressure Zone water mains stubbed to the Avion project boundary at the northeast corner of the Avion project. Figure 2 presents the existing water facilities in the vicinity of the Avion project.

PROPOSED AVION PROJECT

DUAL 12" STUBS FOR AVION PROJECT

PROPOSED HERITAGE BLUFFS PROJECT BY OTHERS

WINE CREEK DR

DUAL 12"

EXISTING 36" RANCHO BERNARDO PIPELINE (793 ZONE)

BERNARDO CENTER DRIVE

CAMINO CRISALIDA

N

0 500 FEET

LEGEND

EXISTING RANCHO BERNARDO 793 ZONE

EXISTING POMERADO PARK 920 ZONE

FIGURE 2

EXISTING WATER FACILITIES

AVION PROJECT

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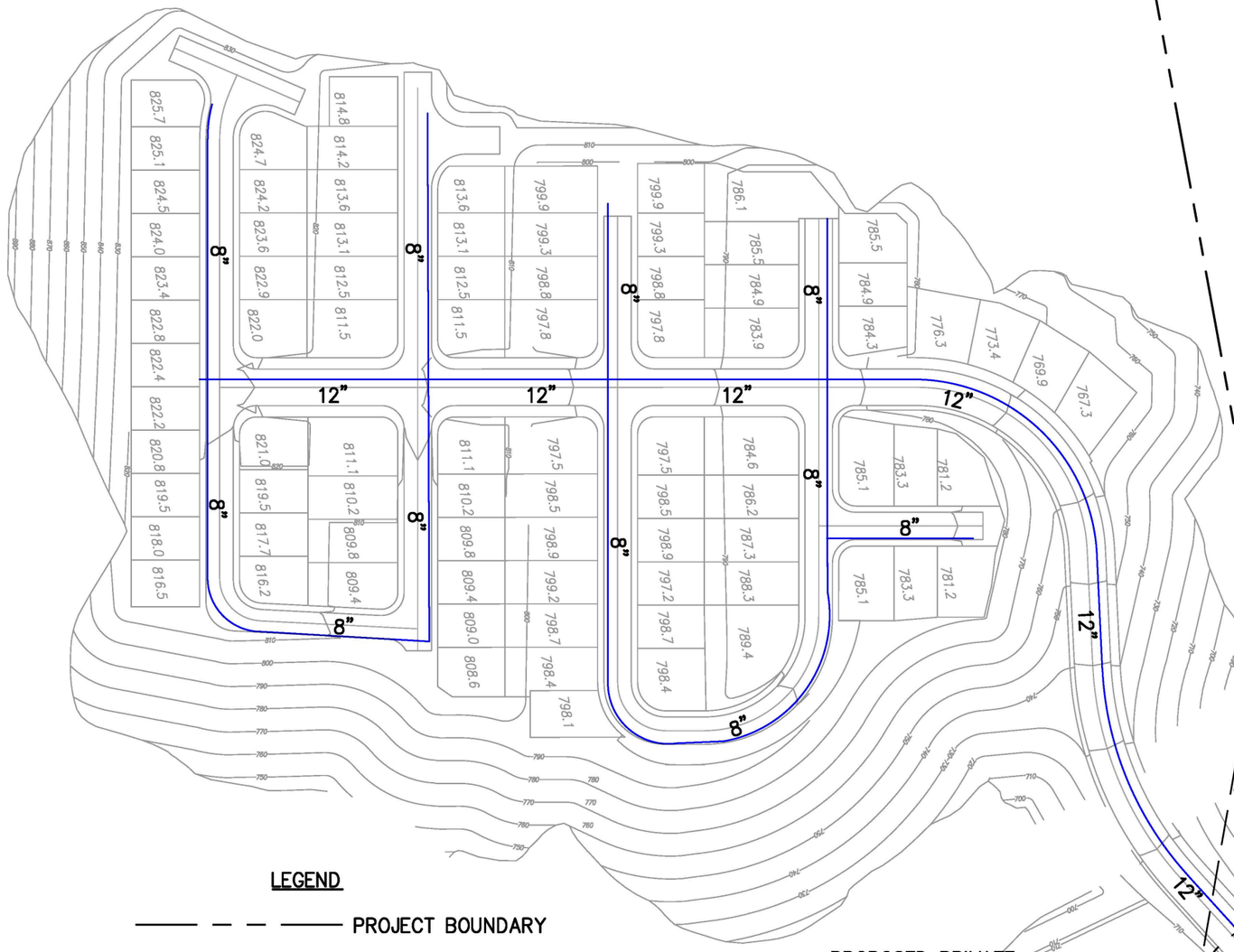
Proposed Water Service to the Avion Project

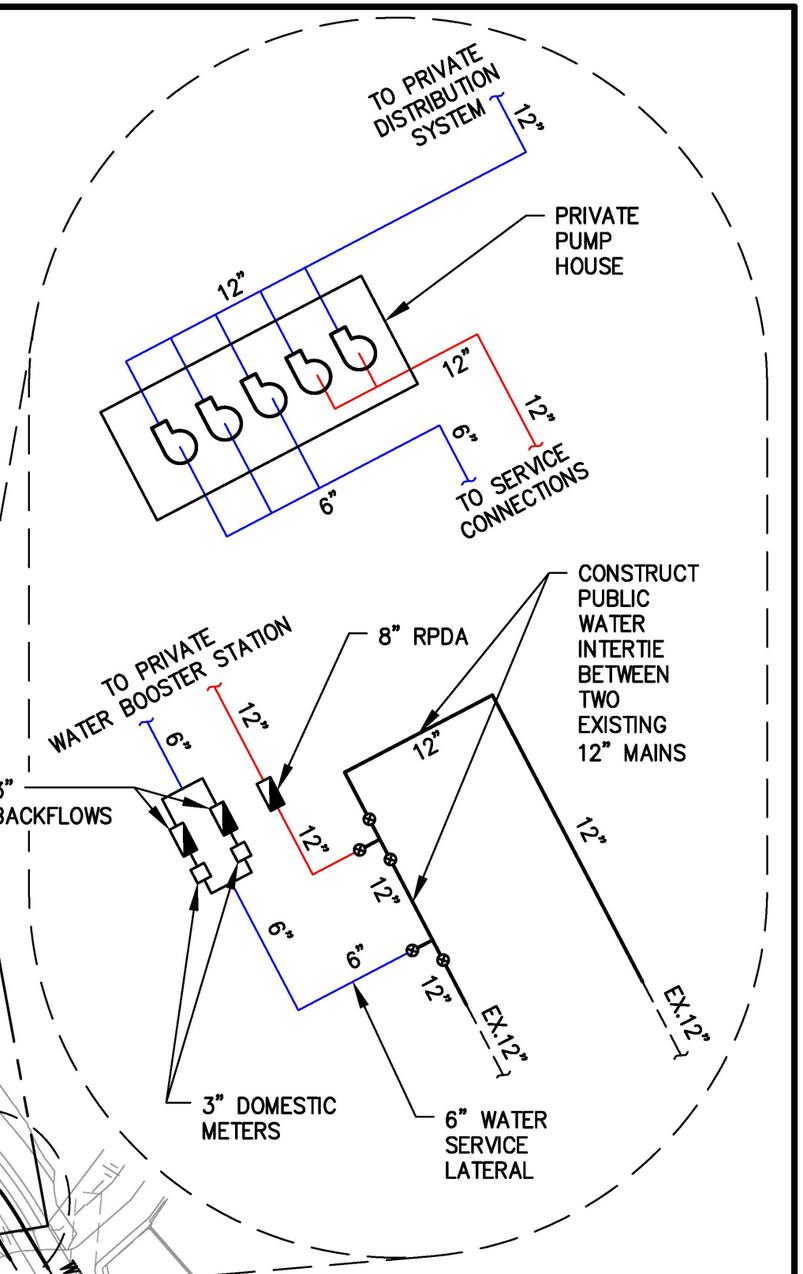
The proposed pad elevations for the Avion project are too high to be served from the 793 Pressure Zone. They are also too high for the Pomerado Park 920 Pressure Zone to provide service. Maximum static pressure within the Avion project from the 920 Pressure Zone would range from a low of 39 psi to a high of 65 psi.

Since this range of service pressures does not meet City design criteria, and no other higher pressure water supply is available, the Avion project will need to boost the water pressure to obtain adequate service. A potable water booster pump station will boost water pressure for both domestic service and fire protection. The water booster station is proposed to be a private facility. Figure 3 presents the proposed water system layout for the Avion project.

The water system for the Avion project is proposed to consist of a 12-inch fire service lateral and a 4-inch domestic service lateral to be located in the Winecreek Drive cul-de-sac at the terminus of the Heritage Bluffs public water system. The proposed 12-inch fire service lateral will include an 8-inch reduced pressure principle detector check assembly after which a 12-inch private fire service protection pipeline will extend to the private water booster station.

The domestic system will consist of a 6-inch water service lateral manifolded to two 3-inch domestic meters followed by 3-inch reduced pressure principle backflow preventers. After the backflow preventers, the 3-inch lines will manifold into a single 6-inch private domestic supply pipeline and extend to the private water booster station. While it is typical to provide a single 4-inch water service lateral for two parallel 3-inch meters, the City of San Diego Public Utilities Department in their cycle review comments dated May 30, 2018, Comment 30, indicated to upsize the water service lateral to 6-inch "...to prevent head loss and provide flow requirements." Figure 3 reflects this recommended domestic water service lateral sizing.





LEGEND

- PROJECT BOUNDARY
- EXISTING PUBLIC WATER LINE
- PROPOSED PUBLIC WATER LINE
- PROPOSED PRIVATE DOMESTIC SERVICE
- PROPOSED PRIVATE FIRE SERVICE

PROPOSED PRIVATE WATER BOOSTER STATION

WINECREEK DRIVE

N

0 120 FEET

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FIGURE 3

PROPOSED WATER LAYOUT

AVION PROJECT

\\ARTIC\DWG\1010005\AP_WAT_FIGURE-3_PROFACILITES.DWG 08-27-18 16:18:52 LAYOUT: LAYOUT

Within the water booster station there will be two sets of pumps. One set of three pumps will take suction from the 6-inch domestic supply pipeline and boost the pressure to provide domestic service to the Avion project via its private onsite water distribution system.

A second set of two pumps will take suction from the 12-inch fire service supply pipeline and provide fire flow capacity to the Avion project. These two fire flow pumps will discharge into the same common discharge pipe header as the domestic pumps, and will provide fire flow capacity for the onsite private fire hydrants connected to the onsite private water distribution system.

Water System Computer Model

The public water system hydraulic analysis needed for the Avion project is to confirm that adequate flow and pressure can be provided by the public water system at the Avion project's points of connection to the public water system. The connection points, as shown in Figure 3, are in the cul-de-sac terminus of Winecreek Drive in the southwest corner of the Heritage Bluffs project. The critical analysis will be to deliver maximum day demands plus 2,000 gpm fire flow to the Avion project connection points with one 12-inch public water line in Bernardo Center Drive out of service.

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 headloss in pipes; the Hazen-Williams "C" value used for all pipes is 120.

The model for this analysis includes the onsite public water system piping for the Heritage Bluffs project and the offsite 920 Pressure Zone piping as recommended for the Heritage Bluffs project. This offsite piping extends to Bernardo Center Drive and Camino Crisalida as shown in Figure 2.

For the computer modeling, a fire hydrant flow test was requested from the City. Appendix B presents the results of the hydrant flow test. As well, Appendix B shows the calculation to extrapolate the available hydraulic gradeline at the Bernardo Center Drive and Camino Crisalida intersection for the maximum day demand plus fire flow scenario. The total flow

for this scenario is 2,250 gpm. Thus, the available hydraulic gradeline to be used at the intersection of Bernardo Center Drive and Camino Crisalida will be 853.4 feet.

Water System Analysis and Results

Results of the computer model hydraulic analysis are provided in Appendix C; Exhibit A provides the corresponding computer model Node and Pipe Diagram. The system was modeled under average day demand, peak hour demand, and maximum day demand plus fire flow scenarios. The demand scenarios were modeled with all pipes open and with a pipe break to verify the reliability of the system.

Offsite Dual 12-inch Water Mains and Intertie Improvements. The critical aspect of the public water supply system for the Avion project is the ability to maintain supply redundancy. For this reason, when the Heritage Bluffs project was designed, the water supply system included two parallel 12-inch water mains from Bernardo Center Drive to Carmel Valley Road, then to Winecreek Drive and to the Heritage Bluffs project. While there are two parallel 12-inch mains, because of the length of these parallel mains (approximately 7,000 feet to the Heritage Bluffs project) if one line was to be out of service, the pressure drop in the second line would be too great to satisfy the City's water system design criteria. Therefore, the dual lines need to have interties so that only sections of any pipeline would be out of service at any one time.

In reviewing the record drawings for the dual 12-inch water lines in Bernardo Center Drive, Carmel Valley Road, and Winecreek Drive, there were no interties shown on the plans. Therefore, this study recommends that interties be constructed on the existing 920 Pressure Zone 12-inch dual water mains.

We recommend that three (3) interties be installed such that no length of 12-inch water supply piping will be longer than 2,200 linear feet. This means that one intertie is to be located in Bernardo Center Drive, one in the Carmel Valley Road segment, and one in Winecreek Drive. Figure 4 shows a schematic design for these interties utilizing some of the existing infrastructure (line valves and cross-ties) that was constructed per the record drawings.

PROPOSED AVION PROJECT

DUAL 12" STUBS FOR AVION PROJECT

DETAIL 1

DETAIL 2

DETAIL 3

PROPOSED HERITAGE BLUFFS PROJECT BY OTHERS

WINE CREEK DR

EXISTING 36" RANCHO BERNARDO PIPELINE (793 ZONE)

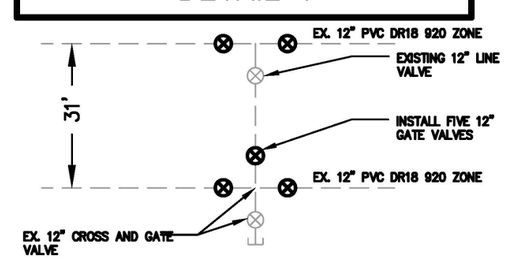
BERNARDO CENTER DRIVE

CAMINO CRISALIDA

N

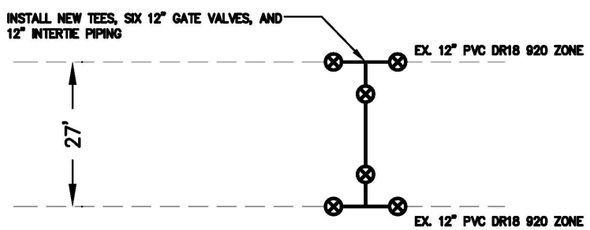
0 500 FEET

DETAIL 1



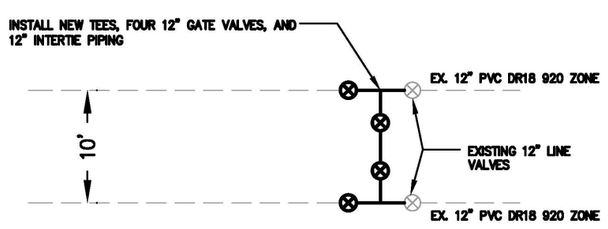
WINECREEK DRIVE STA 29+34.03
(DWG. 38042-104-D)

DETAIL 2



CARMEL VALLEY ROAD STA 148+00
(DWG. 38518-11-D)

DETAIL 3



BERNARDO CENTER DRIVE STA 131+70
(DWG. 38518-13-D)

LEGEND

EXISTING RANCHO BERNARDO 793 ZONE

EXISTING POMERADO PARK 920 ZONE

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FIGURE 4

OFFSITE WATER IMPROVEMENTS

AVION PROJECT

Computer Modeling Results. The results of the computer analysis indicate that the existing public water system from Bernardo Center Drive to the Heritage Bluffs project and through the Heritage Bluffs project to its southwest corner can provide adequate flow and pressure to meet the 20 psi residual criterion for fire flow. Under maximum day demand plus 2,000 gpm fire flow with all pipes open, flow to the Avion project is provided at a residual pressure of 48 psi. Under a pipe break scenario, maximum day demand plus 2,000 gpm fire flow is provided to the Avion project connection point with a residual pressure of 39 psi.

However, note that the City Design Guide allowable pressure drop criterion cannot be achieved considering that the hydrant flow test results in a 29 psi drop from static at the starting point of the dual 12-inch supply piping. A summary of the results in presented in Appendix C.

Water Service to Avion Project. From the two public water system connection points, one for domestic and one for fire service, the Avion project will take the available flow and pressure and design and build a private water booster station to provide sufficient flow and pressure to all the building lots within the project. In order to maintain true redundancy to the public water service for the Avion project, the two existing public 12-inch water stubs in Winecreek Drive must be intertied at the end as is shown in the detail in Figure 3.

The onsite private water pumping and distribution system for the Avion project will be the subject of a separate private water system analysis and summary report that will be prepared for the Avion project. The preparation of this private onsite water system analysis and water booster station preliminary sizing is being delayed until after the Avion project gains tentative map approval to avoid design revisions in the event that the Avion project approval is modified from the currently proposed project.

Hydraulic Control Map

Figure 5 presents a hydraulic control map showing the service areas for the various water pressure zones in the vicinity of the Avion project. This hydraulic control map confirms that no water pressure zones higher than the Pomerado Park 920 Pressure Zone exist in the vicinity of the Avion project.

As determined in this study, the Avion project will be able to obtain water service from the Pomerado Park 920 Pressure Zone by means of constructing a private water booster station within its site. This private water booster station will be supplied by the Pomerado Park 920 Pressure Zone by way of public water service connections to the public water lines in Winecreek Drive.

Hydraulic Grade Line for Private Avion Water System. The minimum hydraulic grade line to be proposed for the Avion private water system will be 980 feet. This is based on providing a minimum of 65 psi static at the highest pad elevation within the project.

The operating hydraulic grade for the Avion private water system is closely tied to the size of the main distribution pipe extending from the private water booster station through the development. A 12-inch line as shown in Figure 3 will reduce the headloss incurred during a fire flow event and thus reduce the pumping head required to deliver the fire flow at 20 psi residual or better. An 8-inch water line may be able to work if the operating hydraulic grade line is set higher than 980 feet.

The best combination of operating hydraulic grade line and main line pipe size will be determined after detailed hydraulic analyses are completed on the onsite private water system. These analyses will include evaluating different pump selections for the different hydraulic conditions and determining which pump selection provides the best long-term reliable and efficient operation.

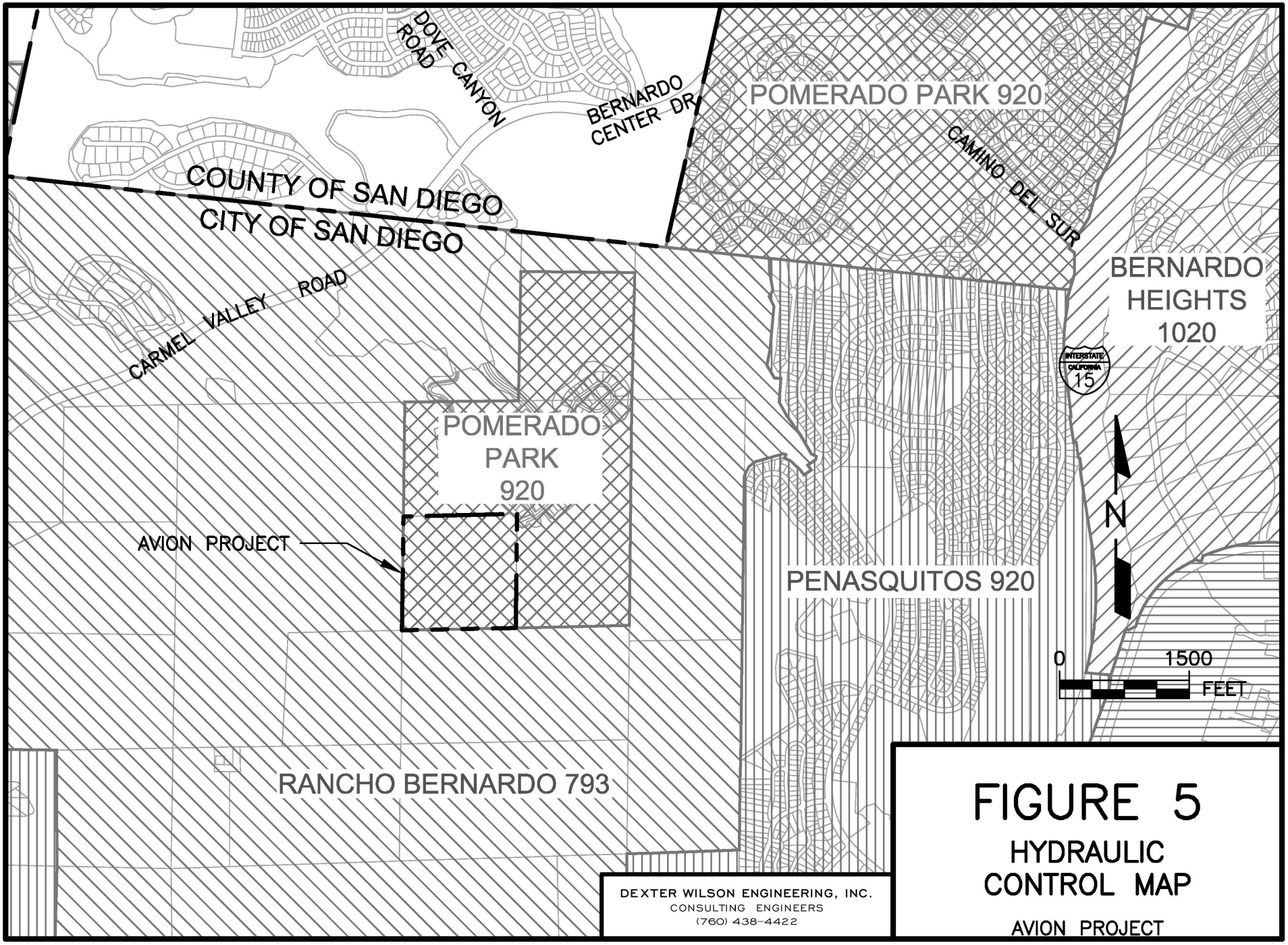

FIGURE 5

HYDRAULIC CONTROL MAP

AVION PROJECT

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Conclusions and Recommendations

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

1. The Avion project will obtain water service from the Pomerado Park 920 Pressure Zone.

2. The Avion project has finish pad elevations which are too high to be served directly from the Pomerado Park 920 Pressure Zone. Onsite maximum static pressures from the Pomerado Park 920 Pressure Zone range from 39 psi to 65 psi.

3. The Avion project will design and build a private water booster station in order to provide adequate flow and pressure within its boundary.

4. Figure 3 provides the recommended water service configuration for the Avion project.

5. The Avion project will make its domestic and fire protection service connections to the existing 12-inch Pomerado Park 920 Pressure Zone public water lines at the southwest terminus of the Heritage Bluffs project in Winecreek Drive.

6. Provided that some offsite water system improvements are made, the existing Pomerado Park 920 Pressure Zone public water system has adequate hydraulic capacity to deliver maximum day demand plus 2,000 gpm fire flow to the Avion project connection points with 48 psi residual pressure (all pipes open) and 39 psi residual pressure (one pipe break scenario).

7. Offsite water system improvements necessary to obtain satisfactory water service to the Avion project include constructing three interties between the existing dual 920 Pressure Zone 12-inch water supply lines. The locations and schematic configurations for these three interties are shown in Figure 4.

8. At the Winecreek Drive cul-de-sac where the Avion project will make its connections to the public water system, the two existing 920 Pressure Zone 12-inch water lines must be intertied with piping and valves as shown in the detail in Figure 3.

9. The onsite private water system analysis and water booster station design for the Avion project will be prepared under separate cover.

10. All building services that will receive service pressures within the Avion project in excess of 80 psi should have individual pressure regulators to meet Uniform Plumbing Code criteria.

11. If any water lines to be constructed by this development are metallic, a California Licensed Corrosion Engineer will be required to perform a soil corrosivity study and to design a Corrosion Control System.

If you have any questions regarding the information or conclusions and recommendations presented in this report, please do not hesitate to call.

Dexter Wilson Engineering, Inc.

Andrew Oven, P.E.

AO:sg

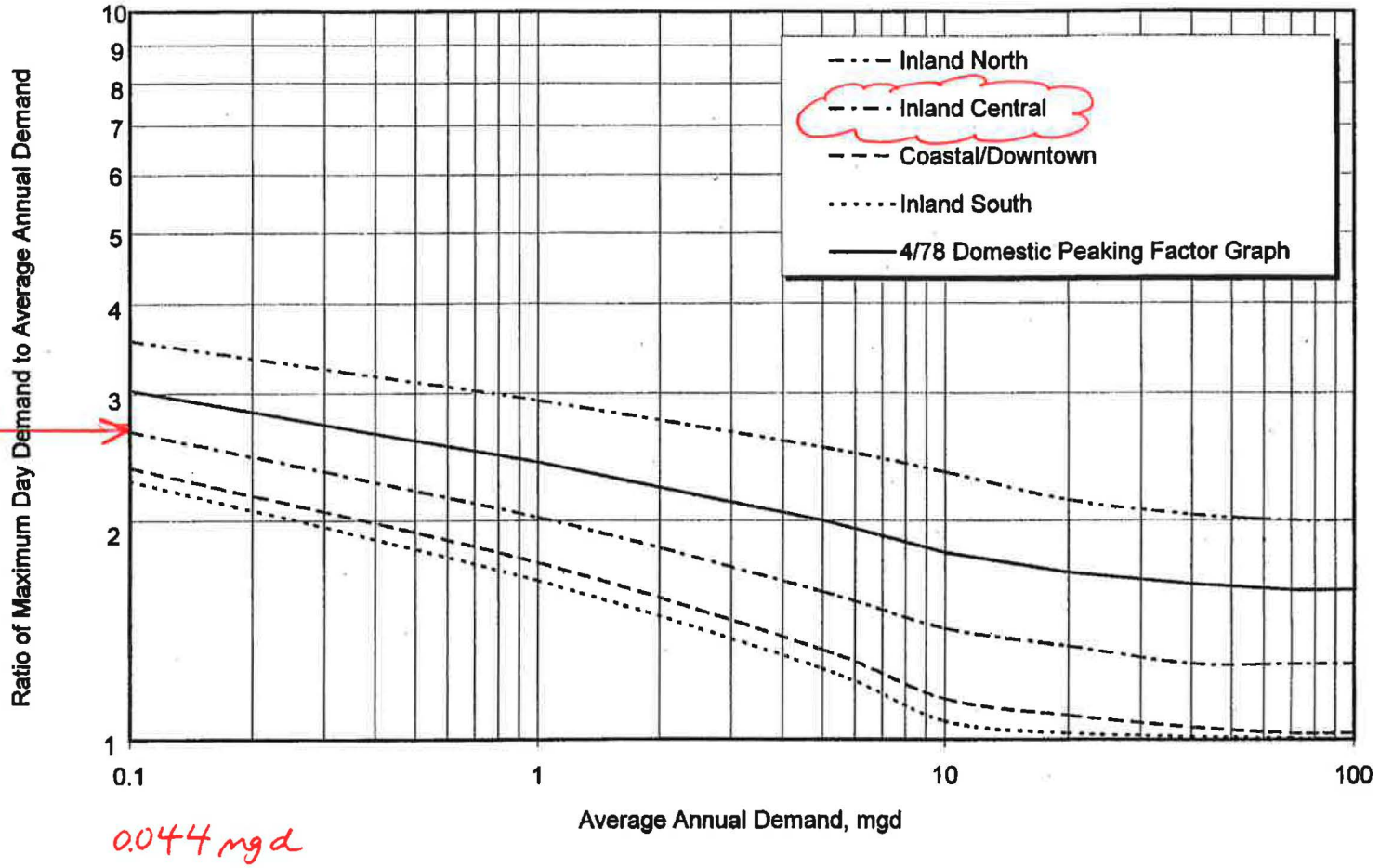
cc: Marina Wurst, Project Design Consultants

Attachments

APPENDIX A

WATER DEMAND PEAKING FACTOR CHARTS

FIGURE 2-2
MAXIMUM DAY DEMAND FACTOR

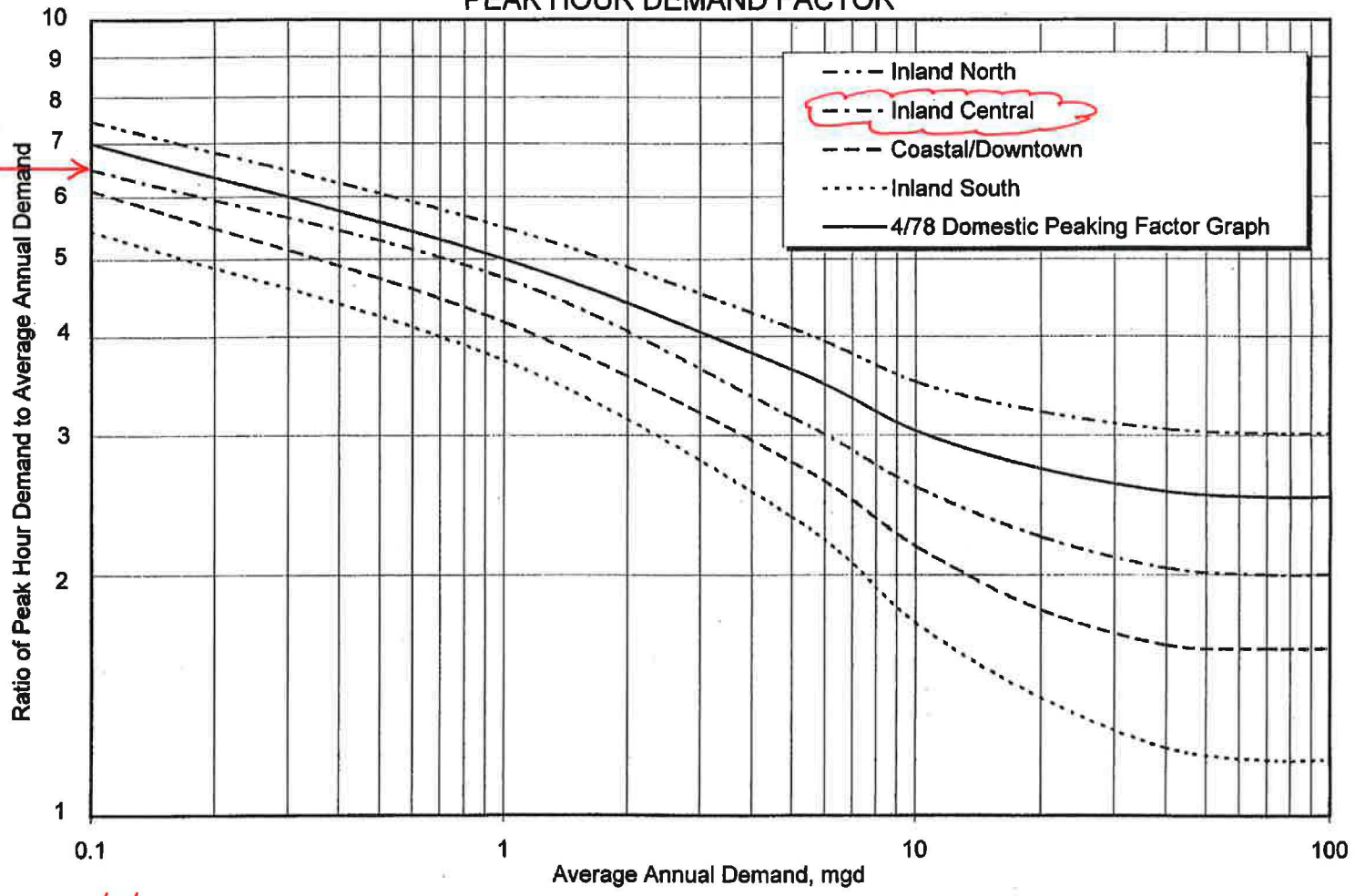


2-4

2.7

0.044 mgd

FIGURE 2-1
PEAK HOUR DEMAND FACTOR



APPENDIX B

FIRE HYDRANT FLOW TEST DATA

City of San Diego
Development Services
Attention: **Hydrant Flow Request**
1222 First Ave., MS-401
San Diego, CA 92101
(619) 446-5000

Hydrant Flow Request

FORM DS-160
October 2016

Fill out the information below completely for all sprinkler system flow requests, including NFPA 13, 13D and 13R systems. E-mail form to: DSDHydrantFlow@sandiego.gov, or mail request to the above address.

Please print or type legibly.

Company Requesting Hydrant Flow:
Dexter Wilson Engineering, Inc.

Telephone No:	Fax No:	E-mail Address:
760-438-4422	760-438-0173	andrew@dwilsoneng.com

Project Number for the Building Permits:
None available at this time.

Location of Hydrants:
15500 Bernardo Center Drive

Cross Street:	City:	State:	ZIP Code:
Camino Crisalida	San Diego	CA	92129

FOR CITY USE ONLY

Facility Sequence Number: (FSN): H534136

Static: 107.9 PSI — Elevation: 666' FEET

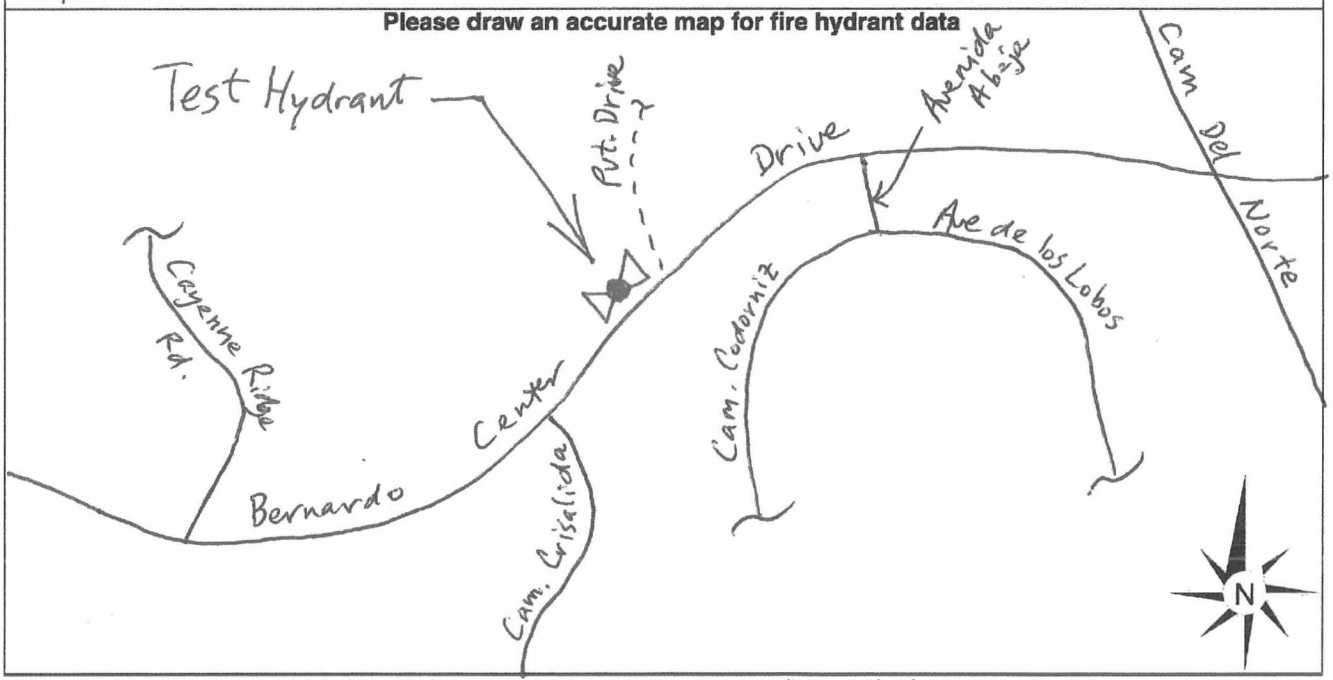
Pitot: MOSER PSI — Residual: 95.2 PSI

Date: 1/25/2018 — Flow: 1506 GPM

Researched in database by: G. PARAISO

The information provided above is based upon a water model. It is the contractor's responsibility to confirm the available static pressure at the system point of connection. If a discrepancy is noticed at that time, notify DSDHydrantFlow@sandiego.gov as soon as possible.

Please draw an accurate map for fire hydrant data

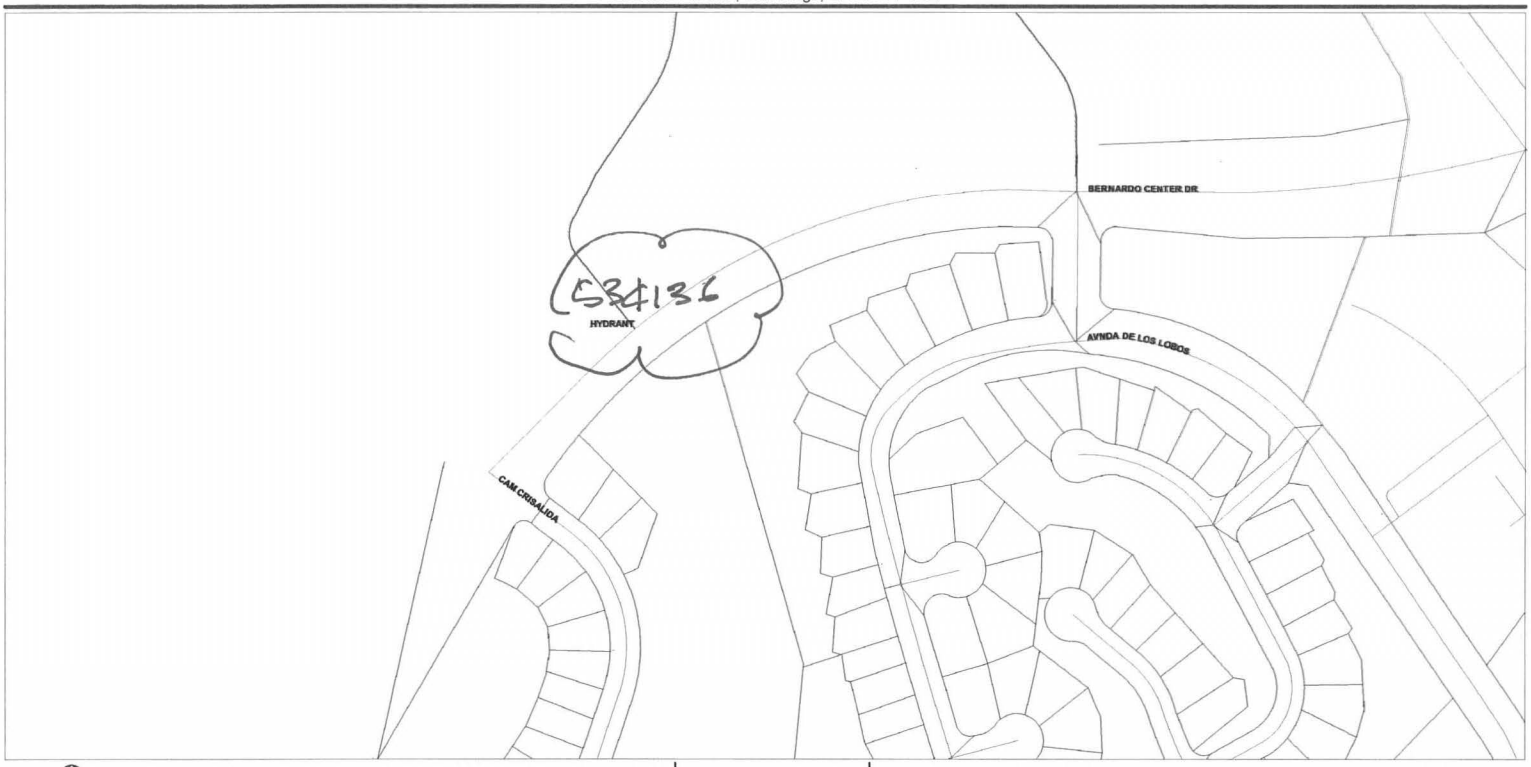


Parcel Information Report

1/25/2018 07:42:54

THE CITY OF SAN DIEGO
Development Services Department
1222 First Avenue, San Diego, CA 92101-4154

Report Number 101



North

316 feet

Scale Is Approximate

Map Layers Included In Report

Description	Visible	Transparent	Has Intersecting Features
Roads	☑		Yes
Freeways	☑		No
Parcels	☑	☑	Yes
Water Hydrants	☑		Yes

Intersecting Features

Roads

Road Name
PRIVATE RD
PRIVATE RD
PRIVATE RD
PRIVATE RD
PRIVATE RD

Parcels

APN	Recordation	Owner Information	Valuation		Other
313-301-3200	Record: 424159 Date: 7/6/1994	E Q R-DEERWOOD VISTAS INC	Land:	$10,275,929	Units: 316
	Legal:	P O BOX 87407	Imp:	$19,509,803	Taxable: ☑
Address(es)	LOT 1 (EX ST)LOT 2&	CHICAGO IL 60680	Total:	$29,785,732	Own Occ: ☐
15598 BERNARDO CENTER DR					

OPARAISO

Fire Hydrant Flow Test Date January 25, 2018

Gauge Hydrant Location	15500 Bernardo Center Drive	**Elev.**	666 feet
Flow Hydrant Location	15500 Bernardo Center Drive	**Elev.**	666 feet

Input Flow Test Results

Static Pressure	107.9	PSI		
Residual Pressure	95.2	PSI		
Hydrant Flow	1506	GPM		
Actual Hydrant Elevation	666	Feet	HGL	915.0 Feet
Estimated Hydrant Elevation		Feet	HGL	0.0 Feet

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

k = 3.87314E-05

Extrapolated Calculations

Q, gpm	Residual Pressure	Available HGL
500	106.2 psi	911.2 ft
700	104.8 psi	907.9 ft
900	103.0 psi	903.7 ft
1100	100.8 psi	898.6 ft
1300	98.2 psi	892.7 ft
1500	95.3 psi	885.9 ft
1700	92.0 psi	878.4 ft
1900	88.4 psi	870.0 ft
2000	86.4 psi	865.5 ft
2100	84.4 psi	860.8 ft
2250	81.2 psi	853.4 ft
2500	75.5 psi	840.2 ft
2700	70.5 psi	828.7 ft
2900	65.2 psi	816.5 ft
3100	59.6 psi	803.6 ft
3300	53.7 psi	789.9 ft
3500	47.5 psi	775.5 ft
3700	40.9 psi	760.4 ft
3900	34.1 psi	744.6 ft
4000	30.5 psi	736.4 ft
4100	26.9 psi	728.1 ft
4300	19.4 psi	710.9 ft
4500	11.7 psi	693.0 ft

Residual Pressure, psi	Available Flow, gpm
0 psi	4,787
10 psi	4,542
20 psi	4,285
25 psi	4,152
30 psi	4,014
35 psi	3,873
40 psi	3,727
45 psi	3,576
50 psi	3,420
55 psi	3,257
60 psi	3,086
65 psi	2,908
70 psi	2,720
75 psi	2,519
80 psi	2,305
85 psi	2,071

APPENDIX C

COMPUTER MODEL OUTPUT

NODE AND PIPE DIAGRAM – Reference Exhibit A at the back of the report

Case 1 - All Pipes Open

Case 2 - Pipe 3 Closed

CASE 1 – ALL PIPES OPEN

The following conditions were modeled:

1. Average Day Demand

2. Peak Hour Demand

3. Maximum Day Demand plus 2,000 gpm Fire Flow at Node 40

Project: Avion Water System Analysis
Date: 2/13/2018
Job Number: 1010-005

Scenario: All Pipes Open - Average Day Demands

Pipe No.	Pipe Size (inches)	Model Run Flow (gpm)	Model Run V (fps)
1	12	46.3	0.13
2	12	46.3	0.13
3	12	46.3	0.13
4	12	46.3	0.13
5	12	42.2	0.12
7	12	50.4	0.14
8	12	46.3	0.13
9	12	46.4	0.13
10	12	46.3	0.13
13	12	38.2	0.11
15	12	35.2	0.1
17	8	8	0.05
19	8	4	0.03
21	12	24.2	0.07
23	8	-1.03	-0.01
25	8	-4.03	-0.03
27	8	-7.03	-0.04
29	8	5	0.03
31	8	5	0.03
33	8	3.91	0.02
35	8	-0.09	0
37	8	3.09	0.02
39	12	25.37	0.07
41	8	5.56	0.04
43	8	1.56	0.01
45	12	22.23	0.06
47	12	20.79	0.06
49	12	16.81	0.05
51	12	-12.81	-0.04
53	12	15.3	0.04
55	12	15.3	0.04

Project: Avion Water System Analysis
Date: 2/13/2018
Job Number: 1010-005

Scenario: All Pipes Open - Average Day Demands

Node No.	Node El. Ft.	HGL Zone Ft.	Static P psi	Model Run P, psi	Delta P from static
1	518	920	174.18	172.02	-2.16
2	678	920	104.85	102.67	-2.18
3	520	920	173.31	171.16	-2.15
4	683	920	102.69	100.5	-2.19
6	682	920	103.12	100.94	-2.18
8	690	920	99.65	97.47	-2.18
10	695	920	97.49	95.3	-2.19
12	690	920	99.65	97.47	-2.18
14	665	920	110.49	108.3	-2.19
16	698	920	96.19	94	-2.19
18	699	920	95.75	93.57	-2.18
20	706	920	92.72	90.53	-2.19
22	706	920	92.72	90.53	-2.19
24	718	920	87.52	85.33	-2.19
26	724	920	84.92	82.73	-2.19
28	739	920	78.42	76.23	-2.19
30	733	920	81.02	78.83	-2.19
32	721	920	86.22	84.03	-2.19
34	713	920	89.69	87.5	-2.19
36	726	920	84.06	81.87	-2.19
38	750	920	73.66	71.47	-2.19
40	710	920	90.99	88.8	-2.19

Project: Avion Water System Analysis
Date: 2/13/2018
Job Number: 1010-005

Scenario: All Pipes Open - Peak Hour Demands

Pipe No.	Pipe Size (inches)	Model Run Flow (gpm)	Model Run V (fps)
1	12	300.95	0.85
2	12	300.95	0.85
3	12	300.95	0.85
4	12	300.95	0.85
5	12	274.29	0.78
7	12	327.61	0.93
8	12	300.95	0.85
9	12	301.61	0.86
10	12	300.95	0.85
13	12	248.29	0.7
15	12	228.79	0.65
17	8	52	0.33
19	8	26	0.17
21	12	157.29	0.45
23	8	-6.7	-0.04
25	8	-26.2	-0.17
27	8	-45.7	-0.29
29	8	32.5	0.21
31	8	32.5	0.21
33	8	25.39	0.16
35	8	-0.61	0
37	8	20.11	0.13
39	12	164.91	0.47
41	8	36.16	0.23
43	8	10.16	0.06
45	12	144.49	0.41
47	12	135.15	0.38
49	12	109.25	0.31
51	12	-83.25	-0.24
53	12	99.45	0.28
55	12	99.45	0.28

Project: Avion Water System Analysis
Date: 2/13/2018
Job Number: 1010-005

Scenario: All Pipes Open - Peak Hour Demands

Node No.	Node El. Ft.	HGL Zone Ft.	Static P psi	Model Run P, psi	Delta P from static
1	518	920	174.18	171.45	-2.73
2	678	920	104.85	101.85	-3.00
3	520	920	173.31	170.88	-2.43
4	683	920	102.69	99.54	-3.15
6	682	920	103.12	99.99	-3.13
8	690	920	99.65	96.49	-3.16
10	695	920	97.49	94.3	-3.19
12	690	920	99.65	96.46	-3.19
14	665	920	110.49	107.29	-3.20
16	698	920	96.19	92.99	-3.20
18	699	920	95.75	92.56	-3.19
20	706	920	92.72	89.53	-3.19
22	706	920	92.72	89.53	-3.19
24	718	920	87.52	84.33	-3.19
26	724	920	84.92	81.72	-3.20
28	739	920	78.42	75.22	-3.20
30	733	920	81.02	77.82	-3.20
32	721	920	86.22	83.01	-3.21
34	713	920	89.69	86.48	-3.21
36	726	920	84.06	80.83	-3.23
38	750	920	73.66	70.44	-3.22
40	710	920	90.99	87.76	-3.23

Project: Avion Water System Analysis
Date: 2/13/2018
Job Number: 1010-005

Scenario: All Pipes Open - Maximum Day Demands + 2000 gpm Fire Flow at Node 40

Pipe No.	Pipe Size (inches)	Model Run Flow (gpm)	Model Run V (fps)
1	12	1125.05	3.19
2	12	1125.05	3.19
3	12	1125.05	3.19
4	12	1125.05	3.19
5	12	1005.97	2.85
7	12	1244.13	3.53
8	12	1125.05	3.19
9	12	1233.33	3.5
10	12	1125.05	3.19
13	12	995.17	2.82
15	12	987.07	2.8
17	8	21.6	0.14
19	8	10.8	0.07
21	12	957.37	2.72
23	8	-148.07	-0.95
25	8	-156.17	-1
27	8	-164.27	-1.05
29	8	13.5	0.09
31	8	13.5	0.09
33	8	10.55	0.07
35	8	-0.25	0
37	8	8.35	0.05
39	12	1031.26	2.93
41	8	199.92	1.28
43	8	189.12	1.21
45	12	1097.34	3.11
47	12	1278.36	3.63
49	12	823.24	2.34
51	12	-812.44	-2.3
53	12	1041.35	2.95
55	12	1041.35	2.95

Project: Avion Water System Analysis
Date: 2/13/2018
Job Number: 1010-005

Scenario: All Pipes Open - Maximum Day Demands + 2000 gpm Fire Flow at Node 40

Node No.	Node El. Ft.	HGL Zone Ft.	Static P psi	Model Run P, psi	Delta P from static
1	518	920	174.18	138.63	-35.55
2	678	920	104.85	66.23	-38.62
3	520	920	173.31	141.13	-32.18
4	683	920	102.69	62.34	-40.35
6	682	920	103.12	63.14	-39.98
8	690	920	99.65	59.17	-40.48
10	695	920	97.49	56.63	-40.86
12	690	920	99.65	58.79	-40.86
14	665	920	110.49	69.63	-40.86
16	698	920	96.19	55.09	-41.10
18	699	920	95.75	54.7	-41.05
20	706	920	92.72	51.8	-40.92
22	706	920	92.72	51.86	-40.86
24	718	920	87.52	46.66	-40.86
26	724	920	84.92	44.05	-40.87
28	739	920	78.42	37.55	-40.87
30	733	920	81.02	39.75	-41.27
32	721	920	86.22	44.73	-41.49
34	713	920	89.69	48.03	-41.66
36	726	920	84.06	41.8	-42.26
38	750	920	73.66	31.85	-41.81
40	710	920	90.99	48.45	-42.54

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
1	0	3	2110.0	12.0	120.0	.00	915.00
2	1	2	1940.0	12.0	120.0	.00	
3	0	3	2110.0	12.0	120.0	.00	915.00
4	1	2	1940.0	12.0	120.0	.00	
5	2	6	1050.0	12.0	120.0	.00	
7	2	4	900.0	12.0	120.0	.00	
8	3	1	2120.0	12.0	120.0	.00	
9	4	22	275.0	12.0	120.0	.00	
10	3	1	2120.0	12.0	120.0	.00	
13	6	8	400.0	12.0	120.0	.00	
15	8	10	300.0	12.0	120.0	.00	
17	10	12	185.0	8.0	120.0	.00	
19	12	14	415.0	8.0	120.0	.00	
21	10	16	200.0	12.0	120.0	.00	
23	16	18	150.0	8.0	120.0	.00	
25	18	20	450.0	8.0	120.0	.00	
27	20	22	180.0	8.0	120.0	.00	
29	22	24	425.0	8.0	120.0	.00	
31	22	24	425.0	8.0	120.0	.00	
33	24	26	260.0	8.0	120.0	.00	
35	26	28	450.0	8.0	120.0	.00	
37	24	28	400.0	8.0	120.0	.00	
39	22	30	300.0	12.0	120.0	.00	
41	30	32	470.0	8.0	120.0	.00	
43	32	34	400.0	8.0	120.0	.00	
45	16	34	370.0	12.0	120.0	.00	
47	34	36	300.0	12.0	120.0	.00	
49	30	38	600.0	12.0	120.0	.00	
51	36	38	525.0	12.0	120.0	.00	
53	36	40	200.0	12.0	120.0	.00	
55	36	40	200.0	12.0	120.0	.00	

JUNCTION NUMBER	DEMAND	ELEVATION	CONNECTING PIPES			
1	.00	518.00	2	4	8	10
2	.00	678.00	2	4	5	7
3	.00	520.00	1	3	8	10
4	4.00	683.00	7	9		
6	4.00	682.00	5	13		
8	3.00	690.00	13	15		
10	3.00	695.00	15	17	21	
12	4.00	690.00	17	19		
14	4.00	665.00	19			
16	3.00	698.00	21	23	45	
18	3.00	699.00	23	25		

20	3.00	706.00	25	27			
22	4.00	706.00	9	27	29	31	39
24	3.00	718.00	29	31	33	37	
26	4.00	724.00	33	35			
28	3.00	739.00	35	37			
30	3.00	733.00	39	41	49		
32	4.00	721.00	41	43			
34	3.00	713.00	43	45	47		
36	3.00	726.00	47	51	53	55	
38	4.00	750.00	49	51			
40	30.60	710.00	53	55			

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

THIS SYSTEM HAS 31 PIPES WITH 22 JUNCTIONS , 8 LOOPS AND 2 FGNS

THE RESULTS ARE OBTAINED AFTER 9 TRIALS WITH AN ACCURACY = .00008

Avion Project
AVERAGE DAY DEMANDS **File: 1010005A**
ALL PIPES OPEN

PIPE NO.	NODE NOS.		FLOWRATE	HEAD LOSS	PUMP HEAD	MINOR LOSS	VELOCITY	HL/1000
1	0	3	46.30	.02	.00	.00	.13	.01
2	1	2	46.30	.02	.00	.00	.13	.01
3	0	3	46.30	.02	.00	.00	.13	.01
4	1	2	46.30	.02	.00	.00	.13	.01
5	2	6	42.20	.01	.00	.00	.12	.01
7	2	4	50.40	.01	.00	.00	.14	.01
8	3	1	46.30	.02	.00	.00	.13	.01
9	4	22	46.40	.00	.00	.00	.13	.01
10	3	1	46.30	.02	.00	.00	.13	.01
13	6	8	38.20	.00	.00	.00	.11	.01
15	8	10	35.20	.00	.00	.00	.10	.01
17	10	12	8.00	.00	.00	.00	.05	.00
19	12	14	4.00	.00	.00	.00	.03	.00
21	10	16	24.20	.00	.00	.00	.07	.00
23	16	18	-1.03	.00	.00	.00	-.01	.00
25	18	20	-4.03	.00	.00	.00	-.03	.00
27	20	22	-7.03	.00	.00	.00	-.04	.00
29	22	24	5.00	.00	.00	.00	.03	.00
31	22	24	5.00	.00	.00	.00	.03	.00
33	24	26	3.91	.00	.00	.00	.02	.00
35	26	28	-.09	.00	.00	.00	.00	.00
37	24	28	3.09	.00	.00	.00	.02	.00
39	22	30	25.37	.00	.00	.00	.07	.00

41	30	32	5.56	.00	.00	.00	.04	.00
43	32	34	1.56	.00	.00	.00	.01	.00
45	16	34	22.23	.00	.00	.00	.06	.00
47	34	36	20.79	.00	.00	.00	.06	.00
49	30	38	16.81	.00	.00	.00	.05	.00
51	36	38	-12.81	.00	.00	.00	-.04	.00
53	36	40	15.30	.00	.00	.00	.04	.00
55	36	40	15.30	.00	.00	.00	.04	.00

JUNCTION NUMBER	DEMAND	GRADE LINE	ELEVATION	PRESSURE
1	.00	914.96	518.00	172.02
2	.00	914.94	678.00	102.67
3	.00	914.98	520.00	171.16
4	4.00	914.93	683.00	100.50
6	4.00	914.93	682.00	100.94
8	3.00	914.93	690.00	97.47
10	3.00	914.93	695.00	95.30
12	4.00	914.92	690.00	97.47
14	4.00	914.92	665.00	108.30
16	3.00	914.92	698.00	94.00
18	3.00	914.92	699.00	93.57
20	3.00	914.93	706.00	90.53
22	4.00	914.93	706.00	90.53
24	3.00	914.93	718.00	85.33
26	4.00	914.92	724.00	82.73
28	3.00	914.92	739.00	76.23
30	3.00	914.92	733.00	78.83
32	4.00	914.92	721.00	84.03
34	3.00	914.92	713.00	87.50
36	3.00	914.92	726.00	81.87
38	4.00	914.92	750.00	71.47
40	30.60	914.92	710.00	88.80
	MAXIMUM PRESSURES			
1	.00	914.96	518.00	172.02
3	.00	914.98	520.00	171.16
14	4.00	914.92	665.00	108.30
	MINIMUM PRESSURES			
38	4.00	914.92	750.00	71.47
28	3.00	914.92	739.00	76.23
30	3.00	914.92	733.00	78.83

THE NET SYSTEM DEMAND = 92.60

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

PIPE NUMBER	FLOWRATE
1	46.30
3	46.30

THE NET FLOW INTO THE SYSTEM FROM FIXED GRADE NODES = 92.60
THE NET FLOW OUT OF THE SYSTEM INTO FIXED GRADE NODES = .00

A SUMMARY OF CONDITIONS SPECIFIED FOR THE NEXT SIMULATION FOLLOWS

THE DEMANDS ARE CHANGED FROM ORIGINAL VALUES BY A FACTOR = 6.50

THE RESULTS ARE OBTAINED AFTER 2 TRIALS WITH AN ACCURACY = .00000

Avion Project
PEAK HOUR DEMANDS
ALL PIPES OPEN

PIPE NO.	NODE NOS.		FLOWRATE	HEAD LOSS	PUMP HEAD	MINOR LOSS	VELOCITY	HL/1000
1	0	3	300.95	.67	.00	.00	.85	.32
2	1	2	300.95	.62	.00	.00	.85	.32
3	0	3	300.95	.67	.00	.00	.85	.32
4	1	2	300.95	.62	.00	.00	.85	.32
5	2	6	274.29	.28	.00	.00	.78	.27
7	2	4	327.61	.34	.00	.00	.93	.37
8	3	1	300.95	.67	.00	.00	.85	.32
9	4	22	301.61	.09	.00	.00	.86	.32
10	3	1	300.95	.67	.00	.00	.85	.32
13	6	8	248.29	.09	.00	.00	.70	.22
15	8	10	228.79	.06	.00	.00	.65	.19
17	10	12	52.00	.02	.00	.00	.33	.09
19	12	14	26.00	.01	.00	.00	.17	.02
21	10	16	157.29	.02	.00	.00	.45	.10
23	16	18	-6.70	.00	.00	.00	-.04	.00
25	18	20	-26.20	-.01	.00	.00	-.17	-.02
27	20	22	-45.70	-.01	.00	.00	-.29	-.07
29	22	24	32.50	.02	.00	.00	.21	.04
31	22	24	32.50	.02	.00	.00	.21	.04
33	24	26	25.39	.01	.00	.00	.16	.02
35	26	28	-.61	.00	.00	.00	.00	.00
37	24	28	20.11	.01	.00	.00	.13	.02
39	22	30	164.91	.03	.00	.00	.47	.10
41	30	32	36.16	.02	.00	.00	.23	.05
43	32	34	10.16	.00	.00	.00	.06	.00
45	16	34	144.49	.03	.00	.00	.41	.08
47	34	36	135.15	.02	.00	.00	.38	.07
49	30	38	109.25	.03	.00	.00	.31	.05
51	36	38	-83.25	-.02	.00	.00	-.24	-.03
53	36	40	99.45	.01	.00	.00	.28	.04
55	36	40	99.45	.01	.00	.00	.28	.04

JUNCTION NUMBER	DEMAND	GRADE LINE	ELEVATION	PRESSURE
1	.00	913.65	518.00	171.45
2	.00	913.04	678.00	101.85
3	.00	914.33	520.00	170.88
4	26.00	912.70	683.00	99.54
6	26.00	912.76	682.00	99.99
8	19.50	912.67	690.00	96.49
10	19.50	912.61	695.00	94.30
12	26.00	912.59	690.00	96.46
14	26.00	912.58	665.00	107.29
16	19.50	912.59	698.00	92.99
18	19.50	912.59	699.00	92.56
20	19.50	912.60	706.00	89.53
22	26.00	912.61	706.00	89.53
24	19.50	912.60	718.00	84.33
26	26.00	912.59	724.00	81.72
28	19.50	912.59	739.00	75.22
30	19.50	912.58	733.00	77.82
32	26.00	912.56	721.00	83.01
34	19.50	912.56	713.00	86.48
36	19.50	912.54	726.00	80.83
38	26.00	912.55	750.00	70.44
40	198.90	912.53	710.00	87.76
	MAXIMUM PRESSURES			
1	.00	913.65	518.00	171.45
3	.00	914.33	520.00	170.88
14	26.00	912.58	665.00	107.29
	MINIMUM PRESSURES			
38	26.00	912.55	750.00	70.44
28	19.50	912.59	739.00	75.22
30	19.50	912.58	733.00	77.82

THE NET SYSTEM DEMAND = 601.90

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

PIPE NUMBER	FLOWRATE
1	300.95
3	300.95

THE NET FLOW INTO THE SYSTEM FROM FIXED GRADE NODES = 601.90
THE NET FLOW OUT OF THE SYSTEM INTO FIXED GRADE NODES = .00

A SUMMARY OF CONDITIONS SPECIFIED FOR THE NEXT SIMULATION FOLLOWS

THE DEMANDS ARE CHANGED FROM ORIGINAL VALUES BY A FACTOR = 2.70

THE FOLLOWING SPECIFIC DEMAND CHANGES ARE MADE :
JUNCTION NUMBER DEMAND

40 2082.70

THE FOLLOWING CHANGES IN PIPE DATA ARE SPECIFIED

FOR PIPE NUMBER 1 THE VALUE OF THE FIXED GRADE IS CHANGED TO 853.4

FOR PIPE NUMBER 3 THE VALUE OF THE FIXED GRADE IS CHANGED TO 853.4

THE RESULTS ARE OBTAINED AFTER 2 TRIALS WITH AN ACCURACY = .00398

MAXIMUM DAY DEMAND PLUS 2000 GPM FIRE FLOW AT NODE 40 ALL PIPES OPEN

PIPE NO.	NODE NOS.		FLOWRATE	HEAD LOSS	PUMP HEAD	MINOR LOSS	VELOCITY	HL/1000
1	0	3	1125.05	7.72	.00	.00	3.19	3.66
2	1	2	1125.05	7.10	.00	.00	3.19	3.66
3	0	3	1125.05	7.72	.00	.00	3.19	3.66
4	1	2	1125.05	7.10	.00	.00	3.19	3.66
5	2	6	1005.97	3.12	.00	.00	2.85	2.97
7	2	4	1244.13	3.97	.00	.00	3.53	4.41
8	3	1	1125.05	7.76	.00	.00	3.19	3.66
9	4	22	1233.33	1.19	.00	.00	3.50	4.34
10	3	1	1125.05	7.76	.00	.00	3.19	3.66
13	6	8	995.17	1.17	.00	.00	2.82	2.91
15	8	10	987.07	.86	.00	.00	2.80	2.87
17	10	12	21.60	.00	.00	.00	.14	.02
19	12	14	10.80	.00	.00	.00	.07	.00
21	10	16	957.37	.54	.00	.00	2.72	2.71
23	16	18	-148.07	-.09	.00	.00	-.95	-.62
25	18	20	-156.17	-.31	.00	.00	-1.00	-.68
27	20	22	-164.27	-.13	.00	.00	-1.05	-.75
29	22	24	13.50	.00	.00	.00	.09	.01
31	22	24	13.50	.00	.00	.00	.09	.01
33	24	26	10.55	.00	.00	.00	.07	.00
35	26	28	-.25	.00	.00	.00	.00	.00
37	24	28	8.35	.00	.00	.00	.05	.00
39	22	30	1031.26	.93	.00	.00	2.93	3.11
41	30	32	199.92	.51	.00	.00	1.28	1.07
43	32	34	189.12	.39	.00	.00	1.21	.97
45	16	34	1097.34	1.29	.00	.00	3.11	3.49
47	34	36	1278.36	1.39	.00	.00	3.63	4.63
49	30	38	823.24	1.23	.00	.00	2.34	2.05
51	36	38	-812.44	-1.05	.00	.00	-2.30	-2.00
53	36	40	1041.35	.63	.00	.00	2.95	3.17
55	36	40	1041.35	.63	.00	.00	2.95	3.17

JUNCTION NUMBER	DEMAND	GRADE LINE	ELEVATION	PRESSURE
1	.00	837.93	518.00	138.63
2	.00	830.83	678.00	66.23
3	.00	845.68	520.00	141.13
4	10.80	826.86	683.00	62.34
6	10.80	827.71	682.00	63.14
8	8.10	826.54	690.00	59.17
10	8.10	825.68	695.00	56.63
12	10.80	825.68	690.00	58.79
14	10.80	825.67	665.00	69.63
16	8.10	825.14	698.00	55.09
18	8.10	825.23	699.00	54.70
20	8.10	825.53	706.00	51.80
22	10.80	825.67	706.00	51.86
24	8.10	825.67	718.00	46.66
26	10.80	825.66	724.00	44.05
28	8.10	825.66	739.00	37.55
30	8.10	824.73	733.00	39.75
32	10.80	824.23	721.00	44.73
34	8.10	823.84	713.00	48.03
36	8.10	822.45	726.00	41.80
38	10.80	823.50	750.00	31.85
40	2082.70	821.82	710.00	48.45
	MAXIMUM PRESSURES			
3	.00	845.68	520.00	141.13
1	.00	837.93	518.00	138.63
14	10.80	825.67	665.00	69.63
	MINIMUM PRESSURES			
38	10.80	823.50	750.00	31.85
28	8.10	825.66	739.00	37.55
30	8.10	824.73	733.00	39.75

THE NET SYSTEM DEMAND = 2250.10

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

PIPE NUMBER	FLOWRATE
1	1125.05
3	1125.05

THE NET FLOW INTO THE SYSTEM FROM FIXED GRADE NODES = 2250.10
THE NET FLOW OUT OF THE SYSTEM INTO FIXED GRADE NODES = .00

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

CASE 2 – PIPE 3 CLOSED

The following conditions were modeled:

1. Average Day Demand

2. Peak Hour Demand

3. Maximum Day Demand plus 2,000 gpm Fire Flow at Node 40

Project: Avion Water System Analysis
Date: 2/13/2018
Job Number: 1010-005

Scenario: Pipe 3 Closed - Average Day Demands

Pipe No.	Pipe Size (inches)	Model Run Flow (gpm)	Model Run V (fps)
1	12	92.6	0.26
2	12	46.3	0.13
3	12	CLOSED	CLOSED
4	12	46.3	0.13
5	12	42.2	0.12
7	12	50.4	0.14
8	12	46.3	0.13
9	12	46.4	0.13
10	12	46.3	0.13
13	12	38.2	0.11
15	12	35.2	0.1
17	8	8	0.05
19	8	4	0.03
21	12	24.2	0.07
23	8	-1.03	-0.01
25	8	-4.03	-0.03
27	8	-7.03	-0.04
29	8	5	0.03
31	8	5	0.03
33	8	3.91	0.02
35	8	-0.09	0
37	8	3.09	0.02
39	12	25.37	0.07
41	8	5.57	0.04
43	8	1.57	0.01
45	12	22.23	0.06
47	12	20.8	0.06
49	12	16.8	0.05
51	12	-12.8	-0.04
53	12	15.3	0.04
55	12	15.3	0.04

Project: Avion Water System Analysis
Date: 2/13/2018
Job Number: 1010-005

Scenario: Pipe 3 Closed - Average Day Demands

Node No.	Node El. Ft.	HGL Zone Ft.	Static P psi	Model Run P, psi	Delta P from static
1	518	920	174.18	171.99	-2.19
2	678	920	104.85	102.65	-2.20
3	520	920	173.31	171.13	-2.18
4	683	920	102.69	100.48	-2.21
6	682	920	103.12	100.91	-2.21
8	690	920	99.65	97.44	-2.21
10	695	920	97.49	95.28	-2.21
12	690	920	99.65	97.44	-2.21
14	665	920	110.49	108.28	-2.21
16	698	920	96.19	93.98	-2.21
18	699	920	95.75	93.54	-2.21
20	706	920	92.72	90.51	-2.21
22	706	920	92.72	90.51	-2.21
24	718	920	87.52	85.31	-2.21
26	724	920	84.92	82.71	-2.21
28	739	920	78.42	76.21	-2.21
30	733	920	81.02	78.81	-2.21
32	721	920	86.22	84.01	-2.21
34	713	920	89.69	87.48	-2.21
36	726	920	84.06	81.84	-2.22
38	750	920	73.66	71.44	-2.22
40	710	920	90.99	88.78	-2.21

Project: Avion Water System Analysis
Date: 2/13/2018
Job Number: 1010-005

Scenario: Pipe 3 Closed - Peak Hour Demands

Pipe No.	Pipe Size (inches)	Model Run Flow (gpm)	Model Run V (fps)
1	12	601.9	1.71
2	12	300.95	0.85
3	12	CLOSED	CLOSED
4	12	300.95	0.85
5	12	274.29	0.78
7	12	327.61	0.93
8	12	300.95	0.85
9	12	301.61	0.86
10	12	300.95	0.85
13	12	248.29	0.7
15	12	228.79	0.65
17	8	52	0.33
19	8	26	0.17
21	12	157.29	0.45
23	8	-6.7	-0.04
25	8	-26.2	-0.17
27	8	-45.7	-0.29
29	8	32.5	0.21
31	8	32.5	0.21
33	8	25.39	0.16
35	8	-0.61	0
37	8	20.11	0.13
39	12	164.91	0.47
41	8	36.16	0.23
43	8	10.16	0.06
45	12	144.49	0.41
47	12	135.15	0.38
49	12	109.25	0.31
51	12	-83.25	-0.24
53	12	99.45	0.28
55	12	99.45	0.28

Project: Avion Water System Analysis
Date: 2/13/2018
Job Number: 1010-005

Scenario: Pipe 3 Closed - Peak Hour Demands

Node No.	Node El. Ft.	HGL Zone Ft.	Static P psi	Model Run P, psi	Delta P from static
1	518	920	174.18	170.69	-3.49
2	678	920	104.85	101.09	-3.76
3	520	920	173.31	170.12	-3.19
4	683	920	102.69	98.78	-3.91
6	682	920	103.12	99.23	-3.89
8	690	920	99.65	95.73	-3.92
10	695	920	97.49	93.54	-3.95
12	690	920	99.65	95.7	-3.95
14	665	920	110.49	106.53	-3.96
16	698	920	96.19	92.23	-3.96
18	699	920	95.75	91.8	-3.95
20	706	920	92.72	88.77	-3.95
22	706	920	92.72	88.77	-3.95
24	718	920	87.52	83.57	-3.95
26	724	920	84.92	80.96	-3.96
28	739	920	78.42	74.46	-3.96
30	733	920	81.02	77.06	-3.96
32	721	920	86.22	82.25	-3.97
34	713	920	89.69	85.72	-3.97
36	726	920	84.06	80.07	-3.99
38	750	920	73.66	69.68	-3.98
40	710	920	90.99	87	-3.99

Project: Avion Water System Analysis
Date: 2/13/2018
Job Number: 1010-005

Scenario: Pipe 3 Closed - Maximum Day Demands + 2000 gpm Fire Flow at Node 40

Pipe No.	Pipe Size (inches)	Model Run Flow (gpm)	Model Run V (fps)
1	12	2250.1	6.38
2	12	1125.05	3.19
3	12	CLOSED	CLOSED
4	12	1125.05	3.19
5	12	1005.97	2.85
7	12	1244.13	3.53
8	12	1125.05	3.19
9	12	1233.33	3.5
10	12	1125.05	3.19
13	12	995.17	2.82
15	12	987.07	2.8
17	8	21.6	0.14
19	8	10.8	0.07
21	12	957.37	2.72
23	8	-148.07	-0.95
25	8	-156.17	-1
27	8	-164.27	-1.05
29	8	13.5	0.09
31	8	13.5	0.09
33	8	10.55	0.07
35	8	-0.25	0
37	8	8.35	0.05
39	12	1031.26	2.93
41	8	199.92	1.28
43	8	189.12	1.21
45	12	1097.34	3.11
47	12	1278.36	3.63
49	12	823.24	2.34
51	12	-812.44	-2.3
53	12	1041.35	2.95
55	12	1041.35	2.95

Project: Avion Water System Analysis
Date: 2/13/2018
Job Number: 1010-005

Scenario: Pipe 3 Closed - Maximum Day Demands + 2000 gpm Fire Flow at Node 40

Node No.	Node El. Ft.	HGL Zone Ft.	Static P psi	Model Run P, psi	Delta P from static
1	518	920	174.18	129.9	-44.28
2	678	920	104.85	57.5	-47.35
3	520	920	173.31	132.4	-40.91
4	683	920	102.69	53.61	-49.08
6	682	920	103.12	54.41	-48.71
8	690	920	99.65	50.44	-49.21
10	695	920	97.49	47.9	-49.59
12	690	920	99.65	50.06	-49.59
14	665	920	110.49	60.89	-49.60
16	698	920	96.19	46.36	-49.83
18	699	920	95.75	45.97	-49.78
20	706	920	92.72	43.07	-49.65
22	706	920	92.72	43.13	-49.59
24	718	920	87.52	37.92	-49.60
26	724	920	84.92	35.32	-49.60
28	739	920	78.42	28.82	-49.60
30	733	920	81.02	31.02	-50.00
32	721	920	86.22	36	-50.22
34	713	920	89.69	39.3	-50.39
36	726	920	84.06	33.07	-50.99
38	750	920	73.66	23.12	-50.54
40	710	920	90.99	39.72	-51.27

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
1	0	3	2110.0	12.0	120.0	.00	915.00
2	1	2	1940.0	12.0	120.0	.00	
3	0	3	2110.0	12.0	120.0	.00	915.00
4	1	2	1940.0	12.0	120.0	.00	
5	2	6	1050.0	12.0	120.0	.00	
7	2	4	900.0	12.0	120.0	.00	
8	3	1	2120.0	12.0	120.0	.00	
9	4	22	275.0	12.0	120.0	.00	
10	3	1	2120.0	12.0	120.0	.00	
13	6	8	400.0	12.0	120.0	.00	
15	8	10	300.0	12.0	120.0	.00	
17	10	12	185.0	8.0	120.0	.00	
19	12	14	415.0	8.0	120.0	.00	
21	10	16	200.0	12.0	120.0	.00	
23	16	18	150.0	8.0	120.0	.00	
25	18	20	450.0	8.0	120.0	.00	
27	20	22	180.0	8.0	120.0	.00	
29	22	24	425.0	8.0	120.0	.00	
31	22	24	425.0	8.0	120.0	.00	
33	24	26	260.0	8.0	120.0	.00	
35	26	28	450.0	8.0	120.0	.00	
37	24	28	400.0	8.0	120.0	.00	
39	22	30	300.0	12.0	120.0	.00	
41	30	32	470.0	8.0	120.0	.00	
43	32	34	400.0	8.0	120.0	.00	
45	16	34	370.0	12.0	120.0	.00	
47	34	36	300.0	12.0	120.0	.00	
49	30	38	600.0	12.0	120.0	.00	
51	36	38	525.0	12.0	120.0	.00	
53	36	40	200.0	12.0	120.0	.00	
55	36	40	200.0	12.0	120.0	.00	

JUNCTION NUMBER	DEMAND	ELEVATION	CONNECTING PIPES			
1	.00	518.00	2	4	8	10
2	.00	678.00	2	4	5	7
3	.00	520.00	1	3	8	10
4	4.00	683.00	7	9		
6	4.00	682.00	5	13		
8	3.00	690.00	13	15		
10	3.00	695.00	15	17	21	
12	4.00	690.00	17	19		
14	4.00	665.00	19			
16	3.00	698.00	21	23	45	
18	3.00	699.00	23	25		

20	3.00	706.00	25	27			
22	4.00	706.00	9	27	29	31	39
24	3.00	718.00	29	31	33	37	
26	4.00	724.00	33	35			
28	3.00	739.00	35	37			
30	3.00	733.00	39	41	49		
32	4.00	721.00	41	43			
34	3.00	713.00	43	45	47		
36	3.00	726.00	47	51	53	55	
38	4.00	750.00	49	51			
40	30.60	710.00	53	55			

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

THIS SYSTEM HAS 31 PIPES WITH 22 JUNCTIONS , 8 LOOPS AND 2 FGNS

A SUMMARY OF CONDITIONS SPECIFIED FOR THE NEXT SIMULATION FOLLOWS

LINE 3 IS CLOSED

THE FOLLOWING CHANGES IN PIPE DATA ARE SPECIFIED

FOR PIPE NUMBER 1 THE VALUE OF THE FIXED GRADE IS CHANGED TO 915.0

FOR PIPE NUMBER 3 THE VALUE OF THE FIXED GRADE IS CHANGED TO 915.0

THE RESULTS ARE OBTAINED AFTER 2 TRIALS WITH AN ACCURACY = .00273

Avion Project
AVERAGE DAY DEMANDS
PIPE 3 IS CLOSED

PIPE NO.	NODE NOS.		FLOWRATE	HEAD LOSS	PUMP HEAD	MINOR LOSS	VELOCITY	HL/1000
1	0	3	92.60	.08	.00	.00	.26	.04
2	1	2	46.30	.02	.00	.00	.13	.01
LINE	3 IS CLOSED							
4	1	2	46.30	.02	.00	.00	.13	.01
5	2	6	42.20	.01	.00	.00	.12	.01
7	2	4	50.40	.01	.00	.00	.14	.01
8	3	1	46.30	.02	.00	.00	.13	.01
9	4	22	46.40	.00	.00	.00	.13	.01
10	3	1	46.30	.02	.00	.00	.13	.01
13	6	8	38.20	.00	.00	.00	.11	.01
15	8	10	35.20	.00	.00	.00	.10	.01
17	10	12	8.00	.00	.00	.00	.05	.00

19	12	14	4.00	.00	.00	.00	.03	.00
21	10	16	24.20	.00	.00	.00	.07	.00
23	16	18	-1.03	.00	.00	.00	-.01	.00
25	18	20	-4.03	.00	.00	.00	-.03	.00
27	20	22	-7.03	.00	.00	.00	-.04	.00
29	22	24	5.00	.00	.00	.00	.03	.00
31	22	24	5.00	.00	.00	.00	.03	.00
33	24	26	3.91	.00	.00	.00	.02	.00
35	26	28	-.09	.00	.00	.00	.00	.00
37	24	28	3.09	.00	.00	.00	.02	.00
39	22	30	25.37	.00	.00	.00	.07	.00
41	30	32	5.57	.00	.00	.00	.04	.00
43	32	34	1.57	.00	.00	.00	.01	.00
45	16	34	22.23	.00	.00	.00	.06	.00
47	34	36	20.80	.00	.00	.00	.06	.00
49	30	38	16.80	.00	.00	.00	.05	.00
51	36	38	-12.80	.00	.00	.00	-.04	.00
53	36	40	15.30	.00	.00	.00	.04	.00
55	36	40	15.30	.00	.00	.00	.04	.00

JUNCTION	NUMBER	DEMAND	GRADE LINE	ELEVATION	PRESSURE
1		.00	914.90	518.00	171.99
2		.00	914.88	678.00	102.65
3		.00	914.92	520.00	171.13
4		4.00	914.87	683.00	100.48
6		4.00	914.88	682.00	100.91
8		3.00	914.87	690.00	97.44
10		3.00	914.87	695.00	95.28
12		4.00	914.87	690.00	97.44
14		4.00	914.87	665.00	108.28
16		3.00	914.87	698.00	93.98
18		3.00	914.87	699.00	93.54
20		3.00	914.87	706.00	90.51
22		4.00	914.87	706.00	90.51
24		3.00	914.87	718.00	85.31
26		4.00	914.87	724.00	82.71
28		3.00	914.87	739.00	76.21
30		3.00	914.87	733.00	78.81
32		4.00	914.87	721.00	84.01
34		3.00	914.87	713.00	87.48
36		3.00	914.87	726.00	81.84
38		4.00	914.87	750.00	71.44
40		30.60	914.87	710.00	88.78
		MAXIMUM PRESSURES			
1		.00	914.90	518.00	171.99
3		.00	914.92	520.00	171.13
14		4.00	914.87	665.00	108.28
		MINIMUM PRESSURES			
38		4.00	914.87	750.00	71.44
28		3.00	914.87	739.00	76.21
30		3.00	914.87	733.00	78.81

THE NET SYSTEM DEMAND = 92.60

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

PIPE NUMBER	FLOWRATE
1	92.60

THE NET FLOW INTO THE SYSTEM FROM FIXED GRADE NODES = 92.60
THE NET FLOW OUT OF THE SYSTEM INTO FIXED GRADE NODES = .00

A SUMMARY OF CONDITIONS SPECIFIED FOR THE NEXT SIMULATION FOLLOWS

THE DEMANDS ARE CHANGED FROM ORIGINAL VALUES BY A FACTOR = 6.50

THE RESULTS ARE OBTAINED AFTER 2 TRIALS WITH AN ACCURACY = .00003

Avion Project
PEAK HOUR DEMANDS
PIPE 3 IS CLOSED

PIPE NO.	NODE NOS.		FLOWRATE	HEAD LOSS	PUMP HEAD	MINOR LOSS	VELOCITY	HL/1000
1	0	3	601.90	2.42	.00	.00	1.71	1.15
2	1	2	300.95	.62	.00	.00	.85	.32
LINE 3 IS CLOSED								
4	1	2	300.95	.62	.00	.00	.85	.32
5	2	6	274.29	.28	.00	.00	.78	.27
7	2	4	327.61	.34	.00	.00	.93	.37
8	3	1	300.95	.67	.00	.00	.85	.32
9	4	22	301.61	.09	.00	.00	.86	.32
10	3	1	300.95	.67	.00	.00	.85	.32
13	6	8	248.29	.09	.00	.00	.70	.22
15	8	10	228.79	.06	.00	.00	.65	.19
17	10	12	52.00	.02	.00	.00	.33	.09
19	12	14	26.00	.01	.00	.00	.17	.02
21	10	16	157.29	.02	.00	.00	.45	.10
23	16	18	-6.70	.00	.00	.00	-.04	.00
25	18	20	-26.20	-.01	.00	.00	-.17	-.02
27	20	22	-45.70	-.01	.00	.00	-.29	-.07
29	22	24	32.50	.02	.00	.00	.21	.04
31	22	24	32.50	.02	.00	.00	.21	.04
33	24	26	25.39	.01	.00	.00	.16	.02
35	26	28	-.61	.00	.00	.00	.00	.00

37	24	28	20.11	.01	.00	.00	.13	.02
39	22	30	164.91	.03	.00	.00	.47	.10
41	30	32	36.16	.02	.00	.00	.23	.05
43	32	34	10.16	.00	.00	.00	.06	.00
45	16	34	144.49	.03	.00	.00	.41	.08
47	34	36	135.15	.02	.00	.00	.38	.07
49	30	38	109.25	.03	.00	.00	.31	.05
51	36	38	-83.25	-.02	.00	.00	-.24	-.03
53	36	40	99.45	.01	.00	.00	.28	.04
55	36	40	99.45	.01	.00	.00	.28	.04

JUNCTION	NUMBER	DEMAND	GRADE LINE	ELEVATION	PRESSURE
1		.00	911.90	518.00	170.69
2		.00	911.28	678.00	101.09
3		.00	912.58	520.00	170.12
4		26.00	910.95	683.00	98.78
6		26.00	911.00	682.00	99.23
8		19.50	910.91	690.00	95.73
10		19.50	910.86	695.00	93.54
12		26.00	910.84	690.00	95.70
14		26.00	910.83	665.00	106.53
16		19.50	910.84	698.00	92.23
18		19.50	910.84	699.00	91.80
20		19.50	910.85	706.00	88.77
22		26.00	910.86	706.00	88.77
24		19.50	910.85	718.00	83.57
26		26.00	910.84	724.00	80.96
28		19.50	910.84	739.00	74.46
30		19.50	910.83	733.00	77.06
32		26.00	910.81	721.00	82.25
34		19.50	910.81	713.00	85.72
36		19.50	910.79	726.00	80.07
38		26.00	910.80	750.00	69.68
40		198.90	910.78	710.00	87.00
		MAXIMUM PRESSURES			
1		.00	911.90	518.00	170.69
3		.00	912.58	520.00	170.12
14		26.00	910.83	665.00	106.53
		MINIMUM PRESSURES			
38		26.00	910.80	750.00	69.68
28		19.50	910.84	739.00	74.46
30		19.50	910.83	733.00	77.06

THE NET SYSTEM DEMAND = 601.90

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

PIPE NUMBER	FLOWRATE
1	601.90

THE NET FLOW INTO THE SYSTEM FROM FIXED GRADE NODES = 601.90
THE NET FLOW OUT OF THE SYSTEM INTO FIXED GRADE NODES = .00

A SUMMARY OF CONDITIONS SPECIFIED FOR THE NEXT SIMULATION FOLLOWS

THE DEMANDS ARE CHANGED FROM ORIGINAL VALUES BY A FACTOR = 2.70

THE FOLLOWING SPECIFIC DEMAND CHANGES ARE MADE :

JUNCTION NUMBER	DEMAND
40	2082.70

THE FOLLOWING CHANGES IN PIPE DATA ARE SPECIFIED

FOR PIPE NUMBER 1 THE VALUE OF THE FIXED GRADE IS CHANGED TO 853.4

FOR PIPE NUMBER 3 THE VALUE OF THE FIXED GRADE IS CHANGED TO 853.4

THE RESULTS ARE OBTAINED AFTER 2 TRIALS WITH AN ACCURACY = .00398

Avion Project
MAXIMUM DAY DEMANDS PLUS 2000 GPM FIRE FLOW AT NODE 40
PIPE 3 IS CLOSED

PIPE NO.	NODE NOS.		FLOWRATE	HEAD LOSS	PUMP HEAD	MINOR LOSS	VELOCITY	HL/1000
1	0	3	2250.10	27.87	.00	.00	6.38	13.21
2	1	2	1125.05	7.10	.00	.00	3.19	3.66
LINE	3 IS CLOSED							
4	1	2	1125.05	7.10	.00	.00	3.19	3.66
5	2	6	1005.97	3.12	.00	.00	2.85	2.97
7	2	4	1244.13	3.97	.00	.00	3.53	4.41
8	3	1	1125.05	7.76	.00	.00	3.19	3.66
9	4	22	1233.33	1.19	.00	.00	3.50	4.34
10	3	1	1125.05	7.76	.00	.00	3.19	3.66
13	6	8	995.17	1.17	.00	.00	2.82	2.91
15	8	10	987.07	.86	.00	.00	2.80	2.87
17	10	12	21.60	.00	.00	.00	.14	.02
19	12	14	10.80	.00	.00	.00	.07	.00
21	10	16	957.37	.54	.00	.00	2.72	2.71
23	16	18	-148.07	-.09	.00	.00	-.95	-.62
25	18	20	-156.17	-.31	.00	.00	-1.00	-.68
27	20	22	-164.27	-.13	.00	.00	-1.05	-.75
29	22	24	13.50	.00	.00	.00	.09	.01
31	22	24	13.50	.00	.00	.00	.09	.01
33	24	26	10.55	.00	.00	.00	.07	.00
35	26	28	-.25	.00	.00	.00	.00	.00

37	24	28	8.35	.00	.00	.00	.05	.00
39	22	30	1031.26	.93	.00	.00	2.93	3.11
41	30	32	199.92	.51	.00	.00	1.28	1.07
43	32	34	189.12	.39	.00	.00	1.21	.97
45	16	34	1097.34	1.29	.00	.00	3.11	3.49
47	34	36	1278.36	1.39	.00	.00	3.63	4.63
49	30	38	823.24	1.23	.00	.00	2.34	2.05
51	36	38	-812.44	-1.05	.00	.00	-2.30	-2.00
53	36	40	1041.35	.63	.00	.00	2.95	3.17
55	36	40	1041.35	.63	.00	.00	2.95	3.17

JUNCTION NUMBER	DEMAND	GRADE LINE	ELEVATION	PRESSURE
1	.00	817.78	518.00	129.90
2	.00	810.68	678.00	57.50
3	.00	825.53	520.00	132.40
4	10.80	806.71	683.00	53.61
6	10.80	807.56	682.00	54.41
8	8.10	806.39	690.00	50.44
10	8.10	805.53	695.00	47.90
12	10.80	805.53	690.00	50.06
14	10.80	805.53	665.00	60.89
16	8.10	804.99	698.00	46.36
18	8.10	805.08	699.00	45.97
20	8.10	805.39	706.00	43.07
22	10.80	805.52	706.00	43.13
24	8.10	805.52	718.00	37.92
26	10.80	805.52	724.00	35.32
28	8.10	805.52	739.00	28.82
30	8.10	804.59	733.00	31.02
32	10.80	804.08	721.00	36.00
34	8.10	803.70	713.00	39.30
36	8.10	802.31	726.00	33.07
38	10.80	803.36	750.00	23.12
40	2082.70	801.67	710.00	39.72
	MAXIMUM PRESSURES			
3	.00	825.53	520.00	132.40
1	.00	817.78	518.00	129.90
14	10.80	805.53	665.00	60.89
	MINIMUM PRESSURES			
38	10.80	803.36	750.00	23.12
28	8.10	805.52	739.00	28.82
30	8.10	804.59	733.00	31.02

THE NET SYSTEM DEMAND = 2250.10

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

PIPE NUMBER	FLOWRATE
1	2250.10

THE NET FLOW INTO THE SYSTEM FROM FIXED GRADE NODES = 2250.10
THE NET FLOW OUT OF THE SYSTEM INTO FIXED GRADE NODES = .00

EXHIBIT A

WATER MODEL NODE AND PIPE DIAGRAM

\\ARTIC\DWG\1010005\AP_WAT_EXHIBIT-A_NODEANDPIPE.DWG 06-13-18 14:44:28 LAYOUT: LAYOUT

DOVE CANYON ROAD

BERNARDO CENTER DRIVE

EXISTING 36" RANCHO BERNARDO PIPELINE (793 ZONE)

OAK CANYON MIDDLE SCHOOL

CRISALIDA

CAMINO

WINE CREEK DR

793 ZONE WATER LINE

HERITAGE BLUFFS PROJECT BOUNDARY

PROPOSED HERITAGE BLUFFS PROJECT BY OTHERS

PROPOSED AVION PROJECT BOUNDARY

PROPOSED AVION PROJECT

PROPOSED PRIVATE WATER BOOSTER STATION

LEGEND

- EXISTING 793 ZONE
- EXISTING 920 ZONE
- PROPOSED 920 ZONE
- PROPOSED PRIVATE SYSTEM
- (0) COMPUTER MODEL NODE
- [1] COMPUTER MODEL PIPE

N

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

EXHIBIT A

NODE AND PIPE DIAGRAM

AVION PROJECT