



Memo

- DEMANDS

To: **Kennedy Jenks Consultants**

Project Manager: Tim Williams

From: **Tuolumne Utilities District**

District Engineer: Erik Johnson

Associate Engineer: Glen Nunnelley

EF
GWN

Date: 03/28/2018

Re: **Treated Water Systems Optimization Plan**

Projected 20-Year Water Demands by Water Service Area

This memorandum will identify projected water demands by customer class and water system for the period of 2017 – 2037. The data contained in this memorandum shall serve as the basis for inputs to the hydraulic model and for determining future treatment plant and transmission main capacities. The count of water service connections is presented by class and system and compared to the known water demand (by system) in gallons per minute (gpm) to arrive at a unit demand. These unit demands are further applied to the anticipated growth in the number of connections at 20 and 40 years to estimate future demands.

Unit Demand

As depicted in *Appendix C*, The Unit Demand is derived from the individual Average Day Demand (ADD) figures, by system, divided by the number of service connections that are served in that system. The ADD is based primarily on the annual distribution volume for each system.

As depicted in *Appendix B*, the system Average Day Demand (ADD) draws from the annual system distribution figures as reported by the District's water operators and use Water Treatment Plant Production and Consumption figures for the 2011-2017 time-frame and the 2008-2010 consumption values used in the previous memo, to check and compare these most recent Distribution ADD figures by system. The Law and Justice Center, Sonora Cancer Center and RV Park in Tuolumne City are just about to come on-line (2017) so the demands for these customers are not reflected in the current ADD readings. As these connections are not part of the current demand, the demand is estimated and incorporated into the design demand for each of these customers and further to the unit demand for growth planning.

The unit demands in gallons per minute (gpm) are separated based on the number of Households, CII and IRR connections.

As depicted in *Appendix A*, the total number of water services are separated by system and by Single-Family, Multi-Family, Wholesale Households, CII & IRR service connections. There is a total of 14,263 Single-Family, Multi-Family, Wholesale Households, CII & IRR service connections (2017) in the TUD system as shown in Column I of *Appendix A*. This is further separated to account for all Households as shown in Column J. As there are multiple Households in the District's Multi-Family service connections, it is further noted that there are 14,123 total Households (which includes all Households in the TUD Wholesale accounts and all Households in the District's Multi-Family service connections). Single-Family service connections are counted as one Household. Separately, there is a total of 1,290 CII connections as shown in Column K. There is approximately 91% Residential Households and about 9% CII service connections.

The memo regarding water service connection growth established an annual non-acquisition growth rate of 0.84% and did not distinguish between growth rates for residential or commercial connections. It is assumed that commercial water services will also grow at 0.84%. For purposes of demands projections, it is important to separate the two types of services because they can have very different water demands.

Most District water systems are predominately residential in nature with the exception being the East Sonora Service Area. East Sonora is comprised of shopping centers and the County's largest concentration of commercial users. The Cuesta/Lambert Service Area is home to the County's largest industrial park. Table A provides the percentage of commercial, industrial, and irrigation connections for the District's most diverse water service areas.

TABLE A

Summary of Account Type as a % of Service Connections for Diverse Water Service Areas (2017)

System	Commercial	Industrial	Irrigation
East Sonora	64%	0%	0%
Cuesta Lambert	48%	2%	9%
Mono Village	27%	0%	0%
Sonora Jamestown	14%	0%	11%

Tuolumne	7%	0%	18%
Crystal Falls	6%	0%	0%
Columbia Gibbs	6%	0%	18%
Apple Valley	2%	0%	0%
Upper Basin	1%	0%	0%
Monte Grande	1%	0%	7%
Scenic View	1%	0%	3%
Cedar Ridge	0%	0%	1%
Ponderosa Hills	0%	0%	1%
Big Hill	0%	0%	0%
Peaceful Pines	0%	0%	0%
Phoenix Lake Park	0%	0%	0%
Wards Ferry	0%	0%	0%

Average Day Demand (ADD) was selected based upon distribution demands within each specific water system service area between 2011-2017. Several District water systems are intertied and transfer water between each other. For example, as shown in *Appendix C*, the Sonora/Jamestown system has an ADD at the treatment plant of 1,424 gpm. However, an average of 171 gpm per day is transferred out of that system to feed the Cuesta Lambert, East Sonora, Mono Village, and Columbia/Gibbs systems. Therefore, the ADD for the Sonora/Jamestown service area is $1,424 - 171 = 1,253$ gpm. Similarly, the Crystal Falls system gets water transferred from the Monte Grande and Upper Basin systems.

It is interesting to note that the water use varies widely by elevation. If the District were to be divided between users above and below Phoenix Lake, the resulting residential unit demands would be:

TABLE B

Weighted Average Residential Unit Water Demands:

Above Phoenix Lake: 184 gpd/residential connection

Below Phoenix Lake: 267 gpd/residential connection

The suspected explanation for this disparity is the contribution of residential irrigation in those customers that are located at the lower elevations below Phoenix Lake.

Peaking Factors

As depicted in *Appendix D*, generally the max day peaking factors were calculated by comparing the ADD for the service area to the Maximum Day Demand (MDD) for the period of 2008-2010. When possible, SCADA data from the production or distribution

magnetic flow meters was used. However, in the absence of SCADA data WTP Operator log sheets were used to calculate the MDD. One flaw in using the log sheets is that the operator doesn't always read the meter at the same time, so more or less than 24 hours could have elapsed between the last reading. Additionally, some MDD could be exaggerated by the volumes leaving the plant at night that are used to fill system storage tanks and aren't actually delivered to the customer's tap.

In the case of Crystal Falls, the distribution pipeline leaving the clearwell goes directly to the Comstock reservoir. Approximately 98% of Crystal Falls service connections are downstream from the Comstock reservoir. The absence of a distribution meter on the Comstock reservoir complicates the determination of an accurate peaking factor for the Crystal Falls system.

Also, some distribution meters register backwash volumes that may overstate peaking factors. A factor of safety will be applied to sizing new treatment facilities to account for losses due to clarifier flushes, filter backwashes, and system distribution losses, etc.

Some systems did not have adequate information to determine the MDD or Peak Hour Demand (PHD) and consequently a peaking factor. In these cases, the large systems (namely Crystal Falls and Sonora) were assigned a MDD peaking factor of 2.0 based on available data from other large systems. Smaller systems, that did not have sufficient data, were separated by location, either above or below Phoenix Lake, and were assigned the value corresponding to the weighted average of those systems for which information was available. Those systems below Phoenix Lake were assigned a MDD peaking factor of 2.20. For systems above Phoenix Lake the MDD peaking factor was assumed to be 2.40.

Systems that did not have adequate data for determination of the PHD peaking factor were separated on the basis of size. Based on other systems with available data, large systems (Crystal Falls and Sonora) were assigned a PHD peaking factor equal to 1.5 times the MDD peaking factor and for smaller systems the assumed value was 2.0 times the MDD peaking factor.

Table D summarizes the 2037 ADD, MDD, and PHD for each system. The ADD's, MDD's, and PHD's listed represent consumptive demands by service area only and do not account for any transfer of water from one treatment plant to serve a different service area. The projections in *Table D* can be applied directly to each water service area; however, if a regional water treatment plant is to be constructed that plant's capacity should be based on the sum of the demands for each service area it will be serving. For example, if a Sierra Pines WTP is to replace Cedar Ridge, Crystal Falls, and Upper Basin then the 2037 MDD would be $205 + 1,258 + 905 = 2,368$ gpm or 3.4 mgd.

All future demands, (ADD, MDD, and PHD) were calculated based on the growth rates established in the memo on growth in water service connections dated March 27, 2018, unit demands, and the peaking factors discussed above.

It is important to note that when calculating average unit demands for each water system, the contribution of wholesale connections was included. Although a wholesale account registers as one account it may include several hundred water connections. The water demands from these individual connections were assumed to be residential.

Peaking factors are summarized in *Table C* below and in more detail in *Appendix B*.

TABLE C
Peaking Factors

SYSTEM	MDD/ADD	PHD/ADD
Apple Valley	2.20	4.40
Big Hill	3.74	7.39
Cedar Ridge	2.86	5.72
Columbia/Gibbs	2.39	3.73
Crystal Falls	2.40	3.60
Cuesta Ctr. - Lambert Lakes	2.20	4.40
East Sonora	2.20	4.40
Mono Village	2.20	4.40
Monte Grande	1.63	3.30
Peaceful Pines	2.40	4.80
Phoenix Lake Park	2.20	4.40
Ponderosa Hills	2.76	5.52
Scenic View/Brook	3.11	6.23
Sonora/Jamestown	2.35	3.53
Tuolumne City	2.64	4.89
Upper Basin	1.80	2.70
Wards Ferry Ranches	2.20	4.40

The assumptions underlying the projections for future water demands are the following:

Assumptions

1. All wholesale water users are residential in nature.
2. For systems without reliable MDD or PHD data, the peaking factor was assumed to be the following:

	<u>MDD/ADD</u>	<u>PHD/MDD</u>
Small Systems Below Phoenix Lake	2.20	2.00
Small Systems Above Phoenix Lake	2.40	2.00
Large Systems	2.00	1.50

3. The average unit demand for commercial, industrial, institutional and irrigation connections for each system was calculated as the average for 2010 billed usage.
4. Data collected from the distribution meters at specific plants does not account for net volume changes in the system's storage tanks and therefore may or may not account for actual consumptive demands over the course of an hour or a day. Since District operators tend to keep tank levels as static as possible, the consumptive demands associated with the net changes in system storage are considered negligible.
5. In some cases, the distribution meter at the WTP measures backwash and clarifier flush volumes and therefore can overstate the demands in the system. This inaccuracy is acceptable and does not jeopardize the value of the data.
6. TUD has eliminated inactive accounts. Although, all accounts are considered "active" there will be a small percentage of service connections that may show irregular water demands. Additionally, an active connection is defined as a connection that could use water. Some systems, such as Cedar Ridge, Crystal Falls, and Upper Basin have a large number of vacation or seasonal homes that have active service connections with irregular water demands.
7. All future demands will be satisfied through surface water with the exception of the Apple Valley, Peaceful Pines, and Wards Ferry Ranches Systems. All other existing wells will be abandoned or placed on standby for emergency use only.
8. No reduction in demands is considered as a result of water conservation.
9. The Black Oak Casino and associated improvements (Tuolumne Band of MeWuk) could possibly connect to the District's system sometime in the future. The impact of that connection has already been realized by the District when it constructed a new WTP (2010) in Tuolumne City and installed a new pressure filter dedicated solely for tribal development. The capacity of that filter is 432 gpm (MDD) and since the District is already prepared to serve this demand it is not included as future growth.

The max day water demands are important when sizing treatment facilities. Water use patterns are important when evaluating system distribution and storage facilities. For those systems that are connected to the District's SCADA system, water use patterns have been developed. The patterns are based upon the average volume of water flowing out of the clearwell by each hour of the day. In most cases the average reflects two-(2) or more years of data, with the exception being Tuolumne and Upper Basin WTPs.

The 2037 water demands are summarized in Table D below and a full listing of ADD, MDD and PHD by year and by system is provided in *Appendix E*:

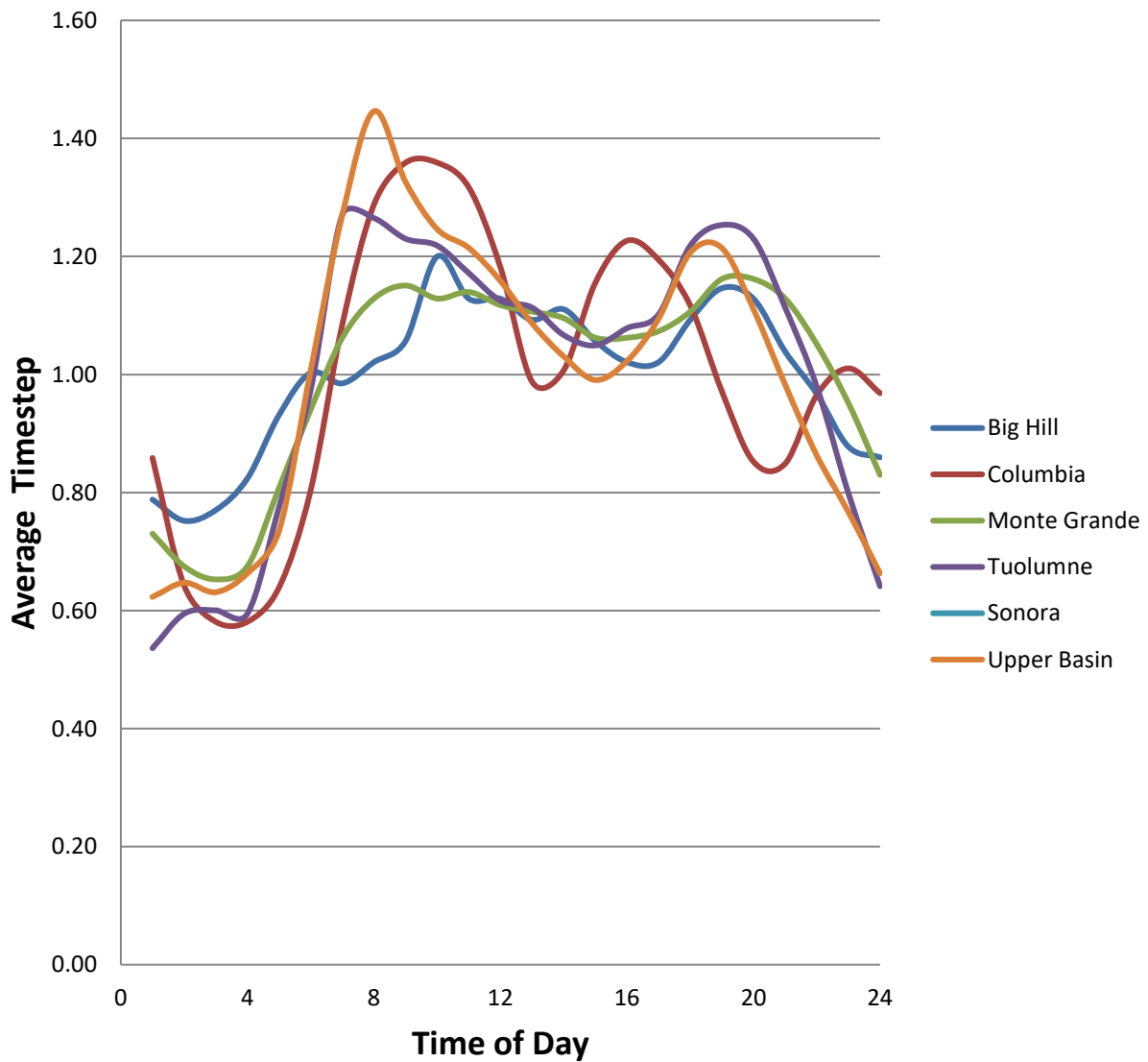
TABLE D

Average Day, Max Day, and Peak Hour Demands - Yr. 2037

SYSTEM	ADD (gpm)	MDD (gpm)	PHD (gpm)
Sonora/Jamestown	1532	3606	5409
Crystal Falls	524	1258	1888
Upper Basin	513	925	1387
Columbia/Gibbs	369	881	1376
Cuesta Ctr. - Lambert Lakes	126	278	556
Tuolumne City	164	435	805
Mono Village	124	274	548
Ponderosa Hills	118	326	653
Cedar Ridge	72	205	410
Scenic View/Brook	72	225	449
Monte Grande	71	115	233
East Sonora	54	119	239
Apple Valley	38	83	165
Big Hill	38	143	282
Phoenix Lake Park	13	28	56
Wards Ferry Ranches	12	27	54
Peaceful Pines	4	10	21
Total (gpm)	3846	8939	14531
Total (MGD)	5.5	12.9	20.9

As stated, water use patterns are important when sizing distribution and storage facilities. Figure 1 is a graph showing the fluctuations in average water demand throughout the course of a typical day. Specific timestep information is being generated for each system.

FIGURE 1.
Water Use Patterns



As the District updates its facilities, installs magnetic flow meters at more sites, and continues to expand its SCADA system information related to water demands will improve. It is the District's intent to update its water demand projections, as well as, the Treated Water Optimization Plan every five-(5) years.

List of Appendices:

Appendix A – TUD CONNECTIONS SORTED BY CLASS AND SYSTEM

Appendix B – AVERAGE DAY DEMAND SORTED BY SYSTEM WITH COMPARISONS

Appendix C – ADD, UNIT DEMAND AND INTERIES BY SYSTEM

Appendix D – PEAKING FACTORS

Appendix E – LISTING OF ADD, MDD AND PHD BY SYSTEM BY YEAR

APPENDIX A
2017 CONNECTIONS SORTED BY CLASSIFICATION AND HOUSEHOLDS

2017 service connections and households

		A	B	C	D	E	F	G	H	I	J	K	L
System		SF	MF	HH-MF	COM	IND	INST	IRR	Wholesale HH	TOTAL OF ALL SERVICE CONNECTIONS All TUD Res. (connections), CII & HH in wholesale accounts (A+B+D+E+F+G+H)	ALL RES. HOUSEHOLDS, All TUD HH and HH in wholesale accounts (A+C+H)	TOTAL CII includes: all TUD COM, INST. INDUSTRIAL, IRR (D+E+F+G)	TOTAL HOUSEHOLDS and CII includes all TUD HH and CII connections (J+K)
Apple Valley		138	0	0	2			2		142	138	4	142
Big Hill	part of CG, BH	230	1	2						231	232	0	232
Cedar Ridge		671	1	2	2		1			675	673	3	676
Columbia Gibbs	part of CG, BH	1515	25	116	81		44	5		1670	1631	130	1761
Crystal Falls	part of UB,CF,MG	2155	16	46	97	2		3		2273	2201	102	2303
Cuesta Lambert	Part of SJ, CL, ES, MV	100	2	6	91	7	3	3		206	106	104	210
East Sonora	Part of SJ, CL, ES, MV	5	1	60	87			2		95	65	89	154
Mono Village	Part of SJ, CL, ES, MV	180	13	102	69			2		265	282	71	354
Monte Grande	part of UB,CF,MG	231	0	0	1		2			234	231	3	234
Peaceful Pines		33	0	0						33	33	0	33
Phoenix Lake Park		56	0	0						56	56	0	56
Ponderosa Hills		629	4	9	2		1		55	691	693	3	696
Scenic View		270	0	0	1		1	1		273	270	3	273
Sonora Jamestown	Part of SJ, CL, ES, MV	3471	262	1021	573	2	86	36	360	4790	4852	697	5549
Tuolumne		596	24	134	45		20	1		686	730	66	796
Upper Basin	part of UB,CF,MG	1474	1	2	14		1		430	1920	1906	15	1921
Wards Ferry		23	0	0						23	23	0	23
	Totals	11778	350	1500	1065	11	159	55	845	14263	14123	1290	15413

Totals Res. & active connections within wholesale accounts (A+B+H)

12973

1290

Totals Res. & CII & IRR & active CONNECTIONS within wholesale accounts

14263

14263

91%

9%

Percent of CII CONNECTIONS as a % of total active CONNECTIONS (K/I)

=

9.0%

APPENDIX B

AVERAGE DAILY DEMAND BY SYSTEM

[illegible]

Projects coming on line shortly not part of acquisitions, growth, or developments

SJ Tuolumne County Law and Justice Center and Adult Jail Facility 33.4 ESFR at 264 gpd

SJ Sonora Cancer Center 6.4 ESFR at 264 gpd

TC RV Park 20 ESFR at 264 gpd

6.2	
1.2	
	3.7

Average Daily Demand, ADD (Distribution, Wells, Transfers) (gpm)																		
2011	32.2	32.2	60.2	279.3	424.5	69.8	61.4	79.1	70.9	3.8	13.0	113.2	61.6	1337.2	129.2	197.7	9.7	
2012	31.9	42.4	66.3	317.7	444.1	69.0	58.3	71.7	69.3	3.5	13.3	122.3	65.8	1385.3	135.8	217.5	11.8	
2013	36.4	42.2	68.9	296.6	450.9	76.4	62.3	75.1	51.0	6.7	13.7	128.0	66.5	1590.3	147.5	235.8	12.2	
2014	22.0	23.0	56.9	187.9	306.5	56.8	57.1	49.9	38.4	2.0	8.7	84.3	40.7	1009.8	90.8	174.1	10.9	
2015	20.2	27.2	51.3	220.8	277.3	49.4	39.8	57.4	91.6	2.8	12.4	85.2	38.7	1008.8	82.9	161.2	9.5	
2016	21.4	36.3	56.4	283.5	338.6	55.2	47.0	57.4	112.1	3.8	11.9	100.9	42.8	1205.0	101.3	195.3	10.8	
2017	25.9	41.6	61.1	301.3	347.2	61.0	49.7	57.4	36.1	6.4	12.3	101.1	45.9	1180.8	104.8	194.2	11.6	

Annual Billed Consumption (MG) from Accounting																		
2008	21.4	21.8	33.5	183.1	273.7	35.2	32.7	42.6	40.6	1.7	5.7	62.2	35.9	711.2	91.3	96.2	5.6	
2009	20.1	21.7	30.9	170.6	264.7	30.8	31.9	39.9	29.9	1.5	4.9	60.8	33.5	651.0	87.2	91.0	6.4	
2010	18.5	18.8	28.8	154.5	233.2	29.1	30.0	37.1	26.0	1.3	4.9	59.9	29.2	596.0	78.8	83.6	5.4	
2011	16.6	17.1	25.4	150.8	216.2	28.9	28.3	35.5	23.4	1.1	5.0	51.0	27.1	547.2	70.2	77.6	4.7	
2012	22.9	19.4	29.5	184.1	264.6	32.3	27.6	37.0	29.4	1.2	5.0	63.0	38.4	660.8	94.9	100.6	5.9	
2013	17.8	17.6	25.4	168.9	238.4	33.1	27.0	36.5	30.0	1.1	4.9	56.7	31.5	580.7	78.3	80.0	6.2	
2014	12.5	13.3	21.5	119.9	165.7	24.0	23.1	27.2	20.4	0.8	3.6	41.1	21.2	423.7	53.5	59.9	4.8	
2015	11.3	12.6	20.0	108.4	159.2	21.0	22.0	26.0	19.2	0.8	3.3	36.7	17.4	397.5	48.6	52.9	4.7	
2016	12.3	14.9	24.2	121.7	185.1	22.6	21.9	28.0	20.1	0.9	3.5	42.0	19.8	431.6	54.3	65.1	4.7	
2017	13.8	16.7	24.5	130.9	196.9	25.0	23.2	28.7	22.0	0.8	3.6	45.8	20.9	461.8	56.2	65.3	5.8	

APPENDIX C
Average Unit Demands by Service Type

System	Total ADD by system service area (including Transfers) (gpm)	Notes	Water Transfers		Notes	Average Flow Distributed by specific WTP and/or Wells (gpm)	Notes	# of Residential HOUSEHOLDS (incl. conn. In wholesale accts.) ²⁰	# of Commercial, Industrial, Institutional & Irrigation Connections	Unit Demands per HOUSEHOLD (gpd/HOUSEHOLD)	Unit Demands per HOUSEHOLD (gpm/HOUSEHOLD)	2010 Unit Demands per Commercial, Industrial, Institutional & Irrigation Connections (gpd/connection) ¹⁷	2010 Unit Demands per Commercial, Industrial, Institutional & Irrigation Connections (gpm/connection) ¹⁷
			from---> to	ADF (gpm)									
Apple Valley (AV)	27	¹	AV --> SV	3.7	²	31	³	138	4	283	0.197	0	0.000
Big Hill (BH)	32	¹	BH--->CG	87		118		232	0	198	0.137	413	0.287
Cedar Ridge (CR)	60	¹				60		673	3	127	0.088	413	0.287
Columbia/Gibbs (CG)	281	¹	SJ> CG & BH>CG	87.8	²	193	⁴	1631	130	204	0.142	548	0.381
Crystal Falls (CF)	370	¹	MG --> CF	103.9	⁵	243	⁷	2201	102	221	0.154	445	0.309
			UB --> CF	22.7	⁶								
Cuesta Ctr. - Lambert Lakes (CL)	63	¹	SJ --> CL	62.9	²	0	⁸	106	104	458	0.318	398	0.277
East Sonora (ES)	54	¹	SJ --> ES	107.1	²	1	⁹	65	89	128	0.089	779	0.541
Mono Village (MV)	64	¹	ES --> MV	54.6	²	9	⁸	282	71	185	0.128	560	0.389
Monte Grande (MG)	67	¹⁰	MG --> CF	103.9	¹¹	171	¹²	231	3	418	0.290	0	0.000
Peaceful Pines (PP)	4	¹				4	¹³	33	0	182	0.126	0	0.000
Phoenix Lake Park (PLP)	12	¹				12	¹³	56	0	313	0.218	0	0.000
Ponderosa Hills (PH)	105	¹				105		693	3	218	0.152	0	0.000
Scenic View/Brook (SV)	52	¹	AV --> SV	3.7	²	48		270	3	276	0.191	0	0.000
Sonora/Jamestown (SJ)	1253	¹⁴	SJ --> CG	1.2	²	1424	¹⁵	4852	697	259	0.180	787	0.547
			SJ --> CL	62.9	²								
			SJ --> ES	107.1	²								
Tuolumne City (TC)	139	¹				139		730	66	151	0.105	1360	0.944
Upper Basin (UB)	197	¹	UB --> CF	22.7	²	219	¹⁶	1906	15	147	0.102	193	0.134
Wards Ferry Ranches (WFR)	11	¹				11	¹³	23	0	685	0.476	0	0.000
TOTALS	2789							14123	1290				

Weighted Avg Residential Daily Demand Above Phoenix ¹⁸	184	gpd
Weighted Avg Residential Daily Demand Below Phoenix ¹⁹	267	gpd

Notes

¹ Average distribution 2011-2017.

² Average transfer rate 2008-2017.

³ Average distribution + transfers to Scenic View 2009-2014.

⁴ Average distribution - transfers in from Sonora/Jamestown 2008-2014.

⁵ Average transfer rate 2011-2017.

⁶ Average transfer rate from 2008-2014

⁷ Average distribution - transfers in from Monte Grande and Upper Basin.

⁸ Average distribution - transfers in from Sonora/Jamestown.

⁹ All of East Sonora's demands are satisfied from Sonora/Jamestown.

¹⁰ Average distribution 2011-2017. (Curtis Creek Ranches and Soulsbyville intertie not completed until late 2008)

¹¹ Average transfer rate 2/3/09-2/3/10.

¹² Average distribution - transfers to Crystal Falls.

¹³ All demands are satisfied from wells.

¹⁴ Avg Day demand based on average Sonora distribution flow avg. 2011-2017

¹⁵ Sum of average distribution rate of Sonora and production rate of Greenley for 11/8/07-11/8/10

¹⁶ Average distribution + transfers to ES, MV, CC.

¹⁷ Based on average 2010 commercial customer account use. Institutional demands are included in the Commerical customer class. Industrial demands, although included here, are negligible and do not change the overall unit demands.

¹⁸ Water systems above Phoenix Lake include Big Hill, Cedar Ridge, Crystal Falls, Peaceful Pines, Ponderosa Hills, Upper Basin

¹⁹ Water systems below Phoenix Lake include Apple Valley, Columbia/Gibbs, Cuesta/Lambert, East Sonora, Mono Village, Monte Grande, Phoenix Lake Park, Scenic View/Brook, Sonora/Jamestown, Wards Ferry Ranches

²⁰ Total households in system by 2010 census adjusted to 2017 via connections plus total connections in wholesale accounts assumed all SF residences

²¹ Plant Production for BH generally uses 2014 forward as that is when the BH>CG intertie started use.

APPENDIX D
Peaking Factors

System	Total ADD in system service area (adjusted for Transfers) (gpm)	Total MDD in system service area (adjusted for Transfers) (gpm)	MDD Notes	Date of MDD	Max Day Peaking Factor (MDD/ADD) ⁹	MDD Peaking Factor Notes	Total PHD in system service area (adjusted for Transfers) (gpm)	PHD Notes	Date (Time) of PHD	PHD/MDD	Peak Hour Peaking Factor (PHD/ADD)	PHD Peaking Factor Notes
Apple Valley	27	No Data		No Data	2.20	¹⁰	No Data		No Data	2.00	4.40	¹⁸
Big Hill	32	119	¹	8/5/2010	3.74		235	¹³	7/30/2010 (4-5pm)	1.97	7.39	
Cedar Ridge	60	172	²	No Data	2.86		No Data		No Data	2.00	5.72	¹⁸
Columbia/Gibbs	281	671	³	7/24/2008	2.39		1048		8/14/2008 (7-8am)	1.56	3.73	
Crystal Falls	370	875	⁴	8/4/2010	2.40	¹¹	1042	¹⁴	7/22/2010 (8-9am)	1.50	3.60	¹⁹
Cuesta Ctr. - Lambert Lakes	63	No Data		No Data	2.20	¹⁰	No Data		No Data	2.00	4.40	¹⁸
East Sonora	54	No Data		No Data	2.20	¹⁰	No Data		No Data	2.00	4.40	¹⁸
Mono Village	64	No Data		No Data	2.20	¹⁰	No Data		No Data	2.00	4.40	¹⁸
Monte Grande	67	109	⁵	6/28/2010	1.63		221	¹⁶	7/15/2009 (7-8am)	2.03	3.30	
Peaceful Pines	4	No Data		No Data	2.40	¹²	No Data		No Data	2.00	4.80	¹⁸
Phoenix Lake Park	12	No Data		No Data	2.20	¹⁰	No Data		No Data	2.00	4.40	¹⁸
Ponderosa Hills	105	290	²	No Data	2.76		No Data		No Data	2.00	5.52	¹⁸
Scenic View/Brook	52	161	²	No Data	3.11		No Data		No Data	2.00	6.23	¹⁸
Sonora/Jamestown	1253	2949	⁶	7/18/2009	2.35	¹¹	3807	¹⁶	7/20/2009 (8-9am)	1.50	3.53	¹⁹
Tuolumne City	139	367	⁷	7/22/2010	2.64		679		7/25/2009 (6-7pm)	1.85	4.89	
Upper Basin	197	354	⁸	7/18/2010	1.80		531	¹⁷	8/1/2010 (8-9am)	1.50	2.70	
Wards Ferry Ranches	11	No Data		No Data	2.20	¹⁰	No Data		No Data	2.00	4.40	¹⁸

Weighted Average Above Phoenix =	2.38	Small Systems with No Data Use -->	2.0 x MDD
Weighted Average Below Phoenix =	2.46	Large Systems with No Data or Unrepresentative Data Use-->	1.5 x MDD
Unweighted Mean Average =	2.43		
Small Systems with No Data (Above Phoenix)Use -->	2.40		
Small Systems with No Data (Below Phoenix)Use -->	2.20		
Large Systems with No Data or Unrepresentative Data Use-->	2.00		
(Crystal Falls and Sonora)			

Notes

- ¹ Max day demand from 6/1/08 - 6/1/10. Includes backwash water. Weeded out data for those days that were influenced by flushing new distribution system.
- ² From WTP operator log sheets for maximum daily production. May not represent a 24 hour period depending on the times in which the reading occurred.
- ³ Distribution meter data from 4/1/08 - 11/1/10.
- ⁴ Through monitoring changes in tank levels the outflow from the Comstock Reservoir was estimated at (678 gpm) + Upper Basin transfers (25 gpm) + Monte Grande transfers (172 gpm) = 875 gpm (All for 8/4/10) Outflow from Comstock Reservoir does not include services in the Comstock Ranch area. Since most services are connected to the Comstock Reservoir and there is not distribution meter on the reservoir, max day and peak hour flows are considered
- ⁵ Calculated as max day demand from distribution meter (360 gpm) - transfer to Crystal Falls (251 gpm). (All on 6/28/10)
- ⁶ Max day demand based on West Dist. Flow (1040 gpm) + East Dist. Flow (1392 gpm) + Greenley Unit #1 Prod. (345 gpm) + Greenley Unit #2 Prod. (345 gpm) - average transfers to East Sonora and Cuesta Lambert (173 gpm)= 2,949 gpm. The District does not have a distribution meter on the Greenley tank or data on max daily transfer rates to East Sonora and Cuesta Lambert; therefore, max day and peak hour flows are considered unrepresentative.
- ⁷ Distribution meter data for 10/1/09 - 10/1/10.
- ⁸ Max distribution flow (380 gpm) - transfers to Crystal Falls (26 gpm) = 354 gpm. (All on 7/18/10).
- ⁹ The max day demand values do not account for the possibility that consumption exceeded production on a specific day and levels of system storage tanks experienced a net decrease.
- ¹⁰ Assumes the peaking factor is equal to the weighted average for systems below Phoenix Lake (MDD/ADD = 2.20)
- ¹¹ Calculated values of MDD/ADD for both systems are +/-1.80. The Sonora/Jamestown system does not have a distribution meter on the Greenley Tank and the Crystal Falls system does not have a distribution meter on the Comstock Tank. Therefore, calculated values for MDD/ADD could underestimate peak flows from these two tanks.
- ¹² Assumes the peaking factor is equal to the weighted average for systems above Phoenix Lake (MDD/ADD = 2.40)
- ¹³ Peak hour distribution flows could be influenced by backwashes.
- ¹⁴ Calculated as Crystal Falls WTP distribution above Comstock Res. (771 gpm) + Upper Basin transfers (22 gpm) + Monte Grande transfers (248 gpm) = 1,041 gpm. (All on 7/22/10). Since there is no distribution meter on the Comstock Tank the peak hour flow is considered unrepresentative.
- ¹⁵ Calculated as Monte Grande WTP distribution (467 gpm) - transfers to Crystal Falls (266 gpm) = 201 gpm. (All on 9/16/10).
- ¹⁶ Based on West Dist. Flow (1584 gpm) + East Dist. Flow (1698 gpm) + Greenley Unit #1 Prod. (351 gpm) + Greenley Unit #2 Prod. (347 gpm) - average transfers to East Sonora and Cuesta Lambert (173 gpm)= 3,807 gpm. The District does not have a distribution meter on the Greenley tank or data on peak hour transfer rates to East Sonora and Cuesta Lambert. Data on peak hour flows is considered unrepresentative.
- ¹⁷ Peak hour distribution flow (553 gpm) - transfers to Crystal Falls (27 gpm) = 526 gpm. (All on 7/14/10).
- ¹⁸ For small systems with no data or unrepresentative data (PHD/MDD = 2.00) Per AWWA M32 typical ranges for PHD/ADD are 1.2 - 2.5.
- ¹⁹ For large systems with no data or unrepresentative data (PHD/MDD = 1.50) Per AWWA M32 typical ranges for PHD/ADD are 1.2 - 2.5

APPENDIX E
ADD, MDD PHD BY SYSTEM AND YEAR

ADD, MDD & PHD BY SYSTEM BY YEARS 2017-2037-2057

Updated March 3/7/2018

SYSTEM	2017			MDD		2037			2057+			MDD Factor	increase in demand	
	ADD (gpm)	MDD (gpm)	PHD (gpm)	MDD 5 years 2022	MDD 10 years 2027	ADD (gpm)	MDD (gpm)	PHD (gpm)	ADD (gpm)	MDD (gpm)	PHD (gpm)		2017-2037	2037-2057
Upper Basin	197	354	531	497	639	513	925	1387	596	1073	1609	1.80	571	148
Crystal Falls	370	882	1332	976	1070	524	1258	1888	597	1433	2150	2.38	377	175
Cedar Ridge	60	172	344	180	188	72	205	410	90	259	517	2.86	33	54
Ponderosa Hills	105	290	580	299	308	118	326	653	140	387	774	2.76	36	61
Tuolumne City	139	367	679	384	401	164	435	805	193	510	944	2.64	68	75
Monte Grande	67	109	221	111	112	71	115	233	75	122	248	1.63	6	7
Big Hill	32	119	235	125	131	38	143	282	45	167	330	3.74	24	24
Columbia/Gibbs	281	671	1048	724	776	369	881	1376	421	1006	1571	2.39	210	125
Sonora/Jamestown	1253	2949	4424	3113	3278	1532	3606	5409	1826	4299	6449	2.35	657	693
East Sonora	54	118	236	118	119	54	119	239	55	121	241	2.20	1	1
Cuesta Ctr. - Lambert Lakes	63	138	275	173	208	126	278	556	148	326	653	2.20	141	48
Mono Village	64	141	282	174	207	124	274	548	172	379	759	2.20	133	106
SONORA Total	1433	3345	5216	3578	3811	1837	4277	6752	2202	5126	8102		932	848
Phoenix Lake Park	12	27	54	27	27	13	28	56	13	30	59	2.20	1	1
Scenic View/Brook	52	161	322	177	193	72	225	449	77	241	481	3.11	64	16
Wards Ferry Ranches	11	24	48	25	25	12	27	54	14	30	60	2.20	3	3
Peaceful Pines	4	10	20	10	10	4	10	21	5	12	23	2.40	0	1
Apple Valley	27	60	119	65	71	38	83	165	47	103	206	2.20	23	21