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FARR WEST
ENGINEERING

TECHNICAL MEMORANDUM

Project: SQUAW VALLEY PUBLIC SERVICE DISTRICT
VSVSP WATER SYSTEM CAPACITY ANALYSIS

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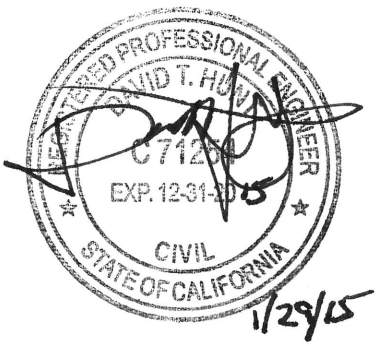

1.0 PURPOSE

This memorandum presents an evaluation of hydraulic capacity of the Squaw Valley Public Service District's (District) water distribution system and will serve as the basis for understanding the Village at Squaw Valley Specific Plan (VSVSP) project impacts as well as projected cumulative development impacts on the water system. The evaluation was performed using the District's hydraulic model and includes the following scenarios:

1. Existing water distribution system
2. Existing water distribution system + VSVSP at Buildout
3. Existing water distribution system + VSVSP at Buildout + Projected Cumulative Development

Each scenario was modeled under maximum day demand (MDD), MDD plus fire flow, and peak hour demand (PHD) conditions.

The evaluation will define the short and long term water distribution system capital improvements necessary to satisfy the capacity requirements defined in the District water code.

2.0 BACKGROUND

2.1 Previous Modeling Efforts

ECO:LOGIC Engineering developed a hydraulic model of the District's water distribution system using Haestad Methods WaterCAD v4.5 in 2001 (SVPSD Water Model, April 9, 2001, ECO:LOGIC Engineering). The data for this model, including existing maximum day demands (MDD), pipe sizes, node elevations, and system layout was taken from a previous water model prepared by Auerbach Engineering Group and West Yost & Associates which used the software KYPIPE. The original model

used a MDD of 656 gallons per minute (gpm). The modeling effort in 2001 included the addition of 170 gpm of additional MDD to account for water demands for projected development at that time, including the Intrawest Phase 1 project, bringing the total MDD to 826 gpm. The 2001 modeling project also included a field calibration effort, which included flowing two fire hydrants; one each on the east side and west side of the Olympic Valley (Valley) (SVPSD Water Model Calibration, December 20, 2001, ECO:LOGIC Engineering). *The results of this modeling effort indicated that the system had no existing hydraulic deficiencies.*

The model was subsequently utilized in 2007 to assess the effects of additional water demands from the proposed Resort at Squaw Creek (RSC) Phase 2 development. An additional 107.4 gpm of MDD was added to the system to account for the estimated RSC Phase 2 water demands. For this work, the model was analyzed with a total MDD of 934 gpm as well as a fire flow of 2,500 gpm at the RSC. The model results indicated that, as the system was currently operated, all water for the RSC was supplied from the 500,000 gallon East Tank and that the existing 10-inch waterline between the main well field (West Tank zone) and the RSC operates normally closed. Under fire flow conditions, the East Tank would drain at a rate exceeding 2,500 gpm and the East Tank Booster Pump Station, with a capacity of 225 gpm, would not be able to replenish the tank in a timely manner. Based on this, it was recommended that a pressure reducing valve (PRV) be installed between the East Tank and the RSC and that the 10-inch waterline be activated so that the RSC would be supplied by the 1.15 million gallon West Tank zone, and supplemented in a fire flow event by flow from the East Tank through the recommended PRV.

2.2 2012 Water Model Update

The water model was most recently updated in 2012 in support of the VSVSP project. This model was created using Bentley's WaterGEMS software. The purpose of this comprehensive update was to create a water model using the District's current GIS information, as well as update the water demands for both quantity and accuracy of spatial location. Farr West utilized primary sources of information to create the water system GIS database which included the following:

- Previous water system model pipe configuration, including attribute information of pipe size and material;
- Field GPS data for valves, meters, and hydrants;
- Aerial photography;
- Limited record drawing information; and
- Elevation data generated using available topographic survey data as well as USGS elevation data.

In assigning water demand data, customer metered data for 2011 was geocoded to Placer County parcel data so that the spatial distribution of demands could be accomplished by individual meters. Based on this, model scenarios were created using the 2011 ADD, as well as MDD using a peaking factor of 2.5. The 2011 ADD was 206 gpm (based on production data), and included an unbilled water percentage of 13%, which was spread evenly across each metered connection. Finally, the model was further calibrated using current well and booster pump station pump curves and operational settings for tank levels and PRV settings.

3.0 WATER CAPACITY ANALYSIS

3.1 Existing Conditions Water Demands

As part of this VSVSP water system capacity analysis, the model was further updated to allow for modeling the effects of proposed and future development within the Valley.

As previously mentioned, the 2012 water model was created based on the spatial distribution of metered water demand data for 2011.

This current model update included revising the 2012 model demands to reflect average metered and production data for the 2001-2014 time period. The 2001-2014 data was also analyzed to calculate an accurate MDD:ADD peaking factor. Based on this, the existing system condition scenario base model was updated with the following demands:

- ADD = 249 gpm
- MDD = 623 gpm
- Peak Hour Demand (PHD) = 934 gpm

The peaking factors associated with these demands include:

- MDD:ADD = 2.5
- PHD:ADD = 3.75

3.2 VSVSP Project Water Demands

VSVSP consultants provided a detailed analysis of water demands associated with the proposed project. The original water demand analysis for the project was submitted in December 2012, and based on comments from the District on water demand factors and changes to the project size and layout, water demands have been adjusted to incorporate these modifications. The ADD for the VSVSP was taken from the *Master Water Study: The Village at Squaw Valley Specific Plan* (MacKay & Somps October 16, 2014). The total annual demand estimate for the VSVSP project at buildout is 234 acre-feet annually, or 145 gpm on an ADD basis. This includes a 9.8% factor to account for system unbilled water. MDD and PHD were calculated using the peaking factors presented in Section 3.1. A summary of these water demands are presented below:

- ADD = 145 gpm
- MDD = 363 gpm
- PHD = 706 gpm (includes 162 gpm for pool refill rates)

The projected VSVSP water demands were added to the appropriate nodes in the water model.

VSVSP water demands also include a peak hour component associated with the operation of the Mountain Adventure Camp (MAC). These demands are associated with filter backwash and pool refill rates. Water demands for the MAC were provided by MacKay & Somps and the Aquatic Development Group, Inc (MAC Aquatic Center Water & Sewer Demand Calculations MacKay & Somps December 2, 2014). This analysis showed a combined pool refill rate of approximately 162 gpm. For the purposes of distribution system capacity, this flow rate was analyzed under PHD conditions.

3.3 Cumulative Projection Water Demands

The District performed a comprehensive analysis of vacant and/or underbuilt residential and commercial properties in the Valley. Water demand projections were developed on a cumulative projection of growth in the Valley based on the 1983 Squaw Valley General Plan & Land Use Ordinance (Placer County) as well as discussions with land owners on approved and planned projects. For those parcels with existing commercial buildings that are assumed to be demolished and redeveloped, the future projection subtracts the existing building area and replaces it with the proposed/anticipated new commercial floor area. The result is a net increase or decrease in floor area and thus takes into account the existing water demand contribution. Table 1 presents the land use and parcel data for these properties, as well as a summary of the number of bedrooms and commercial square footage associated with the cumulative projection. Figure 1 provides the location of the identified parcels.

The District's analysis identified SFR, multi-family, and commercial development potential for approved projects, foreseeable projects, and forecasted development. Ultimately, estimated water use is based on number of lodging units (bedrooms) and commercial square footage and the following water demands factors:

- Single Family Residential – 550 gpd/lot
- Multi-Family Residential – 200 gpd/bedroom
- Commercial – 0.24 gpd/square foot

A 9.8% factor was added to these water demand factors to account for system unbilled water.

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Table 1 – Squaw Valley General Plan Buildout Development Projections
(Does not include VSVSP or SVMWC)

APN	Address	Common Name	Zoning	Parcel Size (acres)	# Bedrooms per Unit	Residence Type	Development Status	# Units (Proposed or GP BO)	# Bedrooms (Proposed or GP BO)	Commercial ft^2 (Proposed or GP BO)
Multi-Family Residential (MFR) & Commercial Development										
096-540-004	1810 Squaw Valley Road	SVPSD old facility - 1810	VC	1.5	2	MFR	tear down	--	75	25,000
096-540-013	Washoe Drive	Empty Lot, PSD water tank with easement	VC	1.15	2	??	vacant	--	29	3,738
096-540-013	Washoe Drive	Empty Lot, PSD water tank with easement	LDR=4	3.171	2	??	partial	--	6	824
096-290-027	235 Squaw Valley Road	Squaw Valley Academy	EC	1.245	2	MFR	developed	--	4	11,000
096-230-036	3039, 3041 River Road	7-11, Tahoe Dave's Skis & Boards	EC	4.9	2	MFR	partial	--	147	15,490
096-290-056	285, 100, 1, 101 Squaw Valley Road	Squaw Valley Park, soccer field, bike trail behind 305 SVR	FR	25.8	2	--	partial	--	0	14,500
096-101-009	1590, 1600, 1604 Squaw Valley Road	Post Office, Unofficial Building	VC	1.7	2	MFR	tear down	--	85	1,264
096-103-031	1650 Squaw Valley Road	Homestead Project, Graham's Restaurant, Christy Hill Lodge B&B	VC	0.736	1	MFR	tear down	0	-7	-2,500
096-103-032	Squaw Valley Road	Homestead Project, Empty lot between Grahams and 72-hour parking	VC	1.4	2	MFR	vacant	28	56	7,280
096-103-033	1601 Christy Lane	Homestead Project, Empty lot north of 7-plex, parking lots including behind Old Bear Pen	VC / HDR-25	0.589	3	MFR	vacant	18	54	7,020
096-103-034	1605 Christy Hill Road	Homestead Project, 7-Plex	VC	0.093	2	MFR	tear down	6	-2	-940
096-103-035	1602 Squaw Valley Road	Homestead Project, Old Bear Pen	VC	0.568	2	MFR	tear down	8	12	-5,220
096-230-062	Squaw Valley Road	Parcel east of Meadows End Court, on Squaw Valley Rd., Squaw Creek	HDR-20	3.43	2	??	vacant	--	51	5,000
096-290-050	325 Squaw Valley Road	Mrs. Poulsen Compound, wetlands, Squaw Creek	HDR-20	11.30	2	??	partial	--	166	10,000
096-020-023	995, 1920 Squaw Valley Road	PlumpJack	VC	3.194	1	MFR	tear down	34	122	7,799
096-230-052	Creeks End Court	Sena / East Parcel - Commercial	HDR-20	16.5	3.5	--	vacant	--	0	27,000
096-230-055	Creeks End Court	Sena / West Parcel - Commercial	HDR-20	3.4	2	--	vacant	--	0	56,000
096-290-011	Squaw Valley Road	Empty Lot - north side of Squaw Valley Road at intersection of Squaw Creek Rd.	EC	0.551	2	--	vacant	--	0	12,001
							MFR & Commercial:		**798**	**195,256**
Resort at Squaw Creek (RSC) - Phase 2 - MFR Development										
096-060-070	350 Squaw Creek Road	Golf Course. Proposed RSC Ph. II; Phase A; 4-units Townhomes	HDR-20 / FR	0.139	2	MFR	vacant	4	8	0
096-290-068	310 Squaw Creek Road	Golf Course. Proposed RSC Ph. II; Phase A; 14-units Townhomes	FR	0.428	2	MFR	vacant	14	28	0
096-290-069	300 Squaw Creek Road	Golf Course. Proposed RSC Ph. II; Phase A; 6-units Townhomes	FR	0.205	2	MFR	vacant	6	12	0
096-290-070	320 Squaw Creek Road	RSC Ph. I Parking Lot. Proposed RSC Ph. II; Phase B; Parking Garages and Employee Housing	HDR-20	1.732	2	MFR	vacant	9	18	0
096-290-071	330 Squaw Creek Road	RSC Ph. I Parking Lot & Tennis Courts. Proposed RSC Ph. II; Phase B; Midrise Condo Tower	HDR-20	0.984	2	MFR	vacant	230	460	0
							RSC Phase II (MFR):		**526**	**-**
							MFR and Commercial Subtotal:		**1,324**	**195,256**
Single-Family Residential (SFR) Development										
PSD	PSD Service Area	PSD Service Area - SFR lots	--	--	3	SFR	vacant	66	198	0
096-060-049	1525 Squaw Valley Road	Stables - SV Ranch Estates	FR	3.9	4	SFR	tear down	4	12	0
096-340-008	448 Squaw Peak Road	Warmouth property. Foundations next to Potato Chip Church	HDR-25	0.269	2	SFR	vacant	4	8	0
096-230-056	Creeks End Court	Olympic Estates	HDR-20	4.2	4	SFR	vacant	16	64	0
096-230-052	Creeks End Court	Sena / East Parcel - SFR lots	HDR-20	16.5	3.5	SFR	vacant	47	165	0
							SFR Subtotal:	**137**	**447**	**-**
							TOTAL:		**1,771**	**195,256**

The projected ADD associated with the SFR parcels is shown in Table 2. The SFR demands are based on full time residency.

Table 2 – Projected Water Demands for Vacant SFR

# Vacant Lots	Demand Factor (gpd/lot)	Total Demand (gpd) (a)
137	550	82,734
		82,734
	ADD, gpm	**57**

(a) Total includes 9.8% system water loss to demand factor

Table 3 presents the ADD water demands for multi-family residential and commercial development. The water demands shown represent the average day demand at 100% occupancy. Actual water demands for multi-family and commercial development will be dependent on occupancy rates in the Valley. Occupancy rates in an alpine resort type community vary by season with higher occupancies occurring during the winter ski season and summer months of July and August and lower occupancy rates seen during the shoulder spring and fall months. Occupancy rates used to determine monthly water use for the cumulative projection analysis were presented by VSVSP in their analysis and were based on a review of Village at Squaw Valley USA occupancy data for fiscal years 2009-2013. This occupancy data is also relevant for use in their cumulative projection analysis. Table 4 provides the projected ADD based on estimated occupancy.

Table 3 – Projected Water Demands for MFR and Commercial at 100% Occupancy

Bedroom Water Demand by Land Use			
Category	Number of Bedrooms	gpd/bedroom (a)	Total Demand (gpd)(b)
Multi-Family Residential	1,324	200	290,760
Commercial Water Demand by Land Use			
Category	Commercial sf	gpd/sf	Sq. Ft. Demand (gpd) (b)
Commercial	195,256	0.24	51,454
Total			**342,213**

(a) (2.0 capita/bedroom) x (100 gpd/capita) = 200 gpd/bedroom

(b) Total includes 9.8% system water loss to demand factor

Table 4 – Projected Water Demands for MFR and Commercial Adjusted for Occupancy

Month	ADD @ 100% Occupancy, gpd	Occupancy Rate	ADD, gpd	Days/Month	Total Demand, gpd
January	342,213	59%	201,906	31	6,259,083
February		72%	246,394	28	6,899,022
March		70%	239,549	31	7,426,031
April		51%	174,529	30	5,235,865
May		37%	126,619	31	3,925,188
June		42%	143,730	30	4,311,889
July		85%	290,881	31	9,017,324
August		68%	232,705	31	7,213,859
September		46%	157,418	30	4,722,545
October		43%	147,152	31	4,561,705
November		26%	88,975	30	2,669,265
December		63%	215,594	31	6,683,428
				Total Annual Demand	**68,925,204**
				ADD, gpm	**131**

Table 5 provides a summary of ADD, MDD and PHD water demands for the General Plan cumulative projections.

Table 5 – Projected ADD, MDD and PHD Water Demands General Plan Cumulative Projections

Land Use	ADD, gpm	MDD, gpm	PHD, gpm
Residential	57	144	215
Commercial/MFR	131	328	492
Total	**189**	**471**	**707**

Projected cumulative water demands were added to the node nearest the identified developable parcel in the model.

3.4 Scenarios

Three model scenarios were developed to assess the water distribution system capacity impacts associated with the proposed VSVSP project as well as a projection of General Plan buildout:

1. Existing water distribution system.
2. Existing water distribution system + VSVSP at Buildout.
3. Existing water distribution system + VSVSP at Buildout + Projected Cumulative Development.

Each scenario was modeled under maximum day demand (MDD), MDD plus fire flow, and peak hour demand (PHD) conditions. Fire flow was modeled using 1,500 gpm for residential parcels, and 2,500 or 3,000 gpm for commercial parcels.

The water demands associated with each scenario are summarized in Table 6. The demands for the existing model conditions are defined in Section 3.1. The demands for the VSVSP and General Plan buildout are described in Sections 3.2 and 3.3.

Table 6 – Water Distribution System Demands in gpm

	ADD	MDD	PHD
Existing Model Conditions (1)	249	623	934
VSVSP Demand (2)	145	363	706*
General Plan Buildout Demand (3)	189	471	707
Model Scenarios			
Existing System	249	623	934
Existing System + VSVSP	394	986	1,640
Existing System + VSVSP + GP Buildout	583	1,457	2,347

(1) ADD based on average water production data for 2001-2014. MDD and PHD based on peaking factors of MDD:ADD = 2.5 and PHD:ADD = 3.75.

(2) ADD from MacKay & Somps Technical Memorandum No. 4 October 16, 2014
* PHD includes 162 gpm peak flow for Mountain Adventure Camp (MAC) pool refill rate.

(3) Based on parcel based analysis provided by District, including SFR, MFR, Commercial

3.5 Capacity Evaluation Criteria

The criteria for evaluating water system capacity includes components source capacity, storage, and distribution system hydraulic capacity as defined in Chapter 16 of the California Waterworks Standards and Section 7 of the District's Water Code.

3.5.1 Source Capacity

Source capacity is defined in the California Waterworks Standards ¶64554 New and Existing Source Capacity. This section requires that all public water systems are required to meet the system's MDD at all times, with the largest source out of service. This section also requires a system to be able to meet four hours of PHD with source capacity, storage capacity, and/or emergency source connections. Both the MDD and PHD requirements are to be met in the system as a whole and in each individual pressure zone.

The District currently meets this source capacity requirement with existing Wells 1R, 2R, 3, and 5R. With the addition of the VSVSP and General Plan buildout development projections, additional wells will be added to the system to satisfy this criteria.

3.5.2 Storage Capacity

The total storage capacity is defined as operating storage, emergency storage, and fire flow storage. A public water system should maintain an operating storage volume based on the system's capacity to produce water, to be sufficient for the system to meet the requirements of MDD. With the District's water supply wells able to satisfy the MDD requirement, operating storage is necessary to supply peak hour water demands that exceed production capacity on the maximum day of use. For this purpose, a value of 25 percent of MDD was used to calculate operating storage. For emergency storage, a capacity equal to one ADD was used. Finally, fire storage was calculated based on up to a 2,500 gpm, 2 hour duration fire event (300,000 gallons) for commercial properties, and 1,500 gpm for 2 hour duration (180,000 gallons) for residential fire flow.

3.5.3 System Pressures and Velocity

Minimum system pressures are defined in the California Waterworks Standards ¶64602 Minimum Pressure. This section requires minimum operating pressures to be maintained throughout the system of not less than 20 pounds per square inch (psi) at all times, including during conditions of MDD with a fire flow event. This section further states that a system that expands its service connections by more than 20 percent, such as with the addition of the VSVSP and General Plan buildout demands, must maintain a minimum operating pressure of not less than 40 psi at all times excluding fire flow.

Section 7 of the District's Water Code also defines minimum system pressure requirements. This section requires minimum system pressures of 35 psi under MDD conditions, 30 psi under PHD conditions, and 20 psi under MDD with fire flow.

Based on the criteria above, the minimum system pressure requirements for the existing system (Scenario 1) are as follows:

- 35 psi during MDD;
- 30 psi during PHD; and
- 20 psi during MDD plus fire flow.

With the addition of the VSVSP and General Plan buildout demands (Scenarios 2 and 3), the minimum system pressure requirements include:

- 40 psi during MDD and PHD; and
- 20 psi during MDD plus fire flow.

Velocity criteria are not specifically addressed in the California Waterworks Standards. Velocity criteria are aimed at limiting high head losses in water distribution and transmission mains, as well as reducing the likelihood of hydraulic surges. Velocity criteria used in this analysis are as follows:

- Velocity shall be less than 8 feet per second under all conditions except fire flow; and
- Velocity shall be less than 20 feet per second under fire flow conditions.

4.0 CAPACITY ANALYSIS RESULTS

4.1 Hydraulic Model

Farr West utilized Innovyze InfoWater Suite 11.0 to create the updated network hydraulic model from the existing 2012 Bentley WaterGEMS model. As described in Section 3.1, the 2012 demand data for Scenario 1 (Existing) was updated to reflect average metered and production data for the 2001-2014 time period, and the data was analyzed to calculate an accurate MDD:ADD peaking factor.

Demands were then added for Scenario 2 (VSVSP) and Scenario 3 (Cumulative) based on the spatial location of the proposed and future demands, and fire flows were assigned based on land use. Minimum required fire flow used for residential structures was 1,500 gpm. Fire flow for commercial buildings was 2,500 gpm at the RSC, and 3,000 gpm for the VSVSP. Fire flow rates were verified by the District. The model was used to determine available fire flow at 20 psi residual pressure under MDD and to identify any deficiencies.

Proposed and future supply sources were added for Scenario 2 (VSVSP) and Scenario 3 (Cumulative) based on the proposed well field configuration from the *Village at Squaw Valley Specific Plan Water Supply Assessment* (WSA) (Farr West et. al., July 3, 2014). The model was used to evaluate system pressures for the various demands in each development scenario, and to recommend infrastructure changes/improvements to fix pressure and fire flow deficiencies.

4.2 Scenario 1 - Existing System

The existing system is made up of three pressure zones; the West Tank Zone 1 (1.15 million gallons storage), the East Tank Zone 2 (500,000 gallons storage), and Zone 3 (130,000 gallons storage). The water supply wells provide supply to the West Tank zone and storage tank. The East Tank Zone is supplied from a 220 gpm booster pump station near Squaw Valley Road and Squaw Peak Road. Zone 3 is supplied by a 70 gpm booster pump station located on Sierra Crest Trail. Figure 2 shows the existing pressure zone boundaries as well as water sources, water storage tanks, and booster pump stations.

At the existing level of development, the system capacity was evaluated with an ADD of 249 gpm, a MDD of 623 gpm, and a PHD of 934 gpm. The demands by pressure zone are shown in Table 7.

Table 7 – Water Demands by Pressure Zone – Existing System (gpm)

	ADD	MDD	PHD
West Tank Zone 1	187	468	701
East Tank Zone 2	53	132	199
Zone 3	9	23	34
Entire System	249	623	934

It should be noted that currently the RSC is fed directly from the East Tank Zone 2. There is an existing 10-inch pipeline between the main well field and the RSC, but it currently operates normally closed.

4.2.1 Source Capacity

The existing system sources and capacity are as follows:

- Well 1R – 420 gpm
- Well 2R – 340 gpm
- Well 3 – 115 gpm
- Well 5R – 425 gpm
- Horizontal Well – 35 gpm

The total source capacity with all sources operational is 1,335 gpm under 24-hour well operation. With the largest source out of service (Well 5R), the total source capacity is 910 gpm. Based on the existing system MDD of 623 gpm, the existing sources meet the capacity requirements defined in Section 3.5.1.

4.2.2 Storage Capacity

The existing system has a total system storage capacity of 1.78 million gallons as follows:

- West Tank Zone 1 – 1.15 million gallons
- East Tank Zone 2 – 500,000 gallons
- Zone 3 – 130,000 gallons

Based on the storage criteria presented in Section 3.5.2, the total existing system storage requirement is shown in Table 8.

Table 8 – Storage Requirements – Existing System

	Criteria	Location	Volume, gallons
Operational Storage	25% MDD		224,000
Emergency Storage	ADD		358,560
Fire Storage	2,500 gpm @ 2 hours	West Zone	300,000
	1,500 gpm @ 2 hours	Zone 3	
Total Storage Required			882,660

The total system storage capacity meets the criteria as shown above. On a zonal basis, the storage requirement for Zone 1 is satisfied, even with a fire flow storage requirement of 300,000 gallons.

Zone 2 also has a fire flow storage requirement of 300,000 gallons based on the RSC fire demand of 2,500 gpm for a 2 hour duration. Zone 2 is currently fed off of the 500,000 gallon East Tank. This tank has the capacity to satisfy the operational and emergency storage requirement, as well as the fire storage requirement. But, the supply for the Zone 2 tank is the 220 gpm East Booster pump station. Under fire flow and ADD conditions, the East Booster pump station would replenish the East Tank in approximately 30 hours. Under fire flow and MDD conditions, it would take approximately 55 hours to refill the East Tank. In order to solve this issue, the 10-inch pipeline between the main well field and the RSC would need to be opened to allow for flow from the West Tank Zone. A PRV would be required between Zone

2 and the RSC to limit the draw during a fire flow event from the East Tank. Increasing the capacity of the Zone 2 Booster Pump Station, in combination with the improvements above, could also help this situation. These system improvements are outlined in more detail below for Scenario 3.

Zone 3 has a fire flow requirement of 1,500 gpm for a 2 hour duration, resulting in a fire flow storage requirement of 180,000 gallons. With a storage capacity of 130,000 gallons, the Zone 3 tank does not satisfy the storage criteria. Additional storage in the amount of approximately 70,000 gallons would be required to satisfy the requirement for operational, emergency, and fire storage for this zone. Also, similar to Zone 2, the booster pump station feeding the Zone 3 tank is undersized to refill the tank in a timely manner after a fire event. The Zone 3 booster pump station can supply approximately 70 gpm with one pump running and a 125 gpm with two pumps running. Under fire flow and ADD conditions, the Zone 3 Booster pump station would replenish the Zone 3 Tank in approximately 25 hours. Under fire flow and MDD conditions, it would take nearly 30 hours to refill the Zone 3 Tank.

4.2.3 System Pressures and Velocity

Model results for Scenario 1 indicate the following minimum pressures for each of the following demand sets:

- ADD: All nodes >35 psi
- MDD: All nodes >35 psi
- PHD: All nodes >30 psi

The system meets the minimum operating criteria for MDD and PHD, as outlined in Section 3.5.3 for an existing system.

Fire flow analysis indicated that the minimum required fire flow of 1,500 gpm is not met in the Granite Chief or Hidden Lake areas. The fire flow available at the top of Granite Chief is approximately 1,000 gpm. The fire flow available at the top of Hidden Lake is approximately 1,275 gpm. The 2,500 gpm fire flow was met for the RSC and the existing Village.

Velocity criteria were met under ADD, MDD, and PHD flow conditions, with maximum velocities less than 5 fps. There are a few areas requiring a commercial fire flow of 2,500 gpm that are served by 6-inch waterlines. Specifically, this included the areas around the 7 Plex and Post Office near Christy Land and Squaw Valley Road, and the 6-inch loop around the OVI. A flow of 2,500 gpm in 6-inch pipe results in flow velocities exceeding 20 fps. These areas were all able to meet the fire flow requirement of 2,500 gpm though.

4.3 Scenario 2 - Existing System + VSVSP at Buildout

The additional water demands associated with the VSVSP will be realized primarily in the western end of the Valley (West Tank Zone 1), with a small demand on the eastern end of the Valley associated with employee housing. No additional water demands will be realized in the East Tank Zone 2 or Zone 3. The

water demands in the West Tank Zone 1 will increase by the demands associated with the project. This includes additional VSVSP demands as follows:

- ADD = 145 gpm
- MDD = 363 gpm
- PHD = 706 gpm

The PHD includes an additional 162 gpm to account for the pool refill rate for the MAC.

The total water demands, including the existing system and the VSVSP would be:

- ADD = 394 gpm
- MDD = 986 gpm
- PHD = 1,640 gpm

The demands by pressure zone are shown in Table 9.

Table 9 – Water Demands by Pressure Zone – Existing System + VSVSP (gpm)

	ADD	MDD	PHD
West Tank Zone 1	332	831	1,407
East Tank Zone 2	53	132	199
Zone 3	9	23	34
Entire System	394	986	1,640

4.3.1 Source Capacity

To satisfy the supply needs of the existing system with the addition of the anticipated development, the Village at Squaw Valley Specific Plan Water Supply Assessment (WSA) (Farr West et. al., July 3, 2014) proposed an expanded well field with new wells required to meet future water demands. Chapter 6 of the WSA describes the groundwater modeling effort and expanded well field configuration in detail. Nine new potential well sites were identified, as well as a relocation of the District's existing Well 1R. The District's Wells 2R, 3, and 5R would remain as is. Some of these wells were indicated to satisfy the VSVSP demand, and some dedicated to provide the necessary water supply to satisfy a portion of the estimated non-project buildout water demands. The wells and locations as modeled in the WSA are shown on Figure 3. With the expanded well field, it was assumed that additional wells would produce a minimum average of 200 gpm. A total of eight wells would be dedicated to water supply for the District's customers. The well field, as proposed, includes more wells than are necessary to meet the MDD of the VSVSP. This will allow for the District to better manage their pumping from the aquifer.

4.3.2 Storage Capacity

Additional water storage capacity will be required in Zone 1 to satisfy the additional demands associated with the VSVSP. The Master Water Study – Village at Squaw Valley Specific Plan (MacKay & Somps October 16, 2014) defined an additional storage quantity of 690,000 gallons. The new water storage tank

may be placed adjacent to the existing West Tank. Collectively, the existing 1.15 million gallon West Tank, with the addition of the new VSVSP tank will provide a total storage capacity of approximately 1.8 million gallons of storage capacity for Zone 1. This is more than adequate storage to satisfy the criteria for operational, emergency, and fire storage for Zone 1.

As no additional demands will be placed on Zones 2 and 3 with the addition of the VSVSP, the storage scenario for these zones are as described previously in Section 4.2.2.

4.3.3 System Pressures and Velocity

With the addition of water demands from the VSVSP, the model was run with an ADD of 394 gpm, a MDD of 986 gpm, and a PHD of 1,640 gpm.

The pressure criteria under this scenario include meeting MDD and PHD with a minimum residual pressure of 40 psi, and MDD with a fire event of 20 psi. The model results indicate that these pressures are met at nearly all locations within the distribution system, with the exception of the upper area in Granite Chief. Pressures in this area were a minimum of 36 psi under flow conditions of MDD and PHD.

However, the model results indicate no change in the pressures from the exiting condition (Scenario 1); development of the VSVSP does not appear to adversely affect the existing system.

Fire flow analysis indicates that the minimum required fire flow of 1,500 gpm is not met in the Granite Chief or Hidden Lake areas. The fire flow available at the top of Granite Chief is approximately 1,250 gpm. The fire flow available at the top of Hidden Lake is approximately 1,300 gpm. Fire flows in these areas improve with the development of the VSVSP, but in order to comply with the California Waterworks Standards for minimum pressure, booster pumps are be required in both areas. The 2,500 gpm fire flow is met for the RSC and the Village.

The following infrastructure improvements required for VSVSP were added to the model (see Figure 3):

- VSVSP piping improvements including new 10” and 12” loops (McKay & Somps Master Plan)
- New West Tank #2/VSVSP Tank (McKay and Somps Master Plan)
- 4 new wells (location to be determined)

Velocity criteria were met under ADD, MDD, and PHD flow conditions, with maximum velocities less than 5 fps. There are a few areas requiring a commercial fire flow of 2,500 gpm that are served by 6-inch waterlines. A flow of 2,500 gpm in 6-inch pipe results in flow velocities exceeding 20 fps. These areas were all able to meet the fire flow requirement of 2,500 gpm.

4.4 Scenario 3 - Existing System + VSVSP at Buildout + Cumulative Development

The additional water demands associated with the projected General Plan buildout will be seen at various locations throughout the system. The parcels associated with the General Plan buildout water demands

are shown on Figure 1. As presented previously in Section 3.3, the additional water demands associated with General Plan buildout are as follows:

- ADD = 189 gpm
- MDD = 472 gpm
- PHD = 708 gpm

The total water demands, including the existing system, VSVSP, and General Plan buildout would be:

- ADD = 583 gpm
- MDD = 1,458 gpm
- PHD = 2,348 gpm

The demands by pressure zone are shown in Table 10.

Table 10 – Water Demands by Pressure Zone – Existing System + VSVSP + General Plan Buildout (gpm)

	ADD	MDD	PHD
West Tank Zone 1	561	1,403	2,266
East Tank Zone 2	10	25	37
Zone 3	12	30	45
Entire System	583	1,458	2,348

Table 10 shows a reduced water demand for Zone 2. This is reflective of bringing the RSC into Zone 1 to satisfy fire flow requirements.

4.4.1 Source Capacity

Similar to the additional water supplies necessary for the VSVSP, the WSA analysis included additional well sites to satisfy the water demands associated with future non-project development. To satisfy the water demands associated with the RSC Phase 2, well 18-3R will be dedicated to the District. It is currently unclear if the expanded well field, when built out, will be able to provide source water capacity to satisfy the MDD with the largest well out of service. Additional groundwater modeling is currently being performed to assess this criteria.

4.4.2 Storage Capacity

With the additional storage provided by the VSVSP project, the total Zone 1 storage will be 1.84 million gallons. Based on the water demands presented above, the total storage requirement for Zone 1 with the addition of the General Plan buildout water demands will be approximately 1.7 million gallons.

The majority of additional demands will be realized in Zone 1. Zones 2 and 3 will see minimal increased water demands associated with less than 20 vacant SFR parcels remaining to be built upon. Therefore, the storage scenario for these zones are as described previously in Section 4.2.2.

4.4.3 System Pressures and Velocity

With the addition of water demands from the VSVSP and projected General Plan buildout development, the model was run with an ADD of 583 gpm, a MDD of 1,458 gpm, and a PHD of 2,348 gpm. The existing system met the criteria for these scenarios with two exceptions. The upper end of the Granite Chief Subdivision did not meet the 40 psi minimum pressure for ADD or MDD.

Model results for Scenario 2 indicate the following minimum pressures for each of the following demand sets:

- ADD: <40 psi at upper end of Granite Chief (36 psi)
- MDD: <40 psi at upper end of Granite Chief (36 psi)
- PHD: <40 psi at upper end of Granite Chief (36 psi), and Hidden Lake (38 psi)

The system does not meet the minimum operating criteria for MDD and PHD, as outlined in Section 3.5.3 for a system that expands its service connections by more than 20 percent. However, the model results indicate no change in the pressures from the exiting condition (Scenario 1); development of the VSVSP and General Plan Buildout does not appear to adversely affect the existing system, with the exception of Hidden Lake at PHD.

Fire flow analysis indicates that the minimum required fire flow of 1,500 gpm is not met in the Granite Chief or Hidden Lake areas. The fire flow available at the top of Granite Chief is approximately 1,270 gpm. The fire flow available at the top of Hidden Lake is approximately 1,150 gpm. Fire flows in Granite Chief improve with the development of the VSVSP and General Plan Buildout, but decrease in Hidden Lake. Again, in order to comply with the California Waterworks Standards minimum pressure criteria, booster pumps will be required in both areas. The 2,500 gpm fire flow was met for the RSC and the Village.

The recommended infrastructure improvements under this scenario are directed at enhancing the hydraulics and fire storage for the RSC and the RSC Phase 2. These improvements allow for fire flow to be provided from both the West Tank Zone 1 and the East Tank Zone 3 during a fire event at the RSC. As mentioned previously, as currently operated, all flow for the RSC area is provided by Zone 2. Further, Zone 2 received water only from the 220 gpm East Booster pump station. These improvements were recommended previously by ECO:LOGIC (SVPSD Water Model – Resort at Squaw Creek Phase II Will Serve Request, January 24, 2007).

The following recommended infrastructure improvements would put the RSC into the West Tank Zone 1 for ADD, MDD, and PHD flows and include (see Figure 4):

- Install PRV on the 12-inch pipeline between the East Tank and the RSC;
- Open existing 10-inch pipeline through golf course;
- Provide a direct connection between the 8-inch Well 5R discharge line and the 10-inch golf course pipeline;
- Increase the capacity of the East Booster pump station;
- Additional water supply wells in the main well field; and
- Dedication of Well 18-3R to the District by RSC.

Other operational adjustments may also be necessary based on the reduced demand on the 500,000 East Tank. With the RSC receiving water under normal flow conditions from the West Tank, the East Tank would be providing water supply to very few residential customers. In order to provide adequate turnover in the East Tank, the Zone 2 PRV would need to be adjusted to a downstream pressure of 120-125 psi. This would allow the East Tank to provide a portion of the water demands to the eastern end of Zone 1.

Velocity criteria were met under ADD, MDD, and PHD flow conditions, with maximum velocities less than 5 fps. There are a few areas requiring a commercial fire flow of 2,500 gpm that are served by 6-inch waterlines. A flow of 2,500 gpm in 6-inch pipe results in flow velocities exceeding 20 fps. These areas were all able to meet the fire flow requirement of 2,500 gpm.

5.0 SUMMARY

This water system capacity analysis was performed to assess the effects of proposed and future development in Olympic Valley. The analysis included evaluating source capacity, storage capacity, minimum system pressures and flow velocity under flow scenarios of ADD, MDD, MDD plus fire, and PHD. The criteria to meet these requirements are defined by the California Waterworks Standards and the District's Water Code.

In general, the existing system portrayed no system deficiencies, with the exception of marginal pressures and fire flow less than 1,500 gpm in the upper areas of Granite Chief and Hidden Lake. Modeling showed that these existing pressure and fire flow situations were not exacerbated with the additional flows from the VSVSP and General Plan buildout water demands. Also, the 130,000 gallon Zone 3 storage tank can only satisfy a fire demand scenario of 1,000 gpm for 2 hours. This modeling effort used the criteria for SFR fire flow requirements of 1,500 gpm for 2 hours. Finally, the RSC fire demand can be meet from the East Tank Zone 2, but supply to the East Tank from the 220 gpm East Booster pump station does not provide a sufficient refill rate in the event of a fire at the RSC. For this reason, it has been previously recommended to put the RSC in Zone 1 with the installation of a PRV near the RSC and opening the existing10-inch pipeline between the main well field and the RSC. Capacity improvements at the East Booster pump station would also provide further operational flexibility.

Velocity criteria were met under ADD, MDD, and PHD flow conditions, with maximum velocities less than 5 fps. There are a few areas requiring a commercial fire flow of 2,500 gpm that are served by 6-inch waterlines. Specifically, this included the areas around the 7 Plex and Post Office near Christy Land and Squaw Valley Road, and the 6-inch loop around the OVI. A flow of 2,500 gpm in 6-inch pipe results in

flow velocities exceeding 20 fps. These areas were all able to meet the fire flow requirement of 2,500 gpm though.

The following infrastructure improvements are required for development of the VSVSP, Scenario 2 (see Figure 3):

- VSVSP piping improvements including new 10" and 12" loops (McKay & Somps Master Plan),
- New West Tank #2/VSVSP Tank (McKay and Somps Master Plan), and
- 4 new wells (locations to be determined).

The following infrastructure improvements are recommended for the General Plan buildout development level, Scenario 3 (see Figure 4):

- Install PRV on the 12-inch pipeline between the East Tank and the RSC;
- Open existing 10-inch pipeline through golf course;
- Provide a direct connection between the 8-inch Well 5R discharge line and the 10-inch golf course pipeline;
- Additional water supply wells in the main well field; and
- Dedication of Well 18-3R to the District by RSC.

Legend

- Commercial/Multi-Family Residential
- Combination Commercial/SFR
- SRF
- Squaw Valley Mutual Water Boundary

096-540-013
096-540-004
096-020-023
096-103-035
096-101-009
096-230-062
096-290-050
096-290-011
096-290-027
096-290-056
096-230-055
096-230-052
096-230-036

SUMMER PL
SQUAW SUMMIT RD
SANDY WY
ERIC RD
WAYNE RD
SQUAW VALLEY RD
HIDDEN LAKE CT
HIDDEN LAKE LP
VICTOR PL
VICTOR DR
TIGER TAIL RD
FOREST GLEN RD
WINDING CREEK RD
TRAILS END
INDIAN TRAIL RD
PAINTED ROCK CT
SHOSHONE WY
SHOSHONE CT
RIVER RD
89
APACHE CT
NAVAJO DR
WASHOE DR
PAIUTE PL
LANNY LN
CHRISTY LN
CHAMONIX PL
SQUAW PEAK WY
SQUAW PEAK RD
VILLAGE SOUTH
VILLAGE EAST
SQUAW CREEK RD
RIDGE CT
MOUNTAIN LIMS WY
VALLEY VIEW CT
SIERRA CREST TR

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SVPSD - VSVSP Water Capacity Analysis
General Plan Buildout Estimates
Figure 1

N

1 " = 1,000 '

The data contained herein does not represent survey delineation and should not be construed as a replacement for the authoritative source. No liability is assumed by Farr West Engineering as to the sufficiency or accuracy of the data.

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Legend

- Squaw Valley Mutual Water Boundary
- Pressure Reducer
- Water Well
- Water Pump Station (PS)
- Tank

Water Pipe

Size

- 6"
- 8"
- 10"
- 12"

Water Pressure Zone

- Zone 1
- Zone 2
- Zone 3

West Tank
Zone 1
1.15 mg

Well 5R
Capacity:
425 gpm

Well 2R
Capacity:
340 gpm

Well 1R
Capacity:
420 gpm

Well 3
Capacity:
115 gpm

10" PVC
Normally Closed

Horizontal Well
Capacity: 25 - 35 gpm

East Booster
Pump Station
Capacity: 225 gpm

Zone 2 PRV
Setting: 100 psi

East Tank
Zone 2
0.5 mg

Zone 3
Tank
0.13 mg

Zone 3 Booster
Pump Station
Capacity: 70 gpm

SUMMER PL
SQUAW SUMMIT RD
SANDY WY
APACHE CT
PAIUTE PL
LANNY LN
CHRISTY LN
SQUAW VALLEY RD
RUSSELL RD
WAYNE RD
HIDDEN LAKE LP
VICTOR PL
TIGER TAIL RD
FOREST GLEN RD
WINDING CREEK RD
INDIAN TRAIL RD
SHOSHONE WY
CREEKS END CT
89
RIVER RD
SQUAW CREEK RD
SIERRA CREST TR
RIDGE CT
SIERRA CREST CT
CHAMONIX PL
SQUAW PEAK WY
SQUAW PEAK RD
GRANITE CHIEF RD
GRANITE CHIEF CT
VILLAGE SOUTH
VILLAGE EAST
SQUAW LP

SVPSD - VSVSP Water Capacity Analysis

Existing Water System

Figure 2

N

1 " = 1,000 '

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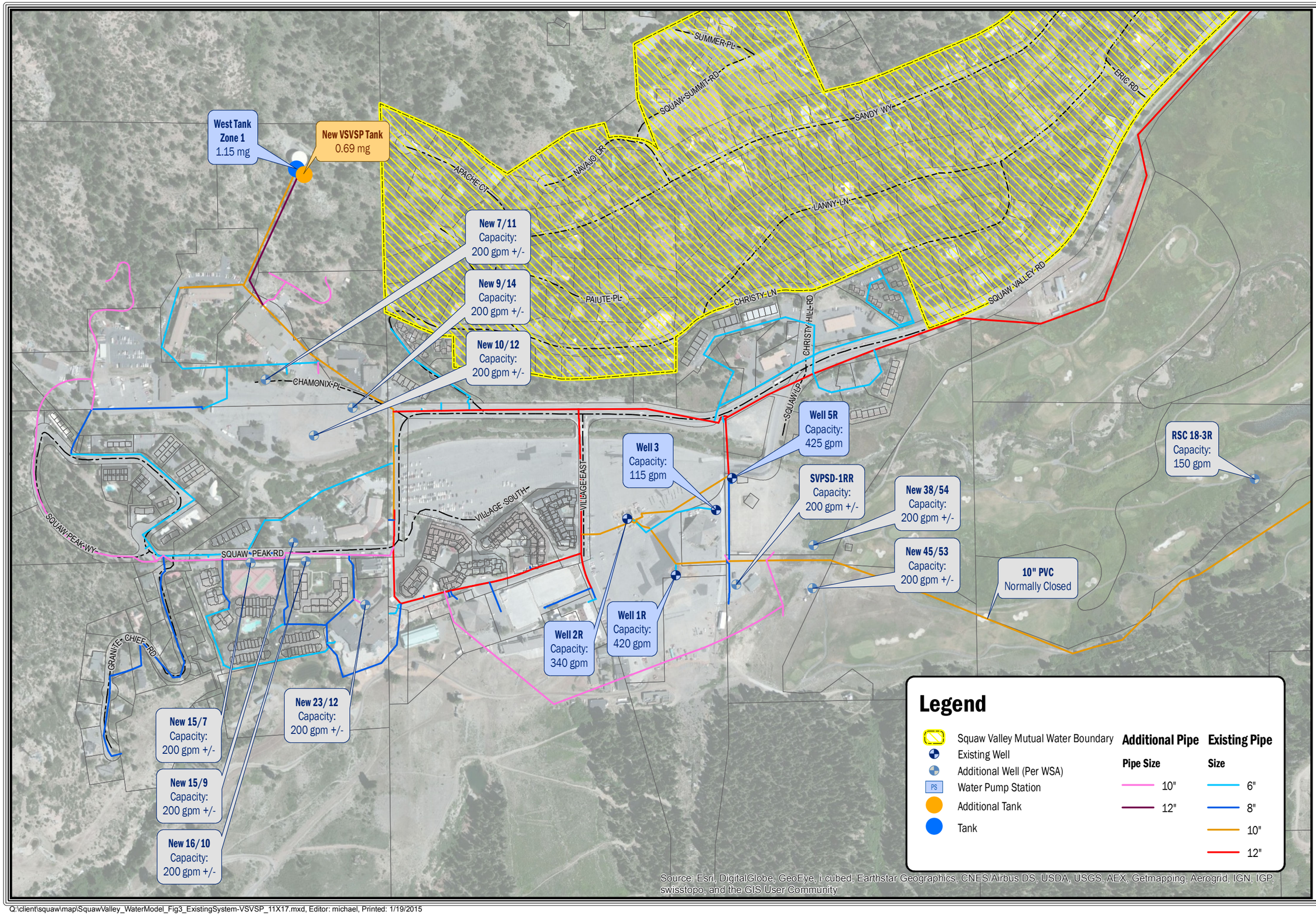

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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SVPSD - VSVSP Water Capacity Analysis

Existing Water System + VSVSP

Figure 3

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Legend

- Squaw Valley Mutual Water Boundary
- Additional Pressure Reducer
- Existing Pressure Reducer
- Existing Well
- Additional Well (Per WSA)
- Water Pump Station (PS)
- Additional Tank
- Tank

Additional Pipe

Pipe Size

- 10"
- 12"

Existing Pipe

Size

- 6"
- 8"
- 10"
- 12"

Water Pressure Zone

Zone

- Zone 1
- Zone 2
- Zone 3

New RSC PRV

RSC Changed to Zone 1 with new RSC PRV

Opened 10" PVC

SUMMER PL
SQUAW SUMMIT RD
SANDY WY
APACHE CT
PAIUTE PL
LANNY LN
CHRISTY LN
FERN RD
SQUAW VALLEY RD
RUSSELL RD
WAYNE RD
HIDDEN LAKE LP
VICTOR PL
TIGER TAIL RD
FOREST GLEN RD
WINDING CREEK RD
INDIAN TRAIL RD
SHOSHONE WY
CREEKS END CT
89
SQUAW CREEK RD
RIDGE CT
SIERRA CREST CT
SIERRA CREST TR
PS
RIVER RD
CHAMONIX PL
SQUAW PEAK WY
SQUAW PEAK RD
VILLAGE SOUTH
VILLAGE EAST
SQUAW LOOP
GRANITE CHIEF RD
GRANITE CHIEF CT

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SVPSD - VSVSP Water Capacity Analysis

Existing Water System + VSVSP + GP Buildout

Figure 4

N

1 " = 1,000 '

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Q:\client\squaw\map\SquawValley_WaterModel_Fig4_ExistingSystem-VSVSP-GP_Buildout_11X17.mxd, Editor: MForrest, Printed: 1/26/2015