City of Sumas

Water System Comprehensive Plan

December 2025

Written by: Sumas City Staff

Special Thanks to: Cascade Engineering Group

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1 Description of Water System

1.1 Ownership and Management

This Water System Plan (WSP) pertains to the City of Sumas public water system. The system has the identification number **84870B** as assigned by the Washington State Department of Health (WDOH). The system is known as the **"Sumas Water Department"** in WDOH official records. The system is owned by the City of Sumas, which is a municipality established pursuant to the authority of Title 35A RCW, the optional municipal code.

Sumas is organized under the Mayor-Council plan of government, as established in chapter 35A.12 RCW. In this plan of government, an elected mayor is the chief executive officer and is in charge of all departments, including the water utility. The mayor has authority to hire necessary staff and delegate responsibility for day-to-day utility operations. An elected five-member council establishes policies and regulations and appropriates funds to conduct operations. A detailed description of Sumas' management and decision-making structure is included in chapter 6.

A copy of the current Water Facilities Inventory form is included as Figure 1.1.

[Figure 1.1. Water Facilities Inventory Form]

1.2 System History and Background

1.2.1 History of System Development

Original settlement in Sumas occurred in the late 1800s and was supported by the presence of springs at the toe of the slope of the glacial upland immediately northwest of town called Moe's Hill, near the site of the current Sumas Wellfield. A diversion box was used to collect spring water and guide it into a ditch heading west along Kneuman Road to town. Eventually a small reservoir was built atop Moe's Hill, and a pump station was used to pump water from Kneuman Road to the reservoir. Over time, a larger 155,000 gallon reservoir was installed and the ditch was replaced by an AC pipe.

This early growth was dependent upon timber and mining booms in the immediate area, and the population of Sumas swelled to about 2,500. There are historic turn-of-the-century plats extending over a much wider area than the existing developed town. By the 1920s, the mining and timber booms had concluded and Sumas had shrunk to a size of less than 700 people. Throughout the middle 1900s, Sumas maintained a stable size and thrived upon border related commerce and agricultural-related services.

Provision of water to surrounding dairy farms began during the middle part of the century. Between 1959 and 1971, three wells were drilled and water was supplied to the City of Nooksack and the rural area to the south. Sumas and the rural area to the east were also fed from

the wells, and everyday use of the spring diversion box was discontinued. The diversion box would now be used only in an emergency. In the early 1970s, Kramer, Chin, & Mayo developed a Water System Comprehensive Plan as part of an extensive utility analysis coincident with installation of a sanitary sewer system. In 1982, the existing 500,000 gallon reservoir was installed.

In the mid-1980s, Sumas began to pursue industrial development. The existence of adequate water, coupled with the border crossing and the confluence of several transportation facilities (Burlington-Northern rail, SR9, SR547, SR546, BC Highway 11, the Trans-Canada Highway, and two major cross-border natural gas pipelines) fostered the development of several industrial uses, including a truck-rail reload facility, a gas-fired cogeneration plant with associated lumber kiln, and a shingle-manufacturing facility. The Port of Bellingham was an important partner in the development of the Sumas Wellfield, and the May Road Wellfield was purchased from the City of Lynden and outfitted with two new wells.

The recent industrial growth has brought increased demand for housing. More industrial growth is expected, and more residential and commercial growth will also follow. The comprehensive plan envisions a town of about 2,810 people by the year 2045.

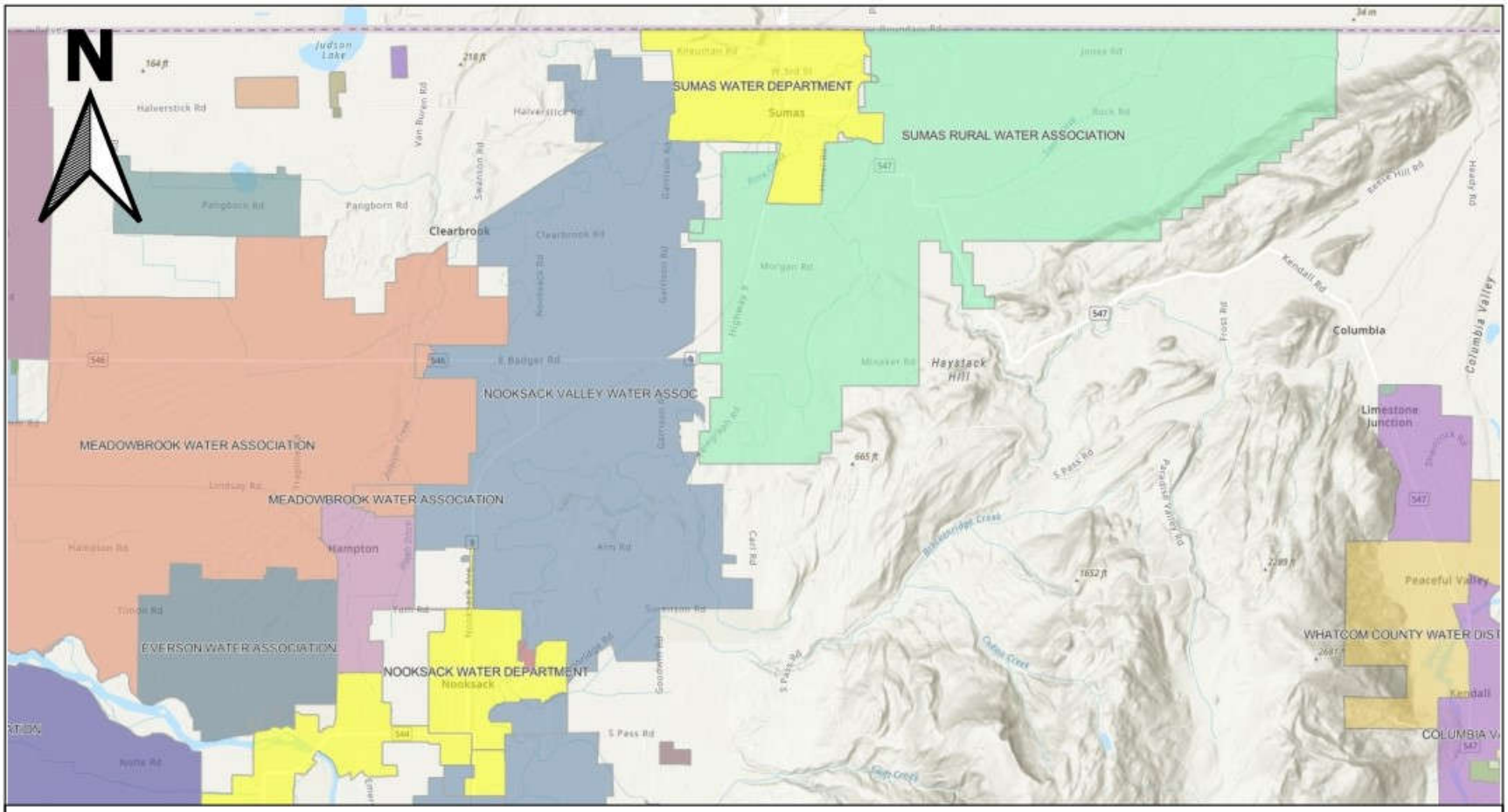
1.2.2 Geography

The only geographic boundaries affecting the Sumas service area are the jurisdictional limits of neighboring purveyors. There are no natural features or man-made structures presenting significant barriers to provision of water service in the vicinity of Sumas. As discussed immediately below, Sumas directly or indirectly provides water to a large area extending about 7 miles south of town. The international border with Canada generally prevents northward extension of the service area, although Sumas did historically provide water to the nearby community of Huntingdon, B.C. This service was largely discontinued in 1989, and only two Canadian customers remain.

See the “General System Description” below for a description of the aquifer supplying Sumas’ water and for a description of the two pressure zones.

1.2.3 Neighboring Purveyors

There are three water systems abutting Sumas. To the north is the water system of the City of Abbotsford, B.C. To the south and southwest is the Nooksack Valley Water Association (NVWA), and to the southeast and east is the Sumas Rural Water Association (SRWA). The latter two associations are wholesale customers that rely upon Sumas for their entire supply. Together with the City of Nooksack, which is a nonadjacent wholesale customer, the rural associations account for roughly 80 percent of the water pumped from the Sumas Wellfield and occupy a 25-square-mile region in the north-central part of Whatcom County. Figure 1.2 shows the Sumas service area in relation to the neighboring rural associations



Projection:
UTM Zone 10 North
NAD 27
Scale: 1:70,000

Data Sources:
Whatcom County
Assessor's Office &
Planning Department and
the City of Sumas

City of Sumas, WA
Figure 1.2
Neighboring Purveyors

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November 17, 2025

1.2.4 Ordinances/Bylaws

Included in Appendix A is a copy of Chapter 20.98 of the Sumas Municipal Code, which establishes improvement standards within new subdivisions. Chapter 20.98 is remarkably brief. The design standards adopted within chapter 7 of this WSP are far more extensive and will be adopted by ordinance.

1.3 Related Plans

The following is a brief discussion of interrelationships between this WSP and other planning documents:

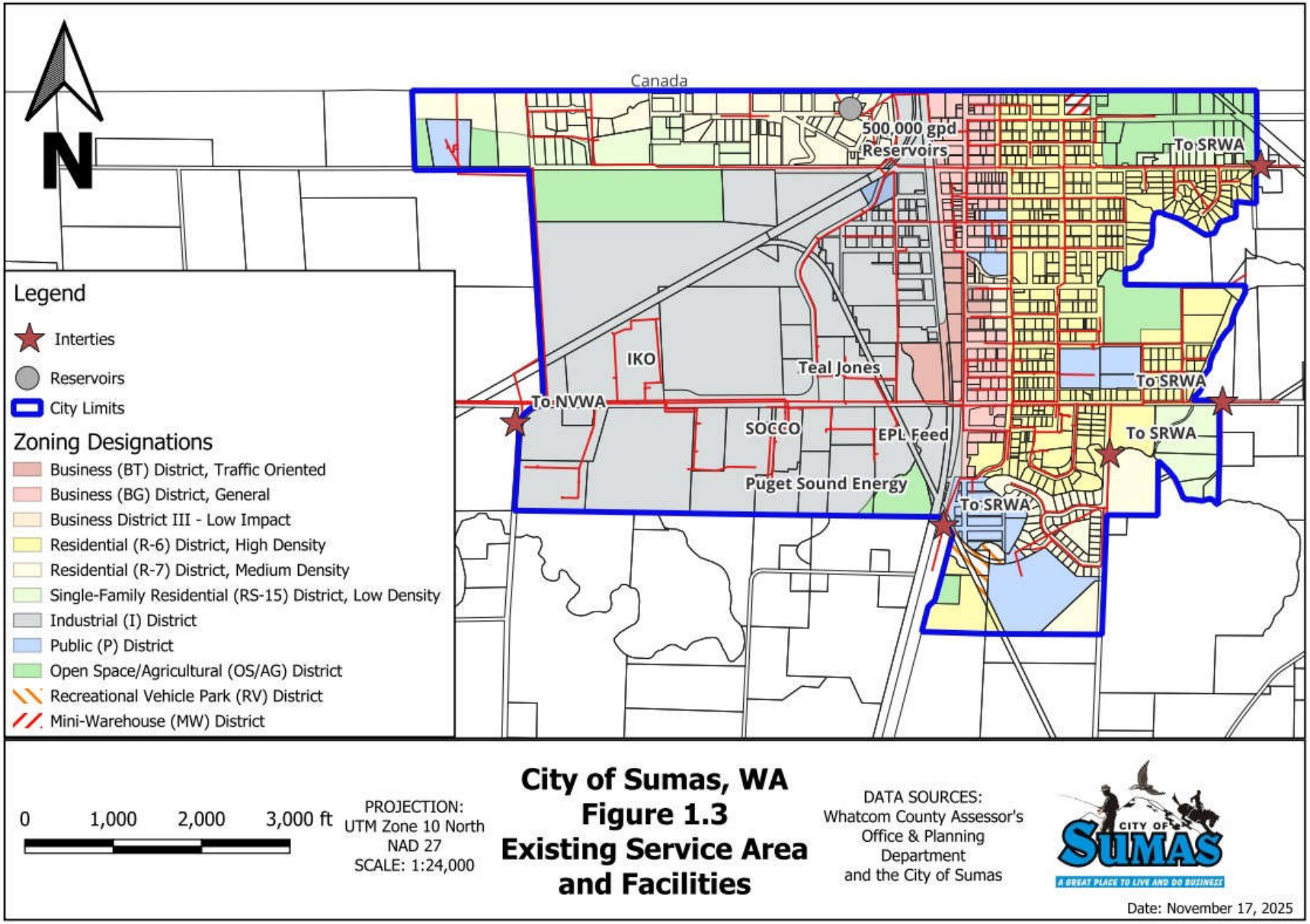
Comprehensive Land Use Plan (CP). Sumas is required to plan under the Growth Management Act (GMA) and has adopted a GMA-compliant CP. The most recent revision to the CP occurred in June 2016 and was used in preparation of this WSP. However, preparations for the next revision to the CP scheduled to be published in December 2025 are underway and information gathered for that revision was used as well. The WSP is consistent with the 2025 CP in that the population projection, existing land use data, and future growth scenarios presented in this WSP are drawn for the 2025 CP, and the proposed Sumas system service area is identical to the UGA identified in the 2025 CP.

Wellhead Protection Program (WHP). Sumas adopted a WHP in 1996. The WHP was developed in accordance with WDOH guidelines and is incorporated by reference as a part of Chapter 5 of this WSP.

1.4 Service Area, Maps, and Land Use

Figure 1.3 shows the existing service area of Sumas' system, together with current zoning districts. The map also shows the locations of roads and buildings, which helps reveal the location and intensity of existing land use.

Generally, Sumas is bisected by the Burlington Northern rail lines that run north through town to the Canadian border. To the west of the rail lines is the industrial district. There are five significant facilities scattered within the district, occupying only about 17% of the available acreage. The facilities are: (1) IKO, a manufacturer of asphalt shingles, which has a demand of about 20,000 gpd; (2) Puget Sound Energy (PSE) has an electric cogeneration plant which has a demand of about 78,500 gpd, met from the May Road Wellfield; (3) EPL, a feed mill; (4) Teal Jones, a lumber storage and manufacturing facility with an associated dry kiln, and (5) SOCCO, another lumber storage and manufacturing facility with an associated dry kiln. The facilities are noted on Figure 1.3.


Canada
500,000 gpd
Reservoirs
To SRWA
IKO
Teal Jones
To NVWA
To SRWA
SOCCO
EPL Feed
To SRWA
Puget Sound Energy
To SRWA
Legend
Interties
Reservoirs
City Limits
Zoning Designations
Business (BT) District, Traffic Oriented
Business (BG) District, General
Business District III - Low Impact
Residential (R-6) District, High Density
Residential (R-7) District, Medium Density
Single-Family Residential (RS-15) District, Low Density
Industrial (I) District
Public (P) District
Open Space/Agricultural (OS/AG) District
Recreational Vehicle Park (RV) District
Mini-Warehouse (MW) District
0
1,000
2,000
3,000 ft
PROJECTION:
UTM Zone 10 North
NAD 27
SCALE: 1:24,000
City of Sumas, WA
Figure 1.3
Existing Service Area
and Facilities
DATA SOURCES:
Whatcom County Assessor's
Office & Planning
Department
and the City of Sumas
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Date: November 17, 2025

Also west of the rail lines, adjacent to the Canadian border, is a panhandle of residential zoning. The panhandle contains more than 40 homes.

Immediately east of the rail lines is the commercial district. There is little vacant land within the commercial district, but not all of the existing development is actually commercial in nature. At the south end of town, some commercial land is still occupied by homes. Commercial development is mostly designed to serve the drive-through traffic generated by the border crossing. There are several gas stations, most with associated mini-marts, and there are several restaurants. There is also border-related development at the north end of the district, including the Customs facility. Aside from the tourist- and border-related development, there is the typical development found in a small town: grocery store, hair salon, post office, city hall, legion hall, realtor, insurance office, and auto-parts store. In terms of water usage, the restaurants and gas stations create the major demands within the commercial district.

East of the commercial area is the historic residential district. Most development within the district is single-family homes, but there are two churches, a school, a library, and about 20 multi-family structures. The density of development is not great (i.e., average lot size of almost 21,000 sq. ft.), because homes were served by septic systems until 1972. There is some infill occurring within the district, but flood regulations generally prohibit any major increase in density within much of the district. Newer residential development has occurred and is occurring on higher land at the northwest panhandle and at the south end of town.

1.5 System Policies

Policy 1: Sumas shall continue wholesale provision of potable water to the Nooksack Valley Water Association, the Sumas Rural Water Association, and the City of Nooksack, as well as the Meadowbrook Water Association, described in more detail below. The volume of water allocated to each customer shall be sufficient to accommodate 20 years of the customer's planned growth as established in the land use CP pertaining to each customer as of December 2025.

In 2015, the City signed an agreement with the Meadowbrook Water Association. They were having issues related to high nitrates and a lack of adequate water rights, so the City expanded its May Road water right to include Meadowbrook's wells. The agreement allows Meadowbrook to operate their wells at a rate to be paid to Sumas, which is a portion of the rate paid by the other wholesale customers. The agreement also allows Meadowbrook to supply a portion of that water to their wholesale customers, including the Northwood Water Association, Northwood Park Water Association, Hampton Water Association, and the Everson Water Association.

Policy 2: Sumas shall not provide wholesale potable water for domestic use to any customer other than those identified in Policy 1.

Policy 3: Sumas shall continue wholesale provision of non-potable (industrial) water to Puget Sound Energy. This water allocation is compatible with existing source capacity and water rights.

Policy 4: At the discretion of the City Council, provision of wholesale water to additional industrial customers may occur. In each such case, the terms of service shall be established in a

written agreement approved by the City Council. See Tables 2-1 and 2-2 for a summary of water allocations and available capacity.

Policy 5: Sumas shall not allow wheeling of water within City-owned facilities. Wheeling means the transportation of water that is supplied by some entity other than the City and that is delivered to a person that is not a wholesale or retail customer of the City.

Policy 6: Sumas shall not approve new retail water service to any person outside City limits, except in cases where human health is threatened as determined by the Whatcom County Health Department.

Policy 7: Sumas shall not approve system extensions to serve urban areas outside the UGA. Sumas may approve extensions to serve rural areas outside the UGA, provided that the target site is within the Sumas service area. Where such an extension is made, the maximum number of connections shall be consistent with county zoning and shall be specified in a legally binding document at the time the extension is approved.

Policy 8: Service to new developments within the service area shall be provided only by direct connection to City facilities. No remote or satellite systems shall be allowed.

Policy 9: Distribution facilities within areas transferred from neighboring systems into City service shall be improved to meet City design and performance standards. The improvement shall either be performed by the neighboring system prior to transfer, in which case the new customers shall pay the standard hookup charge established in City code.

Policy 10: Water facilities within new developments shall be installed consistent with the design and performance standards established in Chapter 7 of this Water System Plan.

Policy 11: All water rates and regulations, hookup cost and Local area facilities charges shall be regulated by chapter 12.04 of the Sumas Municipal Code (SMC).

Policy 12: Facilities necessitated by new development, either on or off the development site, shall be funded solely by the developer, except when oversizing is required by the City. Oversizing means construction of a facility that is larger than would have been required, according to the design standards established in this plan, to accommodate only the new development. Oversizing does not include a facility designed to accommodate the new development, according to minimum applicable standards, that incidentally provides benefits or capacity to customers outside the new development. When oversizing is required by the City, the City shall pay project costs that are in excess of the cost of the facilities that would otherwise have been required by the minimum applicable standards. If developer-funded facilities provide incidental benefits or capacity to undeveloped parts of the service area, the City shall allow the developer to file a latecomer agreement to recover a fair share of the cost from the future development benefiting from the facilities.

Policy 13: No cross-connection shall be allowed that would endanger the potable water supply of the City. As a condition of service, backflow preventers and/or other cross-connection control devices shall be installed at the customer’s expense, as required by the City.

Policy 14: The process for requesting a new service regardless of if it is an individual or group service is as follows. The requester must fill out a Service Request Form at City Hall. Once the hookup fee has been paid, a work order is issued to the water Utility crew who will generally have the meter set in 48 hours. We have done extensive modeling that has shown we have adequate capacity and sufficient water rights until 2045 and still a balance of water rights at that point. The City foresees no non-technical issues related to annexation or water rights issues. When property is annexed into the City, the policy has been to buy the existing infrastructure from the adjacent water purveyor.

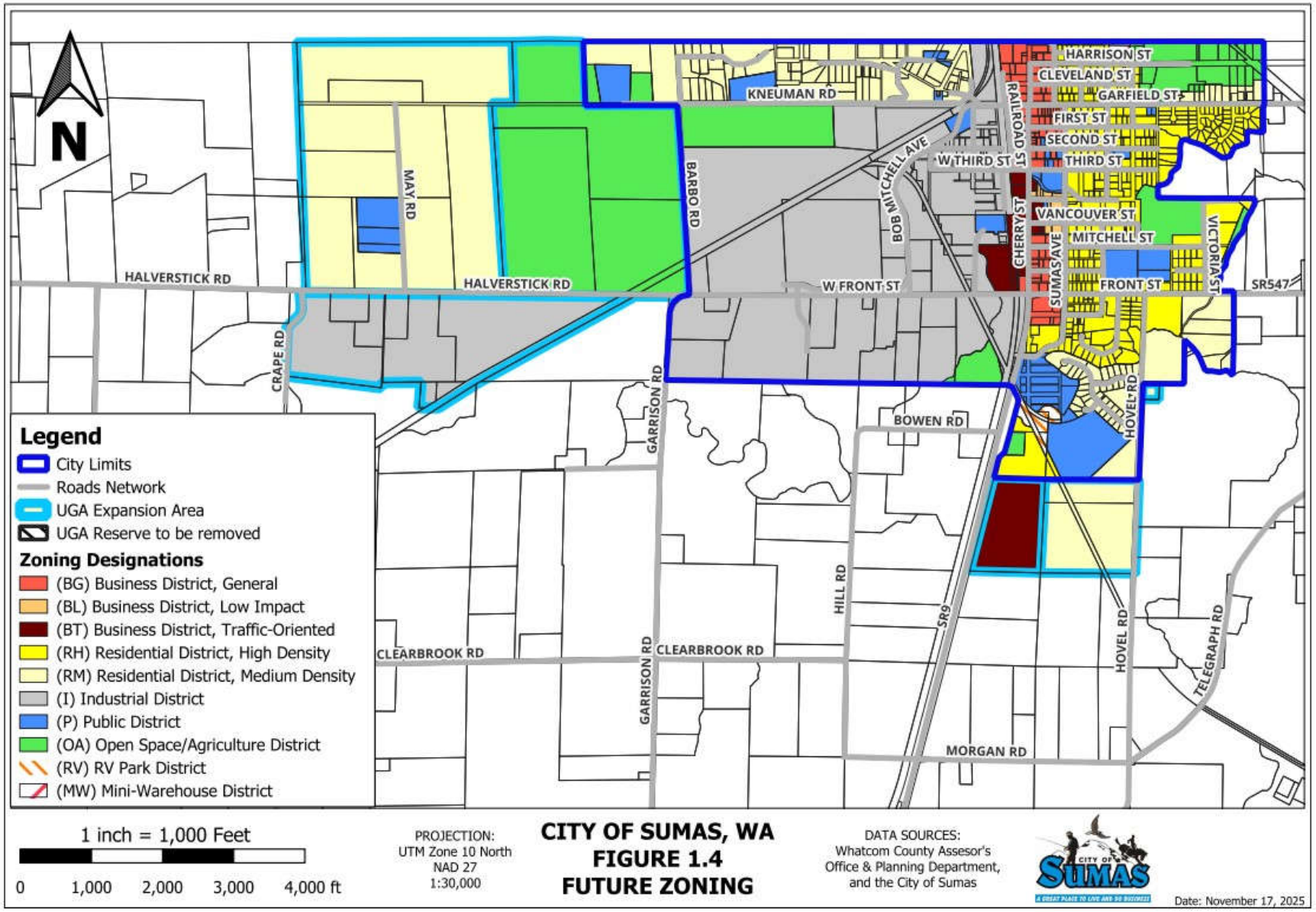
1.6 Duty to Serve

Chapter 10 contains a copy of the service area declaration form filed with Whatcom County as a part of the CWSP planning process.

1.7 Local Government Consistency

Whatcom County Comprehensive Plan (WCCP). Whatcom County adopted a GMA-compliant land use plan in 2016 and was most recently updated in 2023, although a new update will be complete by sometime in early 2026. This WSP is consistent with the WCCP in the following ways:

- The WCCP policies related to prohibition of urban water service outside the UGA (i.e., Countywide Planning Policies (CWPPs) F4, F5, F6, F7, WCCP 5P-3) are supported by the water supply policies discussed later in this chapter.
- The WCCP policies concerning planning for and provision of water within the UGA (i.e., CWPPs D3, N4, WCCP policies 5Q-1, 5Q-2, 2AA-1) are supported by the planning effort leading to development of this WSP.
- The WCCP policies concerning water conservation and water quality protection (i.e., CWPPs N1, N2, N3, N4, N5, N6, WCCP policies 2AA-4, 2AA-5) are consistent with the conservation element within Chapter 4 and the WHP within Chapter 5.


N
KNEUMAN RD
HARRISON ST
CLEVELAND ST
GARFIELD ST
FIRST ST
SECOND ST
THIRD ST
W THIRD ST
RAILROAD ST
BOB MITCHELL AVE
BARBO RD
MAY RD
CHERRY ST
VANCOUVER ST
MITCHELL ST
VICTORIA ST
SUMAS AVE
FRONT ST
SR547
W FRONT ST
HALVERSTICK RD
HALVERSTICK RD
CRAPE RD
GARRISON RD
BOWEN RD
HOVEL RD
HILL RD
SR9
CLEARBROOK RD
CLEARBROOK RD
GARRISON RD
HOVEL RD
TELEGRAPH RD
MORGAN RD
Legend
City Limits
Roads Network
UGA Expansion Area
UGA Reserve to be removed
Zoning Designations
(BG) Business District, General
(BL) Business District, Low Impact
(BT) Business District, Traffic-Oriented
(RH) Residential District, High Density
(RM) Residential District, Medium Density
(I) Industrial District
(P) Public District
(OA) Open Space/Agriculture District
(RV) RV Park District
(MW) Mini-Warehouse District
1 inch = 1,000 Feet
0 1,000 2,000 3,000 4,000 ft
PROJECTION:
UTM Zone 10 North
NAD 27
1:30,000
CITY OF SUMAS, WA
FIGURE 1.4
FUTURE ZONING
DATA SOURCES:
Whatcom County Assesor's
Office & Planning Department,
and the City of Sumas
CITY OF SUMAS
Date: November 17, 2025

Whatcom County Coordinated Water System Plan (CWSP). Whatcom County adopted a WDOH approved CWSP in 2000 and was most recently updated in 2019. A new update to the CWSP is scheduled to be complete by 2026. The City of Sumas has been an active participant in CWSP development and is a member of the Water Utility Coordinating Committee (WUCC). Consistency between the two plans is specifically evidenced in the following way:

- The service area declaration required by the CWSP is included within this WSP.
- The WSP and CWSP establish identical future service area boundaries for Sumas and identify Sumas as an expanding system.
- The design standards established in the CWSP are met or exceeded by the standards established in this WSP.

Comments Regarding Relationships of Plans

The City of Nooksack and the Nooksack Valley Water Association entered into a new contract in June of 2002. An amendment to the agreement to increase the instantaneous flow to 904.2 gpm and increase the annual acre feet to 569.6 was approved in April of 2009. A new contract with the Sumas Rural Water Association to increase the acre feet from 470 to 600 and the instantaneous flow from 500 to 1,100 was approved in January of 2012.

1.8 Watershed Plan Consistency

The Sumas Water Department exists within the boundaries of Water Resource Inventory Area (WRIA) 1 of Washington State, and subject to the requirements of the WRIA 1 Watershed Management Plan. This WSP has been prepared to be consistent with the restrictions, requirements, and objectives of the Watershed Management Plan.

2 Basic Planning Data

2.1 Current Population, Service Connections, and Equivalent Residential Units (ERUs)

2.1.1 Population

The Washington State Office of Financial Management (OFM) conducts a population estimate for each local jurisdiction. Since the 2020 decennial census, the City of Sumas has used these numbers as the official population estimates for Sumas. Based on information from the OFM, the 2023 estimated city population is 1,810 people.

The historic population of the City, as provided by the OFM, is shown in the table below:

Table 2.1: OFM Population Information

Office of Financial Management, Forecasting and Research Division									
Estimates of April 1 Population Density and Land Area by City and Town									
City/ Town Name	Pop. 1980	Pop. 1990	Pop. 2000	Pop. 2010	Pop. 2020	Pop. 2021	Pop. 2022	Pop. 2023	Pop. 2024
Sumas	712	744	978	1,319	1,665	1,740	1,740	1,810	1,835

2.1.2 Service Connections

As of 2023, service connections were as follows:

Table 2.2: 2023 Number of Water Service Connections

Connection type	Number of connections
Single-family	571
Multi-family	64 (53 active)
Comm., Gov., Ind.	108 (77 active)
Agricultural	0
Total	743 (701 Active)

Historic service connections information for the odd years between 2011 and 2023 is provided in the table below.

Table 2.3: Historic Service Connections Information

	Connection Type	# of Connections
2011	Single-Family	308
	Multi-Family	21
	Commercial, Govt, Industrial	74
	Agriculture	0
	Total	403

	Connection Type	# of Connections
2013	Single-Family	398
	Multi-Family	23
	Commercial, Govt, Industrial	69
	Agriculture	0
	Total	490

	Connection Type	# of Connections
2015	Single-Family	450
	Multi-Family	23
	Commercial, Govt, Industrial	101
	Agriculture	0
	Total	574

	Connection Type	# of Connections
2017	Single-Family	494
	Multi-Family	27
	Commercial, Govt, Industrial	103
	Agriculture	0
	Total	624

	Connection Type	# of Connections
2019	Single-Family	517
	Multi-Family	28
	Commercial, Govt, Industrial	106
	Agriculture	0
	Total	651

	Connection Type	# of Connections
2021	Single-Family	562
	Multi-Family	36
	Commercial, Govt, Industrial	104
	Agriculture	0
	Total	702

	Connection Type	# of Connections
2023	Single-Family	571
	Multi-Family	64
	Commercial, Govt, Industrial	108
	Agriculture	0
	Total	743

2.1.3 Equivalent Residential Units (ERUs)

Average Daily Demand (ADD):

ADD values are calculated based on 2023 monthly meter readings provided by the City of Sumas Water Department. The ADD values were calculated by summing the monthly meter readings for the year and dividing by 365 days.

Based on the 2023 data, the system has 701 active connections. Large users were identified as those users that have a Maximum Daily Demand (MDD) greater than 800 gpd – see Table 2.5, *2023: Large Users: >800 gpd*. Based on a review of the meter readings 15 large users were identified. Residential and small business ADD was calculated as the difference between the total and large user ADD. ADD calculations are provided in Appendix 2-1, *City of Sumas: ADD, MDD, and PHD Calculations*.

Table 2.4: City of Sumas Annual Consumption

	Annual Consumption	
	Cubic feet per year	Gallons/day
City Total	7,826,207	160,384
Large Users	2,468,499	50,587
Residential and Small Users	5,357,708	109,796

Based on the 686 residential and small commercial user connections (701 – 15 = 686) and a total annual residential consumption of 109,796 gpd in 2023, one residential ERU equals 160 gpd/user in 2023.

A review of the residential data (see Appendix 2-1) from 1993 to 2023 shows that the residential usage varies from a low of 160 gpd/connection in 2023 to a high of 247 gpd/connection in 1996, for an average of 216 gpd/connection. The average residential usage between 2011 and 2023 is 194 gpd/connection. Based on this information, one ERU is estimated to 200 gpd per residential connection (200 gpd/ERU).

Maximum Daily Demand (MDD):

MDD values are calculated based on a peaking factor multiplied by the ADD values. Daily meter readings for 2009 on well pumps 4R and 5 (which supply water to the combined Sumas and Sumas Rural Water Association systems) have been recorded and are shown in Figure 2.1, *2009 Daily Meter Readings Wells 4R & 5*. From this information the average annual daily pumping volume is 55,100 cubic feet per day (412,000 gpd). Peaking pumping volumes are less than 100,000 cubic feet per day, or 1.8 times the annual average. (Peak readings on March 8 and 9 are attributed to a diversion to the PSE cogeneration plant, normally supplied by the May Road wellfield. This peak reading of 150,000 cubic feet per day is 2.7 times the annual average.) Based on this information, a 2.0 peaking factor from ADD to MDD is very conservative and will be used for this analysis. MDD calculations are provided in Appendix 2-1

Table 2.5: 2023: LARGE USERS: >800 gpd MDD

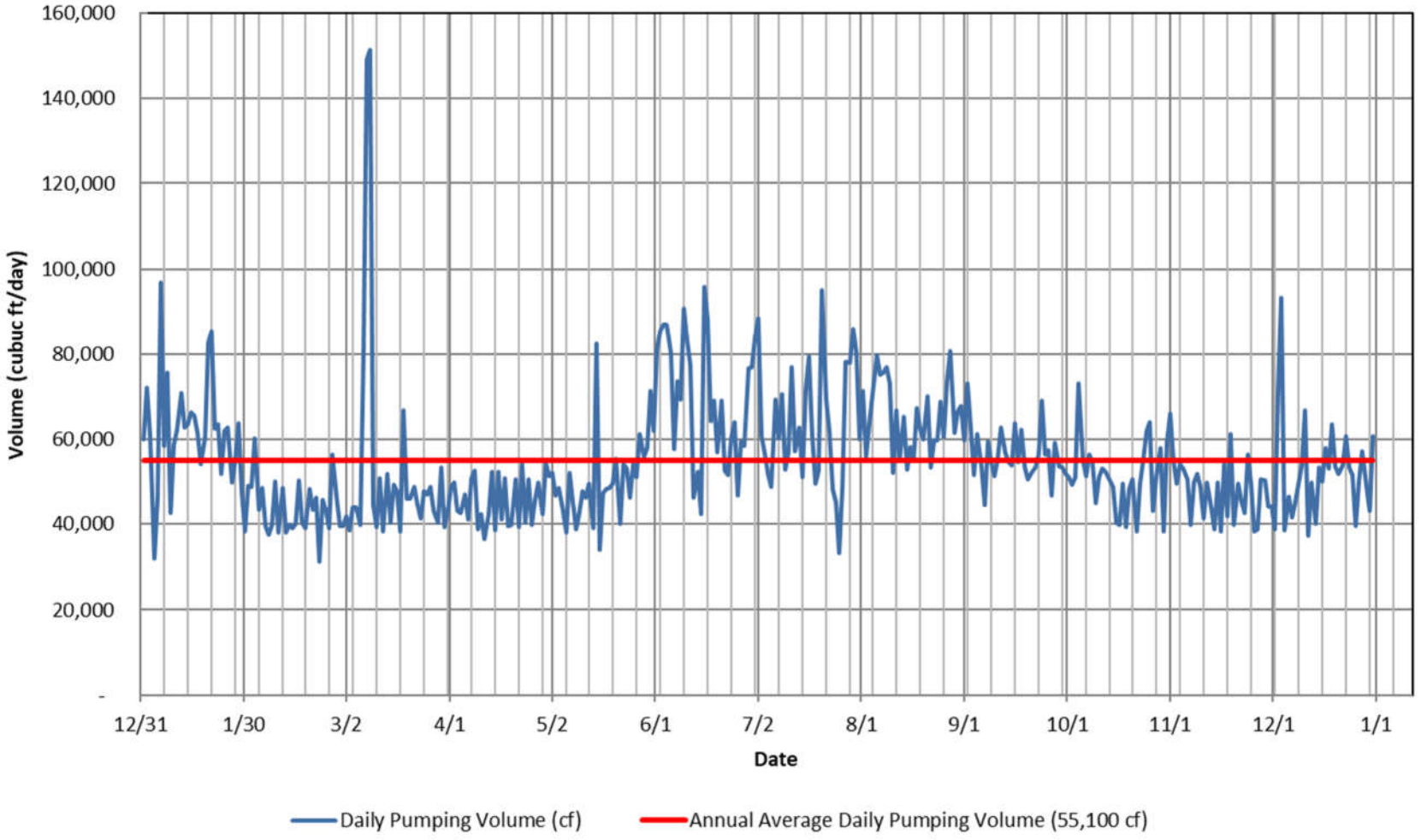
2023 Commercial / Government / Industrial Water Usage

15 Large Users: MDD > 800 gpd

#	Account Name	Street Address	Annual Water Usage (Cubic Feet)	ADD (gpd)	MDD = 2*ADD (gpd)	MDD (gpm)	Assume PHD 2.0*MDD (gpm)	PHD w/ + 16% to get to 18 year Avg. (gpm)
1	IKO Pacific	850 W Front St	1,000,021	20,494	40,987	28.46	57	**66**
2	Teal Jones Lumber	301 Bob Mitchell Ave	384,453	7,879	15,757	10.94	22	**25**
3	EPL Feed	411 W Front St	352,997	7,234	14,468	10.05	20	**23**
4	Sumas RV Park & Campground	9600 Easterbrook Rd	117,780	2,414	4,827	3.35	7	**8**
5	City of Sumas - Howard Bowen Park	399 Frost Rodeo Dr	112,768	2,311	4,622	3.21	6	**7**
6	Bob's Burger & Brew	819 Cherry St	87,650	1,796	3,592	2.49	5	**6**
7	Boomtown	1015 Cherry St	87,218	1,787	3,575	2.48	5	**6**
8	Sumas Investment	121 Cleveland Ave	76,116	1,560	3,120	2.17	4	**5**
9	TRMC Retail LLC	208 Cherry St	47,383	971	1,942	1.35	3	**3**
10	City of Sumas - Third St Park	135 Third St	46,792	959	1,918	1.33	3	**3**
11	El Nopal Restaurant	625 Cherry St	39,380	807	1,614	1.12	2	**3**
12	Socco Forest Products	601 W Front St	34,742	712	1,424	0.99	2	**2**
13	City of Sumas - Rodeo Grounds	1550 Cherry St	28,779	590	1,180	0.82	2	**2**
14	US Customs & Border Protection	9648 Garrison Rd	27,430	562	1,124	0.78	2	**2**
15	General Services Administration	145 Cherry St	24,990	512	1,024	0.71	1	**2**
TOTAL			2,468,499	50,587	101,175	70.26	141	**163**

ADD: Annual Daily Demand
MDD: Maximum Daily Demand
PHD: Peak Hourly Demand

Figure 2.1: 2009 Daily Meter Readings Wells 4R & 5



ERUs

The 15 Large Users consumed 2,468,499 cubic feet, or 50,587 gpd in 2023. Using 200 gpd/ERU, the Large Users have an equivalent of 253 ERUs.

The total number of system ERUs equals the 686 residential and small commercial users plus the 253 Large Users for a total of 939 ERUs.

See Attachment 2-1 for more detailed information on the ADD, MDD, and Peak Hourly Demand (PHD) calculations.

2.2 Water Production and Usage

2.2.1 Water Production

A summary of the source meter data between 2003 to 2023 is provided in the table and figure below. See Appendix 2-2 for the monthly meter readings and water production during these years. The annual summary is provided in the table below.

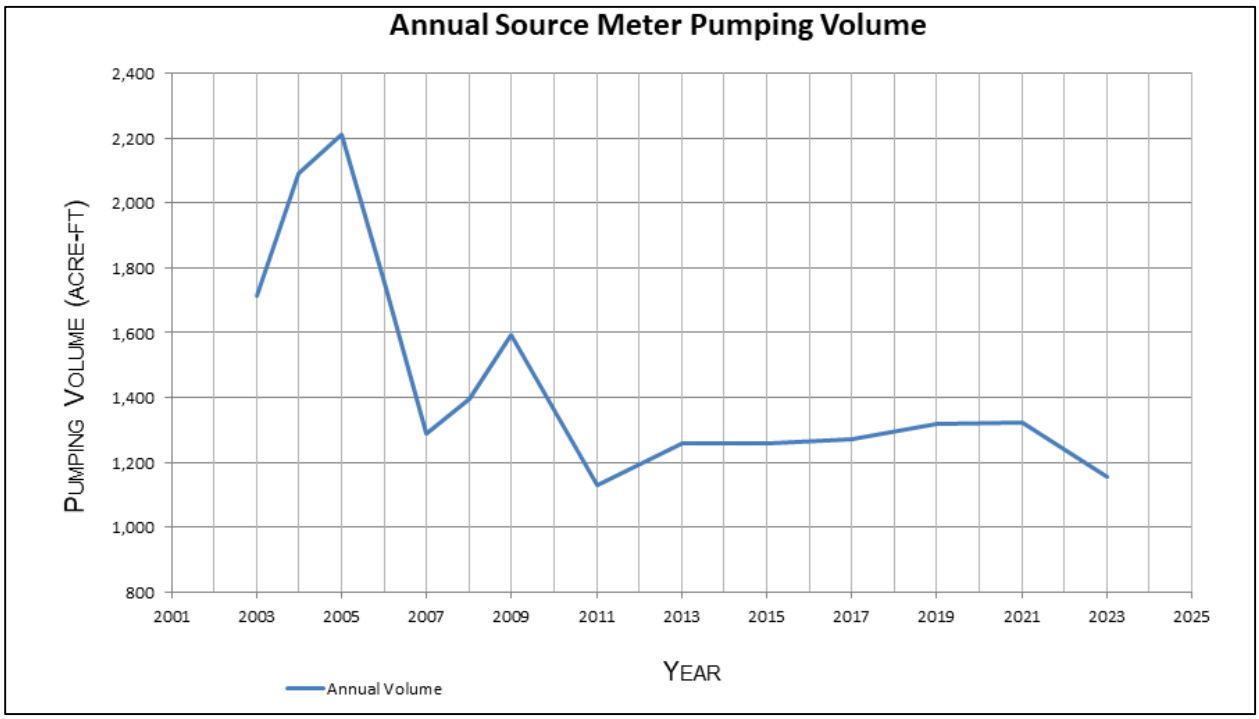
Table 2.6: Annual Source Meter Pumping Volumes

	2003	2004	2005	2006	2007	2008	2009	Average
Source Meters	(acre-ft)	(acre-ft)	(acre-ft)	(acre-ft)	(acre-ft)	(acre-ft)	(acre-ft)	(acre-ft)
May Rd #3	710	786	1,296	395	40	153	371	536
Sumas Well 1, 2, 3 (S06)	572	590	207	643	653	653	619	562
S04	228	314	276	276	214	203	219	247
S05	184	216	257	252	195	272	273	236
S09	18	186	174	185	184	116	111	139
Total Pumped	1,712	2,093	2,210	1,750	1,287	1,397	1,593	1,720

	2011	2013	2015	2017	2019	2021	2023	Average
Source Meters	(acre-ft)	(acre-ft)	(acre-ft)	(acre-ft)	(acre-ft)	(acre-ft)	(acre-ft)	(acre-ft)
May Rd #1	73	88	90	66	46	40	88	70
Sumas Well #4R (SO8)	234	243	244	258	283	251	195	244
Sumas Well #5 (SO7)	263	301	320	307	367	362	42	280
Nooksack Well #2	199	336	338	397	331	438	527	367
Nooksack Well #3	360	292	268	242	290	232	302	284
Total Pumped	1,129	1,260	1,259	1,271	1,317	1,324	1,154	1,245

Water from the May Rd #1 wellfield is pumped to the Puget Sound Energy cogeneration power plant via a separate non-potable water main system.

Figure 2.2: Annual Source Meter Pumping Volumes



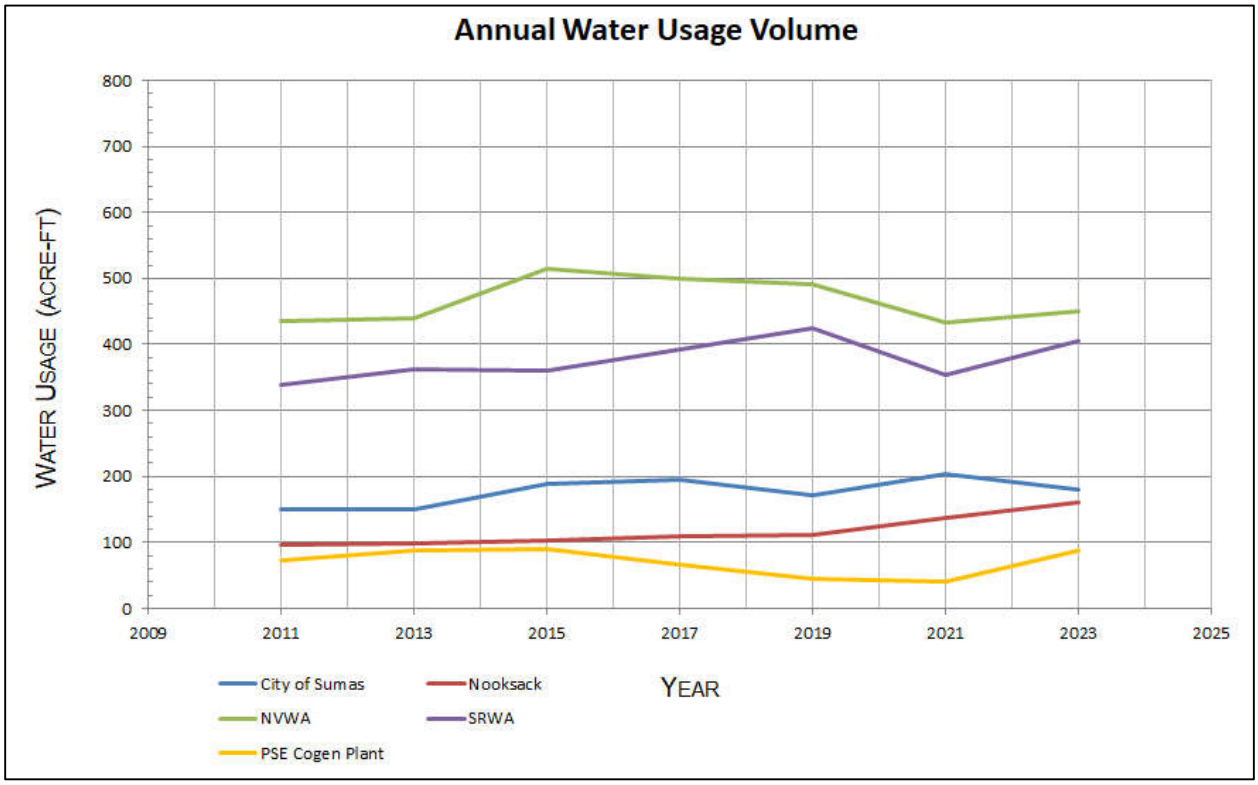
2.2.2 Water Usage

A summary of the annual total use for the most current period (2011 – 2023) is provided in the table and figure below. See Appendix 2-3, *City of Sumas Monthly Water Use*, and Appendix 2-4, *Wholesale Monthly Water Use*, for the available monthly data from 1993 to 1998, 2003 to 2009, and the odd numbered years between 2011 and 2023.

Table 2.5: Annual Water Use Volumes

WATER USE DATA (Cubic Feet)	2011	2013	2015	2017	2019	2021	2023
	(acre-ft)	(acre-ft)	(acre-ft)	(acre-ft)	(acre-ft)	(acre-ft)	(acre-ft)
City of Sumas							
Residential/ Multi	92	92	101	129	104	126	116
Comm/Gov/Ind	59	59	87	66	68	78	64
Subtotal	151	151	188	194	172	204	180
Wholesale							
Nooksack	96	98	102	110	112	138	160
NVWA	436	439	514	500	490	434	449
SRWA	340	362	361	391	424	353	405
Meadowbrook							287
PSE Cogen Plant	73	88	90	66	46	40	88
Subtotal	945	987	1,067	1,067	1,071	966	1,390
Total	1,096	1,138	1,255	1,261	1,243	1,170	1,569

Figure 2.3: Annual Water Use Volumes



2.3 Distribution System Leakage

For more information regarding distribution system leakage, see Chapter 4 of this plan, entitled "Water Use Efficiency Program."

2.4 Water Supply Characteristics

The source of potable water is the Sumas Wellfield, which contains five wells. The wells draw water from the Abbotsford-Sumas aquifer, a glacial sand and gravel upland covering the north end of Whatcom County and extending into lower British Columbia. Although artesian flow conditions exist at each well, submersible pumps or booster pumps are installed to achieve adequate pressure. The wells supply two distinct distribution zones. Two of the wells are used to supply wholesale customers south of town including the Nooksack Valley Water Association (NVWA) and the City of Nooksack. Three of the wells supply Sumas itself and the Sumas Rural Water Association (SRWA), which is located east of town. The two distribution zones normally operate independently, but an intertie is available to allow emergency supply from one system to another.

The City also operates the May Road Wellfield, tapping the same aquifer. There are two wells in the wellfield, one serving Puget Sound Energy's Cogeneration plant and the other tied into the Sumas distribution system.

In 2015, Sumas received approval from the Department of Ecology allowing an additional point of withdrawal under one of the city's water rights. The new point of withdrawal is at the location of one of the Meadowbrook Water Association (MBWA) well fields. Under the terms of a supply agreement entered into in 2015, the city supplies water to MBWA by allowing the association to withdraw additional water from its own wells, but under the Sumas water right. In this way, Sumas can supply the water without actually needing to pump or pipe the water from the city system. Consistent with the Sumas agreement, MBWA intends to supply water to Northwood water association and Northwood Park water associations, both of which have issues related to water quality from their current wells. In the future, MBWA may also supply wholesale water to the Everson water association and the Hampton water association, which are located just north of the city of Everson. In accordance with the Department of Ecology agreement, 18% of the water withdrawn must be discharged into an adjacent creek as mitigation since creek levels were observed to drop when the pumps are in operation. The required 18% diversion for creek mitigation allows for the following:

- Instantaneous Rate
    - - 82 gpm Instantaneous Rate for mitigation
    - Net 369 gpm Instantaneous Rate to MBWA
- 400 acre-ft annual usage
    - 72 acre-ft annual usage for mitigation
    - Net 328 acre-ft annual usage to MBWA

2.5 Water Supply Reliability Evaluation

2.5.1 Source Reliability

- *Quality.* Section 3.2 describes water quality issues in detail. In general, water quality is excellent today, but a long-term trend of increasing nitrate concentration is a threat. If the trend is not reversed, Sumas will ultimately need to either institute water treatment for nitrate removal or develop an alternate source of low-nitrate water (e.g., by developing deeper wells). Chapter 5 describes overall susceptibility of the Abbotsford-Sumas aquifer from which Sumas' water is drawn. The aquifer is a shallow, unconfined aquifer and is very susceptible to contamination from overlying land uses. Agricultural use predominates today in the Sumas capture zone, with over-application of fertilizers being the cause of the nitrate contamination. Sumas is implementing its wellhead protection program, which includes public-education components designed to minimize the threat of contamination of the aquifer. The City of Sumas Wellhead Protection Plan was adopted in 1996. A list of potential contaminants were identified. The City reviewed the list in 2024 and found it still current.
- *Quantity.* The Abbotsford-Sumas aquifer is very prolific. Sumas has had no difficulty developing wells that yield large quantities of water. A brief analysis performed by EMCON for the City of Abbotsford in 1991 demonstrated that existing withdrawals from the aquifer are a relatively small proportion of available recharge (i.e., less than 30 percent). The City of Abbotsford's long term plan calls for *decreasing* reliance upon the aquifer for domestic supply. Abbotsford is developing a surface water supply from Harrison Lake in collaboration with several other Canadian municipalities. Given this decreasing reliance within Sumas' capture zone, the long-term availability of water from the aquifer is assured.

2.5.2 Water Right Adequacy

On the preceding page, Table 4-2 reveals that existing water right permits and certificates can meet system needs for the coming 20 years. There are three controlling water rights. G1-25171C is a municipal right at the Sumas Wellfield in the amount of 1,919 acre-feet per year. Only 60 percent of the water is used today, and the remainder can support all anticipated ordinary growth within the area served by the City of Sumas. As with all inchoate water rights in Washington state, there is some danger that ongoing court cases will result in loss of the unperfected portion of the right. G1-23698P and G1-26398P are the two rights applicable to the May Road Wellfield. They total 1,825 acre-feet per year.

Facilities within the Sumas water system are generally highly reliable. There are no unusual components in the system – all components are standard, proven technology. The line leaks tend to be associated with old galvanized iron pipe that is gradually being replaced within the system. The sand buildup occurred some 27 years after development of Well 4 and was probably associated with the older style of perforations used in the casing.

The sand buildup incident did highlight the need to ensure adequate operation of the system with the largest well out of production. As discussed in section 3.3, a third well at the Sumas Wellfield is eventually needed to provide reliability.

The system is also readily expandable. As demand outpaces the production capacity of Wells 4R and 5, the existing pumps can be upgraded to augment supply. When rated well capacity is approached, development of a new well is straightforward and low risk. Similarly, construction of an additional storage reservoir is easily accomplished when growth exceeds the capacity of the existing reservoir. The improvement program in chapter 8 includes wellfield and storage projects designed to accommodate growth.

2.5.3 Water Shortage Response Plan

When planning for water shortages, it is necessary to remember the overall pattern of consumption by the City's various customers: the vast majority of water is consumed not by people, but by dairy farms and industry. The following response plan is designed to deliver potable water to *people* as a top priority. Please refer to the contingency plans in chapter 6 for further discussion of the most likely failure modes leading to the need for curtailment of water. Following are the prioritized actions to be taken in the event of a shortage. These actions are established in sections 12.04.190 and 12.04.270 of City code, as well as section 5.2(a) of the utility agreement between the City and the SEI co-generation plant.

- *Voluntary curtailment.* Major industrial and wholesale customers are contacted and asked to reduce usage. The number of dairies is small (i.e., 75 total in SRWA and NVWA service areas), so individual dairy owners can be directly contacted by phone. A mailing to in-city customers can also be produced and delivered within three days, instituting odd-even watering days, black-out watering hours, and asking for best conservation efforts.
- *Industrial curtailment.* Industrial customers within Sumas are involuntarily curtailed. City crew can operate valves to reduce or stop delivery of water to these customers. At this point, operation of the emergency intertie with Everson should be explored. Provision of water into the south end of the NVWA system might eliminate the need for involuntary curtailment. The SEI co-generation facility is not contractually obligated to curtail at this point, but they should be asked to voluntarily curtail in advance of their legal obligation to do so.
- *Wholesale curtailment.* The three major wholesale customers are involuntarily curtailed. City crew can operate valves at the interties to reduce or stop delivery outside the City. Contracts with each customer contain provisions allowing such curtailment if inadequate water is available for in-city customers. Given the intertie between Everson and the NVWA system, curtailment of deliveries to the NVWA system should first be explored.
- *SEI co-generation curtailment.* The City's agreement with SEI states that SEI's water will only be curtailed after curtailment of wholesale outside deliveries.
- *Commercial curtailment.* Curtailment of in-city commercial establishments is next in order.
- *Domestic curtailment.* Curtailment of in-city residents is the final step.

As discussed in section 6.5, options are available to interconnect the three existing distribution zones (i.e., May Road nonpotable system, NVWA system, Sumas/SRWA system) and to connect with the nearby City of Abbotsford system.

2.6 Future Population Projections and Land Use

2.6.1 Projected Population

Sumas expects to adopt an update of its comprehensive land-use plan (CP) in December 2025. The CP contains a population projection that was developed in coordination with other jurisdictions in Whatcom County. The overall county population projection used for joint planning is within the range of projections provided by OFM and is therefore consistent with the Washington State Growth Management Act.

Based on the 2025 CP, Sumas expects an annual average growth rate of 2.01 percent (page 2-6 of the CP). The table below shows the resulting populations expected at various points in the future. This table is identical to Table 2-1 in the 2025 Sumas CP.

Table 2.6: Sumas Population Projections

Milestone year	Projected population	Number of newcomers
2020 Census	1,665	-
2023 Baseline	1,810	-
2031 Six-year capital planning horizon.	2,174	364
2035 Mid-point in planning period	2,356	546
2045 Planning period.	2,810	1,000

For the purposes of this Water System Plan, a 20-year projection with a baseline of 2023 is used. The table below provides a summary of the City of Sumas historic population from Washington State office of Financial Management (OFM) website (https://ofm.wa.gov/washington-data-research/population-demographics/population-estimates/april-1-official-populations-estimates). As discussed below, the projected population is also included in this table.

Table 2.7: Sumas Population

Year	Population
2020	1,665
2021	1,740
2022	1,740
2023	1,810
2024	1,835
2035	2,255
2045	2,810

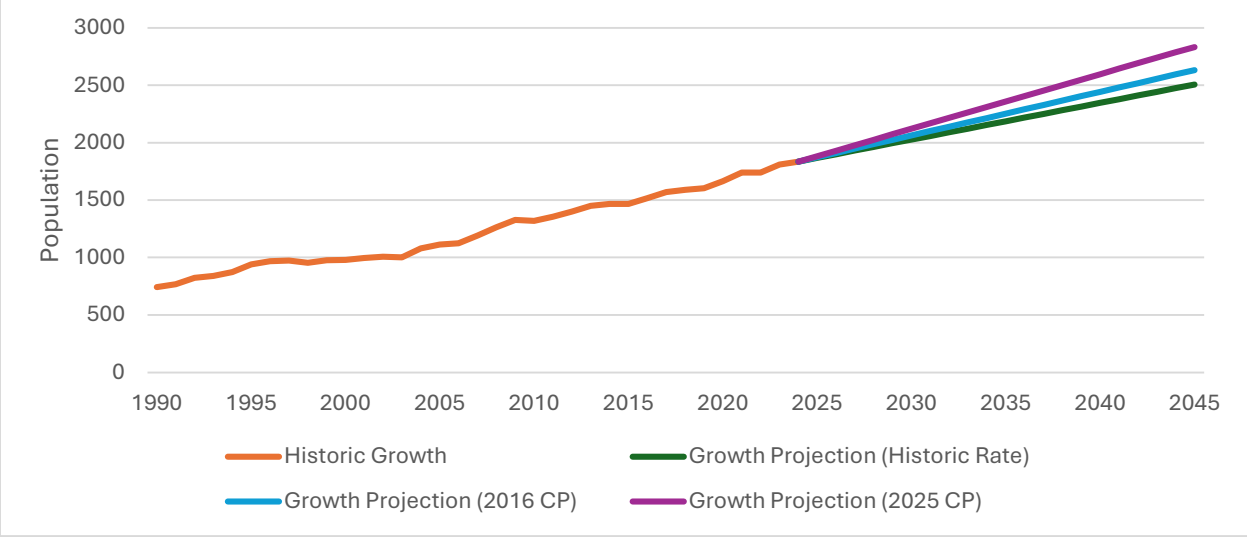
Figure 2.4, *Sumas Population: Actual and Projected*, provides a summary of additional information regarding Sumas population. Prior to 1990, Sumas had a nominal increase in population. During the 34-year period between 1990 and 2024 the population grew at approximately 32 people per year. Figure 2.4 shows Sumas' historic population as well as the projected population based on increasing at a rate of 32 people per year, and the 2025 CP information.

The 2025 CP population projection is based on Sumas' current population with a 2.6% annual average growth rate is also provided in Figure 2.4. Based on Whatcom County's growth projection information, the population of Sumas is estimated to grow at a constant rate of approximately 48 people per year.

Based on a constant population growth rate of 48 people per year, the estimated Sumas population will be 2,121 people in 2030 and 2,692 people in 2042. Based upon a CP ratio of 2.5 people per household there will be an estimated 848 homes in 2030 and 1,134 homes in Sumas in 2045.

The current effective CP was passed in June of 2016. The baseline for the 2016 CP was the population in 2013, which was about 1,449 people. The population projection that was adopted was for the population to increase to 2,323 people by 2036. This is a yearly increase of 38 people, or 2.07% per year. This population projection is more conservative than the 2025 CP projection and is slightly higher than the population projection based on the historic 24-year growth rate. This projection will also be included in Figure 2.4.

Figure 2.4: Sumas Population: Actual and Projected



Note that the Whatcom County Comprehensive Plan, *Allocations for Special Districts by Growth Alternative*, prepared by Leland Consulting Group on June 18, 2025, also provides population information for both the current (2023 baseline) and projected growth (2045) for Water Purveyors. The County uses lower population numbers for the 2023 baseline than the OFM table.

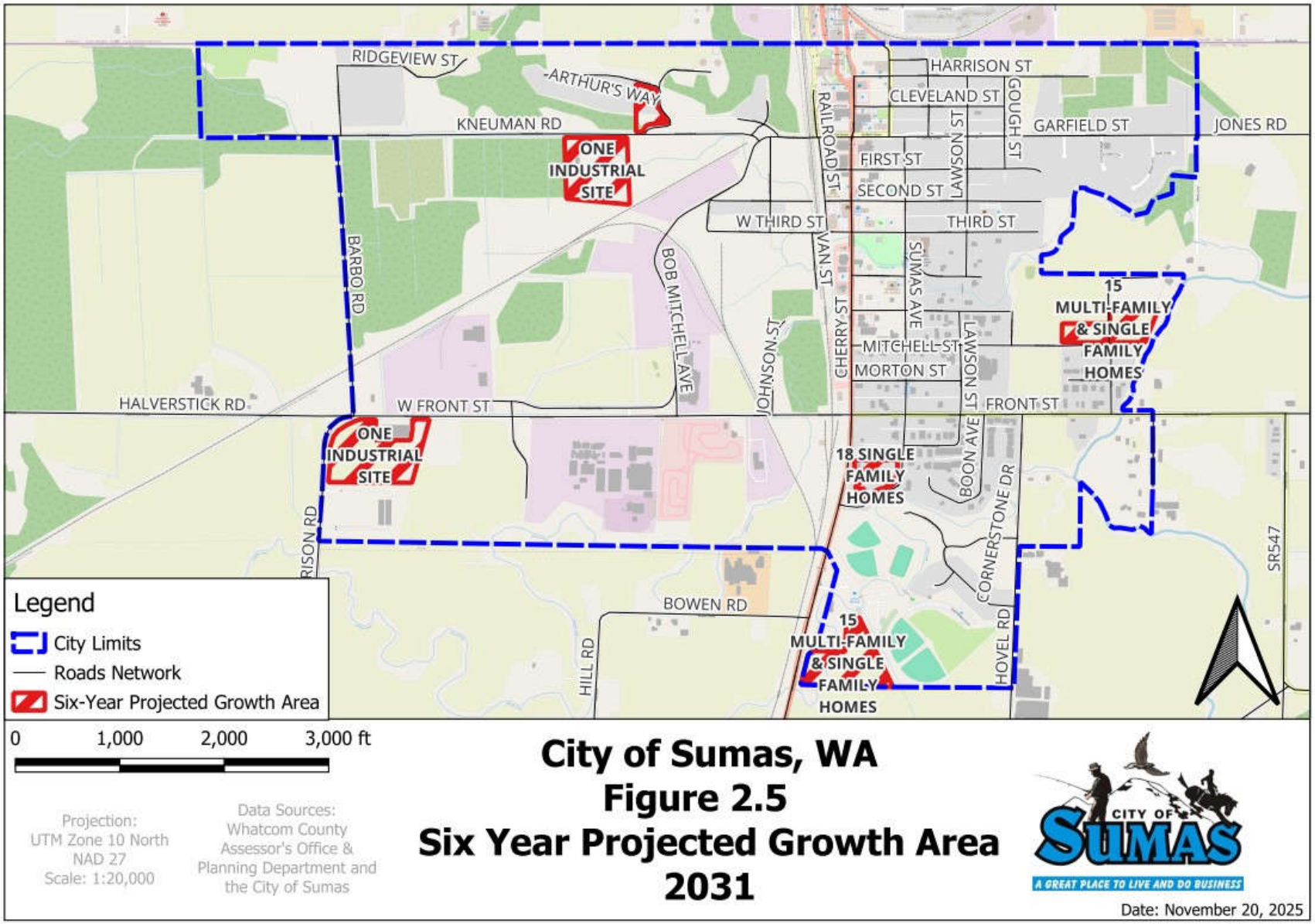
Table 2.8: OFM and Whatcom County Growth Projections

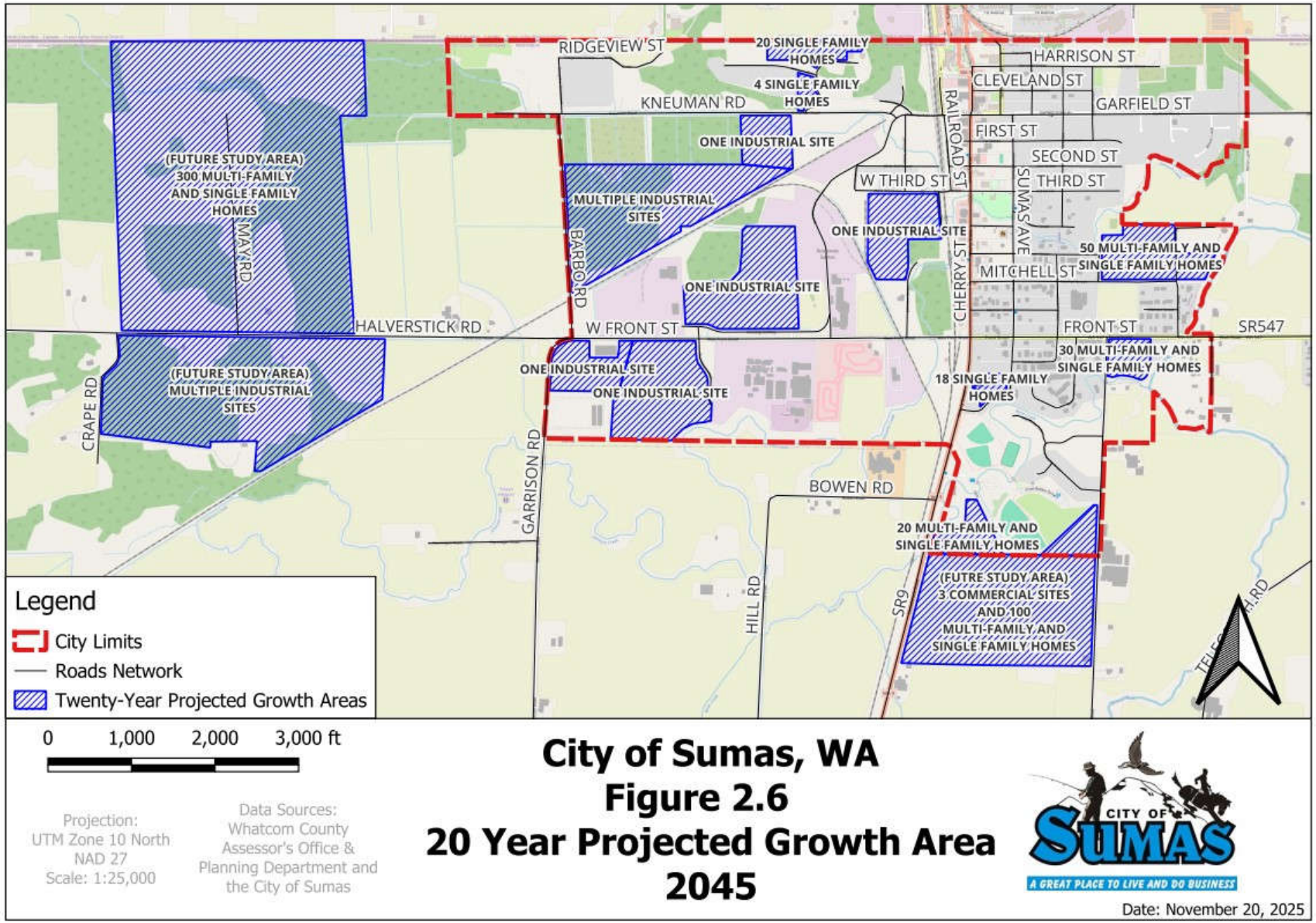
		Population		
		2024 OFM Data	6/18/2025 County Comp Plan Allocations for Special Districts by Growth Alternative	County Info Annual Growth Rate
City of Nooksack	2023	1,560	1,408	
	2045	2,647	2,385	2.42%
NVWA	2023		556	
	2045		782	1.56%
City of Sumas	2023	1,810	1,489	
	2045	2,810	2,493	2.37%
SRWA	2023		173	
	2045		261	1.89%
Meadowbrook	2023		216	
	2045		314	1.72%

The County estimates an annual growth rate of 2.37% for the City of Sumas, which is slightly higher than the OFM 2.0% projection and slightly lower than the 2016 CP rate. The OFM information will be used for the City of Sumas growth projections. The County information will be used for the City of Nooksack, NVWA, SRWA, and the Meadowbrook since it includes projections for each of these systems.

2.6.2 Projected Land Use

Figure 2.5, *Six Year Projected Growth Area*, and Figure 2.6, *20 Year Projected Growth Area*, show the future land-use scenario development areas. The pattern of the projected use is similar to the pattern of the existing use: industrial development is expected west of the Cherry Street north-south rail line, commercial development is expected along the Cherry Street corridor, and residential development is expected at the east of town and west of town in the proposed new unincorporated urban growth areas. The growth areas identified in these maps were used to locate potential residential housing and industrial users in the 2045 condition.


RIDGEVIEW ST
ARTHUR'S WAY
KNEUMAN RD
ONE INDUSTRIAL SITE
HARRISON ST
CLEVELAND ST
GARFIELD ST
JONES RD
RAILROAD ST
GOUGH ST
LAWSON ST
FIRST ST
SECOND ST
W THIRD ST
THIRD ST
VAN ST
SUMAS AVE
15 MULTI-FAMILY & SINGLE FAMILY HOMES
BARBO RD
BOB MITCHELL AVE
JOHNSON ST
CHERRY ST
MITCHELL ST
MORTON ST
LAWSON ST
HALVERSTICK RD
W FRONT ST
FRONT ST
ONE INDUSTRIAL SITE
18 SINGLE FAMILY HOMES
BOON AVE
CORNERSTONE DR
RISON RD
SR547
BOWEN RD
15 MULTI-FAMILY & SINGLE FAMILY HOMES
HILL RD
HOVEL RD
Legend
City Limits
Roads Network
Six-Year Projected Growth Area
0
1,000
2,000
3,000 ft
Projection:
UTM Zone 10 North
NAD 27
Scale: 1:20,000
Data Sources:
Whatcom County
Assessor's Office &
Planning Department and
the City of Sumas
City of Sumas, WA
Figure 2.5
Six Year Projected Growth Area
2031
CITY OF SUMAS
A GREAT PLACE TO LIVE AND DO BUSINESS
Date: November 20, 2025


RIDGEVIEW ST
20 SINGLE FAMILY HOMES
4 SINGLE FAMILY HOMES
KNEUMAN RD
ONE INDUSTRIAL SITE
(FUTURE STUDY AREA) 300 MULTI-FAMILY AND SINGLE FAMILY HOMES
MAY RD
MULTIPLE INDUSTRIAL SITES
BARBO RD
ONE INDUSTRIAL SITE
HALVERSTICK RD
W FRONT ST
ONE INDUSTRIAL SITE
ONE INDUSTRIAL SITE
(FUTURE STUDY AREA) MULTIPLE INDUSTRIAL SITES
CRAPE RD
GARRISON RD
BOWEN RD
HILL RD
SR9
HARRISON ST
CLEVELAND ST
GARFIELD ST
FIRST ST
SECOND ST
THIRD ST
W THIRD ST
RAILROAD ST
SUMAS AVE
CHERRY ST
ONE INDUSTRIAL SITE
MITCHELL ST
50 MULTI-FAMILY AND SINGLE FAMILY HOMES
FRONT ST
SR547
30 MULTI-FAMILY AND SINGLE FAMILY HOMES
18 SINGLE FAMILY HOMES
20 MULTI-FAMILY AND SINGLE FAMILY HOMES
(FUTRE STUDY AREA) 3 COMMERCIAL SITES AND 100 MULTI-FAMILY AND SINGLE FAMILY HOMES
Legend
City Limits
Roads Network
Twenty-Year Projected Growth Areas
0
1,000
2,000
3,000 ft
Projection:
UTM Zone 10 North
NAD 27
Scale: 1:25,000
Data Sources:
Whatcom County Assessor's Office &
Planning Department and the City of Sumas
City of Sumas, WA
Figure 2.6
20 Year Projected Growth Area
2045
CITY OF SUMAS
A GREAT PLACE TO LIVE AND DO BUSINESS
Date: November 20, 2025

2.7 Future Water Demand

2.7.1 Projected City of Sumas Water Demand

As shown in Table 2.10: *Annual Water Use and Water Rights,* Sumas' water consumption has shown a modest but steady increase over the past 10 years. As discussed in Section 2.6.1, City projections estimate a population increase of 1,000 people from 2023 to 2045, which equates to 372 additional ERUs. Consumption from Large User is assumed to increased by 2.0% annually during this same period. The future water demands are estimated based on the ERU count as summarized in the table below.

Table 2.9: Projected Future Water Use

Year	Population	ERUs Residential	ERUs Large Users	Total ERUs	Average Daily Demand (ADD) gpd	Annual Usage (acre-ft)
2023	1,810	686	253	939	160,400[1]	180[1]
2034	2,255	852	314	1,166	233,200[2]	261[2]
2045	2,810	1,058	391	1,449	289,800[2]	324[2]

Note 1: Actual 2023 consumption. Equates to 171 gpd per ERU
Note 2: Based on 200 gpd per ERU

The projected 2045 usage at 324 acre-ft is an 80% increase over the 2023 usage.

2.7.2 Projected Non-Residential (General Industry and Commercial) Water Needs

Consistent with the 2016 CP, Sumas seeks additional industrial growth at the west end of town, as well as revitalization of the Cherry Street commercial area. Projecting non-residential water needs is very difficult because of the wide variety of industries that might locate in Sumas. The existing industries are examples of this variety. For example, the Puget Sound Energy co-generation plant used approximately 78,600 gpd in 2023 for cooling towner makeup. The original developers of the co-generation plant were attracted to Sumas by the availability of water and by the presence of a major natural-gas pipeline that crosses the border just east of town. Other businesses, like the Arrow Reload truck-rail transload facility, use virtually no water. Arrow Reload came to town because of the many highways and rail lines that converge at Sumas. Another industrial user, IKO Pacific, used an average of 20,500 gpd in 2023 for cooling its manufactured asphalt shingles. Also complicating the picture are Sumas' three wholesale customers, the SRWA, the NVWA, and the City of Nooksack. In 2023, the two rural associations consumed approximately 70% of the potable water withdrawn at the Sumas wellfield, with the bulk of that water used to support dairy operations. Predicting the fate of the dairy industry within Whatcom County is uncertain but the pattern appears to be the loss of some dairies with the remaining dairies getting larger. Overall, a small steady annual increase of 2.0% in water demand is anticipated.

2.7.3 Wholesale Customers

2.7.3.1 SRWA

The current water agreement between the City of Sumas and Sumas Rural Water Association (SRWA) was signed on January 26, 2012. In this agreement, Sumas agrees to provide SRWA a maximum annual volume of water equal to 600 acre feet and a maximum instantaneous flow of 1,100 gallons per minute. The City also agrees to provide a maximum instantaneous flow of 700 gallons per minute to the SRWA storage reservoir. The City anticipates that this agreement may change over time and that as SRWA grows, they will request more water. SRWA's historical water usage was evaluated in order for the City to plan for future water allocation in both the city and in SRWA.

Instantaneous Usage

The SRWA expects the overall consumption of the large users (dairies) to slowly increase matching the residential consumption anticipated with the annual population increase of about 1.89 percent (see Appendix 2-16). Although the current agreement with SRWA is for the City to supply a maximum instantaneous flow of 500 gpm, the estimated Peak Hourly Demand (maximum Instantaneous Demand) of the SRWA system increases from 513 gpm in 2023 to 774 gpm in 2045. The City system is capable of delivering these peak hourly demand rates at the SRWA interties. However, based on the City's existing water rights and water allocations to all its wholesale customers, the City can supply this estimated peak hourly demand/instantaneous flow rate from the wellfield. See Table 2.10: *Water Usage and Water Rights*, for additional information.

Based on their anticipated future growth, the City is planning to increase SRWA's annual water allocation from 470 acre-ft per year to 600-ft per year by 2045.

2.7.3.2 NVWA & Nooksack

Since the Nooksack Valley Water Association (NVWA) and the City of Nooksack are supplied by a common system with a common source meter, the two systems will be combined with respect to future allocations. The current water agreement between the City of Sumas and the NVWA and the City of Nooksack was amended on August 28, 2009. In this agreement, Sumas agrees to provide the City of Nooksack a maximum annual volume of water equal to 199 acre feet and to provide the NVWA a maximum annual volume of water equal to 569.6 acre feet, for a total of 768.6 acre feet per year.

The maximum instantaneous flow for the two systems is combined at a rate of 971.5 gallons per minute. Based on the prorated annual usage (569.6/199 split of 768.6 acre-ft), the combined 971.5 gpm instantaneous flow would be split with 74% (720 gpm) going to NVWA and 26% (251.5 gpm) going to the City of Nooksack.

The City anticipates that this agreement may change over time as both systems grow and that they will request more water.

The current water plans for these two systems are the *City of Nooksack Water System Plan Update* by Freeland and Associates, Inc., April 2016; and the *NVWA Water System Analysis* by

Wilson Engineering, February 2005. Both of these systems' comprehensive water plans are currently being updated.

NVWA

Based on current available information, the NVWA estimated annual usage in 2045 is 569.6 acre-ft/year, their current contract allocation (see Appendix 2-17). Their current contract's prorated instantaneous flow rate of 720 gpm is anticipated to be sufficient until 2058. Based on a 2024 instantaneous flow rate of 610 gpm, their proportioned 2045 estimated flow rate is 678 gpm.

City of Nooksack

From the City of Nooksack Comprehensive Land Use Plan 2016-2036 "Future Needs: Source, storage and treatment", the City does not need to develop any additional source, treatment or storage capacity at this time.

Based on current available information, the City of Nooksack's estimated annual usage in 2044 is 183 acre-ft/year (see Appendix 2-18). Their current contract's prorated instantaneous flow rate of 251.5 gpm is anticipated to be sufficient until 2045.

2.7.3.3 PSE Cogen Plant

The Sumas Cogeneration Plant was purchased by PSE in 2009. Water usage by the plant has been inconsistent over the past few years and especially difficult to predict the future demand. The current Sumas-PSE user agreement is set at a peak hourly flow rate of 800 gpm and 969 acre-ft per year, which will be held constant and used for forecasting future demands.

2.7.3.4 Meadowbrook Water Association

In 2015, Sumas received approval from the Department of Ecology allowing an additional point of withdrawal under the May Road wellfield water right. The new point of withdrawal is at the location of one of the Meadowbrook Water Association (MBWA) well fields. Under the terms of a supply agreement entered into in 2015, the City supplies water to MBWA by allowing the association to withdraw additional water from its own wells, but under the Sumas water right. In this way, Sumas can supply water to the MBWA without the need to pump or pipe the water from the City system.

Under the 2015 supply agreement, the MBWA is permitted to withdraw a maximum annual volume of 400 acre-feet and a maximum instantaneous flow rate of 450 gallons per minute from their well field. The maximum permitted allocation is expected to be sufficient through 2045. Also under the 2015 supply agreement, the MVWA is permitted to allocate some of that flow to their wholesale customers, namely Northwood Water Association, Northwood Park Water Association, Hampton Water Association, and Everson Water Association.

2.7.4 Water Demand Forecast

Combining the individual components discussed above, the 20-year demand forecasts anticipated usage is provided in Table 2.10.

2.7.5 Water Rates

Existing water rates are as follows:

- *Residential, commercial, industrial.* $10.40 per month base rate, including first 600 cubic feet (CF). $1.13 for each 100 CF thereafter.
- *Co-gen rate*. $0.55 per 100 CF basic rates.
- *Wholesale.* $0.55 per 100 CF.

Table 2.10: Annual Water Usage and Water Rights

Water Demand	2009/2010		2023		2045	
	Instan-taneous Flow Rate (gpm)	Annual Usage (Acre-ft)	Instan-taneous Flow Rate (gpm)	Annual Usage (Acre-ft)	Instan-taneous Flow Rate (gpm)	Annual Usage (Acre-ft)
City of Sumas	499	198	498	180	724	309
Resid., small Comm. & Ind. Large Users						
Cogen[1]			218	88	337	136
Cogen - PSE User Agreement	800	969	800	969	800	969
SRWA[2]	1,000	352	513	405	774	611
User Agreement	500	470	500	470	500	470
Nooksack & NVRWA[3]	500	614	849	609	930	753
Nooksack & NVWA User Agreement	971.5	768.6	971.5	768.6	971.5	768.6
Nooksack			239	160	251.5	183
Nooksack User Agreement		199	251.5	199	251.5	199.0
NVWA			610	449	678	569.6
NVWA User Agreement		569.6	720.0	569.6	720	569.6
Meadowbrook Water Association			450	287	450	418
User Agreement	0	0	450	400	450	400
Less Mitigation			(81)	(72)	(81)	(72)
Net Usage			369	328	369	328
TOTAL DEMAND			2,528	1,569	3,215	2,227
TOTAL SUMAS DEMAND WITH USER AGREEMENTS	2,771	2,406	3,220	2,788	3,446	2,917
DOE WATER RIGHT	Max. Rate (gpm)	Annual Usage (Acre-ft)	Max. Rate (gpm)	Annual Usage (Acre-ft)	Max. Rate (gpm)	Annual Usage (Acre-ft)
G1-25171 (Kneuman Rd)	2,250	1,919	2,250	1,919	2,250	1,919
G1-23698 (May Rd #1)	800	449	800	449	800	449
G1-26398 (May Rd #2 & #3)	860	1,376	860	1,376	860	1,376
Sub-Total	3,910	3,744	3,910	3,744	3,910	3,744
May Road Mitigation (18% of May Rd Rights)			-298.8	-328.5	-298.8	-328.5
TOTAL WATER RIGHT	3,910	3,744	3,611	3,416	3,611	3,416
WATER RIGHT MINUS TOTAL DEMAND			1,083	1,847	396	1,189
WATER RIGHT MINUS SUMAS DEMAND & WHOLESALE CUSTOMERS AT USER AGREEMENT	1,140	1,338	392	628	166	499

1 - Cogen: Instantanteous rate is assumed 4.0 times annual average flow rate; assumed 2.0% annual growth rate
2 - SRWA: Assumed annual growth rates of 1.89% per County projections
3 - NVWA and Nooksack: Projected usage from current engineering planning information including prorated instantaneous flow rates.

August 19, 2025

3 System Inventory and Analysis

3.1 Asset Management – Asset Inventory and Analysis

3.1.1 Asset Inventory

3.1.1.1 Source

The sources are best discussed as follows, broken down by the particular wells in question. Figures 9 and 10 are schematic drawings of the Sumas and May Road Wellfields, showing the relative locations of the various wells. Appendix F contains well logs and pump specifications for each well.

- *Sumas Wellfield Wells 1, 2, 3 (SO6).* These three wells flow freely through a manifold to the pump house pressurizing the Nooksack/NVWA system. They are the oldest and shallowest wells at this field, all drilled to a depth of about 57 feet in the period from 1959 to 1971. A group of three submersible pumps is used to regulate the rate of withdrawal from the wells. The total maximum sustainable pumping rate is 500 gpm. *(Note: Currently, the NVWA/Nooksack telemetry says their peak pump rate is 800 gpm. In their 20 year plan they are proposing to need their full contract amount of 971.5 gpm instantaneous flow rate. Supplemental water from Wells 4R and/or 5 will be required if this well field is insufficient to provide the future flow rate required.)* If pumped at a greater rate, the cone of depression becomes so deep as to allow excessive air to enter the perforated portions of the casings. Although the wells are 30 to 40 years old, they show no signs of deterioration (e.g., no increase in sanding). The HDPE manifold pipe and the pump house are in good condition and are readily accessible for repair and replacement, so there is no expected date of obsolescence of this source.
- *Sumas Wellfield Well 4R (SO8).* This is the newest well in the field, drilled in 1997. A pump test conducted by Robinson & Noble indicates that the well can sustain a yield of 1,200 gpm, presuming all other wells in the field are operating under normal production conditions. The well is outfitted with a submersible pump capable of pumping 810 gpm against the prevailing head (i.e., reservoir almost full). The submersible pump is 18 years old but was completely rebuilt in 1997, when it was moved from well 4 to well 4R. Well 4, the predecessor to this well, exhibited sand buildup after 28 years of use. This well has a life expectancy of 20+ years.
- *Sumas Wellfield Well 5 (SO7).* This well was drilled in 1992. A pump test conducted by Robinson & Noble indicates that the well can sustain a yield of 1,100 gpm, presuming all other wells in the field are operating under normal production conditions. The well is outfitted with a submersible pump capable of pumping 860 gpm against the prevailing head (i.e., reservoir almost full). The submersible pump was new in 1992. All components of this well are in good shape, and it has a life expectancy of 20+ years.
- *May Road Wellfield Well 1.* This well was drilled in 1992. A pump test conducted by Robinson & Noble indicates that the well can sustain a yield of 200 gpm, not accounting for interference with other wells. The well is outfitted with a submersible pump capable of

pumping 200 gpm against the prevailing head. The submersible pump was new in 1992. All components of this well are in good shape, and it has a life expectancy of 20+ years.

- *May Road Wellfield Well 2.* This well was drilled in 1987. A pump test conducted by Golder indicates that the well can sustain a yield of 500 gpm, not accounting for interference with other wells. There is currently no pump installed in the well. The 8-inch casing is just capable of accommodating a submersible pump rated at 500 gpm. Robinson & Noble anticipate that a maximum of 900 gpm can be withdrawn from wells 2 and 3 in combination, due to interference effects.
- *May Road Wellfield Well 3.* This well was drilled in 1992. A pump test conducted by Robinson & Noble indicates that the well can sustain a yield of 800 gpm, not accounting for interference with other wells. The well is outfitted with a submersible pump capable of pumping 800 gpm against the prevailing head. The submersible pump was new in 1992. All components of this well are in good shape, and it has a life expectancy of 20+ years. Robinson & Noble anticipate that a maximum of 900 gpm can be withdrawn from wells 2 and 3 in combination, due to interference effects.

Long-term monitoring of water table elevation and stream level at the May Road Wellfield reveals no hint of reduction in capacity of the aquifer. The springs at each wellfield continue to flow freely year round.

On February 12, 2010 the Department of Ecology approved a transfer of the G1-26398 water right from May Road wellfield to the Kneuman Road wellfield. This transfer of withdrawal point allows 860 gpm and 1,376 acre-ft per year from the May Road wellfield to be used for municipal use

In 2015, Sumas received approval from the Department of Ecology allowing an additional point of withdrawal under one of the city's water rights for use with the Meadowbrook Water Association. As part of this agreement, 18% of the water withdrawn from the May Road wellfields must be discharged into an adjacent creek as mitigation since creek levels were observed to drop when the pumps are in operation. See Section 2.4, *Water Supply Characteristics*, of this Plan for additional information.

Table 3.1: Summary of Well Field and Pumping Capacity

Source	Wellfield Sustainable Pumping Rate (gpm)	Installed Pump Capacity (gpm)
Sumas Wellfield Wells 1, 2, 3 (SO6)	500	500
Sumas Wellfield Well 4R (S08)	1,200	810
Sumas Wellfield Well 5 (SO7)	1,100	860
Sumas Wellfield Well TOTAL	**2,800**	**2,170**
May Road Wellfield Well 1	200	200
May Road Wellfield Well 2	900	0
May Road Wellfield Well 3		800

May Road Wellfield Well TOTAL	**1,100**	**1,000**
Wellfields TOTAL	**3,900**	**3,170**

3.1.1.2 Reservoirs

The city of Sumas has a single 500,000 gallon reservoir which is utilized to provide all of the storage requirements for the city of Sumas. The reservoir is a concrete tank 60 feet in diameter and 24 feet high (21,149 gallons per ft. of tank height) that was constructed in 1982. The reservoir has a base elevation of 186 feet.

In 2001, the Sumas Rural Water Association, a wholesale customer of the City of Sumas, constructed an identical 500,000 gallon reservoir adjacent to the City of Sumas' concrete tank. This tank is used by SRWA and provides their required equalizing and standby storage. The two tanks are hydraulically connected such that the two tanks respond together and equally to changes in water level. While hydraulically connected, the two tanks are considered to be individual tanks when estimating the respective storage and fire flow requirements for each system. Only the Sumas tank was used to evaluate the Sumas system requirements and performance.

3.1.1.3 Booster Pump Stations/Pressure Zones

Homes located on Moe Hill, west and southwest of the storage reservoirs, with finished floor elevations above Elevation 110', require individual booster pumps to provide adequate pressure to their homes. Each home is also required to have its own double detector check valve to reduce the potential for cross contamination with the public water main system.

3.1.2 Distribution System

3.1.2.1 Sumas System

The existing water distribution system for the City has the following breakdown of pipes and lengths:

Table 3.2: Pipe Inventory

Pipe Diameter (inches)	Length (ft)	Length (miles)
1	2,073	0.39
2	12,052	2.28
4	15,296	2.90
6	19,242	3.64
8	31,138	5.90
10	22,526	4.27
12	762	0.14
Total	130,089	19.52

3.1.2.2 Nooksack and NVWA System

The City of Nooksack and the NVWA receive their potable water from Wells 1, 2, and 3 of the Sumas (Kneuman Rd.) Wellfield through a distribution system independent of the Sumas system. Water from the wells is routed southeast through an eight-inch PVC pipe installed along Kneuman Road then south on the west side of Barbo Road. The pipe continues south and is connected to an existing asbestos cement eight-inch line at the north side of the BNR railroad tracks. The eight-inch asbestos cement line continues to Garrison's Corner (the intersection of Halverstick Road and Garrison Road) and then south along Garrison Road to Nooksack.

There are two existing interties between the Sumas and the Nooksack/NVWA systems: at the wellfield (to allow water from Wells 4R and 5 to supplement Wells 1-3) and at Garrison's Corner.

As outlined in the latest Sumas and NVWA & Nooksack agreement (*Second Amendment to Agreement to Supply Water,* dated August 28, 2009) the City of Sumas' responsibility consists of operating and maintaining the distribution system from the wellfield to Garrison's Corner, from which Nooksack and NVWA take responsibility. In accordance with this agreement Sumas agrees to provide a total maximum annual volume of water equal to 768.6 acre-ft and a maximum instantaneous flow of 971.5 gpm.

3.1.3 Asset Condition & Criticality

3.1.3.1 Source Capacity Analysis

The water rights analysis in Section 3.4.1 (see also Table 2-12) shows that Sumas has adequate water rights for annual usage maximum withdrawal in acre-ft per year for the coming 20-year planning period.

Based on the estimated and the contractual instantaneous flow rates, Sumas also has enough well and pumping capacity for the coming 20-year planning period. Equalizing storage tanks are needed by Nooksack and NVWA to meet their anticipated peak hourly demands.

A discussion of each wellfield is presented below:

- *Sumas (Kneuman Road) Wellfield*
  In the existing configuration, the five wells operating together can produce approximately 2,200 gpm, slightly less than the water right allowable peak of 2,250 gpm. This wellfield is the primary source of water for Sumas, SRWA, Nooksack, and NVWA. In the past, the wells and pumps could reliably provide enough water to meet the peak hourly demand for these four water systems. Wells 4R and 5 would provide enough water to both Sumas and SRWA and provide additional flow to Nooksack & NVWA during their peak demand periods.

  Based on the current peak hourly demand and the current allocations of these four systems (see Table 2-11), the operation of both Pumps 4R and 5, with Wells 1-3, are required to meet the peak demand. In 2023, the combined peak hourly demand of these four systems is greater than the pumping capacity, but less than the well capacity. In order to satisfy this demand, the first option will be to utilize the equalizing storage capacity of each tank to store the difference between the pumping capacity and the peak hourly demand. Other options

include retrofitting Well 4R and Well 5 with pumps that match the well capacity – i.e., 1,100 gpm each and installing a third well.

In 2023, the estimated instantaneous demand for the City of Sumas (438 gpm), SRWA (1,004 gpm), Nooksack & NVWA (1,510 gpm) was 2,952 gpm, which is greater than well capacity of the Kneuman wellfield (2,800 gpm). The combined Kneuman and May Road wellfields total well capacity of 3,900 gpm is about equal to the estimated instantaneous demand for the entire system (3,882 gpm). For both the 2023 and 2045 usage, equalizing storage tanks are need to meet the instantaneous demands while staying below the water right instantaneous demand limit.

As shown in Table 2-9, both the 2023 (1,569 acre-ft) and the projected 2045 annual usage (2,375 acre-ft) are below the 3,416 water right annual usage limit.

- *May Road Wellfield*
  In the existing configuration with minimal usage of Well 2, the two remaining wells operating together can produce about 1,100 gpm, approximately one-third less than the allowable peak of 1,660 gpm. May Rd Well 3, with a water right of 860 gpm and 1,376 acre-ft, is used to supply the PSE co-gen plant, which is allocated 800 gpm and 969 acre-ft per year.

  With the 2010 water right point of transfer change for May Rd 1 to the Kneuman Rd wellfield, the 800 gpm maximum flow rate can be used to supplement the demand for Sumas, SRWA, Nooksack, and NRWA. Although this well capacity is only 200 gpm, the remaining 600 gpm (the difference between the 800 gpm water right and the 200 gpm well capacity) can be reserved for the Pumps 4R and 5. These pumps can then pump the additional 600 gpm from their wells without exceeding the overall water right of 3,050 gpm.

3.1.3.2 Distribution System Analysis

In general, distribution lines are in good condition. The exception tends to be the 2-inch lines, which are typically older galvanized iron pipe. Listed below are pipe segments considered to be in poor conditions. These segments are scheduled for replacement within this improvement program.

Table 3.3: Water Man Replacement in Poor Condition

Segment	Length	Cost
First St. (Sumas to Lawson)	600’	$180,000 ($300/LF)
Alley between 3rd & 2nd (Sumas west to NAPA)	275’	$82,500 ($300/LF)
Victoria Ct. (Kneuman up hill)	300’	$120,000 ($400/LF)
Lawson St. (3rd to Vancouver)	800’	$240,000 ($300/LF)
Mitchell St. (Sumas Ave. to Sumas Market)	200’	$60,000 ($300/LF)
Alley between Mitchell & Morton (Sumas to Cherry)	500’	$150,000 ($300/LF)
Noble St between Sumas Ave & Cherry St.	415’	$124,500 ($300/LF)

3.2 Water Quality

Raw water withdrawn at the two City wellfields is of excellent quality with respect to drinking water standards. The only parameter of concern is nitrate, which is present in elevated concentrations in all wells. At the Sumas Wellfield (which comprises sources SO6 and SO7), nitrate concentrations are below the MCL of 10 mg/l, whereas at the May Road Wellfield (#1 now used for domestic supply) nitrate levels are at times slightly above the MCL.

The graphs in Figures 13a through 13f indicate the trend in nitrate concentration over time at each well. Generally, the trend is toward higher values over time, but the rate of degradation varies from well to well. Wells 1, 2, and 3 (SO1, SO2, and SO3 respectively) are older artesian wells completed at a depth of 57 feet below ground level. Among the five wells at the Sumas Wellfield, these three wells show the fastest rate of degradation and the highest nitrate concentrations. The three graphs also reveal that nitrate concentrations increase as one progresses further up-gradient (and uphill) within the wellfield. Well 1 is the furthest down-gradient and shows the lowest concentrations, while Well 3, with the highest concentrations, is the furthest up-gradient. Wells 4 and 5, which are completed at depths of 80+ feel below ground level, contain the lowest nitrate concentrations. The graphs suggest that nitrate contamination is most prevalent near the top of the water table.

3.3 Design Standards

The following design standards provide the water system performance design criteria and are used to evaluate the existing and future water system.

3.3.1 Water Quality Parameters

Water quality must meet standards established in state and federal regulations. Included in Appendix E is a copy of Chapter 246-290 WAC and of sections of 40 CFR Part 141 that have been adopted by reference by DOH. Pertinent maximum contaminant levels (MCLs) for various contaminants are established in the following sections of state and federal code:

- Bacteriological. As established in WAC 246-290-310(2)
- Inorganic chemicals and physical. As established in WAC 246-290-310(3)
- Radionuclides. As established in WAC 246-290-310(6)

- Volatile Organic chemicals. As established in 40 CFR 141.61(a)
- Synthetic organic chemicals. As established in 40 CFR 141.61(c)

3.3.2 Storage Requirements

The city of Sumas has a single 500,000 gallon reservoir which is utilized to provide all of the storage requirements for the city of Sumas. The reservoir is a concrete tank 60 feet in diameter and 24 feet high (21,149 gallons per ft. of tank height). The reservoir has a base elevation of 186 feet. The source for the reservoir is the Sumas Wellfield which contains two pumps: Pump #4R-810 gpm at 155 ft. of head, and Pump #5 - 866 gpm at 155 ft. of head. These pumping rates are substantially lower than the instantaneous water rights for the wellfield.

In 2001 the Sumas Rural Water Association, a wholesale customer of the City of Sumas, constructed an identical 500,000 gallon reservoir adjacent to the City of Sumas' concrete tank. This tank is used by SRWA and provides their required equalizing and standby storage. The two tanks are hydraulically connected such that the two tanks respond together and equally to changes in water level. While hydraulically connected, the two tanks are considered to be individual tanks when estimating the respective storage and fire flow requirements for each system. Only the Sumas tank was used to evaluate the Sumas system requirements and performance.

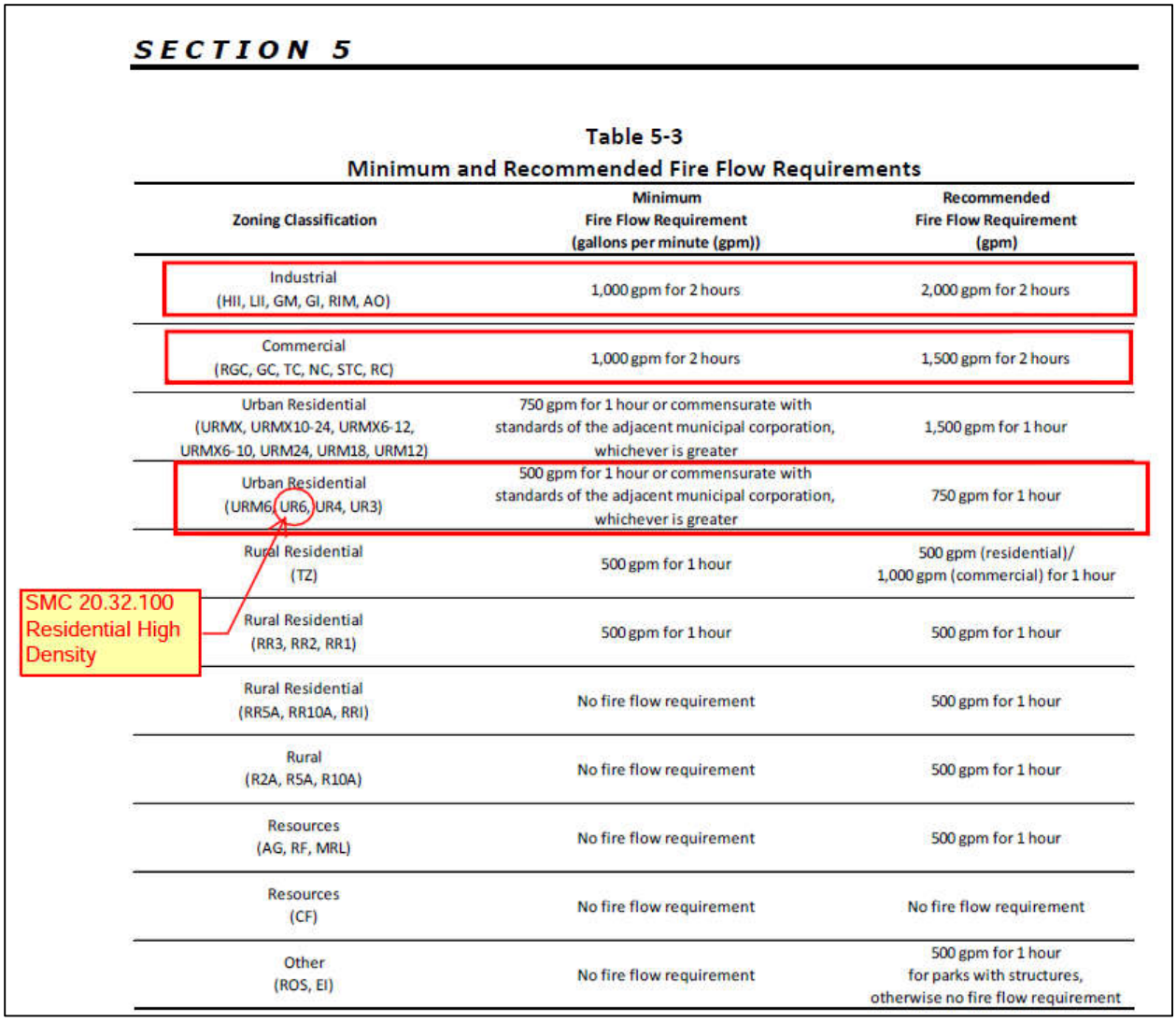
Storage requirements are calculated based on Table 7-1: *Reservoir Storage Component Cross-Section Diagram* from DOH Manual, Chapter 7. Storage calculations are provided in Appendix 3-1. The required minimum storage volumes are summarized in Table 3-3 below.

Operation storage for the system is minimal. The city's operational and maintenance personnel are not aware of any pump manufacturer's requirements regarding excessive cycling times. Under normal operating condition with two cycling pumps, once a pump is activated it will operate for a few hours. This will allow each pump to remain out of service for more than the common 15 minute downtime requirement. No other operational storage requirements are considered.

Equalizing storage has been calculated in accordance with the DOH *Water System Design Manual* (DOH Manual), 2020, and ADD, MDD, and PHD calculations based on the Design Manual requirements (see Appendix 2-15). Currently the wellfield pump capacity exceeds the PHD flow rate therefore no equalizing storage is required for the Sumas system

Fire suppression storage has been calculated in accordance with the Design Manual and the *Whatcom County Coordinated Water System Plan* (WCCWSP*)*, February 2019 Update. These guidelines are followed by the City of Sumas. Fire flow rate and duration requirements are provided in the WCCWSP's Table 5-3: *Minimum and Recommended Fire Flow Requirements*, as shown below.

Table 5-3 from the WCCWSP



SECTION 5

Table 5-3
Minimum and Recommended Fire Flow Requirements

Zoning Classification	Minimum Fire Flow Requirement (gallons per minute (gpm))	Recommended Fire Flow Requirement (gpm)
Industrial (HII, LII, GM, GI, RIM, AO)	1,000 gpm for 2 hours	2,000 gpm for 2 hours
Commercial (RGC, GC, TC, NC, STC, RC)	1,000 gpm for 2 hours	1,500 gpm for 2 hours
Urban Residential (URMX, URMX10-24, URMX6-12, URMX6-10, URM24, URM18, URM12)	750 gpm for 1 hour or commensurate with standards of the adjacent municipal corporation, whichever is greater	1,500 gpm for 1 hour
Urban Residential (URM6, UR6, UR4, UR3)	500 gpm for 1 hour or commensurate with standards of the adjacent municipal corporation, whichever is greater	750 gpm for 1 hour
Rural Residential (TZ)	500 gpm for 1 hour	500 gpm (residential)/ 1,000 gpm (commercial) for 1 hour
Rural Residential (RR3, RR2, RR1)	500 gpm for 1 hour	500 gpm for 1 hour
Rural Residential (RR5A, RR10A, RRI)	No fire flow requirement	500 gpm for 1 hour
Rural (R2A, R5A, R10A)	No fire flow requirement	500 gpm for 1 hour
Resources (AG, RF, MRL)	No fire flow requirement	500 gpm for 1 hour
Resources (CF)	No fire flow requirement	No fire flow requirement
Other (ROS, EI)	No fire flow requirement	500 gpm for 1 hour for parks with structures, otherwise no fire flow requirement

SMC 20.32.100 Residential High Density

The minimum required fire flow for industrial and commercial areas is 1,000 gpm for two hours. In Urban and other residential areas, the minimum required fire flow is 500 gpm for one hour.

The industrial/commercial requirement controls thereby requiring a minimum of 120,000 gallons of fire suppression storage.

These criteria are not anticipated to change over the next 20 years.

Standby Storage has been calculated in accordance with the DOH Manual and ADD, MDD, and PHD calculations based on the DOH Manual requirements. The Standby Storage volumes in the table below are calculated based on two days of storage with each Equivalent Residential Unit (ERU) at 200 gallons per day. The previous DOH Manual did allow a reduction in Standby Storage for a multiple pump system with the largest pump out of service. The current (2020) manual allows this reduction if the water system meets the following criteria for multiple sources. From Section 7.1.1.4 of the DOH Manual:

Water systems with multiple sources

It may be appropriate for design engineers to consider SB volume less than MDD if multiple sources provide mechanical, electrical, treatment, and transmission redundancy and resilience to a single contamination event. Section 7.1.3 lists what we consider to be continuously available sources of supply for reservoir design purposes.

Design engineers may justify a reduction of SB volume based on one or more of the following:

1. The water system and the local fire authority allow for nesting SB and FSS volumes, where the FSS volume is greater than the SB volume. See Section 7.1.1.4.
2. Two or more sources have permanent on-site auxiliary power that starts automatically when the primary power feed is disrupted. With the largest of these sources out of service, the remaining sources plus SB volume can maintain at least 20 psi throughout the distribution system under PHD conditions.
3. Two or more sources receive power from two electrical substations, so that failure of one substation will not interrupt the power supply to the source as

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documented in writing by the power utility. With the largest of these sources out of service, the remaining sources plus SB volume can maintain at least 20 psi throughout the distribution system under PHD conditions.

4. Sources are located in different watersheds, wellhead protection areas, or aquifers.
5. Converting dead storage to standby storage by providing mechanically redundant booster pumping capacity with permanent on-site auxiliary power that starts automatically when the primary power feed is disrupted.

Note that this Multiple Source criteria cannot be met since the sources (wellfields) are not located in different watershed or aquifers (Criteria #4).

The City currently has sufficient storage to meet the current conditions. However, assuming 200 gallons per day per ERU, the projected growth rate, and two days of storage, the current 500,000 gallon reservoir will provide sufficient Standby Storage only until 2036.

In 2023, the actual system average usage was 171 gallons per day. Using this rate, the 500,000 gallon reservoir could provide sufficient Standby Storage until 2045. The existing reservoir is probably adequate for the next 20 years when comparing the historic System Average Daily Demand (ADD)/ERU (171 gpd in 2023) and the planned 2045 System ADD/EDU (200 gpd). A second Sumas reservoir, or a new combined Sumas-SRWA reservoir, will be required in 20 years if the estimated growth is actually achieved and the City wishes to maintain two days of Standby Storage.

Table 3.4: Sumas Storage Requirements in Gallons

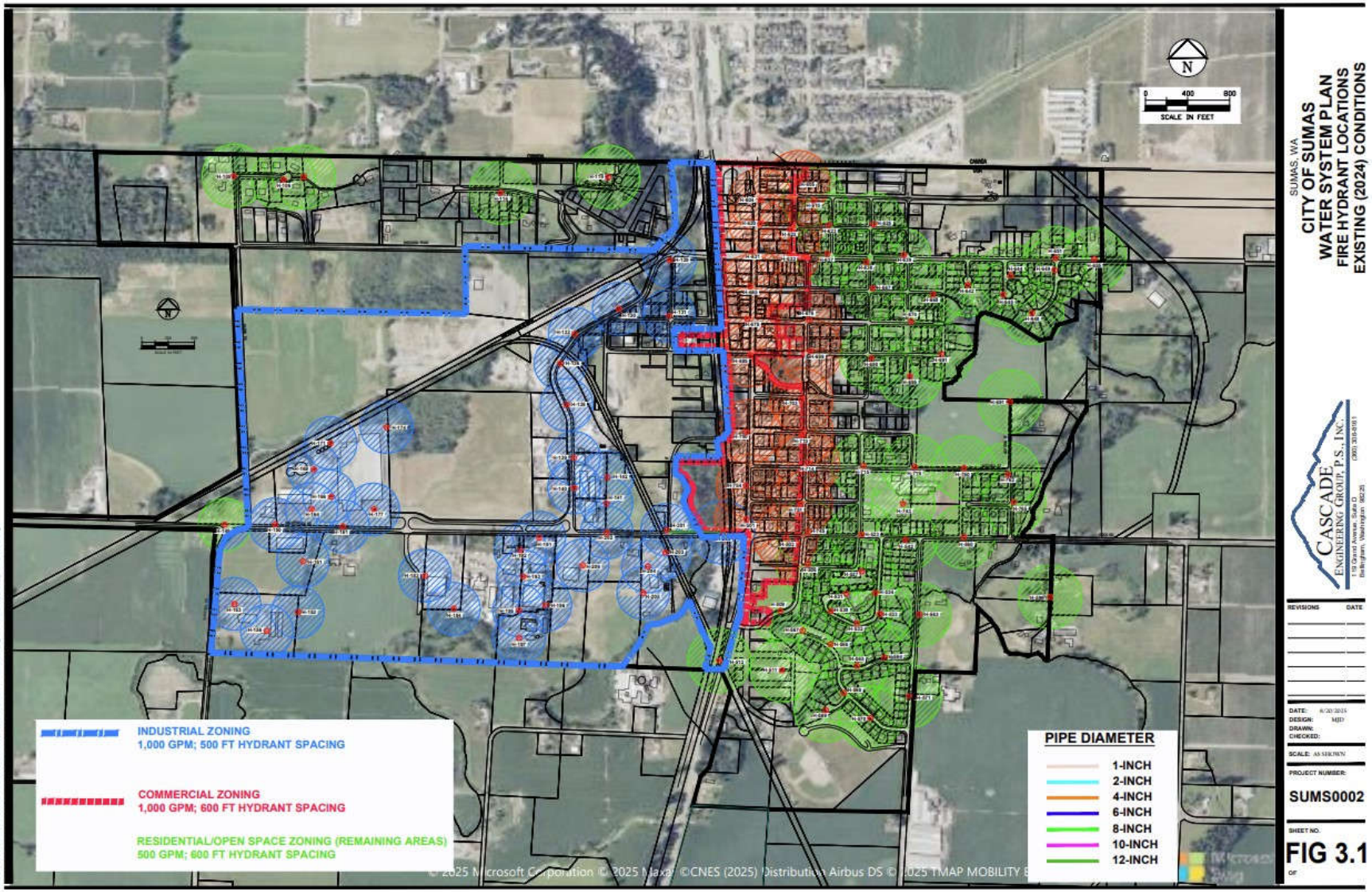
	2024	***2045***
I. Operational Storage	0	0
II. Equalizing Storage	0	0
III. Fire Suppression Storage	120,000	120,000
III. Standby Storage	375,600	579,600
TOTAL ($I+II+III_{max}$)	**375,600**	**579,600**

3.3.3 Fire Flow Rate and Duration

As shown in Table 5-3 from the WCCWSP, the minimum required fire flow for industrial and commercial areas is 1,000 gpm for two hours for one hour. In Urban and other residential areas, the minimum required fire flow is 500 gpm. Figure 3.1, *Fire Hydrant Coverage Areas*, identifies the city's zoning boundaries, existing hydrant locations and coverage area, and minimum fire flow requirements.

Systems analyses for the current (2024) and future (2045) conditions show that the minimum fire flow rates are achieved for each of the hydrants in their respective zone while maintain 20 psi throughout the system except for the hydrants located near the reservoir. Hydrants at ground elevations higher than Elevation 110 ft. cannot provide the required fire flow while maintaining 20 psi in the system.

Figure 3.1: Fire Hydrant Coverage Areas



3.3.4 Minimum System Pressure

Minimum system pressure shall be 30 psi during peak hourly demand periods and 20 psi during fire flow conditions in accordance with Section 5.2.4 *Specific Provisions, Pressure Requirements* of the *Whatcom County Coordinated Water System Plan*, 2019 Update, and Section 6.2.5 *Minimum Distribution System Pressure* of the DOH Manual.

3.3.5 Minimum Pipe Sizes

Within the commercial and residential zones, minimum diameter for water lines is generally eight inches. Six-inch and/or four-inch diameter pipe may be allowed at the discretion of the City when: (a) future extension is not anticipated; and (b) hydraulic modeling confirms that required fire flow is available to hydrants on the line. The City may waive the requirement of hydraulic modeling in instances where the extension consists of a looped six-inch line less than 2,000 feet in length connected at each end to lines eight-inches or larger in diameter. Within the Industrial zone, minimum diameter for water lines is generally ten- inches. Eight-inch diameter pipe may be allowed at the discretion of the City when hydraulic modeling confirms that required fire flow is available to hydrants on the line.

3.3.6 Backup Power Requirements

Sufficient backup power shall be present at each wellfield to maintain all pumps in simultaneous operation.

3.3.7 Valve and Hydrant Spacing:

Valves shall be resilient seated gate valves, Waterous Series 500 or equal, with a minimum pressure rating of 200 psi, and shall conform to the latest revision of AWWA specification C509. Valves shall be installed along the water main at intervals not to exceed 500 feet within the Industrial zone and not to exceed 800 feet within commercial and residential zones. Valves shall be placed on each main at all junction points.

Fire hydrants shall be Clow Medallion fitted with a five-inch Stortz connection on the steamer port, secured to the hydrant with aircraft cable. Fire hydrants shall be installed at intervals of 600 feet within commercial and residential zone districts and intervals of 500 feet within the Industrial zone.

3.4 Capacity Analysis

3.4.1 Water Rights

The following narrative and tables describe the water right permits and certificates issued to Sumas. Permits and certificates are listed in order of priority date and are presented in two groups corresponding to the two wellfields. Chapter 10 contains copies of active water rights.

3.4.1.1 Sumas Wellfield

The final right listed, G1-251171C, supersedes all prior rights and expresses the combined instantaneous and annual quantities that may be withdrawn at this field.

- *3427-C.* Qi = 1.78 cfs, no Qa. This is a surface water permit for the springs located at the site of the present-day Sumas Wellfield. The purpose of use is identified as "domestic supply", and the place of use is "Town of Sumas." This site was also purchased from the Sumas Water Company in 1929. This spring was Sumas' main water supply continuously from 1929 through at least 1959, when the first well was drilled at the Sumas Wellfield. Over time, subsequent supplemental ground water rights were issued with a point of withdrawal very close to the spring. In the report of examination for G1-25171C (see below), the Department of Ecology asserted that in accordance with RCW 90.14.180, surface water right 3427-C was effectively relinquished by the City due to lack of use. The City continues to maintain that the surface water right is available as an emergency water supply.
- *3485-C.* Qi = 2250 gpm, Qa = 405 af/yr. This is the first groundwater right issued at the Sumas Wellfield. The purpose of use is identified as "municipal supply", and the place of use is "Town of Sumas, Town of Nooksack, Rural Nooksack, Rural Sumas, Whatcom County, Washington." Time of use is continuous. Well 1 was drilled appurtenant to this right to a depth of 58 feet. Figure 7 shows the location of Well 1 within the wellfield. The report of examination recommends authorization of withdrawal of 405 acre-feet per year "less any quantity diverted to this town under the existing rights from the spring."
- *G1-00063C.* Qi = 2250 gpm, Qa = 672 af/yr. This is a groundwater right issued at the Sumas Wellfield. The purpose of use is identified as "municipal supply", and the place of use is "Area served by the City of Sumas." The permit application includes a more detailed listing of place of use, including the following sections: 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 29, 30, 31, 32 and 33 in T40N, R4E; 5, 6 and 7 in T40N, R5E; 33, 34, 35 and 36 in T41N, R4E; 31, 32 and 33 in T41N, R5E. Time of use is continuous. This right applies to Wells 2, 3, and 4. Wells 2 and 3 are completed to a depth of 57 feet, while Well 4 is completed to a depth of 68 feet. Figure 7 shows the location of the wells within the wellfield. At the time of issuance in 1971, Wells 2 and 3 were used to feed a pumphouse pressurizing the Nooksack Valley system, and Wells 1 and 4 flowed to a pumphouse that filled the Sumas reservoir. The report of examination mentions that the combined total withdrawals pursuant to this right in combination with 3485-C and 3427-C can not exceed 672 acre-feet per year.
- *G1-24025C.* Qi = 2250 gpm, Qa = 598.8 af/yr. This is a groundwater right issued at the Sumas Wellfield. The purpose of use is identified as "municipal supply and dairy farming", and the place of use is "City of Sumas service area." The report of examination includes a more detailed listing of place of use, including the following sections: 4 and 5 in T39N, R4E; 1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 14, 15, 16, 17, 19, 20, 21, 22, 27, 28, 29, 30, 31, 32, and 33 in T40N, R4E; 6 and 7 in T40N, R5E; 33, 34, 35, and 36 in T41N, R4E; 31, 32, and 33 in T41N, R5E. Time of use is continuous. This right applies to Wells 1, 2, 3, and 4. Although the report of examination derives the permitted volume based upon

calculations that account for Sumas' pre-existing rights, this right is not issued as supplemental to those earlier rights. It is a new primary right.

- *G1-25171C.* Qi = 2250 gpm, Qa = 1919 af/yr. This is a groundwater right issued at the Sumas Wellfield. The purpose of use is identified as "municipal supply and dairy farming", and the place of use is "City of Sumas service area." The report of examination includes a more detailed listing of place of use, including the following sections: 24 and 25 in T40N, R3E; 4 and 5 in T39N, R4E; 1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 14, 15, 16, 17, 19, 20, 21, 22, 27, 28, 29, 30, 31, 32, and 33 in T41 N, R5E. The service area includes all of the City of Everson service area north of the Nooksack River. Time of use is continuous. This right applies to Wells 1, 2, 3, and 4. This right is issued as supplemental to all other pre-existing surface and groundwater rights at the Sumas Wellfield and expresses combined maximum limits on instantaneous withdrawal and annual volume for the Sumas Wellfield as a whole. In 1992, Well 5 was completed to a depth of 80 feet. A change application was submitted to the Department of Ecology and approved in February 2010 see Appendix (I) page 7 outlines the locations of points of withdrawal which includes all the existing wells at the Kneuman Road wellfield.

3.4.1.2 May Road Wellfield

- *4592-P.* Qi = 1.34 cfs, no Qa. This is a surface water permit for the springs located at the site of the present day May Road Wellfield. The purpose of use is identified as "domestic supply", and the place of use is the "Town of Sumas". In the early part of the century, a private association called the Sumas Water Company operated a hydraulic ram at May Road that pumped surface water east to town. The City of Sumas purchased the private water company, including the spring site, in 1929, and use of the water continued for many years thereafter. However, no use of surface water has been made at May Road issuance of this permit in 1946.
- *G1-26398C*. Qi = 860 gpm, Qa = 1376 af/yr. This first was issued as a groundwater permit at the May Road Wellfield. The City applied in 2009 for a Ground Water Application for Change Certificate, the City was able to demonstrate the permit has been perfected by the instantaneous and annual quantity of water on an annual basis. The Certificate was granted in December of 2009 for the purpose of use as "municipal supply and industrial supply" and the place of use is "Within the City of Sumas' 2011 Service Area Boundaries" with the time of use as continuous. The Certificate applies to May Road Wells 1, 2, 3. Well 1 is completed to a depth of 64 feet and Well 3 is completed to a depth of 74 feet. Well 2 is completed to a depth of 70 feet and is located as shown on Figure 8. A stream-mitigation condition is associated with this certificate for each 100 gpm withdrawn at any May Road well pursuant to G1-23698 and G1-26398. An additional 18 gpm must be pumped to an adjacent unnamed creek. Although the mitigation duty imposed within this right is calculated relative to *both* May Road wells, the Qi and Qa volumes associated with this right are distinct from those described for G1-23698C, and the two sets of numbers must be combined to calculate the total withdrawal permitted at the wellfield. Water withdrawn pursuant to this Certificate has so far been delivered to a single individual customer, the PSE co-generation facility, within a

dedicated industrial pipeline and Well 1 has been connected to the City of Sumas Water system. The legal description of location of withdraw is SW ¼ SW ¼ Section 33 Township N41 Range 4

Table 3.5: Existing Water Rights Status
(Equivalent to WDOH Table 3)

Id. #	Name	Date	Source	P/S	Existing Rights		Existing Use		Excess/Deficit	
					Qi (gpm)	Qa (af/yr)	Qi (gpm)	Qa (af/yr)	Qi (gpm)	Qa (af/yr)
Sumas Wellfield										
3427-C	Town of Sumas	3/14/1946	Unnamed spring (at Sumas Wellfield)	P	1.78 cfs	-	0	-	0	-
3485-C	Town of Sumas	6/22/1959	Sumas Wellfield SO1	P	2250	405	-	-	-	-
G1-00063C	City of Sumas	7/15/1971	Sumas Wellfield SO1, SO2, SO3	S	2250	672	-	-	-	-
G1-24024C	City of Sumas	1/15/1982	Sumas Wellfield SO1, SO2, SO3, SO4	P	2250	598.8	-	-	-	-
G1-25171C	City of Sumas	1/20/1988	Sumas Wellfield SO1, SO2, SO3, SO4	S	2250	1919	2160	1149	90	770
			Combined max. withdrawal		2250	1919				
May Road Wellfield										
4592-P	Town of Sumas	3/14/1946	Unnamed spring (at May Rd Wellfield)	P	1.34 cfs	-	0	-	0	-
G1-26398C	City of Sumas	12/10/2009	May Rd wells 1,2,3	S	860	1376	800	270.16	1105.84	0
			Combined max. withdrawal		1860	1376				

[1] Maximum Qa measured at Sumas Wellfield in calendar year 1998.

[2] Maximum Qa measured at May Road Wellfield in calendar year 2009.

Table 3.6: Future Water Rights Status
(Equivalent to WDOH Table 4)

Id. #	Name	Date	Source	P/S	Existing Rights		Existing Use		Excess/Deficit	
					Qi (gpm)	Qa (af/yr)	Qi (gpm)	Qa (af/yr)	Qi (gpm)	Qa (af/yr)
Sumas Wellfield										
3427-C	Town of Sumas	3/14/1946	Unnamed spring (at Sumas Wellfield)	P	1.78 cfs	-	0	-	0	-
3485-C	Town of Sumas	6/22/1959	Sumas Wellfield SO1	P	2250	405	-	-	-	-
G1-00063C	City of Sumas	7/15/1971	Sumas Wellfield SO1, SO2, SO3	S	2250	672	-	-	-	-
G1-24024C	City of Sumas	1/15/1982	Sumas Wellfield SO1, SO2, SO3, SO4	P	2250	598.8	-	-	-	-
G1-25171C	City of Sumas	1/20/1988	Sumas Wellfield SO1, SO2, SO3, SO4	S	2250	1919	2250	1872	0	47
			Combined max. withdrawal		2250	1919				
May Road Wellfield										
4592-P	Town of Sumas	3/14/1946	Unnamed spring (at May Rd Wellfield)	P	1.34 cfs	-	0	-	0	-
G1-26398C	City of Sumas	12/10/2009	May Rd wells 1,2,3	S	1860	1376	860	1376	0	0
			Combined max. withdrawal		1860	1376				

3.4.2 Physical and Hydraulic Capacity Analysis

The 2024 Sumas water system hydraulic model was created by estimating the peak hourly demand at each system node based on the number of residential and large users in the vicinity of the respective node. A Google Earth aerial map of Sumas was used to identify the location and the number of service connections associated with each node. The value of the residential peak hour demand was estimated based on the DOH's Peak Hourly Demand equation (See Section 3.1). Demands at dead end nodes where estimated based on the Maximum Instantaneous Demand (MID) methodology outlined the DOH's *Sizing Guidelines for Public Water Supplies*, September, 1983.

Monthly meter records were used to identify 15 large users in the city's system. Based on these records, the ADD was calculated. The MDD was estimated at 2.0 times the average daily demand (ADD). PHD was estimated at two times the MDD.

Based on the similarity between the population and large users, the 2023 usage information is assumed to be the same for the 2024 condition. The peak hourly demands in the 2024 and 2045 models were calculated by summing the following: the residential demand (based on the DOH PHD methodology), the large user demand (see Chapter 2, Appendix 2-9), and SRWA demand distributed as discussed below.

SRWA Demand

The peak hourly demand for the SRWA system was estimated using their monthly master meter usage in 2023 and 2019 (their peak usage year). Meter records at the SRWA interties were reviewed to determine the distribution of the supplied water at each of the four interties. Based on the 2019 and 2023 meter records the following percentages were assumed to distribute the SRWA demand at the four interties. This same distribution was assumed for the 2045 model (with the Whatcom County Comprehensive Plan projected annual growth rate of 1.89%).

Table 3.7: Estimated Demands at SRWA Interties

Intertie Locations	Node #	2023 Year Total (FT^3)	Average Daily Demand (GPD)	(2.0 * ADD) Max Daily Demand (GPD)	2023 MDD (GPM)	2019 MDD (GPM)	Average Model Demand (GPM)	2045 MDD (GPM) 1.89% Annual Growth
Jones Rd.	J-1	2,113,698	43,316	86,633	60	60	60	91
Rock Rd.	J-2	7,833,220	160,527	321,055	223	167	195	294
Hovel Rd.	J-3	3,832,901	78,548	157,096	109	136	122	184
Ball Park (SR9/Easterbook)	J-4	3,874,620	79,403	158,806	110	162	136	205
SRWA TOTAL		**17,654,439**	**361,795**	**723,590**	**502**	**526**	513	774

SRWA 2023 Annual Usage	405	acre ft /year
SRWA 2019 Annual Usage	424	acre ft /year
Water Right Annual Usage	471	acre ft /year
Water Right Instantaneous Flow	500	gpm

3.4.2.1 ADD, MDD, and PHD

System ADD, MDD, and PHD calculations are included in Appendix 2-15. The following is a summary of these results.

Table 3.8: Summary of ADD, MDD, and PHD

	2009 Sumas Base Line Information	2023		2045	
		Sumas	SRWA	Sumas	SRWA
# of Users	496	701		1,081	
System Annual Consumption (ft^3)	8,633,787	7,826,207		14,141,310	
System Annual Consumption (acre-ft)	198	180		324	
System ADD (gpd)	176,933	160,384		289,800	
System ADD/Users (gpd/user)	357	229		268	
System ADD/ERUs (gpd/ERU)	282	171		200	
System MDD (gpd)	353,866	320,766		579,612	
System MDD/ERU (gpd/ERU)	564	342		400	
# of Residential and Small Users	475	686		1,058	
Residential Annual Consumption (ft^3)	6,546,726	5,357,708		10,325,401	
Residential ADD (gpd)	134,163	109,796		211,600	
Residential ADD/User (gpd/user)	282	160		200	
ERU (gpd/user)	282	200		200	
Residential MDD (gpd)	268,326	219,592		423,200	
Residential MDD/ERU (gpd/ERU)	564	400		400	
# of Large Users*	21	15		23	
Large User Annual Consumption (ft^3)	2,087,061	2,468,499		3,816,249	
Large User ADD (gpd)	42,770	50,587		78,206	
# of ERU 's for Large Users	152	253		391	
Large User MDD (gpd)	85,540	101,174		156,412	
Large User MDD/ERU (gpd/ERU)	565	400		400	
Total ERU's	**627**	**939**		**1,449**	
PHD (gpm)*	499	498	513	724	774
PHD for Combined System (gpm)		**1,011**		**1,498**	

* # of Large Users and their consumption has an assumed annual growth of 2.0%.
SRWA has an assumed annual growth rate of 1.89%.

3.4.2.2 System Modeling

The water system was analyzed using the computer program “Pipe2010” (version 10.009) by KYPipe. "KYPIPE4" is the hydraulic calculation engine behind the Pipe2010: KYPipe hydraulic model. KYPIPE4 was developed by civil engineering professors from the University of Kentucky and has been continually updated and maintained for over 40 years. The KYPipe engine is an industry standard for analyzing pressurized water distribution systems.

Maps of the 2025 Sumas water distribution system are provided in Figure 3.2 (with an aerial overlay) and Figure 3.3 (KY Pipe map that includes junctions and pipe numbers). Maps of the 2045 Sumas water distribution system are provided in Figures 3.4 and 3.5.

Figure 3.2: 2025 Water System Layout

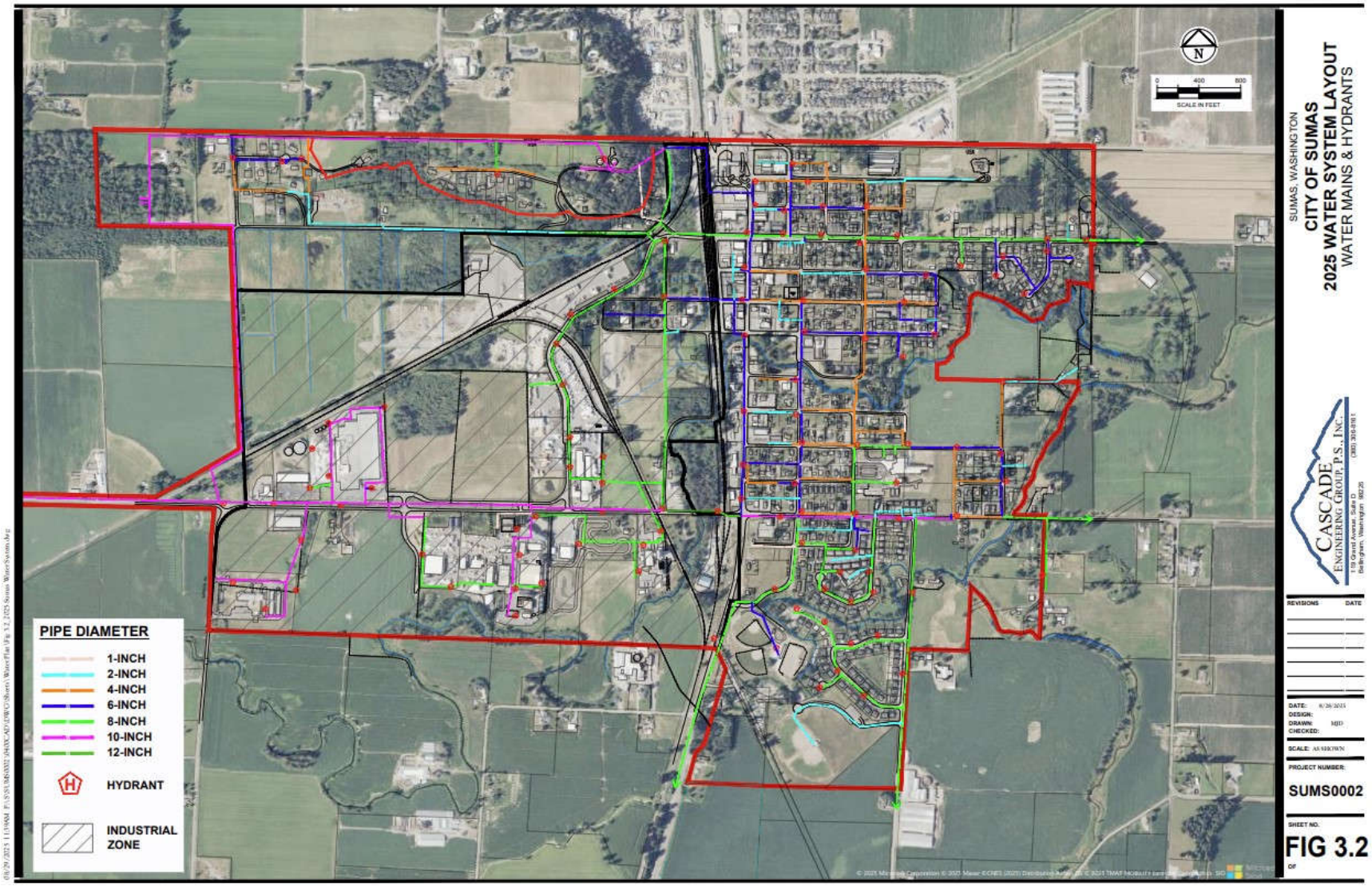


Figure 3.3: 2024 KY Pipe Model Layout Plan

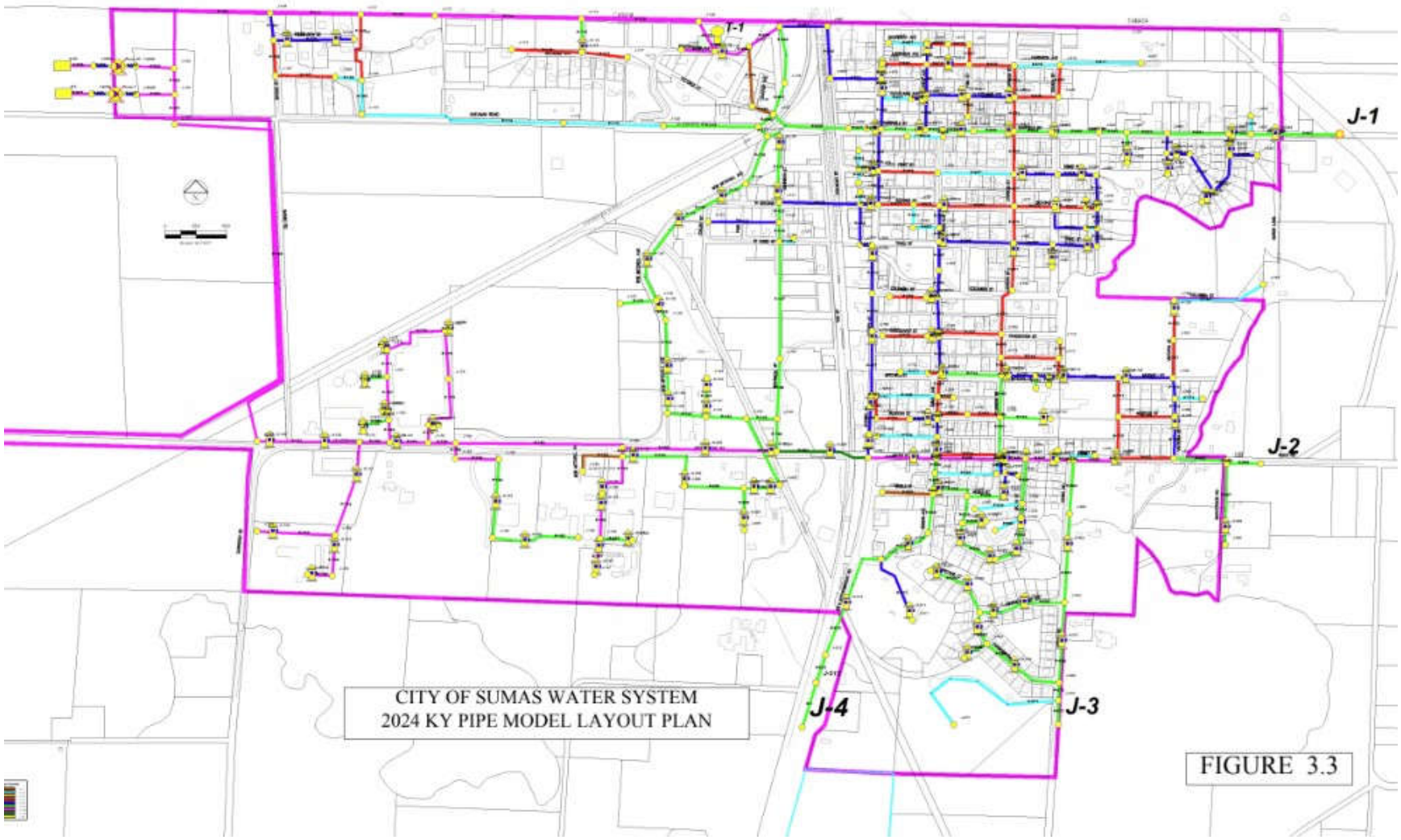


Figure 3.4: 2045 Water System Layout

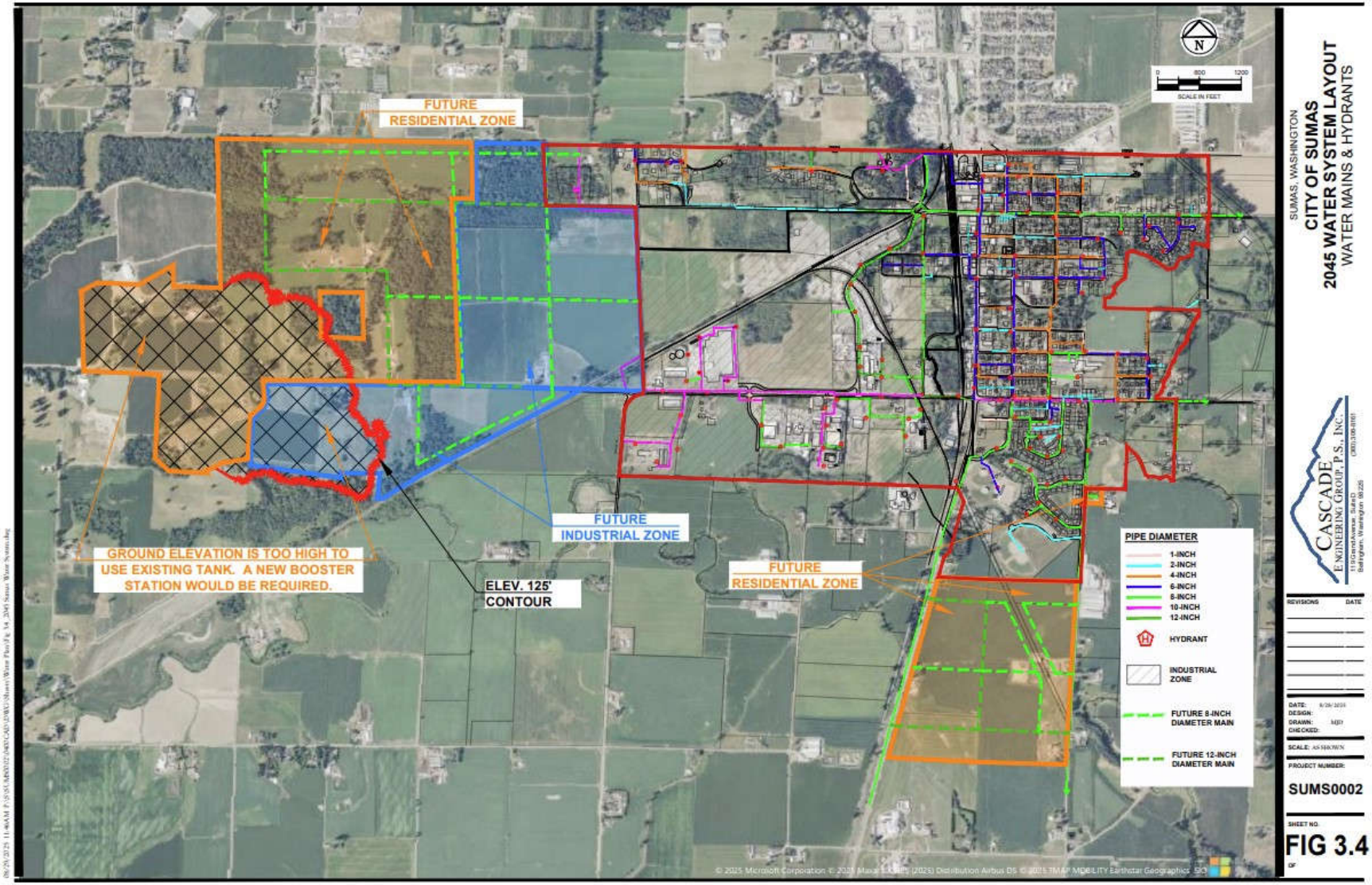
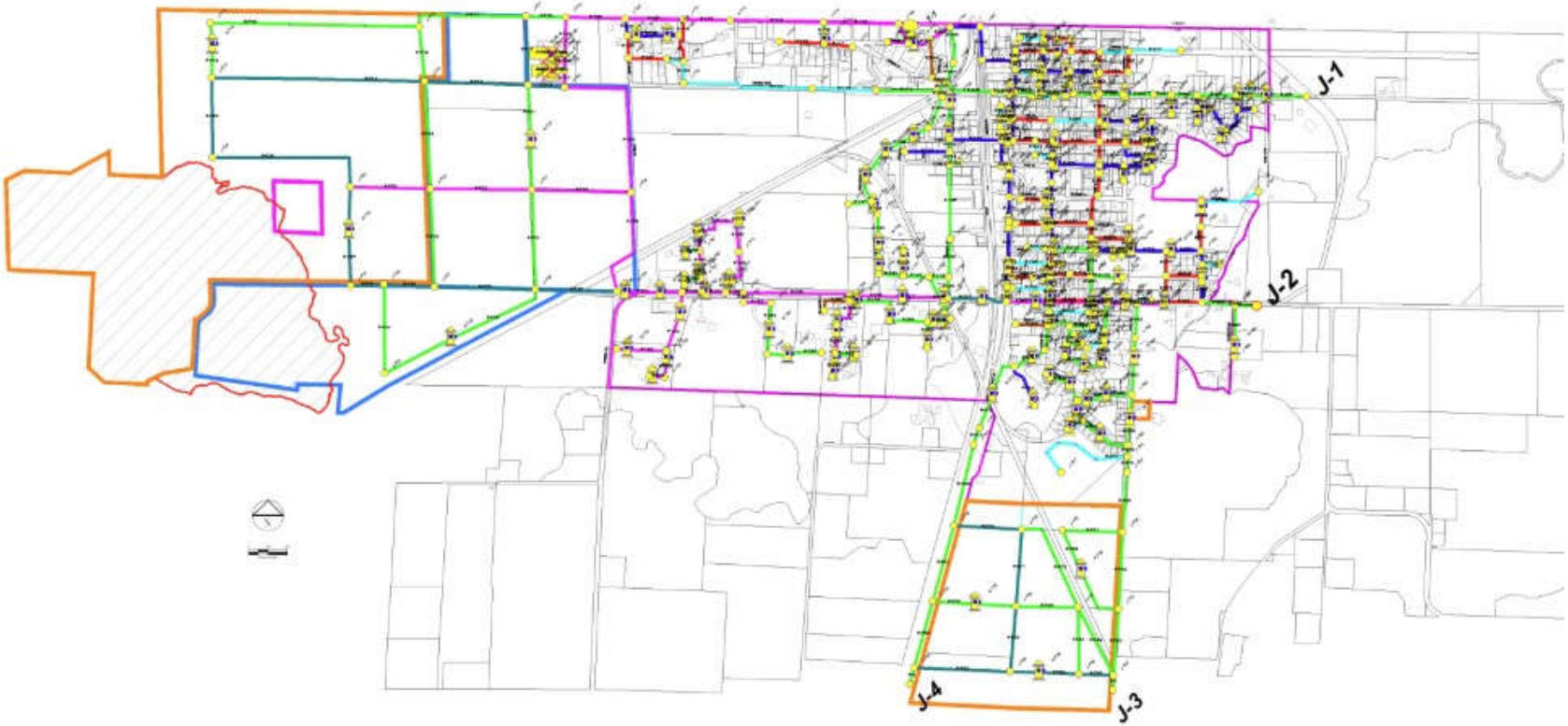


Figure 3.5: 2045 KY Pipe Model Layout Plan



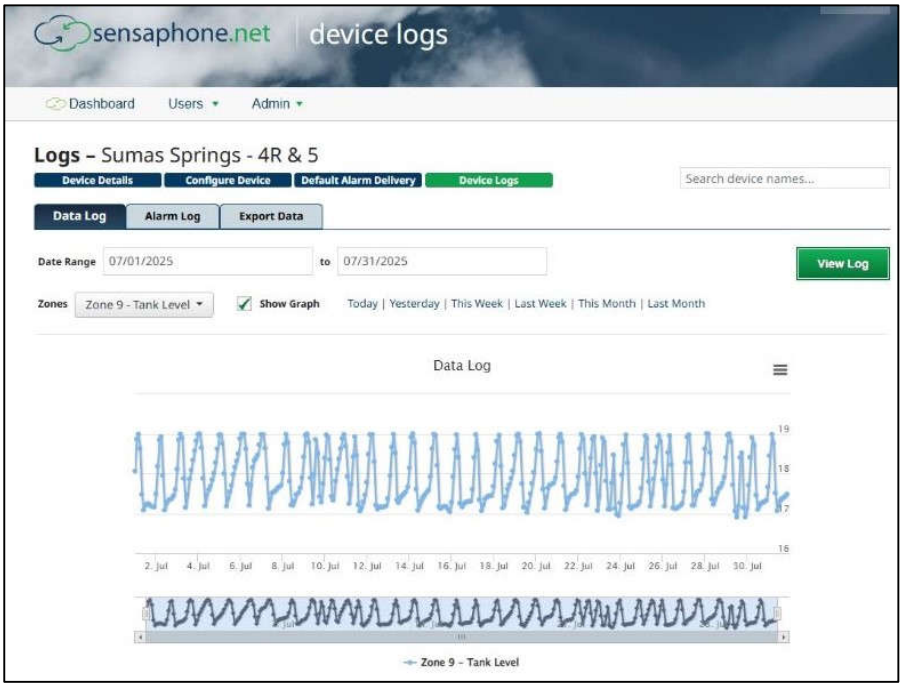
For modeling purposes, system elements are organized into junction nodes, pipes, pumps, and a storage tank. Junction nodes are specific points identified in the system where pipes intersect and elevations and system water demand are identified. Junction demands were calculated based on The value of the residential peak hour demand was estimated based on the DOH's Peak Hourly Demand equation Demands at dead end nodes where estimated based on the Maximum Instantaneous Demand (MID) methodology outlined the DOH's *Sizing Guidelines for Public Water Supplies*, September, 1983.

Monthly meter records were used to identify 15 large and 52 multi-family users in the city's system. Based on these records, the ADD was calculated. For Large Users, the MDD was estimated at 2.0 times the ADD. PHD was estimated at two times the MDD. Multi-Family demands were estimated based on the number of units in the building and the associated ERU count. See Table 3.5 for the SRWA demands.

Node elevations were obtained using Light Detection and Ranging (LiDAR) information from the 2006 USGS mapping for Puget Sound, which is based on Washington State Plane, NAD 83 horizontal datum and NAVD 99 vertical datum. Information on the pipe size, location, material, and age, as well as tank, pump, and wellfield information was provided by the city's water department personnel. Pipe roughness coefficients were estimated based on material type, age, and water department personnel's evaluation of the pipe condition.

The City has installed data collection telemetry that records, among other data, the reservoir water level and the pump cycle operation. The figure below shows that the tank water level consistently remained between 17 and 19 feet for the month of July 2025.

Figure 3.6: Reservoir Water Depth in July 2025



More detailed information was provided for the period beginning on July 30, 2025 and ending at the end of August 1, 2025, as shown in the figure below.

Figure 3.7: Reservoir Water Depth and Pump Cycling between 7/30/2025 and 8/1/2025

This figure shows that only one pump is needed to maintain the tank level at a depth between 17 and 19 feet. Since each pump operates at approximately 850 gpm, the maximum system demand for the entire Sumas + SRWA system is less than 850 gpm since there is a steady rise in the tank level once a pump is turned on.

Two modes of analysis are used to evaluate the water system: steady state and extended period simulation. The steady state analysis is used to determine the operating behavior at a specific point in time, or under steady (unchanging) conditions. This analysis is used to evaluate the point at which the system is operating under its worst-case scenario, that is, the point of maximum system demand, no pumps operating, and the water level in the tank at the bottom of the standby storage section.

The extended period simulation is used to examine the effects on the system with water demands varying over time. This mode of analysis is useful for examining how a tank will drain and fill, or how pressure and flow rates will vary throughout the day.

EPS Demand Pattern: Current Condition

The data in Figure 3-2 shows a relatively consistent pattern of when the tank is refilled (midnight to 4 AM), the pumps are off and the tank level drops (4 AM to 10 AM), and when the pump is on

to meet the hourly demand (10 AM to midnight). The following demand pattern is used to achieve this tank level cycle.

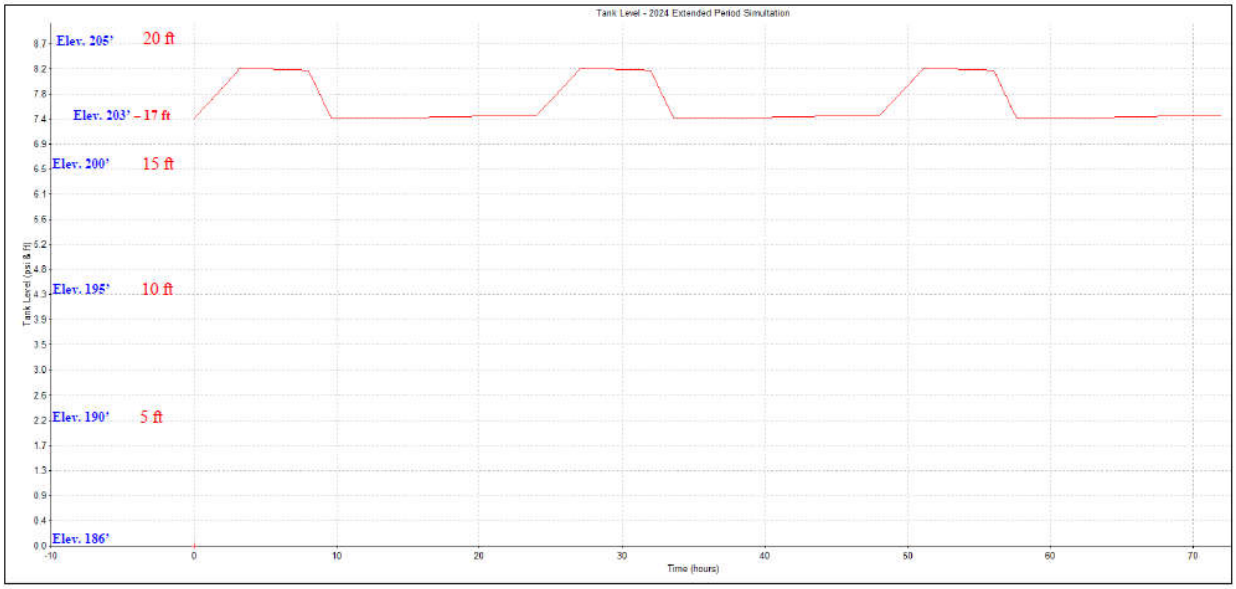
Table 3.9 EPS Demand Pattern

Time From Start (hr)	Multiplier
0.0 – 2.0	0.40
3.0 – 7.0	0.01
8.0 – 23.0	0.83

Using this demand pattern, the EPS model was able to get results very similar to the measured tank level readings with a single pump cycling on and off at similar times of the day.

This same EPS demand pattern is assumed for the 2045 system analysis.

Figure 3.8: Model Results for EPS Reservoir Water Depths and Pump Cycling



3.4.2.3 Results of Hydraulic Analysis

The appendices contain the supporting documentation of the hydraulic analysis. This information includes the modeling demand parameters at each junction node; pipe, tank, and pump information; and the results of the scenario analyses. The analyses include the steady state condition using peak hourly demand, fire flow analysis, and extended period simulations for refilling the storage tank for the existing 2024 and future 2045 condition. Based on the results of these analyses, the existing system appears to be able to meet the anticipated future demands and no improvements to the existing distribution system are proposed to meet the 2045 conditions.

Likewise, no improvements to the transmission lines to SRWA and Nooksack and NVWA are anticipated to 2045.

Existing Condition: 2024

Various modifications of the hydraulic model were run to provide an overall evaluation of the existing system. Worst case scenarios, such as both pumps being out of service and tank water levels at less than full conditions, were assumed for the system evaluation. Improvements to the water system in the past ten years have remedied most of the past system deficiencies identified in the previous Water Plan.

- Steady State: Using the full peak hourly demands, the steady state model shows the system is capable of maintaining pressures between 30 psi to 65 psi throughout the system with neither pump running and as little as six feet of water in the tank, except for the deficiencies noted below – see Appendix 3-4.
- Fire Flow: Using the maximum daily demand the steady state model shows the system is capable of delivering the required fire flow with neither pump operating, the tank water level at the bottom of the standby storage level, and 20 psi residual pressure except as noted below – see Appendix 3-6.
- Extended Period Simulation: Using the hourly demand multipliers listed above, the model shows that both pumps are able to refill the tank fully each day when each is the sole pump in operation – see Appendix 3-8. The present pump controls alternates the pump in operation. During extreme events when both pumps are operating, the tank is easily filled.

System Deficiencies

1. Service connects in the Moe's Hill area experience pressures less than the required 30 psi in the steady state model. This area, which includes the system's ground level storage tank, has ground Elevation between Elev. 140 to 190 feet, while the majority of the Sumas system is between Elev. 40 to 50 feet. Presently there are 27 homes in this area. Each of these homes needs its own booster pumps for their individual service and a backflow preventer to protect the home in the event line pressure drops below 20 psi (see below).

2. The fire flow analysis indicates that the required 500 gpm fire flow cannot be delivered to any of the hydrants located on Moe's Hill. In order for these hydrants to deliver the 500 gpm residential fire flow, the fire truck will need to provide suction to obtain the flow from the line and nearby tank. This will result in reduced or negative pressures in this section of pipe. Backflow protection will be required at each home and pipe line and joint integrity must be maintained to prevent potential groundwater intrusion into the system.

3. The hydrant located at the north end of Victoria Street in the southeast corner of town (H-729) is served by a 300 ft. long, four-inch diameter pipe with two services downstream of the hydrant. Under the existing system with peak hourly demands, the maximum deliverable fire flow to this hydrant is at 500 gpm, while maintaining a minimum of 20

psi at all system nodes. A flow test at this hydrant will confirm if this flow rate can actually be delivered.

4. The existing 1-inch service on Noble St between Sumas Ave & Cherry St dead ends at the west end of Noble Street. The pressure drop in this 400 ft. pipe results in pressures below 30 psi under PHD conditions. A field pressure test at the service connections should confirm model results under current conditions. If pressures are deficient, this line should be looped or replaced with a larger pipe.
5. Currently, the NVWA/Nooksack telemetry states their peak pump rate is 800 gpm. The current Wellfields 1 – 3, which supply Nooksack and NVWA, can maintain a sustainable pumping rate of 500 gpm. The wellfield should be monitored during the peak usage periods (summer months) to verify well drawdown is within acceptable operating parameters.

Future Condition: 2045

Anticipated growth in the city of Sumas over the next 20 years is estimated to include the addition of approximately 372 new residential service connections and eight large industrial users. Figure 3.4 identifies the anticipated location of these new service areas. Water consumption in SRWA is also expected to slowly rise with a corresponding increase in their estimated PHD.

Table 3.10: Estimated Peak Hourly Demand and Pressure at SRWA Interties

Node #	Location	2024		2045	
		PHD (gpm)	Pressure (psi)	PHD (gpm)	Pressure (psi)
J-1	Jones Rd	60	62	91	59
J-2	Rock Rd	195	58	294	52
J-3	Hovel Rd	122	58	184	53
J-4	Ball Park	136	57	205	50
	TOTAL	513		774	

- Steady State: Using the full peak hourly demands, the steady state model shows the system is capable of maintaining pressures between 30 psi to 62 psi throughout the system with neither pump running and as little as six feet of water in the tank, except for the deficiencies noted below – see Appendix 3-5.
- Fire Flow: Using the maximum daily demand the steady state model shows the system is capable of delivering the required fire flow with neither pump operating, the tank water level at the bottom of the standby storage level, and 20 psi residual pressure except as noted below – see Appendix 3-7.

- Extended Period Simulation: Using the hourly demand multipliers listed above, the model shows that a single pump is not able to able to refill the tank fully each day. A second pump is required to operate with the first pump for approximately 11 hours each day to keep the water level above the standby storage level.
- Storage: Additional standby storage is required near the end of this 20 year planning period. The current available storage will be insufficient based on the projected growth, requiring a minimum addition of 80,000 gallons of storage. Approximately 100,000 gallons of equalizing storage should also be added if the City wishes to maintain their current operating condition of running a single pump at a time. (This 100,000 gallon volume is for the combined Sumas and SRWA system.)

System Deficiencies

1. In general the future system responded the same way as the 2024 analysis with a slight reduction in pressure since the PHD will increase by approximately 50%. See comments for 2010 above. In regards to ground elevations and future service connections, in general, connections with ground elevations at or above Elev. 110 ft will require water booster pumps to provide adequate pressure.
2. By 2045, the combined Nooksack, and NVWA system is expected to reach their contractual maximum instantaneous demand flow rate of 971.5 gpm. The current Wellfields 1 – 3, which supply Nooksack and NVWA, can maintain a sustainable pumping rate of 500 gpm. Supplemental water from Wells 4R and/or 5 will be required if this Wellfield1-3 is insufficient to provide the future flow rate required.
3. Supplemental standby storage of approximately 80,000 gallons is required around 2045. Approximately 100,000 gallons of equalizing storage should also be added if the City wished to maintain their current operating condition of running a single pump at a time.
4. The anticipated SRWA annual water usage in 2045 is projected at 611 acre-ft per year, which exceeds their contract allocation of 470 acre-ft per year. This additional water is available for SRWA but their contact should be updated to reflect this change.

3.5 Summary of System Deficiencies

The following is a summary of the system deficiencies and proposed remedial action.

Table 3-11. System Deficiencies and Remedial Action

Deficiency	Remedial Action
Existing 2024 System	
1. Pressures less than the required 30 psi in the Moe's Hill area.	• Existing homeowners have booster pumps. No additional action planned at this time.
2. Fire flow at 500 pm to the three hydrants on Moe's Hill cannot be provided by tanks and wellfield pumps. All fire flow must be	• Annual inspection and monitoring of the pipes and service connections on Moe's Hill is recommended to ensure pipe joint

provided by fire trucks and/or tank suction at the hydrants.	integrity to prevent potential groundwater intrusion into the system.
3. Fire flow to hydrant at the north end of Victoria Street is estimated at 502 gpm.	• A field fire flow test should confirm model results under current conditions. If required, install an orifice plate on the hydrant to limit flow to 250 gpm and mark hydrant as such, or the pipe can be replaced with a minimum six-inch diameter.
4. Noble St between Sumas Ave & Cherry St. Dead end 1-inch service is too small (pressure drop issue).	• A field pressure test at the service connections should confirm model results under current conditions. If pressures are deficient, this line should be looped or replaced with a larger pipe
5. NVWA/Nooksack peak pump rate is 800 gpm, which is greater than the wellfield's 500 gpm max. sustainable pumping rate.	• The wellfield should be monitored during the peak usage periods (summer months) to verify well drawdown is within acceptable operating parameters.
6. City currently keeps their reservoir water level between 17 and 19 feet deep. The required standby storage volume of 375,600 gallons requires 17.8 feet of storage depth.	• City should consider raising the water depth level to operate between 18 and 20 feet, or higher, to obtain additional standby storage.
Future 2045 System	
1. See 2024 deficiencies.	• See remedial action outlined for 2024.
2. Future development in the Moe's Hill and northwest areas with ground elevation greater than Elev. 110 ft. may have pressures that are less than the required 30 psi.	• Future homeowners in these areas will require booster pumps.
3. No existing infrastructure in proposed growth areas.	• Loop the new infrastructure improvements to the existing main distribution lines.
4. Insufficient standby storage by 2045.	• Around 2035 (in 10 years), the City should begin to monitor their water consumption and tank levels to confirm design and growth assumptions. Around 2040, the City should confirm if additional standby storage is needed, and if so, begin the planning, design and budgeting for the new reservoir.

5. Equalizing storage will be required if the City wishes to maintain their current operating procedure of operating one pump at a time.	• The City should add 100,000 gallons of equalizing storage for the combined Sumas and SRWA systems if the City wishes to maintain their single running pump operation practice.

4 Water Use Efficiency Program

In 2003, the Washington State Legislature passed the Municipal Water Law (MWL), which requires municipal water suppliers to have a Water Use Efficiency (WUE) program. After the MWL was passed in 2003, the State Legislature directed the Washington Department of Health (DOH) to adopt an enforceable WUE program, which became effective on January 22, 2007. The fundamental elements of the WUE program are:

- Planning Requirements – collect data, forecast demand, evaluate WUE measures, and install meters on all customer lines
- Distribution System Leakage Standard (DSL) of 10 percent or less water loss.
- Goal Setting and WUE Reporting – publicly establish goals with customers and the community, report annually, and renew WUE program at least every 6 years or as part of regular water system plan updates.

4.1 Water Use Efficiency Program

One of the three elements of the water use efficiency rule is water use efficiency goal setting and performance reporting. Municipal water suppliers must set water use efficiency goals through a public process and report annually on their performance to customers and the Department of Health. Appendix H shows the results of the public hearing and the annual reports.

4.1.1 Water Use Efficiency Requirements WAC 246-290

The City of Sumas has adopted the requirements of WAC 246-290. We are a fully metering system which allows us to identify any leaks or problems. In complying with the Water Use Efficiency Rule a public hearing was held at the May 27, 2014 City Council meeting to establish our Water Use Efficiency (WUE) goals. No public comments were received. In 2024, the City filed its annual WUE Water Loss report, showing 5.2% unaccounted water loss, which is under the State maximum 10%. Copies of the 2023 and 2024 WUE reports can be found in Appendix (H).

4.1.2 Conservation objectives

The objectives of this conservation program are:

- *Decrease unaccounted water.* In 2024, 31 acre-feet of water were pumped at the Sumas Wellfield and not billed to customers. This amounts to approximately 5.1% of supply, as compared to 6.3% in 1995. Sumas will seek to reduce unaccounted water to 5% or less.
- *No long-term increase in agricultural use.* The bulk of Sumas' potable water use is used to dairy farms in the outlying agricultural areas. There is an ongoing trend toward consolidation of small dairy farms into larger operations, combined with an overall increase in the size of the herds. This trend implies an increasing demand for water by the dairy farms. This program will seek to ensure that future demand remains constant, despite the increasing size of herds.

- *Reuse of industrial water.* Heavy industries are using an increasing amount of nonpotable water for cooling purposes. By reusing water wherever possible, the available supply will support a greater number of users.

4.1.3 Evaluation and Selection of Conservation Measures

Sumas is a "small" system according to WDOH guidelines and must therefore evaluate the following recommended conservation measures:

- *Source meters.* Sumas has had source meters in place for several years. This WSP establishes a maintenance schedule, ensuring accuracy of the meters over time.
- *Service meters.* Sumas has had service meters in place for many years. Virtually every residential service meter was replaced in the 1996 – 1997 biennium as part of an upgrade to wand-readable meters. This WSP establishes a maintenance schedule, ensuring accuracy of the meters over time. Starting in 1999 with the largest meters, (i.e., the meters at the interties to the neighboring rural associations), Sumas has replaced all interties meters with compound meters to ensure accurate billings to large users.
- *Conservation pricing.* Sumas has had traditional "decreasing block" pricing in the past. An "increasing block" rate structure is a sensible means of achieving the goal of no long-term increase in dairy use. Such a structure could also help Sumas ensure that the two rural associations do not consume more water than allowed in their supply contracts. Conservation pricing can be instituted by Sumas, but also should be instituted by the end-user customers. In 2000, Sumas met with each rural association to discuss its rate structure. Sumas encouraged use of conservation pricing if not already in place. Sumas will also adopt a new rate schedule that sets conservation rates designed to prevent wholesale customers from exceeding contractual limits.
- *Program promotion.* Each of the above program elements can be implemented by the city with no reliance upon end-user cooperation, so only a minimal program is needed. As part of the annual Consumer Confidence Report, Sumas will inform customers of the meter maintenance and conservation pricing program elements.
- *Lawn watering.* Sumas has adopted a odd-even watering schedule that starts May 1st and ends October 1st. The residents address numbers determines the odd-even day.
- *Appliance rebates.* The City has an Energy Star program for Washing Machines and Dishwashers.
- *Energy Code.* The City of Sumas has adopted the State Energy Code that requires low flow toilets and faucets.

4.1.4 Target Water Savings Projections

The conservation program is expected to achieve a minimum savings goal of 5 percent of the amount pumped at the Sumas Wellfield.

4.1.5 Regional Conservation Program

Because Sumas is a wholesale purveyor to neighboring rural water associations, a coordinated regional conservation program is required according to WDOH guidelines. Sumas will serve as

lead agency for implementation of the following program, applicable to the Sumas service area as well as the service areas of all wholesale customers.

The program objective, as stated earlier, is to avoid any long-term increase in agricultural water use. The program will be implemented as follows:

- *Purveyor assistance - agricultural emphasis.* Sumas will collect information about best management practices for dairies with regard to water conservation. Information sources are expected to be the Ag. Extension service, the Conservation District, and the NRCS. Sumas will develop a brochure and/or informational packet that includes contacts at appropriate existing technical assistance agencies. The brochure will then be mailed to "large users" in the neighboring water associations. Preceding the mailing, Sumas will contact each large user by phone to alert them of the brochure and encourage their voluntary compliance with suggestions.
- *Conservation pricing.* As mentioned above, Sumas will institute conservation pricing.
- *Program promotion.* The direct phone contacts and mailings mentioned above constitute the program promotion.

4.2 Source and Service Metering

4.2.1 Source Metering

Each of the Sumas wells are sufficiently metered to ensure compliance with the Water Use Efficiency requirements. Depending on the type of meter installed, some require calibration to ensure readings are accurate. The oldest source meter was installed in 2013 and will need to be replaced in the next 5 years.

4.2.1.1 Kneuman Road Wellfield

The Kneuman Road Wellfield has four wells currently pumping potable water to the City of Sumas, SRWA, NVWA, and the City of Nooksack. Wells 2 and 3 provide water to both NVWA and the City of Nooksack. These wells are equipped with meters manufactured by Badger Meter. This is a propeller meter which was installed on January 10, 2013. This meter has not been calibrated since installation. Well 3 is also equipped with a meter manufactured by Badger Meter. This is also a propeller meter installed on February 2, 2023. This meter was last calibrated in March of 2024.

Wells 4 and 5 provide water to the City of Sumas and SRWA. Well 4 is equipped with a meter manufactured by McCrometer Inc. It was installed in 2020 and no calibration for this meter has been done. Well 5 is equipped with a propeller meter manufactured by Badger Meter. The unit was installed on February 2, 2023, and has not been calibrated since installation.

4.2.1.2 May Road Wellfield

The May Road Wellfield has two wells currently pumping water. Well 1 (May Rd 1) pumps potable water to help maintain pressure in the Sumas City water system. Well 3 (May Rd 3) pumps non-potable water which is serviced by the Puget Sound Energy co-generation plant. As part of the City's water right for May Rd 3, an amount of water pumped must be augmented by

replacing it back into an adjacent tributary stream which feeds into Johnson Creek. Both the wells and augmentation are metered as part of the Water Use Efficiency program. All meters used are ultrasonic flow meters manufactured by Badger Meter. As these units are ultrasonic meters, they do not require recalibration. The May Rd 1 meter was installed in 2023, while the May Rd 3 and augmentation meters were installed in 2024.

4.2.2 Service Metering

Since 2010, Sumas has been installing service meters manufactured by Badger Meter at each service point. The typical unit model used is known as Model 25. A majority of these meters were installed in 2010, when the City began utilizing automatic meter reading technology. These meters are read monthly and are replaced if found to be faulty. The manufacturer's recommendation for recalibration is for every 20-25 years. The City is expecting to begin system-wide maintenance and replacement efforts starting in 2027 and completing by 2030. The typical cost of a new meter in 2025 is roughly $350.

4.3 Distribution System Leakage

As part of the Water Use Efficiency Program, the City is responsible for calculating the amount of distribution system leakage (DSL) and reporting this information to the DOH. The City is also responsible for creating a Water Loss Control Plan designed to mitigate the amount of DSL that occurs in the system. The requirements for what to include in the Water Loss Control Plan is based on the proportion of DSL which occurs in the system in a three-year period. More information regarding the results of city's most recent DSL reporting are available in Section 2.3 of this WSP.

4.3.1 Methodology

The City utilizes the recommended methodology for calculating DSL, provided by the DOH in the WUE Guidebook. This methodology compares total production to actual consumption, identifying the difference as water loss. The City then uses the difference to calculate percent DSL which is used to determine the level of mitigation required in the Water Loss Control Plan.

4.3.2 Water Loss Control Plan

Once percent DSL is calculated, the City must adopt a Water Loss Control Plan if DSL is calculated to exceed 10 percent. Upon the City's 2024 Water Loss Report, Sumas has managed to stay below the 10 percent DSL threshold in each of the previous three years. Until the City breaches that minimum threshold, Sumas is not required to adopt a Water Loss Control Plan.

4.4 Water Use Efficiency Savings

Since the Water Use Efficiency program went into effect in 2007, the City of Sumas has been working to reduce the amount of DSL which occurs in our water system. Figure 4.1 below shows the history of Sumas' annual Water Use Efficiency reporting from 2009 to 2024. This chart shows the work that has been done on the part of the City to reduce our DSL levels. As shown on the chart, the City's DSL peaked at 25.80% in 2012. Over time, through a thorough accounting

of the City's water usage and an implementation of the WUE goals and strategies, the City of Sumas was able to reduce annual DSL levels to their lowest in 2023 at just 2.67%.

In between those years were a number of outliers in which missing information led to reporting some negative annual DSL levels. Also, national shortages in the manufacturing of water meters due to the outbreak of Covid-19 led to a period of time in 2020 when water pumped at Well #5 went unaccounted for, causing an artificial increase in DSL for that year. Similarly, the November 2021 Nooksack River flood event caused pump failures and water sales to drop, leading to a small artificial increase in DSL for that year.

5 Source Water Protection

5.1 Sanitary Control Area

[Section to be Written]

5.2 Wellhead Protection Program

The City of Sumas Wellhead Protection Plan as adopted on May 28, 1996, is incorporated by reference as the source water protection component of this WSP.

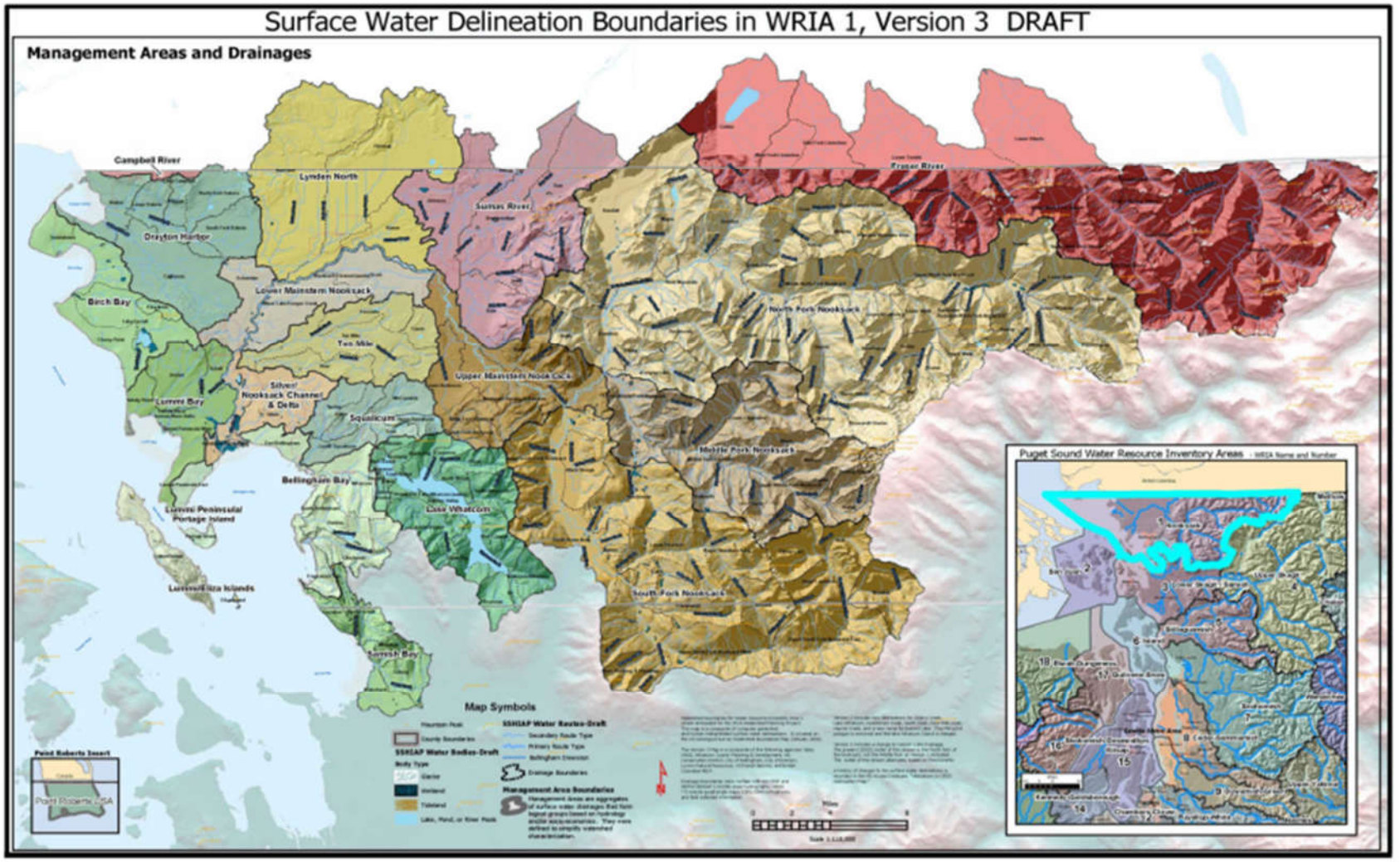
5.3 Watershed Control Program

5.3.1 Watershed Description/Characteristics

Sumas exists within the Sumas River subbasin which is a tributary of the Fraser River basin in British Columbia. The total area of the Sumas River subbasin, as delineated in the Phase 2 report of the Regional Water Supply Plan (RWSP) (Whatcom PUD No. 1, 2023), includes approximately 42,945 acres in Whatcom County and 9,534 acres in Canada. Elevations range from 15 feet to 3,411 feet. The Sumas River subbasin is within Washington State's designated Water Resources Inventory Area #1 (WRIA 1), shown in Figure 1 below.

The only municipalities located in the American portion of the Sumas River subbasin are the Cities of Sumas and Nooksack, as well as Whatcom County. The American portion of the subbasin is divided into different water associations, including: Sumas City Water, Sumas Rural Water Association (SRWA), Nooksack City Water, and the Nooksack Valley Water Association (NVWA). Each of these associations are supplied by the GWI sources located in the Sumas and May Road Wellfields, both administered by Sumas City Water. Both of these wellfields are located within the Sumas River subbasin and use artesian wells to draw from the Sumas-Abbotsford aquifer.

Figure 5.1: Surface Water Delineation Boundaries in WRIA 1 (2005)



5.3.2 Sumas River Subbasin

The primary land use in the Sumas River subbasin is commercial agriculture. Specifically, the primary forms of agriculture present in the subbasin include dairy and berry farming. The margins are dominated by rural and commercial forestry. Agricultural activity, especially berry farming, represents a significant potential detrimental impact to water quality through the use of pesticides and other hazardous chemicals.

Urban land use activities which occur within Sumas City Boundaries, specifically industrial uses, also present a potential detrimental impact on water quality. To combat the potential impacts to water quality, the Sumas and May Road wellfields are located on land owned by the City and which include no other land use activities in order to protect the Sumas system's sources of drinking water.

The Sumas River Subbasin consists of 7 hydrogeological units listed in in the RWSP Phase 2 Report.

The Sumas River is fed by several tributary streams originating from different directions within the subbasin. Dale Creek, Swift Creek, Collins Creek, and Breckenridge Creek are all mountain tributaries draining western portions of the Sumas Mountain. Saar Creek is another mountain tributary which drains a northern portion of Sumas Mountain and Vedder Mountain in British Columbia. Johnson Creek and Bone Creek, along with their tributaries drain glacial plain areas east of the City of Sumas and feed into the Sumas River just east of the City. The glacial/alluvial plain tributaries are highly connected to the Sumas-Abbottsford Aquifer and receive significant baseflow from the aquifer.

The Sumas-Abbotsford Aquifer is largely recharged by infiltration of precipitation. The shallow aquifer discharges to streams, wells, seeps, springs, and vertical leakage to deeper aquifers.

Table 1 below summarizes precipitation data provided by the Whatcom Conservation District from a rain gauge located outside their office in Lynden, WA, located approximately 6 miles southwest of Sumas. The data shows annual precipitation data, as well as total precipitation during the autumn and winter months between each year.

Table 5.1: Precipitation Data (in.) Lynden, WA (2012-2023)

Month	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Jan	4.24	6.52	4.77	6.80	3.36	2.33	7.81	4.61	8.93	5.19	7.02	3.72
Feb	4.50	2.40	3.21	3.37	7.55	5.11	5.12	2.67*	5.86	5.89	2.27	2.64
Mar	5.66	6.96	8.69	5.96	4.58	8.25	3.97	1.82	3.58	1.56	5.74	1.69
Apr	3.72	5.59	3.25	2.01	2.73	4.57	2.91	4.85	1.28	1.50	1.72	2.73
May	0.74	3.99	4.36	0.63	1.77	3.51	0.52	1.63	3.13	1.27	3.80	0.73
Jun	2.48	0.08	1.13	0.24	1.39	1.57	1.20	1.17	2.67	1.67	3.71	1.33
Jul	1.61	0.10	1.34	1.79	0.67	0.19	0.20	0.61	1.16	0.00	0.15	1.40
Aug	0.06	0.98	0.88	0.89	0.08	0.06	0.22	0.82	1.33	1.00	0.24	0.75
Sep	0.00	5.28	3.43	3.77	2.24	1.42	2.46	4.32	2.02	6.28	0.00	1.99
Oct	9.22	2.23	7.15	3.45	8.41	6.42	4.57	5.53	4.57	6.85	3.87	3.66
Nov	7.51	5.30	6.22	6.88	9.89	7.08	7.46	3.34	7.42	17.80	5.50	4.94
Dec	6.65	2.98	6.58	7.05	4.92	7.93	5.32	5.23	9.38	6.85	3.72	7.09
Total (year)	*46.4*	*42.4*	*51.0*	*42.8*	*47.6*	*48.4*	*41.8*	*36.6*	*51.3*	*55.9*	*37.7*	*32.7*
	2011-12	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**2020-21**	**2021-22**	**2022-23**
Storage Period Total (Oct-Mar)	25.19	39.26	27.18	36.08	32.87	38.91	38.33	26.45	32.47	34.01	46.53	21.14

**February 2019 precipitation includes snowfall to rain liquid equivalent.*

Storage Period Total (Oct-Mar) = the total amount of precipitation received from October 1 to March 31. You have to look at two years for this information. For example the storage period for 2016 is calculated from Oct 2015 to Mar 2016.

5.3.3 Existing Regulatory Rules, Authorities and Recommendations

A wide range of regulations are in place to manage and protect water resources in the Sumas River subbasin. These regulations occur at all levels of government. The following is a list and summaries of existing federal, state, and local regulations which manage and protect local water resources:

5.3.3.1 Federal Regulations and Programs

- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA);
- Federal Insecticide, Fungicide, and Rodenticide Act;
- Resource Conservation and Recovery Act;
- Clean Water Act and Water Pollution Control Act;
- Superfund Amendments and Reauthorization Act; and
- Safe Drinking Water Act.

5.3.3.2 State Regulations and Programs

Shoreline Management Act

The Washington State Shoreline Management Act (SMA) was passed by the Washington State Legislature in 1971 and adopted by the voters in 1972. The purpose of the SMA is to protect and enhance the shorelines of the State. For the purposes of the SMA, shorelines are defined as any of the following:

- All marine waters;
- Streams and rivers with greater than 20 cubic feet per second mean annual flow;
- Lakes 20 acres or larger;
- Upland areas called shorelands that extend 200 feet landward from the edge of these waters;
- Biological wetlands and river deltas connected to these water bodies; and
- Some or all of the 100-year floodplain, including all wetlands.

The general process by which the SMA seeks to protect shorelines of the State include preferred land uses such as single-family residences, ports, shoreline recreational uses, water dependent industrial and commercial developments, other developments which provide public access opportunities.

Sumas adopts and enforces the policies of the SMA via the codification of the City of Sumas Shoreline Management Master Program, the most recent update to which was adopted in October of 2023. This Master Program promotes the SMA's preferred land uses within shoreline jurisdiction and enforces State regulations protecting Sumas' shorelines from unmanaged development.

Stormwater Management

Sumas adopts by reference the latest adopted version of the Washington State Department of Ecology Stormwater Management Manual for Western Washington, the latest update to which was adopted in 2024. The Stormwater Management Manual for Western Washington provides guidance on the measures necessary to control the quantity and quality of stormwater runoff. Local jurisdictions such as Sumas use this manual to design and regulate stormwater runoff regulations that reflect best practices in stormwater management.

Local Regulations and Programs

Critical Areas Ordinance (CAO)

The Sumas Critical Areas Ordinance was initially adopted in 2004 with the purpose of providing understandable and reasonable requirements for the use and development of land in proximity to critical areas, while protecting such critical areas based on best available science. For the purposes of this ordinance, Critical Areas are defined as wetlands, geologically hazardous areas, fish and wildlife conservation areas, and aquifer recharge areas.

On top of Sumas, the City of Nooksack and Whatcom County each have their own adopted Critical Areas Ordinances protecting critical areas in the rest of the Sumas River subbasin.

Wellhead Protection Plan

In May of 1996, the Sumas City Council adopted the City of Sumas Wellhead Protection (WPP) which seeks to protect the groundwater sources of drinking water for the City of Sumas and all of its purveyors. The plan identifies potential contamination sources surrounding Sumas' wells and enforces protective measures designed to prevent those contamination sources from reaching Sumas drinking water supply. This WPP enforces regulations at both the Sumas and May Road wellfields. Because of plan and programs such as this, Sumas has enjoyed some of the best tasting water in the State of Washington without the need for treatment.

6 Operation & Maintenance Program

6.1 Water System Management and Personnel

The Sumas water system has the following management and decision-making structure:

- *City Council*. The council is responsible for adoption of a WSP and for adoption of policies and project priorities contained therein. The council is responsible for annual budget appropriations to implement the WSP.
- *Mayor*. The mayor has overall responsibility for implementation of the WSP and operation of the water department. The Mayor prepares an annual budget identifying major water-system projects to be pursued within the year and demonstrating the financial capability to complete the projects. The mayor can authorize a major expenditure in an emergency situation.
- *Public Works Director*. Responsibility for day-to-day operation of the water department is delegated to the Public Works Director by the Mayor. The Public Works Director assigns crew members to tasks and schedules routine tasks and minor and major projects. The Public Works Director orders equipment and supplies as needed and monitors water department expenditures to ensure compliance with the budget.
- *Water Utility Crew Member*. A crew member has responsibility for operation, maintenance, and repair of system facilities on a day-to-day basis. He reports to the Public Works Director and coordinates tasks under the Public Works Director's supervision. A crew member notifies the Public Works Director of deficiencies and operational difficulties that are of a scope or size such that significant expense and/or significant manpower is needed for correction. Some crew members are certified water system operators.
- *Utility Clerk*. The utility clerk is responsible for preparation and mailing of utility bills.

6.1.1 Alignment of Job Responsibilities with Qualifications

The following table identifies which of the above persons is responsible for the various tasks involved in operation of the water department. A certified operator must be involved in the performance of those tasks marked with an asterisk (*) below.

Table 6.1: Job Responsibilities Matrix

Task	Council	Mayor	Public Works Director	Certified Operator	Crew Member	Utility Clerk
Day-to-day operations*			x	x	x	
Preventative maintenance*			x	x	x	
Field engineering*			x	x		
Water quality monitoring*			x	x		

Emergency response		x	x	x	x	
Cross-connection control*			x	x		
CIP implementation	x	x	x			
Budget formulation		x	x			
Response to complaints			x			
Public/press contact		x	x			
Billing						x

6.2 Operations and Preventive Maintenance as Related to Managing Asset Life-Cycle Costs

Figures 3, 4, 11, 12, and 13 show the major components of the water system. Figure 4 is an overall Sumas Wellfield map, and the others are detailed drawings of crucial components.

6.2.1 Sumas/SRWA source and storage

Routine operation. Sumas and SRWA are supplied by wells 4R and 5 (WDOH sources SO8 and SO5 respectively) at the Sumas Wellfield. Both wells pump to a 10-inch line that loops both north and east to the reservoir and south and east to the base of Cherry Street. See Figure 7 and detail Figures 11 and 12. Once the water from the two wells is co-mingled in the 10-inch line, the source is identified as SO7. Each well is fitted with a submersible pump. Specifications and pump curves of the pumps are included within Appendix F.

The reservoir is a concrete tank 60 feet in diameter and 24 feet high, located atop Moe's Hill at an elevation of 186 feet. The tank has a capacity of 500,000 gallons and was built in 1982. The operation of wells 4R and 5 is automatically controlled by four mercury float switches in the reservoir. The two wells operate alternately as lead pump. The lead pump is activated by a float set at a height of 20 feet within the reservoir. The lag pump and a low-water alarm are activated by a float set at a height of 19.5 feet. Both pumps are deactivated by a float set at a height of 22 feet. The high-water alarm is activated by a float set at a height of 22.5 feet.

Preventative maintenance. Routine inspection of the reservoir is performed annually and includes a complete inspection of the vents, screens, overflow drains, hatches, locks, covers, and other appurtenances important in the normal operation of the reservoir. In addition, the drain valve and overflow drain are exercised. Interior condition is inspected every five years. If silting or mineral growth is observed within the reservoir, a contractor is hired to clean the reservoir while full.

Figure 6.1: Well 4/4R Pumphouse

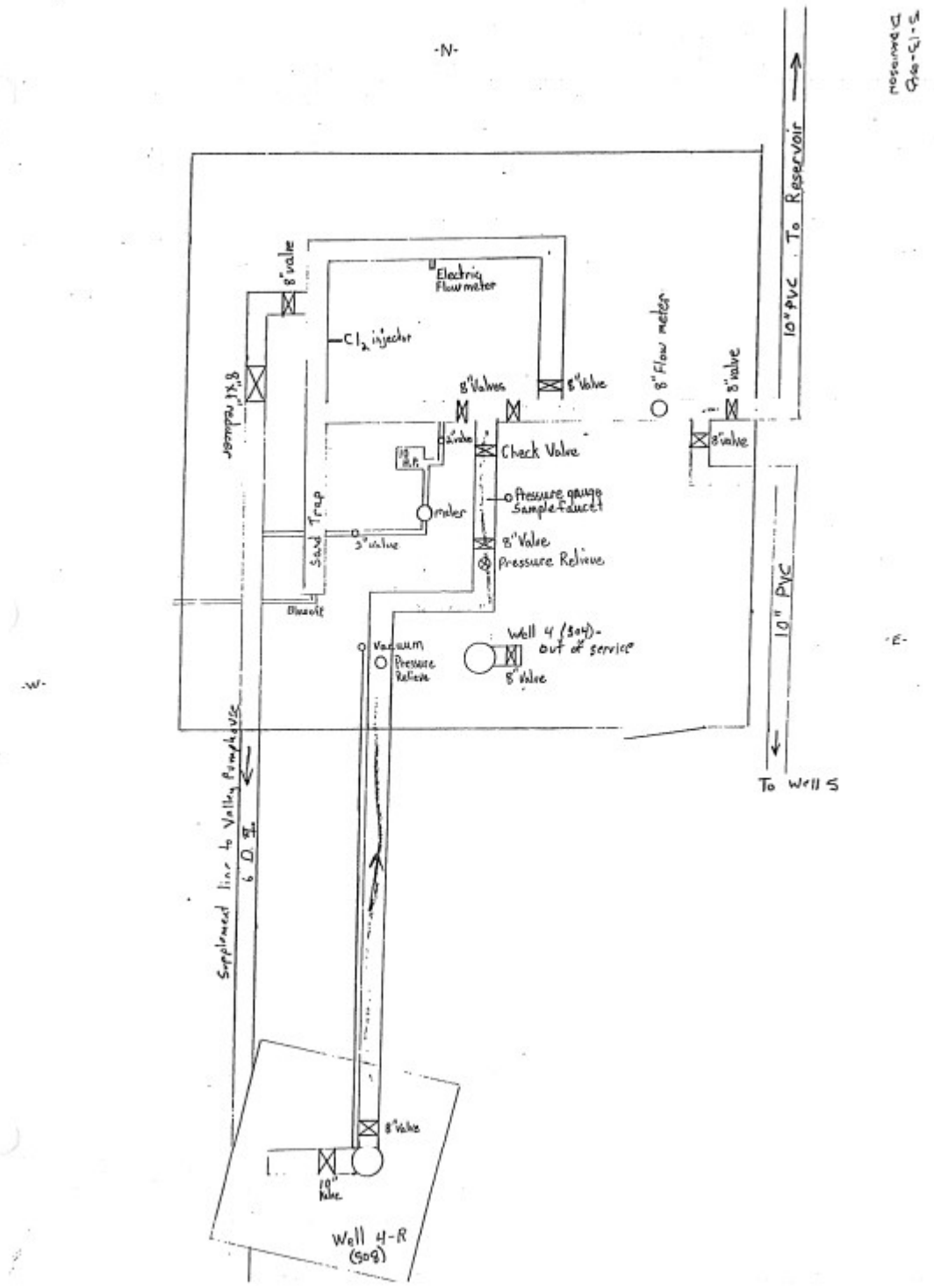


Figure 6.2: Well 5 Pumphouse

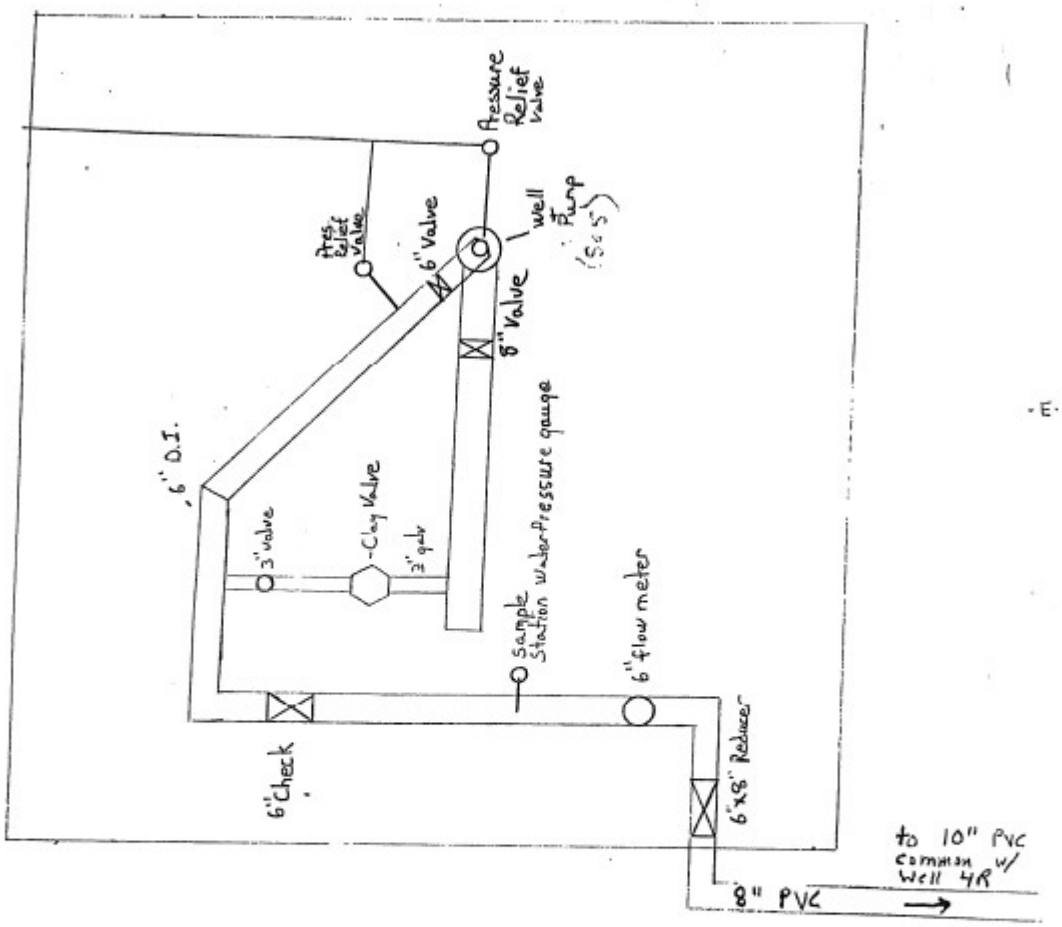
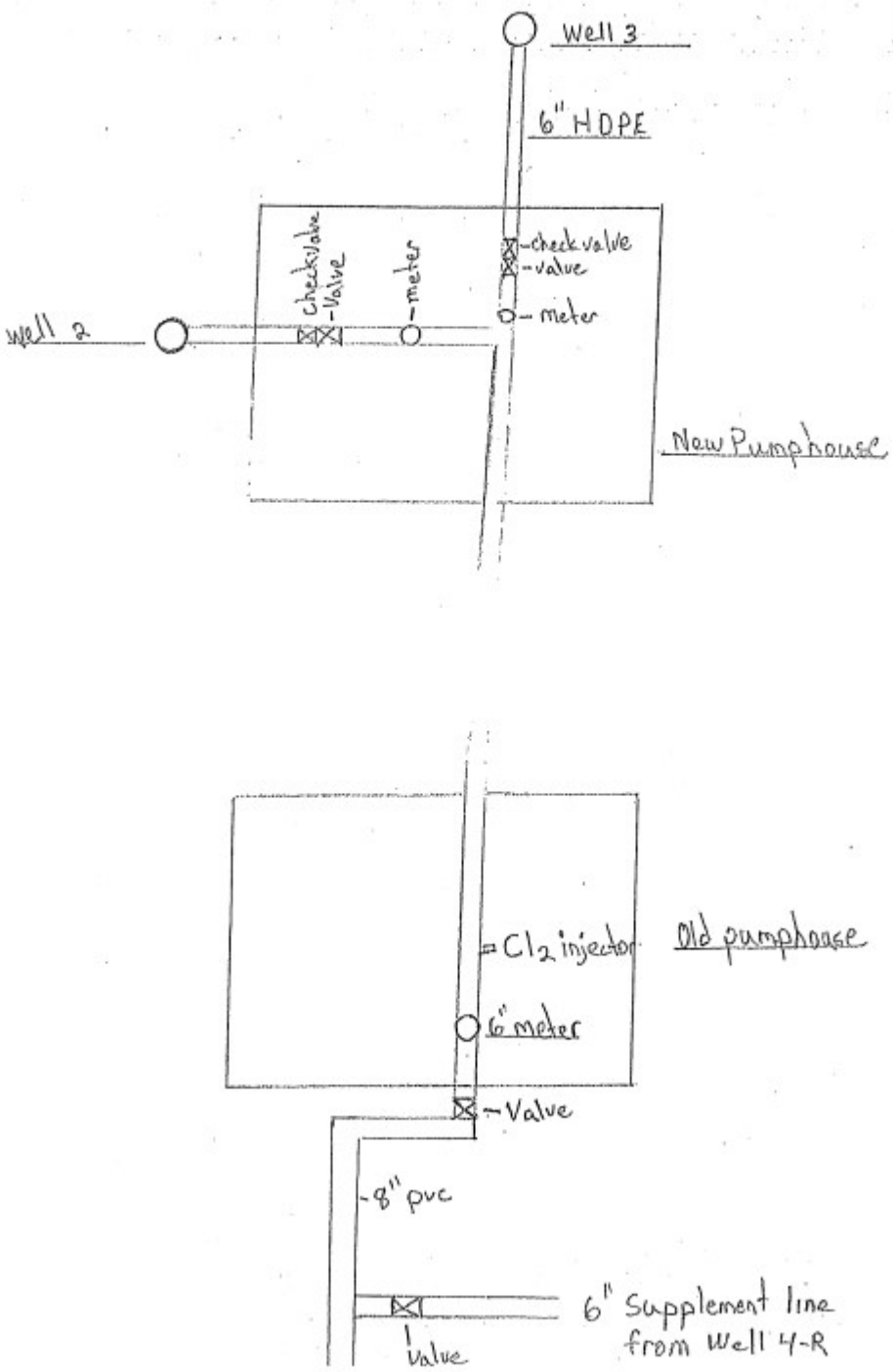


Figure 6.3: Nooksack Valley Pumphouse



Wells 4R and 5 are monitored daily. Pressure is noted, as is metered volume and the time of the reading. A sand trap at well 4R is cleaned daily. On a weekly basis, an amp meter is used to verify current draw of each submersible pump.

The backup generator serving the Sumas Wellfield is tested and serviced annually, and the source meters are calibrated and tested every 5 years.

6.2.2 Nooksack/NVWA source

Routine operation. Nooksack and NVWA are supplied by wells 1, 2, and 3 (WDOH sources SO1, SO2, and SO3, respectively) at the Sumas Wellfield. The three artesian wells flow by gravity through pipes eventually meeting at the Valley Pumphouse. Co-mingled water from the three wells is identified by WDOH as source SO6. See Figure 7 and detail Figure 13.

The Valley Pumphouse contains three centrifugal pumps with differing capacities (10 hp, 15 hp, 30 hp). See Figure 13 for details of pump locations and piping connections. Specifications of the pumps are included within the appendix. The 10 hp pump is manually operated and is run continuously. During periods of low and medium demand, the 15 hp pump is operated on a timer to augment supply during peak hours. The timer is adjusted from day to day as needed. During periods of high demand, typically in the summer, the 15 hp pump is turned off and the manually-operated 30 hp pump is operated continuously. The operator judges demand by observing a pressure gauge on the outgoing line and by directly observing the water height within the Nooksack/NVWA reservoir four miles to the south. Supply volume is controlled with manual discharge valves installed on each pump.

Preventative maintenance. The Valley Pumphouse is monitored daily, and in periods of peak demand is monitored more often. Pressure is noted, as is metered volume and the time of the reading. Bleeder valves at the wellheads of wells 1, 2, and 3 are opened three days each week during periods of low and medium demand and daily during periods of peak demand (i.e., when the 30 hp pump is operating).

The backup generator serving the Sumas Wellfield is tested monthly and serviced annually, and the source meters are calibrated and tested every 5 years.

6.2.3 Sumas distribution system

Routine operation. The Sumas distribution system is normally operated with all valves fully open. The Clearbrook road intertie between the SRWA and NVWA systems is sometimes closed during periods of peak summer demand in order to deliver the maximum supply south to NVWA.

Customer meters are read monthly, on approximately the 20th day of the month. Anomalous readings are verified within a day or two, and customers are immediately notified of apparent leaks. No regular monitoring of unaccounted water is performed. The City intends to begin a monthly estimation of unaccounted water.

Preventative maintenance. The entire system is flushed annually through the hydrants. On an annual basis it is also verified that all valves are open. No regular exercising of valves is performed at this time. The City intends to begin a program of annual exercise of each valve.

Virtually all customer meters (i.e., ¾" and 1") were replaced in 1996 and 1997, in conjunction with a changeover to wand-readable meter heads. A random group of meters will be tested and calibrated at 5-year intervals in order to monitor accuracy and reliability of meters. A schedule for replacement of meters will be developed based upon the data collected. Each meter 1½" or larger will be tested and calibrated every 5 years.

6.2.4 May Road wells and dedicated line

Routine operation. A dedicated industrial (non-potable) pipeline is supplied by wells 1 and 3 in the May Road Wellfield. Neither well has a WDOH source ID number at this time. Well 2 is a nonfunctioning well, used only for observation purposes. Wells 1 and 3 are outfitted with submersible pumps. Specifications and pump curves of the pumps are included within the appendix.

The water right permit for the May Road Wellfield specifies that 18 percent of the water withdrawn at the wellfield be pumped into the neighboring spring-fed stream as mitigation. Well 3 is used to supply the industrial pipeline, and well 1 is used to pump mitigation water. Source meters are monitored and discharge valves are manually adjusted so that the required mitigation ratio is maintained. Measurements are also recorded weekly of staff gauges located in the stream and of water-level readings within observation wells.

Preventative maintenance. The May Road wells are monitored daily. Pressure is noted, as is metered volume pumped for industrial use and pumped for mitigation, and the time of the reading. On a weekly basis, an amp meter is used to verify current draw of each submersible pump.

The backup generator serving the wellfield is tested and serviced annually, and the source meters are calibrated and tested every 5 years.

Table 6.2: Summary of Regular Maintenance Activities

Task	> Daily	Daily	M, W, F	Weekly	Monthly	1 Yr.	5 Yrs.
Sumas Wellfield							
Record pressure		x					
Record source meter Q		x					
Record date/time		x					
Clean sand trap, #4R		x					
Adjust Q - pumphouse	x	x					
Bleed wells 1, 2, 3		x	x				
Check wells 4, 5 amps				x			
Check generator					x		
Calibrate source meters							x
May Rd Wellfield							
Record pressure		x					
Record source meter Q		x					
Verify mitigation Q		x					
Record date/time		x					
Check wells 1, 3 amps				x			
Read staff-gauges					x		
Check generator					x		
Calibrate source meters							x
Reservoir							
Inspect exterior						x	
Exercise drain, overflow						x	
Inspect interior							x
Distribution system							
Read meters					x		
Flush system (hydrants)						x	
Verify valves open						x	
Test small meters							x
Test large meters							x

Equipment, supplies, and chemicals

The City maintains an inventory of all routinely used supplies and chemicals, such as meters, meter boxes, fittings and pipe for construction of a residential tap, bands for repair of leaks, and sodium hypochlorite solution. Supplies for specific projects, such as the pipe, valves, and fittings used in a line replacement, are purchased immediately prior to use. All the above supplies and chemicals are readily available from local suppliers such as Familian NW.

6.3 Comprehensive Water Quality Monitoring

Sumas performs regular monitoring for a variety of possible contaminants, pursuant to the requirements of WAC 246-290. Sumas uses certified laboratories for all required monitoring.

The table below summarizes the schedule of monitoring for the period from 1999 through 2004. Following the table are details of the requirements for particular categories of contaminants.

Table 6.3: Summary of Monitoring Schedule

2020 - 2025

Contaminant	2020	2021	2022	2023	2024	2025
Bacteriological	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly
Inorganic chemicals	January				August	
Nitrate	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly
Lead and copper			January			January
Synthetic organic chemicals			August			
EDB	March					
Volatile organic chemicals			August			
Radionuclides	May					

6.3.1 Coliform Monitoring Program

6.3.1.1 Sampling Locations

Bacteriological sampling is done at seven locations within the system, as shown on Figure 14. Four of the locations are dispersed throughout the distribution system and the other three are source wells. The locations are:

1. Easterbrook Sample Station
2. 409 Cornerstone Sample Station
3. City Shop
4. Garfield Sample Station
5. Vancouver Sample Station
6. 601-A West Front Street
7. Front and Lawson Sample Station (Extra)

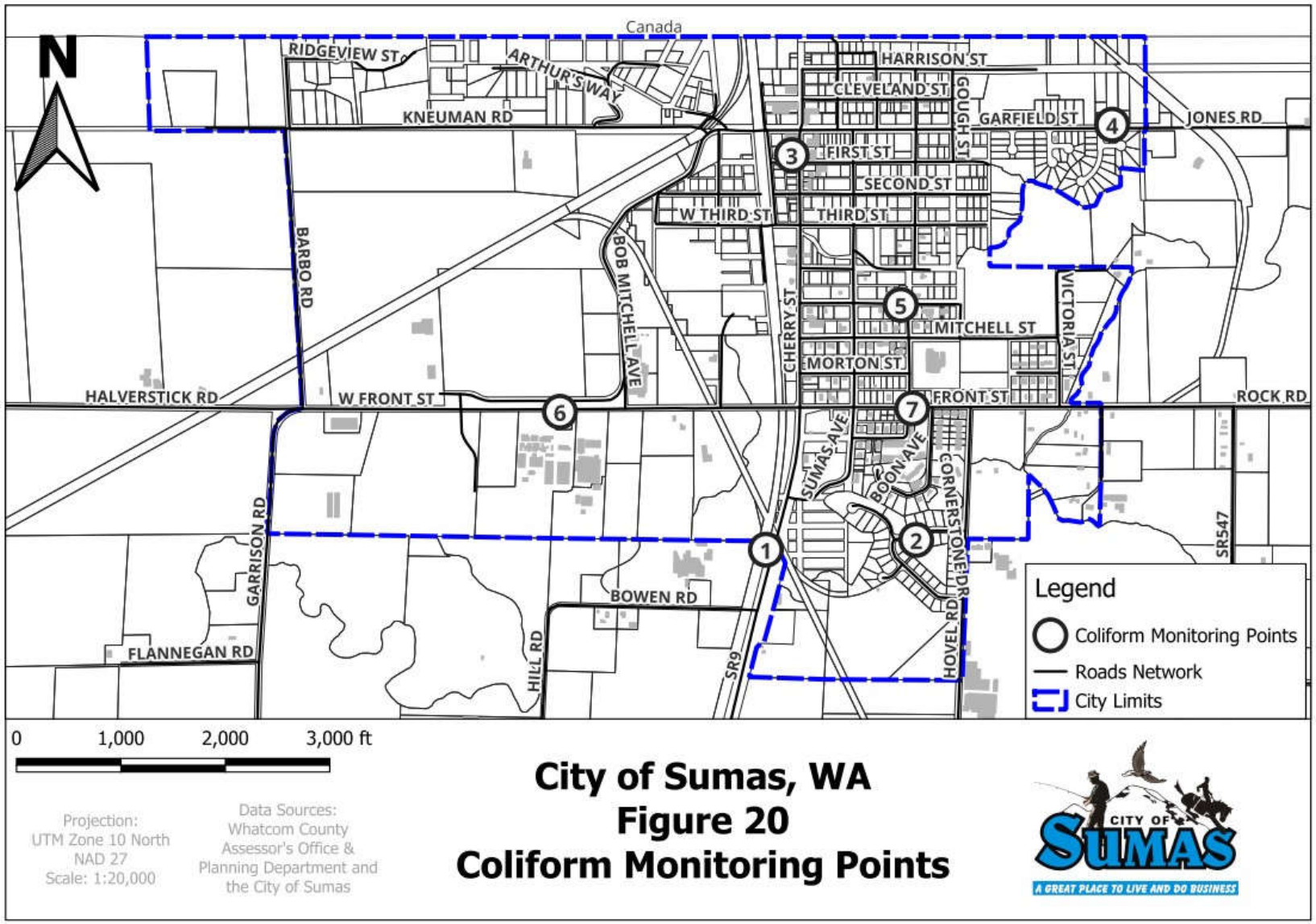
Nooksack – SO6
Sumas – SO7
May Rd – SO9

Schedule.
Sumas is required to collect only one sample each month. Locations are sampled in rotation as shown below. In addition, Sumas elects to monitor location 1 each month.

Table 6.4: Sample Collection Calendar

L1	L2	L 3	L 4	L 5	L 6
Jan	Feb	Mar	Apr	May	June
July	Aug	Sept	Oct	Nov	Dec
Oct	Nov	Dec	Jan	Feb	Mar
Apr	May	June	July	Aug	Sept

Figure 6.2: Coliform Monitoring Points



Follow-up Action

If coliform presence is confirmed in any routine sample, Sumas must perform follow-up actions as described in WAC 246-290-320(2). *It is important to carefully read WAC 246-290-320(2) in order to determine the appropriate action.* In general, though, the sequence is as follows: (1) re-analyze the suspect sample for E. coli or fecal coliform; (2) immediately take four repeat samples (one at original site, one within 5 services upstream, one within 5 services downstream, one at any other location); (3) notify WDOH; (4) find and correct the cause of contamination. In the month following the bad sample (and in each month thereafter until notified otherwise by WDOH), sample five locations.

6.3.2 Water Treatment Monitoring

6.3.2.1 Inorganic Chemicals (IOCs)

Schedule. Sumas is required to take a complete Phase 2/5 IOC sample from each source every three years. The last sample was taken in July of 1996, and the next is scheduled for July of 1999. During the month that IOC sampling is done, nitrate sampling as described below can be skipped, because nitrate is included within the IOC panel.

Sampling location. SO6 and SO7 (i.e., the two composite wellfield sources) are the sources to be sampled, prior to delivery of the water into the distribution system. SO6 is sampled at a faucet downstream of the point at which water from the three wells is combined. The faucet is shown on Figure 13. Because the two wells comprising SO7 pump to distinct places in the distribution system, each well is individually sampled and the samples are then mixed. The sampling faucets at wells 4R and 5 are shown on Figures 11 and 12, respectively.

6.3.2.2 Nitrate

Schedule. Because nitrate is present at a level of greater than 5 mg/l in all wells, Sumas is required to sample for nitrate every quarter. Sumas chooses to sample monthly. The quarterly samples are reported to WDOH, and the intervening samples are not.

Sampling location. SO6 and SO7 (i.e., the composite wellfield sources) are the sources required to be sampled. Sumas chooses to additionally sample each well. Individual wells are sampled at the locations identified in Figures 11, 12, and 13. The composite wellfield samples are drawn as described above for IOCs.

6.3.2.3 Lead and Copper

Schedule. Sumas did a first initial set of 20 samples in July of 1993 and a second initial set of 20 samples in January of 1994. The results were below action levels. A reduced set of 10 samples was taken in December 1996 and another reduced set was taken in June 1997. These results were also below action levels. Sumas has since taken a reduced set of 10 samples at 3-year intervals, with sampling occurring between June and September of the years in question. As shown in Table 6-1, the last set of samples were taken in August of 2024. A new set of samples will need to be taken in August of 2027.

Sampling location. These samples must be collected at the tap within customers' homes. Section 40 CFR 141.86 establishes the priority of which homes should be sampled. The highest priority is given to single-family homes with soldered copper plumbing installed after 1982. There were not enough such "tier 1" homes in Sumas to create an initial set of 20, so lower-priority "tier 2" and "tier 3" sites were present on the original site list. WDOH indicates that the sites sampled for the ongoing reduced-set testing should be from the original pool of 20 and should be "tier 1" homes, if possible. The 1997 samples were taken at the following locations:

Table 6.5: Customers Sampled for Lead and Copper, 2024

Address	Occupant	In 1993 set?
127 Morton St	C. Beardslee	n
310 Third St	J. Clawson	n
3802 Kneuman Rd	G. Lewis	n
1050 Victoria St	J. Clawson	n
226 Morton St	J. Clawson	n
280 Fisk St	T. Stacey	n
103 Ridgeview St	C. Fuhrman	n
1214 Boon Ave	A. Bons	n
409 Cornerstone Dr	A. De Hoog	n
241 Front St	R. Terwisscha	n

6.3.2.4 Synthetic Organic Chemicals (SOCs)

Schedule. For SOCs, sampling is done within the framework of 3-year compliance periods. The upcoming compliance periods are 1999 - 2001 and 2002 - 2004. Frequency of sampling within each period is dependent upon the nature of any "area waivers" granted by WDOH. Sumas completed susceptibility assessments of its wells in 1995. Based upon those results, and upon the results of tests to date, WDOH requires that Sumas sample a single time per compliance period, using EPA method 525.2. Sampling is scheduled for March of 2000. A copy of the area waiver is included in Chapter 10

Sampling location. SO6 and SO7 (i.e., the composite wellfield sources) are the sources required to be sampled. The samples are drawn as described above for IOCs.

6.3.2.5 EDB

Schedule. Special sampling for EDB is required in Sumas because of a single detection that occurred in February of 1994 in well 4 (SO4), a component well of source SO7. Sampling happens annually in March. The special sample in March of 2000 may be omitted because EDB

is included within the full SOC panel scheduled at that time. Upon completion of the March 2000 sample, there will be six consecutive years of non-detects. Sumas assumes that WDOH will remove the requirement for special EDB sampling and thereafter require only the regular SOC sampling as described above.

Sampling location. The only required location for annual sampling is SO7, the composite sample from wells 4R and 5. Sumas chose to conduct annual sampling of SO6 as well. Samples for SO6 and SO7 are drawn as described above for IOCs.

6.3.2.6 Volatile Organic Chemicals (VOCs)

Schedule. For VOCs, sampling is done within the framework of 3-year compliance periods. The upcoming compliance periods are 1999 - 2001 and 2002 - 2004. Frequency of sampling within each period is dependent upon the nature of any "area waivers" granted by WDOH. Sumas completed susceptibility assessments of its wells in 1995. Based upon those results, and upon the results of tests to date, WDOH requires that Sumas sample a single time per compliance period, using EPA method 524.2. Sampling is scheduled for March of 2000. A copy of the area waiver is included in Chapter 10.

Sampling location. SO6 and SO7 (i.e., the composite wellfield sources) are the sources required to be sampled. The samples are drawn as described above for IOCs.

6.3.2.7 Radionuclides

Schedule. Sumas is required to test for radionuclides each 48 months. Sampling is to be done once per quarter over the span of a year, unless initial results are less than half of the established MCL, in which case a single sample may be used. Sampling for radium-226 and radium-228 may be omitted if gross alpha particle activity is less than 5 pCi/L. The initial tests were performed in late 1996, except for well 4R, which was sampled in January of 1998. All results for gross alpha particle activity were below 5 pCi/L, so no testing for radium-226 and radium-228 was done. All results were also less than half of the established MCL, so Sumas does not need to do quarterly sampling. To put all sources on the same schedule, Sumas will sample all sources in January of 2001 and each four years thereafter.

Sampling Location. Sampling is conducted at each individual wellhead. The bleeder valves are used on wells 1, 2, and 3 (SO1, SO2, SO3 respectively), and the sample faucets shown on diagrams 11 and 12 are used on wells 4R and 5 (SO8 and SO5 respectively).

6.3.2.8 Maximum Contaminant Levels

Maximum contaminant levels (MCLs) for the various compounds are as follows (*see Appendix E for entire text of WAC and CFR cited below*):

- IOCs. As established in WAC 246-290-310(3)
- VOCs. As established in 40 CFR 141.61(a)
- SOCs. As established in 40 CFR 141.61(c)
- Radionuclides. As established in WAC 246-290-310(6)
- Bacteriological. As established in WAC 246-290-310(2)

6.3.2.9 Follow-up Action Upon Detection

Follow-up of bacteriological detections is discussed separately above. For other contaminants, follow up shall occur as described in WAC 246-290-320. *The kind of follow-up depends upon*

what kind of detection occurred, and it is important to carefully read WAC 246-290-320 in order to determine the appropriate action. In general, though, Sumas must notify WDOH as described in WAC 246-290-480 (i.e., within 48 hours for an MCL exceedance, on the same business day for a fecal coliform or e. coli detection, and within ten days for a coliform detection), notify the consumers served by the system as described in WAC 246-290-330 (i.e., newspaper notice within 14 days, notice to TV and radio within 72 hours, and direct mail within 45 days), determine the cause of the contamination, and take action as directed by WDOH. Names and addresses of important contacts are included in the Emergency Response Program elsewhere in this plan. There are follow-up actions specific to certain contaminants as follows:

- Nitrate. As established in 40 CFR 141.23(a)(4), 141.23(d)(2), 141.23(d)(3), 141.23(f)(2), 141.23(g), 141.23(m), 141.23(n), and 141.23(o)
- Nitrite. As established in 40 CFR 141.23(a)(4), 141.23(e)(3),), 141.23(f)(2), and 141.23(g)
- All other IOCs. As established in 40 CFR 141.23(a)(4), 141.23(b)(8), 141.23(c)(7), 141.23(f)(1), 141.23(g), 141.23(m), and 141.23(n)
- VOCs. As established in 40 CFR 141.24(f)(11 through 15)
- SOCs. As established in 40 CFR 141.24(b), 141.24(c), and 141.24(h)(7 through 11)

6.4 Emergency Response

System operators are notified of an after-hours water system emergency by automatic pagers linked to the City's voice mail system. A person leaving a message for the public works department causes the system to page the on-call staff member. All crew members and key city employees carry pagers and can be called in as needed.

Table 6.6: Call-out List

Name	Title	Cell Phone Number	Responsibility
Sunny Aulakh	Public Works Director	(360) 201-5322	Diagnosis of problem, formulation of response, direction of crew
Jason Clawson	Water Department	(360) 988-1865	Backup: diagnosis of problem, formulation of response, & labor, backhoe, truck.
Aaron Loreen	Sewer Department	(360) 988-1864	Backup: diagnosis of problem, formulation of response
Nathan Larson	Light Department	(360) 988-1863	Labor, backhoe, truck
Tully McConnell	Light Department	(360) 488-6699	Labor, backhoe, truck

Grant Korthuis	Parks Department	(360) 255-1446	Labor, backhoe, truck
Bruce Bosch	Mayor	(360) 220-1488	OK of major expenditure
Rich Postma	Mayor pro-tempore	(360) 319-0979	Backup: OK of major expenditure

Notification procedures

In the event of a situation in which notice must be delivered to customers, the public, the County health department, and/or WDOH, the notification shall be as specified under WAC 246-290-330. *It is important to carefully read WAC 246-290-320 in order to determine what notice needs to be given to what person or agency.* In general, Sumas must notify WDOH as described in WAC 246-290-480 (i.e., within 48 hours for an MCL exceedance, on the same business day for a fecal coliform or e. coli detection, and within ten days for a coliform detection), and notify consumers served by the system as described in WAC 246-290-330 (i.e., newspaper notice within 14 days, notice to TV and radio within 72 hours, and direct mail within 45 days). Names and addresses of important contacts are shown below:

Agencies:

Whatcom County Health Department

509 Girard Street

Bellingham, WA 98225

(360) 778-6000

(360) 778-6001 fax

Washington Department of Health

Northwest Regional Office

PO Box 47800

Olympia, WA 98504

(253) 395-6750

(253) 395-6760 fax

Wholesale customers:

City of Nooksack

PO Box 4265

Nooksack, WA 98276

(360) 966-2531

(360) 966-2505 fax

Attn: Todd Daniels

Nooksack Valley Water Association

PO Box 558

Everson, WA 98247

(360) 966-3481

Attn: Janice McGillivray

Sumas Rural Water Association

3452 Halverstick Road

Sumas, WA 98295

(360) 988-5014

Attn: Del Heutink

Media:

Pacific Northwest Media Group

2219 Yew Road

Bellingham, WA 98229

(360) 734-9790

(360)734-4551 fax

Cascadia Daily News

1329 N State Street, Suite 201

Bellingham, WA 98225

(360) 922-3090

Bellingham Herald

PO Box 1277

Bellingham, WA 98227

(360)676-2620

(360)647-9260 fax

Lynden Tribune

113 Sixth Street

Lynden, WA 98264

354-4444

398-1731 fax

Vulnerability analysis and contingency operational plan

Following is a table containing a side-by-side listing of the major vulnerabilities of the Sumas water system, together with corresponding contingency operational plans. The contingency plans shown here are consistent with those shown in the Wellhead Protection Plan and the water shortage response plan. *In the event of any listed situation, WDOH should be notified, and the short-and long-term responses should be coordinated with WDOH.*

Table 6.7: Vulnerability Analysis and Contingency Operational Plan

Vulnerability	Contingency Operational Plan
Power failure	Both the Sumas Wellfield and the May Road Wellfield are equipped with backup diesel generators capable of providing enough power to operate all pumps simultaneously. In an extended outage, the generators must be refueled as needed.
Loss of single well due to contamination, mechanical failure, or well failure.	Isolate the well from the distribution system by closing appropriate valve. System can run indefinitely with any one well out of service. If lost well is part of SO6 (i.e., the NVWA supply), it may be necessary to augment the supply to NVWA with water from wells 4R and 5 (both can run as needed). Repair mechanical failure ASAP. Develop remediation plan for contaminated well with hydrogeologist. If well is to be permanently abandoned, develop replacement well to ensure adequate reliability.
Loss of SO6 (the NVWA wells) due to contamination, mechanical failure, or well failure.	Use the component wells of SO7 to supply both the Sumas/SRWA system and the NVWA system. Well 4R (SO8) can be isolated from the Sumas system. This operational mode will be sufficient except in peak demand seasons, in which case the water shortage response plan should be instituted. Use the emergency Everson/Nooksack intertie as necessary. Repair mechanical failures ASAP. Develop remediation plan for contaminated wellfield with hydrogeologist. If wells are to be permanently abandoned, develop replacement well(s) to ensure adequate reliability.
Loss of SO7 (the Sumas/SRWA wells) due to contamination, mechanical failure, or well failure	Use the SO6 wellfield to supply both the Sumas/SRWA system and the NVWA system. Cross-connect the two systems using existing valves at Garrison's Corner. SO6 is not adequate for normal supply of both systems, so the water shortage response plan should be instituted. Advise Nooksack/NVWA to open the emergency Everson/Nooksack intertie. Repair mechanical failures ASAP. For situations that can't be remedied in the short-term, install a cross-connection at Garrison's Corner between the May Road dedicated industrial line and the Sumas distribution system. Perform required water quality tests at the May Road source, and also test the blended source for nitrate levels. If nitrate exceeds MCL, notify customers. If possible, supply industrial customers by delivering contaminated water from SO7

	to Garrison's Corner through the existing NVWA supply line and installing a new cross-connection from that line to the dedicated industrial line. Develop remediation plan for contaminated wellfield with hydrogeologist. If wells are to be permanently abandoned, develop replacement well(s) to ensure adequate reliability.
Loss of both SO7 and SO6 (i.e., entire Sumas Wellfield) due to contamination.	Open the Everson/Nooksack emergency intertie. Institute water shortage response plan. Install new cross-connections at Garrison's Corner so that the May Road Wellfield supplies the potable systems and the Sumas Wellfield supplies industrial customers. Perform required water quality tests at the May Road source. Install emergency intertie with City of Abbotsford water system at Canadian border. Notify customers of exceedance of nitrate MCL. Develop permanent response (i.e., water treatment system, new wellfield).
Loss of reservoir.	Isolate Sumas/SRWA system from reservoir with existing valves. Operate wells 4R and/or 5 in manual mode to pressurize system. Reconfigure impellors and pump controllers as necessary if system must operate in this mode for long duration. Repair and/or replace reservoir ASAP.

6.5 Cross-Connection Control

Chapter 13.38 of the Sumas Municipal Code establishes the authority to regulate any cross-connection that would endanger the potable water supply. A copy of Chapter 13.38 is included in Appendix A. Chapter 13.38 also: designates responsibility for implementation; mandates that only approved cross-connection devices be used; establishes authority for inspection by the City of all portions of a customer's premises; and establishes penalties for violations.

6.5.1 Implementation Responsibility

Implementation of the cross-connection control program is the responsibility of the public works department. The Public Works Director must ensure that program tasks are scheduled and that trained personnel are available. City policy is to have one crew member trained as a cross-connection specialist (CCS-1 certification). Currently that person is Doug Bos. If the specialist leaves the City's employment, another crew member will be trained at City expense as soon as possible. A consultant cross-connection specialist will be used as needed in the interim.

6.5.2 Program Elements

Approval of new construction. The cross-connection specialist shall review each application for a new service or for modification of an existing service. After assessing the degree of hazard

associated with the cross-connection, he shall specify the necessary level of protection. He shall inspect completed installations to ensure the required device is correctly installed and operating.

Inventory of existing devices. The City will develop an inventory of devices currently installed throughout the system. The inventory will be in the form of an electronic spreadsheet containing the following information: device location; device type; last test date; tester's name and certification number; test results (i.e., description of repairs or recommendations for repairs); next test date. The inventory will be a permanent City record.

Survey of existing facilities. The City will survey existing facilities to determine whether retro-fitting with backflow devices is necessary. The survey will target customers in the following priority order: industrial customers; major commercial customers (i.e., > 3,000 CF per month); minor commercial customers; residential services known to contain devices of concern (i.e., automatic sprinklers). The survey process will be publicized ahead of time in the City newsletter. After a given facility has been surveyed, the cross-connection specialist will determine what measure of protection (if any) is required and provide written notice to the property owner of any required changes. The notice will establish a schedule for compliance. The specialist shall then reinspect the site. If changes have not been made, the City will meet with the owner to negotiate a compliance deadline. Water service to the property will be shut off if the owner fails to meet the second deadline. The City expects to conduct the survey during calendar year 1999.

Inspection and testing of devices. The cross-connection specialist shall ensure that all backflow assemblies are tested upon installation and periodically thereafter in accordance with WDOH requirements. A form letter will be used to identify individual customers that testing is due, instruct the customer that only a certified tester may be used, direct the customer to provide a written copy of test results, and establish a deadline. Test results will then be entered into the electronic spreadsheet.

6.6 Recordkeeping, Reporting, and Customer Complaint Program

6.6.1 Customer Complaint Response Program

Sumas will develop a new log of customer complaints regarding the water system. A report form will be completed and added to the log as a result of each customer complaint. The form will also contain a record of the response made by the City. A copy of the report form will be provided to the complainant upon resolution of the problem.

There has been no log maintained in the past, so this WSP contains no historic synopsis of the number and type of complaints. Staff informally report that two kinds of complaints seem to have occurred most often. First, customers have complained of irregularly high water bills. In most cases, the problem has been a leak downstream of the meter, the part of the service that is the owner's responsibility. Second, customers have complained of instances of low pressure. These complaints have usually been associated with major leaks or with planned maintenance activities such as hydrant flushing and line repairs.

6.7 Recordkeeping and Reporting

Sumas maintains the following water system records:

Table 6.8: Sumas Water System Records

Record	Retention schedule
Billing and individual usage. Customer name, service address, billing address, monthly usage and bill amount. Maintained by utility clerk.	Kept electronically for previous two years. Kept in hardcopy printout for previous 6 years.
Usage by class. Subtotal usage per month for customer class and for each major wholesale customer. Maintained by Public Works Director	Electronic file permanently maintained.
Customer complaints. Paper records maintained by Public Works Director.	Kept six years..
Cross-connection devices. Location, type, installation date, test date. Paper records maintained by Public Works Director.	Permanently maintained.
Source meters. Usage per well per month. Maintained by Public Works Director.	Hardcopy kept for 6 years, electronic version permanently maintained.
May Road water right. Stream levels, well water levels, volume pumped for mitigation and for industrial use. Maintained by Public Works Director.	Hardcopy kept for 6 years, electronic version permanently maintained.
Test results – Nitrate. Monthly nitrate reading in each well. Maintained by Public Works Director.	Hardcopy kept for 6 years, electronic version permanently maintained.
Test results – all others. VOCs, SOCs, IOCs, bacteriological, radionuclide, lead & copper. Maintained by Public Works Director.	Hardcopy kept for 6 years.
As-built drawings of all distribution-related projects. Maintained by Public Works Director.	Hardcopy permanently maintained.

For many types of records, the period of retention is established at 6 years in order to match the frequency at which this WSP is updated.

Many of the records are used in update of the WSP, and the results of the record-keeping are submitted to WDOH only within the context of a draft plan update. Source meter records and monthly usage by customer class are examples. The only records that must be submitted regularly to WDOH are water quality test results. Sumas instructs the certified testing lab to submit all such results directly to WDOH.

6.8 Summary of O&M Deficiencies

Table 6-9 below provides an overview of Sumas' O&M deficiencies and a project timeline and cost estimate for when those deficiencies will be addressed.

Table 6.9: Summary of O&M Deficiencies, Expenses, and Needed Action

O&M Deficiency	Action to be Taken	Year	Cost (if any)	Source of funding
Outdated Sample Stations	Installed 4 New Sample Stations	2025	$4,699	Utility Rates
Outdated Meter at the May Rd 3 well	Installed a new meter at the May Rd 3 well	2025	$5,276	Utility Rates
Outdated Meter at the May Rd 3 mitigation site	Installed a new meter at the May Rd 3 mitigation site	2025	$2,921	Utility Rates
Outdated Meter at the May Rd 1 well	Installed a new meter at the May Rd 1 well	2023	$3,400	Utility Rates
Outdated Meter at the Nooksack 3 well	Installed a new meter at the Nooksack 3 well	2023	$4,634	Utility Rates
Outdated Meter at the Sumas 5 well	Installed a new meter at the Sumas 5 well	2023	$4,634	Utility Rates
Faulty Air Valve between Wellheads and Reservoirs	Installed a new air valve connecting the Kneuman Rd wellheads to the reservoir tanks	2025	$918	Utility Rates
Faulty Meter at the Rock Road Master Meter	Will need to install a new meter at the Rock Road Master Meter	2026	$5,600	Utility Rates
Faulty Valve at the Garrison Road Master Meter going to NVWA	A new valve will need to be installed at the Garrison Road Master Meter	2030	$10,000	Utility Rates

7 Distribution Facilities Design and Construction Standards

7.1 Project Review Procedures

7.1.1 Submittal

Design drawings for a proposed distribution system extension shall be prepared in accordance with the following drawing standards:

1. All plans shall be on a reproducible cut sheet, 24" X 36", and shall include a title block and general notes.
2. One set of plans shall be submitted to the City and emailed to the Public Works Director.
3. The scale for plan and profile drawings shall be no less detailed than 1" = 50' for horizontal and 1" = 5' for vertical. When more than one sheet is required to cover all of the construction area, an overall index drawing is required.
4. The plans shall be produced by an experienced draftsperson and shall be of professional workmanship. The plans shall be sealed by a professional engineer licensed in the State of Washington.
5. Plans shall contain the following information:
    - Current plat information.
    - Maximum 5 foot contour based upon NGVD 29 vertical datum.
    - Relationship of the extension to existing and proposed utilities, including water, sewer, storm sewer, electrical, phone, natural gas, and cable TV.
    - Relationship of the extension to street paving, curb, gutters, sidewalks, rights-of-way, and easements.
    - Scale, north arrow, legend, datum, vicinity map, and general notes. The applicant shall also provide the description, location, and elevation of all bench mark data available on the project site and this information, wherever possible, shall be shown on the plans.
    - All detail drawings, including standard details.

7.1.2 Review

The plans shall be reviewed by the City and/or its engineering consultant for conformance to the design and construction standards established in this chapter. If inconsistent with standards, the plans shall be red-lined and returned to the developer for correction and resubmittal. Once consistent with standards, the plans shall be marked as approved by the Public Works Director and one set shall be returned to the developer. The developer shall not begin construction prior to receiving City Council and City Staff approval of plans.

7.2 Policies and Requirements for Outside Parties

1. All water system construction and reconstruction shall be done pursuant to a design that, when fully implemented, will provide the flow volumes and pressures established below. Off-site improvements necessary to meet this requirement shall be the responsibility of the developer. Hydraulic modeling necessary to confirm consistency with standards shall be performed by the City at the developer's expense.
2. Water distribution facilities shall be designed to provide 1,500 gpm within the Industrial zone, 750 gpm within all commercial zones, and 500 gpm within all residential zones.
3. Water storage facilities shall be sized to provide fireflow of 1,000 gpm for 120 minutes.
4. A minimum of 7.5 feet of recorded easement or dedicated right-of-way must be provided on each side of a water line. If an easement or right-of-way contains multiple utilities, the easement or right-of-way must be no less than 30 feet in width.
5. Water lines must generally be looped. A dead-end line is permissible only within a cul-de-sac that abuts already-developed property through which no utility connection can be made. Within a new cul-de-sac abutting undeveloped property, a utility easement is required at the end of the cul-de-sac to provide future looping.
6. Water lines must generally be extended across the full width of a property to allow for future extension. A line need not be extended to the far property boundary when the neighboring parcel is already developed in such a manner that no utility connection can be made.
7. Within new subdivisions, short plats, and binding site plans, water lines should generally be located parallel to the center line on the east or north sides of the street.
8. Where the City determines that the possibility of contamination of the potable water supply exists, the developer shall install appropriate cross-connection control devices in accordance with WAC 246-290-490. The City shall approve the size, kind, and location of device. The City may require that service lines providing fire flow be equipped with a fire detection check valve.
9. Generally a meter must be installed for each structure receiving water service and for each residential dwelling unit. If approved by the City, a single meter may be used to measure the consumption of multiple dwelling units within one building where the building is under single ownership, and to measure the consumption of multiple buildings under single ownership where separate water lines are impractical.

7.3 Construction and Design Standards

The following standards shall apply for water system improvements within the City of Sumas. Existing standards reference below are: "Standard Specification for Road, Bridge, and Municipal Construction," published jointly by the Washington State Department of Transportation and the American Public Works Association (WSDOT/APWA); Standards of the American Water Works Association (AWWA).

1. Design criteria shall be in accordance with the current WDOH "Water System Design Manual" or with the standards established herein, whichever is more stringent.

2. The minimum pressure allowed by the City, at all points within the service area, is 30 psi under conditions of Peak Hourly Demand (PHD), except for fire flow conditions.
3. The minimum pressure allowed by the City, at all points within the service area, is 20 psi under the condition of PHD in combination with fire flow.
4. Within the commercial and residential zones, minimum diameter for water lines is generally 8 inches. 6-inch and/or 4-inch diameter pipe may be allowed at the discretion of the City when: (a) future extension is not anticipated; and (b) hydraulic modeling confirms that required fire flow is available to hydrants on the line. The City may waive the requirement of hydraulic modeling in instances where the extension consists of a looped 6-inch line less than 1,000 feet in length connected at each end to lines 8 inches or larger in diameter. Within the Industrial zone, minimum diameter for water lines is generally 10 inches. 8-inch diameter pipe may be allowed at the discretion of the City when hydraulic modeling confirms that required fire flow is available to hydrants on the line.
5. A hydrant or blow-off assembly shall be installed at the end of any dead-end line greater than 200 feet in length. The location and construction of the blow-off shall be such that there is no possibility of back-siphoning into the distribution system.
6. Air-vacuum release valves shall be provided at points of high elevation within the system.
7. Minimum cover on water mains shall be 3 feet unless otherwise approved by the City. Minimum separation of potable water mains and sanitary sewer lines shall be in accordance with Section 2.41 of the current edition of the "Criteria for Sewage Works Design" published by the Washington State Department of Ecology.
8. All pipe material for new extensions shall be constructed with "lead free" materials in accordance with WAC 246-290-220. Ductile iron pipe shall be AWWA C-151 thickness class 52 with cement-mortar lining, polyethylene encased, and shall meet WSDOT/APWA specification 9-30.1(1). PVC pipe shall be AWWA C-900 and shall meet WSDOT/APWA specification 9-30.1(5)(A). All fittings shall be ductile iron, shall conform to WSDOT/APWA specification 9-30.2, and shall have a minimum pressure rating of 350 psi.
9. Valves shall be resilient seated gate valves, Waterous Series 500 or equal, with a minimum pressure rating of 200 psi, and shall conform to the latest revision of AWWA specification C509. Valves shall be installed along the water main at intervals not to exceed 500 feet within the Industrial zone and not to exceed 800 feet within commercial and residential zones. Valves shall be placed on each main at all junction points.
10. Fire hydrants shall be Clow Medallion fitted with a 5-inch Stortz connection on the steamer port, secured to the hydrant with aircraft cable. Fire hydrants shall be installed at intervals of 600 feet within commercial and residential zone districts and intervals of 500 feet within the Industrial zone.

7.3.1 Construction and Design Standards for Water Mains

1. The developer shall inform and obtain approval from the City for any proposed changes in the water plans prior to construction of that change.
2. The developer is responsible for contacting all utility owners for locations and for field verification of all utility locations prior to construction. The one-call number for

underground utility locates is 811 or 1-800-424-5555. The developer shall be responsible for maintaining the integrity of all existing utilities and for notifying the City promptly of any conflicts with existing utilities.

3. All water line trenching, bedding, installation, and testing shall conform to WSDOT/APWA specifications 7-8 through 7-15, AWWA specifications C600 and C651, and City standard construction detail drawings shown below.
4. Bedding material for ductile iron pipe shall comply with WSDOT/APWA specification 9-03.15. Bedding material for PVC pipe shall comply with WSDOT/APWA specification 9-03.16.
5. Backfill under pavement shall consist of material conforming to WSDOT/APWA 9-03.19. Backfilling shall be in accordance with WSDOT/APWA standard plan drawing B-11 and WSDOT/APWA specification 7-08.3(3), i.e., 95% of maximum density under pavement, 85% of maximum in other areas.
6. Installation of valves shall conform to WSDOT/APWA specification 7-12. A cast iron valve box and concrete marking post shall be installed with each valve.
7. The developer shall mark all underground water lines and services with 14-gauge "locate wire" placed 1 foot above the pipe.
8. All work must be inspected and approved by a representative of the City, and 24 hours notice must be given prior to starting work and to schedule inspections.
9. All water lines, fittings, and appurtenances shall be pressure tested at 200 psi in accordance with WSDOT/APWA specification 7-11.3(11). The developer shall disinfect, flush, and provide representative bacterial tests in accordance with WSDOT/APWA specification 7-11.3(12). The City shall witness the sampling and pressure testing. The developer shall provide the City with 48 hours notice prior to conducting any tests or sampling.
10. A satisfactory bacterial report shall be received by the City before lines are placed in service.
11. Underground fire sprinkler systems shall be installed by a person with a Level "U" certificate or by a person that regularly works for a company that holds such a certificate.

7.4 Construction Certification

Before final acceptance of work by the City, the developer shall provide the City with a certified as-built drawing mylar and print. The as-built drawing shall include:

- The exact location of all water mains and the approximate location of all other underground and above-ground utilities
- The location of all vertical and horizontal bends in the water system. Stationing shall be along the length of the extension.
- The location of all water valves, hydrants, hydrant valves, and blow-offs with distance along centerline and distance from centerline.
- The location of all water service taps into the water main.
- The location of all water service boxes and meters with distances to the main tap and to the corresponding property corners.

- The location of all utilities within easements. This includes distances to the utilities from the easement boundary line.

8 Capital Improvement Program

8.1 Capital Improvement Program Summary and schedule

Detailed discussion of various recommended and required improvements is presented in prior chapters, particularly chapter 3. Presented below is a single consolidated schedule of improvements called for within the WSP. In addition to the capital costs associated with listed improvements, there are ongoing costs associated with implementation of the conservation and wellhead protection programs, O&M improvements, and costs associated with water system planning. These costs are estimated at $40,000 per year.

Sumas maintains a strict policy that the costs of extending utility services to new development is the responsibility of the developer. This policy applies to any extensions to the existing system, including larger costs which may eventually serve multiple developments.

Table 8.1: Capital Improvement Program Schedule

#	Project name, location & type	Cost	Financing source	Year
1	Hydrant coverage remediation	$10,000	rates	Yearly
2	Morton St. hydrant & new loop	$128,000	Rates	2029
3	Alley between Mitchell & Morton (Cherry to Sumas)	$76,000	rates	2028
4	Mitchell St Line upgrade (Cherry to Sumas)	$440,000	rates	2036
5	New Generator for Sumas Wells	$300,000	rates	2031
6	First St Line upgrade (Sumas to Lawson)	$102,850	rates	2033
7	Alley between Third & Second (Sumas to Cherry)	$52,250	Rates	2034
8	Moe's Hill pressure zone booster pump	$400,000	Developer	2034
9	West UGA – New water mains from Halverstick Road to Kneuman Road	$1.5 Million	Developer	2032
10	SR 9 south of Bowen Road to serve UGA – New 8-inch line	$1.3 Million	Developer	2040

11	South UGA – New water mains from SR 9 to Hovel Road	$1 Million	Developer	2040
12	Potential installation of water disinfection system	$1 Million	Capital Facilities Fees	2040

8.2 Prioritization of Capital Improvement Projects

Capital Improvement projects are prioritized based on a variety of factors, including emergencies, availability of funds in the City Budget, greatest need, timing of development, and the potential for combining the project with other capital improvement projects occurring in similar areas. Developer-funded water improvements occur independently of the City's improvement schedule, yet they are coordinated with the City's Public Works Department to maximize efficiency and prevent conflicts.

9 Financial Program

This chapter summarizes the financial viability of the City of Sumas' water utility. This chapter will review the financial history of the utility, current policies and rates, and review the Capital Improvement Plan to determine current conditions. Then, this chapter will determine future policy changes necessary to accommodate Sumas' future growth scenarios.

9.1 Financial History

The City owns and operates the water system alongside a sanitary sewer system, stormwater system, and electrical system. The water utility is accounted for with the sanitary sewer utility in the joint Water/Sewer Fund 401 and includes water sales, operating costs, and capital expenditures. Any remaining funds left in the fund are rolled over to the next fiscal year for future use. Table 9-1 provides a 4-year financial history of the water system portion of the water/sewer fund based on the City's financial reports.

Table 9.1: 4-Year Financial History

401/403 Water Funds				
	2021	2022	2023	2024
Revenue				
Water Sales	$ 444,447.99	$ 437,551.15	$ 565,983.62	$ 655,362.91
Water Service Connections (403 Fund)	$ 43,220.00	$ 32,410.00	$ 18,550.00	$ 5,800.00
Grants	$ 19,933.12	$ 16,566.32	$ 351,535.29	$ 145,500.00
Miscellaneous	$ 3,883.14	$ 2,974.22	$ 16,030.39	$ 15,647.20
Subtotal Water Revenue	**$ 511,484.25**	**$ 489,501.69**	**$ 952,099.30**	**$ 822,310.11**
Expenditure				
Water Operations	$ 452,563.44	$ 551,160.43	$ 578,476.22	$ 631,526.83
Water Capital Expense	$ -	$ 39,516.27	$ 219,661.50	$ 25,686.03
Miscellaneous	$ 353.57	$ 210.45	$ 896.86	$ 849.59
Subtotal Water Revenue	**$ 452,917.01**	**$ 590,887.15**	**$ 799,034.58**	**$ 658,062.45**
Increase/ (Use of Reserves)	**$ 58,567.24**	**$ (101,385.46)**	**$ 153,064.72**	**$ 164,247.66**

At the bottom of Table 9-1, the Increase/ (Use of Reserves) line provides a quick view of whether the revenue was sufficient to meet the expenditures in each year. If revenue is greater than expenses, the reserve levels are increased. If revenues are less than expenditures, the reserves are used to balance the budget for the year. This line table shows that there was a massive increase in expenditures in 2022 that were not covered by the revenues from that year. This was due to the recovery effort required following the November 2021 flooding event which devastated Sumas. Following this event, massive amounts of expenditures were needed to repair various sections of the water system that were damaged. In 2023, Sumas began receiving disaster recovery grants from the Federal Emergency Management Agency (FEMA) to help pay for the rebuild effort, causing the City's revenue to far exceed expenditures.

9.2 Existing Rates and Charges

The City Council has authority to set rates and charges for the water utility to ensure it remains self-sufficient. The rates are reviewed annually during the budget process.

9.2.1 Monthly Water Rates and Charges

The City bills customers monthly for water service. All customers pay a basic charge per meter or unit of $10.40 for the first 600 cubic feet (cf) of water, plus a volume charge based on metered water use of $1.13 for every additional cf paid per month. The Water Associations, which are the City's wholesale customers, pay a flat rate of $0.55 per 100 cf of water. This rate also applies to the Puget Sound Energy co-generation plant.

9.2.2 Water Hookup Charges

Water hookup charges are collected for each new or upgraded connection to the water system. These charges are for the right to connect and make use of the system. Table 9-2 summarizes the current water hookup charges.

Table 9.2: Water System Hookup Rates and Charges

Single-family Residential and Single-Occupancy Commercial	
Size	**Charge**
3/4" Meter	$2,900
1" Meter or Greater	$2,950
Multifamily Residential and Multiple-Occupancy Commercial	
Size	**Charge**
3/4" Meter	$2,900 for first unit, $1,260 thereafter
1" Meter or Greater	$2,950 for first unit, $1,260 thereafter

For all water hookups, the customer charged either the set hookup rate summarizes in Table 9-2, or the actual cost of the hookup, whichever is greater. The multifamily and multiple-occupancy commercial charges are directed towards those time of multi-unit developments that are all served from a single meter. Additionally, whenever a property owner connects to the water facilities which run adjacent to Hovel Road south of Bone creek, that property owner shall be charged an additional local area facilities charge equal to $170 per unit.

9.2.3 Affordability

The Environmental Protection Agency (EPA) defines affordable water rates as 2.5 percent of median household income (MHI) for a community. For the City, the U.S. Census Bureau American Community Survey (ACS) 2023 5-Year Estimate shows that the median household income is roughly $85,000. Using the EPA's affordable water rate metric, this means that an annual water rate of approximately $2,125 is considered affordable. This equates to a monthly water rate of $177.08. In 2023, residential water users in Sumas paid an average of $16.69 per month for their water usage. This shows that Sumas' existing water rates are far below the EPA's affordability threshold.

9.3 Future Rates and Charges

On November 24, 2025, the Sumas City Council passed Ordinance No. 1827, adopting new rates and fees across all utilities. This ordinance includes increases to both the City's water rates and water hookup fees. These new rates will be effective for the January 2026 water bills. Table 9-3 summarizes the new water rates and fees.

Table 9.3: Future Water Utility Rates and Fees

Rate Description	Fee
Residential Rate	
Tier 1 (First 600 CF)	$14.00
Tier 2 (601 CF and above)	$0.013 per CF
Capital Facilities Fee	$0.001 per CF
Commercial Rate	
Tier 1 (First 600 CF)	$14.00
Tier 2 (601 CF to 5,000 CF)	$0.0130 per CF
Tier 3 (5,001 CF and above)	$0.0136 per CF
Capital Facilities Fee	$0.001 per CF
Water Association and PSE Process	
Tier 1 (First 500,000 CF)	$0.0063 per CF
Tier 2 (500,001 CF and above)	$0.0070 per CF
Capital Facilities Fee	$0.001 per CF
Hydrant/Bulk Water Sales	
Base Fee	$21.00
Volume Surcharge	$0.0141 per CF
Hookup Fee	
3/4" (per unit served by its own meter)	$4,200.00
1" and larger (per unit served by its own meter)	$4,500.00
Additional units served by the same meter	$2,100.00
Other Water Fees	
Reconnect Fee (during office hours)	$36.00
Reconnect Fee (after hours)	$217.00
Meter Read (outside of bill cycle)	$18.00

9.3.1 New Rates Affordability

This new rate structure still allows the City to fall well short of the EPA affordability water rate threshold discussed above in Section 9.2.4. If a residential water customer were to use the average August usage amount of approximately 1,000 cubic feet (CF) in a month, they would be charged approximately $20.20. With August being one of the highest months of the year in terms

of water usage, the average customer would be charged somewhat less than $20.20 for most months out of the year.

9.4 Capital Improvement Funding Plan

Funding for capital improvement projects typically comes from the Water/Sewer Fund – 401 and the Water-Sewer Hookups – 403 fund. Both of those funds are derived from monthly water and sewer fees and hookup charges. Due to the joint nature of the funds, both water and sewer capital improvement projects compete for the same sources of funding. This means that only the projects with the most need are able to be funded through this method. Remaining projects are generally funded via external sources such as grants.

While other funding sources are available, many include the issuing of a loan to the City in which repayment with interest would be required. In order to pay back these loans with interest, the City would have to impose an additional debt reduction fee on its customers. This is a path that the City is unwilling to pursue at this time.

With inflation and the cost of materials steadily rising, affordability of these capital improvement projects becomes more impracticable with each passing year. Until inflation and cost of materials begin to level out, a combination of raising utility rates and pursuit of grants will be needed to pay for these improvements. In the meantime, the City will be looking to focus solely on those capital improvement projects that it can afford to pursue in the short term, while simultaneously setting money aside to help pay for those projects that the City cannot afford, but which are necessary, in the long term.

9.5 20-Year Financial Plan

The 20-year financial plan was developed and discussed with Public Works, the City's Finance Department, and the City's engineering consultant. The base year is the adopted 2025 budget.

9.5.1 Key Assumptions

Several key assumptions were used in making the 20-year projections and are shown in Table 9.4. These include the number of new customers per year and three cost escalation factors.

Table 9.4: Key Assumptions

General Cost Escalation	3%
Utility Rate Increases	15%-2%
Residential Housing Growth (390 Homes)	2%
Water Hookup Fee Increase	7.6%
Capital Fee Increase	20%-2%

These assumptions are calculated using average annual percentage increases. For Utility Rate and Capital Fee Increases, these annual increases range from 2% to 15% and from 2% to 20% respectively. Without making these assumptions, the Water/Sewer Fund – 401 and Water/Sewer Hookups Fund would not be stable enough to accommodate the Capital Improvement projects listed in Chapter 8 of this WSP.

9.5.2 20-Year Water Fund Balance and Reserves

The 2025 beginning balance is based derived from the Water/Sewer – 401 fund and the Water/Sewer Hookups – 403 fund. As these funds are based on a combined balance from both the water and sewer utilities, it is not directly apparent how much of those funds come from the water utility or the sewer utility. In order to extract a beginning balance from which to calculate future usage, the City took 33% of the combined beginning balance of the Water/Sewer – 401 fund and 43% of the combined beginning balance of the Water/Sewer Hookups – 403 fund.

Table 9.5: 20-Year Water Fund Outlook

Assumptions	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2035**	**2040**	**2045**
General Cost Escalation	3%	3%	3%	3%	3%	3%	3%	3%	3%
Utility Rate Increases	15%	5%	5%	5%	5%	5%	2%	2%	2%
Residential Housing Growth (390 homes)	2%	2%	2%	2%	2%	2%	2%	2%	2%
Water Hookup Fee Increase	$ 4,200.00	$ 4,410.00	$ 4,630.50	$ 4,862.03	$ 5,105.13	$ 5,360.38	$ 6,515.58	$ 8,315.71	$ 10,613.19
Capital Facility Fee Increase	NEW	20%	20%	20%	15%	15%	2%	2%	2%
Revenues									
401 Water Sales	$ 727,787	$ 779,460	$ 834,802	$ 894,072	$ 957,552	$ 1,025,538	$ 1,201,581	$ 1,464,720	$ 1,785,486
401 Miscellaneous Revenues	$ 88,144	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
403 Water Service Connections	$ 51,500	$ 85,995	$ 90,295	$ 94,809	$ 99,550	$ 104,527	$ 127,054	$ 162,156	$ 206,957
403 Water Capital Facility Fees	$ 77,916	$ 95,369	$ 116,732	$ 142,880	$ 167,598	$ 196,592	$ 259,696	$ 316,568	$ 385,895
Subtotal of Revenues	**$ 945,347**	**$ 965,824**	**$ 1,046,828**	**$ 1,136,762**	**$ 1,229,700**	**$ 1,331,658**	**$ 1,593,331**	**$ 1,948,445**	**$ 2,383,338**
Expenditures									
401 Water Operations	$ 805,061	$ 829,213	$ 854,089	$ 879,712	$ 906,103	$ 933,286	$ 1,050,422	$ 1,217,727	$ 1,411,679
403 Capital Projects/Expenditures	$ 360,409	$ 103,000	$ 186,560	$ 248,520	$ 112,000	$ 460,000	$ 127,000	$ 1,175,333	$ 168,480
Subtotal of Expenditures	**$ 1,165,470**	**$ 932,213**	**$ 1,040,649**	**$ 1,128,232**	**$ 1,018,103**	**$ 1,393,286**	**$ 1,177,422**	**$ 2,393,060**	**$ 1,580,160**
401 Water/Sewer Fund (Only Water Portion)									
(33% of Water/Sewer Fund)									
Beginning Balance	$ 85,685	$ 96,555	$ 51,802	$ 37,515	$ 56,875	$ 113,323	$ 586,306	$ 1,547,827	$ 3,047,492
Ending Balance	$ 96,555	$ 51,802	$ 37,515	$ 56,875	$ 113,323	$ 210,575	$ 742,465	$ 1,799,820	$ 3,426,298
Annual Increase/ (Use) of Reserves	$ 10,870	$ 33,611	$ 6,179	$ 8,530	$ 211,596	$ (61,629)	$ 415,909	$ (444,614)	$ 803,179
Minimum Target Balance (90 Op Exp)	$ 201,265	$ 207,303	$ 213,522	$ 219,928	$ 226,526	$ 233,322	$ 262,606	$ 304,432	$ 352,920
Meets Target?	NO	NO	NO	NO	NO	NO	OK	OK	OK
403 Water/Sewer Hookup Fund (Only Water Portion)									
43% of Total Fund Beginning Balance									
Beginning Balance	$ 316,447	$ 85,454	$ 163,819	$ 184,285	$ 173,454	$ 328,602	$ 187,617	$ 1,057,304	$ 1,867,738
Ending Balance	$ 85,454	$ 163,819	$ 184,285	$ 173,454	$ 328,602	$ 169,722	$ 447,367	$ 360,697	$ 2,292,110
Annual Increase/ (Use) of Reserves	$ (230,993)	$ 78,364	$ 20,467	$ (10,831)	$ 155,148	$ (158,880)	$ 259,750	$ (696,608)	$ 424,372

For the purposes of this WSP, not all years of the 20-Year Water Fund Outlook are shown. Table 9.5 highlights the first six years of the planning period to 2031 but then skips to 2035 and continues in 5-year increments to 2045 thereafter.

These projections are based on current known information and reasonable assumptions. These projections may or may not reflect actual conditions and results should be monitored each year during the budgeting process. An increase in new connections above the 19.5 assumed average annual connections will improve the City's water financial outlook.

9.6 Reserves

With the new water utility rates and connection charges outlined in Section 9.3 of this Chapter, Table 9.5 shows that the Water portions of the combined Water/Sewer – 401 fund and Water/Sewer Hookups – 403 fund are projected to reach a reserve of roughly $2.2 million. This projected reserve will likely change as future conditions will dictate revenue and expenditures in ways which cannot be accurately predicted 20 years in advance.

10 Miscellaneous Documents

10.1 State Environmental Policy Act

[Chapter 10 Miscellaneous Documents]

10.2 Agreements

[Chapter 10 Miscellaneous Documents – Everson/Nooksack Agreement]

10.2.1 Wholesale Water Agreements and Contracts

10.2.2 Emergency Supply Agreements

10.2.3 Wheeling Agreements

10.2.4 Joint-Use Agreements

10.2.5 Mutual Aid Agreements

10.2.6 Regional Emergency Preparedness and Response Agreements

10.2.7 Service Area Agreements

10.2.8 Regional Watershed or Wellhead Planning Participation Agreements

10.2.9 Regional Sampling Program Agreements

10.2.10 Financial Agreements with Lenders or Cost-Sharing Agreements

10.2.11 Inter-local Agreements Pertaining to Drinking Water

10.2.12 Satellite Management Agency Contract, if applicable

10.3 Correspondence

10.4 Appendices

10.4.1 Chapter 2 Appendices

10.4.2 Chapter 3 Appendices

10.4.3 Recommended Supporting Documents

10.4.3.1 Standard Construction Specifications and Construction Design Details

10.4.3.2 Standard Operating Procedures

10.4.3.3 Hydraulic Modeling Information

10.4.3.4 Water Quality Monitoring Results

10.4.3.5 Water Quality Monitoring Summary

10.4.3.6 Water Right Documents

[A completed water right self-assessment form is required]

10.4.3.7 Most Recent Rate Study

10.4.3.8 Recent Expense and Income Annual Reports

10.4.3.9 Easement and Land Ownership Documents

10.4.3.10 Latest Cross Connection Control Annual Summary Report(s)

10.4.3.11 Latest Water Use Efficiency Report(s)

10.4.3.12 Recent Consumer Alerts or Public Notices Issued

10.4.3.13 Monthly Water Treatment Plant Operational Reports, if applicable

10.4.3.14 Current Water Quality Monitoring Summary

10.4.3.15 Documentation of Unmetered Authorized Water Use

10.4.3.16 Operator Certification Documentation

10.4.4 Required Supporting Documents

10.4.4.1 Water Facilities Inventory

10.4.4.2 Consumer Informational Meeting Notification and Minutes

10.4.4.3 Notice Sent to Adjacent Utilities WSP is available for review

10.4.4.4 Monthly Annual Water Production and Consumption Totals

10.4.4.5 Susceptibility Assessment

10.4.4.6 Contaminant Survey and Inventory, and Notification to Land Owners (Wellhead Protection)

10.4.4.7 Notification of Findings to State and Local Agencies, and Emergency Responders, of the Wellhead Protection Program Source Inventory Findings, Wellhead Protection Boundaries, and Contingency Plan

City of Sumas - Water System Connections
Received August 21, 2024

	Connection Type	# of Connections
2011	Single-Family	308
	Multi-Family	21
	Commercial, Govt, Industrial	74
	Agriculture	0
	Total	403

	Connection Type	# of Connections
2013	Single-Family	398
	Multi-Family	23
	Commercial, Govt, Industrial	69
	Agriculture	0
	Total	490

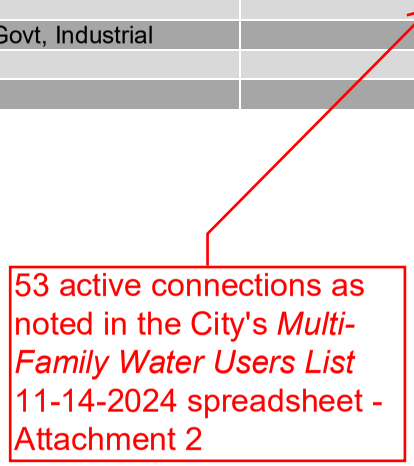
	Connection Type	# of Connections
2015	Single-Family	450
	Multi-Family	23
	Commercial, Govt, Industrial	101
	Agriculture	0
	Total	574

	Connection Type	# of Connections
2017	Single-Family	494
	Multi-Family	27
	Commercial, Govt, Industrial	103
	Agriculture	0
	Total	624

	Connection Type	# of Connections
2019	Single-Family	517
	Multi-Family	28
	Commercial, Govt, Industrial	106
	Agriculture	0
	Total	651

	Connection Type	# of Connections
2021	Single-Family	562
	Multi-Family	36
	Commercial, Govt, Industrial	104
	Agriculture	0
	Total	702

	Connection Type	# of Connections
2023	Single-Family	571
	Multi-Family	64
	Commercial, Govt, Industrial	108
	Agriculture	0
	Total	743



2003	Jan (cubic feet)	Feb (cubic feet)	Mar (cubic feet)	Apr (cubic feet)	May (cubic feet)	Jun (cubic feet)	Jul (cubic feet)	Aug (cubic feet)	Sep (cubic feet)	Oct (cubic feet)	Nov (cubic feet)	Dec (cubic feet)	Year (cubic feet)	Year (acre-ft)
Source Meters														
May Rd #3	2,948,783	2,731,336	3,084,598	3,081,671	65,414	-	3,390,147	3,349,157	3,211,604	2,961,818	2,996,270	3,100,414	30,921,212	710
S06	1,986,880	1,738,120	2,001,270	2,087,780	2,020,650	2,397,100	2,515,430	2,400,430	1,796,620	2,035,090	1,942,000	2,016,520	24,937,890	572
S04	567,433	521,002	583,034	604,759	697,673	1,109,665	1,169,064	1,883,850	1,087,032	675,494	719,906	318,409	9,937,321	228
S05	540,106	443,783	543,516	576,430	743,703	804,318	1,095,307	737,660	1,035,320	680,655	674,558	146,350	8,021,706	184
S09	75,953	69,391	79,258	75,316	79,899	65,212	69,573	66,442	53,374	19,212	43,278	67,578	764,486	18
Total Pumped	6,119,155	5,503,632	6,291,676	6,425,956	3,607,339	4,376,295	8,239,521	8,437,539	7,183,950	6,372,269	6,376,012	5,649,271	74,582,615	1,712
Residential & Comm/Gov/Ind	3,916,376	3,554,097	3,069,012	5,355,755	1,975,062	688,981	3,141,853	1,028,089	3,318,421	3,727,676	4,431,006	2,626,034	36,832,362	846
Wholesale	3,183,513	2,903,164	3,093,867	3,287,468	3,522,534	4,142,530	5,439,030	5,711,130	3,532,849	3,479,030	3,382,701	3,451,033	45,128,849	1,036
Total Billed	7,099,889	6,457,261	6,162,879	8,643,223	5,497,596	4,831,511	8,580,883	6,739,219	6,851,270	7,206,706	7,813,707	6,077,067	81,961,211	1,882
Unaccounted for: Pumped - Billed	(980,734)	(953,629)	128,797	(2,217,267)	(1,890,257)	(455,216)	(341,362)	1,698,320	332,680	(834,437)	(1,437,695)	(427,796)	(7,378,596)	
Bill/Pump Ratio	-16%	-17%	2%	-35%	-52%	-10%	-4%	20%	5%	-13%	-23%	-8%	-10%	Billed > Pumped

2004	Jan (cubic feet)	Feb (cubic feet)	Mar (cubic feet)	Apr (cubic feet)	May (cubic feet)	Jun (cubic feet)	Jul (cubic feet)	Aug (cubic feet)	Sep (cubic feet)	Oct (cubic feet)	Nov (cubic feet)	Dec (cubic feet)	Year (cubic feet)	Year (acre-ft)
Source Meters														
May Rd #3	3,056,056	2,981,390	3,156,248	3,431,300	1,367,847	2,264,322	2,298,716	3,126,403	3,065,374	3,237,847	3,044,104	3,198,811	34,228,418	786
S06	2,089,600	1,785,200	1,943,600	2,048,500	2,241,200	1,342,700	2,892,200	2,785,600	2,152,200	2,161,000	2,169,800	2,108,500	25,720,100	590
S04	865,441	728,275	785,360	792,914	2,360,855	1,605,173	1,367,165	1,629,879	1,181,390	1,192,647	627,834	559,344	13,696,277	314
S05	690,962	582,486	644,425	694,411	1,393,950	1,202,794	1,489,572	1,195,788	538,315	-	440,481	550,641	9,423,825	216
S09	543,863	739,171	555,962	632,754	660,721	661,149	628,703	544,451	623,021	846,497	811,363	849,491	8,097,146	186
Total Pumped	7,245,922	6,816,522	7,085,595	7,599,879	8,024,573	7,076,138	8,676,356	9,282,121	7,560,300	7,437,991	7,093,582	7,266,787	91,165,766	2,093
Residential & Comm/Gov/Ind	3,876,279	3,417,266	3,636,654	3,869,358	3,856,611	2,767,385	3,043,499	5,529,358	3,288,789	4,343,894	3,449,853	3,594,575	44,673,521	1,026
Wholesale	3,582,753	3,318,839	3,453,999	3,480,061	3,694,677	4,068,886	4,985,235	4,699,629	3,566,447	4,036,510	3,348,963	3,312,175	45,548,174	1,046
Total Billed	7,459,032	6,736,105	7,090,653	7,349,419	7,551,288	6,836,271	8,028,734	10,228,987	6,855,236	8,380,404	6,798,816	6,906,750	90,221,695	2,071
Unaccounted for: Pumped - Billed	(213,110)	80,417	(5,058)	250,460	473,285	239,867	647,622	(946,866)	705,064	(942,413)	294,766	360,037	944,071	
Bill/Pump Ratio	-3%	1%	0%	3%	6%	3%	7%	-10%	9%	-13%	4%	5%	1%	Pumped > Billed

2005	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Year
	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(acre-ft)
Source Meters														
May Rd #3	3,091,711	4,285,294	4,526,470	4,023,930	4,656,684	1,734,224	3,451,604	4,823,796	4,858,288	4,299,732	3,775,267	12,911,363	56,438,363	1,296
S06	622,306	642,450	664,925	687,388	711,809	735,282	761,874	791,165	814,823	836,823	857,853	879,085	9,005,783	207
S04	633,743	611,163	1,080,601	990,026	1,039,906	861,390	1,244,318	1,422,700	1,097,058	1,041,016	1,018,663	976,590	12,017,174	276
S05	635,508	569,104	969,358	929,652	1,016,377	784,451	1,239,933	1,357,125	986,042	935,949	915,828	874,799	11,214,126	257
S09	858,342	748,048	543,409	508,943	622,794	758,181	638,088	675,601	643,422	579,826	488,074	521,991	7,586,719	174
Total Pumped	5,841,610	6,856,059	7,784,763	7,139,939	8,047,570	4,873,528	7,335,817	9,070,387	8,399,633	7,693,346	7,055,685	16,163,828	96,262,165	2,210
Residential & Comm/Gov/Ind	2,786,518	3,685,113	3,842,390	3,468,244	3,969,548	588,252	3,290,713	782,286	4,263,038	3,660,689	3,280,925	3,693,971	37,311,687	857
Wholesale	3,775,377	3,284,032	3,476,080	3,348,509	3,759,150	3,697,847	4,074,059	4,929,772	3,354,710	3,419,378	3,260,840	3,445,527	43,825,281	1,006
Total Billed	6,561,895	6,969,145	7,318,470	6,816,753	7,728,698	4,286,099	7,364,772	5,712,058	7,617,748	7,080,067	6,541,765	7,139,498	81,136,968	1,863
Unaccounted for: Pumped - Billed	(720,285)	(113,086)	466,293	323,186	318,872	587,429	(28,955)	3,358,329	781,885	613,279	513,920	9,024,330	15,125,197	
Bill/Pump Ratio	-12%	-2%	6%	5%	4%	12%	0%	37%	9%	8%	7%	56%	16%	Pumped > Billed

2006	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Year
	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(acre-ft)
Source Meters														
May Rd #3	2,512,547	293,787					831,818	2,994,373	2,833,787	2,764,128	2,303,215	2,652,915	17,186,570	395
S06	2,156,600	1,914,500	2,157,600	2,160,700	2,299,500	2,378,300	2,719,500	2,914,400	2,373,700	2,350,300	2,111,400	2,460,000	27,996,500	643
S04	1,000,735	658,034	668,676	585,641	702,486	840,347	1,650,949	1,142,179	1,338,275	1,177,620	1,185,334	1,070,294	12,020,570	276
S05	896,216	585,775	593,422	518,516	622,967	775,641	1,159,705	1,785,227	1,160,360	1,011,069	922,941	941,778	10,973,617	252
S09	446,229	688,449	920,245	893,814	918,869	845,762	496,621	653,106	664,754	685,177	367,043	483,978	8,064,047	185
Total Pumped	7,012,327	4,140,545	4,339,943	4,158,671	4,543,822	4,840,050	6,858,593	9,489,285	8,370,876	7,988,294	6,889,933	7,608,965	76,241,304	1,750
Residential & Comm/Gov/Ind	3,254,361	2,170,312	542,917	523,405	639,452	628,015	1,227,436	5,463,071	3,050,861	4,226,559	3,195,549	3,364,058	28,285,996	649
Wholesale	3,066,427	3,126,660	3,624,207	3,148,199	3,861,059	3,721,277	4,754,346	4,694,767	3,643,369	3,836,661	3,382,504	3,812,491	44,671,967	1,026
Total Billed	6,320,788	5,296,972	4,167,124	3,671,604	4,500,511	4,349,292	5,981,782	10,157,838	6,694,230	8,063,220	6,578,053	7,176,549	72,957,963	1,675
Unaccounted for: Pumped - Billed	691,539	(1,156,427)	172,819	487,067	43,311	490,758	876,811	(668,553)	1,676,646	(74,926)	311,880	432,416	3,283,341	
Bill/Pump Ratio	10%	-28%	4%	12%	1%	10%	13%	-7%	20%	-1%	5%	6%	4%	Pumped > Billed

2007	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Year
	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(acre-ft)
Source Meters														
May Rd #3	940,213	131,469	294,728	382,075									1,748,485	40
S06	2,379,000	2,029,500	2,217,100	2,271,300	2,467,800	2,424,700	2,512,900	2,912,900	2,399,100	2,346,400	2,170,700	2,295,300	28,426,700	653
S04	1,111,016	1,001,671	865,066	618,114	485,721	626,711	996,590	1,024,010	495,307	737,419	697,580	676,965	9,336,170	214
S05	906,229	818,355	713,208	514,425	860,120	819,050	1,193,930	904,157	1,100,374	-	23,810	661,604	8,515,262	195
S09	580,427	398,475	653,796	771,243	796,443	769,197	780,387	706,176	688,689	678,074	610,307	591,430	8,024,644	184
Total Pumped	5,916,885	4,379,470	4,743,898	4,557,157	4,610,084	4,639,658	5,483,807	5,547,243	4,683,470	3,761,893	3,502,397	4,225,299	56,051,261	1,287
Residential & Comm/Gov/Ind	3,825,789	3,475,217	2,759,744	569,748	650,155	746,125	914,221	890,751	744,289	581,193	457,131	515,045	16,129,408	370
Wholesale	3,656,479	2,815,720	3,390,071	3,250,406	3,514,420	3,593,962	4,120,500	4,537,050	3,553,768	3,337,171	3,315,060	3,257,016	42,341,623	972
Total Billed	7,482,268	6,290,937	6,149,815	3,820,154	4,164,575	4,340,087	5,034,721	5,427,801	4,298,057	3,918,364	3,772,191	3,772,061	58,471,031	1,342
Unaccounted for: Pumped - Billed	(1,565,383)	(1,911,467)	(1,405,917)	737,003	445,509	299,571	449,086	119,442	385,413	(156,471)	(269,794)	453,238	(2,419,770)	
Bill/Pump Ratio	-26%	-44%	-30%	16%	10%	6%	8%	2%	8%	-4%	-8%	11%	-4%	Billed > Pumped

2008	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Year
	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(acre-ft)
Source Meters														
May Rd #3								744,264	2,832,326	1,624,518	160,374	1,297,152	6,658,634	153
S06	2,486,000	2,167,900	2,331,200	2,261,800	2,431,500	2,498,600	2,267,800	2,455,600	2,385,400	2,327,400	2,336,100	2,482,300	28,431,600	653
S04	755,668	686,324	586,537	700,027	171,765	540,628	948,850	754,158	1,103,663	944,345	815,307	854,452	8,861,724	203
S05	700,281	634,479	540,120	645,495	1,331,337	936,818	1,633,957	1,412,620	1,183,048	1,013,770	880,188	916,443	11,828,556	272
S09	597,687	553,168	595,858	566,550	502,286	490,441	572,954	527,459	400,534	211,671	44,491	100	5,063,199	116
Total Pumped	4,539,636	4,041,871	4,053,715	4,173,872	4,436,888	4,466,487	5,423,561	5,894,101	7,904,971	6,121,704	4,236,460	5,550,447	60,843,713	1,397
Residential & Comm/Gov/Ind	550,156	523,789	514,007	420,895	500,735	750,387	1,137,106	1,156,644	3,832,060	3,223,154	924,218	554,571	14,087,722	323
Wholesale	3,486,977	3,018,227	3,098,772	3,285,331	3,593,664	3,565,734	4,473,188	3,863,766	3,558,320	3,445,750	2,790,942	3,622,701	41,803,372	960
Total Billed	4,037,133	3,542,016	3,612,779	3,706,226	4,094,399	4,316,121	5,610,294	5,020,410	7,390,380	6,668,904	3,715,160	4,177,272	55,891,094	1,283
Unaccounted for: Pumped - Billed	502,503	499,855	440,936	467,646	342,489	150,366	(186,733)	873,691	514,591	(547,200)	521,300	1,373,175	4,952,619	
Bill/Pump Ratio	11%	12%	11%	11%	8%	3%	-3%	15%	7%	-9%	12%	25%	8%	Pumped > Billed

2009	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Year
	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(cubic feet)	(acre-ft)
Source Meters														
May Rd #3	663,418	1,822,986	-	2,579,187	197,762	356,320	3,287,473	3,377,206	2,832,706	-	-	1,061,949	16,179,007	371
S06	2,394,493	2,268,169	2,620,569	2,055,160	2,180,613	2,441,973	2,157,962	2,627,103	2,201,958	2,072,584	1,943,647	1,995,483	26,959,714	619
S04	1,013,663	583,463	755,508	603,570	668,957	1,015,775	867,086	919,639	790,714	836,652	822,005	654,078	9,531,110	219
S05	1,179,051	811,243	867,647	693,676	766,738	1,283,302	1,275,107	1,517,580	1,026,791	802,206	746,083	911,016	11,880,440	273
S09	94,960	403,801	450,410	444,312	458,686	440,391	572,814	527,459	400,534	247,856	417,740	393,782	4,852,745	111
Total Pumped	5,345,585	5,889,662	4,694,134	6,375,905	4,272,756	5,537,761	8,160,442	8,968,987	7,252,703	3,959,298	3,929,475	5,016,308	69,403,016	1,593
Residential & Comm/Gov/Ind	1,570,788	2,827,989	2,620,064	748,354	805,704	1,066,935	3,125,288	4,313,788	705,795	325,474	1,820,318	2,118,173	22,048,670	506
Wholesale	3,282,394	3,038,069	3,685,297	2,948,492	2,988,429	3,868,739	4,377,714	4,232,064	3,129,172	3,149,172	2,965,159	2,965,889	40,630,590	933
Total Billed	4,853,182	5,866,058	6,305,361	3,696,846	3,794,133	4,935,674	7,503,002	8,545,852	3,834,967	3,474,646	4,785,477	5,084,062	62,679,260	1,439
Unaccounted for: Pumped - Billed	492,403	23,604	(1,611,227)	2,679,059	478,623	602,087	657,440	423,135	3,417,736	484,652	(856,002)	(67,754)	6,723,756	
Bill/Pump Ratio	9%	0%	-34%	42%	11%	11%	8%	5%	47%	12%	-22%	-1%	10%	Pumped > Billed

2011	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Year
	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(acre-f/yr)
Source Meters														
May Rd #1	0	0	490,447	135,539	491,944	476,932	452,348	460,957	345,564	334,495	0	0	3,188,228	73
Sumas Well #4R	980,333	891,943	862,614	766,043	783,903	850,449	877,492	763,463	937,876	764,439	864,218	860,368	10,203,141	234
Sumas Well #5	992,725	905,993	878,214	778,355	797,404	865,301	1,065,340	1,567,110	1,084,096	775,788	874,471	861,371	11,446,170	263
Nooksack Well #2	603,700	475,500	734,700	530,000	707,100	858,800	1,125,600	885,600	952,100	739,500	585,200	490,400	8,688,200	199
Nooksack Well #3	1,338,100	1,287,700	1,344,600	1,391,300	1,329,100	1,379,100	1,408,300	1,017,400	1,262,600	1,295,000	1,278,800	1,339,800	15,671,800	360
Total Pumped	3,914,858	3,561,137	4,310,575	3,601,237	4,109,452	4,430,582	4,929,081	4,694,531	4,582,236	3,909,223	3,602,689	3,551,939	49,197,538	1,129
Residential & Comm/Gov/Ind	448,558	449,941	440,899	449,705	474,247	512,004	629,437	714,790	656,412	446,338	432,536	418,829	6,073,696	139
Wholesale	2,767,211	2,924,396	2,947,555	2,943,978	3,212,871	3,208,063	3,567,602	4,155,498	3,569,670	3,038,802	2,791,905	2,846,210	37,973,761	872
Total Billed	3,215,769	3,374,337	3,388,454	3,393,683	3,687,118	3,720,067	4,197,039	4,870,288	4,226,082	3,485,140	3,224,441	3,265,039	44,047,457	1,011
Unaccounted for: Pumped - Billed	699,089	186,800	922,121	207,554	422,334	710,515	732,042	-175,757	356,154	424,083	378,248	286,900	5,150,081	
Bill/Pump Ratio	18%	5%	21%	6%	10%	16%	15%	-4%	8%	11%	10%	8%	10%	Pumped > Billed

2013	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Year
	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(acre-f/yr)
Source Meters														
May Rd #1	370,735	319,478	351,724	369,639	314,572	339,585	339,786	330,708	323,609	293,221	259,628	217,018	3,829,703	88
Sumas Well #4R	827,927	780,855	825,147	943,970	849,692	881,002	1,338,114	1,154,344	792,152	787,205	749,719	654,946	10,585,073	243
Sumas Well #5	964,585	867,205	844,863	820,574	879,024	1,071,978	1,412,446	2,001,497	1,711,764	1,055,374	729,438	746,283	13,105,031	301
Nooksack Well #2	616,100	1,808,800	1,096,000	1,748,900	1,684,800	1,853,900	2,645,300	1,910,700	285,600	338,900	311,000	350,100	14,650,100	336
Nooksack Well #3	1,221,300	89,300	3,119,300	430,400	316,500	421,700	550,300	681,100	1,564,700	1,466,000	1,401,000	1,439,000	12,700,600	292
Total Pumped	4,000,647	3,865,638	6,237,034	4,313,483	4,044,588	4,568,165	6,285,946	6,078,349	4,677,825	3,940,700	3,450,785	3,407,347	54,870,507	1,260
Residential & Comm/Gov/Ind	455,340	468,565	423,129	537,898	497,646	716,443	701,067	865,532	568,798	422,369	413,185	496,888	6,566,860	151
Wholesale	3,085,861	2,880,326	3,062,208	3,302,679	3,427,124	3,142,403	4,697,604	3,939,452	3,102,486	2,874,094	2,771,705	2,879,868	39,165,810	899
Total Billed	3,541,201	3,348,891	3,485,337	3,840,577	3,924,770	3,858,846	5,398,671	4,804,984	3,671,284	3,296,463	3,184,890	3,376,756	45,732,670	1,050
Unaccounted for: Pumped - Billed	459,446	516,747	2,751,697	472,906	119,818	709,319	887,275	1,273,365	1,006,541	644,237	265,895	30,591	9,137,837	
Bill/Pump Ratio	11%	13%	44%	11%	3%	16%	14%	21%	22%	16%	8%	1%	17%	Pumped > Billed

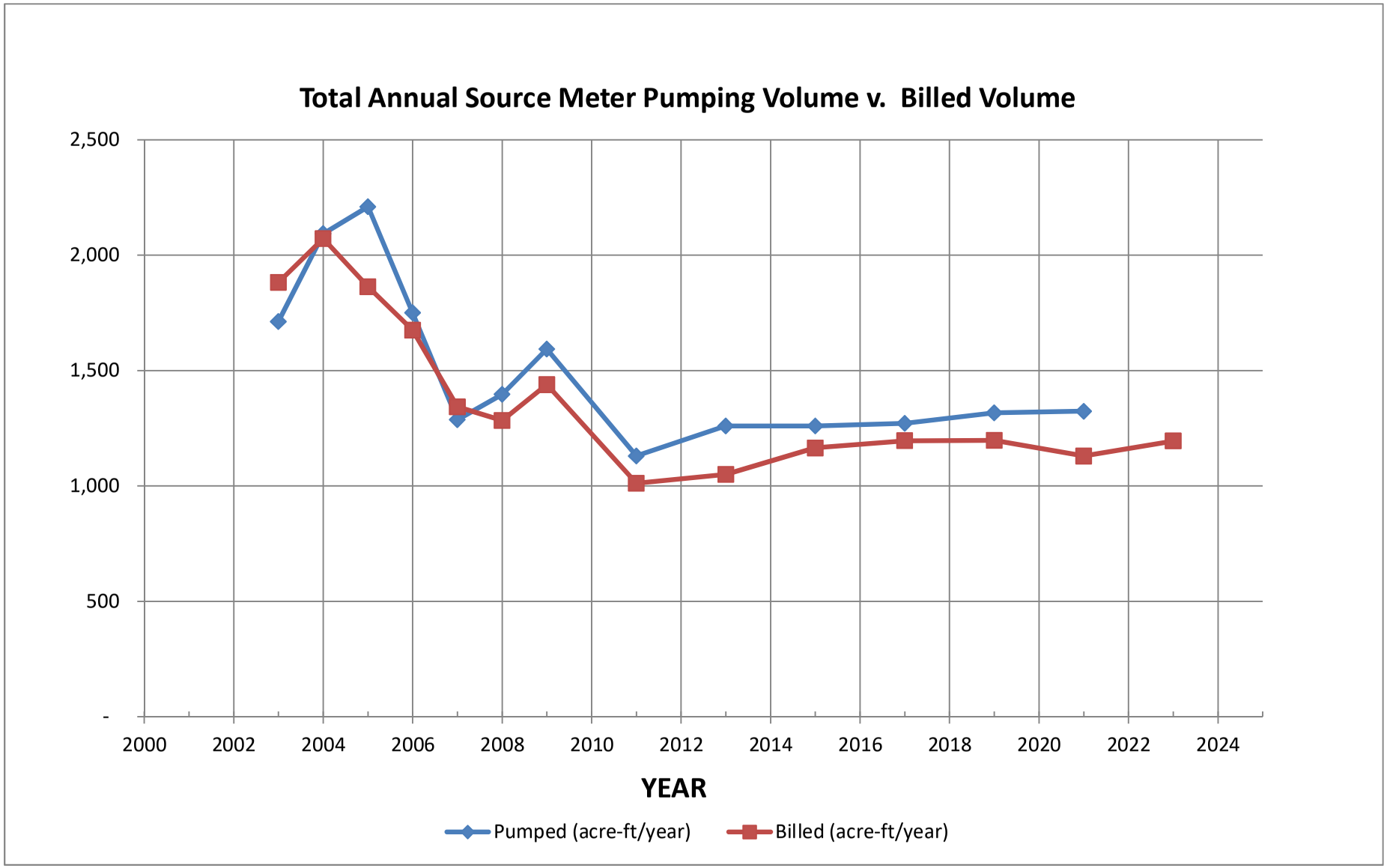
2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Year
	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(acre-f/yr)
Source Meters														
May Rd #1	400,052	362,635	396,670	388,863	368,223	359,534	239,876	163,826	325,940	304,618	308,789	304,858	3,923,885	90
Sumas Well #4R	607,580	214,265	732,807	1,043,663	1,137,968	1,210,441	1,354,706	1,277,313	891,591	756,912	729,278	687,928	10,644,452	244
Sumas Well #5	716,190	1,132,473	864,278	1,228,382	1,321,471	1,547,968	1,777,848	1,559,733	1,099,225	971,885	885,896	832,005	13,937,354	320
Nooksack Well #2	981,200	234,500	1,046,700	946,200	1,186,200	1,898,300	1,808,500	1,422,700	1,176,100	1,091,500	1,081,400	1,831,200	14,704,500	338
Nooksack Well #3	1,004,700	651,700	912,700	972,800	1,048,000	1,226,200	1,389,600	1,416,600	1,000,600	865,500	909,200	255,300	11,652,900	268
Total Pumped	3,709,722	2,595,573	3,953,155	4,579,908	5,061,862	6,242,443	6,570,530	5,840,172	4,493,456	3,990,415	3,914,563	3,911,291	54,863,091	1,259
Residential & Comm/Gov/Ind	450,296	491,727	1,392,021	512,857	540,884	811,555	957,989	761,189	788,692	524,430	494,960	459,940	8,186,540	188
Wholesale	2,983,860	2,643,125	2,997,777	2,960,556	3,419,903	4,777,693	5,023,259	4,604,807	3,644,939	3,180,337	3,239,716	3,075,941	42,551,913	977
Total Billed	3,434,156	3,134,852	4,389,798	3,473,413	3,960,787	5,589,248	5,981,248	5,365,996	4,433,631	3,704,767	3,734,676	3,535,881	50,738,453	1,165
Unaccounted for: Pumped - Billed	275,566	-539,279	-436,643	1,106,495	1,101,075	653,195	589,282	474,176	59,825	285,648	179,887	375,410	4,124,638	
Bill/Pump Ratio	7%	-21%	-11%	24%	22%	10%	9%	8%	1%	7%	5%	10%	8%	Pumped > Billed

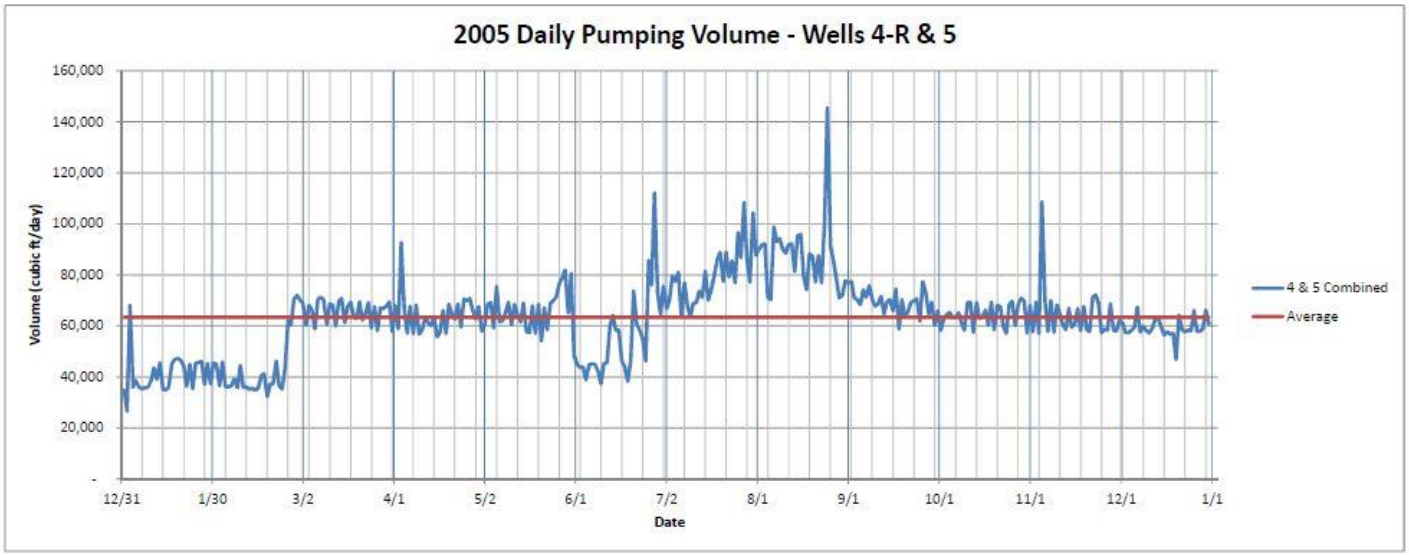
2017	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Year
	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(acre-f/yr)
Source Meters														
May Rd #1	266,238	243,152	254,889	262,883	234,609	261,305	223,287	219,998	235,879	215,573	223,754	217,726	2,859,293	66
Sumas Well #4R	827,045	691,016	720,628	753,783	837,848	1,003,088	1,358,222	1,402,299	1,185,989	882,580	837,192	742,887	11,242,577	258
Sumas Well #5	990,027	824,933	857,232	892,660	997,273	1,191,256	1,597,928	1,680,521	1,419,372	1,058,797	998,917	882,259	13,391,175	307
Nooksack Well #2	1,381,300	1,166,900	1,232,300	1,277,400	1,530,700	1,390,700	2,089,000	2,161,500	1,526,500	1,099,700	1,197,700	1,246,600	17,300,300	397
Nooksack Well #3	811,500	743,000	697,700	781,500	766,900	1,045,300	1,264,300	1,142,300	1,025,700	826,100	724,400	730,800	10,559,500	242
Total Pumped	4,276,110	3,669,001	3,762,749	3,968,226	4,367,330	4,891,649	6,532,737	6,606,618	5,393,440	4,082,750	3,981,963	3,820,272	55,352,845	1,271
Residential & Comm/Gov/Ind	550,963	488,188	515,570	511,656	587,182	606,685	867,454	902,138	793,779	597,589	507,887	1,538,529	8,467,620	194
Wholesale	3,385,969	2,891,693	2,936,235	3,059,061	3,413,687	3,827,751	5,185,670	5,205,614	4,286,565	3,269,935	3,117,255	3,041,646	43,621,081	1,001
Total Billed	3,936,932	3,379,881	3,451,805	3,570,717	4,000,869	4,434,436	6,053,124	6,107,752	5,080,344	3,867,524	3,625,142	4,580,175	52,088,701	1,196
Unaccounted for: Pumped - Billed	339,178	289,120	310,944	397,509	366,461	457,213	479,613	498,866	313,096	215,226	356,821	-759,903	3,264,144	
Bill/Pump Ratio	8%	8%	8%	10%	8%	9%	7%	8%	6%	5%	9%	-20%	6%	Pumped > Billed

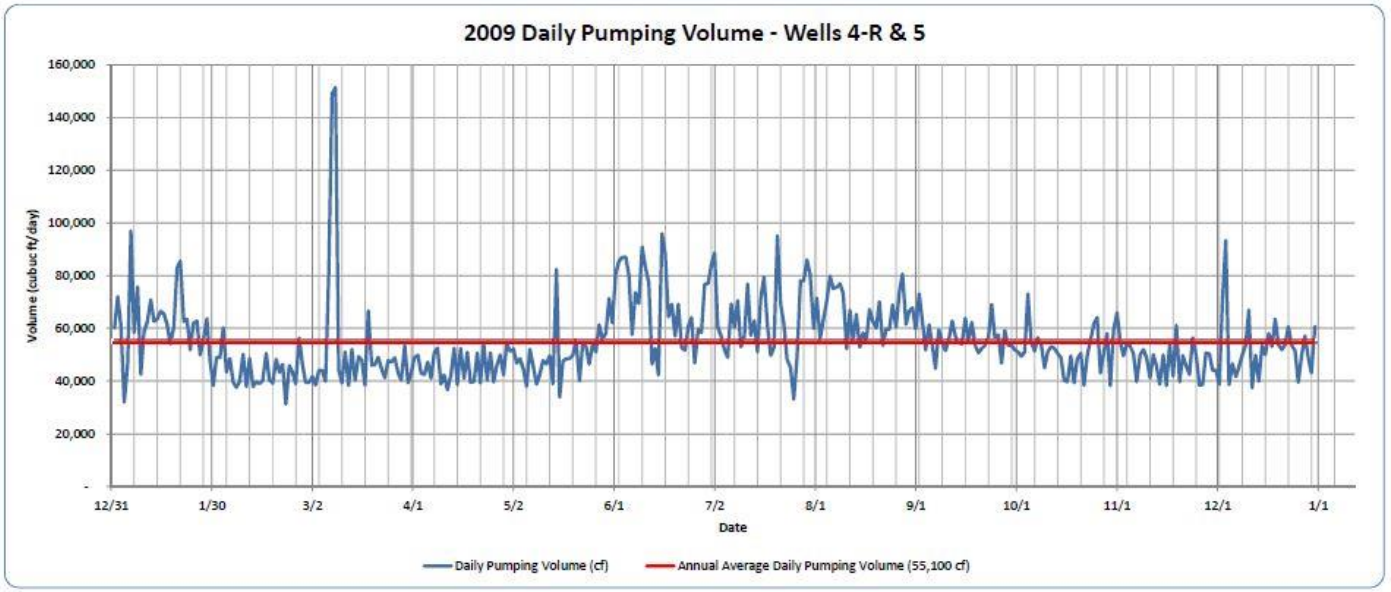
2019	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Year
	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(cubic ft)	(acre-f/yr)
Source Meters														
May Rd #1	186,872	165,817	180,576	168,210	177,835	174,025	161,860	162,716	152,730	157,543	125,272	182,447	1,995,904	46
Sumas Well #4R	1,022,754	1,083,275	1,150,267	1,040,789	1,315,174	1,506,163	1,449,412	1,580,094	1,222,955	934,238	642	2,139	12,307,902	283
Sumas Well #5	959,064	1,019,719	1,085,027	981,243	1,240,307	1,422,553	1,367,874	1,476,110	1,143,783	1,224,840	1,846,818	2,230,187	15,997,525	367
Nooksack Well #2	1,273,000	1,200,800	1,269,000	1,123,300	981,200	1,453,700	1,334,500	1,508,500	1,182,500	1,194,200	903,800	1,001,200	14,425,700	331
Nooksack Well #3	685,600	824,400	902,600	821,400	1,432,800	1,388,600	1,347,200	1,326,800	1,061,100	902,100	771,800	1,169,200	12,633,600	290
Total Pumped	4,127,290	4,294,011	4,587,470	4,134,942	5,147,316	5,945,041	5,660,846	6,054,220	4,763,068	4,412,921	3,648,332	4,585,173	57,360,631	1,317
Residential & Comm/Gov/Ind	425,911	554,279	723,071	507,642	598,579	750,733	753,376	933,961	700,113	524,509	508,411	515,872	7,496,457	172
Wholesale	3,205,665	3,364,488	3,575,501	3,277,165	4,041,856	4,585,975	4,432,966	4,750,066	3,783,210	3,325,571	2,839,538	3,489,509	44,671,510	1,026
Total Billed	3,631,576	3,918,767	4,298,572	3,784,807	4,640,435	5,336,708	5,186,342	5,684,027	4,483,323	3,850,080	3,347,949	4,005,381	52,167,967	1,198
Unaccounted for: Pumped - Billed	495,714	375,244	288,898	350,135	506,881	608,333	474,504	370,193	279,745	562,841	300,383	579,792	5,192,664	
Bill/Pump Ratio	12%	9%	6%	8%	10%	10%	8%	6%	6%	13%	8%	13%	9%	Pumped > Billed

2021	Jan (cubic ft)	Feb (cubic ft)	Mar (cubic ft)	Apr (cubic ft)	May (cubic ft)	Jun (cubic ft)	Jul (cubic ft)	Aug (cubic ft)	Sep (cubic ft)	Oct (cubic ft)	Nov (cubic ft)	Dec (cubic ft)	Year (cubic ft)	Year (acre-f/yr)
Source Meters														
May Rd #1	158,171	161,219	177,742	154,749	140,244	155,364	131,154	115,059	135,606	124,697	75,075	230,512	1,759,590	40
Sumas Well #4R	670,635	686,931	753,477	748,678	809,369	998,059	1,803,444	1,164,852	910,886	709,870	1,027,629	658,577	10,942,408	251
Sumas Well #5	924,518	1,011,748	1,112,088	1,105,418	1,186,335	1,847,706	2,208,336	1,675,752	1,316,620	1,027,803	1,503,813	849,754	15,769,890	362
Nooksack Well #2	1,046,500	1,303,400	1,032,100	1,407,500	1,132,800	1,888,200	2,450,200	2,374,200	2,625,500	1,208,700	915,200	1,701,400	19,085,700	438
Nooksack Well #3	754,200	701,500	1,127,600	787,300	947,200	1,251,400	1,243,600	736,600	176,300	808,000	1,483,600	88,400	10,105,700	232
Total Pumped	3,554,024	3,864,797	4,203,007	4,203,644	4,215,948	6,140,728	7,836,734	6,066,464	5,164,911	3,879,071	5,005,317	3,528,643	57,663,288	1,324
Residential & Comm/Gov/Ind	470,755	643,362	662,816	578,776	648,720	1,118,624	1,336,016	1,766,562	-77,011	552,482	678,219	516,658	8,895,979	204
Wholesale	2,726,525	2,859,173	3,159,047	3,097,328	3,158,864	3,660,128	5,379,076	4,117,180	3,571,929	2,762,480	3,576,217	2,250,037	40,317,984	926
Total Billed	3,197,280	3,502,535	3,821,863	3,676,104	3,807,584	4,778,752	6,715,092	5,883,742	3,494,918	3,314,962	4,254,436	2,766,695	49,213,963	1,130
Unaccounted for: Pumped - Billed	356,744	362,262	381,144	527,540	408,364	1,361,976	1,121,642	182,722	1,669,993	564,109	750,881	761,948	8,449,325	
Bill/Pump Ratio	10%	9%	9%	13%	10%	22%	14%	3%	32%	15%	15%	22%	15%	Pumped > Billed

2023	Jan (cubic ft)	Feb (cubic ft)	Mar (cubic ft)	Apr (cubic ft)	May (cubic ft)	Jun (cubic ft)	Jul (cubic ft)	Aug (cubic ft)	Sep (cubic ft)	Oct (cubic ft)	Nov (cubic ft)	Dec (cubic ft)	Year (cubic ft)	Year (acre-f/yr)
Source Meters														
May Rd #1 (PSE Cogen Billed)	0	233,583	382,019	40,281	227,955	283,971	511,791	489,131	428,035	421,083	392,553	410,441	3,820,843	88
Sumas Well #4R	288,309	202,954	213,020	176,271	132,785	536,834	386,698	1,478,467	1,333,169	1,352,914	1,167,285	1,241,959	8,510,665	195
Sumas Well #5	Meter Not Working	Meter Replaced	217,726	205,681	295,995	251,747	393,756	196,256	76,626	70,436	69,755	50,451	1,828,429	42
Nooksack Well #2	2,741,500	2,125,100	1,348,300	0	2,489,800	2,378,400	2,621,800	2,475,600	2,416,100	2,086,700	1,159,300	1,124,500	22,967,100	527
Nooksack Well #3	0	0	851,000	1,715,900	477,100	470,500	1,185,000	878,200	0	110,800	6,808,000	663,800	13,160,300	302
Total Pumped	3,029,809	2,561,637	3,012,064	2,138,133	3,623,635	3,921,453	5,099,045	5,517,654	4,253,930	4,041,933	9,596,893	3,491,151	50,287,337	1,154
Residential & Comm/Gov/Ind	499,320	527,925	649,452	456,816	583,373	755,230	1,106,814	982,513	622,494	559,704	561,712	520,854	7,826,207	180
Wholesale	3,746,456	3,100,510	3,419,706	2,986,814	4,182,018	4,089,127	5,597,072	4,899,512	3,356,147	3,247,010	2,847,399	2,744,318	44,216,089	1,015
Total Billed	4,245,776	3,628,435	4,069,158	3,443,630	4,765,391	4,844,357	6,703,886	5,882,025	3,978,641	3,806,714	3,409,111	3,265,172	52,042,296	1,195
Unaccounted for: Pumped - Billed	-1,215,967	-1,066,798	-1,057,094	-1,305,497	-1,141,756	-922,904	-1,604,841	-364,371	275,289	235,219	6,187,782	225,979	-1,754,959	
Bill/Pump Ratio	-40%	-42%	-35%	-61%	-32%	-24%	-31%	-7%	6%	6%	64%	6%	-3%	Pumped > Billed


Total Annual Source Meter Pumping Volume v. Billed Volume
2,500
2,000
1,500
1,000
500
-
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
YEAR
Pumped (acre-ft/year)
Billed (acre-ft/year)


2005 Daily Pumping Volume - Wells 4-R & 5
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
-
Volume (cubic ft/day)
12/31
1/30
3/2
4/1
5/2
6/1
7/2
8/1
9/1
10/1
11/1
12/1
1/1
Date
4 & 5 Combined
Average


2009 Daily Pumping Volume - Wells 4-R & 5
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
-
Volume (cubic ft/day)
12/31
1/30
3/2
4/1
5/2
6/1
7/2
8/1
9/1
10/1
11/1
12/1
1/1
Date
Daily Pumping Volume (cf)
Annual Average Daily Pumping Volume (55,100 cf)

				Connections	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Year
	1993	839	Residential	320	271,219	232,301	232,620	337,235	317,085	365,896	398,639	441,480	382,050	263,812	247,596	238,656	2,816,846	65
1			Comm/Gov/Ind	82	3,645,157	3,321,796	2,836,392	5,018,520	1,657,977	323,085	2,743,214	586,609	2,936,371	3,463,864	4,183,410	2,387,378	3,635,285	83
			Subtotal	402	3,916,376	3,554,097	3,069,012	5,355,755	1,975,062	688,981	3,141,853	1,028,089	3,318,421	3,727,676	4,431,006	2,626,034	6,452,131	148
	1994	873	Residential	320	271,219	232,301	232,620	337,235	317,085	365,896	398,639	441,480	382,050	263,812	247,596	238,656	3,036,643	70
1			Comm/Gov/Ind	82	3,645,157	3,321,796	2,836,392	5,018,520	1,657,977	323,085	2,743,214	586,609	2,936,371	3,463,864	4,183,410	2,387,378	3,168,028	73
			Subtotal	402	3,916,376	3,554,097	3,069,012	5,355,755	1,975,062	688,981	3,141,853	1,028,089	3,318,421	3,727,676	4,431,006	2,626,034	6,204,671	142
	1995	940	Residential	320	271,219	232,301	232,620	337,235	317,085	365,896	398,639	441,480	382,050	263,812	247,596	238,656	3,118,880	72
1			Comm/Gov/Ind	82	3,645,157	3,321,796	2,836,392	5,018,520	1,657,977	323,085	2,743,214	586,609	2,936,371	3,463,864	4,183,410	2,387,378	3,363,765	77
			Subtotal	402	3,916,376	3,554,097	3,069,012	5,355,755	1,975,062	688,981	3,141,853	1,028,089	3,318,421	3,727,676	4,431,006	2,626,034	6,482,645	149
	1996	968	Residential	320	271,219	232,301	232,620	337,235	317,085	365,896	398,639	441,480	382,050	263,812	247,596	238,656	3,481,001	80
1			Comm/Gov/Ind	82	3,645,157	3,321,796	2,836,392	5,018,520	1,657,977	323,085	2,743,214	586,609	2,936,371	3,463,864	4,183,410	2,387,378	2,922,654	67
			Subtotal	402	3,916,376	3,554,097	3,069,012	5,355,755	1,975,062	688,981	3,141,853	1,028,089	3,318,421	3,727,676	4,431,006	2,626,034	6,403,655	147
	1997	973	Residential	320	271,219	232,301	232,620	337,235	317,085	365,896	398,639	441,480	382,050	263,812	247,596	238,656	3,590,390	82
1			Comm/Gov/Ind	82	3,645,157	3,321,796	2,836,392	5,018,520	1,657,977	323,085	2,743,214	586,609	2,936,371	3,463,864	4,183,410	2,387,378	2,474,256	57
			Subtotal	402	3,916,376	3,554,097	3,069,012	5,355,755	1,975,062	688,981	3,141,853	1,028,089	3,318,421	3,727,676	4,431,006	2,626,034	6,064,646	139
	1998	954	Residential	320	271,219	232,301	232,620	337,235	317,085	365,896	398,639	441,480	382,050	263,812	247,596	238,656	3,603,924	83
1			Comm/Gov/Ind	82	3,645,157	3,321,796	2,836,392	5,018,520	1,657,977	323,085	2,743,214	586,609	2,936,371	3,463,864	4,183,410	2,387,378	2,592,881	60
			Subtotal	402	3,916,376	3,554,097	3,069,012	5,355,755	1,975,062	688,981	3,141,853	1,028,089	3,318,421	3,727,676	4,431,006	2,626,034	6,196,805	142
	2003	1,002	Residential	320	271,219	232,301	232,620	337,235	317,085	365,896	398,639	441,480	382,050	263,812	247,596	238,656	3,728,909	86
1*			Comm/Gov/Ind	82	3,645,157	3,321,796	2,836,392	5,018,520	1,657,977	323,085	2,743,214	586,609	2,936,371	3,463,864	4,183,410	2,387,378	33,103,855	760
			Subtotal	402	3,916,376	3,554,097	3,069,012	5,355,755	1,975,062	688,981	3,141,853	1,028,089	3,318,421	3,727,676	4,431,006	2,626,034	36,832,764	846
	2004	1,079	Residential	331	288,027	241,301	260,375	261,998	303,657	318,474	484,131	708,341	301,716	266,936	247,128	249,810	3,932,225	90
1*			Comm/Gov/Ind	81	3,588,252	3,175,965	3,376,279	3,607,360	3,552,954	2,448,911	2,559,368	4,821,017	2,987,073	4,076,958	3,202,725	3,344,765	40,741,708	935
			Subtotal	412	3,876,279	3,417,266	3,636,654	3,869,358	3,856,611	2,767,385	3,043,499	5,529,358	3,288,789	4,343,894	3,449,853	3,594,575	44,673,933	1,026
	2005	1,112	Residential	355	278,200	287,569	258,165	259,486	297,657	330,991	370,095	504,696	325,840	263,450	240,023	249,359	3,665,886	84
3			PSE															
1**			Comm/Gov/Ind	99	2,508,318	3,397,544	3,584,225	3,208,758	3,671,891	257,261	2,920,618	277,590	3,937,198	3,397,239	3,040,902	3,444,612	2,742,679	63
			Subtotal	454	2,786,518	3,685,113	3,842,390	3,468,244	3,969,548	588,252	3,290,713	782,286	4,263,038	3,660,689	3,280,925	3,693,971	6,408,565	147
	2006	1,125	Residential	379	251,412	263,312	250,641	252,584	320,876	295,458	540,759	606,475	439,729	309,194	304,641	295,705	4,131,165	95
3			PSE															
1**			Comm/Gov/Ind	91	3,002,949	1,907,000	292,276	270,821	318,576	332,557	686,677	4,856,596	2,611,132	3,917,365	2,890,908	3,068,353	3,553,343	82
			Subtotal	470	3,254,361	2,170,312	542,917	523,405	639,452	628,015	1,227,436	5,463,071	3,050,861	4,226,559	3,195,549	3,364,058	7,684,508	176
	2007	1,191	Residential	397	324,656	253,565	250,324	258,218	318,906	354,308	459,027	470,474	366,053	311,046	256,867	301,865	3,925,706	90

			Connections	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Year
	2008	1,264	Residential	309,380	297,674	309,935	255,112	297,458	293,124	575,635	458,831	363,848	292,245	245,224	273,313	3,971,779	91
3			PSE														
1**			Comm/Gov/Ind	240,776	226,115	204,072	165,783	203,277	457,263	561,471	697,813	3,468,212	2,930,909	678,994	281,258	4,316,140	99
			Subtotal	550,156	523,789	514,007	420,895	500,735	750,387	1,137,106	1,156,644	3,832,060	3,223,154	924,218	554,571	8,287,919	190
	2009	1,327	Residential	359,162	266,498	282,711	296,703	307,302	504,143	455,718	492,480	385,591	71,922	275,212	168,792	3,866,234	89
3			PSE														
1**			Comm/Gov/Ind	1,211,626	2,561,491	2,337,353	451,651	498,402	562,792	2,669,570	3,821,308	320,204	253,552	1,545,106	1,949,381	4,767,553	109
			Subtotal	1,570,788	2,827,989	2,620,064	748,354	805,704	1,066,935	3,125,288	4,313,788	705,795	325,474	1,820,318	2,118,173	8,633,787	198
	2011		Residential/ Multi	295,332	273,587	264,828	261,361	279,650	298,851	377,639	417,324	403,080	269,633	268,936	256,655	3,666,876	84
2			Comm/Gov/Ind	153,226	176,354	176,071	188,344	194,597	213,153	251,798	297,466	253,332	176,705	163,600	162,174	2,406,820	55
			Subtotal	448,558	449,941	440,899	449,705	474,247	512,004	629,437	714,790	656,412	446,338	432,536	418,829	6,073,696	139
	2013		Residential/ Multi	315,833	293,631	249,740	281,324	300,959	326,044	521,327	536,409	351,798	262,419	263,867	295,443	3,998,794	92
2			Comm/Gov/Ind	139,507	174,934	173,389	256,574	196,687	390,399	179,740	329,123	217,000	159,950	149,318	201,445	2,568,066	59
			Subtotal	455,340	468,565	423,129	537,898	497,646	716,443	701,067	865,532	568,798	422,369	413,185	496,888	6,566,860	151
	2015		Residential/ Multi	271,166	265,230	274,519	309,952	309,952	550,485	671,589	498,187	375,967	306,044	283,842	288,808	4,405,741	101
2			Comm/Gov/Ind	179,130	226,497	1,117,502	202,905	230,932	261,070	286,400	263,002	412,725	218,386	211,118	171,132	3,780,799	87
			Subtotal	450,296	491,727	1,392,021	512,857	540,884	811,555	957,989	761,189	788,692	524,430	494,960	459,940	8,186,540	188
	2017		Residential/ Multi	314,049	285,763	300,142	295,265	354,953	377,380	599,065	614,438	518,496	334,235	284,875	1,320,055	5,598,716	129
2			Comm/Gov/Ind	236,914	202,425	215,428	216,391	232,229	229,305	268,389	287,700	275,283	263,354	223,012	218,474	2,868,904	66
			Subtotal	550,963	488,188	515,570	511,656	587,182	606,685	867,454	902,138	793,779	597,589	507,887	1,538,529	8,467,620	194
	2019		Residential/ Multi	290,065	358,459	304,688	290,421	372,769	465,480	446,621	608,119	430,715	315,610	313,350	324,497	4,520,794	104
2			Comm/Gov/Ind	135,846	195,820	418,383	217,221	225,810	285,253	306,755	325,842	269,398	208,899	195,061	191,375	2,975,663	68
			Subtotal	425,911	554,279	723,071	507,642	598,579	750,733	753,376	933,961	700,113	524,509	508,411	515,872	7,496,457	172
	2021		Residential/ Multi	327,324	311,227	371,898	338,534	378,560	731,306	954,599	663,842	397,654	318,819	407,701	284,050	5,485,514	126
2			Comm/Gov/Ind	143,431	332,135	290,918	240,242	270,160	387,318	381,417	1,102,720	(474,665)	233,663	270,518	232,608	3,410,465	78
			Subtotal	470,755	643,362	662,816	578,776	648,720	1,118,624	1,336,016	1,766,562	(77,011)	552,482	678,219	516,658	8,895,979	204
	2023		Residential/ Multi	289,330	286,671	302,464	279,819	508,682	541,446	822,771	691,668	364,972	339,504	312,554	308,098	5,047,979	116
2			Comm/Gov/Ind	209,990	241,254	346,988	176,997	74,691	213,784	284,043	290,845	257,522	220,200	249,158	212,756	2,778,228	64
			Subtotal	499,320	527,925	649,452	456,816	583,373	755,230	1,106,814	982,513	622,494	559,704	561,712	520,854	7,826,207	180

Informaton provided in the 2012 Water System Plan included PSE usage in Comm/Gov/Ind

Information provided in the 2012 Water System Plan included PSE usage in Comm/Gov/Ind. Additional spreadsheet info included PSE usage. Values shown here include a deduct for PSE usage.

City of Sumas - 2023 Multi-Family Water Users List
Received November 14, 2024

2023 Multi-Family Water Users List			
#	**Property Owner**	**Street Address**	**2023 Usage**
1	Gimmaka, Melvin & Carol	316 Front St - House	17,249
2	Hillview Condos	1305 Boon Ave - Sprinklers	18,354
3	Hillview Condos	1305 Boon Ave - House 13	15,319
4	Hillview Condos	1305 Boon Ave - House 6	15,344
5	Hillview Condos	1305 Boon Ave - House 7	14,011
6	Hillview Condos	1305 Boon Ave - House 8	18,306
7	Hillview Condos	1305 Boon Ave- House 5	15,139
8	Hillview Condos	1305 Boon Ave - House 9	18,302
9	Hillview Condos	1305 Boon Ave - House 11	31,237
10	Hillview Condos	1305 Boon Ave - House 10	13,292
11	Hillview Condos	1305 Boon Ave - House 12	14,519
12	Josephson, Teresa	317 Columbia St - House	17,026
13	Scott, Randy	233 Front St	208
~~14~~	~~Whatcom Co. Housing Authority~~	~~408 Second St - Sumas Square~~	~~0~~
15	Standard Properties Corp	470 W Second St - House	24,850
16	Sytsma, Alan & Kimberly	330/332 Garfield St - House	7,882
17	Sytsma, Alan & Kimberly	340/342 Garfield St - House	9,130
18	Creekside Meadows	1400 Boon Ave - House	138,650
~~19~~	~~Creekside Meadows~~	~~1400 Boon Ave - Sprinklers~~	~~1~~
20	Gonzalez, Roberto	229 Front St	2,834
21	DeJong, LLC	910/912 Sumas Ave	9,569
22	Hahn Properties	346 Front St - House	16,691
23	Hahn Properties	322 Front St - House	17,336
24	Hahn Properties	334 Front St - House	13,019
25	Hoy, Bradley	207 Morton St	3,178
26	Hoy, Bradley	209 Morton St	3,198
27	Hoy, Bradley	227 Morton St	1,795
28	Hoy, Bradley	217 Morton St	5,876
29	Jones, Clayton	550 Front St - A & B	12,412
30	Vande Vegte Family Trust	412 Front St - House	23,918
31	Vande Vegte Family Trust	408 Front St	17,836
32	Vande Vegte Family Trust	404 Front St	28,521
33	Murdzia, Mark	320/322 Garfield St	16,068
34	Harder, Shelley	310/312 Garfield St	26,556
35	Roosma, Brennan & Annaleisa	540 Second St - Building C	18,232
36	McMillan, Brent	341 Cleveland Ave A & B	5,375
37	Maan, Harjot	570 Front St	57
38	Maan, Harjot	590 Front St	280
39	Dhami, Varinder	530 Front St	24,811
40	Joshi, Bhushan	510 Front St	13,633
41	Lakeway Ventures LLC	1205 Boon Ave #122	6,806
42	Lakeway Ventures LLC	1205 Boon Ave #124	4,325
43	Lakeway Ventures LLC	1205 Boon Ave #221	3,784
44	Lakeway Ventures LLC	1205 Boon Ave #222	6,032
45	Serenity Rentals	124 Mitchell Ave	9,732
46	Mack, Brendan	136 First St	12,093
47	Flagship Holdings	130 Garfield St/Sunrise Apts	50,070
~~48~~	~~Tank n Tote~~	~~608 Cherry St - Unit D~~	~~0~~
49	James, Gertrude	540 Second St - Building A	9,690
50	Kalsi, Balwant & Manjit	540 Second St - Building B	14,093
51	Woodell, Skyler Griffin, Gavin	1205 Boon Ave #423	1,363
52	Deleon, Adalia	1205 Boon Ave #322	3,553
53	Garrison, Hayley	1205 Boon Ave #422	2,057
54	Honeycutt, Austin and Bailey	1205 Boon Ave #123	2,497
55	Wallace, Terrance	380 Garfield St #203	1,177
56	Rabang, Joe and Risa	1205 Boon Ave #321	1,288
~~57~~	~~Atkinson, Kate and Brandon~~	~~380 Garfield St - House~~	~~1~~
Total			**778,575**

Active Connections: 57 - 4 = 53

City of Sumas - 2023 Multi-Family Water Users List - PHDs

1 ERU = 200 GPD

#	Property Owner	Street Address	2023 Usage (cubic feet)	ADD (gal/day)	# of ERUs Based on Usage	# of ERUs Based on Usage	# of Units	Adjusted # of ERUs	Node	Node Total
1	Mack, Brendan	136 First St	12,093	248	1.2	2	2	1.1	J-666	1.1
2	Horizon Homes NW Inc.	200 Front St					2	1.1	J-744	1.1
	Gonzalez, Roberto	229 Front St	2,834	58	0.3					
	Scott, Randy	233 Front St	208	4	0.0					
3	Gimmaka, Melvin & Carol	316 Front St - House	17,249	353	1.8	2	4	2.2	J-541	
4	Hahn Properties	322 Front St - House	17,336	355	1.8	2	4	2.2	J-541	
5	Hahn Properties	334 Front St - House	13,019	267	1.3	2	4	2.2	J-541	8.8
6	Hahn Properties	346 Front St - House	16,691	342	1.7	2	4	2.2	J-541	
7	Vande Vegte Family Trust	404 Front St	28,521	584	2.9	4	4	2.2	J-543	
8	Vande Vegte Family Trust	408 Front St	17,836	366	1.8	2	4	2.2	J-543	6.6
9	Vande Vegte Family Trust	412 Front St - House	23,918	490	2.5	3	4	2.2	J-543	
10	Joshi, Bhushan	510 Front St	13,633	279	1.4	2	2	1.1	J-582	
11	Dhami, Varinder	530 Front St	24,811	508	2.5	3	3	1.7	J-582	3.9
12	Jones, Clayton	550 Front St - A & B	12,412	254	1.3	2	2	1.1	J-582	
13	Maan, Harjot	570 Front St	57	1	0.0		4	2.2	J-583	
14	Maan, Harjot	590 Front St	280	6	0.0		4	2.2	J-583	4.4
15	Lakeway Ventures LLC	1205 Boon Ave #122	6,806	139	0.7					
16	Honeycutt, Austin and Bailey	1205 Boon Ave #123	2,497	51	0.3					
17	Lakeway Ventures LLC	1205 Boon Ave #124	4,325	89	0.4					
18	Lakeway Ventures LLC	1205 Boon Ave #221	3,784	78	0.4					
19	Lakeway Ventures LLC	1205 Boon Ave #222	6,032	124	0.6	3.2	16	8.9	J-526	8.9
20	Rabang, Joe and Risa	1205 Boon Ave #321	1,288	26	0.1					
21	Deleon, Adalia	1205 Boon Ave #322	3,553	73	0.4					
22	Garrison, Hayley	1205 Boon Ave #422	2,057	42	0.2					
23	Woodell, Skyler Griffin, Gavin	1205 Boon Ave #423	1,363	28	0.1					
24	Hillview Condos	1305 Boon Ave- House 5	15,139	310	1.6					
25	Hillview Condos	1305 Boon Ave - House 6	15,344	314	1.6					
26	Hillview Condos	1305 Boon Ave - House 7	14,011	287	1.4					
27	Hillview Condos	1305 Boon Ave - House 8	18,306	375	1.9					
28	Hillview Condos	1305 Boon Ave - House 9	18,302	375	1.9					
29	Hillview Condos	1305 Boon Ave - House 10	13,292	272	1.4					
30	Hillview Condos	1305 Boon Ave - House 11	31,237	640	3.2					
31	Hillview Condos	1305 Boon Ave - House 12	14,519	298	1.5	17.8	18	22.0	J-537	22.0
32	Hillview Condos	1305 Boon Ave - House 13	15,319	314	1.6					
33	Hillview Condos	1305 Boon Ave - Sprinklers	18,354	376	1.9					
34	Creekside Meadows	1400 Boon Ave - House	138,650	2841	14.2	14.2	20	18.0	J-535	18.0
	Creekside Meadows	1400 Boon Ave - Sprinklers	1	0	0.0					
35	Hoy, Bradley	207 Morton St	3,178	65	0.3		2	1.1	J-747	
36	Hoy, Bradley	209 Morton St	3,198	66	0.3		2	1.1	J-747	
37	Hoy, Bradley	217 Morton St	5,876	120	0.6		2	1.1	J-747	4.4
38	Hoy, Bradley	227 Morton St	1,795	37	0.2		2	1.1	J-747	
39	Serenity Rentals	124 Mitchell Ave	9,732	199	1.0	2	4	2.2	J-712	2.2
40	Flagship Holdings	130 Garfield St/Sunrise Apts	50,070	1026	5.1	6	6	6.0	J-633	6.0
41	Harder, Shelley	310/312 Garfield St	26,556	544	2.7	3	3	1.7	J-637	
42	Murdzia, Mark	320/322 Garfield St	16,068	329	1.6	2	2	1.1	J-637	
43	Sytsma, Alan & Kimberly	330/332 Garfield St - House	7,882	162	0.8		1	0.6	J-637	4.0
44	Sytsma, Alan & Kimberly	340/342 Garfield St - House	9,130	187	0.9		1	0.6	J-637	
45	Atkinson, Kate and Brandon	380 Garfield St - House	1	0	0.0		4	2.2	J-638	2.2
	Wallace, Terrance	380 Garfield St #203	1,177	24	0.1					
	McMillan, Brent	341 Cleveland Ave A & B	5,375	110	0.6					
46	Josephson, Teresa	317 Columbia St - House	17,026	349	1.7	2	1	0.6	J-706	0.6
	Whatcom Co. Housing Authority	408 Second St - Sumas Square	0	0	0.0					
47	Standard Properties Corp	470 W Second St - House	24,850	509	2.5	3	3	1.7	J-130	1.7
48	James, Gertrude	540 Second St - Building A	9,690	199	1.0		2	1.1	J-674	
49	Kalsi, Balwant & Manjit	540 Second St - Building B	14,093	289	1.4		2	1.1	J-674	3.3
50	Roosma, Brennan & Annaleisa	540 Second St - Building C	18,232	374	1.9	2	2	1.1	J-674	
51	DeJong, LLC	910/912 Sumas Ave	9,569	196	1.0		2	1.1	J-709	1.1
52	Ricky Shoker	1039 Sumas Ave					4	2.2	J-749	2.2
	Tank n Tote	608 Cherry St - Unit D	0	0	0.0					
Total			**778,575**	**15,955**	**80**	**81**	**146**	**102.5**		**102.5**

0.55662

August 28, 2025
P:\S\SUMS0002\0600INFO\Water\Water Usage Data\[2023 Multi-Family Users List.xlsx]Sorted

SUMS0002: City of Sumas Water Plan Update
Received 11-12-2024

Notes:

2023 Commercial/ Government/ Industrial Water Users			
#	Account Name	Street Address	Fiscal Water Usage (Cubic Feet)
1	Anker Trucking	1002 Johnson Ave	2,770
2	Arrow Reload Washington Inc	300 Bob Mitchell Ave	1,725
3	BJ's Towing	120 Third St	623
4	BNSF Railway Co		7,270
5	Bob's Burger & Brew	819 Cherry St	87,650
6	Boomtown	1015 Cherry St	87,218
7	Bosch Customs Brokerage	121 Garfield St	38
8	Canyon Industries	901-B W Front St	1,141
9	Cherry Street Market	725 Cherry St	14,283
10	City of Sumas	114 Second St	7,269
11	City of Sumas	461 Second St	3,196
12	City of Sumas	135 Third St	46,792
13	City of Sumas	399 Frost Rodeo Dr	6,235
14	City of Sumas	1550 Cherry St	25,410
15	City of Sumas	399 Frost Rodeo Dr	106,533
16	City of Sumas	135 Noble St	10,172
17	City of Sumas - City Hall	433 Cherry St	4,685
18	City of Sumas - Rodeo Grounds	1550 Cherry St	3,369
19	Class A Bodyworks	240 W Third St	1,456
20	Dansco Corp	315 Cherry St	5,118
21	DRS Northwest	901 W Front St	4,227
22	Duty Free Americas	108 Harrison Ave	5,186
23	Edaleen Dairy	908 Cherry St	8,130
24	El Nopal Restaurant	625 Cherry St	39,380
25	Epl Feed	411 W Front St	352,997
26	Fire District #14	143 Columbia St	8,092
27	General Services Administration	145 Cherry St	24,990
28	IKO Pacific	850 W Front St	1,000,021
29	Interfor Cedarprime Inc	601-C W Front St	15,280
30	Italian Motors USA	529 W Front St	15,441
31	La Gloria Store Inc	444 Cherry St	8,267
32	Larsen, Erik	910 W Front St	1,065
33	Lopez, Aaron	131 Garfield St	1,675
34	Maple Falls Liquor Inc	377 Second St	68
35	Martins Feed Inc	191 W Front St	6,357
36	Mazdak International Group	410 W Third St	1,946
37	Mountain Holdings LLC	446 Harrison Ave	9,943
38	Mountain View Reload	300 Bob Mitchell Ave	8,891
39	Nooksack School District #506	1024 Lawson St	15,186
40	Nori Sushi & Teriyaki	520 Cherry St	13,051
41	Northwest Fiber LLC DBA Ziply Fiber	223 Garfield St	238
42	Pacific Quest Inc.	377 W Second St	88
43	Pacific Rim Properties Inc	311 Bob Mitchell Ave	3,109
44	Package Express	115 Garfield St	1,433
45	Peregrine Property Holdings LLC	120 Vancouver St	2,269
46	Pham, Khanh	601 Cherry St, 603 Cherry St	13,553
47	Postma, Natalie	120 Front St	3,803
48	Rameshwar Mahadev Hindu Temple	112 Columbia St	8
49	Sarbanand Farms LLC	120 Front St	75
50	Ship Happens Inc.	115 First St	1,397
51	Singh, Hakam	534 Cherry St	17,277
52	Sumas Advent Christian Church	125 Front St	1,577
53	Sumas Christian Reformed Church	700 Sumas Ave	1,112
54	Sumas Connection LLC	233 Cherry St	2,757
55	Sumas Drug Store	1143 Cherry St	1,254
56	Socco Forest Products	601 W Front St	34,742
57	Sumas Investment	121 Cleveland Ave	76,116
58	Sumas Investment	340 Cherry St	15,450
59	Sumas Legion Post #212	134 Harrison Ave	1,527
60	Sumas Market	944 Cherry St	4,453
61	Sumas NAPA & Repair	120 Third St	4,195
62	Sumas Professional Building LLC	617 Cherry St	16,036
63	Sumas RV Park & Campground	9600 Easterbrook Rd	117,780
64	Tank n Tote	608 Cherry St	1,440
65	Teal Jones Lumber	200 Bob Mitchell Ave	384,453
66	TNT Machining	285 W Garfield St	4,023
67	TRC, LLC	819 Cherry St	7,060
68	TRMC Retail LLC	208 Cherry St	47,383
69	United Letterlock Group	726 Cherry St	3,541
70	US Customs & Border Protection	9648 Garrison Rd	27,430
71	US Post Office	534 Railroad Ave	2,872
72	Valiente, Claudio & Beverly	481 W Front St	4,802
73	Valley Plumbing & Electric	910 W Front St	115
74	VanDiest, Rich	207 W Second St	1,795
75	Wagner, Andrew & Marie	135 Garfield St	6,722
76	Whatcom Couty Parks Department	461 Second St	3,196
77	Valley Community Church	415 Cherry St	1
		TOTAL	**2,778,228**

	Account Name	Street Address	Water Usage (Cubic Feet)	ADD (gpd)	2*ADD (gpd)	MDD (gpm)	2.0*MDD (gpm)	18 year Avg. (gpm)	NODE
	IKO Pacific	850 W Front St	1,000,021	20,494	40,987	28.46	57		
	Teal Jones Lumber	301 Bob Mitchell Ave	384,453	7,879	15,757	10.94	22		
	EPL Feed	411 W Front St	352,997	7,234	14,468	10.05	20		
	Sumas RV Park & Campground	9600 Easterbrook Rd	117,780	2,414	4,827	3.35	7		
	City of Sumas - Howard Bowen Park	399 Frost Rodeo Dr	112,768	2,311	4,622	3.21	6		
	Bob's Burger & Brew	819 Cherry St	87,650	1,796	3,592	2.49	5		
	Boomtown	1015 Cherry St	87,218	1,787	3,575	2.48	5		
	Sumas Investment	121 Cleveland Ave	76,116	1,560	3,120	2.17	4		
	TRMC Retail LLC	208 Cherry St	47,383	971	1,942	1.35	3		
	City of Sumas - Third St Park	135 Third St	46,792	959	1,918	1.33	3		
	El Nopal Restaurant	625 Cherry St	39,380	807	1,614	1.12	2		
	Socco Forest Products	601 W Front St	34,742	712	1,424	0.99	2		
	City of Sumas - Rodeo Grounds	1550 Cherry St	28,779	590	1,180	0.82	2		
	US Customs & Border Protection	9648 Garrison Rd	27,430	562	1,124	0.78	2		
15	General Services Administration	145 Cherry St	24,990	512	1,024	0.71	1		
	TOTAL		2,468,499	50,587	101,175	70.26	141		

ADD: Annual Daily Demand
MDD: Maximum Daily Demand
PHD: Peak Hourly Demand

1 Source is 2012 Water Comp Plan, Section 2.1, pages 2-2 thru 2-13
Source is 9/20/2024 spreadsheet provided by City of Sumas =>P:\S\SUMS0002\0800REC\810 Incoming\City of Sumas\[2024-09-20 Sumas Water Use Data 2011-2023.xlsx]Total Water Usage w.o. PSE

WHOLESALE USERS MONTHLY WATER USE (Cubic Feet)

	Source		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	cubic feet	acre-ft
1993	1	Nooksack													3,665,689	84
	1	NVWA													14,921,076	343
	1	SRWA													18,354,093	421
1994	1	Nooksack													3,284,007	75
	1	NVWA													16,690,760	383
	1	SRWA													17,729,333	407
1995	1	Nooksack													3,530,886	81
	1	NVWA													17,866,067	410
	1	SRWA													18,746,622	430
1996	1	Nooksack													3,872,274	89
	1	NVWA													17,434,314	400
	1	SRWA													17,113,201	393
1997	1	Nooksack													3,530,148	81
	1	NVWA													18,084,322	415
	1	SRWA													17,255,999	396
1998	1	Nooksack													3,877,227	89
	1	NVWA													17,336,067	398
	1	SRWA													17,566,401	403
2003	1	Nooksack	261,904	238,924	277,611	257,173	277,099	365,836	425,748	405,300	343,356	262,351	225,655	309,930	3,650,887	84
	1	NVWA	1,642,113	1,550,076	1,511,189	1,745,997	1,654,571	2,101,514	3,256,102	3,546,600	1,582,423	1,751,029	1,762,045	1,631,880	23,735,539	545
	1	SRWA	1,279,496	1,114,164	1,305,067	1,284,298	1,590,864	1,675,180	1,757,180	1,759,230	1,607,070	1,465,650	1,395,001	1,509,223	17,742,423	407
				2,903,164	3,093,867	3,287,468	3,522,534	4,142,530	5,439,030	5,711,130	3,532,849	3,479,030	3,382,701	3,451,033	45,128,849	1,036

1 Source is 2012 Water Comp Plan, Section 2.1, pages 2-2 thru 2-13
Source is 9/20/2024 spreadsheet provided by City of Sumas =>P:\S\SUMS0002\0800REC\810 Incoming\City of Sumas\[2024-09-20 Sumas Water Use Data 2011-2023.xlsx]Total Water Usage w.o. PSE

WHOLESALE USERS MONTHLY WATER USE (Cubic Feet)

	Source		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	cubic feet	acre-ft
2004	1	Nooksack	302,008	237,217	285,713	279,715	286,992	380,654	463,507	477,827	255,664	236,027	218,860	298,219	3,722,403	85
	1	NVWA	1,745,548	1,689,713	1,604,330	1,767,175	1,834,387	1,980,131	2,521,890	2,291,092	1,817,687	1,891,256	1,845,200	1,705,956	22,694,365	521
	1	SRWA	1,535,197	1,391,909	1,563,956	1,433,171	1,573,298	1,708,101	1,999,838	1,930,710	1,493,096	1,909,227	1,284,903	1,308,000	19,131,406	439
				3,318,839	3,453,999	3,480,061	3,694,677	4,068,886	4,985,235	4,699,629	3,566,447	4,036,510	3,348,963	3,312,175	45,548,174	1,046
		Nooksack	289,762	244,592	251,078	245,862	309,903	293,214	368,974	477,693	292,758	254,001	246,068	243,237	3,517,142	81
	1	NVWA	1,864,006	1,756,278	1,844,952	1,840,048	2,027,257	2,059,425	2,212,166	2,684,997	1,814,342	1,852,529	1,753,572	1,913,783	23,623,355	542
	1	SRWA	1,621,609	1,283,162	1,380,050	1,262,599	1,421,990	1,345,208	1,492,919	1,767,082	1,247,610	1,312,848	1,261,200	1,288,507	16,684,784	383
				3,284,032	3,476,080	3,348,509	3,759,150	3,697,847	4,074,059	4,929,772	3,354,710	3,419,378	3,260,840	3,445,527	43,825,281	1,006
		Nooksack	281,029	231,747	267,852	280,509	318,932	331,592	500,835	437,982	292,535	311,155	263,344	271,571	3,789,083	87
	1	NVWA	1,551,631	1,687,453	1,876,498	1,615,031	1,936,168	1,956,108	2,454,775	2,481,348	1,765,925	2,012,285	1,794,216	2,126,169	23,257,607	534
	1	SRWA	1,233,767	1,207,460	1,479,857	1,252,659	1,605,959	1,433,577	1,798,736	1,775,437	1,584,909	1,513,221	1,324,944	1,414,751	17,625,277	405
				3,126,660	3,624,207	3,148,199	3,861,059	3,721,277	4,754,346	4,694,767	3,643,369	3,836,661	3,382,504	3,812,491	44,671,967	1,026
		Nooksack	332,473	276,209	290,511	309,030	360,268	344,330	486,407	465,627	425,408	276,697	245,447	241,206	4,053,613	93
	1	NVWA	2,001,657	1,495,711	1,817,109	1,783,920	1,965,136	1,999,360	2,155,503	2,400,773	1,853,492	1,859,823	1,880,373	1,856,074	23,068,931	530
	1	SRWA	1,322,349	1,043,800	1,282,451	1,157,456	1,189,016	1,250,272	1,478,590	1,670,650	1,274,868	1,200,651	1,189,240	1,159,736	15,219,079	349
				2,815,720	3,390,071	3,250,406	3,514,420	3,593,962	4,120,500	4,537,050	3,553,768	3,337,171	3,315,060	3,257,016	42,341,623	972
		Nooksack	285,195	249,280	265,365	269,051	294,452	360,241	525,182	370,521	320,076	300,545	292,956	318,141	3,851,005	88
	1	NVWA	2,041,484	1,804,830	1,809,455	1,951,719	2,120,328	2,005,749	2,395,754	2,088,239	1,948,394	1,981,535	1,740,964	2,158,809	24,047,260	552
	1	SRWA	1,160,298	964,117	1,023,952	1,064,561	1,178,884	1,199,744	1,552,252	1,405,006	1,289,850	1,163,670	757,022	1,145,751	13,905,107	319
				3,018,227	3,098,772	3,285,331	3,593,664	3,565,734	4,473,188	3,863,766	3,558,320	3,445,750	2,790,942	3,622,701	41,803,372	960
		Nooksack	286,223	294,870	282,504	284,277	304,765	484,310	515,173	336,319	286,167	224,450	269,751	287,957	3,856,766	89
	1	NVWA	1,886,857	1,791,370	2,303,636	1,571,753	1,591,515	1,946,720	2,257,947	2,214,381	1,605,493	1,685,590	1,541,649	1,563,513	21,960,424	504
	1	SRWA	1,109,314	951,829	1,099,157	1,092,462	1,092,149	1,437,709	1,604,594	1,681,364	1,237,512	1,239,132	1,153,759	1,114,419	14,813,400	340
				3,038,069	3,685,297	2,948,492	2,988,429	3,868,739	4,377,714	4,232,064	3,129,172	3,149,172	2,965,159	2,965,889	40,630,590	933
		Nooksack	285,257	335,469	322,769	293,721	335,225	349,631	378,336	543,622	405,384	289,235	369,532	293,190	4,201,371	96
	2	NVWA	1,421,203	1,252,831	1,544,091	1,461,049	1,569,115	1,573,699	1,957,664	2,045,128	1,744,546	1,590,875	1,346,838	1,474,310	18,981,349	436
	2	SRWA	1,060,751	1,336,096	1,080,695	1,189,208	1,308,531	1,284,733	1,231,602	1,566,748	1,419,740	1,158,692	1,075,535	1,078,710	14,791,041	340
				2,924,396	2,947,555	2,943,978	3,212,871	3,208,063	3,567,602	4,155,498	3,569,670	3,038,802	2,791,905	2,846,210	37,973,761	872

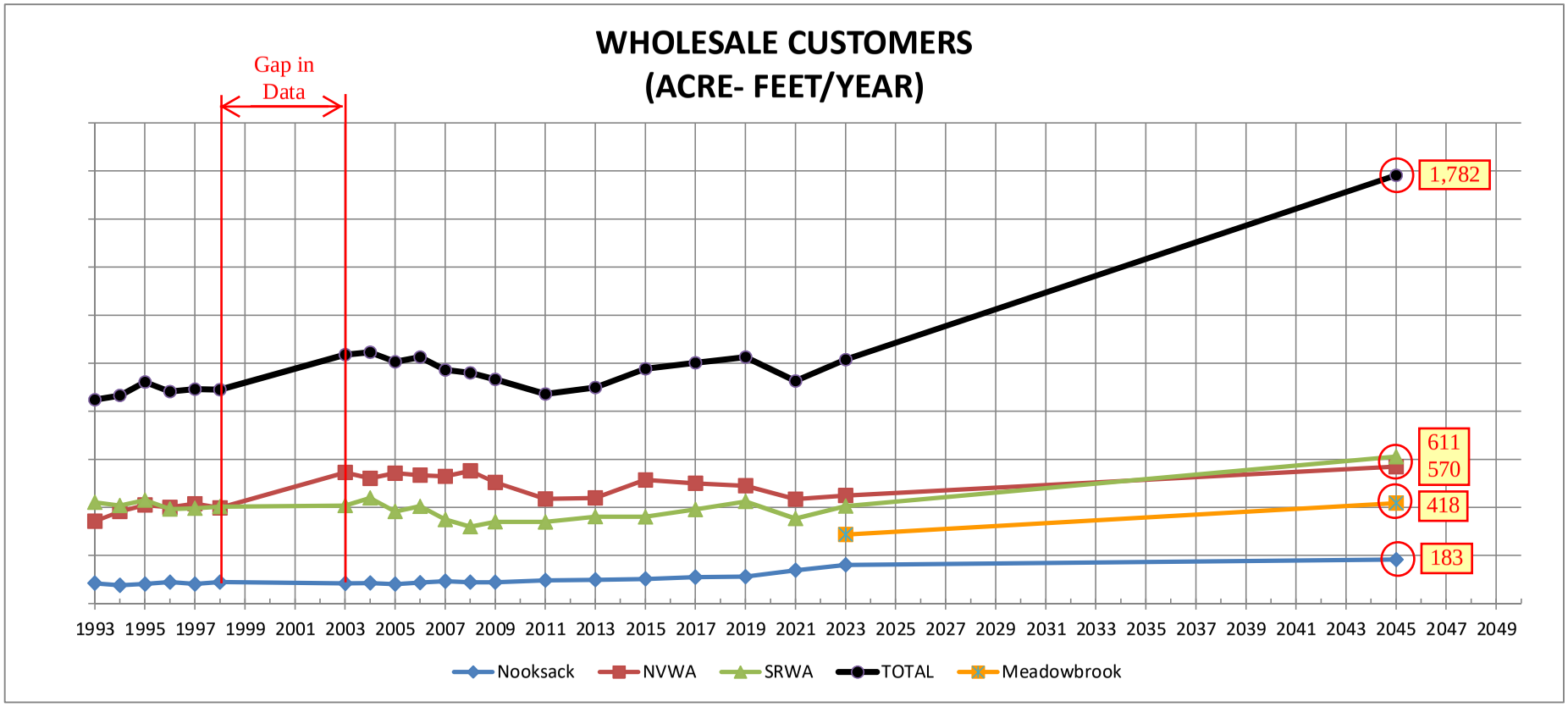
1 Source is 2012 Water Comp Plan, Section 2.1, pages 2-2 thru 2-13
Source is 9/20/2024 spreadsheet provided by City of Sumas =>P:\S\SUMS0002\0800REC\810 Incoming\City of Sumas\[2024-09-20 Sumas Water Use Data 2011-2023.xlsx]Total Water Usage w.o. PSE

WHOLESALE USERS MONTHLY WATER USE (Cubic Feet)

	Source		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	cubic feet	acre-ft
		Nooksack	325,407	256,658	271,140	314,256	312,932	298,207	606,590	434,519	361,436	365,350	341,670	389,789	4,277,954	98
	2	NVWA	1,465,383	1,415,742	1,466,980	1,600,314	1,680,938	1,655,463	2,347,400	1,956,961	1,546,204	1,293,100	1,309,150	1,393,131	19,130,766	439
	2	SRWA	1,295,071	1,207,926	1,324,088	1,388,109	1,433,254	1,188,733	1,743,614	1,547,972	1,194,846	1,215,644	1,120,885	1,096,948	15,757,090	362
				2,880,326	3,062,208	3,302,679	3,427,124	3,142,403	4,697,604	3,939,452	3,102,486	2,874,094	2,771,705	2,879,868	39,165,810	899
		Nooksack	297,277	290,542	314,795	312,007	336,963	608,765	580,434	476,866	340,771	287,744	318,158	284,238	4,448,560	102
	2	NVWA	1,684,103	1,407,278	1,655,255	1,631,163	1,897,787	2,467,125	2,522,646	2,325,454	1,812,419	1,656,766	1,668,482	1,661,272	22,389,750	514
	2	SRWA	1,002,480	945,305	1,027,727	1,017,386	1,185,153	1,701,803	1,920,179	1,802,487	1,491,749	1,235,827	1,253,076	1,130,431	15,713,603	361
				2,643,125	2,997,777	2,960,556	3,419,903	4,777,693	5,023,259	4,604,807	3,644,939	3,180,337	3,239,716	3,075,941	42,551,913	977
		Nooksack	363,168	299,512	301,180	327,846	401,952	439,503	843,142	446,444	396,135	349,813	324,156	302,443	4,795,294	110
	2	NVWA	1,732,792	1,535,148	1,547,840	1,637,784	1,759,042	1,909,087	2,365,438	2,682,096	2,040,825	1,498,427	1,498,804	1,565,577	21,772,860	500
	2	SRWA	1,290,009	1,057,033	1,087,215	1,093,431	1,252,693	1,479,161	1,977,090	2,077,074	1,849,605	1,421,695	1,294,295	1,173,626	17,052,927	391
				2,891,693	2,936,235	3,059,061	3,413,687	3,827,751	5,185,670	5,205,614	4,286,565	3,269,935	3,117,255	3,041,646	43,621,081	1,001
		Nooksack	366,070	321,826	343,361	369,814	448,295	494,935	602,706	559,063	393,447	384,916	166,828	408,466	4,859,727	112
	2	NVWA	1,485,720	1,623,194	1,734,139	1,493,516	1,944,435	2,275,365	2,023,364	2,204,897	1,785,013	1,622,084	1,448,332	1,709,554	21,349,613	490
	2	SRWA	1,353,875	1,419,468	1,498,001	1,413,835	1,649,126	1,815,675	1,806,896	1,986,106	1,604,750	1,318,571	1,224,378	1,371,489	18,462,170	424
				3,364,488	3,575,501	3,277,165	4,041,856	4,585,975	4,432,966	4,750,066	3,783,210	3,325,571	2,839,538	3,489,509	44,671,510	1,026
		Nooksack	363,071	327,719	496,172	429,746	428,169	704,549	905,682	711,107	432,834	390,919	493,052	332,072	6,015,092	138
	2	NVWA	1,331,259	1,488,521	1,505,808	1,525,314	1,519,801	1,372,531	2,471,468	1,798,403	1,760,916	1,330,231	1,718,948	1,081,558	18,904,758	434
	2	SRWA	1,032,195	1,042,933	1,157,067	1,142,268	1,210,894	1,583,048	2,001,926	1,607,670	1,378,179	1,041,330	1,364,217	836,407	15,398,134	353
				2,859,173	3,159,047	3,097,328	3,158,864	3,660,128	5,379,076	4,117,180	3,571,929	2,762,480	3,576,217	2,250,037	40,317,984	926
		Nooksack	440,567	375,983	428,354	394,946	623,375	615,768	456,221	1,779,441	513,888	473,546	446,633	438,756	6,987,478	160
	2	NVWA	1,846,883	1,463,397	1,571,096	1,345,434	1,976,325	1,897,462	2,983,409	1,226,219	1,505,022	1,394,894	1,201,747	1,162,284	19,574,172	449
	2	SRWA	1,459,006	1,261,130	1,420,256	1,246,434	1,582,318	1,575,897	2,157,442	1,893,852	1,337,237	1,378,570	1,199,019	1,143,278	17,654,439	405
				3,100,510	3,419,706	2,986,814	4,182,018	4,089,127	5,597,072	4,899,512	3,356,147	3,247,010	2,847,399	2,744,318	44,216,089	1,015

City of Sumas 2025 Water Comprehensive Plan Update

Wholesale Customers Annual Water Consumption



January	176,179	42,510	394,400	95,165	344,176	83,046	439,120	105,955	
February	157,235	42,004	504,000	134,640	335,973	89,753	422,260	112,804	
March	176,927	42,691	533,150	128,644	335,944	81,060	451,980	109,058	
April	156,203	38,947	529,360	131,987	310,922	77,523	417,350	104,059	
May	163,553	39,464	612,900	147,887	381,313	92,007	491,360	118,560	
June	175,792	43,831	633,800	158,027	477,323	119,013	528,760	131,837	
July	158,839	38,326	621,630	149,993	508,527	122,703	517,900	124,964	
August	181,826	43,873	716,520	172,889	551,760	133,134	536,000	129,332	
September	196,228	48,926	441,390	110,053	459,232	114,502	507,900	126,636	
October	218,730	52,777	301,130	72,660	310,381	74,892	488,330	117,829	
November	157,147	39,182	255,510	63,707	420,921	104,950	390,800	97,439	
December	199,799	48,210	336,490	81,192	357,178	86,184	496,570	119,818	
TOTAL	2,118,458	43,414	5,880,280	120,505	4,793,650	98,237	5,688,330	116,572	18,480,718
	11%		32%		26%		31%		100%

Intertie Locations	Node #	2019 Year Total (FT^3)	Average Daily Demand (GPD)	(2.0 * ADD) Max Daily Demand (GPD)	MDD (GPM)
	J-1	2,118,458	43,414	86,828	60
	J-2	5,880,280	120,505	241,011	167
	J-3	4,793,650	98,237	196,474	136
(SR9/Easterbrook)	J-4	5,688,330	116,572	233,144	162

City of Sumas - 2023 Master Meter Readings at the SRWA Interties

2023	Jones Road		Rock Road		Hovel Road		Ball Park		TOTAL
	Monthly Total (cf)	Daily Average gal/day	Monthly Total (cf)	Daily Average gal/day	Monthly Total (cf)	Daily Average gal/day	Monthly Total (cf)	Daily Average gal/day	ft3
January	201,916	48,720	820,810	198,054	179,370	43,280	256,910	61,990	
February	180,989	48,350	696,650	186,105	157,831	42,163	225,660	60,283	
March	194,916	47,031	762,850	184,068	198,420	47,877	264,070	63,718	
April	168,869	42,105	617,180	153,884	206,725	51,543	253,660	63,246	
May	170,964	41,252	842,170	203,207	242,304	58,466	326,880	78,873	
June	154,507	38,524	869,710	216,848	232,590	57,992	319,090	79,560	
July	207,007	49,949	1,115,150	269,075	399,905	96,493	435,380	105,053	
August	145,321	35,065	621,490	149,960	693,091	167,236	433,950	104,708	
September	144,553	36,042	395,170	98,529	449,314	112,029	348,200	86,818	
October	195,910	47,271	325,600	78,564	463,080	111,737	393,980	95,064	
November	193,004	48,122	265,950	66,310	387,545	96,628	352,520	87,895	
December	155,742	37,579	500,490	120,763	222,726	53,742	264,320	63,778	
TOTAL	2,113,698	43,316	7,833,220	160,527	3,832,901	78,548	3,874,620	79,403	17,654,439
	12%		44%		22%		22%		100%

Chapter 2, Appendix 2-14

Gmail

Mike DiSpigno <mike@cascadecivil.com>

Re: Sumas Water System Plan Update

1 message

Carson Cortez <CCortez@cityofsumas.com> Mon, Apr 14, 2025 at 11:58 AM
To: Mike DiSpigno <mike@cascadecivil.com>
Cc: Sunny Aulakh <SAulakh@cityofsumas.com>, Rollin Harper <rollinh@sehome.com>

Hi Mike,

After a discussion with Rollin regarding housing units and people per household rates, we've decided to make it simple for the purpose of this water system plan and use OFM's estimated 2023 Sumas people per household rate of 2.69. Using that rate with a population growth of 1,000 people over 22 years gets you approximately 372 new homes by 2045.

Thank you,

Carson Cortez CFM
City Planner
City of Sumas
P.O. Box 9, 433 Cherry St.
Sumas, WA 98295
(360) 988 - 5711

2023 Population: 1,810
2024 Population: 1,835
2045 Population: 2,810
Annual Growth Rate 2.0%

CITY OF SUMAS
A GREAT PLACE TO LIVE AND DO BUSINESS

1. EXISTING CONDITION – 2023

1.1 TOTAL CONNECTIONS

Existing System: Information based on water meter records for 2023.

743 Total Connections

Single-Family Connections: **571**[1]

Multi-Family Connections: **64**[1] connections with **53**[2] active

Commercial/Government/Industrial Connections: 108 connections with **77**[3] individual users

TOTAL CONNECTIONS: 571+64+108 = 7431[4]

TOTAL USERS: 571+53+77 =701

1.2 AVERAGE DAILY DEMAND (ADD)

Total Annual Consumption 7,826,207 cubic feet[5]
180 acre-ft
160,384 gallons/day

Large Users Consumption (Defined as usage > 800 gpd MDD) => **15**
Annual Consumption (31%) 2,468,499 cubic feet[6]
50,587 gallons/day

Residential and Small Commercial Consumption
Defined as difference between Total Annual Consumption and 15 Large Users' consumption (< 800 gpd MDD)

Residential and Small Commercial Users => 701 - 15 = **686**

Annual Consumption (69%)
7,826,207 – 2,468,499 = 5,357,708 cubic feet
123 acre-ft
109,796 gallons/day

[1] See Chapter 2, Appendix 2-1
[2] See Chapter 2, Appendix 2-6
[3] See Chapter 2, Appendix 2-8
[4] See Chapter 2, Appendix 2-1
[5] See Chapter 2, Appendix 2-5
[6] See Chapter 2, Appendix 2-9

Average Daily Demand (ADD)

Total Annual Consumption => **2023 System ADD = 160,384 gpd**

$$\text{System ADD} = \left(160{,}384\,\frac{\text{gallons}}{\text{day}}\right)\left(\frac{1}{701\ \text{Total Users}}\right) = 229\ \frac{\text{gallons}}{\text{day} - \text{User}}$$

$$2023\ \text{Residential ADD} = \left(109{,}796\ \frac{\text{gallons}^{7}}{\text{day}}\right)\left(\frac{1}{686\ \ \text{Res} + \text{Comm. Users}}\right)\ = 160\,\frac{\text{gallons}}{\text{day} - \text{User}}$$

1.3 EQUIVALENT RESIDENTIAL UNITS (ERUS)

From 2023 Residential ADD: 1 ERU = 160 gallons/day

=> SEE HISTORICAL COMPARISON

COMPARISON WITH HISTORIC USAGE

From Chapter 2, Appendix 2-5, *City of Sumas Monthly Water Use*

City of Sumas Annual Water Consumption

Year	Residential (cubic feet)	Comm/Gov/Ind (cubic feet)	Total (cubic feet)	Total (gal/day)
2011	3,666,876	2,406,820	6,073,696	124,469
2013	3,998,794	2,568,066	6,566,860	134,576
2015	4,405,741	3,780,799	8,186,540	167,768
2017	5,598,716	2,868,904	8,467,620	173,528
2019	4,520,794	2,975,663	7,496,457	153,626
2021	5,485,514	3,410,465	8,895,979	182,307
2023	5,047,979	2,778,228	7,826,207	160,384
2011-2023 Average	**4,674,916**	**2,969,849**	**7,644,766**	**156,665**

Note Total Average Annual Consumption (at 7,644,766 cf) is slightly less than the 2023 consumption

[7] From Page 1: Annual Consumption minus 15 Large User's Consumption

Peak Annual Consumption (2021: 8,895,979) 8,895,979 cubic feet
204 acre-ft
182,307 gallons/day
14% increase over 2023

A review of historical data shows the following for Residential ADD:

Year	Useage[8] cf/yr	Residential Single & Multi-Family Connections[9] (ERUs)	gpd/ connection	2011 - 2023 gpd/ connection
1993	2,816,846	265	218	
1994	3,036,643	270	230	
1995	3,118,880	274	233	
1996	3,481,001	289	247	
1997	3,590,390	299	246	
1998	3,603,924	303	244	
2003	3,728,909	320	239	
2004	3,932,225	331	243	
2005	3,665,886	355	212	
2006	4,131,165	379	223	
2007	3,925,706	397	203	
2008	3,971,779			
2009	3,866,234			
2011	3,666,876	329	228	228
2013	3,998,794	421	195	195
2015	4,405,741	473	191	191
2017	5,598,716	521	220	220
2019	4,520,794	545	170	170
2021	5,485,514	598	188	188
2023	5,047,979	635	163	163
Average	3,979,700		216	194
Max	5,598,716	635	247	228
Min	2,816,846	265	163	163

Historically the average ERU values since 2011 is 194 gallons/day => **Say 200 gpd**

[8] See Chapter 2, Appendix 2-5
[9] See 2012 Water Plan for 1993 – 2007 values; see Chapter 2, Appendix 2-1 for 2011 – 2023 values (total of Single-Family + Multi-Family)

Equivalent Residential Units (ERUs)

**** USE THIS => From Residential ADD: 1 ERU = 200 gallons/day ****

ERUs for 2023 Large Users:

$$ERUs = \left(50{,}587\,\frac{gallons}{day}\right)\left(\frac{1}{200\ gpd/ERU}\right) = 253$$

Total ERUs in System: 686 + 253 = 939

1.4 AVERAGE DAILY DEMAND (ADD)/ERU: 2023

$$ADD = \left(2023\ Total\ Consumption\ (gpd)\right)\left(\frac{1}{Total\ \#\ of\ ERUs}\right)$$

$$ADD = \left(160{,}384\,\frac{gallons}{day}\right)\left(\frac{1}{939\ ERUs}\right) = 171\ gpd/ERU$$

1.5 MAXIMUM DAILY DEMAND (MDD): 2023

MDD = Peaking Factor * ADD

Daily meter readings for well pumps 4 and 5 (which supply water to combined Sumas and Sumas Rural Water Association systems) were last recorded in 2009 and are shown in Chapter 2, Appendix 2-4. From this information the annual average daily pumping volume is 55,100 cubic feet per day (412,000 gpd). Daily peaking pumping volumes are at approximately 100,000 cubic feet per day, or 1.8 times the annual average. (Note *2005 Daily Pumping Volumes*, has similar results.) Based on this information a 2.0 peaking factor is very conservative and will be used for this analysis.

MDD = Peaking Factor * ADD

= 2.0 *200 gpd/ERU = 400 gpd/ERU ($ERU_{MDD)}$

Note: the lower limit for ERU_{MDD} is 350 gallons/day/residential connection (WAC 246-290-221(4)). Therefore, use this 400 gpm.

MDD = 400 gpd/ERU (= ERU_{MDD})

$$2023\ Sumas\ System\ MDD = \left(400\,\frac{gallons}{day\ ERU}\right)\left(\frac{939\ \text{ERUs}}{1}\right)\left(\frac{1\ \text{day}}{1{,}440\ min}\right) = 261\ gpm$$

1.6 PEAK HOURLY DEMAND (PHD): 2023

(Reference: WSDOH Water System Design Manual, 2020, Equation 3-1, page 37)

Equation 3-1: Determine PHD

$$PHD = (ERU_{MDD} / 1440)\,[(C)(N) + F] + 18$$

Where	**PHD**	=	Peak Hourly Demand, total system (gallons per minute)
	C	=	Coefficient Associated with Ranges of ERUs
	N	=	Number of ERUs based on MDD
	F	=	Factor Associated with Ranges of ERUs
	ERU_{MDD}	=	Maximum Day Demand per ERU (gallons per day)

C and F are coefficients based the number of ERUs

Table 3-1

Number of ERUs (N)	C	F
15 – 50	3.0	0
51 – 100	2.5	25
101 – 250	2.0	75
251 – 500	1.8	125
> 500	1.6	225

-=> when N is greater than 501 ERUs: C = 1.6 and F = 225

ERU_{MDD} = 400 gpd
C = 1.6
N = 939 ERUs (Total ERUs in System)
F = 225

$$PHD = \left(400\,\frac{gpd}{1440}\right)(1.6 * 939 + 225) + 18 = 498\ gpm$$

2023 Sumas PHD = 498 gpm

1.7 ESTIMATION OF INSTANTANEOUS USAGE BASED ON ANNUAL USAGE (ANNUAL USAGE TO PHD RATIO)

Annual Usage: City of Sumas 2023 Usage: 180 acre-ft = 112 gpm

Instantaneous Usage = PHD = 498 gpm

$$\frac{\text{PHD}}{\text{Annual Uage}} = \left(498\frac{\text{gallons}}{\text{min}}\right)\left(\frac{\text{min}}{112\text{ gallons}}\right) = 4.4$$

Assume ~ 4.0 ratio

1.8 MDD/PHD RATIO FOR FIRE FLOW ANALYSIS

The KYPipe analysis is based on Peak Hour Demand (PHD). The Fire Flow Analysis allows a reduction in demands to Maximum Daily Demand (MDD) levels. A global reduction factor is used to reduce the node demands from a PHD demand to a MDD demand.

4.5.4 Step 4: Capacity Based on Distribution Facilities

Design engineers **must** use a hydraulic analysis when evaluating distribution system capacity (WAC 246-290-230(1)). In most cases, DOH will require a well-documented hydraulic model. We may accept manual calculations for some small, simple systems. Chapter 6 discusses transmission and distribution system design in detail.

Design engineers typically evaluate distribution systems under two conditions:

- Peak hour demand (PHD) (WAC 246-290-230(5))
- Maximum day demand (MDD) plus fire flow, if applicable (WAC 246-290-230(6))

Water System Design Manual
DOH 331-123, June 2020 90

Use a hydraulic analysis to determine whether the size of distribution system components can adequately provide residual pressure at the customer meter or property line according to the water system's adopted standards, or the following minimum residual pressures, whichever is greater:

- At least 30 psi for new water systems or additions to existing water systems under PHD conditions (WAC 246-290-230(5))
- At the approved design pressure, but not less than 20 psi, under PHD for existing systems (WAC 246-290-420(2))
- At least 20 psi under demands that include MDD and fire flow (WAC 246-290-230(6).

$$\frac{\text{2023 System MDD}}{\text{Sumas only PHD}} = \frac{261\ gpm}{498\ gpm} = 0.52$$

Global reduction factor of 0.52 is used for the Fire Flow Analysis in the system's PHD Model.

1.9 INTERTIE DEMAND TO SRWA

Monthly volumes at the four SRWA interties are recorded by the City at each of the four master meter – see Attachment 8A, *2023 Master Meter Readings at the SRWA Interties*, and Attachment 8B, *2019 Master Meter Readings at the SRWA Interties.* The table below summarizes the results and provides the estimated demand at each of the intertie locations.

Intertie Locations	Node #	2023 Year Total (FT^3)	Average Daily Demand (GPD)	(2.0 * ADD) Max Daily Demand (GPD)	2023 MDD (GPM)	2019 MDD (GPM)	Average Model Demand (GPM)	2045 MDD (GPM) 1.89% Annual Growth
Jones Rd.	J-1	2,113,698	43,316	86,633	60	60	60	91
Rock Rd.	J-2	7,833,220	160,527	321,055	223	167	195	294
Hovel Rd.	J-3	3,832,901	78,548	157,096	109	136	122	184
Ball Park (SR9/Easterbook)	J-4	3,874,620	79,403	158,806	110	162	136	205
SRWA TOTAL		**17,654,439**	**361,795**	**723,590**	**502**	**526**	513	774

SRWA 2023 Annual Usage 405 acre ft /year
SRWA 2019 Annual Usage 424 acre ft /year

Water Right Annual Usage	471	acre ft /year
Water Right Instantaneous Flow	500	gpm

2019 was the peak usage for SRWA in the last 10 years. For planning purposes, the average of the 2019 and 2023 usage is used for calculating the demand at each intertie location.

Total 2023 SRWA Peak Hourly Demand: 513 gpm

1.10 COMBINE SUMAS & SRWA PHD = 498 + 513 = 1,011 GPM

2. 20 YEAR FUTURE CONDITION - 2045

2.1 PROJECTED POPULATION GROWTH – 2045

Based on information from the Whatcom County Comprehensive Plan[10], the following table provides the current population, estimated future population, and annual growth rate in/to 2045. Based on City of Sumas planning information the estimated population will increase by 1,000 people by 2045[11]. Based on a people per household rate of 2.69, this equates to 372 new homes or 372 new ERUs.

		Population	
		6/18/2025 County Comp Plan Allocations for Special Districts by Growth Alternative	County Info Annual Growth Rate
City of Nooksack	2023	1,408	
	2045	2,385	2.42%
NVWA	2023	556	
	2045	782	1.56%
City of Sumas	2023	1,489	
	2045	2,493	2.37%
SRWA	2023	173	
	2045	261	1.89%
Meadowbrook	2023	216	
	2045	314	1.72%

2.2 TOTAL CONNECTIONS – 2045

Residential and Small Commercial Users

2023 Residential and Small Commercial Users => 686 (see page 1)

2045 Additional Users => 372

[10] See *Whatcom County Comprehensive Plan, Allocations for Special Districts by Growth Alternative*, prepared by Leland Consulting Group, June 18, 2025

[11] See Chapter 2, Appendix 2-14

2045 Total Users = 686 + 372 = 1,058 Users

Large Users

2023 Large User ERUs => 253 (see page 4)

2045 Large User ERUs (assume 2.0% annual growth) => $253(1+0.02)^{(2045-2023)}$ = 391 ERUs

2.3 EQUIVALENT RESIDENTIAL UNITS (ERUS) - 2045

2045 Total ERUs = 1,058 + 391 = 1,449 ERUs

2.4 AVERAGE DAILY DEMAND (ADD) - 2045

1 ERU = 200 gpd

System ADD = (1,449 ERUs) (200 gallons/day) = 289,800 gpd
= 14,141,310 cubic feet/year
= 324 acre-ft/year

SYSTEM ADD = 289,800 gpd = 324 acre-ft/year

Note: if 2.37% annual growth rate is used

System ADD	2023	180 acre-ft/year
	2045	with 2.37% annual growth rate => 301 acre-ft/year

2.5 MAXIMUM DAILY DEMAND (MDD) - 2045

MDD = 2.0 * ADD = 2.0 * 289,800 gpd = 579,600 gpd = 400 gpm

Note: the lower limit for ERU_{MDD} is 350 gallons/day/residential connection (WAC 246-290-221(4)). Therefore, use this 400 gpm.

MDD = 400 gpd/ERU (= ERU_{MDD})

$$2045\ Sumas\ System\ MDD = \left(400\frac{gallons}{day\ ERU}\right)\left(\frac{1{,}449\ \text{ERUs}}{1}\right)\left(\frac{1\ \text{day}}{1{,}440\ min}\right) = 402\ gpm$$

2.6 PEAK HOURLY DEMAND (PHD) - 2045

(Reference: WSDOH Water System Design Manual, 2020, Equation 3-1, page 37)

Equation 3-1: Determine PHD

$$PHD = (ERU_{MDD} / 1440)\,[(C)(N) + F] + 18$$

Where	**PHD**	=	Peak Hourly Demand, total system (gallons per minute)
	C	=	Coefficient Associated with Ranges of ERUs
	N	=	Number of ERUs based on MDD
	F	=	Factor Associated with Ranges of ERUs
	ERU_{MDD}	=	Maximum Day Demand per ERU (gallons per day)

C and F are coefficients based the number of ERUs

Table 3-1

Number of ERUs (N)	C	F
15 – 50	3.0	0
51 – 100	2.5	25
101 – 250	2.0	75
251 – 500	1.8	125
> 500	1.6	225

-=> when N is greater than 501 ERUs: C = 1.6 and F = 225

ERU_{MDD} = 400 gpd
C = 1.6
N = 1,449 ERUs (Total ERUs in System)
F = 225

$$PHD = \left(400\frac{gpd}{1440}\right)(1.6 * 1{,}449 + 225) + 18 = 724\ gpm$$

2045 Sumas PHD = 724 gpm

2.7 MDD/PHD RATIO FOR FIRE FLOW ANALYSIS

The KYPipe analysis is based on Peak Hour Demand (PHD). The Fire Flow Analysis allows a reduction in demands to Maximum Daily Demand (MDD) levels. A global reduction factor is used to reduce the node demands from a PHD demand to a MDD demand.

$$\frac{\text{2045 System MDD}}{\text{Sumas only PHD}} = \frac{402\ gpm}{724\ gpm} = 0.56$$

2.8 INTERTIE DEMAND TO SRWA - 2045

From the Whatcom County Comprehensive Plan, the SRWA annual growth rate is assumed to be 1.89%. PHD flow rates at the four interties are provided in the table below:

Intertie Locations	Node #	2023 Year Total (FT^3)	Average Daily Demand (GPD)	(2.0 * ADD) Max Daily Demand (GPD)	2023 MDD (GPM)	2019 MDD (GPM)	Average Model Demand (GPM)	2045 MDD (GPM) 1.89% Annual Growth
Jones Rd.	J-1	2,113,698	43,316	86,633	60	60	60	91
Rock Rd.	J-2	7,833,220	160,527	321,055	223	167	195	294
Hovel Rd.	J-3	3,832,901	78,548	157,096	109	136	122	184
Ball Park (SR9/Easterbook)	J-4	3,874,620	79,403	158,806	110	162	136	205
SRWA TOTAL		**17,654,439**	**361,795**	**723,590**	**502**	**526**	513	774

SRWA 2023 Annual Usage	405	acre ft /year
SRWA 2019 Annual Usage	424	acre ft /year
Water Right Annual Usage	471	acre ft /year
Water Right Instantaneous Flow	500	gpm

Total SRWA Peak Hourly Demand: 774 gpm

2.9 COMBINE SUMAS & SRWA PHD = 724 + 774 = 1,498 GPM

CASCADE
ENGINEERING GROUP, P.S., INC.

MEMORANDUM

DATE: July 30, 2025
TO: **File**

FROM: Michael DiSpigno
SUBJECT: **Sumas Water System Plan Update**
Sumas Rural Water Association - Water System Planning Information
PROJECT: SUMS0002
COPIES:

Telephone conversation notes from speaking with Del Heutink of the Sumas Rural Water Association (SRWA).

- SRWA is not currently working on an update to their water system plan.
- There has been a decrease in the number of dairies over the years but the remaining dairies have been getting larger. The overall dairy water usage has been about the same.
- The County's projected annual increase in population for SRWA until 2045 is 1.89%. Del believes this is a realistic projection for SRWA.

CASCADE
ENGINEERING GROUP, P.S., INC.

MEMORANDUM

DATE: August 8, 2025 and August 13, 2025
TO: **File**

FROM: Michael DiSpigno
SUBJECT: **Sumas Water System Plan Update**
Nooksack Valley Water Association Water System Planning Information
PROJECT: SUMS0002
COPIES: Dave Olson – Water System Services (via email)
Curt Schoenfelder – Wilson Engineering (via email)
Eric Hull – Wilson Engineering(via email)

August 8, 2025

Telephone conversation notes from speaking with Dave Olson at Water System Services. Dave is working on the Nooksack Valley Water Association (NVWA) water system plan update. The following are the summary points of this discussion:

- Dave and Wilson Engineering are currently working on an update to the association's water plan with anticipated completion in about one month.
- No significant changes to NVWA water system is anticipated over the next 20 years.
    - The current water right allocation is adequate for NVWA.
    - Instantaneous demand can stay at the current Sumas wellfield pumping capacity (Wellfield 1, 2, & 3; pumps 2 & #3R).
- Anticipated demand will stay the same.
    - Dairy/agriculture usage is expected to decline. No new diaries will be allowed and the current number of diaries is expected to decline over the years.
    - The decline in dairy use will allow water to be allocated to residential use with no overall net increase in usage.
    - Currently diaries use approximately 80% of the total usage with the remaining in residential usage.

August 13, 2025

As a follow up to my phone call with Dave on August 8, 2025, we had a video call meeting that included Dave, Curt Schoenfelder and Eric Hull of Wilson Engineering, and me at 9:00 AM today. The following are the summary points of this discussion:

- NVWA is responsible for the water system from the city of Sumas city limits to the City of Nooksack (Nooksack) city limits.

- NVWA and Nooksack (N&N) share three water reservoirs for a total of 700,000 gallons of storage ((1) 500k, and (2) 100k tanks all hydraulically connected to act together). The peak tank level fluctuations appear to be in the four foot range.

- Sumas provides water to their combined systems from the Sumas 1, 2, and 3 wellfield. 2012 Sumas Water Comp Plan says the maximum sustainable pumping rate at this wellfield is 500 gpm.

- N&N tank telemetry controls when the wellfield pumps are operating. Based on N&N records the peak pumping rate received is in the summer at about 800 gpm with both pumps operating.

- The design annual growth rate for the NRWA system is based on the old Whatcom County Comp Plan's 1.3% growth rate. With the anticipated decline in ag/dairy use, the growth rate is attributed to residential growth only. This results in an anticipated annual addition of 4 to 5 ERUs per year. The anticipate 20 year Annual Usage will be within the contract allocation of 569.6 acre-ft/year.

- The N&N contract allocations are as follows:

    - N&N Annual Usage: 768.6 acre-ft
        - NVWA Annual Usage: 569.6 acre-ft (74%)
        - Nooksack Annual Usage: 199 acre-ft (26%)

    - N&N Max. Instantaneous Flow Rate (Qi): 971.5 gpm
        - NVWA (Assumed Proportion at 74%): 720.0 gpm
        - Nooksack (R*emaining Rate)*: 251.5 gpm

    => NVWA needs to coordinate and confirm instantaneous flow rate distribution with Nooksack.

- In 2023/2024, the NVWA Qi is 610 gpm, with their estimated Peak Hourly Demand at 1,151 gpm. Equalizing storage in their tanks makes up the difference in flow rates.

- In their 20 year and long term (33 years - 2058) forecasts, NVWA maintain their Qi at or below 720 gpm. (2045 proportioned rate is 678 gpm.)

- Meadowbrook Water Association

    - Dept. of Ecology agreement allowed the Sumas water right withdrawal location to include the existing Meadowbrook wellfield (an additional point of withdrawal).

    - Agreement requires 18% of the water withdrawn to discharge into the adjacent creek as mitigation since creek levels were observed to drop when the pumps are in operation.

CASCADE
ENGINEERING GROUP, P.S., INC.

MEMORANDUM

DATE: August 8, 2025
TO: **File**

FROM: Michael DiSpigno
SUBJECT: **Sumas Water System Plan Update**
City of Nooksack Water System Planning Information
PROJECT: SUMS0002
COPIES:

Telephone conversation notes from speaking with Mike Bratt at Freeland and Associates. Mike is working on the City of Nooksack's water system plan update.

- Mike is currently working on an update to the city plan with anticipated completion in about one month.

- City annual historic use was typically in the 90-100 acre-ft per year range. There has been a rise in usage over the past few years.
  - 2020 – 116 acre-ft
  - 2023 – 140.1 acre-ft (a typically due to a lot of line flushing)

- 2023 information
  - 1,573 people
  - PHD => 323 gpm

- 2044 information
  - 2,568 people (info from Rollin Harper at Sehome Planning)
  - Projected annual usage => 183 acre-ft/year
  - PHD => 436 gpm

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u
	Residence Units		NVWA Maximum Daily Demand (gpd/ERU)	City Maximum Daily Demand (gpd/ERU)	NVWA Maximum Daily Demand (gpd)	City Maximum Daily Demand (gpd)	NVWA Peak Hourly Demand (gpm)	City Peak Hourly Demand (gpm)	City & NVWA Peak Hourly Demand (gpm)	Operational Storage (gal)	Equalizing Storage (gal)	Standby Storage (Minimum) (gal)	Standby Storage (Mulitple Sources) (gal)	Existing Storage						
2023	1,643	644	642	350	1,054,512	225,400	1,290	323	1,528	0	83,462	457,400	404,207	457,400	120,000	Yes	0	540,862	700,000	126
2024	1,229	658	715	350	879,000	230,300	1,151	329	1,342	0	55,636	377,400	239,857	377,400	120,000	Yes	0	433,036	700,000	129
2025	1,233	673	716	350	883,300	235,550	1,156	334	1,353	0	57,208	381,200	249,254	381,200	120,000	Yes	0	438,408	700,000	132
2026	1,237	687	718	350	887,600	240,450	1,161	340	1,363	0	58,725	384,800	258,301	384,800	120,000	Yes	0	443,525	700,000	135
2027	1,241	702	719	350	891,900	245,700	1,165	346	1,373	0	60,297	388,600	267,697	388,600	120,000	Yes	0	448,897	700,000	138
2028	1,245	716	720	350	896,200	250,600	1,170	351	1,384	0	61,815	392,200	276,744	392,200	120,000	Yes	0	454,015	700,000	140
2029	1,248	731	722	350	900,500	255,850	1,175	357	1,394	0	63,395	395,800	286,140	395,800	120,000	Yes	0	459,195	700,000	143
2030	1,252	745	723	350	904,800	260,750	1,180	362	1,404	0	64,913	399,400	295,187	399,400	120,000	Yes	0	464,313	700,000	146
2031	1,256	760	724	350	909,100	266,000	1,185	368	1,415	0	66,486	403,200	304,583	403,200	120,000	Yes	0	469,686	700,000	149
2032	1,260	774	725	350	913,400	270,900	1,189	374	1,425	0	68,005	406,800	313,630	406,800	120,000	Yes	0	474,805	700,000	152
2033	1,265	789	725	350	917,700	276,150	1,194	380	1,435	0	69,573	410,800	323,027	410,800	120,000	Yes	0	480,373	700,000	155
2034	1,269	803	727	350	922,000	281,050	1,199	385	1,445	0	71,092	414,400	332,073	414,400	120,000	Yes	0	485,492	700,000	157
2035	1,273	817	728	350	926,300	285,950	1,204	390	1,456	0	72,611	418,000	341,120	418,000	120,000	Yes	0	490,611	700,000	160
2036	1,277	832	729	350	930,600	291,200	1,209	396	1,466	0	74,186	421,800	350,516	421,800	120,000	Yes	0	495,986	700,000	163
2037	1,281	846	730	350	934,900	296,100	1,213	402	1,476	0	75,706	425,400	359,563	425,400	120,000	Yes	0	501,106	700,000	166
2038	1,286	861	730	350	939,200	301,350	1,218	408	1,487	0	77,276	429,400	368,959	429,400	120,000	Yes	0	506,676	700,000	169
2039	1,290	875	731	350	943,500	306,250	1,223	413	1,497	0	78,796	433,000	378,006	433,000	120,000	Yes	0	511,796	700,000	172
2040	1,295	890	732	350	947,800	311,500	1,228	419	1,507	0	80,366	437,000	387,403	437,000	120,000	Yes	0	517,366	700,000	174
2041	1,299	904	733	350	952,100	316,400	1,233	424	1,517	0	81,887	440,600	396,449	440,600	120,000	Yes	0	522,487	700,000	177
2042	1,304	919	733	350	956,400	321,650	1,237	430	1,528	0	83,458	444,600	405,846	444,600	120,000	Yes	0	528,058	700,000	180
2043	1,308	933	734	350	960,700	326,550	1,242	436	1,538	0	84,979	448,200	414,892	448,200	120,000	Yes	0	533,179	700,000	183
2044	1,313	948	735	350	965,000	331,800	1,247	441	1,549	0	86,551	452,200	424,289	452,200	120,000	Yes	0	538,751	700,000	186

(150 min)(PHD - Q_{total})
(2 days)(ADD)(N)-[(1,440 min)(Q_{total} - Q_{max})], Q_{total} - Q_{max} = 582 gpm
(200 gpd/ERU)(N)
(1,000 gpm)(120 min) = 120,000 gallons

971.5 gpm (per latest Water Supply Agreement)
389 gpm (based on percentage of source supply)

City of Nooksack Max. Annual Volume =	199.0	ac-ft/yr = 64,844,439	gal/yr
City of Nooksack Max. Instantaneous Flow Rate =	239.2	gpm	(From Water Supply Agreement & NVWA Water Right Self Assessment)
City of Nooksack ADD =	175	gpd/ERU	
City of Nooksack Approvable Capacity (Based on max volume) =	1,015	ERU	=[Max Supply Volume(ac-ft)*43,560(cf/ac-ft)*7.48(gal/cf)]/[ADD(gpd/ERU)*365 days/yr]
City of Nooksack Approvable Capacity (Based on max flow rate) =	984	ERU	(From Max. Instantaneous Flow Rate)

Storage Analysis

The city of Sumas and Sumas Rural Water Association (SRWA) each have 500,000 gallon reservoirs which work in tandem to provide all of the storage requirements for both the city of Sumas and the SRWA. The two reservoirs are each concrete tanks 60 feet in diameter and 24 feet high (**21,149 gallons per ft. of reservoir height**).

- The reservoirs have a base elevation at Elev. 186 feet.
- The reservoirs have an overflow elevation at Elev. 209 feet (23 ft.)
- Tank low alarm at 16.5 ft => Elev. 202.5'
- Tank high alarm at 19.5 ft => Elev. 205.5'
- The source for the reservoirs is the Sumas Well Field which contains two pumps:
    - Pump #4R- 810 gpm at 155 ft. of head, and
    - Pump #5 - 866 gpm at 155 ft. of head.

For this analysis each reservoir is assumed to be independent of the other with each system having its own reservoir. Therefore, only a single reservoir will be utilized for the City's storage analysis

Table 7-1: Reservoir Storage Component Cross-Section Diagram

High Level Alarm. Overflow above ***pump off*** elevation

Pump(s) Off	**Operational Storage (OS) Component** Not part of ES. Not applicable for continuous pumping systems. Minimum OS volume for pump protection can be conservatively calculated as the pump supply capacity (in gpm) times 2.5 minutes.
Pump(s) On	OS = Operational storage component (gallons).
	Equalizing Storage (ES) Component For call-on-demand: ***ES = (PHD - Q_S)(150 min.)***, but in no case less than zero. *ES* = Equalizing storage component (gallons). *PHD* = Peak hourly demand (gpm). Q_S = Total of all permanent and seasonal sources (gpm).
Maintain 30 psi (required)	See Section 7.1.1.2 for sizing criteria for continuous pumping operations.
Low Level Alarm	**Fire Suppression Storage (FSS) Component** For Single Sources: ***FSS = (FF)(t_m)*** FSS = Fire suppression storage component (gallons). FF = Needed fire flow rate, expressed in gpm as specified by fire authority or the Coordination Act, whichever is greater.
Maintain 20 psi (required)	t_m = Duration of FF rate, expressed in minutes as specified by fire authority.
	Standby Storage (SB) Component ***SB = (N)(SB_I)(T_d)*** SB = Total standby storage component, or its equivalent, in gallons. N = Number of ERUs based on the ERU_{MDD} value SB_I = Locally adopted unit SB volume in gallons per day per ERU (number of ERUs based on the ERU_{MDD} value) T_d = Number of days selected to meet water system-determined standard of reliability
Maintain 20 psi (recommended)	We recommend a minimum SB volume of at least 200 gallons per ERU.
	Dead Storage (DS) Portion of a gravity reservoir that does not provide required minimum pressure.

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1. EXISTING CONDITION – 2024

1.1 OPERATION STORAGE

The city's operational and maintenance personnel are not aware of any pump manufacturer's requirements regarding excessive cycling times. Under normal operating condition with two cycling pumps, once a pump is activated it will operate for a few hours. This will allow each pump to remain out of service for more than the common 15 minute downtime requirement. No other operational storage requirements are considered.

1.2 EQUALIZING STORAGE

References:

- Washington State Department of Health *Water System Design Manual* (DOH Manual), June 2020, Section 7.1.1.2, page 176
- City of Sumas ADD, MDD, and PHD Calculations (PHD Calcs.), August 2025

CITY OF SUMAS

From DOH Manual: Equation 7-1:

$ES = (PHD - Q_S)$ (150 min), but in no case less than zero

ES = Equalizing storage component (gallons)
PHD = Peak Hourly Demand (gpm)
Q_S = Sum of all installed and active supply source capacities except emergency supply (gpm)
= Sum of all pump capacities = 810+866= 1,676 gpm

From PHD Calcs.: PHD = 498 gpm

ES = (498 gpm – 1,676 gpm) (150 min) < 0 **therefore no equalizing storage required.**

COMBINED SUMAS AND SRWA

Both systems are supplied by the same wellfield and pumps. Therefore the combined PHD should be compared to the pump capacity.

$ES = (PHD - Q_S)$ (150 min)

PHD-Sumas = 498 gpm
PHD-SRWA = 513 gpm
TOTAL PHD = 1,011 gpm

Q_S = Sum of all pump capacities = 810+866= 1,676 gpm

ES = (1,011 gpm – 1,676 gpm) (150 min)) < 0 **therefore no equalizing storage required.**

Note: Under current conditions a single pump can fill the tank under typical summer conditions (see Chapter 3, Sections 3.4.3.1 and 3.4.3.2). A multiplier of approximately 0.83 reduces the combined PHD of 1,011 gpm to 839 gpm, about the average rate of the two pumps.

1.3 STANDBY STORAGE

Reference:

- DOH Manual, Section 7.1.1.3, page 177
- City of Sumas ADD, MDD, and PHD Calculations (PHD Calcs.), August 2025

From DOH Manual: Equation 7-2:

$SB = (N)\ (SB_i)\ (T_d)$

SB = Total standby storage component (gallons)
N = Number of ERUs = 939
SB_i = SB volume in gpd/ERU

From PHD Calcs: ADD => 200 gpd/ERU

T_d = Assume 2 days

SB = (939 ERUs)(200 gpd/ERU) (2 days) = 375,600 gallons

For this reservoir, 375,600 gallons equals 17.8 feet of reservoir height.

Note: ERU_{MDD} = 383 gpd (a little less than two times ADD). Standby Storage calculated by one day of ERU_{MDD} is less than two days of ERU_{ADD}.

Check with Average 2 Day Usage

	2023 Annual Use (acre-ft)	Daily Average Use (gpd)	2 x Daily Average Use (gallons)
Sumas	180	160,384	320,768
SRWA	405	361,795	723,590
TOTAL			1,044,358

Note: The DOH Manual does allow a reduction in Standby Storage if the water system meets the criteria for multiple sources. From Section 7.1.1.4 of the DOH Manual:

Water systems with multiple sources

It may be appropriate for design engineers to consider SB volume less than MDD if multiple sources provide mechanical, electrical, treatment, and transmission redundancy and resilience to a single contamination event. Section 7.1.3 lists what we consider to be continuously available sources of supply for reservoir design purposes.

Design engineers may justify a reduction of SB volume based on one or more of the following:

1. The water system and the local fire authority allow for nesting SB and FSS volumes, where the FSS volume is greater than the SB volume. See Section 7.1.1.4.
2. Two or more sources have permanent on-site auxiliary power that starts automatically when the primary power feed is disrupted. With the largest of these sources out of service, the remaining sources plus SB volume can maintain at least 20 psi throughout the distribution system under PHD conditions.
3. Two or more sources receive power from two electrical substations, so that failure of one substation will not interrupt the power supply to the source as

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documented in writing by the power utility. With the largest of these sources out of service, the remaining sources plus SB volume can maintain at least 20 psi throughout the distribution system under PHD conditions.

4. Sources are located in different watersheds, wellhead protection areas, or aquifers.
5. Converting dead storage to standby storage by providing mechanically redundant booster pumping capacity with permanent on-site auxiliary power that starts automatically when the primary power feed is disrupted.

Note: Multiple Source criteria cannot be met since sources are not located in different watershed or aquifers (Criteria #4).

1.4 FIRE SUPPRESSION STORAGE

Reference:

- DOH Manual, Section 7.1.1.4 (page 179)
- *Whatcom County Coordinated Water System Plan Update* (WCCWSP), August 2019 (guidelines followed by the City of Sumas)

From DOH Manual: Equation 7-3:

$$FSS = (FF)\ (t_m)$$

FSS = Fire suppression storage component (gallons)
FF = Required fire flow rate (gpm), as specified by fire protection authority or under WAC 246-293-640, whichever is greater

t_m = Duration of FF rate (minutes), as specified by fire protection authority or under WAC 246-293-640, whichever is greater

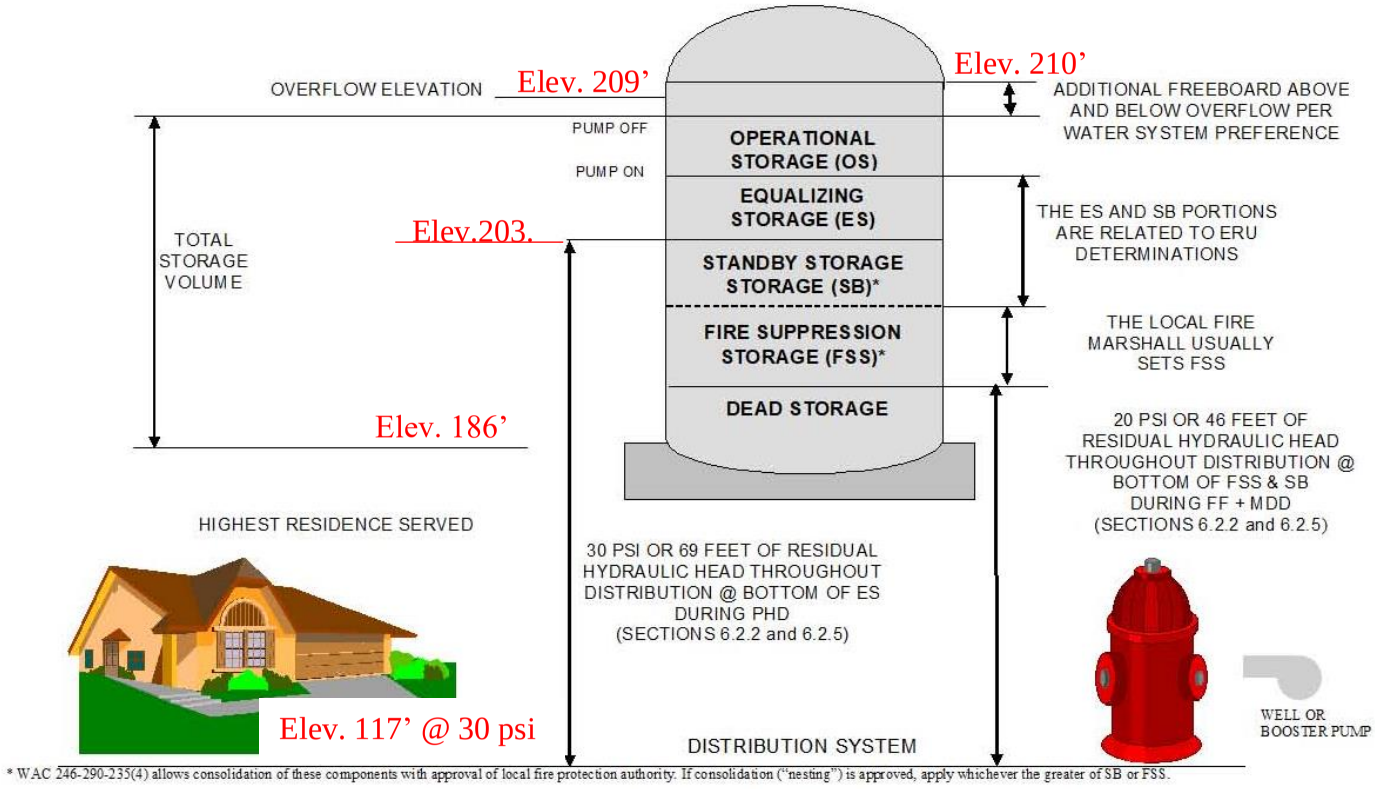
From WCCWSP, Table 5-3, pg. 5-14:
Maximum fire flow is for industrial areas: FF = 1,000 gpm, t_m = 120 min.

FSS = (1,000 gpm) (120 min) = 120,000 gallons

For this reservoir, 120,000 gallons equals 5.7 feet of reservoir height.

Note that Fire Suppression Storage can be consolidated or nested within the Standby Storage if the local fire protection authority does not require them to be additive. Therefore, the volume of the Standby Storage at 375,600 gallons controls.

Figure 7-1: Reservoir Storage Components



* WAC 246-290-235(4) allows consolidation of these components with approval of local fire protection authority. If consolidation (“nesting”) is approved, apply whichever the greater of SB or FSS.

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2. FUTURE CONDITION (20 YEARS) – 2045

2.1 OPERATION STORAGE

No other operational storage requirements are still assumed.

2.2 EQUALIZING STORAGE

2045 Equalizing Storage:

References:

- Washington State Department of Health *Water System Design Manual* (DOH Manual), June 2020, Section 7.1.1.2, page 176
- City of Sumas ADD, MDD, and PHD Calculations (PHD Calcs.), August 2025

CITY OF SUMAS

From DOH Manual Equation 7-1:

$ES = (PHD - Q_S)$ (150 min), but in no case less than zero

ES = Equalizing storage component (gallons)
PHD = Peak Hourly Demand (gpm)
Q_S = Sum of all installed and active supply source capacities except emergency supply (gpm)
= Assume same pumps, or similar, are in effect. Sum of all pump capacities = 810+866= 1,676 gpm

From PHD Calcs.: PHD_{2045} = 724 gpm

ES = (724 gpm – 1,676 gpm) (150 min) < 0 **therefore no equalizing storage required.**

COMBINED SUMAS AND SRWA

Both systems are supplied by the same wellfield and pumps. Therefore the combined PHD should be compared to the pump capacity.

$ES = (PHD - Q_S)$ (150 min)

PHD-Sumas = 724 gpm
PHD-SRWA = 774 gpm
TOTAL PHD = 1,498 gpm (gpm)

Q_S = Sum of all pump capacities = 810+866= 1,676 gpm

ES = (1,498 gpm – 1,676 gpm) (150 min) < 0 **therefore no equalizing storage required.**

ES required if only one pump is operating: assume average pump rate of 835 gpm

Full PHD:

ES = (1,498 gpm - 835 gpm) (150 min)

ES = 99,450 gallons

Modified PHD:

Note: Under current conditions a single pump can fill the tank under typical summer conditions (see Chapter 3, Sections 3.4.3.1 and 3.4.3.2). A multiplier of approximately 0.83 reduces the combined PHD of 1,011 gpm to 839 gpm, about the average rate of the two pumps. Applying this multiplier to the future PHD (1,498 gpm), the estimated maximum flow rate is 1,243 gpm.

ES = (1,243 gpm - 835 gpm) (150 min)

ES = 61,200 gallons

2.3 STANDBY STORAGE

Reference:

- DOH Manual, Section 7.1.1.3, page 177
- City of Sumas ADD, MDD, and PHD Calculations (PHD Calcs.), August 2025

DOH Manual: Current Equation 7-2:

$SB = (N)\ (SB_i)\ (T_d)$

SB = Total standby storage component (gallons)
N = Number of ERUs in 2045 = 1,449
SB_i = SB volume in gpd/ERU

From PHD Calcs: ADD = 200 gpd/ERU

T_d = Assume 2 days

SB = (1,449 ERUs)(200 gpd/ERU) (2 days) = 579,600 gallons > reservoir capacity

Existing reservoir is not adequate to provide this level of standby storage.

WHEN IS MAXIMUM CAPACITY REACHED: YEARS

Number of ERUs with 500,000 gallons of storage:

SB =(# of ERUs)(200 gpd/ERU) (2 days) = 500,000 gallons

$$ERUs = \left(\frac{500{,}000 \text{ gallons}}{(200 \frac{gpd}{ERU})(2\ days)} \right) = 1{,}250$$

2023: 939 ERUs
2045: 1,449 ERUs => by interpolation: 1,250 ERUs in 13.4 years from 2023

Standby Storage limit will be reached in approximately 2036.

WHEN IS MAXIMUM CAPACITY REACHED: REDUCING 2 DAY ERU USAGE

ERU gallons per day rate with 500,000 gallons of storage:

SB =(1,449 of ERUs)(## gpd/ERU) (2 days) = 500,000 gallons

$$ERU \frac{gallons}{day} = \left(\frac{500{,}000 \text{ gallons}}{(1{,}449\ ERUs)(2\ days)} \right) = \frac{172.5 gallons}{day} / ERU$$

A review of past ERU usage shows that 170 gpd is consistent with the actual user usage.

Note: Multiple Source criteria cannot be met since sources are not located in different watershed or aquifers (Criteria #4).

Water systems with multiple sources

It may be appropriate for design engineers to consider SB volume less than MDD if multiple sources provide mechanical, electrical, treatment, and transmission redundancy and resilience to a single contamination event. Section 7.1.3 lists what we consider to be continuously available sources of supply for reservoir design purposes.

Design engineers may justify a reduction of SB volume based on one or more of the following:

1. The water system and the local fire authority allow for nesting SB and FSS volumes, where the FSS volume is greater than the SB volume. See Section 7.1.1.4.
2. Two or more sources have permanent on-site auxiliary power that starts automatically when the primary power feed is disrupted. With the largest of these sources out of service, the remaining sources plus SB volume can maintain at least 20 psi throughout the distribution system under PHD conditions.
3. Two or more sources receive power from two electrical substations, so that failure of one substation will not interrupt the power supply to the source as

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documented in writing by the power utility. With the largest of these sources out of service, the remaining sources plus SB volume can maintain at least 20 psi throughout the distribution system under PHD conditions.

4. Sources are located in different watersheds, wellhead protection areas, or aquifers.
5. Converting dead storage to standby storage by providing mechanically redundant booster pumping capacity with permanent on-site auxiliary power that starts automatically when the primary power feed is disrupted.

Conclusion: Existing reservoir is probably adequate for the next 20 years when comparing the historic System ADD/ERU (171 gpd in 2023) and the planned 2045 System ADD/ERU (200 gpd). A second Sumas reservoir will be required in 20 years if the estimated growth is actually achieved and the City wished to maintain two days of Standby Storage.

2.4 FIRE SUPPRESSION STORAGE

Reference:

- DOH Manual, Section 7.1.1.4 (page 179)
- *Whatcom County Coordinated Water System Plan Update* (WCCWSP), August 2019 (guidelines followed by the City of Sumas)

From DOH Manual: Equation 7-3:

$$FSS = (FF)\ (t_m)$$

FSS = Fire suppression storage component (gallons)
FF = Required fire flow rate (gpm), as specified by fire protection authority or under WAC 246-293-640, whichever is greater

t_m = Duration of FF rate (minutes), as specified by fire protection authority or under WAC 246-293-640, whichever is greater

From WCCWSP, Table 5-3, pg. 5-14:
Maximum fire flow is for industrial areas: FF = 1,000 gpm, t_m = 120 min.

FSS = (1,000 gpm) (120 min) = 120,000 gallons

For this reservoir, 120,000 gallons equals 5.7 feet of reservoir height.

Note that Fire Suppression Storage can be consolidated or nested within the Standby Storage.

3. SUMMARY OF REQUIRED STORAGE VOLUMES

Table: Sumas Storage Requirements in Gallons

	2024	***2045***
I. Operational Storage	0	0
II. Equalizing Storage	0	0
III. Fire Suppression Storage	120,000	120,000
III. Standby Storage	375,600	579,600
TOTAL ($I+II+III_{max}$)	**375,600**	**579,600**

City of Sumas

2024 Node Demand Information: **2024 System**

August 13, 2025

	Node Number	Location	Downstream Nodes	Node Location	SMALL USERS 2024 # of Services[1]	SMALL USERS Cum. # of Services	SMALL USERS Mult-Family ERUs	SMALL USERS Cum. MID	SMALL USERS MID Node Demand (gpm)	Multi-Family (gpm)	Residential Multi-Fam Small Comm. (gpm)	LARGE USER[2] (gpm)	Sum (gpm)	Factored Sum (gpm)	Intertie (gpm)	TOTAL NODE DEMAND (gpm)
	1	JONES ROAD INTERTIE													60	60
	2	ROCK ROAD INTERTIE													195	195
	3	HOVEL ROAD INTERTIE													122	122
	4	BALLPARL/SR9/ESTERBROOK INTERTIE													136	136
1	101	pumps		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
2	102	pumps		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
3	103	E of Spring, N of Kneuman		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
4	104	Border, N of Spring St.		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
5	105	E & W of Spring St & Ridgeview	106	loop	3	12		9.0	-22.0		-22.0		-22.0	-16.5		-16.5
6	106	Ridgeview St, east end		DE	9	9		31.0	31.0		31.0		31.0	23.3		23.3
7	107	Spring St		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
8	108	E of Spring, N of Kneuman		loop	5	5		3.8	3.8		3.8		3.8	2.8		2.8
9	109	E of Spring, N of Kneuman		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
10	110	W of Spring, N of Kneuman		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
11	111	Border, N of Ridgeview		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
12	112	Border, N of Ridgeview		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
13	113	Kneuman, S of Arthur		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
14	114	Border, N of Arthur	115, 116, 117	loop	0	15		11.3	-31.7		-31.7		-31.7	-23.9		-23.9
15	115	W end of Arthur		DE	5	5		23.0	23.0		23.0		23.0	17.3		17.3
16	116	Mid Arthur		DE	6	15		43.0	-1.0		-1.0		-1.0	-0.8		-0.8
17	117	E end of Arthur's Way		DE	4	4		21.0	21.0		21.0		21.0	15.8		15.8
18	118	Huntington Ave near Tank		DE	1	1		15.0	15.0		15.0		15.0	11.3		11.3
19	119	SW of tank	118	loop	1	2		1.5	-13.5		-13.5		-13.5	-10.2		-10.2
20	120	Border, NW of tank		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
21	122	N of Barker, E of tanks		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
22	123	Border, E of tanks		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
23	124	E of Barker		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
24	125	E end of Victoria near Barker		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
25	126	Barker		loop	4	4		3.0	3.0		3.0		3.0	2.3		2.3
26	127	E end of W. Garfield		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
27	128	W. Garfield, S of Victoria		loop	2	2		1.5	1.5		1.5		1.5	1.1		1.1
28	129	W. Garfield & Bob Mitchell		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
29	130	Bob Mitchell north end (470 W Second St)		loop	0	0		0.0	0.0	1.7	1.7		1.7	1.3		1.3
30	131	Johnson & W. Second		loop	2	2		1.5	1.5		1.5		1.5	1.1		1.1
31	132	Johnson & Pine	133	loop	4	8		6.0	-15.0		-15.0		-15.0	-11.3		-11.3
32	133	W end of Locust		DE	4	4		21.0	21.0		21.0		21.0	15.8		15.8
33	134	Johnson & W Third	135	loop	0	1		0.8	-14.2		-14.2		-14.2	-10.7		-10.7
34	135	E end of W Third		DE	1	1		15.0	15.0		15.0		15.0	11.3		11.3
35	136	Bob Mitchell	137	loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
36	137	Dead End of Bob Mitchell		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
37	138	Bob Mitchell (Teal Jones)		loop	0	0		0.0	0.0		0.0	19	19.0	14.3		14.3
38	140	Bob Mitchell (Teal Jones)		loop	0	0		0.0	0.0		0.0	6	6.0	4.5		4.5
39	141	Inside Teal Jones, E of Bob Mitchell	142	loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
40	142	Dead end inside Teal Jones		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
41	145	W of Johnson, N of W Front		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
42	146	Johnson & N of W Front		loop	2	2		1.5	1.5		1.5		1.5	1.1		1.1
43	147	Johnson & N of W Front		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
44	150	Barbo & W Front St (west end)		loop	6	6		4.5	4.5		4.5		4.5	3.4		3.4
45	151	W Front St near IKO	152-156	loop	0	2		1.5	-15.5		-15.5		-15.5	-11.7		-11.7
46	152	Border Patrol Office	153, 155, 156	DE	0	2		0.0	0.0		0.0		0.0	0.0		0.0
47	153	Border Patrol near Garrison Rd		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
48	155	Border Patrol Office	156	DE	0	2		17.0	0.0		0.0		0.0	0.0		0.0
49	156	Border Patrol Office		DE	2	2		17.0	17.0		17.0	2	19.0	14.3		14.3
50	161	IKO @ W Entrance		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
51	162	IKO loop to W Warehouse	163, 164	loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
52	163	IKO W Warehouse	164	DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0

	Node Number	Location	Downstream Nodes	Node Location	SMALL USERS 2024 # of Services[1]	SMALL USERS Cum. # of Services	SMALL USERS Mult-Family ERUs	SMALL USERS Cum. MID	SMALL USERS MID Node Demand (gpm)	Multi-Family (gpm)	Residential Multi-Fam Small Comm. (gpm)	LARGE USER[2] (gpm)	Sum (gpm)	Factored Sum (gpm)	Intertie (gpm)	TOTAL NODE DEMAND (gpm)
53	164	IKO W Warehouse hydrant		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
54	165	IKO west loop	166	loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
55	166	IKO west loop hydrant		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
56	167	IKO west loop	168, 169	loop	0	0		0.0	0.0		0.0	17	17.0	12.8		12.8
57	168	IKO west loop to hydrant	169	DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
58	169	IKO west loop hydrant		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
59	171	IKO west loop	172	loop	0	0		0.0	0.0		0.0	39	39.0	29.4		29.4
60	172	IKO west loop to hydrant		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
61	173	IKO NE corner of loop	174	loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
62	174	IKO NE corner of loop to hydrant									0.0		0.0	0.0		0.0
63	175	IKO east loop		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
64	176	IKO east loop	177	loop	0	0		0.0	0.0		0.0	10	10.0	7.5		7.5
65	177	IKO east loop at hydrant		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
66	178	IKO @ E Entrance		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
67	181	N side - W Front St E of IKO's east entrance	182-185	loop	0	1		0.8	-14.2		-14.2		-14.2	-10.7		-10.7
68	182	S side - W Front St E of IKO's east entrance	183, 184, 185	DE	0	1		0.0	0.0		0.0		0.0	0.0		0.0
69	183	S side - W Front St	184, 185	DE	0	1		0.0	0.0		0.0		0.0	0.0		0.0
70	184	Darryl Jones Way	185	DE	0	1		0.0	0.0		0.0		0.0	0.0		0.0
71	185	Socco - SE corner		DE	1	1		15.0	15.0		15.0		15.0	11.3		11.3
72	190	N side - W Front St E of Socco's east entrance		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
73	191	S side - W Front St E of Socco's east entrance	192-197	loop	0	3		2.3	-29.7		-29.7		-29.7	-22.4		-22.4
74	192	Socco Office		DE	1	1		15.0	15.0		15.0		15.0	11.3		11.3
75	193	Cedar Prime office	195, 196, 197	DE	1	2		17.0	2.0		2.0	0	2.0	1.5		1.5
76	195	Thompson Lane (Socco)	196, 197	DE	0	1		0.0	0.0		0.0	2	2.0	1.5		1.5
77	196	Thompson Lane hydrant		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
78	197	Thompson Lane - PSE		DE	1	1		15.0	15.0		15.0		15.0	11.3		11.3
79	201	W Front & Johnson		loop	2	2		1.5	1.5		1.5		1.5	1.1		1.1
80	203	W Front @ EPL Feed		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
81	204	W Front @ EPL Feed	205	loop	0	1		0.8	-14.2		-14.2	23	8.8	6.6		6.6
82	205	EPL Feed hydrant		DE	1	1		15.0	15.0		15.0		15.0	11.3		11.3
83	206	Italian Motors		loop	1	1		0.8	0.8		0.8	0	0.8	0.6		0.6
84	501	Front St & Easterbrook/SR9		loop	0	0		0	0		0.0		0.0	0.0		0.0
85	502	Front St & Sumas Ave		loop	5	5		3.8	3.8		3.8		3.8	2.8		2.8
86	503	Front St & Sumas Ave		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
87	504	Sumas Av & ally south of W Front		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
88	506	Noble St & Sumas Ave		loop	3	3		2.3	2.3		2.3		2.3	1.7		1.7
89	507	Noble St & Sumas Ave	508-513	loop	0	6		4.5	-33.5		-33.5		-33.5	-25.2		-25.2
90	508	W end of Noble St		DE	1	1		15.0	15.0		15.0		15.0	11.3		11.3
91	509	Sumas Ave & Capstone Ct		DE	3	5		23.0	6.0		6.0		6.0	4.5		4.5
92	510	Sumas Ave & W of Capstone Ct		DE	1	2		17.0	-13.0		-13.0		-13.0	-9.8		-9.8
93	511	Rodeo Grounds		DE		1		15.0	15.0		15.0	2	17.0	12.8		12.8
94	512	RV Park & Camp Grounds		DE	0	1		0.0	0.0		0.0	8	8.0	6.0		6.0
95	513	SR 9/Easterbrook		DE	1	1		15.0	15.0		15.0		15.0	11.3		11.3
96	520	Front St & Lawson Ave (SE)		loop	5	5		3.8	3.8		3.8		3.8	2.8		2.8
97	521	Front St & Lawson Ave (SW)		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
98	523	Front St & Lawson Ave (SW)		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
99	524	Lawson St & ally south of W Front (W)		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
100	525	1205 Boon (N)	526	loop	0	1		0.8	-9.8		-9.8		-9.8	-7.4		-7.4
101	526	1205 Boon (NE)		DE	0	1		15.0	10.6	4.5	15.0		15.0	11.3		11.3
102	527	1205 Boon (S)		loop	0	0		0.0	0.0	4.5	4.5		4.5	3.4		3.4
103	528	Nobel St NE of 1305 Boon		loop	9	9		6.8	6.8		6.8		6.8	5.1		5.1
104	530	End of Boon St cul-de-sac	531	loop	0	0			0.0		0.0		0.0	0.0		0.0
105	531	W end of 1350 Boon St development		DE	0	0			0.0		0.0		0.0	0.0		0.0
106	532	Boon St cul-de-sac		loop	6	6		4.5	4.5		4.5		4.5	3.4		3.4
107	533	S end of Boon St		loop	10	10		7.5	7.5		7.5		7.5	5.7		5.7
108	534	1401 Boon St (on loop)	535	loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
109	535	1400 Boon St (inside complex)		DE	0	0			0.0	18.0	18.0		18.0	13.6		13.6
110	536	1305 Boon St (on loop)	537	loop	2	2		1.5	1.5		1.5		1.5	1.1		1.1
111	537	1305 Boon St (inside complex)		DE	0	0		0.0	0.0	22.0	22.0		22.0	16.6		16.6
112	540	Front St & Boon St (S)	541	loop	5	5		3.8	3.8		3.8		3.8	2.8		2.8
113	541	316-346 Front St & Boon St (N)		DE	0	0		0.0	0.0	8.8	8.8		8.8	6.6		6.6

	Node Number	Location	Downstream Nodes	Node Location	SMALL USERS 2024 # of Services[1]	Cum. # of Services	Mult-Family ERUs	Cum. MID	MID Node Demand (gpm)	Multi-Family (gpm)	Residential Multi-Fam Small Comm. (gpm)	LARGE USER[2] (gpm)	Sum (gpm)	Factored Sum (gpm)	Intertie (gpm)	TOTAL NODE DEMAND (gpm)
114	542	Front St, E of Hovel (S)	543	loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
115	543	404-412 Front St, E of Hovel (N)		DE	0	0		0.0	0.0	6.6	6.6		6.6	5.0		5.0
116	544	Front St & Hovel Rd (S)	545	loop	3	4		3.0	-12.0		-12.0		-12.0	-9.0		-9.0
117	545	Front St, W of Hovel (N)		DE	1	1		15.0	15.0		15.0		15.0	11.3		11.3
118	561	Front St & Hovel Rd (E)	562-571	loop	3	58		43.7	-64.3		-64.3		-64.3	-48.4		-48.4
119	562	Hovel Rd by creek	563-571	DE	5	55		108.0	-18.0		-18.0		-18.0	-13.6		-13.6
120	563	Hovel Rd & Cornerstone Dr (N)	565-571	DE	12	39		91.0	37.0		37.0		37.0	27.9		27.9
121	565	Cornerstone Dr & Capstone Ct	565-571	DE	11	11		35.0	2.0		2.0		2.0	1.5		1.5
122	566	Capstone Ct - end	566-571	DE	5	5		23.0	23.0		23.0		23.0	17.3		17.3
123	567	Cornerstone Dr - W loop	568	DE	8	8		29.0	10.0		10.0		10.0	7.5		7.5
124	568	Cornerstone Dr - W loop cul-du-sac		DE	3	3		19.0	19.0		19.0		19.0	14.3		14.3
125	569	Hovel Rd & Cornerstone Dr (N)	50	DE	11	11		35.0	35.0		35.0		35.0	26.4		26.4
126	570	Hovel Rd S of Conerstone Dr (S)		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
127	571	Ball Field		DE							0.0	7	7.0	5.3		5.3
128	572			DE							0.0		0.0	0.0		0.0
129	581	Front St, W of Hovel (S)		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
130	582	510-550 Front St, W of Hovel (N)		loop	0	0		0.0	0.0	3.9	3.9		3.9	2.9		2.9
131	583	570-590 Front St & Victoria St	584-587	loop	1	11		8.3	-24.7	4.4	-20.3		-20.3	-15.3		-15.3
132	584	Front St & Swartwood Rd (N)	#########	DE	3	10		33.0	6.0		6.0		6.0	4.5		4.5
133	585	Front St & Swartwood Rd (S)	586	DE	0	7		0.0	0.0		0.0		0.0	0.0		0.0
134	586	Swartwood Rd, S end		DE	7	7		27.0	27.0		27.0		27.0	20.3		20.3
135	587			DE				0.0	0.0		0.0		0.0	0.0		0.0
136	601	Border E of tracks, SW of Border Crossing Bldg		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
137	602	Border E of tracks, NW of Border Crossing Bldg		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
138	603	206 Cherry St, S of Harrison Ave (TRMC Retail)		loop	0	0		0.0	0.0		0.0	3	3.0	2.3		2.3
139	604	145 Cherry St & Harrison Ave (Border Patrol)		loop	0	0		0.0	0.0		0.0	2	2.0	1.5		1.5
140	605	Harrison & Sumas Ave		loop	8	8		6.0	6.0		6.0		6.0	4.5		4.5
141	606	Harrison & Boundary Ave	607	loop	0	1		0.8	-14.2		-14.2		-14.2	-10.7		-10.7
142	607	W end of Boundary Ave		DE	1	1		15.0	15.0		15.0		15.0	11.3		11.3
143	610	Harrison & Fisk St		loop	6	6		4.5	4.5		4.5		4.5	3.4		3.4
144	611	Boundary Ave & Fisk		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
145	612	Bondary Ave E of Sumas Ave		loop	3	3		2.3	2.3		2.3		2.3	1.7		1.7
146	615	Harrison & Lawson St		loop	4	4		3.0	3.0		3.0		3.0	2.3		2.3
147	616	Harrison & Gough St	616	loop	2	3		2.3	-12.7		-12.7		-12.7	-9.6		-9.6
148	617	E end of Harrison Ave		DE	1	1		15.0	15.0		15.0		15.0	11.3		11.3
149	619										0.0		0.0	0.0		0.0
150	620	121 Cherry St & Cleveland Ave (Sumas Investment)		loop	1	1		0.8	0.8		0.8	5	5.8	4.3		4.3
151	621	Cleveland Ave, W of Sumas Ave		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
152	622	Cleveland Ave & Sumas Ave		loop	4	4		3.0	3.0		3.0		3.0	2.3		2.3
153	623	Cleveland Ave & Fisk St	624	loop	8	8		6.0	-9.0		-9.0		-9.0	-6.8		-6.8
154	624	Fisk St, N of Cleveland		DE	1	1		15.0	15.0		15.0		15.0	11.3		11.3
155	625	Cleveland Ave & Lawson St		loop	8	8		6.0	6.0		6.0		6.0	4.5		4.5
156	626	Cleveland Ave & Gough St		loop	4	4		3.0	3.0		3.0		3.0	2.3		2.3
157	630	Garfield St, E of RR tracks		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
158	631	Garfield St, E of RR tracks		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
159	632	340 Garfield St & Cherry St		loop	4	4		3.0	3.0		3.0	0	3.0	2.3		2.3
160	633	130 Garfield St & Sumas Ave		loop	0	0		0.0	0.0	6	6.0		6.0	4.5		4.5
161	634	Garfield St & Sumas Ave	635, 636	loop	4	9		6.8	-16.2		-16.2		-16.2	-12.2		-12.2
162	635	Garfield St between Sumas Ave jog in N-S Roads	636	DE	1	5		23.0	2.0		2.0		2.0	1.5		1.5
163	636	Garfield St between Sumas Ave jog in N-S Roads		DE	1	4		21.0	21.0		21.0		21.0	15.8		15.8
164	637	310-320 Garfield St & Fisk St		loop	4	4		3.0	3.0	4	7.0		7.0	5.3		5.3
165	638	380 Garfield St & Lawson St		loop	4	70		52.7	-70.3	2.2	-68.1		-68.1	-51.3		-51.3
166	639	Garfield St & Gough St		DE	3	70		123.0	3.0		3.0		3.0	2.3		2.3
167	640	Garfield St & E of Gough St		DE	0	67		0.0	0.0		0.0		0.0	0.0		0.0
168	641	Garfield St & Roosevelt Ct	642	DE	6	67		120.0	-11.0		-11.0		-11.0	-8.3		-8.3
169	642	Roosevelt Court		DE	4	4		21.0	21.0		21.0		21.0	15.8		15.8
170	643	Garfield St & Jefferson Ct		DE	7	57		110.0	-16.0		-16.0		-16.0	-12.1		-12.1
171	644	Jefferson Ct & Lincoln Circle	645	DE	3	16		45.0	-7.0		-7.0		-7.0	-5.3		-5.3
172	645	Jefferson Ct		DE	5	5		23.0	23.0		23.0		23.0	17.3		17.3
173	646	Lincoln Circle		DE	8	8		29.0	29.0		29.0		29.0	21.8		21.8
174	647	Wilson Lane, S end	648	DE	4	10		33.0	8.0		8.0		8.0	6.0		6.0

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175	648	Wilson Lane, S end		DE	6	6		25.0	25.0		25.0		25.0	18.8		18.8
176	649	Wilson Ln & Taylor Circle	650	DE	7	13		39.0	-19.0		-19.0		-19.0	-14.3		-14.3
177	650	Taylor Circle		DE	6	6		25.0	25.0		25.0		25.0	18.8		18.8
178	651	Jones Rd & Wilson Ln	655, 656, 657	DE	7	34		81.0	21.0		21.0		21.0	15.8		15.8
179	655	Jones Rd, E of Wilson Ln	656, 657	DE	3	4		21.0	6.0		6.0		6.0	4.5		4.5
180	656	N of Jones Rd, E of Wilson Ln	70	DE	1	1		15.0	15.0		15.0		15.0	11.3		11.3
181	~~657~~	~~JONES ROAD INTERTIE~~									0.0		0.0	0.0		0.0
182	661	First ST, E of Cherry	662, 663	DE	0	4		21.0	-13.0		-13.0		-13.0	-9.8		-9.8
183	662	First ST, E of Cherry		DE	2	2		17.0	17.0		17.0		17.0	12.8		12.8
184	663	First ST, E of Cherry		DE	2	2		17.0	17.0		17.0		17.0	12.8		12.8
185	664	First ST, E of Cherry	661, 662, 663	DE	0	4		0.0	0.0		0.0		0.0	0.0		0.0
186	665	First St & Cherry	661 - 664	loop	0	4		3.0	-18.0		-18.0		-18.0	-13.5		-13.5
187	666	136 First St & Sumas Ave		loop	6	6		4.5	4.5	1.1	5.6		5.6	4.2		4.2
188	667	First St & Lawson		loop	8	8		6.0	6.0		6.0		6.0	4.5		4.5
189	668	First St & Gough		loop	6	6		4.5	4.5		4.5		4.5	3.4		3.4
190	669	First St , E end		loop	5	5		3.8	3.8		3.8		3.8	2.8		2.8
191	670	Second St, E end		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
192	671	Second St, E end		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
193	672	Second St, E end	673	loop	0	2		1.5	-15.5		-15.5		-15.5	-11.7		-11.7
194	673	Second St, E end		DE	2	2		17.0	17.0		17.0		17.0	12.8		12.8
195	674	540 Second St, E of Lawson		loop	0	0		0.0	0.0	3.3	3.3		3.3	2.5		2.5
196	675	Second St & Lawson St		loop	9	9		6.8	6.8		6.8		6.8	5.1		5.1
197	676	Second St & Sumas Ave		loop	4	4		3.0	3.0		3.0		3.0	2.3		2.3
198	677	Second St & E of Cherry St		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
199	678	Second St & 520/534 Cherry St		loop	1	1		0.8	0.8		0.8	0	0.8	0.6		0.6
200	679	Second St, 601/617 Cherry St	680	loop	0	1		0.8	-14.2		-14.2	0	-14.2	-10.7		-10.7
201	680	Second St, W of Cherry St		DE	1	1		15.0	15.0		15.0		15.0	11.3		11.3
202	684	825 Cherry St (Nopal Rest.)		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
203	685	Third St & 725 Cherry (Cherry St Market)		loop	4	4		3.0	3.0		3.0		3.0	2.3		2.3
204	686	S of Second St & W of Sumas Ave		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
205	687	S of Second St & Sumas Ave		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
206	688	Third St & Sumas Ave		loop	5	5		3.8	3.8		3.8		3.8	2.8		2.8
207	689	Sumas Ave, S of (135) Third St (City Park)		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
208	690	Third St & Lawson St		loop	11	11		8.3	8.3		8.3		8.3	6.2		6.2
209	691	Third St & Gough St		loop	9	9		6.8	6.8		6.8		6.8	5.1		5.1
210	692	Gough St, N or Third St		loop	2	2		1.5	1.5		1.5		1.5	1.1		1.1
211	693	N or Third St & W of Gough St		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
212	694										0.0		0.0	0.0		0.0
213	695										0.0		0.0	0.0		0.0
214	700	Cherry St & Vancouver St		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
215	701	819 Cherry St, N of Vancouver, W of Columbia (Bob's Burger		loop	0	0		0.0	0.0		0.0	6	6.0	4.5		4.5
216	702	Columbia St, E of Cherry St		DE	4	4		21.0	21.0		21.0		21.0	15.8		15.8
217	703	Columbia St, W of Sumas Ave		DE	1	5		23.0	2.0		2.0		2.0	1.5		1.5
218	704	Columbia St & Sumas Ave	702, 703	loop	3	8		6.0	-17.0		-17.0		-17.0	-12.8		-12.8
219	706	317 Columbia St & Lawson St		loop	7	7		5.3	5.3	0.6	5.9		5.9	4.4		4.4
220	707	Vancouver St & Lawson St		loop	8	8		6.0	6.0		6.0		6.0	4.5		4.5
221	708	Vancouver St & Sumas Ave		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
222	709	Vancouver St & 910-912 Sumas Ave	711, 710	loop	1	6		4.5	-18.5	1.1	-17.4		-17.4	-13.1		-13.1
223	710	Vancouver St, W of Sumas Ave	711	DE	0	5		0.0	0.0		0.0		0.0	0.0		0.0
224	711	Vancouver St, E of Cherry St		DE	5	5		23.0	23.0		23.0		23.0	17.3		17.3
225	712	142 Mitchell St, E of Cherry St		DE	2	2		17.0	17.0	2.2	19.2		19.2	14.5		14.5
226	713	Mitchell St, W of Sumas Ave	712	DE	0	2		0.0	0.0		0.0		0.0	0.0		0.0
227	714	Mitchell St & Sumas Ave	711, 712	loop	7	9		6.8	-10.2		-10.2		-10.2	-7.7		-7.7
228	715	Mitchell St & Lawson St		loop	9	9		6.8	6.8		6.8		6.8	5.1		5.1
229	716	Lawson St, N of Mitchell St		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
230	717	N of Mitchell & Gough St	717	loop	3	5		3.8	-13.2		-13.2		-13.2	-10.0		-10.0
231	718	Vancouver St & Gough St		DE	2	2		17.0	17.0		17.0		17.0	12.8		12.8
232	719	Mitchell St. & Gough St.		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
233	720	Mitchell St., W of Gough St.	721	loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
234	721	Mitchell St., W of Gough St. -School Hydrant		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
235	722	Mitchell St., W of Gough St.	723	loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0

	Node Number	Location	Downstream Nodes	Node Location	SMALL USERS 2024 # of Services[1]	Cum. # of Services	Mult-Family ERUs	Cum. MID	MID Node Demand (gpm)	Multi-Family (gpm)	Residential Multi-Fam Small Comm. (gpm)	LARGE USER[2] (gpm)	Sum (gpm)	Factored Sum (gpm)	Intertie (gpm)	TOTAL NODE DEMAND (gpm)
236	723	Mitchell St., W of Gough St. -School service		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
237	724										0.0		0.0	0.0		0.0
238	740	Front St & Lawson St		loop	2	2		1.5	1.5		1.5		1.5	1.1		1.1
239	741	Morton St & Lawson St		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
240	742	Morton St & Lawson St - SCHOOL	743	loop	0	1		0.8	-14.2		-14.2	0	-14.2	-10.7		-10.7
241	743	Morton St & Lawson St - SCHOOL HYDRANT		DE	0	1		15.0	15.0		15.0		15.0	11.3		11.3
242	744	200 Front St & Sumas Ave		loop	3	3		2.3	2.3	1.1	3.4		3.4	2.5		2.5
243	745	Sumas Ave, N of Front St	746	loop	0	4		3.0	-18.0		-18.0		-18.0	-13.5		-13.5
244	746	N of Front St, E of Cherry St		DE	4	4		21.0	21.0		21.0		21.0	15.8		15.8
245	747	207-225 Morton St between Sumas Ave & Lawson		loop	6	6		4.5	4.5	4.4	8.9		8.9	6.7		6.7
246	748	Sumas Ave between Morton & Mitchell	749	loop	0	2		1.5	-15.5		-15.5		-15.5	-11.7		-11.7
247	749	E of Sumas Ave between Morton & Mitchell (1036 Sumas Ave		DE	2	2		17.0	17.0	2.2	19.2		19.2	14.5		14.5
248	750	Morton St & Sumas Ave		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
249	751	Morton St, W of Sumas		loop	3	3		2.3	2.3		2.3		2.3	1.7		1.7
250	752	Morton St, E of Cherry St		loop	5	5		3.8	3.8		3.8		3.8	2.8		2.8
251	753	E of Cherry St, N of Morton St		loop	3	3		2.3	2.3		2.3		2.3	1.7		1.7
252	754	1015 Cherry St, N of Morton St (Boomtown)		loop	0	0		0.0	0.0		0.0	12	12.0	9.0		9.0
253	755	Cherry St, N of Front St		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
254	756										0.0		0.0	0.0		0.0
255	760	Mitchell St, E of School, W of Victoria St		loop	3	3		2.3	2.3		2.3		2.3	1.7		1.7
256	761	E end of Morton St, W of Victoria St		loop	6	6		4.5	4.5		4.5		4.5	3.4		3.4
257	762	Mitchell St & Victoria St	773, 774, 775	loop	3	6		4.5	-14.5		-14.5		-14.5	-10.9		-10.9
258	763	Victoria St, N of Mitchell St		DE	1	3		19.0	2.0		2.0		2.0	1.5		1.5
259	764	Columbia St & Victoria St		DE	0	2		0.0	0.0		0.0		0.0	0.0		0.0
260	765	Columbia St, E of Victoria ST		DE	2	2		17.0	17.0		17.0		17.0	12.8		12.8
261	766	Victoria St, S of Mitchell	767	loop	0	2		1.5	-15.5		-15.5		-15.5	-11.7		-11.7
262	767	E of Victoria, S of Mitchell		DE	2	2		17.0	17.0		17.0		17.0	12.8		12.8
263	768	Morton St & Victoria St		loop	6	6		4.5	4.5		4.5		4.5	3.4		3.4
		TOTALS			525	1,185	0	2,283.4	395.4	102.5	497.9	163	661	497.8	513	1,010.8
																1010.8

[1] "# of services" at each node is based on a review of a city aerial photo showing home and buisnesss locations. The number of residential connections used in the model (527) is less than the number of residentail connections the City presently has (571).

[2] "Large User" gpm rates comes from actual usage with estimated peaking factors (see Large User Worksheet). PHD flow rates, as estimated using DOH conversion to ERUs, was not used.

System PHD	497.8		Loop Factor
Table Sum	661		0.753
(Formula from 1983 Sizing Guidelines table)			

City of Sumas

2045 Node Demand Information: **2045 System**

August 13, 2025

	Node Number	2045 PHD Location	Downstream Nodes	Node Location	SMALL USERS 2024 # of Services[1]	SMALL USERS Cum. # of Services	SMALL USERS Mult-Family ERUs	SMALL USERS Cum. MID	SMALL USERS MID Node Demand (gpm)	Multi-Family (gpm)	Residential Multi-Fam Small Comm. (gpm)	LARGE USER[2] (gpm)	Sum (gpm)	Factored Sum (gpm)	Intertie (gpm)	TOTAL NODE DEMAND (gpm)
	1	JONES ROAD INTERTIE													91	91
	2	ROCK ROAD INTERTIE													294	294
	3	HOVEL ROAD INTERTIE													184	184
	4	BALLPARL/SR9/ESTERBROOK INTERTIE													205	205
1	101	pumps		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
2	102	pumps		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
3	103	E of Spring, N of Kneuman		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
4	104	Border, N of Spring St.		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
5	105	E & W of Spring St & Ridgeview	106	loop	3	12		9.5	-21.5		-21.5		-21.5	-17.0		-17.0
6	106	Ridgeview St, east end		DE	9	9		31.0	31.0		31.0		31.0	24.6		24.6
7	107	Spring St		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
8	108	E of Spring, N of Kneuman		loop	5	5		4.0	4.0		4.0		4.0	3.1		3.1
9	109	E of Spring, N of Kneuman		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
10	110	W of Spring, N of Kneuman		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
11	111	Border, N of Ridgeview		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
12	112	Border, N of Ridgeview		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
13	113	Kneuman, S of Arthur		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
14	114	Border, N of Arthur	115, 116, 11	loop	0	15		11.9	-31.1		-31.1		-31.1	-24.7		-24.7
15	115	W end of Arthur		DE	5	5		23.0	23.0		23.0		23.0	18.2		18.2
16	116	Mid Arthur		DE	6	15		43.0	-1.0		-1.0		-1.0	-0.8		-0.8
17	117	E end of Arthur's Way		DE	4	4		21.0	21.0		21.0		21.0	16.7		16.7
18	118	Huntington Ave near Tank		DE	1	1		15.0	15.0		15.0		15.0	11.9		11.9
19	119	SW of tank	118	loop	1	2		1.6	-13.4		-13.4		-13.4	-10.6		-10.6
20	120	Border, NW of tank		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
21	122	N of Barker, E of tanks		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
22	123	Border, E of tanks		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
23	124	E of Barker		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
24	125	E end of Victoria near Barker		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
25	126	Barker		loop	4	4		3.2	3.2		3.2		3.2	2.5		2.5
26	127	E end of W. Garfield		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
27	128	W. Garfield, S of Victoria		loop	2	2		1.6	1.6		1.6		1.6	1.3		1.3
28	129	W. Garfield & Bob Mitchell		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
29	130	Bob Mitchell north end (470 W Second St)		loop	0	0		0.0	0.0	1.7	1.7		1.7	1.3		1.3
30	131	Johnson & W. Second		loop	2	2		1.6	1.6		1.6		1.6	1.3		1.3
31	132	Johnson & Pine	133	loop	4	8		6.3	-14.7		-14.7		-14.7	-11.6		-11.6
32	133	W end of Locust		DE	4	4		21.0	21.0		21.0		21.0	16.7		16.7
33	134	Johnson & W Third	135	loop	0	1		0.8	-14.2		-14.2		-14.2	-11.3		-11.3
34	135	E end of W Third		DE	1	1		15.0	15.0		15.0		15.0	11.9		11.9
35	136	Bob Mitchell	137	loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
36	137	Dead End of Bob Mitchell		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
37	138	Bob Mitchell (Teal Jones)		loop	0	0		0.0	0.0		0.0	19	19.0	15.1		15.1
38	140	Bob Mitchell (Teal Jones)		loop	0	0		0.0	0.0		0.0	6	6.0	4.8		4.8
39	141	Inside Teal Jones, E of Bob Mitchell	142	loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
40	142	Dead end inside Teal Jones		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
41	145	W of Johnson, N of W Front		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
42	146	Johnson & N of W Front		loop	2	2		1.6	1.6		1.6		1.6	1.3		1.3
43	147	Johnson & N of W Front		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
44	150	Barbo & W Front St (west end)		loop	6	6		4.8	4.8		4.8		4.8	3.8		3.8
45	151	W Front St near IKO	152-156	loop	0	2		1.6	-15.4		-15.4		-15.4	-12.2		-12.2
46	152	Border Patrol Office	153, 155, 15	DE	0	2		0.0	0.0		0.0		0.0	0.0		0.0
47	153	Border Patrol near Garrison Rd		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
48	155	Border Patrol Office	156	DE	0	2		17.0	0.0		0.0		0.0	0.0		0.0
49	156	Border Patrol Office		DE	2	2		17.0	17.0		17.0	2	19.0	15.1		15.1
50	161	IKO @ W Entrance		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
51	162	IKO loop to W Warehouse	163, 164	loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
52	163	IKO W Warehouse	164	DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0

	Node Number	2045 PHD Location	Downstream Nodes	Node Location	SMALL USERS 2024 # of Services[1]	Cum. # of Services	Mult-Family ERUs	Cum. MID	MID Node Demand (gpm)	Multi-Family (gpm)	Residential Multi-Fam Small Comm. (gpm)	LARGE USER[2] (gpm)	Sum (gpm)	Factored Sum (gpm)	Intertie (gpm)	TOTAL NODE DEMAND (gpm)
53	164	IKO W Warehouse hydrant		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
54	165	IKO west loop	166	loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
55	166	IKO west loop hydrant		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
56	167	IKO west loop	168, 169	loop	0	0		0.0	0.0		0.0	17	17.0	13.5		13.5
57	168	IKO west loop to hydrant	169	DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
58	169	IKO west loop hydrant		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
59	171	IKO west loop	172	loop	0	0		0.0	0.0		0.0	39	39.0	30.9		30.9
60	172	IKO west loop to hydrant		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
61	173	IKO NE corner of loop	174	loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
62	174	IKO NE corner of loop to hydrant									0.0		0.0	0.0		0.0
63	175	IKO east loop		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
64	176	IKO east loop	177	loop	0	0		0.0	0.0		0.0	10	10.0	7.9		7.9
65	177	IKO east loop at hydrant		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
66	178	IKO @ E Entrance		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
67	181	N side - W Front St E of IKO's east entrance	182-185	loop	0	1		0.8	-14.2		-14.2		-14.2	-11.3		-11.3
68	182	S side - W Front St E of IKO's east entrance	183, 184, 185	DE	0	1		0.0	0.0		0.0		0.0	0.0		0.0
69	183	S side - W Front St	184, 185	DE	0	1		0.0	0.0		0.0		0.0	0.0		0.0
70	184	Darryl Jones Way	185	DE	0	1		0.0	0.0		0.0		0.0	0.0		0.0
71	185	Socco - SE corner		DE	1	1		15.0	15.0		15.0		15.0	11.9		11.9
72	190	N side - W Front St E of Socco's east entrance		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
73	191	S side - W Front St E of Socco's east entrance	192-197	loop	0	3		2.4	-29.6		-29.6		-29.6	-23.5		-23.5
74	192	Socco Office		DE	1	1		15.0	15.0		15.0		15.0	11.9		11.9
75	193	Cedar Prime office	195, 196, 197	DE	1	2		17.0	2.0		2.0	0	2.0	1.6		1.6
76	195	Thompson Lane (Socco)	196, 197	DE	0	1		0.0	0.0		0.0	2	2.0	1.6		1.6
77	196	Thompson Lane hydrant		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
78	197	Thompson Lane - PSE		DE	1	1		15.0	15.0		15.0		15.0	11.9		11.9
79	201	W Front & Johnson		loop	2	2		1.6	1.6		1.6		1.6	1.3		1.3
80	203	W Front @ EPL Feed		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
81	204	W Front @ EPL Feed	205	loop	0	1		0.8	-14.2		-14.2	23	8.8	7.0		7.0
82	205	EPL Feed hydrant		DE	1	1		15.0	15.0		15.0		15.0	11.9		11.9
83	206	Italian Motors		loop	1	1		0.8	0.8		0.8	0	0.8	0.6		0.6
84	501	Front St & Easterbrook/SR9		loop	0	0		0	0		0.0		0.0	0.0		0.0
85	502	Front St & Sumas Ave		loop	5	5		4.0	4.0		4.0		4.0	3.1		3.1
86	503	Front St & Sumas Ave		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
87	504	Sumas Av & ally south of W Front		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
88	506	Noble St & Sumas Ave		loop	3	3		2.4	2.4		2.4		2.4	1.9		1.9
89	507	Noble St & Sumas Ave	508-513	loop	0	6		4.8	-33.2		-33.2		-33.2	-26.4		-26.4
90	508	W end of Noble St		DE	1	1		15.0	15.0		15.0		15.0	11.9		11.9
91	509	Sumas Ave & Capstone Ct		DE	3	5		23.0	6.0		6.0		6.0	4.8		4.8
92	510	Sumas Ave & W of Capstone Ct		DE	1	2		17.0	-13.0		-13.0		-13.0	-10.3		-10.3
93	511	Rodeo Grounds		DE		1		15.0	15.0		15.0	2	17.0	13.5		13.5
94	512	RV Park & Camp Grounds		DE	0	1		0.0	0.0		0.0	8	8.0	6.3		6.3
95	513	SR 9/Easterbrook		DE	1	1		15.0	15.0		15.0		15.0	11.9		11.9
96	520	Front St & Lawson Ave (SE)		loop	5	5		4.0	4.0		4.0		4.0	3.1		3.1
97	521	Front St & Lawson Ave (SW)		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
98	523	Front St & Lawson Ave (SW)		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
99	524	Lawson St & ally south of W Front (W)		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
100	525	1205 Boon (N)	526	loop	0	1		0.8	-9.8		-9.8		-9.8	-7.7		-7.7
101	526	1205 Boon (NE)		DE	0	1		15.0	10.6	4.5	15.0		15.0	11.9		11.9
102	527	1205 Boon (S)		loop	0	0		0.0	0.0	4.5	4.5		4.5	3.5		3.5
103	528	Nobel St NE of 1305 Boon		loop	9	9		7.1	7.1		7.1		7.1	5.7		5.7
104	530	End of Boon St cul-de-sac	531	loop	0	0			0.0		0.0		0.0	0.0		0.0
105	531	W end of 1350 Boon St development		DE	0	0			0.0		0.0		0.0	0.0		0.0
106	532	Boon St cul-de-sac		loop	6	6		4.8	4.8		4.8		4.8	3.8		3.8
107	533	S end of Boon St		loop	10	10		7.9	7.9		7.9		7.9	6.3		6.3
108	534	1401 Boon St (on loop)	535	loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
109	535	1400 Boon St (inside complex)		DE	0	0			0.0	18.0	18.0		18.0	14.3		14.3
110	536	1305 Boon St (on loop)	537	loop	2	2		1.6	1.6		1.6		1.6	1.3		1.3
111	537	1305 Boon St (inside complex)		DE	0	0		0.0	0.0	22.0	22.0		22.0	17.4		17.4
112	540	Front St & Boon St (S)	541	loop	5	5		4.0	4.0		4.0		4.0	3.1		3.1
113	541	316-346 Front St & Boon St (N)		DE	0	0		0.0	0.0	8.8	8.8		8.8	7.0		7.0

	Node Number	2045 PHD Location	Downstream Nodes	Node Location	SMALL USERS 2024 # of Services[1]	Cum. # of Services	Mult-Family ERUs	Cum. MID	MID Node Demand (gpm)	Multi-Family (gpm)	Residential Multi-Fam Small Comm. (gpm)	LARGE USER[2] (gpm)	Sum (gpm)	Factored Sum (gpm)	Intertie (gpm)	TOTAL NODE DEMAND (gpm)
114	542	Front St, E of Hovel (S)	543	loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
115	543	404-412 Front St, E of Hovel (N)		DE	0	0		0.0	0.0	6.6	6.6		6.6	5.2		5.2
116	544	Front St & Hovel Rd (S)	545	loop	3	4		3.2	-11.8		-11.8		-11.8	-9.4		-9.4
117	545	Front St, W of Hovel (N)		DE	1	1		15.0	15.0		15.0		15.0	11.9		11.9
118	561	Front St & Hovel Rd (E)	562-571	loop	3	58		46.0	-62.0		-62.0		-62.0	-49.2		-49.2
119	562	Hovel Rd by creek	563-571	DE	5	55		108.0	-18.0		-18.0		-18.0	-14.3		-14.3
120	563	Hovel Rd & Cornerstone Dr (N)	565-571	DE	12	39		91.0	37.0		37.0		37.0	29.3		29.3
121	565	Cornerstone Dr & Capstone Ct	565-571	DE	11	11		35.0	2.0		2.0		2.0	1.6		1.6
122	566	Capstone Ct - end	566-571	DE	5	5		23.0	23.0		23.0		23.0	18.2		18.2
123	567	Cornerstone Dr - W loop	568	DE	8	8		29.0	10.0		10.0		10.0	7.9		7.9
124	568	Cornerstone Dr - W loop cul-du-sac		DE	3	3		19.0	19.0		19.0		19.0	15.1		15.1
125	569	Hovel Rd & Cornerstone Dr (N)	50	DE	11	11		35.0	35.0		35.0		35.0	27.8		27.8
126	570	Hovel Rd S of Conerstone Dr (S)		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
127	571	Ball Field		DE							0.0	7	7.0	5.6		5.6
128	572			DE							0.0		0.0	0.0		0.0
129	581	Front St, W of Hovel (S)		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
130	582	510-550 Front St, W of Hovel (N)		loop	0	0		0.0	0.0	3.9	3.9		3.9	3.1		3.1
131	583	570-590 Front St & Victoria St	584-587	loop	1	11		8.7	-24.3	4.4	-19.9		-19.9	-15.8		-15.8
132	584	Front St & Swartwood Rd (N)	#########	DE	3	10		33.0	6.0		6.0		6.0	4.8		4.8
133	585	Front St & Swartwood Rd (S)	586	DE	0	7		0.0	0.0		0.0		0.0	0.0		0.0
134	586	Swartwood Rd, S end		DE	7	7		27.0	27.0		27.0		27.0	21.4		21.4
135	587			DE				0.0	0.0		0.0		0.0	0.0		0.0
136	601	Border E of tracks, SW of Border Crossing Bldg		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
137	602	Border E of tracks, NW of Border Crossing Bldg		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
138	603	206 Cherry St, S of Harrison Ave (TRMC Retail)		loop	0	0		0.0	0.0		0.0	3	3.0	2.4		2.4
139	604	145 Cherry St & Harrison Ave (Border Patrol)		loop	0	0		0.0	0.0		0.0	2	2.0	1.6		1.6
140	605	Harrison & Sumas Ave		loop	8	8		6.3	6.3		6.3		6.3	5.0		5.0
141	606	Harrison & Boundary Ave	607	loop	0	1		0.8	-14.2		-14.2		-14.2	-11.3		-11.3
142	607	W end of Boundary Ave		DE	1	1		15.0	15.0		15.0		15.0	11.9		11.9
143	610	Harrison & Fisk St		loop	6	6		4.8	4.8		4.8		4.8	3.8		3.8
144	611	Boundary Ave & Fisk		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
145	612	Bondary Ave E of Sumas Ave		loop	3	3		2.4	2.4		2.4		2.4	1.9		1.9
146	615	Harrison & Lawson St		loop	4	4		3.2	3.2		3.2		3.2	2.5		2.5
147	616	Harrison & Gough St	616	loop	2	3		2.4	-12.6		-12.6		-12.6	-10.0		-10.0
148	617	E end of Harrison Ave		DE	1	1		15.0	15.0		15.0		15.0	11.9		11.9
149	619										0.0		0.0	0.0		0.0
150	620	121 Cherry St & Cleveland Ave (Sumas Investment)		loop	1	1		0.8	0.8		0.8	5	5.8	4.6		4.6
151	621	Cleveland Ave, W of Sumas Ave		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
152	622	Cleveland Ave & Sumas Ave		loop	4	4		3.2	3.2		3.2		3.2	2.5		2.5
153	623	Cleveland Ave & Fisk St	624	loop	8	8		6.3	-8.7		-8.7		-8.7	-6.9		-6.9
154	624	Fisk St, N of Cleveland		DE	1	1		15.0	15.0		15.0		15.0	11.9		11.9
155	625	Cleveland Ave & Lawson St		loop	8	8		6.3	6.3		6.3		6.3	5.0		5.0
156	626	Cleveland Ave & Gough St		loop	4	4		3.2	3.2		3.2		3.2	2.5		2.5
157	630	Garfield St, E of RR tracks		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
158	631	Garfield St, E of RR tracks		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
159	632	340 Garfield St & Cherry St		loop	4	4		3.2	3.2		3.2	0	3.2	2.5		2.5
160	633	130 Garfield St & Sumas Ave		loop	0	0		0.0	0.0	6	6.0		6.0	4.8		4.8
161	634	Garfield St & Sumas Ave	635, 636	loop	4	9		7.1	-15.9		-15.9		-15.9	-12.6		-12.6
162	635	Garfield St between Sumas Ave jog in N-S Roads	636	DE	1	5		23.0	2.0		2.0		2.0	1.6		1.6
163	636	Garfield St between Sumas Ave jog in N-S Roads		DE	1	4		21.0	21.0		21.0		21.0	16.7		16.7
164	637	310-320 Garfield St & Fisk St		loop	4	4		3.2	3.2	4	7.2		7.2	5.7		5.7
165	638	380 Garfield St & Lawson St		loop	4	70		55.5	-67.5	2.2	-65.3		-65.3	-51.8		-51.8
166	639	Garfield St & Gough St		DE	3	70		123.0	3.0		3.0		3.0	2.4		2.4
167	640	Garfield St & E of Gough St		DE	0	67		0.0	0.0		0.0		0.0	0.0		0.0
168	641	Garfield St & Roosevelt Ct	642	DE	6	67		120.0	-11.0		-11.0		-11.0	-8.7		-8.7
169	642	Roosevelt Court		DE	4	4		21.0	21.0		21.0		21.0	16.7		16.7
170	643	Garfield St & Jefferson Ct		DE	7	57		110.0	-16.0		-16.0		-16.0	-12.7		-12.7
171	644	Jefferson Ct & Lincoln Circle	645	DE	3	16		45.0	-7.0		-7.0		-7.0	-5.6		-5.6
172	645	Jefferson Ct		DE	5	5		23.0	23.0		23.0		23.0	18.2		18.2
173	646	Lincoln Circle		DE	8	8		29.0	29.0		29.0		29.0	23.0		23.0
174	647	Wilson Lane, S end	648	DE	4	10		33.0	8.0		8.0		8.0	6.3		6.3

	Node Number	2045 PHD Location	Downstream Nodes	Node Location	SMALL USERS 2024 # of Services[1]	Cum. # of Services	Mult-Family ERUs	Cum. MID	MID Node Demand (gpm)	Multi-Family (gpm)	Residential Multi-Fam Small Comm. (gpm)	LARGE USER[2] (gpm)	Sum (gpm)	Factored Sum (gpm)	Intertie (gpm)	TOTAL NODE DEMAND (gpm)
175	648	Wilson Lane, S end		DE	6	6		25.0	25.0		25.0		25.0	19.8		19.8
176	649	Wilson Ln & Taylor Circle	650	DE	7	13		39.0	-19.0		-19.0		-19.0	-15.1		-15.1
177	650	Taylor Circle		DE	6	6		25.0	25.0		25.0		25.0	19.8		19.8
178	651	Jones Rd & Wilson Ln	655, 656, 657	DE	7	34		81.0	21.0		21.0		21.0	16.7		16.7
179	655	Jones Rd, E of Wilson Ln	656, 657	DE	3	4		21.0	6.0		6.0		6.0	4.8		4.8
180	656	N of Jones Rd, E of Wilson Ln	70	DE	1	1		15.0	15.0		15.0		15.0	11.9		11.9
181	~~657~~	~~JONES ROAD INTERTIE~~									0.0		0.0	0.0		0.0
182	661	First ST, E of Cherry	662, 663	DE	0	4		21.0	-13.0		-13.0		-13.0	-10.3		-10.3
183	662	First ST, E of Cherry		DE	2	2		17.0	17.0		17.0		17.0	13.5		13.5
184	663	First ST, E of Cherry		DE	2	2		17.0	17.0		17.0		17.0	13.5		13.5
185	664	First ST, E of Cherry	661, 662, 663	DE	0	4		0.0	0.0		0.0		0.0	0.0		0.0
186	665	First St & Cherry	661 - 664	loop	0	4		3.2	-17.8		-17.8		-17.8	-14.1		-14.1
187	666	136 First St & Sumas Ave		loop	6	6		4.8	4.8	1.1	5.9		5.9	4.6		4.6
188	667	First St & Lawson		loop	8	8		6.3	6.3		6.3		6.3	5.0		5.0
189	668	First St & Gough		loop	6	6		4.8	4.8		4.8		4.8	3.8		3.8
190	669	First St , E end		loop	5	5		4.0	4.0		4.0		4.0	3.1		3.1
191	670	Second St, E end		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
192	671	Second St, E end		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
193	672	Second St, E end	673	loop	0	2		1.6	-15.4		-15.4		-15.4	-12.2		-12.2
194	673	Second St, E end		DE	2	2		17.0	17.0		17.0		17.0	13.5		13.5
195	674	540 Second St, E of Lawson		loop	0	0		0.0	0.0	3.3	3.3		3.3	2.6		2.6
196	675	Second St & Lawson St		loop	9	9		7.1	7.1		7.1		7.1	5.7		5.7
197	676	Second St & Sumas Ave		loop	4	4		3.2	3.2		3.2		3.2	2.5		2.5
198	677	Second St & E of Cherry St		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
199	678	Second St & 520/534 Cherry St		loop	1	1		0.8	0.8		0.8	0	0.8	0.6		0.6
200	679	Second St, 601/617 Cherry St	680	loop	0	1		0.8	-14.2		-14.2	0	-14.2	-11.3		-11.3
201	680	Second St, W of Cherry St		DE	1	1		15.0	15.0		15.0		15.0	11.9		11.9
202	684	825 Cherry St (Nopal Rest.)		loop	0	0		0.0	0.0	3	3.0		3.0	2.4		2.4
203	685	Third St & 725 Cherry (Cherry St Market)		loop	4	4		3.2	3.2	0	3.2		3.2	2.5		2.5
204	686	S of Second St & W of Sumas Ave		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
205	687	S of Second St & Sumas Ave		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
206	688	Third St & Sumas Ave		loop	5	5		4.0	4.0		4.0		4.0	3.1		3.1
207	689	Sumas Ave, S of (135) Third St (City Park)		loop	0	0		0.0	0.0	3	3.0		3.0	2.4		2.4
208	690	Third St & Lawson St		loop	11	11		8.7	8.7		8.7		8.7	6.9		6.9
209	691	Third St & Gough St		loop	9	9		7.1	7.1		7.1		7.1	5.7		5.7
210	692	Gough St, N or Third St		loop	2	2		1.6	1.6		1.6		1.6	1.3		1.3
211	693	N or Third St & W of Gough St		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
212	694										0.0		0.0	0.0		0.0
213	695										0.0		0.0	0.0		0.0
214	700	Cherry St & Vancouver St		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
215	701	819 Cherry St, N of Vancouver, W of Columbia (Bob's Burger		loop	0	0		0.0	0.0		0.0	6	6.0	4.8		4.8
216	702	Columbia St, E of Cherry St		DE	4	4		21.0	21.0		21.0		21.0	16.7		16.7
217	703	Columbia St, W of Sumas Ave		DE	1	5		23.0	2.0		2.0		2.0	1.6		1.6
218	704	Columbia St & Sumas Ave	702, 703	loop	3	8		6.3	-16.7		-16.7		-16.7	-13.2		-13.2
219	706	317 Columbia St & Lawson St		loop	7	7		5.6	5.6	0.6	6.2		6.2	4.9		4.9
220	707	Vancouver St & Lawson St		loop	8	8		6.3	6.3		6.3		6.3	5.0		5.0
221	708	Vancouver St & Sumas Ave		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
222	709	Vancouver St & 910-912 Sumas Ave	711, 710	loop	1	6		4.8	-18.2	1.1	-17.1		-17.1	-13.6		-13.6
223	710	Vancouver St, W of Sumas Ave	711	DE	0	5		0.0	0.0		0.0		0.0	0.0		0.0
224	711	Vancouver St, E of Cherry St		DE	5	5		23.0	23.0		23.0		23.0	18.2		18.2
225	712	142 Mitchell St, E of Cherry St		DE	2	2		17.0	17.0	2.2	19.2		19.2	15.2		15.2
226	713	Mitchell St, W of Sumas Ave	712	DE	0	2		0.0	0.0		0.0		0.0	0.0		0.0
227	714	Mitchell St & Sumas Ave	711, 712	loop	7	9		7.1	-9.9		-9.9		-9.9	-7.8		-7.8
228	715	Mitchell St & Lawson St		loop	9	9		7.1	7.1		7.1		7.1	5.7		5.7
229	716	Lawson St, N of Mitchell St		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
230	717	N of Mitchell & Gough St	717	loop	3	5		4.0	-13.0		-13.0		-13.0	-10.3		-10.3
231	718	Vancouver St & Gough St		DE	2	2		17.0	17.0		17.0		17.0	13.5		13.5
232	719	Mitchell St. & Gough St.		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
233	720	Mitchell St., W of Gough St.	721	loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
234	721	Mitchell St., W of Gough St. -School Hydrant		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
235	722	Mitchell St., W of Gough St.	723	loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0

	Node Number	2045 PHD Location	Downstream Nodes	Node Location	SMALL USERS 2024 # of Services[1]	Cum. # of Services	Mult-Family ERUs	Cum. MID	MID Node Demand (gpm)	Multi-Family (gpm)	Residential Multi-Fam Small Comm. (gpm)	LARGE USER[2] (gpm)	Sum (gpm)	Factored Sum (gpm)	Intertie (gpm)	TOTAL NODE DEMAND (gpm)
236	723	Mitchell St., W of Gough St. -School service		DE	0	0		0.0	0.0		0.0		0.0	0.0		0.0
237	724										0.0		0.0	0.0		0.0
238	740	Front St & Lawson St		loop	2	2		1.6	1.6		1.6		1.6	1.3		1.3
239	741	Morton St & Lawson St		loop	1	1		0.8	0.8		0.8		0.8	0.6		0.6
240	742	Morton St & Lawson St - SCHOOL	743	loop	0	1		0.8	-14.2		-14.2	0	-14.2	-11.3		-11.3
241	743	Morton St & Lawson St - SCHOOL HYDRANT		DE	0	1		15.0	15.0		15.0		15.0	11.9		11.9
242	744	200 Front St & Sumas Ave		loop	3	3		2.4	2.4	1.1	3.5		3.5	2.8		2.8
243	745	Sumas Ave, N of Front St	746	loop	0	4		3.2	-17.8		-17.8		-17.8	-14.1		-14.1
244	746	N of Front St, E of Cherry St		DE	4	4		21.0	21.0		21.0		21.0	16.7		16.7
245	747	207-225 Morton St between Sumas Ave & Lawson		loop	6	6		4.8	4.8	4.4	9.2		9.2	7.3		7.3
246	748	Sumas Ave between Morton & Mitchell	749	loop	0	2		1.6	-15.4		-15.4		-15.4	-12.2		-12.2
247	749	E of Sumas Ave between Morton & Mitchell (1036 Sumas Ave		DE	2	2		17.0	17.0	2.2	19.2		19.2	15.2		15.2
248	750	Morton St & Sumas Ave		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
249	751	Morton St, W of Sumas		loop	3	3		2.4	2.4		2.4		2.4	1.9		1.9
250	752	Morton St, E of Cherry St		loop	5	5		4.0	4.0		4.0		4.0	3.1		3.1
251	753	E of Cherry St, N of Morton St		loop	3	3		2.4	2.4		2.4		2.4	1.9		1.9
252	754	1015 Cherry St, N of Morton St (Boomtown)		loop	0	0		0.0	0.0		0.0	12	12.0	9.5		9.5
253	755	Cherry St, N of Front St		loop	0	0		0.0	0.0		0.0		0.0	0.0		0.0
254	756										0.0		0.0	0.0		0.0
255	760	Mitchell St, E of School, W of Victoria St		loop	3	3		2.4	2.4		2.4		2.4	1.9		1.9
256	761	E end of Morton St, W of Victoria St		loop	6	6		4.8	4.8		4.8		4.8	3.8		3.8
257	762	Mitchell St & Victoria St	773, 774, 775	loop	3	6		4.8	-14.2		-14.2		-14.2	-11.3		-11.3
258	763	Victoria St, N of Mitchell St		DE	1	3		19.0	2.0		2.0		2.0	1.6		1.6
259	764	Columbia St & Victoria St		DE	0	2		0.0	0.0		0.0		0.0	0.0		0.0
260	765	Columbia St, E of Victoria ST		DE	2	2		17.0	17.0		17.0		17.0	13.5		13.5
261	766	Victoria St, S of Mitchell	767	loop	0	2		1.6	-15.4		-15.4		-15.4	-12.2		-12.2
262	767	E of Victoria, S of Mitchell		DE	2	2		17.0	17.0		17.0		17.0	13.5		13.5
263	768	Morton St & Victoria St		loop	6	6		4.8	4.8		4.8		4.8	3.8		3.8
		2024 TOTALS			525	1,185	0	2,304.3	416.3	108.5						
																0.0
264	J-F10	Future NW Residential											0.0	0.0		0.0
265	J-F11	Future NW Industrial										4	4.0	3.2		3.2
266	J-F12	Future NW Residential											0.0	0.0		0.0
267	J-F13	Future NW Residential									10		10.0	7.9		7.9
268	J-F14	Future NW Residential											0.0	0.0		0.0
269	J-F15	Future NW Industrial										10	10.0	7.9		7.9
270	J-F16	Future NW Industrial										10	10.0	7.9		7.9
271	J-F20	Future NW Industrial											0.0	0.0		0.0
272	J-F21	Future NW Industrial										15	15.0	11.9		11.9
273	J-F22	Future NW Industrial										10	10.0	7.9		7.9
274	J-F23	Future NW Residential									15		15.0	11.9		11.9
275	J-F24	Future NW Residential									15		15.0	11.9		11.9
276	J-F30	Future NW Industrial										15	15.0	11.9		11.9
277	J-F31	Future NW Industrial										10	10.0	7.9		7.9
278	J-F32	Future NW Industrial											0.0	0.0		0.0
279	J-F33	Future NW Industrial										15	15.0	11.9		11.9
280	J-F34	Future NW Residential											0.0	0.0		0.0
													0.0	0.0		0.0
281	J-F50	Future SE Residential											0.0	0.0		0.0
282	J-F51	Future SE Residential											0.0	0.0		0.0
283	J-F52	Future SE Residential											0.0	0.0		0.0
284	J-F53	Future SE Residential									15		15.0	11.9		11.9
285	J-F54	Future SE Residential									15		15.0	11.9		11.9
286	J-F55	Future SE Residential									15		15.0	11.9		11.9
287	J-F56	Future SE Residential									15		15.0	11.9		11.9
288	J-F57	Future SE Residential									10		10.0	7.9		7.9
289	J-F58	Future SE Residential									9		9.0	7.1		7.1
290	J-F59	Future SE Residential									9		9.0	7.1		7.1

	Node Number	2045 PHD Location	Downstream Nodes	Node Location	SMALL USERS 2024 # of Services[1]	Cum. # of Services	Mult-Family ERUs	Cum. MID	MID Node Demand (gpm)	Multi-Family (gpm)	Residential Multi-Fam Small Comm. (gpm)	LARGE USER[2] (gpm)	Sum (gpm)	Factored Sum (gpm)	Intertie (gpm)	TOTAL NODE DEMAND (gpm)
291	J-F60	Future SE Residential									9		9.0	7.1		7.1
292	J-F61	Future SE Residential											0.0	0.0		0.0
		TOTALS									661.8	252	914	724.5	774	1,498.5
									Future Demand Added		137.0	89.0				

[1] "# of services" at each node is based on a review of a city aerial photo showing home and buisnesss locations. The number of residential connections used in the model (527) is less than the number of residentail connections the City presently has (571).

[2] "Large User" gpm rates comes from actual usage with estimated peaking factors (see Large User Worksheet). PHD flow rates, as estimated using DOH conversion to ERUs, was not used.

System PHD	724.5	Loop Factor
Table Sum	914	0.793

(Formula from 1983 Sizing Guidelines table)

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* * * * * * * * * * * * *  K Y P I P E  * * * * * * * * * * * * *
*                                                                 *
*  Pipe Network Modeling Software                                 *
*                                                                 *
*  CopyRighted by KYPIPE LLC (www.kypipe.com)                     *
*  Version: 10.009  10/01/2019                                    *
*  Serial #:  6-5118003                                           *
*  Interface:  Classic                                            *
*  Licensed for Pipe2010                                          *
*                                                                 *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
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Date & Time: Thu Aug 14 15:27:26 2025

Master File : p:\s\sums0002\0600info\water\ky pipe\steady state\2025-08_2024 steady state.KYP\2025-08_2024 steady state.P2K

SUMMARY OF ORIGINAL DATA

UNITS SPECIFIED

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

PIPELINE DATA

STATUS CODE: XX -CLOSED PIPE CV -CHECK VALVE

PIPE NAME	NODE NAMES #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.
P-1	J-513	J-4	385.00	8.00	140.0000	0.00
P-101	J-101	J-103	240.00	10.00	140.0000	0.00
P-102	J-102	J-101	218.00	10.00	140.0000	0.00
P-103	J-104	J-102	1245.00	10.00	140.0000	0.00
P-104	J-105	J-104	221.00	6.00	130.0000	0.00
P-105	J-105	J-106	658.00	6.00	130.0000	0.00
P-106	J-107	J-105	290.00	4.00	140.0000	0.00
P-107	J-108	J-107	490.00	4.00	140.0000	0.00
P-108	J-109	J-108	219.00	2.00	140.0000	0.00
P-109	J-109	J-110	275.00	2.00	130.0000	0.00
P-110	J-111	J-109	612.00	4.00	130.0000	0.00
P-111	J-111	J-104	742.00	10.00	140.0000	0.00
P-112	J-112	J-111	606.00	10.00	140.0000	0.00
P-113	J-114	J-112	1197.00	10.00	140.0000	0.00
P-114	J-110	J-113	1663.00	2.00	140.0000	0.00

PIPE NAME	NODE NAMES #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.
P-115	J-114	J-116	274.00	8.00	140.0000	0.00
P-116	J-116	J-115	573.00	4.00	140.0000	0.00
P-117	J-116	J-117	373.00	4.00	140.0000	0.00
P-118	J-120	J-114	959.00	10.00	140.0000	0.00
P-119	J-113	J-128	817.00	2.00	140.0000	0.00
P-120	J-119	J-120	278.00	10.00	140.0000	0.00
P-130	J-129	J-130	429.00	8.00	140.0000	0.00
P-131	J-129	J-131	684.00	8.00	140.0000	0.00
P-132	J-131	J-132	163.00	8.00	140.0000	0.00
P-133	J-132	J-133	580.00	6.00	140.0000	0.00
P-134	J-132	J-134	161.00	8.00	140.0000	0.00
P-135	J-134	J-135	153.00	2.00	140.0000	0.00
P-136	J-130	J-136	1389.00	8.00	140.0000	0.00
P-137	J-136	J-137	298.00	8.00	140.0000	0.00
P-138	J-136	J-138	180.00	8.00	140.0000	0.00
P-139	J-138	J-140	760.00	8.00	140.0000	0.00
P-141	J-140	J-141	315.00	8.00	140.0000	0.00
P-142	J-141	J-142	313.00	8.00	140.0000	0.00
P-143	J-141	J-145	328.00	8.00	140.0000	0.00
P-144	J-203	J-145	606.00	8.00	130.0000	0.00
P-145	J-145	J-146	251.00	8.00	140.0000	0.00
P-146	J-147	J-146	492.00	8.00	140.0000	0.00
P-147	J-134	J-147	955.00	8.00	140.0000	0.00
P-148	J-146	J-201	265.00	8.00	140.0000	0.00
P-150	J-103	J-150	3508.00	10.00	140.0000	0.00
P-151	J-150	J-151	835.00	10.00	140.0000	0.00
P-152	J-151	J-152	791.00	10.00	140.0000	0.00
P-153	J-152	J-153	639.00	10.00	140.0000	0.00
P-155	J-152	J-155	334.00	10.00	140.0000	0.00
P-156	J-155	J-156	203.00	10.00	140.0000	0.00
P-160	J-151	J-161	249.00	10.00	140.0000	0.00
P-161	J-161	J-178	312.00	10.00	140.0000	0.00
P-162	J-161	J-162	182.00	10.00	130.0000	0.00
P-163	J-162	J-163	217.00	8.00	130.0000	0.00
P-164	J-163	J-164	60.00	6.00	130.0000	0.00
P-165	J-162	J-165	81.00	10.00	130.0000	0.00
P-166	J-165	J-166	50.00	6.00	130.0000	0.00
P-167	J-165	J-167	271.00	10.00	130.0000	0.00
P-168	J-167	J-168	182.00	8.00	130.0000	0.00
P-169	J-168	J-169	43.00	6.00	130.0000	0.00
P-171	J-167	J-171	221.00	10.00	130.0000	0.00
P-172	J-171	J-172	60.00	6.00	130.0000	0.00
P-173	J-171	J-173	578.00	10.00	130.0000	0.00
P-174	J-173	J-174	42.00	6.00	130.0000	0.00
P-175	J-173	J-175	396.00	10.00	130.0000	0.00
P-176	J-175	J-176	550.00	10.00	130.0000	0.00
P-177	J-176	J-177	86.00	6.00	130.0000	0.00
P-178	J-176	J-178	145.00	10.00	130.0000	0.00
P-180	J-178	J-181	226.00	10.00	140.0000	0.00
P-182	J-181	J-182	123.00	10.00	140.0000	0.00
P-183	J-182	J-183	357.00	10.00	140.0000	0.00
P-184	J-183	J-184	643.00	8.00	140.0000	0.00
P-185	J-184	J-185	711.00	8.00	140.0000	0.00

PIPE NAME	NODE NAMES #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.
P-190	J-181	J-190	1387.00	10.00	140.0000	0.00
P-191	J-190	J-191	74.00	10.00	140.0000	0.00
P-192	J-191	J-192	453.00	1.00	140.0000	0.00
P-193	J-191	J-193	466.00	10.00	140.0000	0.00
P-194	J-206	J-191	770.00	8.00	140.0000	0.00
P-195	J-193	J-195	366.00	10.00	140.0000	0.00
P-196	J-195	J-196	263.00	8.00	130.0000	0.00
P-197	J-195	J-197	298.00	10.00	140.0000	0.00
P-201	J-201	J-501	762.00	12.00	140.0000	0.00
P-203	J-203	J-204	296.00	8.00	140.0000	0.00
P-205	J-204	J-205	343.00	8.00	140.0000	0.00
P-206	J-206	J-204	489.00	8.00	140.0000	0.00
P-300	T-1	J-119	98.00	10.00	140.0000	0.00
P-301	J-119	J-118	273.00	10.00	140.0000	0.00
P-302	J-119	J-122	300.00	10.00	100.0000	0.00
P-303	J-122	J-123	299.00	10.00	100.0000	0.00
P-304	J-122	J-126	493.00	1.00	130.0000	0.00
P-305	J-123	J-124	466.00	8.00	100.0000	0.00
P-306	J-126	J-125	185.00	1.00	130.0000	0.00
P-307	J-124	J-125	273.00	8.00	100.0000	0.00
P-310	J-125	J-127	161.00	8.00	100.0000	0.00
P-312	J-128	J-127	778.00	8.00	140.0000	0.00
P-313	J-127	J-129	104.00	8.00	140.0000	0.00
P-496	J-190	J-201	1259.00	10.00	140.0000	0.00
P-501	J-501	J-502	551.00	10.00	140.0000	0.00
P-502	J-502	J-503	4.00	10.00	130.0000	0.00
P-503	J-744	J-503	29.00	6.00	130.0000	0.00
P-504	J-502	J-504	123.00	8.00	140.0000	0.00
P-505	J-504	J-524	506.00	2.00	100.0000	0.00
P-506	J-504	J-506	132.00	8.00	140.0000	0.00
P-507	J-506	J-507	41.00	8.00	140.0000	0.00
P-508	J-507	J-508	415.00	1.00	100.0000	0.00
P-509	J-507	J-509	320.00	8.00	140.0000	0.00
P-510	J-509	J-510	454.00	8.00	140.0000	0.00
P-511	J-510	J-511	594.00	6.00	140.0000	0.00
P-512	J-512	J-510	995.00	8.00	140.0000	0.00
P-513	J-512	J-513	240.00	8.00	140.0000	0.00
P-516	J-669	J-670	226.00	6.00	140.0000	0.00
P-520	J-503	J-520	508.00	10.00	140.0000	0.00
P-521	J-520	J-521	13.00	10.00	140.0000	0.00
P-522	J-521	J-523	10.00	10.00	140.0000	0.00
P-523	J-506	J-528	332.00	8.00	140.0000	0.00
P-524	J-524	J-520	125.00	2.00	100.0000	0.00
P-525	J-523	J-525	148.00	6.00	140.0000	0.00
P-526	J-525	J-526	104.00	6.00	140.0000	0.00
P-527	J-525	J-527	192.00	6.00	140.0000	0.00
P-528	J-527	J-528	298.00	8.00	140.0000	0.00
P-529	J-528	J-530	227.00	8.00	140.0000	0.00
P-530	J-530	J-531	195.00	8.00	140.0000	0.00
P-531	J-530	J-532	156.00	8.00	140.0000	0.00
P-532	J-532	J-533	322.00	8.00	140.0000	0.00
P-533	J-533	J-534	462.00	8.00	140.0000	0.00
P-534	J-534	J-535	237.00	2.00	140.0000	0.00

PIPE NAME	NODE NAMES #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.
P-535	J-534	J-536	118.00	8.00	140.0000	0.00
P-536	J-536	J-537	391.00	2.00	140.0000	0.00
P-537	J-536	J-540	367.00	8.00	140.0000	0.00
P-540	J-523	J-540	200.00	10.00	140.0000	0.00
P-541	J-540	J-541	59.00	2.00	140.0000	0.00
P-542	J-540	J-542	259.00	10.00	140.0000	0.00
P-543	J-542	J-543	75.00	2.00	140.0000	0.00
P-544	J-542	J-544	107.00	10.00	140.0000	0.00
P-545	J-544	J-545	237.00	2.00	140.0000	0.00
P-546	J-544	J-561	26.00	10.00	140.0000	0.00
P-548	J-567	J-568	221.00	8.00	140.0000	0.00
P-550	J-563	J-569	656.00	8.00	140.0000	0.00
P-562	J-561	J-562	442.00	8.00	140.0000	0.00
P-563	J-562	J-563	724.00	8.00	140.0000	0.00
P-565	J-563	J-565	708.00	8.00	140.0000	0.00
P-566	J-565	J-566	568.00	8.00	140.0000	0.00
P-567	J-565	J-567	278.00	8.00	140.0000	0.00
P-569	J-567	J-569	695.00	8.00	140.0000	0.00
P-570	J-569	J-570	146.00	8.00	140.0000	0.00
P-571	J-570	J-571	1472.00	2.00	140.0000	0.00
P-573	J-570	J-3	196.00	8.00	140.0000	0.00
P-580	J-561	J-581	334.00	10.00	140.0000	0.00
P-581	J-581	J-582	49.00	6.00	140.0000	0.00
P-582	J-582	J-583	457.00	4.00	100.0000	0.00
P-583	J-583	J-584	434.00	8.00	140.0000	0.00
P-585	J-584	J-585	25.00	8.00	140.0000	0.00
P-586	J-585	J-2	278.00	8.00	140.0000	0.00
P-587	J-585	J-586	664.00	8.00	140.0000	0.00
P-601	J-123	J-601	390.00	6.00	130.0000	0.00
P-602	J-601	J-602	426.00	6.00	130.0000	0.00
P-603	J-602	J-603	416.00	6.00	130.0000	0.00
P-605	J-604	J-605	363.00	4.00	140.0000	0.00
P-607	J-606	J-607	315.00	2.00	140.0000	0.00
P-610	J-605	J-610	347.00	4.00	140.0000	0.00
P-611	J-611	J-610	160.00	4.00	140.0000	0.00
P-612	J-612	J-611	175.00	4.00	140.0000	0.00
P-613	J-606	J-612	168.00	4.00	130.0000	0.00
P-615	J-610	J-615	370.00	4.00	100.0000	0.00
P-616	J-615	J-616	374.00	2.00	130.0000	0.00
P-617	J-616	J-617	671.00	2.00	140.0000	0.00
P-620	J-619	J-633	259.00	6.00	140.0000	0.00
P-621	J-620	J-621	273.00	2.00	140.0000	0.00
P-622	J-621	J-619	121.00	6.00	140.0000	0.00
P-623	J-622	J-623	342.00	6.00	140.0000	0.00
P-624	J-623	J-624	167.00	1.00	140.0000	0.00
P-625	J-623	J-625	379.00	6.00	140.0000	0.00
P-626	J-625	J-626	360.00	4.00	140.0000	0.00
P-627	J-616	J-626	259.00	4.00	140.0000	0.00
P-630	J-125	J-630	652.00	8.00	140.0000	0.00
P-631	J-630	J-631	150.00	8.00	140.0000	0.00
P-632	J-631	J-632	119.00	8.00	140.0000	0.00
P-633	J-632	J-633	361.00	8.00	140.0000	0.00
P-634	J-633	J-634	143.00	8.00	140.0000	0.00

PIPE NAME	NODE NAMES #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.
P-635	J-634	J-635	54.00	6.00	140.0000	0.00
P-636	J-635	J-636	293.00	2.00	140.0000	0.00
P-637	J-634	J-637	251.00	8.00	140.0000	0.00
P-638	J-637	J-638	328.00	8.00	140.0000	0.00
P-639	J-638	J-639	307.00	8.00	140.0000	0.00
P-640	J-639	J-640	388.00	8.00	140.0000	0.00
P-641	J-640	J-641	227.00	8.00	140.0000	0.00
P-642	J-641	J-642	252.00	8.00	140.0000	0.00
P-643	J-641	J-643	332.00	8.00	140.0000	0.00
P-644	J-643	J-644	162.00	6.00	140.0000	0.00
P-645	J-644	J-645	171.00	6.00	140.0000	0.00
P-646	J-644	J-646	189.00	6.00	130.0000	0.00
P-647	J-646	J-647	364.00	6.00	140.0000	0.00
P-648	J-647	J-648	125.00	6.00	140.0000	0.00
P-649	J-647	J-649	345.00	6.00	140.0000	0.00
P-650	J-649	J-650	223.00	6.00	140.0000	0.00
P-651	J-643	J-651	504.00	8.00	140.0000	0.00
P-652	J-649	J-651	176.00	6.00	140.0000	0.00
P-655	J-651	J-655	182.00	8.00	140.0000	0.00
P-656	J-655	J-656	149.00	2.00	140.0000	0.00
P-657	J-655	J-1	726.00	8.00	140.0000	0.00
P-660	J-665	J-664	104.00	6.00	140.0000	0.00
P-661	J-664	J-661	59.00	2.00	130.0000	0.00
P-662	J-661	J-662	150.00	2.00	100.0000	0.00
P-663	J-661	J-663	114.00	2.00	100.0000	0.00
P-666	J-665	J-666	482.00	4.00	140.0000	0.00
P-667	J-666	J-667	625.00	2.00	100.0000	0.00
P-668	J-667	J-668	358.00	6.00	140.0000	0.00
P-669	J-668	J-669	314.00	6.00	140.0000	0.00
P-670	J-670	J-671	47.00	6.00	140.0000	0.00
P-671	J-671	J-672	91.00	4.00	140.0000	0.00
P-672	J-672	J-673	68.00	1.00	140.0000	0.00
P-673	J-672	J-674	256.00	4.00	140.0000	0.00
P-674	J-674	J-675	330.00	4.00	140.0000	0.00
P-675	J-675	J-676	613.00	4.00	100.0000	0.00
P-676	J-677	J-676	210.00	4.00	100.0000	0.00
P-677	J-678	J-677	288.00	4.00	100.0000	0.00
P-678	J-678	J-679	148.00	6.00	130.0000	0.00
P-679	J-131	J-679	662.00	6.00	140.0000	0.00
P-680	J-679	J-680	97.00	2.00	140.0000	0.00
P-684	J-679	J-684	329.00	6.00	100.0000	0.00
P-687	J-686	J-687	213.00	2.00	100.0000	0.00
P-689	J-690	J-688	610.00	6.00	140.0000	0.00
P-690	J-694	J-690	318.00	6.00	140.0000	0.00
P-691	J-691	J-694	362.00	6.00	140.0000	0.00
P-692	J-693	J-692	89.00	2.00	140.0000	0.00
P-693	J-674	J-693	425.00	6.00	140.0000	0.00
P-694	J-694	J-695	188.00	6.00	140.0000	0.00
P-702	J-703	J-702	298.00	4.00	130.0000	0.00
P-703	J-704	J-703	93.00	6.00	140.0000	0.00
P-707	J-708	J-707	513.00	4.00	130.0000	0.00
P-710	J-710	J-711	367.00	4.00	140.0000	0.00
P-711	J-713	J-712	225.00	2.00	100.0000	0.00

PIPE NAME	NODE NAMES #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.
P-712	J-714	J-713	98.00	4.00	140.0000	0.00
P-714	J-714	J-715	502.00	8.00	140.0000	0.00
P-716	J-716	J-717	472.00	4.00	140.0000	0.00
P-717	J-717	J-718	160.00	1.00	140.0000	0.00
P-718	J-717	J-719	146.00	4.00	140.0000	0.00
P-719	J-720	J-719	74.00	6.00	100.0000	0.00
P-720	J-720	J-721	70.00	8.00	140.0000	0.00
P-721	J-722	J-720	109.00	6.00	100.0000	0.00
P-722	J-722	J-723	100.00	8.00	140.0000	0.00
P-723	J-724	J-722	222.00	6.00	100.0000	0.00
P-730	J-709	J-710	96.00	6.00	140.0000	0.00
P-731	J-715	J-724	58.00	8.00	140.0000	0.00
P-739	J-742	J-741	20.00	8.00	140.0000	0.00
P-740	J-740	J-521	47.00	8.00	140.0000	0.00
P-741	J-747	J-741	265.00	4.00	120.0000	0.00
P-742	J-742	J-743	415.00	8.00	140.0000	0.00
P-743	J-741	J-715	322.00	8.00	140.0000	0.00
P-745	J-744	J-740	514.00	4.00	100.0000	0.00
P-747	J-751	J-756	224.00	6.00	130.0000	0.00
P-748	J-753	J-748	503.00	2.00	100.0000	0.00
P-749	J-748	J-749	132.00	1.00	140.0000	0.00
P-750	J-756	J-745	142.00	6.00	100.0000	0.00
P-751	J-752	J-751	278.00	4.00	140.0000	0.00
P-752	J-753	J-752	187.00	4.00	130.0000	0.00
P-753	J-754	J-753	38.00	6.00	130.0000	0.00
P-756	J-745	J-746	494.00	2.00	140.0000	0.00
P-770	J-719	J-760	493.00	6.00	100.0000	0.00
P-771	J-760	J-761	322.00	4.00	130.0000	0.00
P-772	J-760	J-762	444.00	6.00	100.0000	0.00
P-773	J-762	J-766	172.00	6.00	100.0000	0.00
P-774	J-766	J-767	226.00	2.00	140.0000	0.00
P-775	J-766	J-768	146.00	6.00	100.0000	0.00
P-776	J-761	J-768	458.00	4.00	100.0000	0.00
P-777	J-768	J-583	342.00	6.00	100.0000	0.00
P-779	J-582	J-761	336.00	4.00	130.0000	0.00
P-781	J-762	J-763	309.00	4.00	140.0000	0.00
P-783	J-763	J-764	322.00	4.00	140.0000	0.00
P-784	J-764	J-765	763.00	2.00	140.0000	0.00
P-801	J-603	J-604	126.00	6.00	130.0000	0.00
P-803	J-603	J-620	115.00	6.00	140.0000	0.00
P-805	J-620	J-632	296.00	6.00	140.0000	0.00
P-807	J-632	J-665	344.00	6.00	140.0000	0.00
P-809	J-665	J-678	277.00	6.00	140.0000	0.00
P-811	J-684	J-685	97.00	6.00	100.0000	0.00
P-813	J-685	J-701	397.00	6.00	100.0000	0.00
P-815	J-701	J-700	309.00	6.00	100.0000	0.00
P-817	J-700	J-754	524.00	6.00	100.0000	0.00
P-819	J-755	J-754	314.00	6.00	100.0000	0.00
P-821	J-501	J-755	194.00	6.00	100.0000	0.00
P-831	J-605	J-606	164.00	6.00	130.0000	0.00
P-833	J-605	J-622	250.00	6.00	130.0000	0.00
P-835	J-622	J-619	25.00	6.00	140.0000	0.00
P-841	J-677	J-686	187.00	2.00	100.0000	0.00

PIPE NAME	NODE NAMES #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.
P-843	J-676	J-687	181.00	6.00	100.0000	0.00
P-845	J-687	J-688	113.00	6.00	100.0000	0.00
P-847	J-688	J-689	235.00	6.00	100.0000	0.00
P-849	J-689	J-704	221.00	6.00	100.0000	0.00
P-851	J-704	J-708	287.00	6.00	100.0000	0.00
P-852	J-708	J-709	33.00	6.00	100.0000	0.00
P-853	J-709	J-714	301.00	6.00	100.0000	0.00
P-855	J-748	J-714	191.00	4.00	100.0000	0.00
P-857	J-748	J-750	140.00	4.00	100.0000	0.00
P-858	J-750	J-747	245.00	4.00	100.0000	0.00
P-859	J-750	J-756	45.00	6.00	100.0000	0.00
P-861	J-745	J-744	147.00	6.00	100.0000	0.00
P-871	J-615	J-625	256.00	4.00	130.0000	0.00
P-873	J-625	J-638	278.00	4.00	100.0000	0.00
P-875	J-638	J-667	350.00	4.00	130.0000	0.00
P-877	J-667	J-675	264.00	4.00	130.0000	0.00
P-879	J-675	J-690	299.00	4.00	130.0000	0.00
P-881	J-690	J-706	386.00	4.00	100.0000	0.00
P-883	J-706	J-707	398.00	4.00	100.0000	0.00
P-885	J-707	J-716	191.00	4.00	100.0000	0.00
P-887	J-716	J-715	146.00	4.00	100.0000	0.00
P-891	J-740	J-742	308.00	8.00	140.0000	0.00
P-893	J-671	J-692	161.00	6.00	140.0000	0.00
P-895	J-692	J-691	149.00	6.00	140.0000	0.00
P-901	J-902B	J-101	80.00	10.00	140.0000	0.00
P-902	J-900B	J-102	80.00	10.00	140.0000	0.00
P-903	O-Pump 5	J-902B	2.00	6.00	130.0000	0.00
P-904	O-Pump 4R	J-900B	2.00	6.00	130.0000	0.00
P-905	J-901A	I-Pump 5	2.00	6.00	130.0000	0.00
P-906	J-900A	I-Pump 4R	2.00	6.00	130.0000	0.00
P-907	R-5	J-901A	24.00	10.00	130.0000	0.00
P-908	R-4R	J-900A	24.00	10.00	130.0000	0.00

P U M P/L O S S E L E M E N T D A T A

THERE IS A DEVICE AT NODE Pump 4R DESCRIBED BY THE FOLLOWING DATA: (ID= 2)

HEAD (ft)	FLOWRATE (gpm)	EFFICIENCY (%)
320.00	0.00	65.00
240.00	600.00	74.00
160.00	800.00	73.50

THERE IS A DEVICE AT NODE Pump 5 DESCRIBED BY THE FOLLOWING DATA: (ID= 1)

HEAD (ft)	FLOWRATE (gpm)	EFFICIENCY (%)
317.00	0.00	63.00
215.00	600.00	43.00
145.00	900.00	59.00

N O D E D A T A

NODE NAME	NODE TITLE	EXTERNAL DEMAND (gpm)	JUNCTION ELEVATION (ft)	EXTERNAL GRADE (ft)
O-Pump 4R		0.00	50.00	
O-Pump 5		0.00	50.00	
J-1		60.00	39.00	
J-2		195.00	43.00	
J-3		122.00	44.00	
J-4		136.00	48.00	
J-101		0.00	53.00	
J-102		0.00	53.00	
J-103		0.60	51.00	
J-104		0.00	88.00	
J-105		-16.50	86.00	
J-106		23.30	107.00	
J-107		0.00	63.00	
J-108		2.80	63.00	
J-109		0.60	61.00	
J-110		0.60	46.00	
J-111		0.00	115.00	
J-112		0.00	161.00	
J-113		0.60	43.00	
J-114		-23.90	183.00	
J-115		17.30	161.00	
J-116		-0.80	146.00	
J-117		15.80	145.00	
J-118		11.30	185.00	
J-119		-10.20	187.00	
J-120		0.00	180.00	
J-122		0.00	144.00	
J-123		0.00	78.00	
J-124		0.00	49.00	
J-125		0.00	48.00	
J-126		2.30	92.00	
J-127		0.60	46.00	
J-128		1.10	52.00	
J-129		0.00	46.00	
J-130		1.30	46.00	
J-131		1.10	44.00	
J-132		-11.30	42.00	
J-133		15.80	44.00	
J-134		-10.70	41.00	
J-135		11.30	42.00	
J-136		0.00	46.00	
J-137		0.00	46.00	
J-138		14.30	46.00	
J-140		4.50	46.00	
J-141		0.00	45.00	
J-142		0.00	45.00	
J-145		0.00	43.00	
J-146		1.10	44.00	

NODE NAME	NODE TITLE	EXTERNAL DEMAND (gpm)	JUNCTION ELEVATION (ft)	EXTERNAL GRADE (ft)
J-147		0.00	45.00	
J-150		3.40	51.00	
J-151		-11.70	49.00	
J-152		0.00	48.00	
J-153		0.00	51.00	
J-155		0.00	49.00	
J-156		14.30	50.00	
J-161		0.00	49.00	
J-162		0.00	50.00	
J-163		0.00	53.00	
J-164		0.00	53.00	
J-165		0.00	50.00	
J-166		0.00	50.00	
J-167		12.80	50.00	
J-168		0.00	51.00	
J-169		0.00	51.00	
J-171		29.40	50.00	
J-172		0.00	50.00	
J-173		0.00	50.00	
J-174		0.00	50.00	
J-175		0.00	50.00	
J-176		7.50	50.00	
J-177		0.00	50.00	
J-178		0.00	45.00	
J-181		-10.70	45.00	
J-182		0.00	45.00	
J-183		0.00	44.00	
J-184		0.00	47.00	
J-185		11.30	50.00	
J-190		0.00	45.00	
J-191		-22.40	45.00	
J-192		11.30	47.00	
J-193		1.50	50.00	
J-195		1.50	51.00	
J-196		0.00	51.00	
J-197		11.30	50.00	
J-201		1.10	47.00	
J-203		0.00	47.00	
J-204		6.60	45.00	
J-205		11.30	46.00	
J-206		0.60	45.00	
J-501		0.00	44.00	
J-502		2.80	42.00	
J-503		0.00	42.00	
J-504		0.00	42.00	
J-506		1.70	44.00	
J-507		-25.20	44.00	
J-508		11.30	44.00	
J-509		4.50	45.00	
J-510		-9.80	44.00	
J-511		12.80	44.00	
J-512		6.00	48.00	

NODE NAME	NODE TITLE	EXTERNAL DEMAND (gpm)	JUNCTION ELEVATION (ft)	EXTERNAL GRADE (ft)
J-513		11.30	48.00	
J-520		2.80	43.00	
J-521		0.00	43.00	
J-523		0.00	40.00	
J-524		0.00	44.00	
J-525		-7.40	44.00	
J-526		11.30	44.00	
J-527		3.40	44.00	
J-528		5.10	44.00	
J-530		0.00	44.00	
J-531		0.00	43.00	
J-532		3.40	44.00	
J-533		5.70	45.00	
J-534		0.00	43.00	
J-535		13.60	43.00	
J-536		1.10	42.00	
J-537		16.60	44.00	
J-540		2.80	43.00	
J-541		6.60	43.00	
J-542		0.60	43.00	
J-543		5.00	43.00	
J-544		-9.00	43.00	
J-545		11.30	43.00	
J-561		-48.40	43.00	
J-562		-13.60	44.00	
J-563		27.90	45.00	
J-565		1.50	45.00	
J-566		17.30	45.00	
J-567		7.50	44.00	
J-568		14.30	44.00	
J-569		26.40	44.00	
J-570		0.00	44.00	
J-571		5.30	44.00	
J-581		0.60	42.00	
J-582		2.90	42.00	
J-583		-15.30	44.00	
J-584		4.50	42.00	
J-585		0.00	42.00	
J-586		20.30	40.00	
J-601		0.00	47.00	
J-602		0.00	48.00	
J-603		2.30	43.00	
J-604		1.50	43.00	
J-605		4.50	42.00	
J-606		-10.70	43.00	
J-607		11.30	44.00	
J-610		3.40	40.00	
J-611		0.00	40.00	
J-612		1.70	42.00	
J-615		2.30	38.00	
J-616		-9.60	37.00	
J-617		11.30	38.00	

NODE NAME	NODE TITLE	EXTERNAL DEMAND (gpm)	JUNCTION ELEVATION (ft)	EXTERNAL GRADE (ft)
J-619		0.00	41.00	
J-620		4.30	43.00	
J-621		0.60	41.00	
J-622		2.30	41.00	
J-623		-6.80	40.00	
J-624		11.30	40.00	
J-625		4.50	40.00	
J-626		2.30	39.00	
J-630		0.00	45.00	
J-631		0.00	44.00	
J-632		2.30	44.00	
J-633		4.50	43.00	
J-634		-12.20	42.00	
J-635		1.50	42.00	
J-636		15.80	42.00	
J-637		5.30	42.00	
J-638		-51.30	41.00	
J-639		2.30	39.00	
J-640		0.00	38.00	
J-641		-8.30	39.00	
J-642		15.80	40.00	
J-643		-12.10	39.00	
J-644		-5.30	39.00	
J-645		17.30	41.00	
J-646		21.80	39.00	
J-647		6.00	41.00	
J-648		18.80	41.00	
J-649		-14.30	40.00	
J-650		18.80	40.00	
J-651		15.80	40.00	
J-655		4.50	40.00	
J-656		11.30	39.00	
J-661		-9.80	42.00	
J-662		12.80	43.00	
J-663		12.80	41.00	
J-664		0.00	42.00	
J-665		-13.50	42.00	
J-666		4.20	42.00	
J-667		4.50	41.00	
J-668		3.40	40.00	
J-669		2.80	40.00	
J-670		0.00	40.00	
J-671		0.00	40.00	
J-672		-11.70	40.00	
J-673		12.80	42.00	
J-674		2.50	40.00	
J-675		5.10	40.00	
J-676		2.30	42.00	
J-677		0.60	41.00	
J-678		0.60	41.00	
J-679		-10.70	41.00	
J-680		11.30	41.00	

NODE NAME	NODE TITLE	EXTERNAL DEMAND (gpm)	JUNCTION ELEVATION (ft)	EXTERNAL GRADE (ft)
J-684		0.00	43.00	
J-685		2.30	43.00	
J-686		0.60	40.00	
J-687		0.00	42.00	
J-688		2.80	42.00	
J-689		0.00	44.00	
J-690		6.20	41.00	
J-691		5.10	41.00	
J-692		1.10	40.00	
J-693		0.60	40.00	
J-694		0.00	41.00	
J-695		0.00	41.00	
J-700		0.00	44.00	
J-701		4.50	44.00	
J-702		15.80	43.00	
J-703		1.50	44.00	
J-704		-12.80	44.00	
J-706		4.40	42.00	
J-707		4.50	40.00	
J-708		0.60	41.00	
J-709		-13.10	41.00	
J-710		0.00	41.00	
J-711		17.30	43.00	
J-712		14.50	43.00	
J-713		0.00	42.00	
J-714		-7.70	42.00	
J-715		5.10	40.00	
J-716		0.00	40.00	
J-717		-10.00	40.00	
J-718		12.80	40.00	
J-719		0.00	39.00	
J-720		0.00	39.00	
J-721		0.00	39.00	
J-722		0.00	40.00	
J-723		0.00	40.00	
J-724		0.00	40.00	
J-740		1.10	43.00	
J-741		0.60	41.00	
J-742		-10.70	41.00	
J-743		11.30	40.00	
J-744		2.50	42.00	
J-745		-13.50	44.00	
J-746		15.80	44.00	
J-747		6.70	42.00	
J-748		-11.70	42.00	
J-749		14.50	41.00	
J-750		0.00	42.00	
J-751		1.70	43.00	
J-752		2.80	43.00	
J-753		1.70	44.00	
J-754		9.00	44.00	
J-755		0.00	44.00	

NODE NAME	NODE TITLE	EXTERNAL DEMAND (gpm)	JUNCTION ELEVATION (ft)	EXTERNAL GRADE (ft)
J-756		0.00	42.00	
J-760		1.70	40.00	
J-761		3.40	40.00	
J-762		-10.90	41.00	
J-763		1.50	42.00	
J-764		0.00	42.00	
J-765		12.80	42.00	
J-766		-11.70	42.00	
J-767		12.80	40.00	
J-768		3.40	42.00	
J-900A		0.00	50.00	
J-900B		0.00	50.00	
J-901A		0.00	50.00	
J-902B		0.00	50.00	
R-5		----	50.00	50.00
R-4R		----	50.00	50.00
T-1		----	186.00	192.00
I-Pump 4R		0.00	50.00	
I-Pump 5		0.00	50.00	

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

OUTPUT SELECTION: ALL RESULTS ARE INCLUDED IN THE TABULATED OUTPUT
MAXIMUM AND MINIMUM PRESSURES = 5
MAXIMUM AND MINIMUM VELOCITIES = 5
MAXIMUM AND MINIMUM HEAD LOSS/1000 = 5

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

NUMBER OF PIPES .....(P) = 312
NUMBER OF END NODES .....(J) = 270
NUMBER OF PRIMARY LOOPS .....(L) = 40
NUMBER OF SUPPLY NODES .....(F) = 3
NUMBER OF SUPPLY ZONES .....(Z) = 1

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Case: 0

RESULTS OBTAINED AFTER 6 TRIALS: ACCURACY = 0.43388E-03

S I M U L A T I O N D E S C R I P T I O N (L A B E L)

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

STATUS CODE: XX -CLOSED PIPE CV -CHECK VALVE

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
P-1	J-513	J-4	136.00	0.15	0.00	0.87	0.40	0.40
P-101	J-101	J-103	346.95	0.18	0.00	1.42	0.76	0.76
P-102	J-102	J-101	346.95	0.16	0.00	1.42	0.76	0.76
P-103	J-104	J-102	346.95	0.94	0.00	1.42	0.76	0.76
P-104	J-105	J-104	-1.80	0.00	0.00	0.02	0.00	0.00
P-105	J-105	J-106	23.30	0.05	0.00	0.26	0.07	0.07
P-106	J-107	J-105	5.00	0.01	0.00	0.13	0.03	0.03
P-107	J-108	J-107	5.00	0.01	0.00	0.13	0.03	0.03
P-108	J-109	J-108	7.80	0.37	0.00	0.80	1.70	1.70
P-109	J-109	J-110	8.71	0.66	0.00	0.89	2.39	2.39
P-110	J-111	J-109	17.11	0.17	0.00	0.44	0.29	0.29
P-111	J-111	J-104	348.75	0.57	0.00	1.42	0.76	0.76
P-112	J-112	J-111	365.86	0.51	0.00	1.49	0.83	0.83
P-113	J-114	J-112	365.86	1.00	0.00	1.49	0.83	0.83
P-114	J-110	J-113	8.11	3.04	0.00	0.83	1.83	1.83
P-115	J-114	J-116	32.30	0.01	0.00	0.21	0.03	0.03
P-116	J-116	J-115	17.30	0.15	0.00	0.44	0.25	0.25
P-117	J-116	J-117	15.80	0.08	0.00	0.40	0.21	0.21
P-118	J-120	J-114	374.26	0.83	0.00	1.53	0.87	0.87
P-119	J-113	J-128	7.51	1.29	0.00	0.77	1.58	1.58
P-120	J-119	J-120	374.26	0.24	0.00	1.53	0.87	0.87
P-130	J-129	J-130	124.93	0.15	0.00	0.80	0.34	0.34
P-131	J-129	J-131	169.52	0.41	0.00	1.08	0.60	0.60
P-132	J-131	J-132	140.84	0.07	0.00	0.90	0.42	0.42
P-133	J-132	J-133	15.80	0.02	0.00	0.18	0.03	0.03
P-134	J-132	J-134	136.34	0.06	0.00	0.87	0.40	0.40
P-135	J-134	J-135	11.30	0.52	0.00	1.15	3.38	3.38
P-136	J-130	J-136	123.63	0.46	0.00	0.79	0.33	0.33
P-137	J-136	J-137	0.00	0.00	0.00	0.00	0.00	0.00
P-138	J-136	J-138	123.63	0.06	0.00	0.79	0.33	0.33
P-139	J-138	J-140	109.33	0.20	0.00	0.70	0.26	0.26
P-141	J-140	J-141	104.83	0.08	0.00	0.67	0.24	0.24
P-142	J-141	J-142	0.00	0.00	0.00	0.00	0.00	0.00
P-143	J-141	J-145	104.83	0.08	0.00	0.67	0.24	0.24
P-144	J-203	J-145	21.90	0.01	0.00	0.14	0.02	0.02
P-145	J-145	J-146	126.73	0.09	0.00	0.81	0.35	0.35
P-146	J-147	J-146	135.74	0.19	0.00	0.87	0.39	0.39
P-147	J-134	J-147	135.74	0.38	0.00	0.87	0.39	0.39
P-148	J-146	J-201	261.38	0.35	0.00	1.67	1.33	1.33
P-150	J-103	J-150	346.35	2.64	0.00	1.41	0.75	0.75
P-151	J-150	J-151	342.95	0.62	0.00	1.40	0.74	0.74
P-152	J-151	J-152	14.30	0.00	0.00	0.06	0.00	0.00
P-153	J-152	J-153	0.00	0.00	0.00	0.00	0.00	0.00
P-155	J-152	J-155	14.30	0.00	0.00	0.06	0.00	0.00
P-156	J-155	J-156	14.30	0.00	0.00	0.06	0.00	0.00
P-160	J-151	J-161	340.35	0.18	0.00	1.39	0.73	0.73
P-161	J-161	J-178	238.48	0.12	0.00	0.97	0.38	0.38
P-162	J-161	J-162	101.87	0.02	0.00	0.42	0.09	0.09
P-163	J-162	J-163	0.00	0.00	0.00	0.00	0.00	0.00

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
P-164	J-163	J-164	0.00	0.00	0.00	0.00	0.00	0.00
P-165	J-162	J-165	101.87	0.01	0.00	0.42	0.09	0.09
P-166	J-165	J-166	0.00	0.00	0.00	0.00	0.00	0.00
P-167	J-165	J-167	101.87	0.02	0.00	0.42	0.09	0.09
P-168	J-167	J-168	0.00	0.00	0.00	0.00	0.00	0.00
P-169	J-168	J-169	0.00	0.00	0.00	0.00	0.00	0.00
P-171	J-167	J-171	89.07	0.02	0.00	0.36	0.07	0.07
P-172	J-171	J-172	0.00	0.00	0.00	0.00	0.00	0.00
P-173	J-171	J-173	59.67	0.02	0.00	0.24	0.03	0.03
P-174	J-173	J-174	0.00	0.00	0.00	0.00	0.00	0.00
P-175	J-173	J-175	59.67	0.01	0.00	0.24	0.03	0.03
P-176	J-175	J-176	59.67	0.02	0.00	0.24	0.03	0.03
P-177	J-176	J-177	0.00	0.00	0.00	0.00	0.00	0.00
P-178	J-176	J-178	52.17	0.00	0.00	0.21	0.03	0.03
P-180	J-178	J-181	290.65	0.12	0.00	1.19	0.54	0.54
P-182	J-181	J-182	11.30	0.00	0.00	0.05	0.00	0.00
P-183	J-182	J-183	11.30	0.00	0.00	0.05	0.00	0.00
P-184	J-183	J-184	11.30	0.00	0.00	0.07	0.00	0.00
P-185	J-184	J-185	11.30	0.00	0.00	0.07	0.00	0.00
P-190	J-181	J-190	290.05	0.75	0.00	1.18	0.54	0.54
P-191	J-190	J-191	43.60	0.00	0.00	0.18	0.02	0.02
P-192	J-191	J-192	11.30	44.72	0.00	4.62	98.73	98.73
P-193	J-191	J-193	14.30	0.00	0.00	0.06	0.00	0.00
P-194	J-206	J-191	-40.40	0.03	0.00	0.26	0.04	0.04
P-195	J-193	J-195	12.80	0.00	0.00	0.05	0.00	0.00
P-196	J-195	J-196	0.00	0.00	0.00	0.00	0.00	0.00
P-197	J-195	J-197	11.30	0.00	0.00	0.05	0.00	0.00
P-201	J-201	J-501	506.72	0.48	0.00	1.44	0.63	0.63
P-203	J-203	J-204	-21.90	0.00	0.00	0.14	0.01	0.01
P-205	J-204	J-205	11.30	0.00	0.00	0.07	0.00	0.00
P-206	J-206	J-204	39.80	0.02	0.00	0.25	0.04	0.04
P-300	T-1	J-119	1010.20	0.54	0.00	4.13	5.47	5.47
P-301	J-119	J-118	11.30	0.00	0.00	0.05	0.00	0.00
P-302	J-119	J-122	634.84	1.30	0.00	2.59	4.32	4.32
P-303	J-122	J-123	631.54	1.28	0.00	2.58	4.28	4.28
P-304	J-122	J-126	3.31	5.73	0.00	1.35	11.63	11.63
P-305	J-123	J-124	434.76	2.96	0.00	2.77	6.35	6.35
P-306	J-126	J-125	1.01	0.24	0.00	0.41	1.28	1.28
P-307	J-124	J-125	434.76	1.73	0.00	2.77	6.35	6.35
P-310	J-125	J-127	288.64	0.48	0.00	1.84	2.97	2.97
P-312	J-128	J-127	6.41	0.00	0.00	0.04	0.00	0.00
P-313	J-127	J-129	294.45	0.17	0.00	1.88	1.65	1.65
P-496	J-190	J-201	246.45	0.51	0.00	1.01	0.40	0.40
P-501	J-501	J-502	509.71	0.85	0.00	2.08	1.54	1.54
P-502	J-502	J-503	292.23	0.00	0.00	1.19	0.63	0.63
P-503	J-744	J-503	-17.69	0.00	0.00	0.20	0.04	0.04
P-504	J-502	J-504	214.67	0.11	0.00	1.37	0.92	0.92
P-505	J-504	J-524	1.84	0.11	0.00	0.19	0.22	0.22
P-506	J-504	J-506	212.83	0.12	0.00	1.36	0.91	0.91
P-507	J-506	J-507	146.90	0.02	0.00	0.94	0.46	0.46
P-508	J-507	J-508	11.30	76.40	0.00	4.62	184.10	184.10
P-509	J-507	J-509	160.80	0.17	0.00	1.03	0.54	0.54
P-510	J-509	J-510	156.30	0.23	0.00	1.00	0.51	0.51
P-511	J-510	J-511	12.80	0.01	0.00	0.15	0.02	0.02
P-512	J-512	J-510	-153.30	0.49	0.00	0.98	0.49	0.49

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
P-513	J-512	J-513	147.30	0.11	0.00	0.94	0.46	0.46
P-516	J-669	J-670	42.01	0.04	0.00	0.48	0.18	0.18
P-520	J-503	J-520	274.54	0.25	0.00	1.12	0.49	0.49
P-521	J-520	J-521	273.59	0.01	0.00	1.12	0.49	0.49
P-522	J-521	J-523	290.86	0.01	0.00	1.19	0.55	0.55
P-523	J-506	J-528	64.23	0.03	0.00	0.41	0.10	0.10
P-524	J-524	J-520	1.84	0.03	0.00	0.19	0.22	0.22
P-525	J-523	J-525	9.29	0.00	0.00	0.11	0.01	0.01
P-526	J-525	J-526	11.30	0.00	0.00	0.13	0.02	0.02
P-527	J-525	J-527	5.39	0.00	0.00	0.06	0.00	0.00
P-528	J-527	J-528	1.99	0.00	0.00	0.01	0.00	0.00
P-529	J-528	J-530	61.12	0.02	0.00	0.39	0.09	0.09
P-530	J-530	J-531	0.00	0.00	0.00	0.00	0.00	0.00
P-531	J-530	J-532	61.12	0.01	0.00	0.39	0.09	0.09
P-532	J-532	J-533	57.72	0.03	0.00	0.37	0.08	0.08
P-533	J-533	J-534	52.02	0.03	0.00	0.33	0.07	0.07
P-534	J-534	J-535	13.60	1.13	0.00	1.39	4.76	4.76
P-535	J-534	J-536	38.42	0.00	0.00	0.25	0.04	0.04
P-536	J-536	J-537	16.60	2.69	0.00	1.70	6.88	6.88
P-537	J-536	J-540	20.72	0.00	0.00	0.13	0.01	0.01
P-540	J-523	J-540	281.57	0.10	0.00	1.15	0.51	0.51
P-541	J-540	J-541	6.60	0.07	0.00	0.67	1.25	1.25
P-542	J-540	J-542	292.89	0.14	0.00	1.20	0.55	0.55
P-543	J-542	J-543	5.00	0.06	0.00	0.51	0.75	0.75
P-544	J-542	J-544	287.29	0.06	0.00	1.17	0.53	0.53
P-545	J-544	J-545	11.30	0.80	0.00	1.15	3.38	3.38
P-546	J-544	J-561	284.99	0.01	0.00	1.16	0.53	0.53
P-548	J-567	J-568	14.30	0.00	0.00	0.09	0.01	0.01
P-550	J-563	J-569	110.30	0.18	0.00	0.70	0.27	0.27
P-562	J-561	J-562	208.60	0.39	0.00	1.33	0.87	0.87
P-563	J-562	J-563	222.20	0.71	0.00	1.42	0.98	0.98
P-565	J-563	J-565	84.00	0.11	0.00	0.54	0.16	0.16
P-566	J-565	J-566	17.30	0.00	0.00	0.11	0.01	0.01
P-567	J-565	J-567	65.20	0.03	0.00	0.42	0.10	0.10
P-569	J-567	J-569	43.40	0.03	0.00	0.28	0.05	0.05
P-570	J-569	J-570	127.30	0.05	0.00	0.81	0.35	0.35
P-571	J-570	J-571	5.30	1.22	0.00	0.54	0.83	0.83
P-573	J-570	J-3	122.00	0.06	0.00	0.78	0.32	0.32
P-580	J-561	J-581	124.79	0.04	0.00	0.51	0.11	0.11
P-581	J-581	J-582	124.19	0.07	0.00	1.41	1.36	1.36
P-582	J-582	J-583	70.57	2.93	0.00	1.80	6.40	6.40
P-583	J-583	J-584	219.80	0.42	0.00	1.40	0.96	0.96
P-585	J-584	J-585	215.30	0.02	0.00	1.37	0.93	0.93
P-586	J-585	J-2	195.00	0.21	0.00	1.24	0.77	0.77
P-587	J-585	J-586	20.30	0.01	0.00	0.13	0.01	0.01
P-601	J-123	J-601	196.78	1.42	0.00	2.23	3.65	3.65
P-602	J-601	J-602	196.78	1.56	0.00	2.23	3.65	3.65
P-603	J-602	J-603	196.78	1.52	0.00	2.23	3.65	3.65
P-605	J-604	J-605	52.72	0.73	0.00	1.35	2.00	2.00
P-607	J-606	J-607	11.30	1.06	0.00	1.15	3.38	3.38
P-610	J-605	J-610	8.06	0.02	0.00	0.21	0.06	0.06
P-611	J-611	J-610	5.51	0.00	0.00	0.14	0.03	0.03
P-612	J-612	J-611	5.51	0.01	0.00	0.14	0.03	0.03
P-613	J-606	J-612	7.21	0.01	0.00	0.18	0.06	0.06
P-615	J-610	J-615	10.16	0.07	0.00	0.26	0.18	0.18

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
P-616	J-615	J-616	1.03	0.02	0.00	0.10	0.05	0.05
P-617	J-616	J-617	11.30	2.27	0.00	1.15	3.38	3.38
P-620	J-619	J-633	6.74	0.00	0.00	0.08	0.01	0.01
P-621	J-620	J-621	8.99	0.60	0.00	0.92	2.21	2.21
P-622	J-621	J-619	8.39	0.00	0.00	0.10	0.01	0.01
P-623	J-622	J-623	31.71	0.04	0.00	0.36	0.11	0.11
P-624	J-623	J-624	11.30	16.49	0.00	4.62	98.73	98.73
P-625	J-623	J-625	27.21	0.03	0.00	0.31	0.08	0.08
P-626	J-625	J-626	2.97	0.00	0.00	0.08	0.01	0.01
P-627	J-616	J-626	-0.67	0.00	0.00	0.02	0.00	0.00
P-630	J-125	J-630	147.13	0.30	0.00	0.94	0.46	0.46
P-631	J-630	J-631	147.13	0.07	0.00	0.94	0.46	0.46
P-632	J-631	J-632	147.13	0.05	0.00	0.94	0.46	0.46
P-633	J-632	J-633	157.78	0.19	0.00	1.01	0.52	0.52
P-634	J-633	J-634	160.03	0.08	0.00	1.02	0.53	0.53
P-635	J-634	J-635	17.30	0.00	0.00	0.20	0.04	0.04
P-636	J-635	J-636	15.80	1.84	0.00	1.61	6.28	6.28
P-637	J-634	J-637	154.93	0.13	0.00	0.99	0.50	0.50
P-638	J-637	J-638	149.63	0.15	0.00	0.95	0.47	0.47
P-639	J-638	J-639	152.40	0.15	0.00	0.97	0.49	0.49
P-640	J-639	J-640	150.10	0.18	0.00	0.96	0.48	0.48
P-641	J-640	J-641	150.10	0.11	0.00	0.96	0.48	0.48
P-642	J-641	J-642	15.80	0.00	0.00	0.10	0.01	0.01
P-643	J-641	J-643	142.60	0.14	0.00	0.91	0.43	0.43
P-644	J-643	J-644	55.74	0.05	0.00	0.63	0.31	0.31
P-645	J-644	J-645	17.30	0.01	0.00	0.20	0.04	0.04
P-646	J-644	J-646	43.74	0.04	0.00	0.50	0.23	0.23
P-647	J-646	J-647	21.94	0.02	0.00	0.25	0.05	0.05
P-648	J-647	J-648	18.80	0.01	0.00	0.21	0.04	0.04
P-649	J-647	J-649	-2.86	0.00	0.00	0.03	0.00	0.00
P-650	J-649	J-650	18.80	0.01	0.00	0.21	0.04	0.04
P-651	J-643	J-651	98.96	0.11	0.00	0.63	0.22	0.22
P-652	J-649	J-651	-7.36	0.00	0.00	0.08	0.01	0.01
P-655	J-651	J-655	75.80	0.02	0.00	0.48	0.13	0.13
P-656	J-655	J-656	11.30	0.50	0.00	1.15	3.38	3.38
P-657	J-655	J-1	60.00	0.06	0.00	0.38	0.09	0.09
P-660	J-665	J-664	15.80	0.00	0.00	0.18	0.03	0.03
P-661	J-664	J-661	15.80	0.43	0.00	1.61	7.21	7.21
P-662	J-661	J-662	12.80	1.19	0.00	1.31	7.93	7.93
P-663	J-661	J-663	12.80	0.90	0.00	1.31	7.93	7.93
P-666	J-665	J-666	11.24	0.06	0.00	0.29	0.11	0.11
P-667	J-666	J-667	7.04	1.64	0.00	0.72	2.62	2.62
P-668	J-667	J-668	48.21	0.08	0.00	0.55	0.24	0.24
P-669	J-668	J-669	44.81	0.06	0.00	0.51	0.21	0.21
P-670	J-670	J-671	42.01	0.01	0.00	0.48	0.18	0.18
P-671	J-671	J-672	5.42	0.00	0.00	0.14	0.03	0.03
P-672	J-672	J-673	12.80	8.46	0.00	5.23	124.36	124.36
P-673	J-672	J-674	4.32	0.00	0.00	0.11	0.02	0.02
P-674	J-674	J-675	-1.00	0.00	0.00	0.03	0.00	0.00
P-675	J-675	J-676	3.21	0.01	0.00	0.08	0.02	0.02
P-676	J-677	J-676	45.75	0.60	0.00	1.17	2.87	2.87
P-677	J-678	J-677	52.23	1.06	0.00	1.33	3.67	3.67
P-678	J-678	J-679	47.64	0.04	0.00	0.54	0.26	0.26
P-679	J-131	J-679	27.58	0.06	0.00	0.31	0.08	0.08
P-680	J-679	J-680	11.30	0.33	0.00	1.15	3.38	3.38

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
P-684	J-679	J-684	74.62	0.32	0.00	0.85	0.99	0.99
P-687	J-686	J-687	5.27	0.33	0.00	0.54	1.53	1.53
P-689	J-690	J-688	20.39	0.03	0.00	0.23	0.05	0.05
P-690	J-694	J-690	32.60	0.04	0.00	0.37	0.11	0.11
P-691	J-691	J-694	32.60	0.04	0.00	0.37	0.11	0.11
P-692	J-693	J-692	2.21	0.01	0.00	0.23	0.17	0.17
P-693	J-674	J-693	2.81	0.00	0.00	0.03	0.00	0.00
P-694	J-694	J-695	0.00	0.00	0.00	0.00	0.00	0.00
P-702	J-703	J-702	15.80	0.07	0.00	0.40	0.25	0.25
P-703	J-704	J-703	17.30	0.00	0.00	0.20	0.04	0.04
P-707	J-708	J-707	8.29	0.04	0.00	0.21	0.07	0.07
P-710	J-710	J-711	17.30	0.09	0.00	0.44	0.25	0.25
P-711	J-713	J-712	14.50	2.25	0.00	1.48	9.99	9.99
P-712	J-714	J-713	14.50	0.02	0.00	0.37	0.18	0.18
P-714	J-714	J-715	65.63	0.05	0.00	0.42	0.10	0.10
P-716	J-716	J-717	28.06	0.29	0.00	0.72	0.62	0.62
P-717	J-717	J-718	12.80	19.90	0.00	5.23	124.36	124.36
P-718	J-717	J-719	25.26	0.07	0.00	0.64	0.51	0.51
P-719	J-720	J-719	70.95	0.07	0.00	0.81	0.90	0.90
P-720	J-720	J-721	0.00	0.00	0.00	0.00	0.00	0.00
P-721	J-722	J-720	70.95	0.10	0.00	0.81	0.90	0.90
P-722	J-722	J-723	0.00	0.00	0.00	0.00	0.00	0.00
P-723	J-724	J-722	70.95	0.20	0.00	0.81	0.90	0.90
P-730	J-709	J-710	17.30	0.00	0.00	0.20	0.04	0.04
P-731	J-715	J-724	70.95	0.01	0.00	0.45	0.12	0.12
P-739	J-742	J-741	-1.29	0.00	0.00	0.01	0.00	0.00
P-740	J-740	J-521	17.28	0.00	0.00	0.11	0.01	0.01
P-741	J-747	J-741	14.84	0.07	0.00	0.38	0.25	0.25
P-742	J-742	J-743	11.30	0.00	0.00	0.07	0.00	0.00
P-743	J-741	J-715	12.95	0.00	0.00	0.08	0.01	0.01
P-745	J-744	J-740	17.69	0.25	0.00	0.45	0.49	0.49
P-747	J-751	J-756	43.83	0.05	0.00	0.50	0.23	0.23
P-748	J-753	J-748	5.80	0.92	0.00	0.59	1.83	1.83
P-749	J-748	J-749	14.50	20.68	0.00	5.92	156.67	156.67
P-750	J-756	J-745	4.80	0.00	0.00	0.05	0.01	0.01
P-751	J-752	J-751	45.53	0.42	0.00	1.16	1.53	1.53
P-752	J-753	J-752	48.33	0.37	0.00	1.23	1.95	1.95
P-753	J-754	J-753	55.83	0.01	0.00	0.63	0.35	0.35
P-756	J-745	J-746	15.80	3.10	0.00	1.61	6.28	6.28
P-770	J-719	J-760	96.21	0.78	0.00	1.09	1.58	1.58
P-771	J-760	J-761	-3.53	0.00	0.00	0.09	0.02	0.02
P-772	J-760	J-762	98.03	0.73	0.00	1.11	1.63	1.63
P-773	J-762	J-766	94.63	0.26	0.00	1.07	1.53	1.53
P-774	J-766	J-767	12.80	0.96	0.00	1.31	4.25	4.25
P-775	J-766	J-768	93.53	0.22	0.00	1.06	1.50	1.50
P-776	J-761	J-768	43.80	1.21	0.00	1.12	2.65	2.65
P-777	J-768	J-583	133.93	1.00	0.00	1.52	2.91	2.91
P-779	J-582	J-761	50.72	0.72	0.00	1.29	2.14	2.14
P-781	J-762	J-763	14.30	0.06	0.00	0.37	0.18	0.18
P-783	J-763	J-764	12.80	0.05	0.00	0.33	0.15	0.15
P-784	J-764	J-765	12.80	3.24	0.00	1.31	4.25	4.25
P-801	J-603	J-604	54.22	0.04	0.00	0.62	0.34	0.34
P-803	J-603	J-620	140.26	0.20	0.00	1.59	1.70	1.70
P-805	J-620	J-632	126.96	0.42	0.00	1.44	1.41	1.41
P-807	J-632	J-665	114.01	0.40	0.00	1.29	1.16	1.16

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
P-809	J-665	J-678	100.47	0.25	0.00	1.14	0.92	0.92
P-811	J-684	J-685	74.62	0.10	0.00	0.85	0.99	0.99
P-813	J-685	J-701	72.32	0.37	0.00	0.82	0.93	0.93
P-815	J-701	J-700	67.82	0.26	0.00	0.77	0.83	0.83
P-817	J-700	J-754	67.82	0.43	0.00	0.77	0.83	0.83
P-819	J-755	J-754	-2.98	0.00	0.00	0.03	0.00	0.00
P-821	J-501	J-755	-2.98	0.00	0.00	0.03	0.00	0.00
P-831	J-605	J-606	7.81	0.00	0.00	0.09	0.01	0.01
P-833	J-605	J-622	32.36	0.03	0.00	0.37	0.13	0.13
P-835	J-622	J-619	-1.65	0.00	0.00	0.02	0.00	0.00
P-841	J-677	J-686	5.87	0.35	0.00	0.60	1.87	1.87
P-843	J-676	J-687	46.66	0.07	0.00	0.53	0.41	0.41
P-845	J-687	J-688	51.93	0.06	0.00	0.59	0.50	0.50
P-847	J-688	J-689	69.52	0.20	0.00	0.79	0.86	0.86
P-849	J-689	J-704	69.52	0.19	0.00	0.79	0.86	0.86
P-851	J-704	J-708	65.02	0.22	0.00	0.74	0.76	0.76
P-852	J-708	J-709	56.13	0.02	0.00	0.64	0.58	0.58
P-853	J-709	J-714	51.93	0.15	0.00	0.59	0.50	0.50
P-855	J-748	J-714	20.50	0.12	0.00	0.52	0.65	0.65
P-857	J-748	J-750	-17.50	0.07	0.00	0.45	0.48	0.48
P-858	J-750	J-747	21.54	0.17	0.00	0.55	0.71	0.71
P-859	J-750	J-756	-39.03	0.01	0.00	0.44	0.30	0.30
P-861	J-745	J-744	2.50	0.00	0.00	0.03	0.00	0.00
P-871	J-615	J-625	6.84	0.01	0.00	0.17	0.05	0.05
P-873	J-625	J-638	26.56	0.29	0.00	0.68	1.05	1.05
P-875	J-638	J-667	75.09	1.55	0.00	1.92	4.42	4.42
P-877	J-667	J-675	29.43	0.21	0.00	0.75	0.78	0.78
P-879	J-675	J-690	20.12	0.12	0.00	0.51	0.39	0.39
P-881	J-690	J-706	26.14	0.39	0.00	0.67	1.02	1.02
P-883	J-706	J-707	21.74	0.29	0.00	0.56	0.72	0.72
P-885	J-707	J-716	25.53	0.19	0.00	0.65	0.97	0.97
P-887	J-716	J-715	-2.53	0.00	0.00	0.06	0.01	0.01
P-891	J-740	J-742	-0.69	0.00	0.00	0.00	0.00	0.00
P-893	J-671	J-692	36.59	0.02	0.00	0.42	0.14	0.14
P-895	J-692	J-691	37.70	0.02	0.00	0.43	0.15	0.15
P-901	J-902B	J-101	0.00	0.00	0.00	0.00	0.00	0.00
P-902	J-900B	J-102	0.00	0.00	0.00	0.00	0.00	0.00
P-903	O-Pump 5	J-902B	0.00	0.00	0.00	0.00	0.00	0.00
P-904	O-Pump 4R	J-900B	0.00	0.00	0.00	0.00	0.00	0.00
P-905	J-901A	I-Pump 5	0.00	0.00	0.00	0.00	0.00	0.00
P-906	J-900A	I-Pump 4R	0.00	0.00	0.00	0.00	0.00	0.00
P-907	R-5	J-901A	0.00	0.00	0.00	0.00	0.00	0.00
P-908	R-4R	J-900A	0.00	0.00	0.00	0.00	0.00	0.00

P U M P/L O S S E L E M E N T R E S U L T S

NAME	FLOWRATE gpm	INLET HEAD ft	OUTLET HEAD ft	PUMP HEAD ft	EFFIC-ENCY %	USEFUL POWER Hp	INCREMTL COST $	TOTAL COST $	#PUMPS PARALLEL	#PUMPS SERIES	NPSH Avail. ft	Case
Device "Pump 4R" is closed												
Pump 4R	0.00	0.00	137.37	0.0	75.00	0.	0.0	0.0	**	**	33.2	0.0000
Device "Pump 5" is closed												
Pump 5	0.00	0.00	137.21	0.0	75.00	0.	0.0	0.0	**	**	33.2	0.0000

N O D E R E S U L T S

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
O-Pump 4R		0.00	187.37	50.00	137.37	59.53
O-Pump 5		0.00	187.21	50.00	137.21	59.46
J-1		60.00	182.45	39.00	143.45	62.16
J-2		195.00	176.49	43.00	133.49	57.85
J-3		122.00	178.79	44.00	134.79	58.41
J-4		136.00	179.35	48.00	131.35	56.92
J-101		0.00	187.21	53.00	134.21	58.16
J-102		0.00	187.37	53.00	134.37	58.23
J-103		0.60	187.03	51.00	136.03	58.95
J-104		0.00	188.32	88.00	100.32	43.47
J-105		-16.50	188.32	86.00	102.32	44.34
J-106		23.30	188.27	107.00	81.27	35.22
J-107		0.00	188.32	63.00	125.32	54.31
J-108		2.80	188.34	63.00	125.34	54.31
J-109		0.60	188.71	61.00	127.71	55.34
J-110		0.60	188.05	46.00	142.05	61.56
J-111		0.00	188.88	115.00	73.88	32.02
J-112		0.00	189.39	161.00	28.39	12.30
J-113		0.60	185.01	43.00	142.01	61.54
J-114		-23.90	190.39	183.00	7.39	3.20
J-115		17.30	190.23	161.00	29.23	12.67
J-116		-0.80	190.38	146.00	44.38	19.23
J-117		15.80	190.30	145.00	45.30	19.63
J-118		11.30	191.46	185.00	6.46	2.80
J-119		-10.20	191.46	187.00	4.46	1.93
J-120		0.00	191.22	180.00	11.22	4.86
J-122		0.00	190.17	144.00	46.17	20.01
J-123		0.00	188.89	78.00	110.89	48.05
J-124		0.00	185.93	49.00	136.93	59.34
J-125		0.00	184.20	48.00	136.20	59.02
J-126		2.30	184.43	92.00	92.43	40.06
J-127		0.60	183.72	46.00	137.72	59.68
J-128		1.10	183.72	52.00	131.72	57.08
J-129		0.00	183.55	46.00	137.55	59.60
J-130		1.30	183.40	46.00	137.40	59.54
J-131		1.10	183.14	44.00	139.14	60.29
J-132		-11.30	183.07	42.00	141.07	61.13
J-133		15.80	183.05	44.00	139.05	60.26
J-134		-10.70	183.01	41.00	142.01	61.54
J-135		11.30	182.49	42.00	140.49	60.88
J-136		0.00	182.94	46.00	136.94	59.34
J-137		0.00	182.94	46.00	136.94	59.34
J-138		14.30	182.88	46.00	136.88	59.31
J-140		4.50	182.68	46.00	136.68	59.23
J-141		0.00	182.60	45.00	137.60	59.63
J-142		0.00	182.60	45.00	137.60	59.63
J-145		0.00	182.52	43.00	139.52	60.46
J-146		1.10	182.44	44.00	138.44	59.99

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
J-147		0.00	182.63	45.00	137.63	59.64
J-150		3.40	184.38	51.00	133.38	57.80
J-151		-11.70	183.77	49.00	134.77	58.40
J-152		0.00	183.76	48.00	135.76	58.83
J-153		0.00	183.76	51.00	132.76	57.53
J-155		0.00	183.76	49.00	134.76	58.40
J-156		14.30	183.76	50.00	133.76	57.96
J-161		0.00	183.58	49.00	134.58	58.32
J-162		0.00	183.57	50.00	133.57	57.88
J-163		0.00	183.57	53.00	130.57	56.58
J-164		0.00	183.57	53.00	130.57	56.58
J-165		0.00	183.56	50.00	133.56	57.88
J-166		0.00	183.56	50.00	133.56	57.88
J-167		12.80	183.54	50.00	133.54	57.87
J-168		0.00	183.54	51.00	132.54	57.43
J-169		0.00	183.54	51.00	132.54	57.43
J-171		29.40	183.52	50.00	133.52	57.86
J-172		0.00	183.52	50.00	133.52	57.86
J-173		0.00	183.50	50.00	133.50	57.85
J-174		0.00	183.50	50.00	133.50	57.85
J-175		0.00	183.49	50.00	133.49	57.84
J-176		7.50	183.47	50.00	133.47	57.84
J-177		0.00	183.47	50.00	133.47	57.84
J-178		0.00	183.47	45.00	138.47	60.00
J-181		-10.70	183.34	45.00	138.34	59.95
J-182		0.00	183.34	45.00	138.34	59.95
J-183		0.00	183.34	44.00	139.34	60.38
J-184		0.00	183.34	47.00	136.34	59.08
J-185		11.30	183.34	50.00	133.34	57.78
J-190		0.00	182.59	45.00	137.59	59.62
J-191		-22.40	182.59	45.00	137.59	59.62
J-192		11.30	137.86	47.00	90.86	39.37
J-193		1.50	182.59	50.00	132.59	57.45
J-195		1.50	182.59	51.00	131.59	57.02
J-196		0.00	182.59	51.00	131.59	57.02
J-197		11.30	182.59	50.00	132.59	57.45
J-201		1.10	182.08	47.00	135.08	58.54
J-203		0.00	182.53	47.00	135.53	58.73
J-204		6.60	182.54	45.00	137.54	59.60
J-205		11.30	182.53	46.00	136.53	59.17
J-206		0.60	182.56	45.00	137.56	59.61
J-501		0.00	181.61	44.00	137.61	59.63
J-502		2.80	180.76	42.00	138.76	60.13
J-503		0.00	180.75	42.00	138.75	60.13
J-504		0.00	180.64	42.00	138.64	60.08
J-506		1.70	180.52	44.00	136.52	59.16
J-507		-25.20	180.50	44.00	136.50	59.15
J-508		11.30	104.10	44.00	60.10	26.04
J-509		4.50	180.33	45.00	135.33	58.64
J-510		-9.80	180.10	44.00	136.10	58.98
J-511		12.80	180.09	44.00	136.09	58.97

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
J-512		6.00	179.61	48.00	131.61	57.03
J-513		11.30	179.50	48.00	131.50	56.98
J-520		2.80	180.50	43.00	137.50	59.59
J-521		0.00	180.50	43.00	137.50	59.58
J-523		0.00	180.49	40.00	140.49	60.88
J-524		0.00	180.53	44.00	136.53	59.16
J-525		-7.40	180.49	44.00	136.49	59.15
J-526		11.30	180.49	44.00	136.49	59.15
J-527		3.40	180.49	44.00	136.49	59.15
J-528		5.10	180.49	44.00	136.49	59.15
J-530		0.00	180.47	44.00	136.47	59.14
J-531		0.00	180.47	43.00	137.47	59.57
J-532		3.40	180.46	44.00	136.46	59.13
J-533		5.70	180.43	45.00	135.43	58.69
J-534		0.00	180.40	43.00	137.40	59.54
J-535		13.60	179.27	43.00	136.27	59.05
J-536		1.10	180.39	42.00	138.39	59.97
J-537		16.60	177.70	44.00	133.70	57.94
J-540		2.80	180.39	43.00	137.39	59.54
J-541		6.60	180.32	43.00	137.32	59.50
J-542		0.60	180.25	43.00	137.25	59.47
J-543		5.00	180.19	43.00	137.19	59.45
J-544		-9.00	180.19	43.00	137.19	59.45
J-545		11.30	179.39	43.00	136.39	59.10
J-561		-48.40	180.18	43.00	137.18	59.44
J-562		-13.60	179.79	44.00	135.79	58.84
J-563		27.90	179.08	45.00	134.08	58.10
J-565		1.50	178.96	45.00	133.96	58.05
J-566		17.30	178.96	45.00	133.96	58.05
J-567		7.50	178.94	44.00	134.94	58.47
J-568		14.30	178.93	44.00	134.93	58.47
J-569		26.40	178.90	44.00	134.90	58.46
J-570		0.00	178.85	44.00	134.85	58.44
J-571		5.30	177.63	44.00	133.63	57.91
J-581		0.60	180.14	42.00	138.14	59.86
J-582		2.90	180.07	42.00	138.07	59.83
J-583		-15.30	177.15	44.00	133.15	57.70
J-584		4.50	176.73	42.00	134.73	58.38
J-585		0.00	176.70	42.00	134.70	58.37
J-586		20.30	176.70	40.00	136.70	59.24
J-601		0.00	187.46	47.00	140.46	60.87
J-602		0.00	185.91	48.00	137.91	59.76
J-603		2.30	184.39	43.00	141.39	61.27
J-604		1.50	184.35	43.00	141.35	61.25
J-605		4.50	183.62	42.00	141.62	61.37
J-606		-10.70	183.62	43.00	140.62	60.94
J-607		11.30	182.56	44.00	138.56	60.04
J-610		3.40	183.60	40.00	143.60	62.23
J-611		0.00	183.60	40.00	143.60	62.23
J-612		1.70	183.61	42.00	141.61	61.36
J-615		2.30	183.53	38.00	145.53	63.06

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
J-616		-9.60	183.52	37.00	146.52	63.49
J-617		11.30	181.25	38.00	143.25	62.08
J-619		0.00	183.59	41.00	142.59	61.79
J-620		4.30	184.19	43.00	141.19	61.18
J-621		0.60	183.59	41.00	142.59	61.79
J-622		2.30	183.59	41.00	142.59	61.79
J-623		-6.80	183.55	40.00	143.55	62.21
J-624		11.30	167.06	40.00	127.06	55.06
J-625		4.50	183.52	40.00	143.52	62.19
J-626		2.30	183.52	39.00	144.52	62.62
J-630		0.00	183.90	45.00	138.90	60.19
J-631		0.00	183.83	44.00	139.83	60.59
J-632		2.30	183.78	44.00	139.78	60.57
J-633		4.50	183.59	43.00	140.59	60.92
J-634		-12.20	183.51	42.00	141.51	61.32
J-635		1.50	183.51	42.00	141.51	61.32
J-636		15.80	181.67	42.00	139.67	60.52
J-637		5.30	183.38	42.00	141.38	61.27
J-638		-51.30	183.23	41.00	142.23	61.63
J-639		2.30	183.08	39.00	144.08	62.43
J-640		0.00	182.90	38.00	144.90	62.79
J-641		-8.30	182.79	39.00	143.79	62.31
J-642		15.80	182.79	40.00	142.79	61.87
J-643		-12.10	182.64	39.00	143.64	62.25
J-644		-5.30	182.59	39.00	143.59	62.22
J-645		17.30	182.59	41.00	141.59	61.35
J-646		21.80	182.55	39.00	143.55	62.21
J-647		6.00	182.53	41.00	141.53	61.33
J-648		18.80	182.53	41.00	141.53	61.33
J-649		-14.30	182.53	40.00	142.53	61.76
J-650		18.80	182.52	40.00	142.52	61.76
J-651		15.80	182.53	40.00	142.53	61.76
J-655		4.50	182.51	40.00	142.51	61.75
J-656		11.30	182.01	39.00	143.01	61.97
J-661		-9.80	182.95	42.00	140.95	61.08
J-662		12.80	181.76	43.00	138.76	60.13
J-663		12.80	182.04	41.00	141.04	61.12
J-664		0.00	183.37	42.00	141.37	61.26
J-665		-13.50	183.38	42.00	141.38	61.26
J-666		4.20	183.32	42.00	141.32	61.24
J-667		4.50	181.68	41.00	140.68	60.96
J-668		3.40	181.60	40.00	141.60	61.36
J-669		2.80	181.53	40.00	141.53	61.33
J-670		0.00	181.49	40.00	141.49	61.31
J-671		0.00	181.48	40.00	141.48	61.31
J-672		-11.70	181.48	40.00	141.48	61.31
J-673		12.80	173.02	42.00	131.02	56.78
J-674		2.50	181.48	40.00	141.48	61.31
J-675		5.10	181.48	40.00	141.48	61.31
J-676		2.30	181.46	42.00	139.46	60.43
J-677		0.60	182.07	41.00	141.07	61.13

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
J-678		0.60	183.12	41.00	142.12	61.59
J-679		-10.70	183.08	41.00	142.08	61.57
J-680		11.30	182.76	41.00	141.76	61.43
J-684		0.00	182.76	43.00	139.76	60.56
J-685		2.30	182.66	43.00	139.66	60.52
J-686		0.60	181.72	40.00	141.72	61.41
J-687		0.00	181.39	42.00	139.39	60.40
J-688		2.80	181.33	42.00	139.33	60.38
J-689		0.00	181.13	44.00	137.13	59.42
J-690		6.20	181.36	41.00	140.36	60.82
J-691		5.10	181.44	41.00	140.44	60.86
J-692		1.10	181.46	40.00	141.46	61.30
J-693		0.60	181.48	40.00	141.48	61.31
J-694		0.00	181.40	41.00	140.40	60.84
J-695		0.00	181.40	41.00	140.40	60.84
J-700		0.00	182.04	44.00	138.04	59.82
J-701		4.50	182.29	44.00	138.29	59.93
J-702		15.80	180.86	43.00	137.86	59.74
J-703		1.50	180.94	44.00	136.94	59.34
J-704		-12.80	180.94	44.00	136.94	59.34
J-706		4.40	180.97	42.00	138.97	60.22
J-707		4.50	180.68	40.00	140.68	60.96
J-708		0.60	180.72	41.00	139.72	60.54
J-709		-13.10	180.70	41.00	139.70	60.54
J-710		0.00	180.70	41.00	139.70	60.54
J-711		17.30	180.60	43.00	137.60	59.63
J-712		14.50	178.28	43.00	135.28	58.62
J-713		0.00	180.53	42.00	138.53	60.03
J-714		-7.70	180.55	42.00	138.55	60.04
J-715		5.10	180.50	40.00	140.50	60.88
J-716		0.00	180.49	40.00	140.49	60.88
J-717		-10.00	180.20	40.00	140.20	60.75
J-718		12.80	160.30	40.00	120.30	52.13
J-719		0.00	180.13	39.00	141.13	61.15
J-720		0.00	180.19	39.00	141.19	61.18
J-721		0.00	180.19	39.00	141.19	61.18
J-722		0.00	180.29	40.00	140.29	60.79
J-723		0.00	180.29	40.00	140.29	60.79
J-724		0.00	180.49	40.00	140.49	60.88
J-740		1.10	180.50	43.00	137.50	59.58
J-741		0.60	180.50	41.00	139.50	60.45
J-742		-10.70	180.50	41.00	139.50	60.45
J-743		11.30	180.50	40.00	140.50	60.88
J-744		2.50	180.75	42.00	138.75	60.13
J-745		-13.50	180.75	44.00	136.75	59.26
J-746		15.80	177.65	44.00	133.65	57.91
J-747		6.70	180.57	42.00	138.57	60.05
J-748		-11.70	180.67	42.00	138.67	60.09
J-749		14.50	159.99	41.00	118.99	51.56
J-750		0.00	180.74	42.00	138.74	60.12
J-751		1.70	180.80	43.00	137.80	59.72

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
J-752		2.80	181.23	43.00	138.23	59.90
J-753		1.70	181.59	44.00	137.59	59.62
J-754		9.00	181.61	44.00	137.61	59.63
J-755		0.00	181.61	44.00	137.61	59.63
J-756		0.00	180.75	42.00	138.75	60.13
J-760		1.70	179.35	40.00	139.35	60.38
J-761		3.40	179.35	40.00	139.35	60.39
J-762		-10.90	178.62	41.00	137.62	59.64
J-763		1.50	178.57	42.00	136.57	59.18
J-764		0.00	178.52	42.00	136.52	59.16
J-765		12.80	175.28	42.00	133.28	57.75
J-766		-11.70	178.36	42.00	136.36	59.09
J-767		12.80	177.40	40.00	137.40	59.54
J-768		3.40	178.14	42.00	136.14	58.99
J-900A		0.00	50.00	50.00	0.00	0.00
J-900B		0.00	187.37	50.00	137.37	59.53
J-901A		0.00	50.00	50.00	0.00	0.00
J-902B		0.00	187.21	50.00	137.21	59.46
R-5		----	50.00	50.00	0.00	0.00
R-4R		----	50.00	50.00	0.00	0.00
T-1		----	192.00	186.00	6.00	2.60
I-Pump 4R		0.00	50.00	50.00	0.00	0.00
I-Pump 5		0.00	50.00	50.00	0.00	0.00

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

P R E S S U R E S

JUNCTION NUMBER	MAXIMUM PRESSURES psi	JUNCTION NUMBER	MINIMUM PRESSURES psi
J-616	63.49	J-119	1.93
J-615	63.06	T-1	2.60
J-640	62.79	J-118	2.80
J-626	62.62	J-114	3.20
J-639	62.43	J-120	4.86

V E L O C I T I E S

PIPE NUMBER	MAXIMUM VELOCITY (ft/s)	PIPE NUMBER	MINIMUM VELOCITY (ft/s)
P-749	5.92	P-891	0.00
P-672	5.23	P-739	0.01
P-717	5.23	P-528	0.01
P-192	4.62	P-627	0.02
P-508	4.62	P-835	0.02

H L + M L / 1 0 0 0

PIPE NUMBER	MAXIMUM HL+ML/1000 (ft/ft)	PIPE NUMBER	MINIMUM HL+ML/1000 (ft/ft)
P-508	184.10	P-891	0.00
P-749	156.67	P-739	0.00
P-672	124.36	P-528	0.00
P-717	124.36	P-835	0.00
P-192	98.73	P-104	0.00

H L / 1 0 0 0

PIPE NUMBER	MAXIMUM HL/1000 (ft/ft)	PIPE NUMBER	MINIMUM HL/1000 (ft/ft)
P-508	184.10	P-891	0.00
P-749	156.67	P-739	0.00
P-672	124.36	P-528	0.00
P-717	124.36	P-835	0.00
P-192	98.73	P-104	0.00

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

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

NODE NAME	FLOWRATE gpm	NODE TITLE
R-5	0.00	
R-4R	0.00	
T-1	1010.20	

NET SYSTEM INFLOW = 1010.20
NET SYSTEM OUTFLOW = 0.00
NET SYSTEM DEMAND = 1010.20

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

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*                                                                 *
*  Pipe Network Modeling Software                                 *
*                                                                 *
*  CopyRighted by KYPIPE LLC (www.kypipe.com)                     *
*  Version: 10.009  10/01/2019                                    *
*  Serial #:  6-5118003                                           *
*  Interface:  Classic                                            *
*  Licensed for Pipe2010                                          *
*                                                                 *
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Date & Time: Thu Aug 14 16:21:29 2025

Master File : P:\s\sums0002\0600info\water\ky pipe\steady state\2025-08_2045 steady state.KYP\2025-08_2045 steady state.P2K

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

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

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

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

STATUS CODE: XX -CLOSED PIPE CV -CHECK VALVE

P I P E N A M E	NODE NAMES #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.
P-3	J-F61	J-3	190.00	8.00	140.0000	0.00
P-4	J-F60	J-4	222.00	8.00	140.0000	0.00
P-100	J-F10	J-102	467.00	10.00	140.0000	0.00
P-101	J-101	J-103	213.00	10.00	140.0000	0.00
P-103	J-104	J-F10	762.00	10.00	140.0000	0.00
P-104	J-105	J-104	221.00	6.00	130.0000	0.00
P-105	J-105	J-106	658.00	6.00	130.0000	0.00
P-106	J-107	J-105	288.00	4.00	140.0000	0.00
P-107	J-108	J-107	490.00	4.00	140.0000	0.00
P-108	J-109	J-108	219.00	2.00	140.0000	0.00
P-109	J-109	J-110	275.00	2.00	130.0000	0.00
P-110	J-111	J-109	612.00	4.00	130.0000	0.00
P-111	J-111	J-104	742.00	10.00	140.0000	0.00
P-112	J-112	J-111	606.00	10.00	140.0000	0.00
P-113	J-114	J-112	1197.00	10.00	140.0000	0.00

PIPE NAME	NODE NAMES #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.
P-114	J-110	J-113	1663.00	2.00	140.0000	0.00
P-115	J-114	J-116	272.00	8.00	140.0000	0.00
P-116	J-116	J-115	575.00	4.00	140.0000	0.00
P-117	J-116	J-117	371.00	4.00	140.0000	0.00
P-118	J-120	J-114	959.00	10.00	140.0000	0.00
P-119	J-113	J-128	817.00	2.00	140.0000	0.00
P-120	J-119	J-120	278.00	10.00	140.0000	0.00
P-130	J-129	J-130	429.00	8.00	140.0000	0.00
P-131	J-129	J-131	684.00	8.00	140.0000	0.00
P-132	J-131	J-132	163.00	8.00	140.0000	0.00
P-133	J-132	J-133	580.00	6.00	140.0000	0.00
P-134	J-132	J-134	161.00	8.00	140.0000	0.00
P-135	J-134	J-135	153.00	2.00	140.0000	0.00
P-136	J-130	J-136	1389.00	8.00	140.0000	0.00
P-137	J-136	J-137	298.00	8.00	140.0000	0.00
P-138	J-136	J-138	181.00	8.00	140.0000	0.00
P-139	J-138	J-140	760.00	8.00	140.0000	0.00
P-141	J-140	J-141	315.00	8.00	140.0000	0.00
P-142	J-141	J-142	313.00	8.00	140.0000	0.00
P-143	J-141	J-145	328.00	8.00	140.0000	0.00
P-144	J-203	J-145	606.00	8.00	130.0000	0.00
P-145	J-145	J-146	253.00	8.00	140.0000	0.00
P-146	J-147	J-146	492.00	8.00	140.0000	0.00
P-147	J-134	J-147	955.00	8.00	140.0000	0.00
P-148	J-146	J-201	265.00	8.00	140.0000	0.00
P-149	J-103	J-F20	2113.00	10.00	140.0000	0.00
P-150	J-F20	J-150	1441.00	10.00	140.0000	0.00
P-151	J-150	J-151	835.00	10.00	140.0000	0.00
P-152	J-151	J-152	791.00	10.00	140.0000	0.00
P-153	J-152	J-153	639.00	10.00	140.0000	0.00
P-155	J-152	J-155	334.00	10.00	140.0000	0.00
P-156	J-155	J-156	203.00	10.00	140.0000	0.00
P-160	J-151	J-161	249.00	10.00	140.0000	0.00
P-161	J-161	J-178	312.00	10.00	140.0000	0.00
P-162	J-161	J-162	185.00	10.00	130.0000	0.00
P-163	J-162	J-163	217.00	8.00	130.0000	0.00
P-164	J-163	J-164	60.00	6.00	130.0000	0.00
P-165	J-162	J-165	81.00	10.00	130.0000	0.00
P-166	J-165	J-166	50.00	6.00	130.0000	0.00
P-167	J-165	J-167	271.00	10.00	130.0000	0.00
P-168	J-167	J-168	182.00	8.00	130.0000	0.00
P-169	J-168	J-169	43.00	6.00	130.0000	0.00
P-171	J-167	J-171	221.00	10.00	130.0000	0.00
P-172	J-171	J-172	60.00	6.00	130.0000	0.00
P-173	J-171	J-173	578.00	10.00	130.0000	0.00
P-174	J-173	J-174	42.00	6.00	130.0000	0.00
P-175	J-173	J-175	396.00	10.00	130.0000	0.00
P-176	J-175	J-176	551.00	10.00	130.0000	0.00
P-177	J-176	J-177	86.00	6.00	130.0000	0.00
P-178	J-176	J-178	145.00	10.00	130.0000	0.00
P-180	J-178	J-181	226.00	10.00	140.0000	0.00
P-182	J-181	J-182	123.00	10.00	140.0000	0.00
P-183	J-182	J-183	357.00	10.00	140.0000	0.00

PIPE NAME	NODE NAMES #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.
P-184	J-183	J-184	652.00	8.00	140.0000	0.00
P-185	J-184	J-185	706.00	8.00	140.0000	0.00
P-190	J-181	J-190	1387.00	10.00	140.0000	0.00
P-191	J-190	J-191	73.00	10.00	140.0000	0.00
P-192	J-191	J-192	453.00	1.00	140.0000	0.00
P-193	J-191	J-193	464.00	10.00	140.0000	0.00
P-194	J-206	J-191	770.00	8.00	140.0000	0.00
P-195	J-193	J-195	368.00	10.00	140.0000	0.00
P-196	J-195	J-196	263.00	8.00	130.0000	0.00
P-197	J-195	J-197	298.00	10.00	140.0000	0.00
P-201	J-201	J-501	762.00	12.00	140.0000	0.00
P-203	J-203	J-204	297.00	8.00	140.0000	0.00
P-205	J-204	J-205	340.00	8.00	140.0000	0.00
P-206	J-206	J-204	486.00	8.00	140.0000	0.00
P-300	T-1	J-119	99.00	10.00	140.0000	0.00
P-301	J-119	J-118	273.00	10.00	140.0000	0.00
P-302	J-119	J-122	300.00	10.00	100.0000	0.00
P-303	J-122	J-123	299.00	10.00	100.0000	0.00
P-304	J-122	J-126	493.00	1.00	130.0000	0.00
P-305	J-123	J-124	466.00	8.00	100.0000	0.00
P-306	J-126	J-125	185.00	1.00	130.0000	0.00
P-307	J-124	J-125	273.00	8.00	100.0000	0.00
P-310	J-125	J-127	161.00	8.00	100.0000	0.00
P-312	J-128	J-127	778.00	8.00	140.0000	0.00
P-313	J-127	J-129	104.00	8.00	140.0000	0.00
P-496	J-190	J-201	1259.00	10.00	140.0000	0.00
P-501	J-501	J-502	551.00	10.00	140.0000	0.00
P-502	J-502	J-503	4.00	10.00	130.0000	0.00
P-503	J-744	J-503	29.00	6.00	130.0000	0.00
P-504	J-502	J-504	123.00	8.00	140.0000	0.00
P-505	J-504	J-524	506.00	2.00	100.0000	0.00
P-506	J-504	J-506	132.00	8.00	140.0000	0.00
P-507	J-506	J-507	41.00	8.00	140.0000	0.00
P-508	J-507	J-508	415.00	1.00	100.0000	0.00
P-509	J-507	J-509	320.00	8.00	140.0000	0.00
P-510	J-509	J-510	453.00	8.00	140.0000	0.00
P-511	J-510	J-511	594.00	6.00	140.0000	0.00
P-512	J-512	J-510	995.00	8.00	140.0000	0.00
P-513	J-512	J-513	230.00	8.00	140.0000	0.00
P-516	J-669	J-670	226.00	6.00	140.0000	0.00
P-520	J-503	J-520	508.00	10.00	140.0000	0.00
P-521	J-520	J-521	13.00	10.00	140.0000	0.00
P-522	J-521	J-523	10.00	10.00	140.0000	0.00
P-523	J-506	J-528	329.00	8.00	140.0000	0.00
P-524	J-524	J-520	125.00	2.00	100.0000	0.00
P-525	J-523	J-525	148.00	6.00	140.0000	0.00
P-526	J-525	J-526	104.00	6.00	140.0000	0.00
P-527	J-525	J-527	193.00	6.00	140.0000	0.00
P-528	J-527	J-528	298.00	8.00	140.0000	0.00
P-529	J-528	J-530	229.00	8.00	140.0000	0.00
P-530	J-530	J-531	196.00	8.00	140.0000	0.00
P-531	J-530	J-532	155.00	8.00	140.0000	0.00
P-532	J-532	J-533	322.00	8.00	140.0000	0.00

PIPE NAME	NODE NAMES #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.
P-533	J-533	J-534	462.00	8.00	140.0000	0.00
P-534	J-534	J-535	237.00	2.00	140.0000	0.00
P-535	J-534	J-536	118.00	8.00	140.0000	0.00
P-536	J-536	J-537	392.00	2.00	140.0000	0.00
P-537	J-536	J-540	368.00	8.00	140.0000	0.00
P-540	J-523	J-540	200.00	10.00	140.0000	0.00
P-541	J-540	J-541	58.00	2.00	140.0000	0.00
P-542	J-540	J-542	260.00	10.00	140.0000	0.00
P-543	J-542	J-543	75.00	2.00	140.0000	0.00
P-544	J-542	J-544	107.00	10.00	140.0000	0.00
P-545	J-544	J-545	237.00	2.00	140.0000	0.00
P-546	J-544	J-561	26.00	10.00	140.0000	0.00
P-548	J-567	J-568	221.00	8.00	140.0000	0.00
P-550	J-563	J-569	656.00	8.00	140.0000	0.00
P-562	J-561	J-562	442.00	8.00	140.0000	0.00
P-563	J-562	J-563	724.00	8.00	140.0000	0.00
P-565	J-563	J-565	709.00	8.00	140.0000	0.00
P-566	J-565	J-566	568.00	8.00	140.0000	0.00
P-567	J-565	J-567	278.00	8.00	140.0000	0.00
P-569	J-567	J-569	695.00	8.00	140.0000	0.00
P-570	J-569	J-570	146.00	8.00	140.0000	0.00
P-571	J-570	J-571	1472.00	2.00	140.0000	0.00
P-573	J-570	J-572	196.00	8.00	140.0000	0.00
P-580	J-561	J-581	334.00	10.00	140.0000	0.00
P-581	J-581	J-582	49.00	6.00	140.0000	0.00
P-582	J-582	J-583	463.00	4.00	100.0000	0.00
P-583	J-583	J-584	428.00	8.00	140.0000	0.00
P-585	J-584	J-585	25.00	8.00	140.0000	0.00
P-586	J-585	J-2	278.00	8.00	140.0000	0.00
P-587	J-585	J-586	662.00	8.00	140.0000	0.00
P-601	J-123	J-601	390.00	6.00	130.0000	0.00
P-602	J-601	J-602	426.00	6.00	130.0000	0.00
P-603	J-602	J-603	416.00	6.00	130.0000	0.00
P-605	J-604	J-605	363.00	4.00	140.0000	0.00
P-607	J-606	J-607	315.00	2.00	140.0000	0.00
P-610	J-605	J-610	349.00	4.00	140.0000	0.00
P-611	J-611	J-610	160.00	4.00	140.0000	0.00
P-612	J-612	J-611	175.00	4.00	140.0000	0.00
P-613	J-606	J-612	168.00	4.00	130.0000	0.00
P-615	J-610	J-615	368.00	4.00	100.0000	0.00
P-616	J-615	J-616	374.00	2.00	130.0000	0.00
P-617	J-616	J-617	671.00	2.00	140.0000	0.00
P-620	J-619	J-633	260.00	6.00	140.0000	0.00
P-621	J-620	J-621	273.00	2.00	140.0000	0.00
P-622	J-621	J-619	121.00	6.00	140.0000	0.00
P-623	J-622	J-623	342.00	6.00	140.0000	0.00
P-624	J-623	J-624	167.00	1.00	140.0000	0.00
P-625	J-623	J-625	379.00	6.00	140.0000	0.00
P-626	J-625	J-626	360.00	4.00	140.0000	0.00
P-627	J-616	J-626	259.00	4.00	140.0000	0.00
P-630	J-125	J-630	652.00	8.00	140.0000	0.00
P-631	J-630	J-631	148.00	8.00	140.0000	0.00
P-632	J-631	J-632	121.00	8.00	140.0000	0.00

PIPE NAME	NODE NAMES #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.
P-633	J-632	J-633	360.00	8.00	140.0000	0.00
P-634	J-633	J-634	144.00	8.00	140.0000	0.00
P-635	J-634	J-635	55.00	6.00	140.0000	0.00
P-636	J-635	J-636	293.00	2.00	140.0000	0.00
P-637	J-634	J-637	251.00	8.00	140.0000	0.00
P-638	J-637	J-638	328.00	8.00	140.0000	0.00
P-639	J-638	J-639	307.00	8.00	140.0000	0.00
P-640	J-639	J-640	389.00	8.00	140.0000	0.00
P-641	J-640	J-641	227.00	8.00	140.0000	0.00
P-642	J-641	J-642	254.00	8.00	140.0000	0.00
P-643	J-641	J-643	331.00	8.00	140.0000	0.00
P-644	J-643	J-644	162.00	6.00	140.0000	0.00
P-645	J-644	J-645	171.00	6.00	140.0000	0.00
P-646	J-644	J-646	189.00	6.00	130.0000	0.00
P-647	J-646	J-647	364.00	6.00	140.0000	0.00
P-648	J-647	J-648	125.00	6.00	140.0000	0.00
P-649	J-647	J-649	345.00	6.00	140.0000	0.00
P-650	J-649	J-650	223.00	6.00	140.0000	0.00
P-651	J-643	J-651	504.00	8.00	140.0000	0.00
P-652	J-649	J-651	176.00	6.00	140.0000	0.00
P-655	J-651	J-655	182.00	8.00	140.0000	0.00
P-656	J-655	J-656	149.00	2.00	140.0000	0.00
P-657	J-655	J-1	715.00	8.00	140.0000	0.00
P-660	J-665	J-664	104.00	6.00	140.0000	0.00
P-661	J-664	J-661	59.00	2.00	130.0000	0.00
P-662	J-661	J-662	150.00	2.00	100.0000	0.00
P-663	J-661	J-663	114.00	2.00	100.0000	0.00
P-666	J-665	J-666	482.00	4.00	140.0000	0.00
P-667	J-666	J-667	625.00	2.00	100.0000	0.00
P-668	J-667	J-668	361.00	6.00	140.0000	0.00
P-669	J-668	J-669	311.00	6.00	140.0000	0.00
P-670	J-670	J-671	45.00	6.00	140.0000	0.00
P-671	J-671	J-672	91.00	4.00	140.0000	0.00
P-672	J-672	J-673	68.00	1.00	140.0000	0.00
P-673	J-672	J-674	256.00	4.00	140.0000	0.00
P-674	J-674	J-675	330.00	4.00	140.0000	0.00
P-675	J-675	J-676	613.00	4.00	100.0000	0.00
P-676	J-677	J-676	210.00	4.00	100.0000	0.00
P-677	J-678	J-677	288.00	4.00	100.0000	0.00
P-678	J-678	J-679	148.00	6.00	130.0000	0.00
P-679	J-131	J-679	662.00	6.00	140.0000	0.00
P-680	J-679	J-680	100.00	2.00	140.0000	0.00
P-684	J-679	J-684	329.00	6.00	100.0000	0.00
P-687	J-686	J-687	213.00	2.00	100.0000	0.00
P-689	J-690	J-688	611.00	6.00	140.0000	0.00
P-690	J-694	J-690	317.00	6.00	140.0000	0.00
P-691	J-691	J-694	362.00	6.00	140.0000	0.00
P-692	J-693	J-692	89.00	2.00	140.0000	0.00
P-693	J-674	J-693	425.00	6.00	140.0000	0.00
P-694	J-694	J-695	188.00	6.00	140.0000	0.00
P-702	J-703	J-702	298.00	4.00	130.0000	0.00
P-703	J-704	J-703	93.00	6.00	140.0000	0.00
P-707	J-708	J-707	513.00	4.00	130.0000	0.00

PIPE NAME	NODE NAMES #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.
P-710	J-710	J-711	367.00	4.00	140.0000	0.00
P-711	J-713	J-712	225.00	2.00	100.0000	0.00
P-712	J-714	J-713	98.00	4.00	140.0000	0.00
P-714	J-714	J-715	502.00	8.00	140.0000	0.00
P-716	J-716	J-717	472.00	4.00	140.0000	0.00
P-717	J-717	J-718	160.00	1.00	140.0000	0.00
P-718	J-717	J-719	146.00	4.00	140.0000	0.00
P-719	J-720	J-719	74.00	6.00	100.0000	0.00
P-720	J-720	J-721	70.00	8.00	140.0000	0.00
P-721	J-722	J-720	109.00	6.00	100.0000	0.00
P-722	J-722	J-723	100.00	8.00	140.0000	0.00
P-723	J-724	J-722	222.00	6.00	100.0000	0.00
P-730	J-709	J-710	99.00	6.00	140.0000	0.00
P-731	J-715	J-724	58.00	8.00	140.0000	0.00
P-739	J-742	J-741	20.00	8.00	140.0000	0.00
P-740	J-740	J-521	47.00	8.00	140.0000	0.00
P-741	J-747	J-741	265.00	4.00	120.0000	0.00
P-742	J-742	J-743	415.00	8.00	140.0000	0.00
P-743	J-741	J-715	322.00	8.00	140.0000	0.00
P-745	J-744	J-740	514.00	4.00	100.0000	0.00
P-747	J-751	J-756	224.00	6.00	130.0000	0.00
P-748	J-753	J-748	499.00	2.00	100.0000	0.00
P-749	J-748	J-749	132.00	1.00	140.0000	0.00
P-750	J-756	J-745	142.00	6.00	100.0000	0.00
P-751	J-752	J-751	278.00	4.00	140.0000	0.00
P-752	J-753	J-752	187.00	4.00	130.0000	0.00
P-753	J-754	J-753	42.00	6.00	130.0000	0.00
P-756	J-745	J-746	494.00	2.00	140.0000	0.00
P-770	J-719	J-760	493.00	6.00	100.0000	0.00
P-771	J-760	J-761	322.00	4.00	130.0000	0.00
P-772	J-760	J-762	444.00	6.00	100.0000	0.00
P-773	J-762	J-766	172.00	6.00	100.0000	0.00
P-774	J-766	J-767	226.00	2.00	140.0000	0.00
P-775	J-766	J-768	146.00	6.00	100.0000	0.00
P-776	J-761	J-768	458.00	4.00	100.0000	0.00
P-777	J-768	J-583	338.00	6.00	100.0000	0.00
P-779	J-582	J-761	336.00	4.00	130.0000	0.00
P-781	J-762	J-763	309.00	4.00	140.0000	0.00
P-783	J-763	J-764	322.00	4.00	140.0000	0.00
P-784	J-764	J-765	763.00	2.00	140.0000	0.00
P-801	J-603	J-604	126.00	6.00	130.0000	0.00
P-803	J-603	J-620	115.00	6.00	140.0000	0.00
P-805	J-620	J-632	296.00	6.00	140.0000	0.00
P-807	J-632	J-665	344.00	6.00	140.0000	0.00
P-809	J-665	J-678	277.00	6.00	140.0000	0.00
P-811	J-684	J-685	97.00	6.00	100.0000	0.00
P-813	J-685	J-701	397.00	6.00	100.0000	0.00
P-815	J-701	J-700	309.00	6.00	100.0000	0.00
P-817	J-700	J-754	524.00	6.00	100.0000	0.00
P-819	J-755	J-754	314.00	6.00	100.0000	0.00
P-821	J-501	J-755	194.00	6.00	100.0000	0.00
P-831	J-605	J-606	164.00	6.00	130.0000	0.00
P-833	J-605	J-622	250.00	6.00	130.0000	0.00

PIPE NAME	NODE NAMES #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.
P-835	J-622	J-619	25.00	6.00	140.0000	0.00
P-841	J-677	J-686	187.00	2.00	100.0000	0.00
P-843	J-676	J-687	181.00	6.00	100.0000	0.00
P-845	J-687	J-688	113.00	6.00	100.0000	0.00
P-847	J-688	J-689	235.00	6.00	100.0000	0.00
P-849	J-689	J-704	221.00	6.00	100.0000	0.00
P-851	J-704	J-708	290.00	6.00	100.0000	0.00
P-852	J-708	J-709	31.00	6.00	100.0000	0.00
P-853	J-709	J-714	301.00	6.00	100.0000	0.00
P-855	J-748	J-714	191.00	4.00	100.0000	0.00
P-857	J-748	J-750	140.00	4.00	100.0000	0.00
P-858	J-750	J-747	245.00	4.00	100.0000	0.00
P-859	J-750	J-756	45.00	6.00	100.0000	0.00
P-861	J-745	J-744	147.00	6.00	100.0000	0.00
P-871	J-615	J-625	258.00	4.00	130.0000	0.00
P-873	J-625	J-638	277.00	4.00	100.0000	0.00
P-875	J-638	J-667	350.00	4.00	130.0000	0.00
P-877	J-667	J-675	264.00	4.00	130.0000	0.00
P-879	J-675	J-690	298.00	4.00	130.0000	0.00
P-881	J-690	J-706	388.00	4.00	100.0000	0.00
P-883	J-706	J-707	398.00	4.00	100.0000	0.00
P-885	J-707	J-716	191.00	4.00	100.0000	0.00
P-887	J-716	J-715	146.00	4.00	100.0000	0.00
P-891	J-740	J-742	309.00	8.00	140.0000	0.00
P-893	J-671	J-692	162.00	6.00	140.0000	0.00
P-895	J-692	J-691	149.00	6.00	140.0000	0.00
P-900	J-102	J-101	218.00	10.00	140.0000	0.00
P-901	J-902B	J-101	80.00	10.00	140.0000	0.00
P-902	J-900B	J-102	80.00	10.00	140.0000	0.00
P-903	O-Pump 5	J-902B	2.00	6.00	130.0000	0.00
P-904	O-Pump 4R	J-900B	2.00	6.00	130.0000	0.00
P-905	J-901A	I-Pump 5	2.00	6.00	130.0000	0.00
P-906	J-900A	I-Pump 4R	2.00	6.00	130.0000	0.00
P-907	R-5	J-901A	24.00	10.00	130.0000	0.00
P-908	R-4R	J-900A	24.00	10.00	130.0000	0.00
P-F10	J-F10	J-F11	514.00	8.00	140.0000	0.00
P-F11	J-F11	J-F12	1509.00	8.00	140.0000	0.00
P-F12	J-F12	J-F13	2677.00	8.00	140.0000	0.00
P-F13	J-F13	J-F14	703.00	8.00	140.0000	0.00
P-F14	J-F15	J-F14	2732.00	12.00	140.0000	0.00
P-F15	J-F16	J-F15	1324.00	12.00	140.0000	0.00
P-F16	J-103	J-F16	471.00	12.00	140.0000	0.00
P-F17	J-F11	J-F16	881.00	12.00	140.0000	0.00
P-F18	J-F12	J-F15	707.00	8.00	140.0000	0.00
P-F20	J-F21	J-F20	1275.00	10.00	140.0000	0.00
P-F21	J-F16	J-F21	1338.00	8.00	140.0000	0.00
P-F22	J-F22	J-F21	1300.00	10.00	140.0000	0.00
P-F23	J-F15	J-F22	1377.00	8.00	140.0000	0.00
P-F24	J-F23	J-F22	1028.00	10.00	140.0000	0.00
P-F25	J-F23	J-F24	2125.00	12.00	140.0000	0.00
P-F26	J-F14	J-F24	1023.00	12.00	140.0000	0.00
P-F30	J-F30	J-150	1049.00	12.00	140.0000	0.00
P-F31	J-F21	J-F30	1285.00	8.00	140.0000	0.00

PIPE NAME	NODE NAMES #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.
P-F32	J-F31	J-F30	1296.00	12.00	140.0000	0.00
P-F33	J-F33	J-F30	2270.00	8.00	140.0000	0.00
P-F34	J-F33	J-F32	1141.00	8.00	140.0000	0.00
P-F35	J-F32	J-F31	645.00	12.00	140.0000	0.00
P-F36	J-F34	J-F32	429.00	12.00	140.0000	0.00
P-F37	J-F34	J-F23	1268.00	12.00	140.0000	0.00
P-F38	J-F22	J-F31	1256.00	8.00	140.0000	0.00
P-F50	J-F50	J-572	769.00	8.00	140.0000	0.00
P-F51	J-F50	J-F52	770.00	8.00	140.0000	0.00
P-F52	J-F51	J-F52	1359.00	8.00	140.0000	0.00
P-F53	J-F51	J-F50	987.00	8.00	140.0000	0.00
P-F54	J-F61	J-F51	854.00	8.00	140.0000	0.00
P-F60	J-513	J-F54	1069.00	8.00	140.0000	0.00
P-F61	J-F54	J-F55	1008.00	8.00	140.0000	0.00
P-F62	J-F55	J-F60	880.00	8.00	140.0000	0.00
P-F63	J-F60	J-F59	1232.00	12.00	140.0000	0.00
P-F64	J-F59	J-F58	878.00	12.00	140.0000	0.00
P-F65	J-F58	J-F61	441.00	12.00	140.0000	0.00
P-F66	J-F61	J-F57	981.00	8.00	140.0000	0.00
P-F67	J-F58	J-F57	854.00	8.00	140.0000	0.00
P-F68	J-F56	J-F59	839.00	12.00	140.0000	0.00
P-F69	J-F56	J-F57	796.00	8.00	140.0000	0.00
P-F70	J-F55	J-F56	1073.00	8.00	140.0000	0.00
P-F71	J-F53	J-F56	988.00	12.00	140.0000	0.00
P-F72	J-F53	J-F57	1357.00	8.00	140.0000	0.00
P-F74	J-F53	J-F54	874.00	12.00	140.0000	0.00

P U M P/L O S S E L E M E N T D A T A

THERE IS A DEVICE AT NODE Pump 4R DESCRIBED BY THE FOLLOWING DATA: (ID= 2)

HEAD (ft)	FLOWRATE (gpm)	EFFICIENCY (%)
320.00	0.00	65.00
240.00	600.00	74.00
160.00	800.00	73.50

THERE IS A DEVICE AT NODE Pump 5 DESCRIBED BY THE FOLLOWING DATA: (ID= 1)

HEAD (ft)	FLOWRATE (gpm)	EFFICIENCY (%)
317.00	0.00	63.00
215.00	600.00	43.00
145.00	900.00	59.00

N O D E D A T A

NODE NAME	NODE TITLE	EXTERNAL DEMAND (gpm)	JUNCTION ELEVATION (ft)	EXTERNAL GRADE (ft)
O-Pump 4R		0.00	50.00	
O-Pump 5		0.00	50.00	
J-1		91.00	39.00	
J-2		294.00	43.00	
J-3		184.00	44.00	
J-4		205.00	50.00	
J-101		0.00	53.00	
J-102		0.00	53.00	
J-103		0.60	51.00	
J-104		0.00	88.00	
J-105		-17.00	86.00	
J-106		24.60	107.00	
J-107		0.00	63.00	
J-108		3.10	63.00	
J-109		0.60	61.00	
J-110		0.60	46.00	
J-111		0.00	115.00	
J-112		0.00	161.00	
J-113		0.60	43.00	
J-114		-24.70	183.00	
J-115		18.20	161.00	
J-116		-0.80	146.00	
J-117		16.70	145.00	
J-118		11.90	185.00	
J-119		-10.60	187.00	
J-120		0.00	180.00	
J-122		0.00	144.00	
J-123		0.00	78.00	
J-124		0.00	49.00	
J-125		0.00	48.00	
J-126		2.50	92.00	
J-127		0.60	46.00	
J-128		1.30	52.00	
J-129		0.00	46.00	
J-130		1.30	46.00	
J-131		1.30	44.00	
J-132		-11.60	42.00	
J-133		16.70	44.00	
J-134		-11.30	41.00	
J-135		11.90	42.00	
J-136		0.00	46.00	
J-137		0.00	46.00	
J-138		15.10	46.00	
J-140		4.80	46.00	
J-141		0.00	45.00	
J-142		0.00	45.00	
J-145		0.00	43.00	
J-146		1.30	44.00	
J-147		0.00	45.00	

NODE NAME	NODE TITLE	EXTERNAL DEMAND (gpm)	JUNCTION ELEVATION (ft)	EXTERNAL GRADE (ft)
J-150		3.80	51.00	
J-151		-12.20	49.00	
J-152		0.00	48.00	
J-153		0.00	51.00	
J-155		0.00	49.00	
J-156		15.10	50.00	
J-161		0.00	49.00	
J-162		0.00	50.00	
J-163		0.00	53.00	
J-164		0.00	53.00	
J-165		0.00	50.00	
J-166		0.00	50.00	
J-167		13.50	50.00	
J-168		0.00	51.00	
J-169		0.00	51.00	
J-171		30.90	50.00	
J-172		0.00	50.00	
J-173		0.00	50.00	
J-174		0.00	50.00	
J-175		0.00	50.00	
J-176		7.90	50.00	
J-177		0.00	50.00	
J-178		0.00	45.00	
J-181		-11.30	45.00	
J-182		0.00	45.00	
J-183		0.00	44.00	
J-184		0.00	47.00	
J-185		11.90	50.00	
J-190		0.00	45.00	
J-191		-23.50	45.00	
J-192		11.90	47.00	
J-193		1.60	50.00	
J-195		1.60	51.00	
J-196		0.00	51.00	
J-197		11.90	50.00	
J-201		1.30	47.00	
J-203		0.00	47.00	
J-204		7.00	45.00	
J-205		11.90	46.00	
J-206		0.60	45.00	
J-501		0.00	44.00	
J-502		3.10	42.00	
J-503		0.00	42.00	
J-504		0.00	42.00	
J-506		1.90	44.00	
J-507		-26.40	44.00	
J-508		11.90	44.00	
J-509		4.80	45.00	
J-510		-10.30	44.00	
J-511		13.50	44.00	
J-512		6.30	48.00	
J-513		11.90	48.00	

NODE NAME	NODE TITLE	EXTERNAL DEMAND (gpm)	JUNCTION ELEVATION (ft)	EXTERNAL GRADE (ft)
J-520		3.10	43.00	
J-521		0.00	43.00	
J-523		0.00	40.00	
J-524		0.00	44.00	
J-525		-7.70	44.00	
J-526		11.90	44.00	
J-527		3.50	44.00	
J-528		5.70	44.00	
J-530		0.00	44.00	
J-531		0.00	43.00	
J-532		3.80	44.00	
J-533		6.30	45.00	
J-534		0.00	43.00	
J-535		14.30	43.00	
J-536		1.30	42.00	
J-537		17.40	44.00	
J-540		3.10	43.00	
J-541		7.00	43.00	
J-542		0.60	43.00	
J-543		5.20	43.00	
J-544		-9.40	43.00	
J-545		11.90	43.00	
J-561		-49.20	43.00	
J-562		-14.30	44.00	
J-563		29.30	45.00	
J-565		1.60	45.00	
J-566		18.20	45.00	
J-567		7.90	44.00	
J-568		15.10	44.00	
J-569		27.80	44.00	
J-570		0.00	44.00	
J-571		5.60	44.00	
J-572		0.00	44.00	
J-581		0.60	42.00	
J-582		3.10	42.00	
J-583		-15.80	43.00	
J-584		4.80	42.00	
J-585		0.00	42.00	
J-586		21.40	40.00	
J-601		0.00	47.00	
J-602		0.00	48.00	
J-603		2.40	43.00	
J-604		1.60	43.00	
J-605		5.00	42.00	
J-606		-11.30	43.00	
J-607		11.90	44.00	
J-610		3.80	40.00	
J-611		0.00	40.00	
J-612		1.90	42.00	
J-615		2.50	38.00	
J-616		-10.00	37.00	
J-617		11.90	38.00	

NODE NAME	NODE TITLE	EXTERNAL DEMAND (gpm)	JUNCTION ELEVATION (ft)	EXTERNAL GRADE (ft)
J-619		0.00	41.00	
J-620		4.60	43.00	
J-621		0.60	41.00	
J-622		2.50	41.00	
J-623		-6.90	40.00	
J-624		11.90	40.00	
J-625		5.00	40.00	
J-626		2.50	39.00	
J-630		0.00	45.00	
J-631		0.00	44.00	
J-632		2.50	44.00	
J-633		4.80	43.00	
J-634		-12.60	42.00	
J-635		1.60	42.00	
J-636		16.70	42.00	
J-637		5.70	42.00	
J-638		-51.80	41.00	
J-639		2.40	39.00	
J-640		0.00	38.00	
J-641		-8.70	39.00	
J-642		16.70	40.00	
J-643		-12.70	39.00	
J-644		-5.60	39.00	
J-645		18.20	41.00	
J-646		23.00	39.00	
J-647		6.30	41.00	
J-648		19.80	41.00	
J-649		-15.10	40.00	
J-650		19.80	40.00	
J-651		16.70	40.00	
J-655		4.80	40.00	
J-656		11.90	39.00	
J-661		-10.30	42.00	
J-662		13.50	43.00	
J-663		13.50	41.00	
J-664		0.00	42.00	
J-665		-14.10	42.00	
J-666		4.60	42.00	
J-667		5.00	41.00	
J-668		3.80	40.00	
J-669		3.10	40.00	
J-670		0.00	40.00	
J-671		0.00	40.00	
J-672		-12.20	40.00	
J-673		13.50	42.00	
J-674		2.60	40.00	
J-675		5.70	40.00	
J-676		2.50	42.00	
J-677		0.60	41.00	
J-678		0.60	41.00	
J-679		-11.30	41.00	
J-680		11.90	41.00	

NODE NAME	NODE TITLE	EXTERNAL DEMAND (gpm)	JUNCTION ELEVATION (ft)	EXTERNAL GRADE (ft)
J-684		2.40	43.00	
J-685		2.50	43.00	
J-686		0.60	40.00	
J-687		0.00	42.00	
J-688		3.10	42.00	
J-689		2.40	44.00	
J-690		6.90	41.00	
J-691		5.70	41.00	
J-692		1.30	40.00	
J-693		0.60	40.00	
J-694		0.00	41.00	
J-695		0.00	41.00	
J-700		0.00	44.00	
J-701		4.80	44.00	
J-702		16.70	43.00	
J-703		1.60	44.00	
J-704		-13.20	44.00	
J-706		4.90	42.00	
J-707		5.00	40.00	
J-708		0.60	41.00	
J-709		-13.60	41.00	
J-710		0.00	41.00	
J-711		18.20	43.00	
J-712		15.20	43.00	
J-713		0.00	42.00	
J-714		-7.80	42.00	
J-715		5.70	40.00	
J-716		0.00	40.00	
J-717		-10.30	40.00	
J-718		13.50	40.00	
J-719		0.00	39.00	
J-720		0.00	39.00	
J-721		0.00	39.00	
J-722		0.00	40.00	
J-723		0.00	40.00	
J-724		0.00	40.00	
J-740		1.30	43.00	
J-741		0.60	41.00	
J-742		-11.30	41.00	
J-743		11.90	40.00	
J-744		2.80	42.00	
J-745		-14.10	44.00	
J-746		16.70	44.00	
J-747		7.30	42.00	
J-748		-12.20	42.00	
J-749		15.20	41.00	
J-750		0.00	42.00	
J-751		1.90	43.00	
J-752		3.10	43.00	
J-753		1.90	44.00	
J-754		9.50	44.00	
J-755		0.00	44.00	

NODE NAME	NODE TITLE	EXTERNAL DEMAND (gpm)	JUNCTION ELEVATION (ft)	EXTERNAL GRADE (ft)
J-756		0.00	42.00	
J-760		1.90	40.00	
J-761		3.80	40.00	
J-762		-11.30	41.00	
J-763		1.60	42.00	
J-764		0.00	42.00	
J-765		13.50	42.00	
J-766		-12.20	42.00	
J-767		13.50	40.00	
J-768		3.80	42.00	
J-900A		0.00	50.00	
J-900B		0.00	50.00	
J-901A		0.00	50.00	
J-902B		0.00	50.00	
J-F10		0.00	79.00	
J-F11		3.20	74.00	
J-F12		0.00	101.00	
J-F13		7.90	120.00	
J-F14		0.00	100.00	
J-F15		7.90	67.00	
J-F16		7.90	50.00	
J-F20		0.00	45.00	
J-F21		11.90	48.00	
J-F22		7.90	53.00	
J-F23		11.90	82.00	
J-F24		11.90	120.00	
J-F30		11.90	51.00	
J-F31		7.90	50.00	
J-F32		0.00	70.00	
J-F33		11.90	85.00	
J-F34		0.00	91.00	
J-F50		0.00	48.00	
J-F51		0.00	49.00	
J-F52		0.00	48.00	
J-F53		11.90	48.00	
J-F54		11.90	50.00	
J-F55		11.90	50.00	
J-F56		11.90	49.00	
J-F57		7.90	50.00	
J-F58		7.10	50.00	
J-F59		7.10	50.00	
J-F60		7.10	50.00	
J-F61		0.00	48.00	
R-5		----	50.00	50.00
R-4R		----	50.00	50.00
T-1		----	186.00	192.00
I-Pump 4R		0.00	50.00	
I-Pump 5		0.00	50.00	

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

OUTPUT SELECTION: ALL RESULTS ARE INCLUDED IN THE TABULATED OUTPUT
MAXIMUM AND MINIMUM PRESSURES = 5
MAXIMUM AND MINIMUM VELOCITIES = 5
MAXIMUM AND MINIMUM HEAD LOSS/1000 = 5

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

NUMBER OF PIPES .....(P) = 359
NUMBER OF END NODES .....(J) = 300
NUMBER OF PRIMARY LOOPS .....(L) = 57
NUMBER OF SUPPLY NODES .....(F) = 3
NUMBER OF SUPPLY ZONES .....(Z) = 1

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Case: 0

RESULTS OBTAINED AFTER 6 TRIALS: ACCURACY = 0.72784E-03

S I M U L A T I O N D E S C R I P T I O N (L A B E L)

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

STATUS CODE: XX -CLOSED PIPE CV -CHECK VALVE

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
P-3	J-F61	J-3	184.00	0.13	0.00	1.17	0.69	0.69
P-4	J-F60	J-4	205.00	0.19	0.00	1.31	0.85	0.85
P-100	J-F10	J-102	351.09	0.36	0.00	1.43	0.77	0.77
P-101	J-101	J-103	351.09	0.16	0.00	1.43	0.77	0.77
P-103	J-104	J-F10	606.19	1.62	0.00	2.48	2.13	2.13
P-104	J-105	J-104	3.51	0.00	0.00	0.04	0.00	0.00
P-105	J-105	J-106	24.60	0.05	0.00	0.28	0.08	0.08
P-106	J-107	J-105	11.11	0.03	0.00	0.28	0.11	0.11
P-107	J-108	J-107	11.11	0.05	0.00	0.28	0.11	0.11
P-108	J-109	J-108	14.21	1.13	0.00	1.45	5.16	5.16
P-109	J-109	J-110	9.82	0.82	0.00	1.00	2.98	2.98
P-110	J-111	J-109	24.63	0.34	0.00	0.63	0.56	0.56
P-111	J-111	J-104	602.68	1.56	0.00	2.46	2.10	2.10
P-112	J-112	J-111	627.31	1.37	0.00	2.56	2.26	2.26
P-113	J-114	J-112	627.31	2.71	0.00	2.56	2.26	2.26
P-114	J-110	J-113	9.22	3.85	0.00	0.94	2.32	2.32
P-115	J-114	J-116	34.10	0.01	0.00	0.22	0.03	0.03
P-116	J-116	J-115	18.20	0.16	0.00	0.46	0.28	0.28

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
P-117	J-116	J-117	16.70	0.09	0.00	0.43	0.24	0.24
P-118	J-120	J-114	636.70	2.23	0.00	2.60	2.33	2.33
P-119	J-113	J-128	8.62	1.67	0.00	0.88	2.04	2.04
P-120	J-119	J-120	636.70	0.65	0.00	2.60	2.33	2.33
P-130	J-129	J-130	168.91	0.25	0.00	1.08	0.59	0.59
P-131	J-129	J-131	234.64	0.74	0.00	1.50	1.09	1.09
P-132	J-131	J-132	194.05	0.12	0.00	1.24	0.76	0.76
P-133	J-132	J-133	16.70	0.02	0.00	0.19	0.03	0.03
P-134	J-132	J-134	188.95	0.12	0.00	1.21	0.73	0.73
P-135	J-134	J-135	11.90	0.57	0.00	1.22	3.72	3.72
P-136	J-130	J-136	167.61	0.81	0.00	1.07	0.58	0.58
P-137	J-136	J-137	0.00	0.00	0.00	0.00	0.00	0.00
P-138	J-136	J-138	167.61	0.11	0.00	1.07	0.58	0.58
P-139	J-138	J-140	152.51	0.37	0.00	0.97	0.49	0.49
P-141	J-140	J-141	147.71	0.15	0.00	0.94	0.46	0.46
P-142	J-141	J-142	0.00	0.00	0.00	0.00	0.00	0.00
P-143	J-141	J-145	147.71	0.15	0.00	0.94	0.46	0.46
P-144	J-203	J-145	47.01	0.04	0.00	0.30	0.06	0.06
P-145	J-145	J-146	194.73	0.19	0.00	1.24	0.77	0.77
P-146	J-147	J-146	188.35	0.36	0.00	1.20	0.72	0.72
P-147	J-134	J-147	188.35	0.69	0.00	1.20	0.72	0.72
P-148	J-146	J-201	381.78	0.71	0.00	2.44	2.68	2.68
P-149	J-103	J-F20	189.53	0.52	0.00	0.77	0.25	0.25
P-150	J-F20	J-150	219.18	0.47	0.00	0.90	0.32	0.32
P-151	J-150	J-151	499.58	1.24	0.00	2.04	1.49	1.49
P-152	J-151	J-152	15.10	0.00	0.00	0.06	0.00	0.00
P-153	J-152	J-153	0.00	0.00	0.00	0.00	0.00	0.00
P-155	J-152	J-155	15.10	0.00	0.00	0.06	0.00	0.00
P-156	J-155	J-156	15.10	0.00	0.00	0.06	0.00	0.00
P-160	J-151	J-161	496.68	0.37	0.00	2.03	1.47	1.47
P-161	J-161	J-178	356.57	0.25	0.00	1.46	0.80	0.80
P-162	J-161	J-162	140.11	0.03	0.00	0.57	0.16	0.16
P-163	J-162	J-163	0.00	0.00	0.00	0.00	0.00	0.00
P-164	J-163	J-164	0.00	0.00	0.00	0.00	0.00	0.00
P-165	J-162	J-165	140.11	0.01	0.00	0.57	0.16	0.16
P-166	J-165	J-166	0.00	0.00	0.00	0.00	0.00	0.00
P-167	J-165	J-167	140.11	0.04	0.00	0.57	0.16	0.16
P-168	J-167	J-168	0.00	0.00	0.00	0.00	0.00	0.00
P-169	J-168	J-169	0.00	0.00	0.00	0.00	0.00	0.00
P-171	J-167	J-171	126.61	0.03	0.00	0.52	0.13	0.13
P-172	J-171	J-172	0.00	0.00	0.00	0.00	0.00	0.00
P-173	J-171	J-173	95.71	0.05	0.00	0.39	0.08	0.08
P-174	J-173	J-174	0.00	0.00	0.00	0.00	0.00	0.00
P-175	J-173	J-175	95.71	0.03	0.00	0.39	0.08	0.08
P-176	J-175	J-176	95.71	0.04	0.00	0.39	0.08	0.08
P-177	J-176	J-177	0.00	0.00	0.00	0.00	0.00	0.00
P-178	J-176	J-178	87.81	0.01	0.00	0.36	0.07	0.07
P-180	J-178	J-181	444.38	0.27	0.00	1.82	1.20	1.20
P-182	J-181	J-182	11.90	0.00	0.00	0.05	0.00	0.00
P-183	J-182	J-183	11.90	0.00	0.00	0.05	0.00	0.00
P-184	J-183	J-184	11.90	0.00	0.00	0.08	0.00	0.00
P-185	J-184	J-185	11.90	0.00	0.00	0.08	0.00	0.00
P-190	J-181	J-190	443.78	1.65	0.00	1.81	1.19	1.19
P-191	J-190	J-191	70.01	0.00	0.00	0.29	0.04	0.04
P-192	J-191	J-192	11.90	49.22	0.00	4.86	108.65	108.65

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
P-193	J-191	J-193	15.10	0.00	0.00	0.06	0.00	0.00
P-194	J-206	J-191	-66.51	0.08	0.00	0.42	0.11	0.11
P-195	J-193	J-195	13.50	0.00	0.00	0.06	0.00	0.00
P-196	J-195	J-196	0.00	0.00	0.00	0.00	0.00	0.00
P-197	J-195	J-197	11.90	0.00	0.00	0.05	0.00	0.00
P-201	J-201	J-501	754.25	1.00	0.00	2.14	1.31	1.31
P-203	J-203	J-204	-47.01	0.02	0.00	0.30	0.06	0.06
P-205	J-204	J-205	11.90	0.00	0.00	0.08	0.00	0.00
P-206	J-206	J-204	65.91	0.05	0.00	0.42	0.10	0.10
P-300	T-1	J-119	1498.70	1.13	0.00	6.12	11.36	11.36
P-301	J-119	J-118	11.90	0.00	0.00	0.05	0.00	0.00
P-302	J-119	J-122	860.70	2.28	0.00	3.52	7.59	7.59
P-303	J-122	J-123	856.29	2.25	0.00	3.50	7.52	7.52
P-304	J-122	J-126	4.40	9.74	0.00	1.80	19.75	19.75
P-305	J-123	J-124	590.09	5.21	0.00	3.77	11.18	11.18
P-306	J-126	J-125	1.90	0.77	0.00	0.78	4.17	4.17
P-307	J-124	J-125	590.09	3.05	0.00	3.77	11.18	11.18
P-310	J-125	J-127	396.83	0.86	0.00	2.53	5.36	5.36
P-312	J-128	J-127	7.32	0.00	0.00	0.05	0.00	0.00
P-313	J-127	J-129	403.55	0.31	0.00	2.58	2.97	2.97
P-496	J-190	J-201	373.77	1.09	0.00	1.53	0.87	0.87
P-501	J-501	J-502	760.80	1.78	0.00	3.11	3.24	3.24
P-502	J-502	J-503	418.33	0.00	0.00	1.71	1.23	1.23
P-503	J-744	J-503	-19.21	0.00	0.00	0.22	0.05	0.05
P-504	J-502	J-504	339.37	0.26	0.00	2.17	2.15	2.15
P-505	J-504	J-524	2.47	0.19	0.00	0.25	0.38	0.38
P-506	J-504	J-506	336.90	0.28	0.00	2.15	2.12	2.12
P-507	J-506	J-507	278.99	0.06	0.00	1.78	1.50	1.50
P-508	J-507	J-508	11.90	84.09	0.00	4.86	202.62	202.62
P-509	J-507	J-509	293.49	0.53	0.00	1.87	1.64	1.64
P-510	J-509	J-510	288.69	0.72	0.00	1.84	1.60	1.60
P-511	J-510	J-511	13.50	0.01	0.00	0.15	0.02	0.02
P-512	J-512	J-510	-285.49	1.55	0.00	1.82	1.56	1.56
P-513	J-512	J-513	279.19	0.34	0.00	1.78	1.50	1.50
P-516	J-669	J-670	61.64	0.08	0.00	0.70	0.37	0.37
P-520	J-503	J-520	399.13	0.50	0.00	1.63	0.98	0.98
P-521	J-520	J-521	398.50	0.01	0.00	1.63	0.98	0.98
P-522	J-521	J-523	440.91	0.01	0.00	1.80	1.18	1.18
P-523	J-506	J-528	56.01	0.03	0.00	0.36	0.08	0.08
P-524	J-524	J-520	2.47	0.05	0.00	0.25	0.38	0.38
P-525	J-523	J-525	34.09	0.02	0.00	0.39	0.12	0.12
P-526	J-525	J-526	11.90	0.00	0.00	0.14	0.02	0.02
P-527	J-525	J-527	29.89	0.02	0.00	0.34	0.10	0.10
P-528	J-527	J-528	26.39	0.01	0.00	0.17	0.02	0.02
P-529	J-528	J-530	76.70	0.03	0.00	0.49	0.14	0.14
P-530	J-530	J-531	0.00	0.00	0.00	0.00	0.00	0.00
P-531	J-530	J-532	76.70	0.02	0.00	0.49	0.14	0.14
P-532	J-532	J-533	72.90	0.04	0.00	0.47	0.12	0.12
P-533	J-533	J-534	66.60	0.05	0.00	0.43	0.11	0.11
P-534	J-534	J-535	14.30	1.24	0.00	1.46	5.22	5.22
P-535	J-534	J-536	52.30	0.01	0.00	0.33	0.07	0.07
P-536	J-536	J-537	17.40	2.94	0.00	1.78	7.51	7.51
P-537	J-536	J-540	33.60	0.01	0.00	0.21	0.03	0.03
P-540	J-523	J-540	406.81	0.20	0.00	1.66	1.02	1.02
P-541	J-540	J-541	7.00	0.08	0.00	0.71	1.39	1.39

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
P-542	J-540	J-542	430.31	0.29	0.00	1.76	1.13	1.13
P-543	J-542	J-543	5.20	0.06	0.00	0.53	0.80	0.80
P-544	J-542	J-544	424.51	0.12	0.00	1.73	1.10	1.10
P-545	J-544	J-545	11.90	0.88	0.00	1.22	3.72	3.72
P-546	J-544	J-561	422.01	0.03	0.00	1.72	1.09	1.09
P-548	J-567	J-568	15.10	0.00	0.00	0.10	0.01	0.01
P-550	J-563	J-569	159.53	0.35	0.00	1.02	0.53	0.53
P-562	J-561	J-562	289.71	0.71	0.00	1.85	1.61	1.61
P-563	J-562	J-563	304.01	1.27	0.00	1.94	1.76	1.76
P-565	J-563	J-565	115.19	0.21	0.00	0.74	0.29	0.29
P-566	J-565	J-566	18.20	0.01	0.00	0.12	0.01	0.01
P-567	J-565	J-567	95.39	0.06	0.00	0.61	0.21	0.21
P-569	J-567	J-569	72.39	0.09	0.00	0.46	0.12	0.12
P-570	J-569	J-570	204.11	0.12	0.00	1.30	0.84	0.84
P-571	J-570	J-571	5.60	1.35	0.00	0.57	0.92	0.92
P-573	J-570	J-572	198.51	0.16	0.00	1.27	0.80	0.80
P-580	J-561	J-581	181.50	0.08	0.00	0.74	0.23	0.23
P-581	J-581	J-582	180.90	0.13	0.00	2.05	2.72	2.72
P-582	J-582	J-583	103.67	6.04	0.00	2.65	13.05	13.05
P-583	J-583	J-584	320.20	0.83	0.00	2.04	1.93	1.93
P-585	J-584	J-585	315.40	0.05	0.00	2.01	1.88	1.88
P-586	J-585	J-2	294.00	0.46	0.00	1.88	1.65	1.65
P-587	J-585	J-586	21.40	0.01	0.00	0.14	0.01	0.01
P-601	J-123	J-601	266.20	2.49	0.00	3.02	6.39	6.39
P-602	J-601	J-602	266.20	2.72	0.00	3.02	6.39	6.39
P-603	J-602	J-603	266.20	2.66	0.00	3.02	6.39	6.39
P-605	J-604	J-605	71.19	1.27	0.00	1.82	3.49	3.49
P-607	J-606	J-607	11.90	1.17	0.00	1.22	3.72	3.72
P-610	J-605	J-610	10.24	0.03	0.00	0.26	0.10	0.10
P-611	J-611	J-610	7.15	0.01	0.00	0.18	0.05	0.05
P-612	J-612	J-611	7.15	0.01	0.00	0.18	0.05	0.05
P-613	J-606	J-612	9.05	0.01	0.00	0.23	0.09	0.09
P-615	J-610	J-615	13.59	0.11	0.00	0.35	0.30	0.30
P-616	J-615	J-616	1.38	0.03	0.00	0.14	0.08	0.08
P-617	J-616	J-617	11.90	2.49	0.00	1.22	3.72	3.72
P-620	J-619	J-633	14.95	0.01	0.00	0.17	0.03	0.03
P-621	J-620	J-621	12.15	1.05	0.00	1.24	3.86	3.86
P-622	J-621	J-619	11.55	0.00	0.00	0.13	0.02	0.02
P-623	J-622	J-623	40.40	0.06	0.00	0.46	0.17	0.17
P-624	J-623	J-624	11.90	18.15	0.00	4.86	108.65	108.65
P-625	J-623	J-625	35.40	0.05	0.00	0.40	0.13	0.13
P-626	J-625	J-626	3.02	0.00	0.00	0.08	0.01	0.01
P-627	J-616	J-626	-0.52	0.00	0.00	0.01	0.00	0.00
P-630	J-125	J-630	195.17	0.50	0.00	1.25	0.77	0.77
P-631	J-630	J-631	195.17	0.11	0.00	1.25	0.77	0.77
P-632	J-631	J-632	195.17	0.09	0.00	1.25	0.77	0.77
P-633	J-632	J-633	207.06	0.31	0.00	1.32	0.86	0.86
P-634	J-633	J-634	217.21	0.14	0.00	1.39	0.94	0.94
P-635	J-634	J-635	18.30	0.00	0.00	0.21	0.04	0.04
P-636	J-635	J-636	16.70	2.04	0.00	1.71	6.96	6.96
P-637	J-634	J-637	211.51	0.23	0.00	1.35	0.90	0.90
P-638	J-637	J-638	205.81	0.28	0.00	1.31	0.85	0.85
P-639	J-638	J-639	188.50	0.22	0.00	1.20	0.72	0.72
P-640	J-639	J-640	186.10	0.28	0.00	1.19	0.71	0.71
P-641	J-640	J-641	186.10	0.16	0.00	1.19	0.71	0.71

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
P-642	J-641	J-642	16.70	0.00	0.00	0.11	0.01	0.01
P-643	J-641	J-643	178.10	0.22	0.00	1.14	0.65	0.65
P-644	J-643	J-644	66.31	0.07	0.00	0.75	0.42	0.42
P-645	J-644	J-645	18.20	0.01	0.00	0.21	0.04	0.04
P-646	J-644	J-646	53.71	0.06	0.00	0.61	0.33	0.33
P-647	J-646	J-647	30.71	0.04	0.00	0.35	0.10	0.10
P-648	J-647	J-648	19.80	0.01	0.00	0.22	0.05	0.05
P-649	J-647	J-649	4.61	0.00	0.00	0.05	0.00	0.00
P-650	J-649	J-650	19.80	0.01	0.00	0.22	0.05	0.05
P-651	J-643	J-651	124.49	0.17	0.00	0.79	0.34	0.34
P-652	J-649	J-651	-0.09	0.00	0.00	0.00	0.00	0.00
P-655	J-651	J-655	107.70	0.05	0.00	0.69	0.26	0.26
P-656	J-655	J-656	11.90	0.55	0.00	1.22	3.72	3.72
P-657	J-655	J-1	91.00	0.13	0.00	0.58	0.19	0.19
P-660	J-665	J-664	16.70	0.00	0.00	0.19	0.03	0.03
P-661	J-664	J-661	16.70	0.47	0.00	1.71	7.98	7.98
P-662	J-661	J-662	13.50	1.31	0.00	1.38	8.75	8.75
P-663	J-661	J-663	13.50	1.00	0.00	1.38	8.75	8.75
P-666	J-665	J-666	14.46	0.09	0.00	0.37	0.18	0.18
P-667	J-666	J-667	9.86	3.06	0.00	1.01	4.89	4.89
P-668	J-667	J-668	68.54	0.16	0.00	0.78	0.45	0.45
P-669	J-668	J-669	64.74	0.13	0.00	0.73	0.41	0.41
P-670	J-670	J-671	61.64	0.02	0.00	0.70	0.37	0.37
P-671	J-671	J-672	7.98	0.01	0.00	0.20	0.06	0.06
P-672	J-672	J-673	13.50	9.33	0.00	5.51	137.25	137.25
P-673	J-672	J-674	6.68	0.01	0.00	0.17	0.04	0.04
P-674	J-674	J-675	0.29	0.00	0.00	0.01	0.00	0.00
P-675	J-675	J-676	6.79	0.05	0.00	0.17	0.08	0.08
P-676	J-677	J-676	64.48	1.14	0.00	1.65	5.42	5.42
P-677	J-678	J-677	73.27	1.98	0.00	1.87	6.86	6.86
P-678	J-678	J-679	68.94	0.08	0.00	0.78	0.52	0.52
P-679	J-131	J-679	39.28	0.11	0.00	0.45	0.16	0.16
P-680	J-679	J-680	11.90	0.37	0.00	1.22	3.72	3.72
P-684	J-679	J-684	107.62	0.64	0.00	1.22	1.94	1.94
P-687	J-686	J-687	7.59	0.64	0.00	0.78	3.01	3.01
P-689	J-690	J-688	34.09	0.08	0.00	0.39	0.12	0.12
P-690	J-694	J-690	49.85	0.08	0.00	0.57	0.25	0.25
P-691	J-691	J-694	49.85	0.09	0.00	0.57	0.25	0.25
P-692	J-693	J-692	3.19	0.03	0.00	0.33	0.32	0.32
P-693	J-674	J-693	3.79	0.00	0.00	0.04	0.00	0.00
P-694	J-694	J-695	0.00	0.00	0.00	0.00	0.00	0.00
P-702	J-703	J-702	16.70	0.08	0.00	0.43	0.27	0.27
P-703	J-704	J-703	18.30	0.00	0.00	0.21	0.04	0.04
P-707	J-708	J-707	11.84	0.07	0.00	0.30	0.14	0.14
P-710	J-710	J-711	18.20	0.10	0.00	0.46	0.28	0.28
P-711	J-713	J-712	15.20	2.45	0.00	1.55	10.90	10.90
P-712	J-714	J-713	15.20	0.02	0.00	0.39	0.20	0.20
P-714	J-714	J-715	104.95	0.12	0.00	0.67	0.24	0.24
P-716	J-716	J-717	40.87	0.59	0.00	1.04	1.25	1.25
P-717	J-717	J-718	13.50	21.96	0.00	5.51	137.25	137.25
P-718	J-717	J-719	37.67	0.16	0.00	0.96	1.07	1.07
P-719	J-720	J-719	103.53	0.13	0.00	1.17	1.81	1.81
P-720	J-720	J-721	0.00	0.00	0.00	0.00	0.00	0.00
P-721	J-722	J-720	103.53	0.20	0.00	1.17	1.81	1.81
P-722	J-722	J-723	0.00	0.00	0.00	0.00	0.00	0.00

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
P-723	J-724	J-722	103.53	0.40	0.00	1.17	1.81	1.81
P-730	J-709	J-710	18.20	0.00	0.00	0.21	0.04	0.04
P-731	J-715	J-724	103.53	0.01	0.00	0.66	0.24	0.24
P-739	J-742	J-741	-18.60	0.00	0.00	0.12	0.01	0.01
P-740	J-740	J-521	42.40	0.00	0.00	0.27	0.05	0.05
P-741	J-747	J-741	23.23	0.15	0.00	0.59	0.58	0.58
P-742	J-742	J-743	11.90	0.00	0.00	0.08	0.00	0.00
P-743	J-741	J-715	4.04	0.00	0.00	0.03	0.00	0.00
P-745	J-744	J-740	25.71	0.51	0.00	0.66	0.99	0.99
P-747	J-751	J-756	66.34	0.11	0.00	0.75	0.49	0.49
P-748	J-753	J-748	8.62	1.90	0.00	0.88	3.81	3.81
P-749	J-748	J-749	15.20	22.57	0.00	6.21	170.97	170.97
P-750	J-756	J-745	11.90	0.00	0.00	0.14	0.03	0.03
P-751	J-752	J-751	68.24	0.90	0.00	1.74	3.23	3.23
P-752	J-753	J-752	71.34	0.75	0.00	1.82	4.02	4.02
P-753	J-754	J-753	81.87	0.03	0.00	0.93	0.72	0.72
P-756	J-745	J-746	16.70	3.44	0.00	1.71	6.96	6.96
P-770	J-719	J-760	141.20	1.58	0.00	1.60	3.21	3.21
P-771	J-760	J-761	-5.41	0.01	0.00	0.14	0.03	0.03
P-772	J-760	J-762	144.71	1.49	0.00	1.64	3.36	3.36
P-773	J-762	J-766	140.91	0.55	0.00	1.60	3.20	3.20
P-774	J-766	J-767	13.50	1.06	0.00	1.38	4.69	4.69
P-775	J-766	J-768	139.61	0.46	0.00	1.58	3.14	3.14
P-776	J-761	J-768	64.92	2.51	0.00	1.66	5.49	5.49
P-777	J-768	J-583	200.73	2.08	0.00	2.28	6.16	6.16
P-779	J-582	J-761	74.13	1.45	0.00	1.89	4.31	4.31
P-781	J-762	J-763	15.10	0.06	0.00	0.39	0.20	0.20
P-783	J-763	J-764	13.50	0.05	0.00	0.34	0.16	0.16
P-784	J-764	J-765	13.50	3.58	0.00	1.38	4.69	4.69
P-801	J-603	J-604	72.79	0.07	0.00	0.83	0.58	0.58
P-803	J-603	J-620	191.01	0.35	0.00	2.17	3.01	3.01
P-805	J-620	J-632	174.26	0.75	0.00	1.98	2.54	2.54
P-807	J-632	J-665	159.87	0.75	0.00	1.81	2.17	2.17
P-809	J-665	J-678	142.81	0.49	0.00	1.62	1.76	1.76
P-811	J-684	J-685	105.22	0.18	0.00	1.19	1.86	1.86
P-813	J-685	J-701	102.72	0.71	0.00	1.17	1.78	1.78
P-815	J-701	J-700	97.92	0.50	0.00	1.11	1.63	1.63
P-817	J-700	J-754	97.92	0.85	0.00	1.11	1.63	1.63
P-819	J-755	J-754	-6.55	0.00	0.00	0.07	0.01	0.01
P-821	J-501	J-755	-6.55	0.00	0.00	0.07	0.01	0.01
P-831	J-605	J-606	9.65	0.00	0.00	0.11	0.01	0.01
P-833	J-605	J-622	46.30	0.06	0.00	0.53	0.25	0.25
P-835	J-622	J-619	3.40	0.00	0.00	0.04	0.00	0.00
P-841	J-677	J-686	8.19	0.65	0.00	0.84	3.47	3.47
P-843	J-676	J-687	68.78	0.15	0.00	0.78	0.85	0.85
P-845	J-687	J-688	76.37	0.12	0.00	0.87	1.03	1.03
P-847	J-688	J-689	107.36	0.45	0.00	1.22	1.93	1.93
P-849	J-689	J-704	104.96	0.41	0.00	1.19	1.85	1.85
P-851	J-704	J-708	99.86	0.49	0.00	1.13	1.69	1.69
P-852	J-708	J-709	87.42	0.04	0.00	0.99	1.32	1.32
P-853	J-709	J-714	82.82	0.36	0.00	0.94	1.20	1.20
P-855	J-748	J-714	29.53	0.24	0.00	0.75	1.28	1.28
P-857	J-748	J-750	-23.91	0.12	0.00	0.61	0.86	0.86
P-858	J-750	J-747	30.53	0.33	0.00	0.78	1.36	1.36
P-859	J-750	J-756	-54.44	0.02	0.00	0.62	0.55	0.55

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
P-861	J-745	J-744	9.30	0.00	0.00	0.11	0.02	0.02
P-871	J-615	J-625	9.71	0.03	0.00	0.25	0.10	0.10
P-873	J-625	J-638	37.09	0.54	0.00	0.95	1.95	1.95
P-875	J-638	J-667	106.20	2.94	0.00	2.71	8.40	8.40
P-877	J-667	J-675	42.51	0.41	0.00	1.09	1.54	1.54
P-879	J-675	J-690	30.31	0.25	0.00	0.77	0.82	0.82
P-881	J-690	J-706	39.17	0.84	0.00	1.00	2.15	2.15
P-883	J-706	J-707	34.27	0.67	0.00	0.87	1.68	1.68
P-885	J-707	J-716	41.11	0.45	0.00	1.05	2.35	2.35
P-887	J-716	J-715	0.25	0.00	0.00	0.01	0.00	0.00
P-891	J-740	J-742	-18.00	0.00	0.00	0.11	0.01	0.01
P-893	J-671	J-692	53.66	0.05	0.00	0.61	0.29	0.29
P-895	J-692	J-691	55.55	0.05	0.00	0.63	0.31	0.31
P-900	J-102	J-101	351.09	0.17	0.00	1.43	0.77	0.77
P-901	J-902B	J-101	0.00	0.00	0.00	0.00	0.00	0.00
P-902	J-900B	J-102	0.00	0.00	0.00	0.00	0.00	0.00
P-903	O-Pump 5	J-902B	0.00	0.00	0.00	0.00	0.00	0.00
P-904	O-Pump 4R	J-900B	0.00	0.00	0.00	0.00	0.00	0.00
P-905	J-901A	I-Pump 5	0.00	0.00	0.00	0.00	0.00	0.00
P-906	J-900A	I-Pump 4R	0.00	0.00	0.00	0.00	0.00	0.00
P-907	R-5	J-901A	0.00	0.00	0.00	0.00	0.00	0.00
P-908	R-4R	J-900A	0.00	0.00	0.00	0.00	0.00	0.00
P-F10	J-F10	J-F11	255.09	0.65	0.00	1.63	1.27	1.27
P-F11	J-F11	J-F12	76.39	0.21	0.00	0.49	0.14	0.14
P-F12	J-F12	J-F13	42.60	0.12	0.00	0.27	0.05	0.05
P-F13	J-F13	J-F14	34.70	0.02	0.00	0.22	0.03	0.03
P-F14	J-F15	J-F14	122.86	0.12	0.00	0.35	0.05	0.05
P-F15	J-F16	J-F15	200.16	0.15	0.00	0.57	0.11	0.11
P-F16	J-103	J-F16	160.96	0.04	0.00	0.46	0.08	0.08
P-F17	J-F11	J-F16	175.51	0.08	0.00	0.50	0.09	0.09
P-F18	J-F12	J-F15	33.79	0.02	0.00	0.22	0.03	0.03
P-F20	J-F21	J-F20	29.65	0.01	0.00	0.12	0.01	0.01
P-F21	J-F16	J-F21	128.41	0.48	0.00	0.82	0.36	0.36
P-F22	J-F22	J-F21	5.83	0.00	0.00	0.02	0.00	0.00
P-F23	J-F15	J-F22	103.19	0.33	0.00	0.66	0.24	0.24
P-F24	J-F23	J-F22	-19.87	0.00	0.00	0.08	0.00	0.00
P-F25	J-F23	J-F24	-145.66	0.13	0.00	0.41	0.06	0.06
P-F26	J-F14	J-F24	157.56	0.07	0.00	0.45	0.07	0.07
P-F30	J-F30	J-150	284.20	0.23	0.00	0.81	0.22	0.22
P-F31	J-F21	J-F30	92.70	0.25	0.00	0.59	0.19	0.19
P-F32	J-F31	J-F30	169.33	0.11	0.00	0.48	0.08	0.08
P-F33	J-F33	J-F30	34.08	0.07	0.00	0.22	0.03	0.03
P-F34	J-F33	J-F32	-45.98	0.06	0.00	0.29	0.05	0.05
P-F35	J-F32	J-F31	107.64	0.02	0.00	0.31	0.04	0.04
P-F36	J-F34	J-F32	153.62	0.03	0.00	0.44	0.07	0.07
P-F37	J-F34	J-F23	-153.62	0.09	0.00	0.44	0.07	0.07
P-F38	J-F22	J-F31	69.59	0.14	0.00	0.44	0.11	0.11
P-F50	J-F50	J-572	-198.51	0.61	0.00	1.27	0.80	0.80
P-F51	J-F50	J-F52	78.95	0.11	0.00	0.50	0.14	0.14
P-F52	J-F51	J-F52	-78.95	0.20	0.00	0.50	0.14	0.14
P-F53	J-F51	J-F50	-119.56	0.31	0.00	0.76	0.31	0.31
P-F54	J-F61	J-F51	-198.51	0.68	0.00	1.27	0.80	0.80
P-F60	J-513	J-F54	267.29	1.48	0.00	1.71	1.38	1.38
P-F61	J-F54	J-F55	74.81	0.13	0.00	0.48	0.13	0.13
P-F62	J-F55	J-F60	68.82	0.10	0.00	0.44	0.11	0.11

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
P-F63	J-F60	J-F59	-143.28	0.07	0.00	0.41	0.06	0.06
P-F64	J-F59	J-F58	-51.87	0.01	0.00	0.15	0.01	0.01
P-F65	J-F58	J-F61	-34.81	0.00	0.00	0.10	0.00	0.00
P-F66	J-F61	J-F57	-20.30	0.01	0.00	0.13	0.01	0.01
P-F67	J-F58	J-F57	-24.15	0.01	0.00	0.15	0.02	0.02
P-F68	J-F56	J-F59	98.51	0.03	0.00	0.28	0.03	0.03
P-F69	J-F56	J-F57	13.01	0.00	0.00	0.08	0.01	0.01
P-F70	J-F55	J-F56	-5.91	0.00	0.00	0.04	0.00	0.00
P-F71	J-F53	J-F56	129.33	0.05	0.00	0.37	0.05	0.05
P-F72	J-F53	J-F57	39.35	0.05	0.00	0.25	0.04	0.04
P-F74	J-F53	J-F54	-180.58	0.08	0.00	0.51	0.09	0.09

P U M P/L O S S E L E M E N T R E S U L T S

NAME	FLOWRATE gpm	INLET HEAD ft	OUTLET HEAD ft	PUMP HEAD ft	EFFIC-ENCY %	USEFUL POWER Hp	INCREMTL COST $	TOTAL COST $	#PUMPS PARALLEL	#PUMPS SERIES	NPSH Avail. ft	Case
Device "Pump 4R" is closed												
Pump 4R	0.00	0.00	130.37	0.0	75.00	0.	0.0	0.0	**	**	33.2	0.0000
Device "Pump 5" is closed												
Pump 5	0.00	0.00	130.20	0.0	75.00	0.	0.0	0.0	**	**	33.2	0.0000

N O D E R E S U L T S

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
O-Pump 4R		0.00	180.37	50.00	130.37	56.49
O-Pump 5		0.00	180.20	50.00	130.20	56.42
J-1		91.00	175.20	39.00	136.20	59.02
J-2		294.00	162.64	43.00	119.64	51.84
J-3		184.00	165.88	44.00	121.88	52.82
J-4		205.00	165.74	50.00	115.74	50.15
J-101		0.00	180.20	53.00	127.20	55.12
J-102		0.00	180.37	53.00	127.37	55.19
J-103		0.60	180.04	51.00	129.04	55.92
J-104		0.00	182.35	88.00	94.35	40.89
J-105		-17.00	182.35	86.00	96.35	41.75
J-106		24.60	182.30	107.00	75.30	32.63
J-107		0.00	182.38	63.00	119.38	51.73
J-108		3.10	182.44	63.00	119.44	51.76
J-109		0.60	183.57	61.00	122.57	53.11
J-110		0.60	182.75	46.00	136.75	59.26
J-111		0.00	183.91	115.00	68.91	29.86
J-112		0.00	185.28	161.00	24.28	10.52
J-113		0.60	178.90	43.00	135.90	58.89
J-114		-24.70	187.99	183.00	4.99	2.16
J-115		18.20	187.83	161.00	26.83	11.62
J-116		-0.80	187.99	146.00	41.99	18.19
J-117		16.70	187.90	145.00	42.90	18.59
J-118		11.90	190.87	185.00	5.87	2.55
J-119		-10.60	190.87	187.00	3.87	1.68
J-120		0.00	190.23	180.00	10.23	4.43
J-122		0.00	188.60	144.00	44.60	19.33
J-123		0.00	186.35	78.00	108.35	46.95
J-124		0.00	181.14	49.00	132.14	57.26
J-125		0.00	178.09	48.00	130.09	56.37
J-126		2.50	178.86	92.00	86.86	37.64
J-127		0.60	177.23	46.00	131.23	56.86
J-128		1.30	177.23	52.00	125.23	54.27
J-129		0.00	176.92	46.00	130.92	56.73
J-130		1.30	176.66	46.00	130.66	56.62
J-131		1.30	176.17	44.00	132.17	57.28
J-132		-11.60	176.05	42.00	134.05	58.09
J-133		16.70	176.03	44.00	132.03	57.21
J-134		-11.30	175.93	41.00	134.93	58.47
J-135		11.90	175.36	42.00	133.36	57.79
J-136		0.00	175.85	46.00	129.85	56.27
J-137		0.00	175.85	46.00	129.85	56.27
J-138		15.10	175.75	46.00	129.75	56.22
J-140		4.80	175.38	46.00	129.38	56.06
J-141		0.00	175.23	45.00	130.23	56.43
J-142		0.00	175.23	45.00	130.23	56.43
J-145		0.00	175.08	43.00	132.08	57.23
J-146		1.30	174.89	44.00	130.89	56.72
J-147		0.00	175.24	45.00	130.24	56.44

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
J-150		3.80	179.05	51.00	128.05	55.49
J-151		-12.20	177.81	49.00	128.81	55.82
J-152		0.00	177.81	48.00	129.81	56.25
J-153		0.00	177.81	51.00	126.81	54.95
J-155		0.00	177.81	49.00	128.81	55.82
J-156		15.10	177.81	50.00	127.81	55.38
J-161		0.00	177.44	49.00	128.44	55.66
J-162		0.00	177.41	50.00	127.41	55.21
J-163		0.00	177.41	53.00	124.41	53.91
J-164		0.00	177.41	53.00	124.41	53.91
J-165		0.00	177.40	50.00	127.40	55.21
J-166		0.00	177.40	50.00	127.40	55.21
J-167		13.50	177.36	50.00	127.36	55.19
J-168		0.00	177.36	51.00	126.36	54.75
J-169		0.00	177.36	51.00	126.36	54.75
J-171		30.90	177.33	50.00	127.33	55.17
J-172		0.00	177.33	50.00	127.33	55.17
J-173		0.00	177.28	50.00	127.28	55.15
J-174		0.00	177.28	50.00	127.28	55.15
J-175		0.00	177.25	50.00	127.25	55.14
J-176		7.90	177.20	50.00	127.20	55.12
J-177		0.00	177.20	50.00	127.20	55.12
J-178		0.00	177.19	45.00	132.19	57.28
J-181		-11.30	176.92	45.00	131.92	57.17
J-182		0.00	176.92	45.00	131.92	57.17
J-183		0.00	176.92	44.00	132.92	57.60
J-184		0.00	176.92	47.00	129.92	56.30
J-185		11.90	176.92	50.00	126.92	55.00
J-190		0.00	175.27	45.00	130.27	56.45
J-191		-23.50	175.27	45.00	130.27	56.45
J-192		11.90	126.05	47.00	79.05	34.25
J-193		1.60	175.27	50.00	125.27	54.28
J-195		1.60	175.26	51.00	124.26	53.85
J-196		0.00	175.26	51.00	124.26	53.85
J-197		11.90	175.26	50.00	125.26	54.28
J-201		1.30	174.18	47.00	127.18	55.11
J-203		0.00	175.12	47.00	128.12	55.52
J-204		7.00	175.14	45.00	130.14	56.39
J-205		11.90	175.13	46.00	129.13	55.96
J-206		0.60	175.19	45.00	130.19	56.41
J-501		0.00	173.18	44.00	129.18	55.98
J-502		3.10	171.39	42.00	129.39	56.07
J-503		0.00	171.39	42.00	129.39	56.07
J-504		0.00	171.13	42.00	129.13	55.96
J-506		1.90	170.85	44.00	126.85	54.97
J-507		-26.40	170.79	44.00	126.79	54.94
J-508		11.90	86.70	44.00	42.70	18.50
J-509		4.80	170.26	45.00	125.26	54.28
J-510		-10.30	169.54	44.00	125.54	54.40
J-511		13.50	169.52	44.00	125.52	54.39
J-512		6.30	167.98	48.00	119.98	51.99
J-513		11.90	167.64	48.00	119.64	51.84

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
J-520		3.10	170.89	43.00	127.89	55.42
J-521		0.00	170.88	43.00	127.88	55.41
J-523		0.00	170.87	40.00	130.87	56.71
J-524		0.00	170.94	44.00	126.94	55.01
J-525		-7.70	170.85	44.00	126.85	54.97
J-526		11.90	170.85	44.00	126.85	54.97
J-527		3.50	170.83	44.00	126.83	54.96
J-528		5.70	170.82	44.00	126.82	54.96
J-530		0.00	170.79	44.00	126.79	54.94
J-531		0.00	170.79	43.00	127.79	55.38
J-532		3.80	170.77	44.00	126.77	54.93
J-533		6.30	170.73	45.00	125.73	54.48
J-534		0.00	170.68	43.00	127.68	55.33
J-535		14.30	169.44	43.00	126.44	54.79
J-536		1.30	170.67	42.00	128.67	55.76
J-537		17.40	167.73	44.00	123.73	53.62
J-540		3.10	170.66	43.00	127.66	55.32
J-541		7.00	170.58	43.00	127.58	55.29
J-542		0.60	170.37	43.00	127.37	55.19
J-543		5.20	170.31	43.00	127.31	55.17
J-544		-9.40	170.25	43.00	127.25	55.14
J-545		11.90	169.37	43.00	126.37	54.76
J-561		-49.20	170.22	43.00	127.22	55.13
J-562		-14.30	169.51	44.00	125.51	54.39
J-563		29.30	168.24	45.00	123.24	53.41
J-565		1.60	168.04	45.00	123.04	53.32
J-566		18.20	168.03	45.00	123.03	53.31
J-567		7.90	167.98	44.00	123.98	53.72
J-568		15.10	167.98	44.00	123.98	53.72
J-569		27.80	167.89	44.00	123.89	53.69
J-570		0.00	167.77	44.00	123.77	53.63
J-571		5.60	166.42	44.00	122.42	53.05
J-572		0.00	167.62	44.00	123.62	53.57
J-581		0.60	170.15	42.00	128.15	55.53
J-582		3.10	170.01	42.00	128.01	55.47
J-583		-15.80	163.97	43.00	120.97	52.42
J-584		4.80	163.14	42.00	121.14	52.50
J-585		0.00	163.10	42.00	121.10	52.47
J-586		21.40	163.09	40.00	123.09	53.34
J-601		0.00	183.86	47.00	136.86	59.31
J-602		0.00	181.14	48.00	133.14	57.69
J-603		2.40	178.48	43.00	135.48	58.71
J-604		1.60	178.40	43.00	135.40	58.67
J-605		5.00	177.14	42.00	135.14	58.56
J-606		-11.30	177.13	43.00	134.13	58.12
J-607		11.90	175.96	44.00	131.96	57.18
J-610		3.80	177.10	40.00	137.10	59.41
J-611		0.00	177.11	40.00	137.11	59.41
J-612		1.90	177.12	42.00	135.12	58.55
J-615		2.50	176.99	38.00	138.99	60.23
J-616		-10.00	176.96	37.00	139.96	60.65
J-617		11.90	174.47	38.00	136.47	59.14

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
J-619		0.00	177.07	41.00	136.07	58.97
J-620		4.60	178.13	43.00	135.13	58.56
J-621		0.60	177.08	41.00	136.08	58.97
J-622		2.50	177.07	41.00	136.07	58.97
J-623		-6.90	177.02	40.00	137.02	59.37
J-624		11.90	158.87	40.00	118.87	51.51
J-625		5.00	176.97	40.00	136.97	59.35
J-626		2.50	176.96	39.00	137.96	59.78
J-630		0.00	177.59	45.00	132.59	57.45
J-631		0.00	177.47	44.00	133.47	57.84
J-632		2.50	177.38	44.00	133.38	57.80
J-633		4.80	177.07	43.00	134.07	58.10
J-634		-12.60	176.93	42.00	134.93	58.47
J-635		1.60	176.93	42.00	134.93	58.47
J-636		16.70	174.89	42.00	132.89	57.59
J-637		5.70	176.71	42.00	134.71	58.37
J-638		-51.80	176.43	41.00	135.43	58.68
J-639		2.40	176.20	39.00	137.20	59.46
J-640		0.00	175.93	38.00	137.93	59.77
J-641		-8.70	175.77	39.00	136.77	59.27
J-642		16.70	175.77	40.00	135.77	58.83
J-643		-12.70	175.55	39.00	136.55	59.17
J-644		-5.60	175.48	39.00	136.48	59.14
J-645		18.20	175.48	41.00	134.48	58.27
J-646		23.00	175.42	39.00	136.42	59.12
J-647		6.30	175.38	41.00	134.38	58.23
J-648		19.80	175.38	41.00	134.38	58.23
J-649		-15.10	175.38	40.00	135.38	58.67
J-650		19.80	175.37	40.00	135.37	58.66
J-651		16.70	175.38	40.00	135.38	58.67
J-655		4.80	175.34	40.00	135.34	58.65
J-656		11.90	174.78	39.00	135.78	58.84
J-661		-10.30	176.16	42.00	134.16	58.13
J-662		13.50	174.84	43.00	131.84	57.13
J-663		13.50	175.16	41.00	134.16	58.14
J-664		0.00	176.63	42.00	134.63	58.34
J-665		-14.10	176.63	42.00	134.63	58.34
J-666		4.60	176.54	42.00	134.54	58.30
J-667		5.00	173.49	41.00	132.49	57.41
J-668		3.80	173.33	40.00	133.33	57.77
J-669		3.10	173.20	40.00	133.20	57.72
J-670		0.00	173.11	40.00	133.11	57.68
J-671		0.00	173.10	40.00	133.10	57.68
J-672		-12.20	173.09	40.00	133.09	57.67
J-673		13.50	163.76	42.00	121.76	52.76
J-674		2.60	173.08	40.00	133.08	57.67
J-675		5.70	173.08	40.00	133.08	57.67
J-676		2.50	173.03	42.00	131.03	56.78
J-677		0.60	174.17	41.00	133.17	57.71
J-678		0.60	176.14	41.00	135.14	58.56
J-679		-11.30	176.07	41.00	135.07	58.53
J-680		11.90	175.70	41.00	134.70	58.37

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
J-684		2.40	175.43	43.00	132.43	57.39
J-685		2.50	175.25	43.00	132.25	57.31
J-686		0.60	173.52	40.00	133.52	57.86
J-687		0.00	172.88	42.00	130.88	56.71
J-688		3.10	172.76	42.00	130.76	56.66
J-689		2.40	172.31	44.00	128.31	55.60
J-690		6.90	172.84	41.00	131.84	57.13
J-691		5.70	173.01	41.00	132.01	57.20
J-692		1.30	173.05	40.00	133.05	57.66
J-693		0.60	173.08	40.00	133.08	57.67
J-694		0.00	172.92	41.00	131.92	57.16
J-695		0.00	172.92	41.00	131.92	57.16
J-700		0.00	174.04	44.00	130.04	56.35
J-701		4.80	174.54	44.00	130.54	56.57
J-702		16.70	171.81	43.00	128.81	55.82
J-703		1.60	171.89	44.00	127.89	55.42
J-704		-13.20	171.90	44.00	127.90	55.42
J-706		4.90	172.00	42.00	130.00	56.33
J-707		5.00	171.33	40.00	131.33	56.91
J-708		0.60	171.41	41.00	130.41	56.51
J-709		-13.60	171.37	41.00	130.37	56.49
J-710		0.00	171.36	41.00	130.36	56.49
J-711		18.20	171.26	43.00	128.26	55.58
J-712		15.20	168.53	43.00	125.53	54.40
J-713		0.00	170.99	42.00	128.99	55.89
J-714		-7.80	171.01	42.00	129.01	55.90
J-715		5.70	170.88	40.00	130.88	56.72
J-716		0.00	170.88	40.00	130.88	56.72
J-717		-10.30	170.29	40.00	130.29	56.46
J-718		13.50	148.33	40.00	108.33	46.94
J-719		0.00	170.14	39.00	131.14	56.83
J-720		0.00	170.27	39.00	131.27	56.88
J-721		0.00	170.27	39.00	131.27	56.88
J-722		0.00	170.47	40.00	130.47	56.54
J-723		0.00	170.47	40.00	130.47	56.54
J-724		0.00	170.87	40.00	130.87	56.71
J-740		1.30	170.88	43.00	127.88	55.41
J-741		0.60	170.88	41.00	129.88	56.28
J-742		-11.30	170.88	41.00	129.88	56.28
J-743		11.90	170.88	40.00	130.88	56.71
J-744		2.80	171.39	42.00	129.39	56.07
J-745		-14.10	171.39	44.00	127.39	55.20
J-746		16.70	167.95	44.00	123.95	53.71
J-747		7.30	171.04	42.00	129.04	55.92
J-748		-12.20	171.25	42.00	129.25	56.01
J-749		15.20	148.68	41.00	107.68	46.66
J-750		0.00	171.37	42.00	129.37	56.06
J-751		1.90	171.50	43.00	128.50	55.68
J-752		3.10	172.40	43.00	129.40	56.07
J-753		1.90	173.15	44.00	129.15	55.97
J-754		9.50	173.18	44.00	129.18	55.98
J-755		0.00	173.18	44.00	129.18	55.98

NODE NAME	NODE TITLE	EXTERNAL DEMAND gpm	HYDRAULIC GRADE ft	NODE ELEVATION ft	PRESSURE HEAD ft	NODE PRESSURE psi
J-756		0.00	171.39	42.00	129.39	56.07
J-760		1.90	168.55	40.00	128.55	55.71
J-761		3.80	168.56	40.00	128.56	55.71
J-762		-11.30	167.06	41.00	126.06	54.63
J-763		1.60	167.00	42.00	125.00	54.17
J-764		0.00	166.95	42.00	124.95	54.14
J-765		13.50	163.37	42.00	121.37	52.59
J-766		-12.20	166.51	42.00	124.51	53.95
J-767		13.50	165.45	40.00	125.45	54.36
J-768		3.80	166.05	42.00	124.05	53.76
J-900A		0.00	50.00	50.00	0.00	0.00
J-900B		0.00	180.37	50.00	130.37	56.49
J-901A		0.00	50.00	50.00	0.00	0.00
J-902B		0.00	180.20	50.00	130.20	56.42
J-F10		0.00	180.73	79.00	101.73	44.08
J-F11		3.20	180.08	74.00	106.08	45.97
J-F12		0.00	179.87	101.00	78.87	34.18
J-F13		7.90	179.75	120.00	59.75	25.89
J-F14		0.00	179.73	100.00	79.73	34.55
J-F15		7.90	179.85	67.00	112.85	48.90
J-F16		7.90	180.00	50.00	130.00	56.33
J-F20		0.00	179.51	45.00	134.51	58.29
J-F21		11.90	179.53	48.00	131.53	56.99
J-F22		7.90	179.53	53.00	126.53	54.83
J-F23		11.90	179.52	82.00	97.52	42.26
J-F24		11.90	179.65	120.00	59.65	25.85
J-F30		11.90	179.28	51.00	128.28	55.59
J-F31		7.90	179.38	50.00	129.38	56.07
J-F32		0.00	179.40	70.00	109.40	47.41
J-F33		11.90	179.34	85.00	94.34	40.88
J-F34		0.00	179.43	91.00	88.43	38.32
J-F50		0.00	167.00	48.00	119.00	51.57
J-F51		0.00	166.69	49.00	117.69	51.00
J-F52		0.00	166.89	48.00	118.89	51.52
J-F53		11.90	166.08	48.00	118.08	51.17
J-F54		11.90	166.16	50.00	116.16	50.34
J-F55		11.90	166.03	50.00	116.03	50.28
J-F56		11.90	166.03	49.00	117.03	50.71
J-F57		7.90	166.02	50.00	116.02	50.28
J-F58		7.10	166.01	50.00	116.01	50.27
J-F59		7.10	166.00	50.00	116.00	50.27
J-F60		7.10	165.93	50.00	115.93	50.24
J-F61		0.00	166.01	48.00	118.01	51.14
R-5		----	50.00	50.00	0.00	0.00
R-4R		----	50.00	50.00	0.00	0.00
T-1		----	192.00	186.00	6.00	2.60
I-Pump 4R		0.00	50.00	50.00	0.00	0.00
I-Pump 5		0.00	50.00	50.00	0.00	0.00

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

P R E S S U R E S

JUNCTION NUMBER	MAXIMUM PRESSURES psi	JUNCTION NUMBER	MINIMUM PRESSURES psi
J-616	60.65	J-119	1.68
J-615	60.23	J-114	2.16
J-626	59.78	J-118	2.55
J-640	59.77	T-1	2.60
J-639	59.46	J-120	4.43

V E L O C I T I E S

PIPE NUMBER	MAXIMUM VELOCITY (ft/s)	PIPE NUMBER	MINIMUM VELOCITY (ft/s)
P-749	6.21	P-652	0.00
P-300	6.12	P-887	0.01
P-672	5.51	P-674	0.01
P-717	5.51	P-627	0.01
P-192	4.86	P-F22	0.02

H L + M L / 1 0 0 0

PIPE NUMBER	MAXIMUM HL+ML/1000 (ft/ft)	PIPE NUMBER	MINIMUM HL+ML/1000 (ft/ft)
P-508	202.62	P-652	0.00
P-749	170.97	P-674	0.00
P-672	137.25	P-887	0.00
P-717	137.25	P-627	0.00
P-192	108.65	P-F22	0.00

H L / 1 0 0 0

PIPE NUMBER	MAXIMUM HL/1000 (ft/ft)	PIPE NUMBER	MINIMUM HL/1000 (ft/ft)
P-508	202.62	P-652	0.00
P-749	170.97	P-674	0.00
P-672	137.25	P-887	0.00
P-717	137.25	P-627	0.00
P-192	108.65	P-F22	0.00

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

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

       NODE        FLOWRATE       NODE
       NAME         gpm           TITLE
    -----------------------------------------
     R-5               0.00
     R-4R              0.00
     T-1            1498.70

NET SYSTEM INFLOW  =   1498.70
NET SYSTEM OUTFLOW =      0.00
NET SYSTEM DEMAND  =   1498.70


          ***** HYDRAULIC ANALYSIS COMPLETED *****
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Fireflow/Hydrant Report: EXISTING CONDITIONS

Scenario: 2024 Steady State Hydrant Analysis
Global Demand Factor for this Scenario: 0.520 MDD/PHD = 0.52

Specified Minimum Pressure(psi): 20.0
Minimum Static Pressure(psi) : 26.7 <= 26.7 psi equals 62 feet of head
Tank base is at Elev. 186 ft.
All nodes above Elev. 186 - 62 = Elev. 124 will be ignored
These are only the nodes right around the tank.

Flow-1: Flowrate to maintain the specified pressure at (hydrant) node
Node-2: Node that has a lower pressure than specified value at Flow-1
Flow-2: Flowrate to maintain the specified pressure at Node-2

TANK WATER ELEVATION: 192 ft.
(Top of tank - Standby Storage Depth: 210' - 18' = 192')

Hose Constant = 0.00 NO PUMPS ON

Required Min Flow gpm	Hydrant Node	Hydrant Constant	Elevation ft	Static Pressure psi	Flow-1 gpm	Flow-2 gpm	Node-2	Flow Capacity gpm	NFPA Color	Status
500	H-105	0	88	44.6	1,270	1,003	J-106	1,003	GREEN	ok
500	H-106	0	107	36.4	715			715	ORANGE	ok
500	H-116	0	148	18.9	-568			-568	RED	NG
500	H-119	0	186	2.5	-7,412			-7,412	RED	NG
1,000	H-129	0	46	62.2	2,760	2,502	J-126	2,502	BLUE	ok
1,000	H-130	0	46	62.1	2,434			2,434	BLUE	ok
1,000	H-131	0	44	63.0	2,693	2,522	J-126	2,522	BLUE	ok
1,000	H-132	0	44	63.0	2,353			2,353	BLUE	ok
1,000	H-136	0	46	62.1	2,269			2,269	BLUE	ok
1,000	H-138	0	46	62.1	2,256			2,256	BLUE	ok
1,000	H-139	0	46	62.1	2,292			2,292	BLUE	ok
1,000	H-140	0	46	62.1	2,338			2,338	BLUE	ok
1,000	H-141	0	45	62.5	2,388			2,388	BLUE	ok
1,000	H-142	0	45	62.5	2,207			2,207	BLUE	ok
500	H-149	0	50	60.5	2,570	2,352	J-111	2,352	BLUE	ok

SUMAS WATER SYSTEM
2024 HYDRANT FIRE FLOW ANALYSIS

Required Min Flow gpm	Hydrant Node	Hydrant Constant	Elevation ft	Static Pressure psi	Flow-1 gpm	Flow-2 gpm	Node-2	Flow Capacity gpm	NFPA Color	Status
1,000	H-150	0	50	60.5	2,564	2,406	J-111	2,406	BLUE	ok
1,000	H-151	0	49	60.9	2,449	2,418	J-153	2,418	BLUE	ok
1,000	H-152	0	49	60.9	2,219			2,219	BLUE	ok
1,000	H-153	0	50	60.5	2,081			2,081	BLUE	ok
1,000	H-156	0	50	60.5	2,082			2,082	BLUE	ok
1,000	H-161	0	42	63.9	2,689	2,521	J-163	2,521	BLUE	ok
1,000	H-164	0	53	59.1	2,037			2,037	BLUE	ok
1,000	H-166	0	50	60.4	2,320			2,320	BLUE	ok
1,000	H-169	0	51	60.0	2,099			2,099	BLUE	ok
1,000	H-171	0	50	60.4	2,275			2,275	BLUE	ok
1,000	H-174	0	50	60.4	2,248			2,248	BLUE	ok
1,000	H-177	0	50	60.4	2,289			2,289	BLUE	ok
1,000	H-183	0	46	62.1	2,071	2,020	J-185	2,020	BLUE	ok
1,000	H-184	0	46	62.1	1,741	1,699	J-185	1,699	BLUE	ok
1,000	H-191	0	45	62.5	2,618	2,437	J-192	2,437	BLUE	ok
1,000	H-192	0	50	60.3	2,401			2,401	BLUE	ok
1,000	H-193	0	51	59.9	2,332			2,332	BLUE	ok
1,000	H-195	0	51	59.9	2,203			2,203	BLUE	ok
1,000	H-196	0	51	59.9	1,999			1,999	BLUE	ok
1,000	H-197	0	50	60.3	2,161			2,161	BLUE	ok
1,000	H-200	0	47	61.5	2,601	2,254	J-508	2,254	BLUE	ok
1,000	H-201	0	47	61.6	2,657	2,311	J-508	2,311	BLUE	ok
1,000	H-202	0	45	62.5	2,673	2,360	J-508	2,360	BLUE	ok
1,000	H-203	0	46	62.0	2,346			2,346	BLUE	ok
1,000	H-204	0	45	62.5	2,347			2,347	BLUE	ok
1,000	H-205	0	46	62.0	2,089			2,089	BLUE	ok
1,000	H-206	0	46	62.0	2,362			2,362	BLUE	ok
1,000	H-501	0	44	62.8	2,077			2,077	BLUE	ok
1,000	H-502	0	43	63.2	2,504	2,113	J-508	2,113	BLUE	ok
500	H-506	0	44	62.7	2,285	1,955	J-508	1,955	BLUE	ok
500	H-509	0	47	61.3	1,800	1,785	J-4	1,785	BLUE	ok
500	H-511	0	44	62.6	1,159			1,159	GREEN	ok
500	H-512	0	46	61.7	1,459	1,439	J-4	1,439	GREEN	ok

SUMAS WATER SYSTEM
2024 HYDRANT FIRE FLOW ANALYSIS

Required Min Flow gpm	Hydrant Node	Hydrant Constant	Elevation ft	Static Pressure psi	Flow-1 gpm	Flow-2 gpm	Node-2	Flow Capacity gpm	NFPA Color	Status
500	H-523	0	43	63.1	2,374	2,057	J-508	2,057	BLUE	ok
500	H-527	0	44	62.6	2,154	2,017	J-508	2,017	BLUE	ok
500	H-530	0	44	62.6	2,157	2,015	J-508	2,015	BLUE	ok
500	H-531	0	43	63.1	2,066	2,009	J-508	2,009	BLUE	ok
500	H-532	0	45	62.2	2,112	2,026	J-508	2,026	BLUE	ok
500	H-533	0	44	62.6	2,126	2,034	J-508	2,034	BLUE	ok
500	H-534	0	43	63.1	2,158	2,040	J-508	2,040	BLUE	ok
500	H-542	0	43	63.1	2,258	2,055	J-508	2,055	BLUE	ok
500	H-560	0	42	63.5	2,063			2,063	BLUE	ok
500	H-563	0	45	62.1	1,684			1,684	BLUE	ok
500	H-564	0	44	62.5	1,439			1,439	GREEN	ok
500	H-565	0	44	62.5	1,415			1,415	GREEN	ok
500	H-566	0	45	62.0	1,339			1,339	GREEN	ok
500	H-567	0	44	62.5	1,288			1,288	GREEN	ok
500	H-568	0	44	62.4	1,403			1,403	GREEN	ok
500	H-569	0	44	62.4	1,353			1,353	GREEN	ok
500	H-570	0	44	62.4	1,397			1,397	GREEN	ok
500	H-571	0	44	62.5	1,437			1,437	GREEN	ok
500	H-586	0	41	63.5	936			936	ORANGE	ok
1,000	H-604	0	43	63.6	2,174			2,174	BLUE	ok
1,000	H-605	0	42	63.9	1,669	1,649	J-607	1,649	BLUE	ok
500	H-610	0	41	64.4	1,301			1,301	GREEN	ok
1,000	H-620	0	43	63.6	2,434			2,434	BLUE	ok
1,000	H-622	0	41	64.3	2,061			2,061	BLUE	ok
500	H-623	0	40	64.8	1,810	1,770	J-624	1,770	BLUE	ok
500	H-625	0	40	64.8	1,661			1,661	BLUE	ok
1,000	H-631	0	44	63.1	2,815	2,521	J-126	2,521	BLUE	ok
1,000	H-633	0	43	63.5	2,561			2,561	BLUE	ok
500	H-637	0	42	63.9	2,347			2,347	BLUE	ok
500	H-638	0	41	64.3	2,202			2,202	BLUE	ok
500	H-639	0	39	65.1	1,957	1,933	J-648	1,933	BLUE	ok
500	H-642	0	40	64.7	1,574			1,574	BLUE	ok
500	H-644	0	39	65.1	1,387			1,387	GREEN	ok

SUMAS WATER SYSTEM
2024 HYDRANT FIRE FLOW ANALYSIS

Required Min Flow gpm	Hydrant Node	Hydrant Constant	Elevation ft	Static Pressure psi	Flow-1 gpm	Flow-2 gpm	Node-2	Flow Capacity gpm	NFPA Color	Status
500	H-645	0	41	64.2	1,288			1,288	GREEN	ok
500	H-648	0	41	64.2	1,254			1,254	GREEN	ok
500	H-649	0	40	64.6	1,375			1,375	GREEN	ok
500	H-651	0	40	64.6	1,419			1,419	GREEN	ok
500	H-655	0	40	64.6	1,334			1,334	GREEN	ok
1,000	H-665	0	42	63.9	2,188	2,169	J-662	2,169	BLUE	ok
500	H-667	0	41	64.1	1,433			1,433	GREEN	ok
500	H-668	0	40	64.5	1,385			1,385	GREEN	ok
500	H-674	0	40	64.5	1,125			1,125	GREEN	ok
500	H-676	0	42	63.6	1,206			1,206	GREEN	ok
1,000	H-678	0	41	64.3	2,342			2,342	BLUE	ok
1,000	H-685	0	43	63.4	1,550			1,550	BLUE	ok
1,000	H-688	0	42	63.6	1,605			1,605	BLUE	ok
500	H-690	0	41	64.1	1,189			1,189	GREEN	ok
500	H-691	0	41	64.1	1,399			1,399	GREEN	ok
500	H-695	0	41	64.1	1,328			1,328	GREEN	ok
1,000	H-700	0	44	62.8	1,485			1,485	GREEN	ok
1,000	H-703	0	44	62.7	1,487			1,487	GREEN	ok
1,000	H-710	0	41	64.0	1,667	1,647	J-711	1,647	BLUE	ok
1,000	H-714	0	42	63.5	2,080	2,061	J-712	2,061	BLUE	ok
500	H-715	0	40	64.4	2,206	2,103	J-508	2,103	BLUE	ok
500	H-719	0	39	64.8	1,636			1,636	BLUE	ok
500	H-729	0	42	63.3	502			502	ORANGE	ok
500	H-743	0	40	64.4	2,006			2,006	BLUE	ok
500	H-745	0	42	63.5	2,243	2,081	J-508	2,081	BLUE	ok
1,000	H-751	0	43	63.1	1,812			1,812	BLUE	ok
1,000	H-754	0	43	63.2	1,816			1,816	BLUE	ok
500	H-760	0	40	64.2	1,361			1,361	GREEN	ok
500	H-765	0	42	63.2	1,134			1,134	GREEN	ok

Fireflow/Hydrant Report: FUTURE CONDITIONS

Scenario: 2045 Steady State Hydrant Analysis
Global Demand Factor for this Scenario: 0.570 MDD/PHD = 0.57

Specified Minimum Pressure(psi): 20.0
Minimum Static Pressure(psi) : 26.7 <= 26.7 psi equals 62 feet of head
Tank base is at Elev. 186 ft.
All nodes above Elev. 186 - 62 = Elev. 124 will be ignored
These are only the nodes right around the tank.

Flow-1: Flowrate to maintain the specified pressure at (hydrant) node
Node-2: Node that has a lower pressure than specified value at Flow-1
Flow-2: Flowrate to maintain the specified pressure at Node-2

TANK WATER ELEVATION: 192 ft.
(Top of tank - Standby Storage Depth: 210' - 18' = 192')

Hose Constant = 0.00 NO PUMPS ON

Required Min Flow gpm	Hydrant Node	Hydrant Constant	Elevation ft	Static Pressure psi	Flow-1 gpm	Flow-2 gpm	Node-2	Flow Capacity gpm	NFPA Color	Status
500	H-105	0	88	43.6	1,196	917	J-106	917	ORANGE	ok
500	H-106	0	107	35.4	659			659	ORANGE	ok
500	H-116	0	148	18.5	-658			-658	RED	NG
500	H-119	0	186	2.4	-7,625			-7,625	RED	NG
1,000	H-129	0	46	60.9	2,680	1,512	J-F24	1,512	BLUE	ok
1,000	H-130	0	46	60.9	2,359	1,496	J-F24	1,496	GREEN	ok
1,000	H-131	0	44	61.7	2,616	1,498	J-F24	1,498	GREEN	ok
1,000	H-132	0	44	61.7	2,282	1,485	J-F24	1,485	GREEN	ok
1,000	H-136	0	46	60.8	2,198	1,471	J-F24	1,471	GREEN	ok
1,000	H-138	0	46	60.8	2,186	1,456	J-F24	1,456	GREEN	ok
1,000	H-139	0	46	60.8	2,223	1,434	J-F24	1,434	GREEN	ok
1,000	H-140	0	46	60.7	2,269	1,421	J-F24	1,421	GREEN	ok
1,000	H-141	0	45	61.1	2,320	1,397	J-F24	1,397	GREEN	ok
1,000	H-142	0	50	59.0	2,071	1,397	J-F24	1,397	GREEN	ok
500	H-149	0	50	59.5	2,744	1,102	J-F24	1,102	GREEN	ok

SUMAS WATER SYSTEM
2045 HYDRANT FIRE FLOW ANALYSIS

Required Min Flow gpm	Hydrant Node	Hydrant Constant	Elevation ft	Static Pressure psi	Flow-1 gpm	Flow-2 gpm	Node-2	Flow Capacity gpm	NFPA Color	Status
1,000	H-150	0	50	59.4	2,698	1,134	J-F24	1,134	GREEN	ok
1,000	H-151	0	49	59.8	2,534	1,155	J-F24	1,155	GREEN	ok
1,000	H-152	0	49	59.8	2,266	1,155	J-F24	1,155	GREEN	ok
1,000	H-153	0	50	59.4	2,112	1,155	J-F24	1,155	GREEN	ok
1,000	H-156	0	50	59.4	2,113	1,155	J-F24	1,155	GREEN	ok
1,000	H-161	0	42	62.8	2,790	1,175	J-F24	1,175	GREEN	ok
1,000	H-164	0	53	58.0	2,051	1,174	J-F24	1,174	GREEN	ok
1,000	H-166	0	50	59.3	2,365	1,175	J-F24	1,175	GREEN	ok
1,000	H-169	0	51	58.9	2,118	1,175	J-F24	1,175	GREEN	ok
1,000	H-171	0	50	59.3	2,313	1,175	J-F24	1,175	GREEN	ok
1,000	H-174	0	50	59.3	2,283	1,177	J-F24	1,177	GREEN	ok
1,000	H-177	0	50	59.3	2,326	1,184	J-F24	1,184	GREEN	ok
1,000	H-183	0	46	61.0	2,073	1,202	J-F24	1,202	GREEN	ok
1,000	H-184	0	46	61.0	1,724	1,202	J-F24	1,202	GREEN	ok
1,000	H-191	0	45	61.1	2,583	1,313	J-F24	1,313	GREEN	ok
1,000	H-192	0	50	59.0	2,359	1,308	J-F24	1,308	GREEN	ok
1,000	H-193	0	51	58.5	2,287	1,308	J-F24	1,308	GREEN	ok
1,000	H-195	0	51	58.5	2,155	1,308	J-F24	1,308	GREEN	ok
1,000	H-196	0	51	58.5	1,949	1,308	J-F24	1,308	GREEN	ok
1,000	H-197	0	50	59.0	2,113	1,308	J-F24	1,308	GREEN	ok
1,000	H-200	0	47	60.0	2,511	1,364	J-F24	1,364	GREEN	ok
1,000	H-201	0	47	60.1	2,581	1,354	J-F24	1,354	GREEN	ok
1,000	H-202	0	45	61.1	2,617	1,340	J-F24	1,340	GREEN	ok
1,000	H-203	0	47	60.3	2,272	1,342	J-F24	1,342	GREEN	ok
1,000	H-204	0	47	60.3	2,258	1,339	J-F24	1,339	GREEN	ok
1,000	H-205	0	46	60.7	2,031	1,337	J-F24	1,337	GREEN	ok
1,000	H-206	0	46	60.7	2,306	1,329	J-F24	1,329	GREEN	ok
1,000	H-501	0	44	61.3	1,995	1,384	J-F24	1,384	GREEN	ok
1,000	H-502	0	43	61.5	2,390	1,843	J-508	1,843	BLUE	ok
500	H-506	0	44	60.9	2,171	1,699	J-508	1,699	BLUE	ok
500	H-509	0	47	59.5	1,822	1,386	J-F24	1,386	GREEN	ok
500	H-511	0	44	60.7	1,149			1,149	GREEN	ok
500	H-512	0	46	59.7	1,624	1,387	J-F24	1,387	GREEN	ok

SUMAS WATER SYSTEM
2045 HYDRANT FIRE FLOW ANALYSIS

Required Min Flow gpm	Hydrant Node	Hydrant Constant	Elevation ft	Static Pressure psi	Flow-1 gpm	Flow-2 gpm	Node-2	Flow Capacity gpm	NFPA Color	Status
500	H-523	0	43	61.3	2,250	1,778	J-508	1,778	BLUE	ok
500	H-527	0	44	60.9	2,038	1,745	J-508	1,745	BLUE	ok
500	H-530	0	44	60.9	2,039	1,744	J-508	1,744	BLUE	ok
500	H-531	0	43	61.3	1,956	1,387	J-F24	1,387	GREEN	ok
500	H-532	0	45	60.4	1,996	1,387	J-F24	1,387	GREEN	ok
500	H-533	0	44	60.9	2,010	1,388	J-F24	1,388	GREEN	ok
500	H-534	0	43	61.3	2,043	1,762	J-508	1,762	BLUE	ok
500	H-542	0	43	61.3	2,151	1,769	J-508	1,769	BLUE	ok
500	H-560	0	42	61.6	1,962	1,389	J-F24	1,389	GREEN	ok
500	H-563	0	45	60.2	1,764	1,388	J-F24	1,388	GREEN	ok
500	H-564	0	44	60.5	1,592	1,388	J-F24	1,388	GREEN	ok
500	H-565	0	44	60.5	1,567	1,388	J-F24	1,388	GREEN	ok
500	H-566	0	45	60.0	1,462	1,388	J-F24	1,388	GREEN	ok
500	H-567	0	44	60.5	1,389			1,389	GREEN	ok
500	H-568	0	44	60.5	1,558	1,388	J-F24	1,388	GREEN	ok
500	H-569	0	44	60.5	1,491	1,388	J-F24	1,388	GREEN	ok
500	H-570	0	44	60.5	1,569	1,388	J-F24	1,388	GREEN	ok
500	H-571	0	44	60.5	1,618	1,388	J-F24	1,388	GREEN	ok
500	H-586	0	41	61.0	846			846	ORANGE	ok
1,000	H-604	0	43	62.5	2,104	1,734	J-F24	1,734	BLUE	ok
1,000	H-605	0	42	62.7	1,612	1,590	J-607	1,590	BLUE	ok
500	H-610	0	41	63.2	1,259			1,259	GREEN	ok
1,000	H-620	0	43	62.5	2,354	1,721	J-F24	1,721	BLUE	ok
1,000	H-622	0	41	63.1	1,987	1,654	J-F24	1,654	BLUE	ok
500	H-623	0	40	63.6	1,747	1,690	J-624	1,690	BLUE	ok
500	H-625	0	40	63.6	1,604			1,604	BLUE	ok
1,000	H-631	0	44	61.9	2,720	1,641	J-F24	1,641	BLUE	ok
1,000	H-633	0	43	62.3	2,466	1,643	J-F24	1,643	BLUE	ok
500	H-637	0	42	62.7	2,256	1,637	J-F24	1,637	BLUE	ok
500	H-638	0	41	63.1	2,115	1,631	J-F24	1,631	BLUE	ok
500	H-639	0	39	63.9	1,876	1,630	J-F24	1,630	BLUE	ok
500	H-642	0	40	63.4	1,504			1,504	BLUE	ok
500	H-644	0	39	63.8	1,326			1,326	GREEN	ok

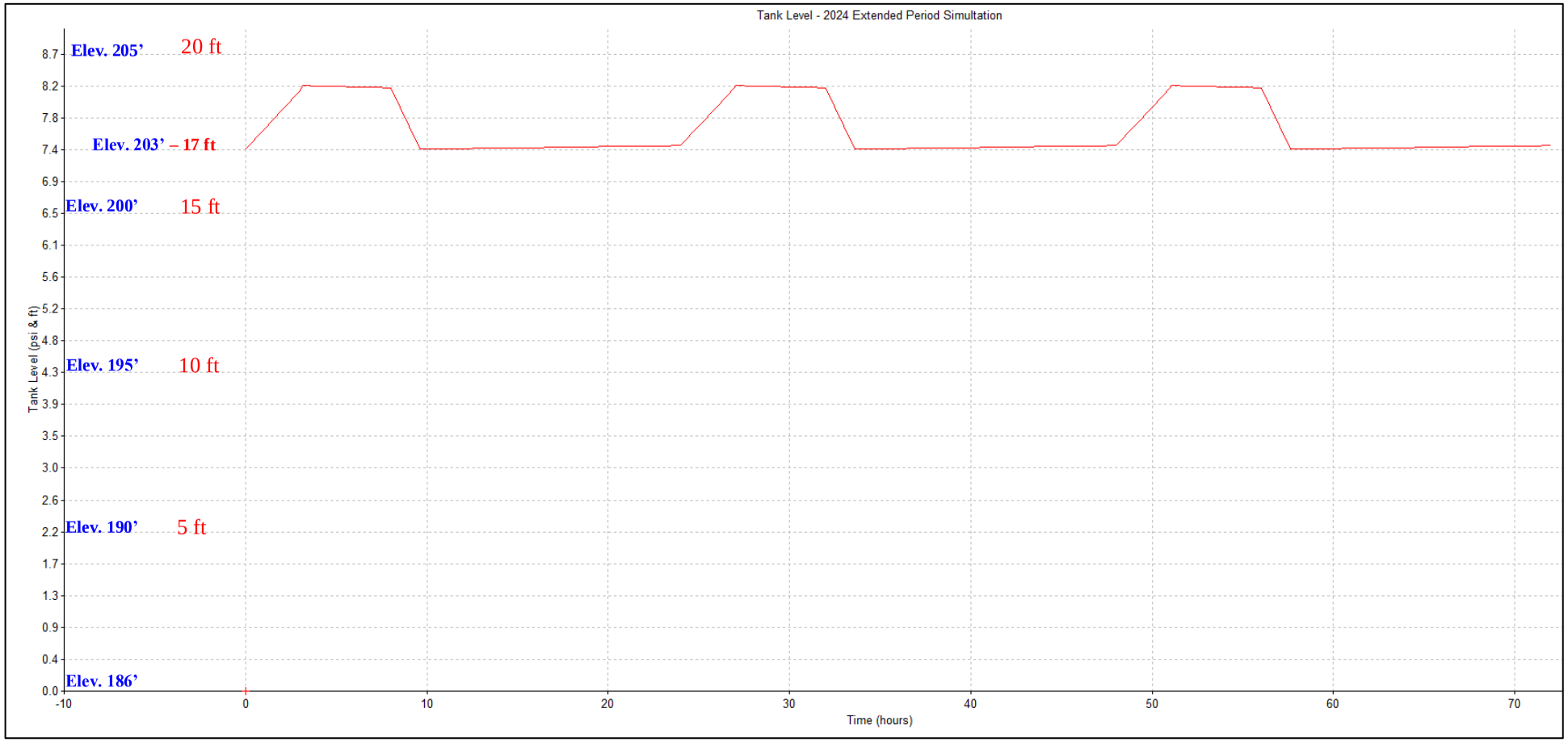
SUMAS WATER SYSTEM
2045 HYDRANT FIRE FLOW ANALYSIS

Required Min Flow gpm	Hydrant Node	Hydrant Constant	Elevation ft	Static Pressure psi	Flow-1 gpm	Flow-2 gpm	Node-2	Flow Capacity gpm	NFPA Color	Status
500	H-645	0	41	62.9	1,232			1,232	GREEN	ok
500	H-648	0	41	62.9	1,199			1,199	GREEN	ok
500	H-649	0	40	63.3	1,312			1,312	GREEN	ok
500	H-651	0	40	63.3	1,353			1,353	GREEN	ok
500	H-655	0	40	63.3	1,272			1,272	GREEN	ok
1,000	H-665	0	42	62.6	2,113	1,584	J-F24	1,584	BLUE	ok
500	H-667	0	41	62.6	1,376			1,376	GREEN	ok
500	H-668	0	40	63.0	1,330			1,330	GREEN	ok
500	H-674	0	40	63.0	1,083			1,083	GREEN	ok
500	H-676	0	42	62.1	1,159			1,159	GREEN	ok
1,000	H-678	0	41	63.0	2,264	1,533	J-F24	1,533	BLUE	ok
1,000	H-685	0	43	62.0	1,495			1,495	GREEN	ok
1,000	H-688	0	42	62.1	1,535			1,535	BLUE	ok
500	H-690	0	41	62.5	1,136			1,136	GREEN	ok
500	H-691	0	41	62.5	1,342			1,342	GREEN	ok
500	H-695	0	41	62.5	1,275			1,275	GREEN	ok
1,000	H-700	0	44	61.4	1,430			1,430	GREEN	ok
1,000	H-703	0	44	61.1	1,417			1,417	GREEN	ok
1,000	H-710	0	41	62.3	1,583	1,437	J-F24	1,437	GREEN	ok
1,000	H-714	0	42	61.8	1,971	1,408	J-F24	1,408	GREEN	ok
500	H-715	0	40	62.6	2,090	1,402	J-F24	1,402	GREEN	ok
500	H-719	0	39	62.9	1,537	1,398	J-F24	1,398	GREEN	ok
500	H-729	0	42	61.2	475	471	J-765	471	RED	NG
500	H-743	0	40	62.6	1,904	1,395	J-F24	1,395	GREEN	ok
500	H-745	0	42	61.8	2,133	1,386	J-F24	1,386	GREEN	ok
1,000	H-751	0	43	61.4	1,727	1,388	J-F24	1,388	GREEN	ok
1,000	H-754	0	43	61.7	1,745	1,407	J-F24	1,407	GREEN	ok
500	H-760	0	40	62.2	1,263			1,263	GREEN	ok
500	H-765	0	42	61.0	1,033			1,033	GREEN	ok
500	H-F13	0	110	33.7	1,187	924	J-F13	924	ORANGE	ok
1,000	H-F21	0	48	60.5	2,531	1,078	J-F24	1,078	GREEN	ok
500	H-F23	0	86	44.0	1,939	1,053	J-F24	1,053	GREEN	ok
1,000	H-F33	0	53	58.3	2,098	1,074	J-F24	1,074	GREEN	ok

SUMAS WATER SYSTEM
2045 HYDRANT FIRE FLOW ANALYSIS

Required Min Flow gpm	Hydrant Node	Hydrant Constant	Elevation ft	Static Pressure psi	Flow-1 gpm	Flow-2 gpm	Node-2	Flow Capacity gpm	NFPA Color	Status
500	H-F52	0	49	58.1	1,368			1,368	GREEN	ok
500	H-F55	0	50	57.6	1,341			1,341	GREEN	ok
500	H-F59	0	50	57.6	1,386			1,386	GREEN	ok

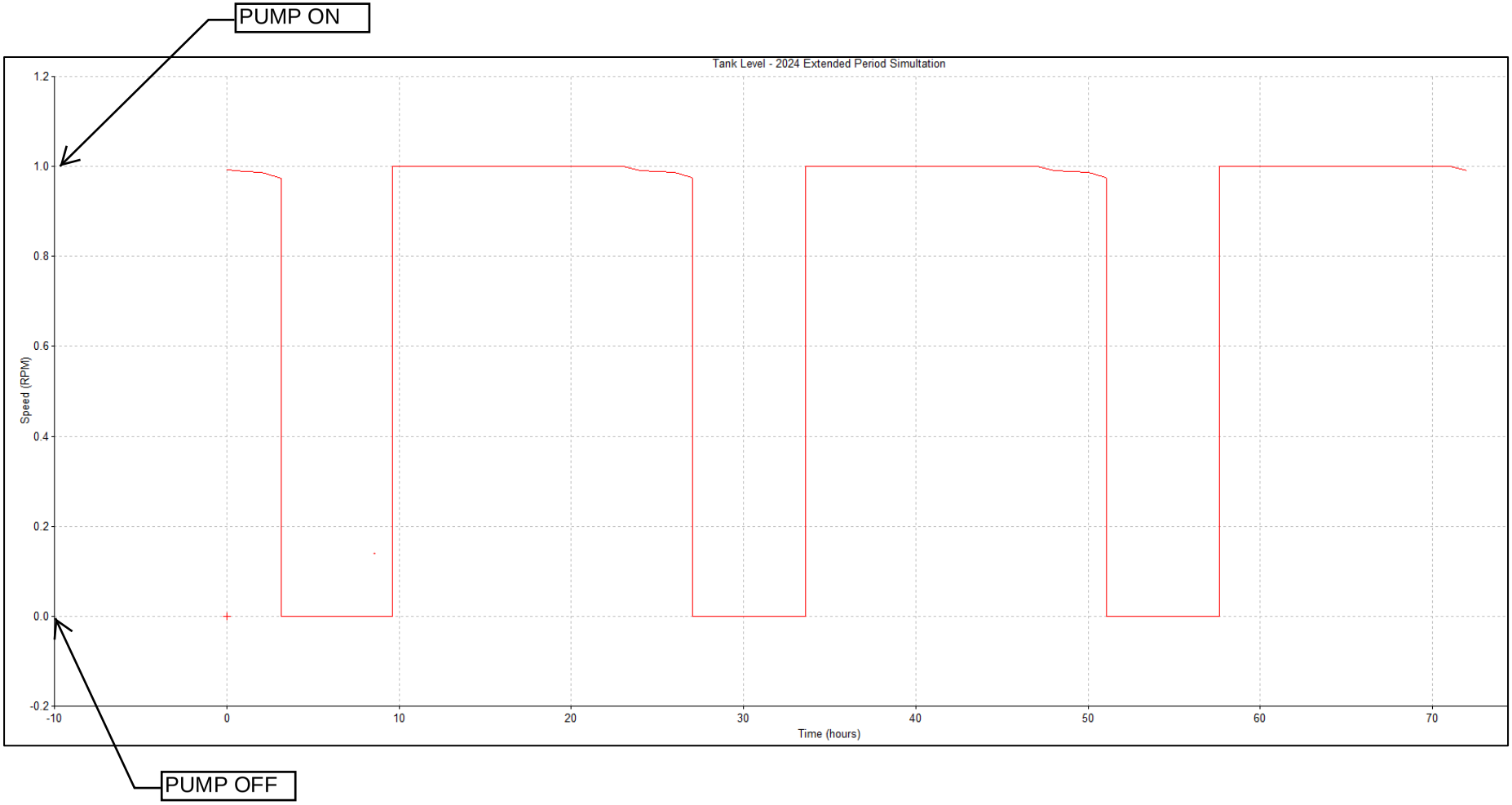
2024 Extended Period Simulation



- SINGLE PUMP (#5) ON WHEN TANK LEVEL IS BELOW 17.0' AND OFF AT 19.0'

2025 Sumas Water System Plan Update
2024 Extended Period Simulation – Pump On/Off Status

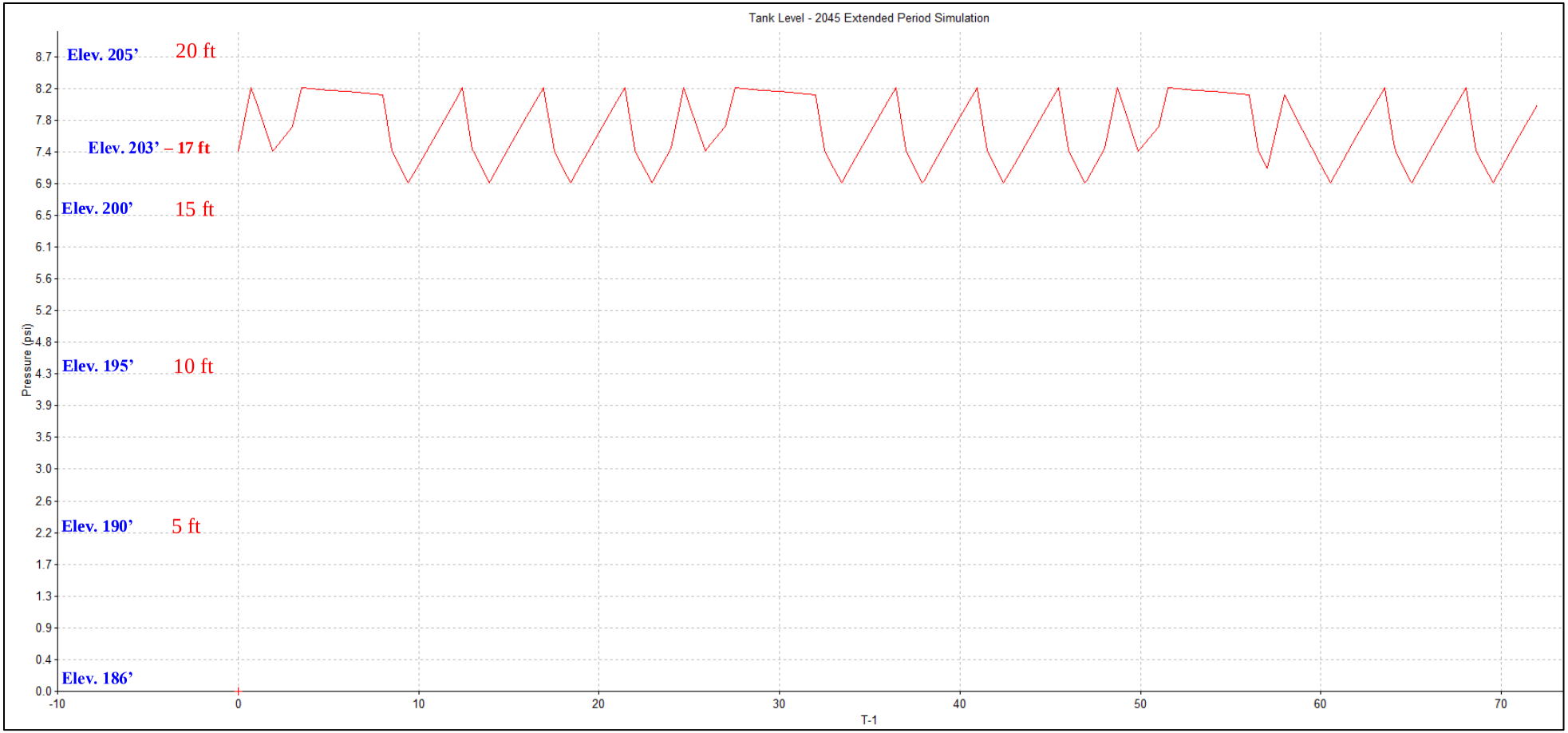
August 25, 2025



2024

- SINGLE PUMP (#5) ON WHEN TANK LEVEL IS BELOW 17.0’ AND OFF AT 19.0’

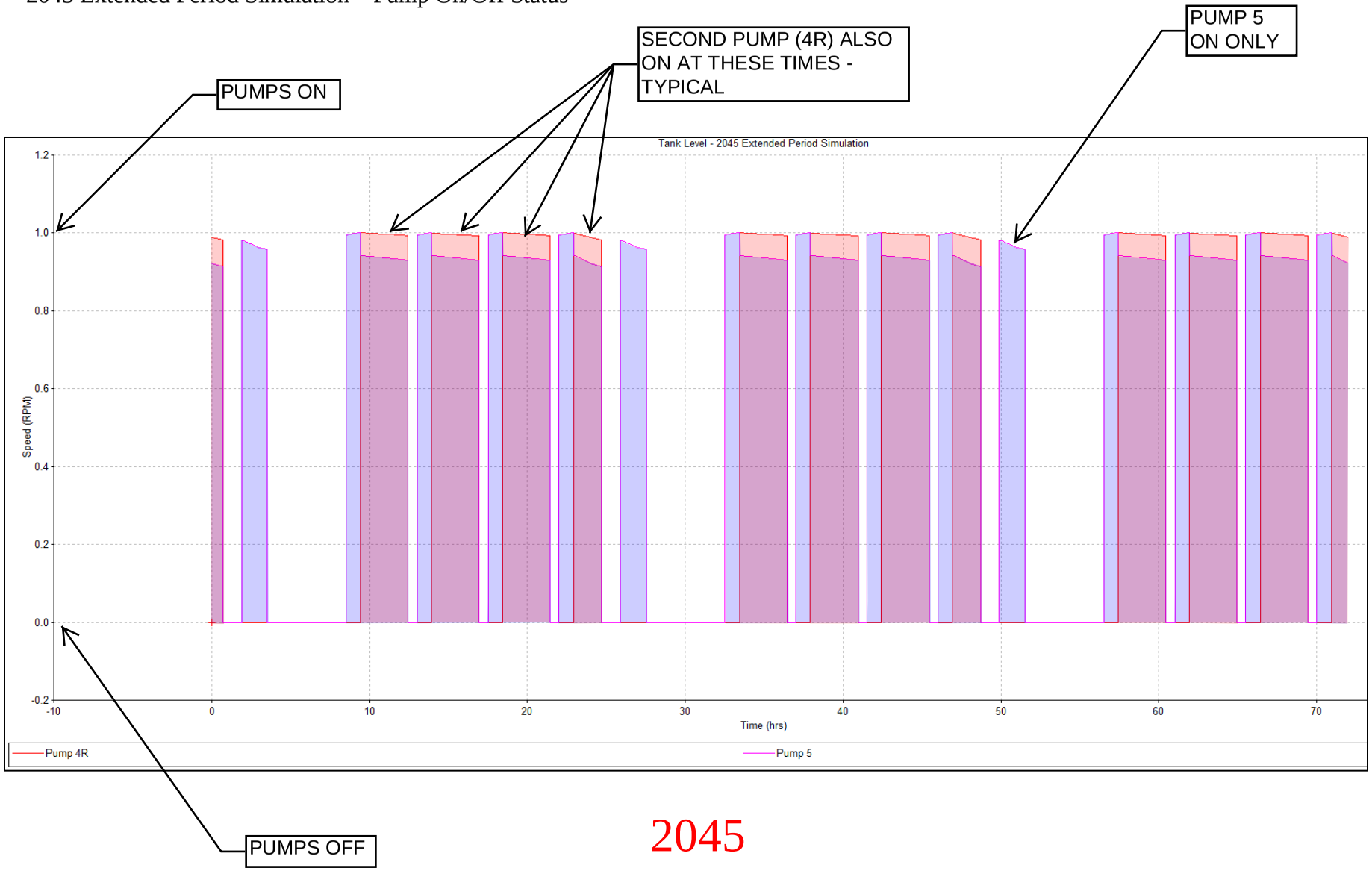
2045 Extended Period Simulation



- PUMP 5 IS ON WHEN TANK LEVEL IS BELOW 17.0' AND OFF AT 19.0'
- PUMP 4R IS ON WHEN TANK LEVEL IS BELOW 16.0' AND OFF AT 19.0'

2025 Sumas Water System Plan Update
2045 Extended Period Simulation – Pump On/Off Status

August 25, 2025



2045

- PUMP 5 IS ON WHEN TANK LEVEL IS BELOW 17.0' AND OFF AT 19.0'
- PUMP 4R IS ON WHEN TANK LEVEL IS BELOW 16.0' AND OFF AT 19.0'