Merritt Reserve Development

Rolesville, North Carolina

Developer: BRD Land & Investment
6433 Bannington Road
Charlotte, North Carolina 28226

PRELIMINARY WATER MODELING REPORT & CALCULATIONS

June 12, 2025

BY: Patrick W. Lewis, P.E., ENV SP

PROJECT #R230004

American Engineering Associates - Southeast, PA
830 Greenbrier Circle, Suite 110
Chesapeake, Virginia 23320
(757) 468 - 6800
www.American-EA.com

AMERICAN Engineering

American Engineering Associates - Southeast, PA
Chesapeake, Virginia
(757) 468 - 6800
www.American-EA.com

Table of Contents

American Engineering Associates - Southeast, PA
Chesapeake, Virginia
(757) 468 - 6800
www.American-EA.com

Design Narrative:

The Merritt Reserve Development is a proposed 503-unit residential development, including 237 single-family homes and 266 townhomes. The development is located on a parcel of property on the northwest corner of the intersection of Fowler Road and Rolesville Road in Rolesville, NC. The Merritt Reserve Development will access Raleigh Water's existing water distribution system on a 16-inch water main that runs along the west side of Rolesville Road.

Modeling was performed using WaterCAD software. The Appendix contains an overall layout figure showing the piping locations, including domestic pressures and flows, as well as modeling information for each scenario, including:

- Pipe table with flows
- Junction Table with pressures at each node

Water Model Input Parameters:

General: A hydrant flow test is performed by others at Raleigh Water fire hydrants WHYD196641 and WHYD196642. The test hydrant (WHYD196641) is located on Rolesville Road approximately 126 feet south of Emily Lane and the flow hydrant (WHYD196642) is located at the intersection of Rolesville and Fowler Road.

A copy of the hydrant test and pump curve for the hydrant developed from the test is included in the Appendix. The results from the hydrant test and the developed pump curve were entered into the water model as a pump. The calculated pump was used as a source for the existing system.

The proposed water distribution system in the development will consist of ductile iron piping and will connect to an existing Raleigh Water ductile iron pipe. The proposed system was modeled using a Hazen Williams C factor of 130 for ductile iron pipes. Pipes were imported into the WaterCAD model from utility plans CAD files, and their lengths were increased by 10% to account for losses from fittings and valves.

Domestic Scenario: Domestic water demand was calculated in accordance with the North Carolina Rules Governing Water Supply Systems. Per 15A NCAC 18C .0409 – Service Connections, Paragraph (1) Table 1, a residential service

connection is required to be designed for average daily flow of 400 gallons per day (GPD) of flow. Converting this flow to gallons per minute (GPM),

$$400\ GPD * \frac{1\ hour}{60\ minutes} * \frac{1\ day}{24\ hours} = 0.2778\ GPM$$

Using a peaking factor of 2.5,

$$Peak\ Flow\ per\ Residence = 0.2778\ GPM * 2.5\ Peaking\ Factor = 0.694\ GPM$$

To measure the effects of the residential demands within the Merritt Reserve Development most conservatively, demands that are located between two junction nodes were applied to the node farthest from the source pump in the model. The domestic scenario was modeled with all domestic demands turned on.

As a result of the domestic analysis, nodes were determined to have high pressures. Building code requires that pressure reducing valves (PRV) be installed at locations which see pressures higher than 80 psi. In order to provide the flexibility to change local elevations at the time of construction, it is recommended that PRV be installed at all lots that will see a pressure greater than 75 psi.

Schematic figures of the development showing nodes with pressures greater than 75 psi and the lots which are assigned to those nodes are included in the Appendix of this report. These figures show the nodes as well as the lots where PRV are to be installed in red text/lines.

Fire Flow Scenario: The single-family structures that are proposed to be constructed within this development are expected to be less than 3,600 square feet (SF). NFPA 13 and North Carolina Building Code Appendix B require a minimum of 1,000 GPM at 20 pounds per square inch (PSI) of flow be provided at a fire hydrant within 500 feet of a single-family residential structure between 0 and 3,600 SF in size and not covered by sprinkler systems. Domestic demands for all lots were turned on in the fire flow scenario.

It should be noted that because all future domestic demands were turned on for the development, these fire flows represent the most conservative conditions. If the modeling results show sufficient fire flows for the overall development, any individual phase that is constructed can be expected to meet regulatory requirements.

American Engineering Associates - Southeast, PA
Chesapeake, Virginia
(757) 468 - 6800
www.American-EA.com

Results:

The proposed water system was modeled for each scenario using WaterCAD water modeling software. The results domestic scenario pressure results are included in Table A below. The results fire flow scenario pressure results are included in Table B below. Table B only includes the nodes which represent fire hydrants within the development, since those nodes will be providing fire flows.

Table A – Domestic Scenario Results

Junction	Minimum Pressure, PSI
J-29	66
J-166	67
J-105	67
J-27	67
J-47	67
J-73	67
J-130	68
J-2	68
J-81	68
J-71	68
J-165	69
J-103	69
J-7	69
J-95	69

Junction	Minimum Pressure, PSI
J-30	69
J-129	69
J-146	69
J-162	69
J-159	70
J-106	70
J-28	70
J-114	70
J-48	70
J-158	70
J-63	70
J-11	70
J-151	70
J-74	70

American Engineering Associates - Southeast, PA
Chesapeake, Virginia
(757) 468 - 6800
www.American-EA.com

Table A – Domestic Scenario Results - Continued

Junction	Minimum Pressure, PSI
J-150	70
J-13	71
J-1	71
J-82	71
J-72	71
J-115	71
J-104	72
J-145	72
J-8	72
J-96	72
J-116	72
J-89	72
J-33	72
J-122	72
J-19	73

Junction	Minimum Pressure, PSI
J-152	73
J-12	73
J-64	73
J-139	74
J-14	74
J-85	74
J-131	74
J-101	74
J-90	75
J-60	75
J-34	75
J-149	75
J-20	75
J-43	76
J-9	77

Table A – Domestic Scenario Results - Continued

Junction	Minimum Pressure, PSI
J-53	77
J-164	77
J-86	77
J-21	77
J-102	77
J-25	78
J-132	78
J-59	78
J-93	78
J-83	78
J-44	79
J-97	79
J-111	79
J-75	79
J-10	79

Junction	Minimum Pressure, PSI
J-5	80
J-87	80
J-148	80
J-163	80
J-22	80
J-54	80
J-136	80
J-26	80
J-120	81
J-94	81
J-137	81
J-84	81
J-135	81
J-128	82
J-98	82

Table A – Domestic Scenario Results - Continued

Junction	Minimum Pressure, PSI
J-119	82
J-17	82
J-110	82
J-6	82
J-88	82
J-76	83
J-35	83
J-117	84
J-55	84
J-23	84
J-57	84
J-91	85
J-109	85
J-77	85
J-18	85

Junction	Minimum Pressure, PSI
J-31	86
J-123	86
J-36	86
J-56	86
J-24	87
J-134	87
J-141	87
J-58	87
J-92	87
J-78	88
J-32	89
J-133	89
J-126	89
J-49	89
J-3	90

Table A – Domestic Scenario Results - Continued

Junction	Minimum Pressure, PSI
J-15	91
J-50	92
J-140	93
J-67	93
J-79	93
J-4	93
J-46	93
J-142	93
J-124	93
J-16	94
J-68	96
J-45	96
J-80	96
J-125	97
J-107	97

Junction	Minimum Pressure, PSI
J-147	97
J-66	99
J-69	99
J-108	100
J-51	100
J-61	101
J-65	102
J-70	102
J-52	103
J-62	104
J-143	104

Table B – Fire Flow Scenario Results

Junction	Calculated Residual Pressure, PSI	Maximum Available Flow, GPM
J-46	20	1445
J-35	20	1798
J-110	20	1514
J-31	24	1965
J-49	30	1965
J-107	35	1965
J-124	20	1708
J-15	20	1945
J-51	20	1881
J-55	21	1965
J-57	23	1965
J-67	34	1965
J-69	41	1965
J-61	44	1965
J-66	43	1965
J-79	39	1965
J-77	32	1965

Table B – Fire Flow Scenario Results

Junction	Calculated Residual Pressure, PSI	Maximum Available Flow, GPM
J-75	28	1965
J-60	25	1978
J-63	20	1999
J-73	20	1955
J-71	20	2000
J-53	27	1962
J-101	20	1866
J-85	22	1951
J-83	23	1943
J-3	40	1932
J-17	29	1927
J-43	20	1926
J-91	33	1927
J-13	20	1979
J-81	20	1911
J-47	20	2000

Table B – Fire Flow Scenario Results

Junction	Calculated Residual Pressure, PSI	Maximum Available Flow, GPM
J-23	35	1926
J-87	28	1925
J-97	28	1924
J-5	27	1921
J-9	26	1921
J-2	20	1893
J-95	20	1812
J-11	20	1928
J-103	20	1873
J-166	20	1835
J-105	20	1823
J-93	25	1921
J-89	20	1902
J-25	29	1923
J-27	20	1886
J-21	28	1926

Table B – Fire Flow Scenario Results

Junction	Calculated Residual Pressure, PSI	Maximum Available Flow, GPM
J-33	20	1924
J-19	23	1923
J-7	20	1923
J-29	20	1839

Conclusion:

The existing Raleigh Water distribution system can provide both domestic and fire flow demands that meet code requirements for the entire development and will support the development of any individual phase.

American Engineering Associates - Southeast, PA
Chesapeake, Virginia
(757) 468 - 6800
www.American-EA.com

APPENDIX

American Engineering Associates - Southeast, PA
Chesapeake, Virginia
(757) 468 - 6800
www.American-EA.com

Fire Hydrant Flow Test Results

Raleigh

TEST LOCATION

Address/Location Description 1224 Rolesville Rd, Wake Forest, NC 27587

Test hydrant Facility ID WHYD 196641

Flow hydrant Facility ID WHYD 196642

Signed by: Daniel Alexander Cheek 20CCFEC6A83485...
5/2/2025

NORTH CAROLINA PROFESSIONAL SEAL 058923 ENGINEER DANIEL ALEXANDER CHEEK

APPLICATION INFORMATION

Name WithersRavenel, Inc.

Address 115 Mackenan Drive, Cary, NC 27511

Contact Person Zachary Bowen Phone 919-678-3867

Email zbowen@withersravenel.com

SYSTEM INFORMATION

Test Date 4/29/2025

Time of Test 10:52 AM

Nearest Elevated Tank Rolesville

Test Hydrant Elevation

Main Size 16" DIP

Pressure Zone 560

Tank Hydraulic Grade 546.38

Use 20ft below pressure zone (tank overflow) for design*

Pump Info Pump #2 - Forestville On

Theoretical Pressure

RESULTS

Static Pressure 67 psi

Residual Pressure 52 psi

Outlet Diameter 2.5 inches

Number of Outlets Flowing 2

Flow Hydrant Discharge Pressure 19, 13 psi

Volume of Discharge 1,312 gpm

Water usage during test 5,000 Total Gal

Test Completed by: Ling Z. & Mike B.

Testing Company: WithersRavenel, Inc.

Checked by:

Date

SEAL (if applicable)

Notes:

Please attach the following supporting documentation to this form;
Labeled map of location of test identifying test hydrant and flow hydrant
Calculation demonstrating how the discharge flow was determined
Calculation demonstrating the available fire flow at a residual pressure of 20 psi
Printout of any recorded data supporting the static and residual pressure at the test hydrant.
Printout of any recorded data supporting the discharge pressure of the flow hydrant.

*To maintain system water quality, storage tanks may be maintained as low as 20’ below overflow.

updated August 2019

WithersRavenel
Our People. Your Success.

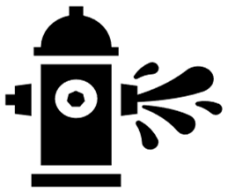
Hydrant Test Data

Project Name	Merritt Properties Fire Flow Test
WR Project #	25-0397
Test Designation	Test 1
Test Date	April 29, 2025
Test Hydrant Location	WHYD196641 (See Map)
Flow Hydrant Location	WHYD196642 (See Map)

Hydrant Test

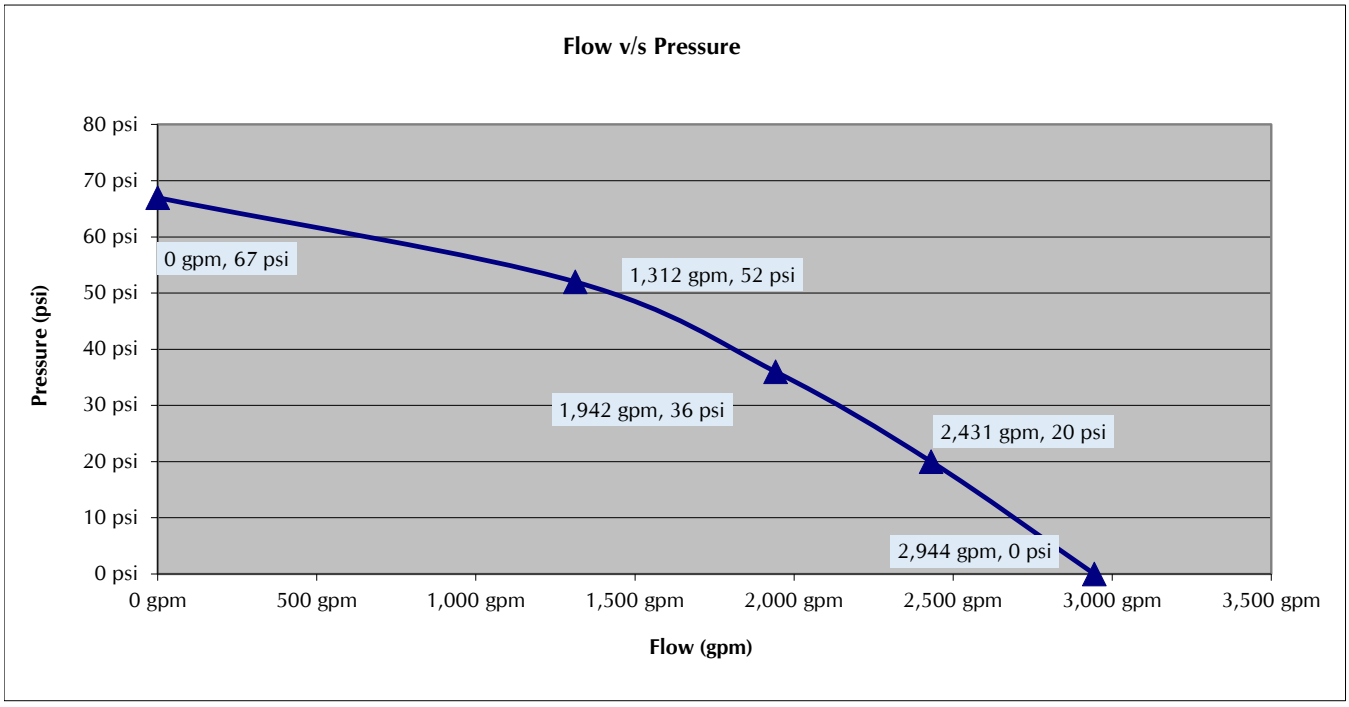
Test Hydrant Static Pressure	67 psi
Test Hydrant Residual Pressure	52 psi
Nozzle 1 Pressure	19 psi
Nozzle 1 Flow (from chart)	718 gpm
Nozzle 2 Pressure	13 psi
Nozzle 2 Flow (from chart)	594 gpm
Total Calculated Flow	1,312 gpm
Pressure Drop	15 psi

Equipment Used
2.5-inch Hose Monster w/ 2-inch Pitotless Nozzle
2.5-inch Hose Monster w/ 2-inch Pitotless Nozzle

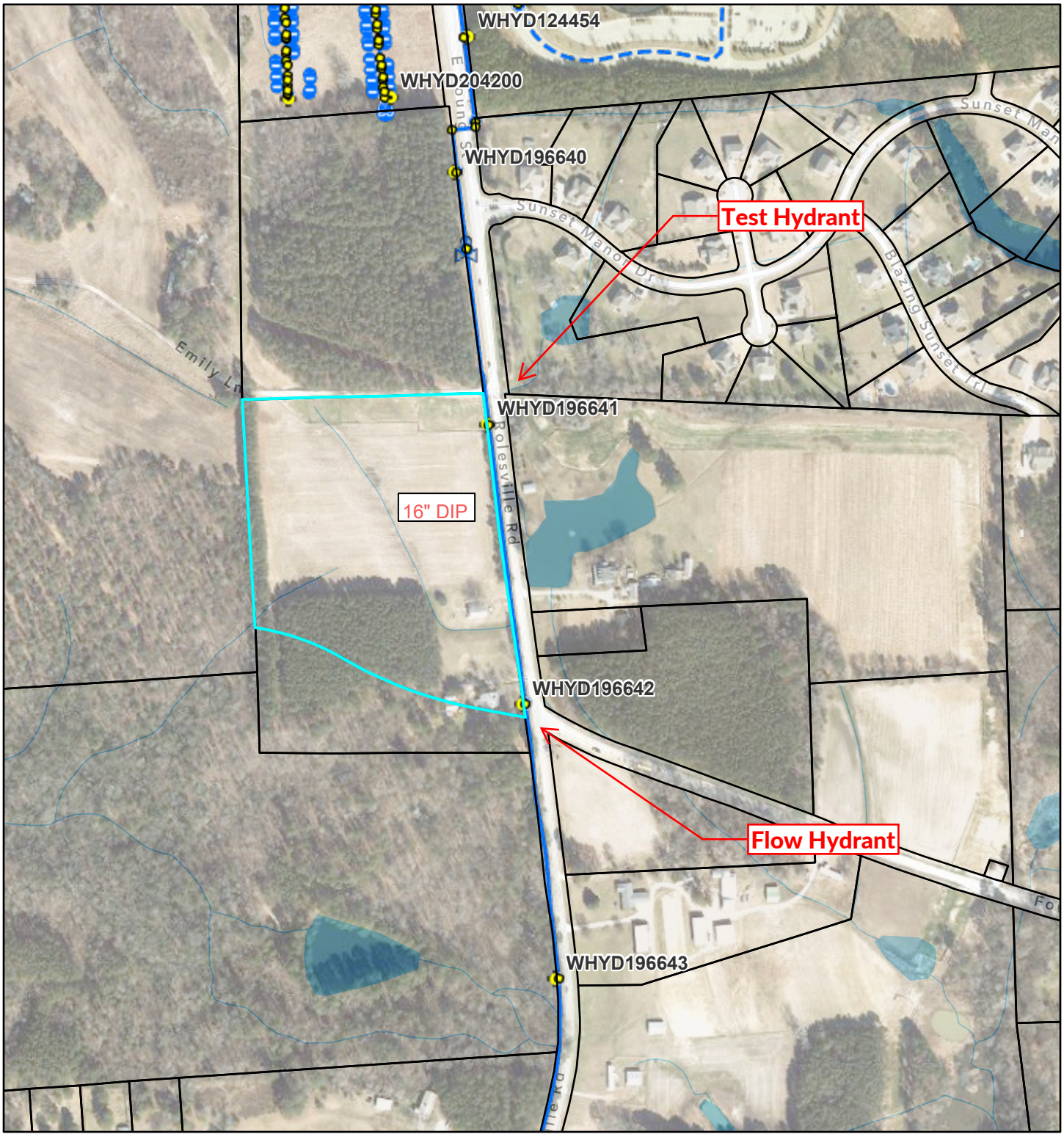


Flow/Pressure Relationship

Flow	Pressure	Head
0 gpm	67 psi	155 ft
1,312 gpm	52 psi	120 ft
1,942 gpm	36 psi	83 ft
2,431 gpm	20 psi	46 ft
2,944 gpm	0 psi	0 ft



1224 Rolesville Rd



4/21/2025, 9:59:31 AM

1:4,800

0 0.04 0.08 0.16 mi

0 0.05 0.1 0.2 km

City of Raleigh and Wake County, Lee Kimmel, Sarah Lanier, Andrew Hayes

Web AppBuilder for ArcGIS
Lee Kimmel, Sarah Lanier, Andrew Hayes |

HOSE MONSTER COMPANY

2” PITOTLESS NOZZLE®

PN2THD - GPM FLOW CHART

FC-PN2THD.2023.04.30.MA

	HM2H	OA
PSI	GPM	GPM
10	521	529
11	547	555
12	571	579
13	594	603
14	617	626
15	638	648
16	659	669
17	679	689
18	699	709
19	718	729
20	737	748
21	755	766
22	773	784
23	790	802
24	807	819
25	824	836
26	840	853
27	856	869
28	872	885
29	887	900
30	903	916

	HM2H	OA
PSI	GPM	GPM
31	918	931
32	932	946
33	947	960
34	961	975
35	975	989
36	989	1003
37	1002	1017
38	1016	1031
39	1029	1044
40	1042	1057
41	1055	1071
42	1068	1084
43	1081	1096
44	1093	1109
45	1106	1122
46	1118	1134
47	1130	1146
48	1142	1158
49	1154	1170
50	1165	1182
51	1177	1194

	HM2H	OA
PSI	GPM	GPM
52	1188	1206
53	1200	1217
54	1211	1229
55	1222	1240
56	1233	1251
57	1244	1262
58	1255	1273
59	1266	1284
60	1277	1295
61	1287	1306
62	1298	1317
63	1308	1327
64	1318	1338
65	1329	1348
66	1339	1358
67	1349	1369
68	1359	1379
69	1369	1389
70	1379	1399

THIS DEVICE IS FM APPROVED

The pressure vs. flow rate data developed within this flow chart is based on the average K-factor measured during laboratory testing. This data has been determined to be within the acceptable limitations for accuracy. It is the user’s responsibility to verify that the correct chart and column is being used.

HM2H | 2 ½” Hose Monster® Model II or Flusher with flow splitter (HM2H, HM2HF) Use this column if the Pitotless Nozzle® is connected to the 2 ½” Hose Monster® or Flusher. The built-in pitot or flow splitter must be installed for accuracy.

OA | Open Atmosphere - Use this column when the Pitotless Nozzle® is connected directly to a test header or hydrant flowing openly to atmosphere.

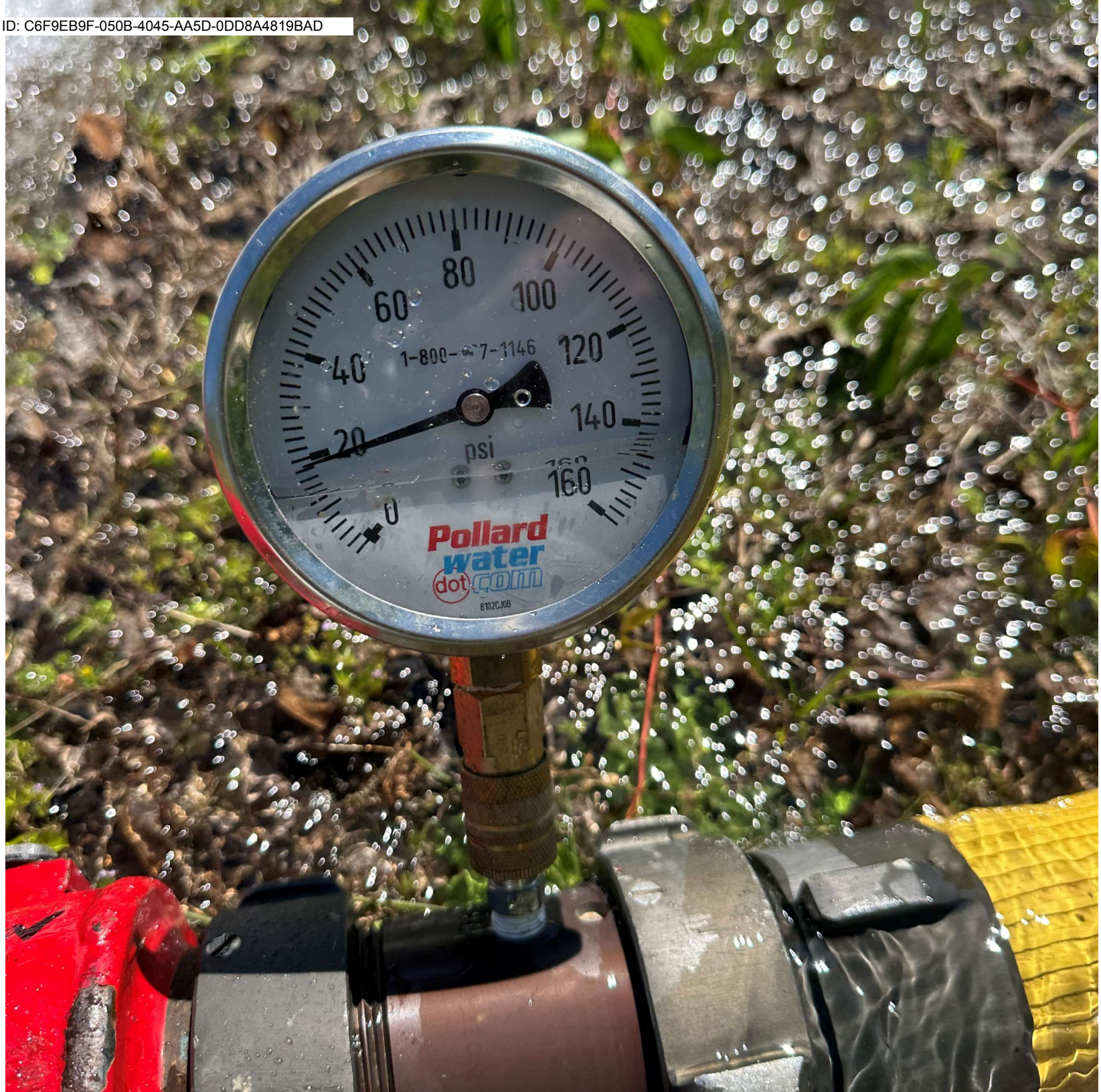
GET THE MOST OUT OF YOUR HOSE MONSTER® HARDWARE

FIRE PUMP TESTING SOFTWARE

Professional-grade software that helps you work better! Keep your reports clean, your results accurate, and your process streamlined with Hose Monster’s FPT Software.

LEARN MORE AT HOSEMONSTER.COM/RESOURCES

(888) 202-9987 (847) 434-0073 service@hosemonster.com hosemonster.com



American Engineering Associates - Southeast, PA
Chesapeake, Virginia
(757) 468 - 6800
www.American-EA.com

Spreadsheet Calculation of 20 PSI Hydrant Residual Flow

AVAILABLE FIRE FLOW

AMERICAN Engineering

CALCULATIONS BY:	Charles Jerome
CHECKED BY:	Patrick Lewis
DATE:	5/28/2025
PROJECT:	Merritt Reserve Water Model
PROJECT #	R230004

Available Fire Flow is calculated based on the results of a recent hydrant flow test

Date of Hydrant Flow Test:	04/29/25	
Fire Hydrant used for Flow Rate:	WHYD196642	
Hydrant Flow Rate:	1,312	gallons per minute
Fire Hydrant used for Pressure:	WHYD196641	
Static Pressure:	67	psi
Residual Pressure:	52	psi

Calculate the Available Fire Flow based on a minimum residual pressure

Minimum Residual Pressure: 20 psi

Qr = Qf x [hr ^ (0.54) / hf ^ (0.54)]

Qr = available flow at minimum residual pressure

Qf = flow rate measured during test

hr = pressure drop to minimum residual pressure

hf = pressure drop measured during test

Qr = 1,312 x 8.00 / 4.32

Available Fire Flow = 2,431 gallons per minute

American Engineering Associates - Southeast, PA
Chesapeake, Virginia
(757) 468 - 6800
www.American-EA.com

Source Pump Curve for Model

Merritt Reserve Water Model
Active Scenario: Domestic
Pump Definition Detailed Report: Hydrant Flow Test

Element Details			
ID	458	Notes	
Label	Hydrant Flow Test		

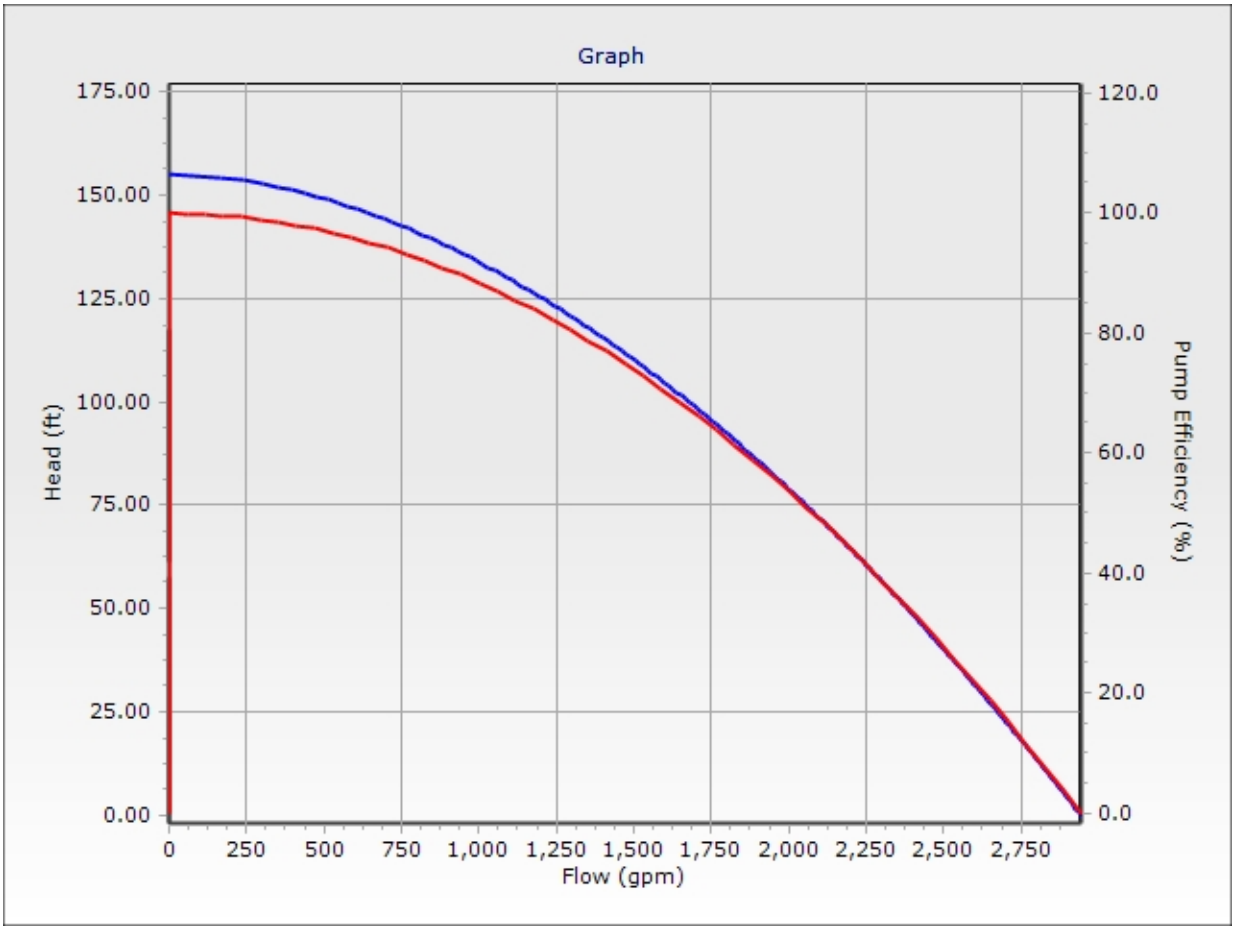
Pump Curve

Flow (gpm)	Head (ft)
0	155.00
1,312	120.00
1,942	83.00
2,431	46.00
2,944	0.00

Pump Efficiency Type			
Pump Efficiency Type	Best Efficiency Point	Motor Efficiency	100.0 %
BEP Efficiency	100.0 %	Is Variable Speed Drive?	False
BEP Flow	0 gpm		

Transient (Physical)			
Inertia (Pump and Motor)	0.000 lb·ft²	Specific Speed	SI=25, US=1280
Speed (Full)	0 rpm	Reverse Spin Allowed?	True

Merritt Reserve Water Model
Active Scenario: Domestic
Pump Definition Detailed Report: Hydrant Flow Test



American Engineering Associates - Southeast, PA
Chesapeake, Virginia
(757) 468 - 6800
www.American-EA.com

Domestic Model

- Schematic Results
- High Pressure Schematic Figures
- Pipe Table
- Junction Table

Merritt Reserve
Domestic Demand Model Layout Figure 1

NOT TO SCALE

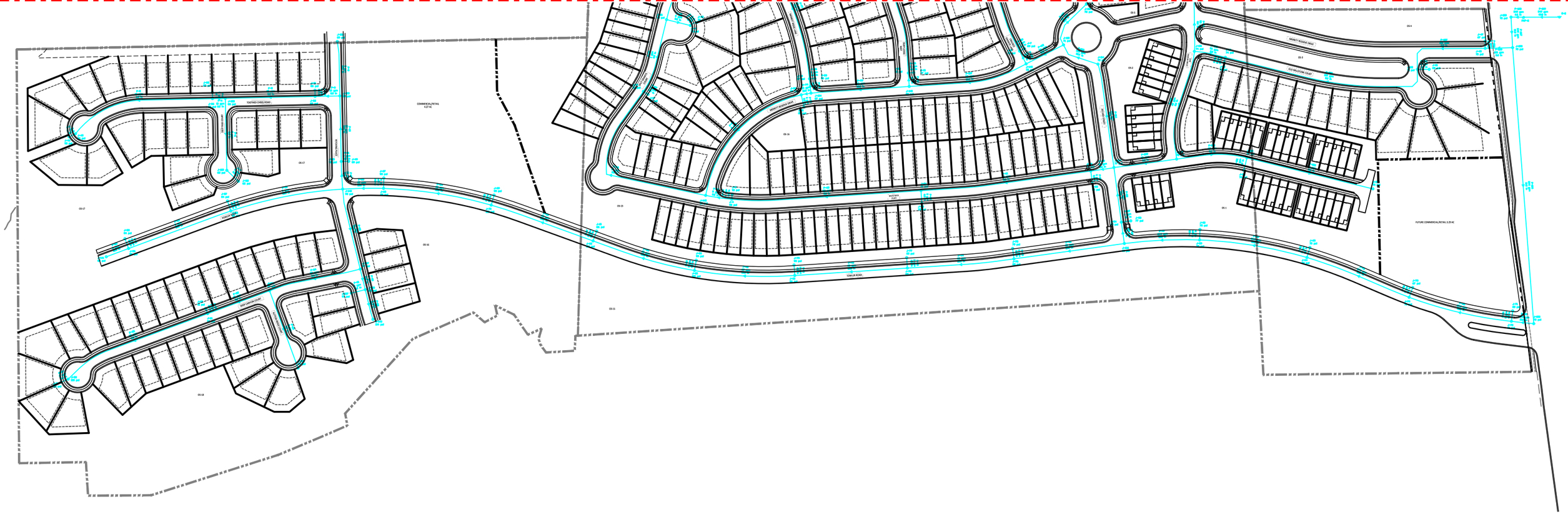
Match Line Figure 2

Merritt Reserve
Domestic Demand Model Layout Figure 2

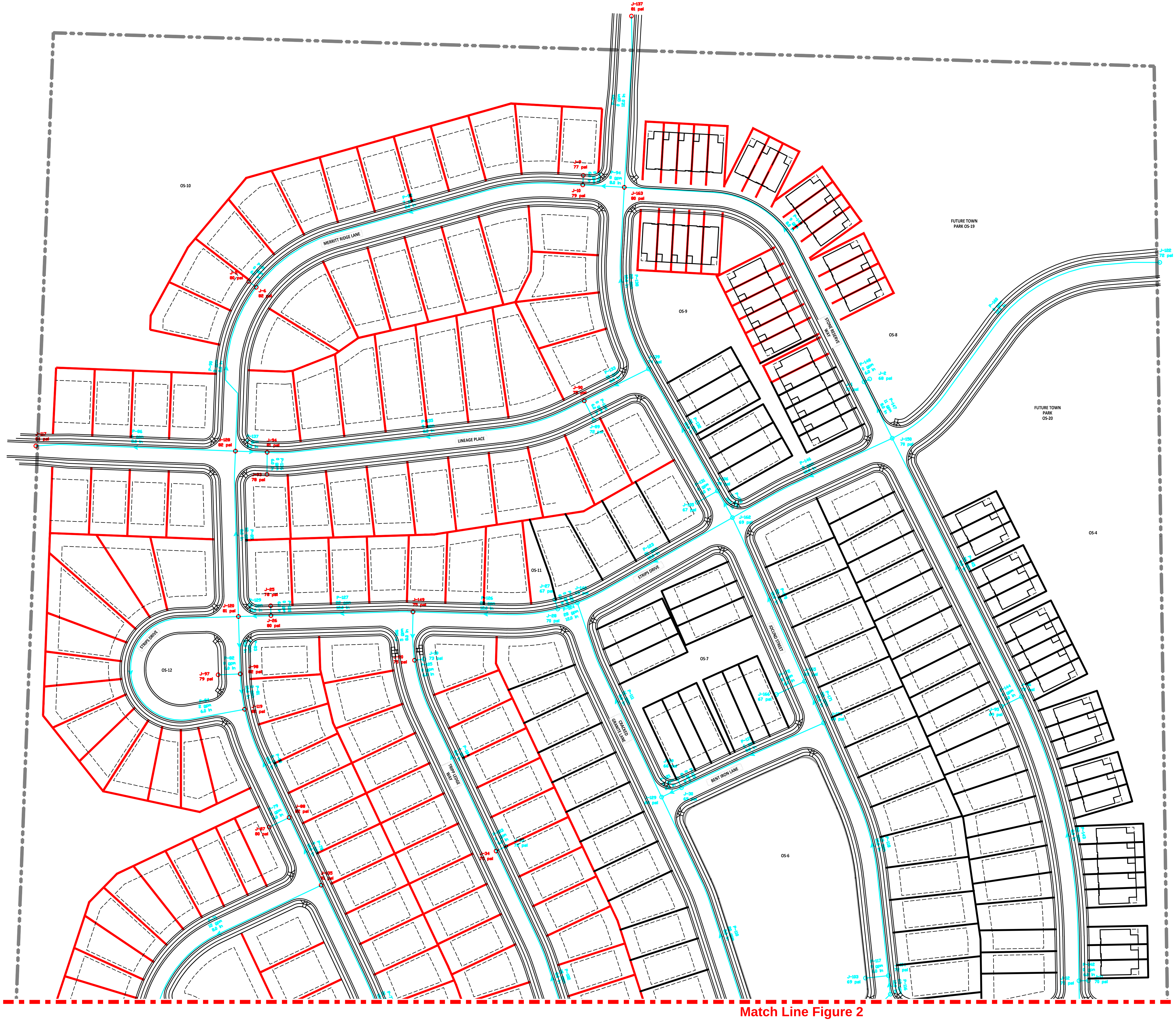
NOT TO SCALE

N

Match Line Figure 1



Merritt Reserve
Domestic Demand High Pressure Figure 1



N

NOTE:

RED OUTLINE INDICATES THAT THE PROPERTY REQUIRES A PRESSURE REDUCING VALVE (PRV) DUE TO PRESSURE EXCEEDING 75 PSI

NOT TO SCALE

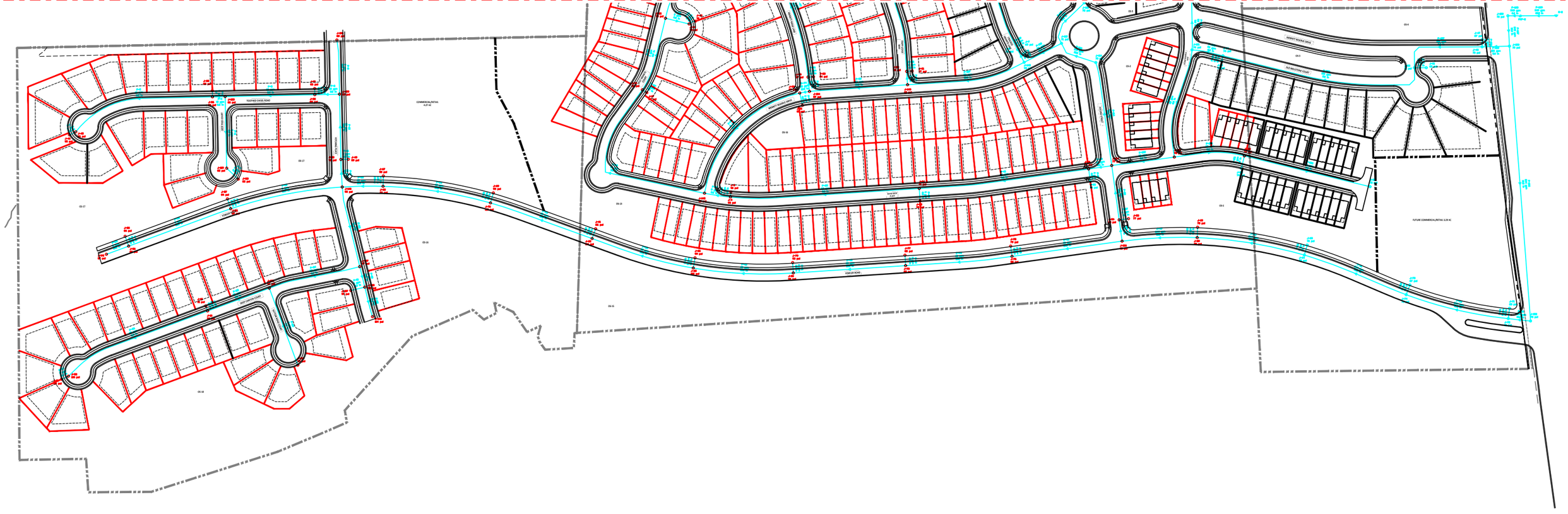
Merritt Reserve
Domestic Demand High Pressure Figure 2

NOTE:

RED OUTLINE INDICATES THAT THE PROPERTY REQUIRES A PRESSURE REDUCING VALVE (PRV) DUE TO PRESSURE EXCEEDING 75 PSI

NOT TO SCALE

N



Merritt Reserve Water Model
Active Scenario: Domestic
FlexTable: Pipe Table

Label	Diameter (in)	Length (User Defined) (ft)	Flow (gpm)	Headloss (ft)	Headloss Gradient (ft/ft)	Is Active?	Velocity (ft/s)	Is Open?	Hazen-Williams C
P-167	16.0	112	349	0.01	0.000	True	0.56	True	130.0
P-168	6.0	3	349	0.02	0.008	True	3.96	True	150.0
P-169	60.0	110	349	0.00	0.000	True	0.04	True	150.0
P-51	12.0	336	244	0.06	0.000	True	0.69	True	130.0
P-53	12.0	322	244	0.06	0.000	True	0.69	True	130.0
P-166	16.0	859	244	0.04	0.000	True	0.39	True	130.0
P-47	12.0	231	244	0.04	0.000	True	0.69	True	130.0
P-49	12.0	333	244	0.06	0.000	True	0.69	True	130.0
P-55	12.0	69	244	0.01	0.000	True	0.69	True	130.0
P-58	12.0	168	199	0.02	0.000	True	0.56	True	130.0
P-56	12.0	66	199	0.01	0.000	True	0.56	True	130.0
P-113	12.0	128	163	0.01	0.000	True	0.46	True	130.0
P-114	12.0	320	163	0.03	0.000	True	0.46	True	130.0
P-155	8.0	640	106	0.18	0.000	True	0.67	True	130.0
P-159	8.0	36	106	0.01	0.000	True	0.67	True	130.0
P-157	8.0	263	106	0.07	0.000	True	0.67	True	130.0
P-153	8.0	97	96	0.02	0.000	True	0.61	True	130.0
P-112	12.0	129	94	0.00	0.000	True	0.27	True	130.0
P-107	12.0	369	72	0.01	0.000	True	0.21	True	130.0
P-115	12.0	157	69	0.00	0.000	True	0.19	True	130.0
P-116	12.0	33	69	0.00	0.000	True	0.19	True	130.0
P-118	12.0	459	68	0.01	0.000	True	0.19	True	130.0
P-171	12.0	58	55	0.00	0.000	True	0.16	True	130.0
P-141	8.0	168	53	0.01	0.000	True	0.34	True	130.0
P-143	8.0	510	52	0.04	0.000	True	0.33	True	130.0
P-170	12.0	222	50	0.00	0.000	True	0.14	True	130.0
P-99	12.0	301	49	0.00	0.000	True	0.14	True	130.0
P-59	8.0	73	48	0.00	0.000	True	0.30	True	130.0
P-61	8.0	524	48	0.03	0.000	True	0.30	True	130.0
P-40	12.0	308	45	0.00	0.000	True	0.13	True	130.0
P-42	12.0	345	45	0.00	0.000	True	0.13	True	130.0
P-44	12.0	328	45	0.00	0.000	True	0.13	True	130.0
P-36	12.0	330	45	0.00	0.000	True	0.13	True	130.0
P-46	12.0	341	45	0.00	0.000	True	0.13	True	130.0
P-38	12.0	323	45	0.00	0.000	True	0.13	True	130.0
P-33	12.0	125	45	0.00	0.000	True	0.13	True	130.0
P-34	12.0	334	45	0.00	0.000	True	0.13	True	130.0
P-140	8.0	339	42	0.02	0.000	True	0.27	True	130.0
P-130	12.0	54	37	0.00	0.000	True	0.10	True	130.0
P-132	12.0	244	36	0.00	0.000	True	0.10	True	130.0
P-145	8.0	504	36	0.02	0.000	True	0.23	True	130.0
P-75	12.0	44	31	0.00	0.000	True	0.09	True	130.0
P-77	12.0	446	31	0.00	0.000	True	0.09	True	130.0
P-63	8.0	581	29	0.01	0.000	True	0.18	True	130.0

Merritt Reserve Water Model
Active Scenario: Domestic
FlexTable: Pipe Table

Label	Diameter (in)	Length (User Defined) (ft)	Flow (gpm)	Headloss (ft)	Headloss Gradient (ft/ft)	Is Active?	Velocity (ft/s)	Is Open?	Hazen-Williams C
P-124	12.0	36	28	0.00	0.000	True	0.08	True	130.0
P-126	12.0	253	28	0.00	0.000	True	0.08	True	130.0
P-23	12.0	251	27	0.00	0.000	True	0.08	True	130.0
P-24	8.0	286	23	0.00	0.000	True	0.15	True	130.0
P-138	12.0	326	22	0.00	0.000	True	0.06	True	130.0
P-127	12.0	249	22	0.00	0.000	True	0.06	True	130.0
P-123	12.0	309	21	0.00	0.000	True	0.06	True	130.0
P-108	8.0	44	20	0.00	0.000	True	0.13	True	130.0
P-110	8.0	526	20	0.01	0.000	True	0.13	True	130.0
P-150	8.0	217	20	0.00	0.000	True	0.13	True	130.0
P-129	12.0	57	18	0.00	0.000	True	0.05	True	130.0
P-17	12.0	85	18	0.00	0.000	True	0.05	True	130.0
P-15	12.0	200	18	0.00	0.000	True	0.05	True	130.0
P-8	8.0	76	18	0.00	0.000	True	0.12	True	130.0
P-5	8.0	275	18	0.00	0.000	True	0.12	True	130.0
P-25	8.0	202	17	0.00	0.000	True	0.11	True	130.0
P-152	8.0	397	16	0.00	0.000	True	0.10	True	130.0
P-111	8.0	370	16	0.00	0.000	True	0.10	True	130.0
P-100	8.0	41	15	0.00	0.000	True	0.10	True	130.0
P-102	8.0	486	15	0.00	0.000	True	0.10	True	130.0
P-66	8.0	595	14	0.00	0.000	True	0.09	True	130.0
P-26	8.0	476	13	0.00	0.000	True	0.08	True	130.0
P-74	12.0	31	13	0.00	0.000	True	0.04	True	130.0
P-85	8.0	289	12	0.00	0.000	True	0.08	True	130.0
P-71	8.0	396	12	0.00	0.000	True	0.08	True	130.0
P-139	8.0	194	12	0.00	0.000	True	0.07	True	130.0
P-147	8.0	110	11	0.00	0.000	True	0.07	True	130.0
P-133	8.0	125	10	0.00	0.000	True	0.06	True	130.0
P-4	6.0	40	10	0.00	0.000	True	0.11	True	130.0
P-2	6.0	452	10	0.01	0.000	True	0.11	True	130.0
P-149	8.0	601	9	0.00	0.000	True	0.06	True	130.0
P-78	12.0	131	9	0.00	0.000	True	0.03	True	130.0
P-135	8.0	565	9	0.00	0.000	True	0.06	True	130.0
P-146	12.0	311	8	0.00	0.000	True	0.02	True	130.0
P-94	8.0	73	8	0.00	0.000	True	0.05	True	130.0
P-65	8.0	80	8	0.00	0.000	True	0.05	True	130.0
P-80	12.0	205	8	0.00	0.000	True	0.02	True	130.0
P-72	12.0	451	8	0.00	0.000	True	0.02	True	130.0
P-92	8.0	614	7	0.00	0.000	True	0.05	True	130.0
P-119	8.0	273	6	0.00	0.000	True	0.04	True	130.0
P-86	8.0	349	6	0.00	0.000	True	0.04	True	130.0
P-106	8.0	85	5	0.00	0.000	True	0.03	True	130.0
P-83	12.0	100	4	0.00	0.000	True	0.01	True	130.0
P-104	8.0	363	4	0.00	0.000	True	0.02	True	130.0

Merritt Reserve Water Model
Active Scenario: Domestic
FlexTable: Pipe Table

Label	Diameter (in)	Length (User Defined) (ft)	Flow (gpm)	Headloss (ft)	Headloss Gradient (ft/ft)	Is Active?	Velocity (ft/s)	Is Open?	Hazen-Williams C
P-30	12.0	65	3	0.00	0.000	True	0.01	True	130.0
P-81	12.0	63	3	0.00	0.000	True	0.01	True	130.0
P-90	8.0	306	3	0.00	0.000	True	0.02	True	130.0
P-29	6.0	252	3	0.00	0.000	True	0.03	True	130.0
P-32	12.0	94	3	0.00	0.000	True	0.01	True	130.0
P-69	8.0	75	3	0.00	0.000	True	0.02	True	130.0
P-121	8.0	39	2	0.00	0.000	True	0.01	True	130.0
P-6	6.0	220	2	0.00	0.000	True	0.02	True	130.0
P-84	6.0	491	2	0.00	0.000	True	0.02	True	130.0
P-68	8.0	232	1	0.00	0.000	True	0.01	True	130.0
P-154	6.0	17	0	0.00	0.000	True	0.00	True	130.0
P-105	6.0	17	0	0.00	0.000	True	0.00	True	130.0
P-101	6.0	17	0	0.00	0.000	True	0.00	True	130.0
P-128	6.0	17	0	0.00	0.000	True	0.00	True	130.0
P-50	6.0	32	0	0.00	0.000	True	0.00	True	130.0
P-35	6.0	32	0	0.00	0.000	True	0.00	True	130.0
P-62	6.0	39	0	0.00	0.000	True	0.00	True	130.0
P-60	6.0	39	0	0.00	0.000	True	0.00	True	130.0
P-134	6.0	39	0	0.00	0.000	True	0.00	True	130.0
P-73	6.0	39	0	0.00	0.000	True	0.00	True	130.0
P-136	6.0	39	0	0.00	0.000	True	0.00	True	130.0
P-144	6.0	39	0	0.00	0.000	True	0.00	True	130.0
P-31	6.0	44	0	0.00	0.000	True	0.00	True	130.0
P-48	6.0	32	0	0.00	0.000	True	0.00	True	130.0
P-91	6.0	17	0	0.00	0.000	True	0.00	True	130.0
P-109	6.0	17	0	0.00	0.000	True	0.00	True	130.0
P-28	6.0	17	0	0.00	0.000	True	0.00	True	130.0
P-76	6.0	17	0	0.00	0.000	True	0.00	True	130.0
P-125	6.0	17	0	0.00	0.000	True	0.00	True	130.0
P-156	6.0	36	0	0.00	0.000	True	0.00	True	130.0
P-79	6.0	39	0	0.00	0.000	True	0.00	True	130.0
P-54	6.0	32	0	0.00	0.000	True	0.00	True	130.0
P-27	6.0	23	0	0.00	0.000	True	0.00	True	130.0
P-82	6.0	39	0	0.00	0.000	True	0.00	True	130.0
P-165	6.0	19	0	0.00	0.000	True	0.00	True	130.0
P-103	6.0	19	0	0.00	0.000	True	0.00	True	130.0
P-3	6.0	19	0	0.00	0.000	True	0.00	True	130.0
P-7	6.0	48	0	0.00	0.000	True	0.00	True	130.0
P-64	6.0	15	0	0.00	0.000	True	0.00	True	130.0
P-93	6.0	17	0	0.00	0.000	True	0.00	True	130.0
P-67	6.0	17	0	0.00	0.000	True	0.00	True	130.0
P-16	6.0	23	0	0.00	0.000	True	0.00	True	130.0
P-151	6.0	40	0	0.00	0.000	True	0.00	True	130.0
P-117	6.0	40	0	0.00	0.000	True	0.00	True	130.0

Merritt Reserve Water Model
Active Scenario: Domestic
FlexTable: Pipe Table

Label	Diameter (in)	Length (User Defined) (ft)	Flow (gpm)	Headloss (ft)	Headloss Gradient (ft/ft)	Is Active?	Velocity (ft/s)	Is Open?	Hazen-Williams C
P-172	6.0	35	0	0.00	0.000	True	0.00	True	130.0
P-57	6.0	30	0	0.00	0.000	True	0.00	True	130.0
P-41	6.0	32	0	0.00	0.000	True	0.00	True	130.0
P-142	6.0	17	0	0.00	0.000	True	0.00	True	130.0
P-22	12.0	73	0	0.00	0.000	True	0.00	True	130.0
P-21	6.0	32	0	0.00	0.000	True	0.00	True	130.0
P-19	6.0	32	0	0.00	0.000	True	0.00	True	130.0
P-37	6.0	32	0	0.00	0.000	True	0.00	True	130.0
P-164	6.0	32	0	0.00	0.000	True	0.00	True	130.0
P-43	6.0	32	0	0.00	0.000	True	0.00	True	130.0
P-95	12.0	299	0	0.00	0.000	True	0.00	True	130.0
P-120	6.0	18	0	0.00	0.000	True	0.00	True	130.0
P-70	6.0	22	0	0.00	0.000	True	0.00	True	130.0
P-158	6.0	22	0	0.00	0.000	True	0.00	True	130.0
P-18	12.0	350	0	0.00	0.000	True	0.00	True	130.0
P-20	12.0	333	0	0.00	0.000	True	0.00	True	130.0
P-1	6.0	22	0	0.00	0.000	True	0.00	True	130.0
P-131	6.0	41	0	0.00	0.000	True	0.00	True	130.0
P-52	6.0	32	0	0.00	0.000	True	0.00	True	130.0
P-45	6.0	32	0	0.00	0.000	True	0.00	True	130.0
P-148	6.0	11	0	0.00	0.000	True	0.00	True	130.0
P-39	6.0	32	0	0.00	0.000	True	0.00	True	130.0
P-9	12.0	166	0	0.00	0.000	True	0.00	True	130.0
P-160	12.0	592	0	0.00	0.000	True	0.00	True	130.0
P-137	8.0	55	0	0.00	0.000	True	0.00	True	130.0

Merritt Reserve Water Model
Active Scenario: Domestic
FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-29	393.90	0	547.15	66
J-166	392.90	0	547.15	67
J-105	392.61	0	547.15	67
J-27	392.14	0	547.15	67
J-47	392.19	0	547.50	67
J-73	391.49	0	547.40	67
J-130	389.34	6	547.15	68
J-2	389.28	0	547.15	68
J-81	389.45	0	547.42	68
J-71	389.18	0	547.46	68
J-165	388.77	6	547.15	69
J-103	388.58	0	547.16	69
J-7	388.09	0	547.16	69
J-95	387.59	0	547.17	69
J-30	387.36	4	547.15	69
J-129	387.03	7	547.15	69
J-146	386.67	8	547.15	69
J-162	386.54	1	547.15	69
J-159	386.17	0	547.52	70
J-106	385.76	1	547.15	70
J-28	385.64	0	547.15	70
J-114	385.33	0	547.17	70
J-48	385.34	0	547.50	70
J-158	385.34	0	547.51	70
J-63	385.15	0	547.33	70
J-11	384.94	0	547.21	70
J-151	384.87	16	547.19	70
J-74	384.72	0	547.40	70
J-150	384.24	16	547.15	70
J-13	382.99	0	547.24	71
J-1	382.81	2	547.15	71
J-82	382.97	0	547.42	71
J-72	382.41	0	547.46	71
J-115	381.91	0	547.16	71
J-104	381.86	1	547.16	72
J-145	381.58	1	547.16	72
J-8	381.56	0	547.16	72
J-96	381.05	17	547.17	72
J-116	381.01	0	547.16	72
J-89	380.77	0	547.14	72
J-33	380.42	0	547.15	72
J-122	380.17	0	547.15	72
J-19	379.56	0	547.15	73
J-152	379.22	0	547.47	73
J-12	378.41	1	547.21	73
J-64	378.38	0	547.33	73

Merritt Reserve Water Model
Active Scenario: Domestic
FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-139	376.64	3	547.15	74
J-14	376.46	10	547.24	74
J-85	376.23	0	547.20	74
J-131	375.54	1	547.22	74
J-101	375.42	0	547.20	74
J-90	374.24	1	547.14	75
J-60	374.21	0	547.27	75
J-34	373.85	12	547.15	75
J-149	373.43	1	547.15	75
J-20	373.04	8	547.15	75
J-43	372.11	0	547.14	76
J-9	369.94	0	547.14	77
J-53	369.88	0	547.22	77
J-164	369.72	0	547.20	77
J-86	369.70	0	547.20	77
J-21	369.26	0	547.15	77
J-102	368.85	4	547.20	77
J-25	367.71	0	547.14	78
J-132	367.63	10	547.20	78
J-59	367.45	0	547.27	78
J-93	365.93	0	547.14	78
J-83	365.74	0	547.16	78
J-44	365.37	3	547.14	79
J-97	365.05	0	547.14	79
J-111	364.45	10	547.14	79
J-75	363.55	0	547.23	79
J-10	363.41	1	547.14	79
J-5	363.32	0	547.14	80
J-87	363.21	0	547.14	80
J-148	363.21	8	547.15	80
J-163	362.94	24	547.14	80
J-22	362.68	0	547.15	80
J-54	362.62	0	547.22	80
J-136	361.93	0	547.23	80
J-26	361.09	3	547.14	80
J-120	359.90	1	547.14	81
J-94	359.37	9	547.14	81
J-137	359.32	0	547.14	81
J-84	359.21	19	547.16	81
J-135	358.92	10	547.14	81
J-128	358.60	3	547.14	82
J-98	358.52	1	547.14	82
J-119	357.79	13	547.14	82
J-17	357.52	0	547.14	82
J-110	357.54	0	547.21	82
J-6	356.78	10	547.14	82

Merritt Reserve Water Model
Active Scenario: Domestic
FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-88	356.68	1	547.14	82
J-76	356.31	0	547.23	83
J-35	354.55	0	547.21	83
J-117	354.12	6	547.14	84
J-55	354.06	0	547.21	84
J-23	353.00	0	547.15	84
J-57	352.65	0	547.21	84
J-91	351.64	0	547.15	85
J-109	351.31	2	547.21	85
J-77	351.28	0	547.22	85
J-18	350.94	13	547.14	85
J-31	349.27	0	547.21	86
J-123	348.62	6	547.21	86
J-36	347.98	0	547.21	86
J-56	347.28	0	547.21	86
J-24	346.46	0	547.15	87
J-134	346.27	6	547.15	87
J-141	346.19	0	547.21	87
J-58	345.64	0	547.21	87
J-92	345.18	5	547.15	87
J-78	344.20	0	547.22	88
J-32	342.44	0	547.21	89
J-133	342.11	0	547.21	89
J-126	341.88	0	547.21	89
J-49	341.62	0	547.21	89
J-3	338.19	0	547.15	90
J-15	335.86	0	547.20	91
J-50	334.68	0	547.21	92
J-140	332.62	0	547.21	93
J-67	332.38	0	547.21	93
J-79	332.04	0	547.22	93
J-4	331.68	21	547.15	93
J-46	331.57	0	547.20	93
J-142	331.22	2	547.15	93
J-124	331.17	3	547.20	93
J-16	329.33	3	547.20	94
J-68	325.61	0	547.21	96
J-45	325.36	10	547.20	96
J-80	325.02	0	547.22	96
J-125	323.24	3	547.20	97
J-107	322.41	0	547.21	97
J-147	322.10	1	547.21	97
J-66	319.40	0	547.22	99
J-69	318.93	0	547.21	99
J-108	315.64	1	547.21	100
J-51	314.92	0	547.20	100

Merritt Reserve Water Model
Active Scenario: Domestic
FlexTable: Junction Table

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-61	314.27	0	547.22	101
J-65	312.19	0	547.22	102
J-70	312.16	0	547.21	102
J-52	308.13	13	547.20	103
J-62	307.64	0	547.22	104
J-143	306.29	3	547.21	104

American Engineering Associates - Southeast, PA
Chesapeake, Virginia
(757) 468 - 6800
www.American-EA.com

Fire Flow Model Results

Merritt Reserve Water Model

Active Scenario: Domestic

Fire Flow Node FlexTable: Fire Flow Results Table

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Fire Flow Status
J-46	1,000	1,445	20	20	Passed
J-45	1,000	1,462	20	23	Passed
J-110	1,000	1,514	20	20	Passed
J-109	1,000	1,564	20	23	Passed
J-151	1,000	1,672	20	20	Passed
J-124	1,000	1,708	20	20	Passed
J-35	1,000	1,798	20	20	Passed
J-95	1,000	1,812	20	20	Passed
J-105	1,000	1,823	20	20	Passed
J-36	1,000	1,828	20	23	Passed
J-166	1,000	1,835	20	20	Passed
J-29	1,000	1,839	20	20	Passed
J-101	1,000	1,866	20	20	Passed
J-102	1,000	1,867	20	27	Passed
J-103	1,000	1,873	20	20	Passed
J-123	1,000	1,876	20	24	Passed
J-51	1,000	1,881	20	20	Passed
J-30	1,000	1,884	20	23	Passed
J-27	1,000	1,886	20	20	Passed
J-129	1,000	1,892	20	23	Passed
J-2	1,000	1,893	20	20	Passed
J-89	1,000	1,902	20	20	Passed
J-96	1,000	1,902	20	23	Passed
J-81	1,000	1,911	20	20	Passed
J-52	1,000	1,915	20	23	Passed
J-165	1,000	1,920	20	22	Passed
J-130	1,000	1,920	20	22	Passed
J-146	1,000	1,920	20	23	Passed
J-162	1,000	1,920	20	23	Passed
J-28	1,000	1,920	20	23	Passed
J-106	1,000	1,921	20	23	Passed
J-139	1,000	1,921	20	27	Passed
J-137	1,000	1,921	20	33	Passed
J-163	1,000	1,921	20	32	Passed
J-9	1,000	1,921	20	26	Passed
J-10	1,000	1,921	20	31	Passed
J-90	1,000	1,921	20	26	Passed
J-1	1,000	1,921	20	23	Passed
J-6	1,000	1,921	20	32	Passed
J-5	1,000	1,921	20	27	Passed
J-93	1,000	1,921	20	25	Passed
J-94	1,000	1,921	20	32	Passed
J-128	1,000	1,922	20	33	Passed
J-117	1,000	1,922	20	26	Passed

Merritt Reserve Water Model

Active Scenario: Domestic

Fire Flow Node FlexTable: Fire Flow Results Table

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Fire Flow Status
J-149	1,000	1,922	20	28	Passed
J-7	1,000	1,923	20	20	Passed
J-122	1,000	1,923	20	23	Passed
J-150	1,000	1,923	20	23	Passed
J-8	1,000	1,923	20	25	Passed
J-25	1,000	1,923	20	29	Passed
J-26	1,000	1,923	20	34	Passed
J-20	1,000	1,923	20	27	Passed
J-19	1,000	1,923	20	23	Passed
J-120	1,000	1,923	20	34	Passed
J-33	1,000	1,924	20	20	Passed
J-97	1,000	1,924	20	28	Passed
J-98	1,000	1,924	20	35	Passed
J-119	1,000	1,924	20	35	Passed
J-34	1,000	1,925	20	25	Passed
J-87	1,000	1,925	20	28	Passed
J-88	1,000	1,925	20	35	Passed
J-135	1,000	1,925	20	34	Passed
J-22	1,000	1,926	20	32	Passed
J-21	1,000	1,926	20	28	Passed
J-104	1,000	1,926	20	25	Passed
J-148	1,000	1,926	20	33	Passed
J-116	1,000	1,926	20	25	Passed
J-24	1,000	1,926	20	40	Passed
J-23	1,000	1,926	20	35	Passed
J-145	1,000	1,926	20	25	Passed
J-44	1,000	1,926	20	26	Passed
J-111	1,000	1,926	20	28	Passed
J-43	1,000	1,926	20	20	Passed
J-134	1,000	1,926	20	40	Passed
J-91	1,000	1,927	20	33	Passed
J-92	1,000	1,927	20	40	Passed
J-18	1,000	1,927	20	33	Passed
J-17	1,000	1,927	20	29	Passed
J-115	1,000	1,928	20	25	Passed
J-11	1,000	1,928	20	20	Passed
J-142	1,000	1,929	20	46	Passed
J-3	1,000	1,932	20	40	Passed
J-4	1,000	1,932	20	45	Passed
J-114	1,000	1,934	20	24	Passed
J-83	1,000	1,943	20	23	Passed
J-84	1,000	1,943	20	30	Passed
J-15	1,000	1,945	20	20	Passed
J-86	1,000	1,951	20	29	Passed

Merritt Reserve Water Model

Active Scenario: Domestic

Fire Flow Node FlexTable: Fire Flow Results Table

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Fire Flow Status
J-85	1,000	1,951	20	22	Passed
J-164	1,000	1,953	20	30	Passed
J-73	1,000	1,955	20	20	Passed
J-132	1,000	1,959	20	29	Passed
J-12	1,000	1,961	20	23	Passed
J-54	1,000	1,962	20	34	Passed
J-53	1,000	1,962	20	27	Passed
J-140	1,000	1,965	20	37	Passed
J-57	1,000	1,965	20	23	Passed
J-136	1,000	1,965	20	34	Passed
J-56	1,000	1,965	20	28	Passed
J-77	1,000	1,965	20	32	Passed
J-78	1,000	1,965	20	39	Passed
J-133	1,000	1,965	20	32	Passed
J-49	1,000	1,965	20	30	Passed
J-66	1,000	1,965	20	43	Passed
J-68	1,000	1,965	20	40	Passed
J-80	1,000	1,965	20	46	Passed
J-58	1,000	1,965	20	30	Passed
J-62	1,000	1,965	20	51	Passed
J-67	1,000	1,965	20	34	Passed
J-70	1,000	1,965	20	47	Passed
J-147	1,000	1,965	20	40	Passed
J-79	1,000	1,965	20	39	Passed
J-126	1,000	1,965	20	31	Passed
J-50	1,000	1,965	20	36	Passed
J-108	1,000	1,965	20	43	Passed
J-31	1,000	1,965	20	24	Passed
J-61	1,000	1,965	20	44	Passed
J-75	1,000	1,965	20	28	Passed
J-65	1,000	1,965	20	50	Passed
J-76	1,000	1,965	20	35	Passed
J-143	1,000	1,965	20	47	Passed
J-125	1,000	1,965	20	32	Passed
J-69	1,000	1,965	20	41	Passed
J-107	1,000	1,965	20	35	Passed
J-141	1,000	1,965	20	28	Passed
J-32	1,000	1,965	20	29	Passed
J-55	1,000	1,965	20	21	Passed
J-16	1,000	1,965	20	23	Passed
J-131	1,000	1,970	20	26	Passed
J-60	1,000	1,978	20	25	Passed
J-59	1,000	1,978	20	31	Passed
J-14	1,000	1,979	20	25	Passed

Merritt Reserve Water Model

Active Scenario: Domestic

Fire Flow Node FlexTable: Fire Flow Results Table

Label	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Fire Flow Status
J-13	1,000	1,979	20	20	Passed
J-63	1,000	1,999	20	20	Passed
J-64	1,000	1,999	20	27	Passed
J-47	1,000	2,000	20	20	Passed
J-48	1,000	2,000	20	26	Passed
J-71	1,000	2,000	20	20	Passed
J-72	1,000	2,000	20	27	Passed
J-74	1,000	2,000	20	25	Passed
J-82	1,000	2,000	20	23	Passed
J-152	1,000	2,000	20	28	Passed
J-158	1,000	2,000	20	27	Passed
J-159	1,000	2,000	20	27	Passed