ROBINSON NOBLE

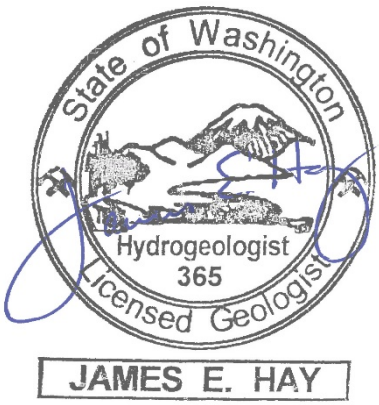
Technical Memorandum

To: Henry Chen, Engineering and Capital Projects Director
Cascade Water Alliance

From: James E. Hay, LHG, CPG

Date: July 1, 2022

Subject: Independent Water Supply Audit
Sammamish Plateau Water & Sewer District
(Robinson Noble project no.: 3400-001A)



1 – Audit Purpose

Cascade Water Alliance (Cascade) is a municipal corporation formed by its Member agencies under RWC 39.106, the Joint Municipal Utility Services Act. The seven Member agencies entered into the Cascade Joint Municipal Utilities Services Agreement, dated March 28, 2012 (the "Joint Agreement"). Cascade serves as a regional wholesale water supplier to its Members, some of which own independent water systems.

As a part of the water supply relationship under the Joint Agreement, Members with independent supply are responsible for maintaining that supply capacity and availability, with Cascade's supply obligation incremental to that independent supply. As a part of Cascade's original formation, each Member's water supplies were "audited" to determine both regulatory and physical capacity. These water supply audits formed part of the basis for, and terms of, membership and remain the basis for Members' independent supply obligations. Cascade is now conducting new and updated water supply audits of the four Members with independent supply, including the Sammamish Plateau Water and Sewer District.

The results of these audits are only for Cascade's purposes of implementation of the Joint Agreement. The focus of these audits is to quantify the Members' available water supply capacity, both in terms of regulatory and infrastructure capacity, and their ability to meet established production requirements. The results will be used to update the inventory of Members' independent supplies, establish Members' independent supply capacity, and determine our Member's individual and collective ability to meet their related production requirements. Like prior audits, this evaluation primarily considers system characteristics and production data for a three-year period, in this case the 2017 – 2019 calendar years.

2 – Introduction

Sammamish Plateau Water & Sewer District (SPWSD) is a special purpose district that owns and operates a Group A community water system. Table 1 summarizes data for the system as presented in the Washington State Department of Health (Health) Water Facilities Inventory form, accessed on July 8, 2021. SPWSD's water service area is shown in Figure 1.

Table 1: Sammamish Plateau Water & Sewer Water System

Water System Name:	Sammamish Plateau Water & Sewer
WSDOH System ID No.:	40900
Address:	1510 228th Ave SE, Sammamish, WA 98075
Operations Manager:	Andrew Tuchscherer
Total Service Connections:	24,162 [a]
Source Wells In Service:	Wells 1R, 2.1, 2.2, 4R, 9, 10, 11.1, 11.2, 12R, 13R

[a] The total service connections indicated by Health on the WFI form (24,162) is the number of residential units that receive water from the water system. In contrast, purveyors typically count the physical number of service connections (18,981). This value is lower because a single, physical connection to a multi-family building serves multiple residential units.

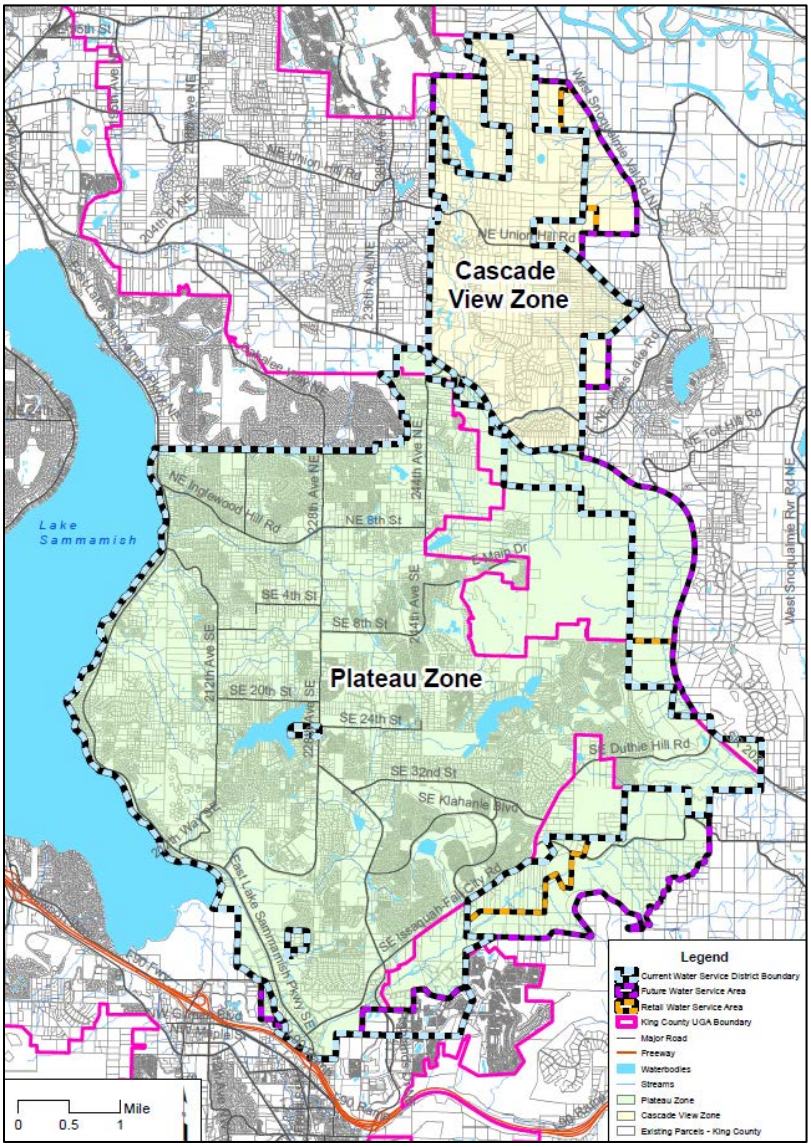


Figure 1: SPWSD's *Water System service area*
(excerpted from SPSWD's 2018 Water Comprehensive Plan)

3 – Independent Sources of Supply

SPWSD currently has ten source wells in service, summarized in Table 2. Two additional wells, Wells 7 and 8, are currently offline due to PFAS contamination.

Table 2: Summary of Source Wells in Service

Well No.	Unique Well ID	Source No.	Year Drilled	Depth (ft bgs) [a]	Casing Diameter (in) [a]	Screen Diameter (in)	Screen Interval (ft bgs)	Test Rate (gpm) / year / SC (gpm/ft) [a,b]	Pump Capacity (gpm)
1R	AAD-358	01	1984	159	12	12T [c]	137 – 147	610 / 1984 / 50.0	500
2.1	AAD-361	02	1968	132	12	12T	96 – 116	500 / 1968 / 13.9 330 / 1983 / 15.3	500
2.2	AAD-383	15	1993	180	16	16T	150 – 175	188 / 1996 / 13.2 500 / 2009 / 11.2	500
4R	AAS-270	17	2004	854	20	12P [c]	709 – 844 [d]	2,000 / 2004 / 26.7	1,800
9	AAD-365	13	1991	303	24	24T	194 – 219	2,340 / 1992 / 104 2,310 / 1996 / 102	2,300
10	AAD-363	11	1993	193	12	10P	135 – 183 [d]	508 / 1993 / 13.2	500
11.1	AAD-381	14	1993	499	10	6P	409 – 486 [d]	389 / 1995 / 4.5	500
11.2	AAD-382	12	1993	884	16	8P	785 – 880 [d]	973 / 1995 / 19	1,800
12R	AEC-911	16	1999	145	12	12T	135 – 145	201 / 1999 / 86.6	200
13R	AAS-174	24	2006	949	12	6P	794.8 – 941.6 [d]	800 / 2006 / 8.8	260

[a] ft bgs, feet below ground surface; in, inches; gpm, gallons per minute; SC, specific capacity; gpm/ft, gallons per minute per foot of drawdown

[b] Specific capacity (SC), a measure of well efficiency calculated by dividing the production rate by the drawdown incurred, is technically only directly comparable for equivalent production rates and durations. While such tests are typically at least 24 hours in duration, the durations reflected in Table 2, where specified, range from 3 hours (Well 12R) to 504 hours (Well 9, 1996 test).

[c] "P" and "T" denote pipe- and telescope-size screen, respectively.

[d] Includes intervals of blank casing.

4 – Regulatory Status of Sources

4.1 – Water System

The regulatory requirements for Group A water systems are specified in Chapter 246-290 WAC, governed by the Washington State Department of Health (Health). The fundamental planning and engineering document for water and sewer districts is their Comprehensive Plan (CP). The District's CP, last updated in October 2019, contains detailed information about all aspects of the District's system, including infrastructure and service area, source approval, demand projections, production capacity, water rights, and overall regulatory compliance. A wellhead protection plan (WHPP) is a primary source water protection requirement (WAC 246-290-135). According to WHPP documents included in

the CP, wellhead protection areas (WHPAs)[1] for most of the District's wells have been evaluated with numerical modeling techniques, widely considered to be the most sophisticated method. WHPAs were delineated for some of the Plateau wells (Zone II Wells 1R, 2.1, 2.2, and 10) in 2007,[2] and WHPAs for the Lower Issaquah Valley wells (Wells 7, 8, and Well 9) were delineated in 2017. WHPAs for the Cascade View wells (Wells 12R and 13R) were defined with the calculated fixed radius (CFR) method. According to the CP, the District continues to use prior generations of WHPAs, developed with simpler methods and generally larger in extent, to provide greater protection of their groundwater resources. Correspondingly, Health's Source Water Assessment Program (SWAP) GIS Mapping Tool (GMT)[3] shows a mix of CFR and analytically derived WHPAs.[4]

Health also summarizes the current status of key aspects of the water system via reports accessible from Sentry Internet.[5] The Water Facilities Inventory (WFI) Report, last updated on December 13, 2019, shows that SPSWD's wells have the approved source numbers and pump capacities[6] shown in Table 2. As of July 8, 2021, Health's Pre-Adequacy Data Summary Report indicates the District has a current and valid operating permit, a permit category color of green,[7] no current water quality violations or compliance actions, and the total approved connections are unspecified (not limited).

4.1.1 – Water Treatment

Source approval also indicates that water provided by the District's wells meets potable water standards after any necessary treatment and blending. As discussed in the CP, the primary treatment for both the Plateau and Cascade View zones is chlorination and fluoridation. The only exception to this is water from the Plateau Zone delivered to the 3-MG Tank, jointly operated with Northeast Sammamish Sewer & Water District, which is not chlorinated or fluoridated. Lead and copper levels in the distribution system are controlled via a corrosion-control system adjusting pH from Wells 1R,

---

[1] A WHPA reflects a portion of the zone of contribution of water to a well, including both horizontal and vertical flow; however, WHPAs present a "flat" birds-eye view of the area contributing water to a well without respect to depth. Historically, WHPAs have consisted of three time-of-travel (TOT) boundaries: one-year (Zone 1), five-year (Zone 2), and ten-year (Zone 3). As of April 9, 1999, WAC 246-290-135(3)(c)(ii) requires that a six-month TOT boundary also be delineated as part of Zone 1.

[2] Though modeled, no new TOT boundaries for Zones 1-3 were presented for Wells 4R, 11.1, or 11.2 because "the ten-year capture zone for none of these wells extends up to the water table." These regulatory boundaries are generally presumed to represent horizontal flow and there is no depth exemption in WAC 246-290-135(3)(c)(ii), which requires either the standard TOT boundaries "or boundaries established using alternate criteria approved by the department." No alternate criteria are presented in the WHPP documents.

[3] https://www.doh.wa.gov/CommunityandEnvironment/DrinkingWater/SourceWater/GISMappingTool, accessed June 17, 2021.

[4] The only wells in the SWAP GMT with six-month TOT boundaries are Wells 4R, 7, 12R, and 13R, all of which were delineated by the CFR method. Neither the 2007 nor 2017 report references delineation of six-month TOT boundaries.

[5] https://fortress.wa.gov/doh/eh/portal/odw/si/Intro.aspx, accessed June 17, 2021.

[6] Two pumps have been replaced and have slightly different capacities than shown on the WFI Report: Well 11.2 (2,000 gpm per the WFI Report) and Well 13R (200 gpm per the WFI Report). The values in Table 2 are correct.

[7] Per Health, "Systems in this category are considered adequate for existing uses and new service connections up to the number of approved service connections."

2.1, 2.2, 9, and 10. Filtration plants using chlorine and ferric chloride reduce iron and manganese from Wells 2.1, 2.2, 4R, 11.1, 11.2, 12R, and 13R.

4.2 – Water Rights

Water rights consist of an instantaneous quantity (gallons per minute, gpm) referred to as "Qi," and an annual quantity (acre-feet per year, afy), referred to as "Qa." These quantities may be additive or non-additive. Additive quantities define the full allocation of water that may be produced, whereas non-additive quantities provide flexibility in which sources produce the water. For the purposes of the current audit, it is the additive quantities that are most relevant.

As reflected in the Washington State Department of Ecology's (Ecology's) Water Right Tracking System (WRTS), the District maintains 19 water rights, seventeen associated with the wells in service and two associated with Wells 7 and 8 (currently offline). The District's full water rights portfolio authorizes a Qi of between 8,312.5 gpm (May 1 to October 31) and 10,612.5 gpm (November 1 to April 30) and a Qa of 8,067.13 afy. Excluding the two offline wells, the remaining ten source wells would normally be limited to an additive Qi of 5,112.5 gpm and an additive Qa of 5,393.13 afy; however, through a temporary change application involving Wells 7, 8, and 9, the ten wells are authorized for an additive Qi of 7,362.5 gpm and an additive Qa of 8,067.13 afy, as summarized in Table 3 (see table note b). This data is consistent with that presented in the District's CP with the exception of G1-06228C (Well 10). The CP indicates the additive Qa under this right is 22.5 afy; however, the WRTS entry and Superseding Certificate explicitly indicate the Qa, transferred from GWC 5140-A, is only 5.0 afy.

5 – Physical Status of Sources

Site visits to all twelve District wells were conducted on December 18, 2019. Based on the information reviewed, all wells appear compliant with Chapter 18.104 RCW (Water Well Construction) and the subsequent WAC 173-160 (Minimum Standards for Construction and Maintenance of Wells).[8] The physical capacity of the District's in-service wells to produce water is summarized below. For the majority of these wells, this capacity is indicated by both historical pump test data and the capacity of the installed pump. In the case of Wells 9 and 10, this data also includes the results of pump tests conducted by District personnel as part of the audit process. Note that actual production capacities may also be constrained by a variety of factors that are beyond the scope of this audit and not evaluated herein, including: short- and long-term variations in water level, groundwater recharge, and water quality; and both operations and resource management decisions.

5.1 – Well 1R

According to this well's Water Well Report, at construction Well 1R was tested at a constant rate of 610 gpm for 6 hours. At the end of the test, the drawdown was 12.2 feet, indicating a 6-hour specific capacity of 50 gpm/ft. The installed well pump is capable of 500 gpm, and the discharge pipe, valves, and flow meter are 4-inch diameter.

[8] Note that Well 2.1 was constructed prior to the July 1, 1971 effective date of Chapter 18.104 RCW.

Table 3: Sammamish Plateau Water & Sewer District Groundwater Rights

		Instantaneous Quantity (Qi)		Annual Quantity (Qa)	
	Document No.	Additive	Non-additive	Additive	Non-additive
Wells in Service					
Well 1R	G1-*00342C G1-25438C	300 gpm 200 gpm [a]		448 afy	448 afy [a]
Wells 2.1 & 2.2	G1-*09533C G1-00749C	500 gpm 20 gpm		800 afy 10.5 afy	
Well 4R	G1-*10373C G1-23022C	200 gpm 550 gpm		224 afy	880 afy
Wells 4R & 11.1	G1-*07653C	100 gpm		160 afy	
Wells 4R, 11.1 & 11.2	CG1-23897C@1	600 gpm		768 afy	
Well 9 [b]	G1-26014C *(G1-00289C [b])* *(G1-25428C [b])*	*(2,250 gpm [b])*	2,000 gpm [c]	*(2,674 afy [b])*	1,608 afy [c]
Well 10	G1-27166C [d] G1-06228C	500 gpm 100 gpm		378.5 afy 5.0 afy [e]	186.5 afy
Well 11.2	G1-26572P G1-22861C	580 gpm 1,000 gpm		568.45 afy 1,600 afy	
Well 12R	G1-00027CWRIS G1-24363CWRIS	100 gpm 100 gpm		108 afy 12.0 afy	
Well 13R	G1-25963C G1-25831C(A)	200 gpm 62.5 gpm		224 afy 86.68 afy	
		5,112.5 gpm *(7,362.5 gpm [b])*		5,393.13 afy *(8,067.13 afy [b])*	
Offline Wells					
Wells 7 & 8 [b]	G1-00289C G1-25428C	3,200 gpm 2,300 gpm [c]		936 afy 1,738 afy [c]	
		3,200 – 5,500 gpm [f]		2,674 afy	

[a] WRTS data is contradictory regarding additive and non-additive quantities. The WRTS entry for G1-25438C indicates both quantities are supplemental (non-additive), but the Report of Examination (ROE) and certificate indicate the Qi is primary (additive) and the Qa is supplemental (non-additive). The WRTS entry for CG1-25438C indicates both quantities are primary (additive), but no documents are available. Values above are consistent with the District's CP.

[b] Since June 2017, Well 9 has been operating, under a temporary change authorization, as a point of withdrawal (POW) for G1-00289C and G1-25428C with a Qi of 2,250 gpm (year-round) and a Qa of 2,674 afy (1,738 af from November 1 to April 30 and 936 af from May 1 to October 31). Subsequent to the audit timeframe, permanent water right changes approved in June 2021 made Well 9 a permanent POW for these rights.

[c] Seasonally available from November 1 to April 30.

[d] The WRTS entry indicates both Qi and Qa are supplemental (non-additive), but the Report of Examination (ROE) and certificate indicate the full Qi is additive and the Qa (565 afy) is split as 378.5 afy additive and 186.5 afy non-additive. Values above are consistent with the District's CP.

[e] The WRTS entry and Superseding Certificate identify the additive Qa as 5.0 afy, transferred from GWS 5140-A, for a total of 383.5 afy (additive) from both rights for Well 10. The District's CP lists the Qa for G1-06228C as 22.5 afy.

[f] 3,200 gpm (G1-00289C) is available year-round; 5,500 gpm (G1-00289C and G1-25428C) is seasonally available November 1 to April 30.

5.2 – Well 2.1

According to this well's Water Well Report, at construction Well 2.1 was tested at a constant rate of 500 gpm for 12 hours. At the end of the test, the drawdown was 36 feet, indicating a 12-hour specific capacity of 13.9 gpm/ft. Per District records, the well was also tested in 1983 at a rate of 330 gpm for an unspecified duration; drawdown in the well was roughly 21.6 feet, indicating a specific capacity of 15.3 gpm/ft. The installed well pump is capable of 500 gpm, and the discharge pipe, valves, and flow meter are 4-inch diameter.

5.3 – Well 2.2

According to this well's Water Well Report, at construction Well 2.2 was tested at a constant rate of 500 gpm for 24 hours. At the end of the test, the drawdown was 44.59 feet, indicating a 24-hour specific capacity of 11.2 gpm/ft. The installed well pump is capable of 500 gpm, and the discharge pipe and valves are 4-inch diameter with an 8-inch distribution pipe and flow meter.

5.4 – Well 4R

According to this well's Water Well Report, at construction Well 4R was tested at a constant rate of 2,000 gpm for 7 hours. At the end of the test, the drawdown was 75 feet, indicating a 7-hour specific capacity of 26.7 gpm/ft. The installed well pump is capable of 1,800 gpm (to the 550 zone), and the discharge pipe, valves, and flow meter are 8-inch diameter.

5.5 – Well 9

According to this well's Water Well Report, at construction Well 9 was tested at a constant rate of 2,340 gpm for 229 hours (9.5 days). At the end of the test, the drawdown was 22.45 feet, indicating a 229-hour specific capacity of 104.2 gpm/ft. According to District records, the well was also tested in 1996 at 2,310 gpm for 21.5 days; at the end of this test, drawdown in the well was roughly 22.6 feet, indicating a similar specific capacity of 102 gpm/ft. The installed well pump is capable of 2,300 gpm, and the discharge pipe, valves, and flow meter are 8-inch diameter.

On January 13th, 2021, District personnel conducted a 500-minute (8.3-hour) constant-rate test of Well 9 at an average rate of 2,212 gpm. The well was offline for approximately 4.7 hours in advance of the test, and static water level was stable at 11.65 feet below the top of the sounding tube. Total drawdown at the end of the test was 20.68 feet, indicating an 8.3-hour specific capacity of 107.0 gpm/ft. As the drawdown slope was essentially flat for the duration of the test, the projected 24-hour specific capacity is the same, indicating that the well is just as efficient now as it was at construction. At the 2,250-gpm rate under the temporary water right change, the well uses roughly 21.0 feet of drawdown (12.1% of the available drawdown) after 24 hours of continuous production.

The District's 10-year Capital Plan, presented in the 2019 CP, includes two Well 9 projects: a pump and motor upgrade to maximize well capacity and the potential treatment for perflourochemicals.

5.6 – Well 10

According to this well's Water Well Report, at construction Well 10 was tested at a constant rate of 508 gpm for 24 hours. At the end of the test, the drawdown was 38 feet, indicating a 24-hour specific capacity of 13.4 gpm/ft. The installed well pump is capable of 500 gpm, and the discharge pipe and valves are 4-inch diameter with an 8-inch distribution pipe and flow meter.

On December 30th, 2020, District personnel conducted a 412-minute (6.9-hour) test of Well 10 at an average rate of 496.5 gpm. The well was offline for at least 7.6 hours in advance of the test, and stat-

ic water level was stable at 74.43 feet below top of casing. Once the production rate stabilized, drawdown increased slowly for the first 40 minutes, then maintained a log-linear trend until approximately 250 minutes into the test. At this point, a positive aquifer boundary was intercepted, and the drawdown assumed a shallower, log-linear trend until the test was concluded. Total drawdown at the end of the test was 39.66 feet, indicating a 6.9-hour specific capacity of 12.5 gpm/ft. The projected 24-hour specific capacity is estimated at 12.1 gpm/ft, indicating that the well is roughly 10% less efficient than at construction. At the 500-gpm rate, the well uses roughly 41.2 feet of drawdown (68% of the available drawdown) after 24 hours of continuous production.

5.7 – Well 11.1

According to District records, Well 11.1 was tested in 1995, slightly more than two years after construction, at a constant rate of 389 gpm for an unspecified duration. At the end of the test, the drawdown was roughly 86.4 feet, indicating a specific capacity of 4.5 gpm/ft. The installed well pump is capable of 500 gpm.[9] The discharge pipe and valves are 4-inch diameter with an 8-inch distribution pipe and flow meter.

5.8 – Well 11.2

According to District records, Well 11.2 was tested in 1995, slightly more than two years after construction, at a constant rate of 973 gpm for an unspecified duration. At the end of the test, the drawdown was roughly 51.2 feet, indicating a specific capacity of 19.0 gpm/ft. The installed well pump is capable of up to 1,800 gpm, depending on the system pressure of the zone into which it pumps.[10] The control valve that determines when the pump turns on is 6-inch diameter, and the discharge piping and valve are 8-inch diameter with a 12-inch distribution pipe and flow meter.

5.9 – Well 12R

According to this well's Water Well Report, at construction Well 12R was tested at a constant rate of 201 gpm for 3 hours. At the end of the test, the drawdown was 2.32 feet, indicating a 3-hour specific capacity of 86.6 gpm/ft. The installed well pump is capable of 200 gpm, and the discharge pipe, valves, and flow meter are 4-inch diameter.

5.10 – Well 13R

According to this well's Water Well Report, at construction Well 13R was tested at a constant rate of 800 gpm for 9 hours. At the end of the test, the drawdown was 91 feet, indicating a 9-hour specific capacity of 8.8 gpm/ft. The installed well pump is capable of 260 gpm, and the discharge pipe, valves, and flow meter are 4-inch diameter.

5.11 – Interties

In addition to their two interties with Cascade, the District has two, free-flowing (net-zero) interties and six emergency interties. A summary of these is provided below.

---

[9] The installed pump is capable of more than the original test rate; however, at 500 gpm the well would still only use 77.6% of its available drawdown presuming a 20% lower specific capacity of 3.6 gpm/ft.

[10] The installed pump is capable of approximately double the original test rate; however, at 1,800 gpm the well would still only use 24.3% of its available drawdown presuming a 40% lower specific capacity of 11.4 gpm/ft.

5.11.1 – Northeast Sammamish Sewer & Water District (NSSWD)

The District has four interties with NSSWD. The two, free-flowing (net-zero) interties between the District and NSSWD are located at the intersection of 216th Avenue NE and NE 17th Street and 1910 226th Place NE. These connections enable shared use of the 3-MG Tank; water from both the District and NSSWD is untreated. The two emergency interties are located at the intersection of East Lake Sammamish Parkway and NE 20th Street and at the intersection of NE 19th Place and 208th Street.

5.11.2 – City of Issaquah (City)

The District has two, bi-directional emergency interties with the City called the 1st Avenue NE Emergency Intertie and the SE 56th Street Emergency Intertie. The 1st Avenue NE Emergency Intertie is located at the intersection of 1st Avenue NE and Juniper Street through a 6-inch diameter pipe. The agreement is for an emergency standby source of water, with an emergency defined as any event that requires the District's or City's water supply to be augmented on a temporary, emergent basis; the water provided by both parties is treated.

The SE 56th Street Emergency Intertie is located at the intersection of SE 56th Street and 221st Avenue SE through an 8-inch diameter pipe. The intertie provides both the District and the City with an emergency standby source of water; the water provided by both parties is treated.

5.11.3 – Union Hill Water Association (UHWA)

The District has one, emergency intertie between the District and UHWA located at the intersection of NE 52nd Street and 244th Avenue NE. The intertie is not operational without a booster pump connection. Water from the District is treated and water from UHWA is untreated.

5.11.4 – Ames Lake Water Association (ALWA)

The District has one, one-way emergency intertie to supply ALWA with treated water, located at the intersection of NE Union Hill Road and 272nd Avenue NE. The District agrees to provide ALWA with water during emergencies, including but not limited to: power outages, a pump system failure, or failure in the ALWA water distribution system that impairs ALWA's capacity for fire protection purposes or public consumption. An emergency shall terminate when ALWA water system is restored to its pre-emergency status. The agreement does not guarantee the availability of water to ALWA at all times based on District's needs and water demand.

6 – Cascade Production Requirements

Combined production, in millions of gallons, from SPSWD's wells[11] for 2017 through 2019 calendar years is presented in Table 4 (peak month and year **underlined and in bold**; peak season shaded).[12]

[11] 2017 production includes 226.55 million gallons from Well 7, produced from May through August; no production occurred in 2018 or 2019. No production from Well 8 occurred during the three-year period. All data is from pump logs, not SCADA.

[12] This audit only considers production data from 2017 – 2019; it was not finalized until 2022 due to delays caused by the COVID-19 pandemic.

Table 4: 2017 - 2019 Production (millions of gallons)

	J	F	M	A	M	J	J	A	S	O	N	D	Total
2017	90.50	77.59	76.58	70.79	104.61	165.05	259.39	**271.06**	199.14	93.92	71.97	80.95	**1,561.55**
2018	79.69	72.02	92.19	75.56	141.41	187.51	**244.40**	225.94	125.59	77.24	88.12	56.50	1,466.16
2019	90.18	73.48	63.77	87.24	153.86	193.35	206.30	**236.45**	103.81	80.20	72.40	64.06	1,425.10
Average	86.79	74.36	77.51	77.87	133.29	181.97	236.70	**244.48**	142.85	83.79	77.49	67.17	1,484.27

As a Member of Cascade, the District agreed to maximum production requirements from their independent supply sources, based on three-year production averages (2001 – 2003).[13] In 2011, the Cascade Board established a minimum Demand Share for SPWSD of 1.0 MGD and waived the District's production requirements as of 2012 (Resolution No. 2011-17).[14] Though there is a general waiver of production requirements currently in effect, Table 5 summarizes the District's recent average and peak-season day production, based on the data from Table 4, and peak-day values based on both well pump capacity[15] (Table 2) and additive instantaneous (Qi) water rights (Table 3).[16,17]

Table 5: Independent Source Production Summary

Production Metric	Production Requirement	2017 – 2019 Values	Peak Year (2017) Values	Peak Year Difference
Average Day	4.89 MGD	4.07 MGD	4.28 MGD	(0.61 MGD)
Peak-season Day	7.90 MGD	6.61 MGD	7.33 MGD	(0.57 MGD)
Production Metric	**Production Requirement**	**Peak-day Values**		**Peak-day Difference**
Peak-day Capacity	9.88 MGD [a]	10.57 MGD (pump capacity) [b] 8.84 MGD (additive water rights) [c]		0.81 MGD (1.05 MGD) [c,d]

[a] Does not include additive Qi of 2,300 gpm from G1-25428C due to seasonal restrictions (November 1 to April 30).

[b] Includes Well 9 operating at 2,250 gpm, available year-round under the temporary change authorization for the G1-00289C and G1-25428C additive rights.

[c] Additive water rights exceed the Peak-day Capacity requirement without the 20-hour pumping limitation.

[13] As defined in the Member Water Audit prepared for Cascade, dated May 23, 2008.

[14] In 2021, the Board reduced SPWSD's minimum Demand Share to 0.25 MGD and re-established production requirements as of 2025 (Resolution No. 2021-01).

[15] Note that this simple sum of pump capacities may be an overestimate of actual production capacity as it makes no allowance for drawdown interference between wells.

[16] Average Day production calculated by dividing the three-year average annual production by 365 days. Peak-season Day production calculated by dividing the three-year average peak season production (June through September) by 122 days. Peak-day capacity calculated by multiplying instantaneous capacity (either pump capacity or additive water rights) multiplied by 20 hours of production (83.3% of maximum production).

[17] Members must manage their resources to meet a wide variety of physical and regulatory constraints, so production history may not be indicative of the ability or intent to produce a maximum volume of water in any given year.

[d] Future pumping of the full Qi under G1-00289C (3,200 gpm) will result in a surplus of 0.09 MGD.

7 – Recommendations

7.1 – Wellhead Protection Plan

The continued use of the older generation of analytically derived WHPAs, without modification, may provide inadequate protection for some Plateau wells. The District's CP states that the WHPAs delineated in 2007 "…using the finite element model were smaller than those previously defined using analytical methods. To provide conservative protection of the groundwater resources, the District continues to utilize the larger contributing area delineated by the analytical method." The numerically modeled 1-, 5-, and 10-year capture zones presented in the 2007 report for Wells 1R, 2.1, 2.2, and 10 are indeed smaller; however, the analytically derived WHPAs don't entirely encompass the numerically-derived WHPAs. Notably, the majority of Well 1R's 1-, 5-, and 10-year capture zones (and the margins of the 5- and 10-year capture zones for Wells 2.1, 2.2, and 10) fall outside of the analytically-derived WHPAs.[18] The 2007 WHPP states that since "…the groundwater flow model has been calibrated to transient conditions and incorporates vertical groundwater flow and monthly pumping and groundwater recharge variations, the model-simulated WHPAs may be more representative of well contributing areas than WHPAs estimated using analytical methods." If accurate, this suggests that the existing analytically derived WHPAs do not necessarily provide the conservative protection intended. In fact, future contaminant inventories looking only within the older WHPAs may not identify or rank potential hazards.

Recommendation: The District should modify the existing analytically derived WHPAs for the Plateau Wells to include a buffer so that the entirety of all numerically derived WHPAs are included. By expanding the WHPAs laterally, many of them will merge, particularly the 5- and 10-year WHPAs. Figure 2 shows how this might be accomplished for the 10-year TOT boundaries; the black lines connect with the existing 10-year boundaries to create a single 10-year TOT boundary.

[18] Since no numerically derived TOT boundaries for Zones 1-3 are presented in the 2007 WHPP document for Wells 4R, 11.1, or 11.2, no similar comparison could be made.

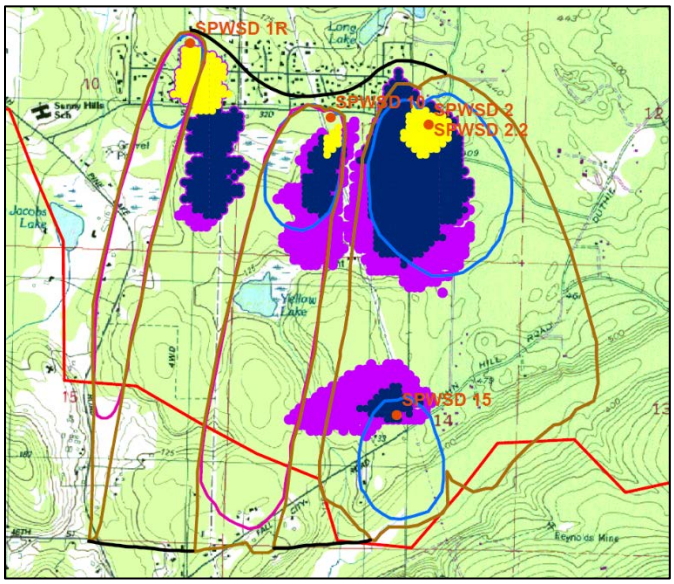


Figure 2: Expanded buffers (connecting black lines)

This same evaluation should be made for Well 11.2. If analytical (or numerical) modeling is available for Wells 11.1 (which has a default 1,000-foot buffer in the SWAP GMT) and Well 4R (calculated fixed-radius), they may also be evaluated. Digital maps or shape files of the updated TOT boundaries should be provided to the Source Water Protection Program.

The District's CP and WHPP documents appear to omit any reference to six-month TOT boundaries for their wells, though the SWAP GMT shows they have been defined with the CFR method for Wells 4R, 12R, and 13R. Although WAC 246-290-135(3)(c)(ii) states that six-month TOT boundaries are part of the minimum requirements for a wellhead protection plan, Health does not currently mandate this requirement, provided that capture zones are numerically modeled and part of an approved CP, as is the case here. So while the District's WHPP is compliant and the lack of six-month TOT boundaries does not impact the District's ability to meet its Cascade production requirements, they are strongly preferred by Health.

Recommendation: The District should consider having six-month TOT boundaries delineated for all wells during its next wellhead protection plan update. Digital maps or shape files of the updated TOT boundaries should be provided to the Source Water Protection Program, as noted above, to update the SWAP GMT.

8 – Conclusion

The purpose of this audit has been to summarize current production status and alert members to potential risks, now and in the future. It is intended to be used by Members to help ensure that they remain able to comply with their contractual obligations to Cascade.

All Cascade Members, including Sammamish Plateau Water & Sewer District, have complied with their contractual production requirements to-date, particularly given the production waivers for all three metrics (Average Day, Peak-season Day, and Peak-day Capacity) discussed above. At some point, should such waivers expire and not be further extended, this audit and the production history indicate an ability to substantively meet the independent production requirements. The District's in-

stalled pump capacity exceeds its Peak-day Capacity commitment; however, under the temporary change authorization for Well 9 (now permanent), the additive water rights will fall below that level until such time as the full G1-00289C water right quantity is once again available from Wells 7 and 8.