CALAVERAS COUNTY WATER DISTRICT

EBBETTS PASS
SYSTEM EVALUATION

November 2013

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This report titled:

Calaveras County Water District
Ebbetts Pass System Evaluation

has been prepared by or under the direct supervision of the following registered Civil Engineers:

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1 EXECUTIVE SUMMARY

1.1 EXECUTIVE SUMMARY

The Ebbetts Pass Water System serves multiple communities along the Ebbetts Pass/Highway 4 corridor that range in elevation from approximately 3,000 feet to over 5,300 feet. The system consists of 65 pressure zones, 16 storage tanks, 9 pumping stations, one water treatment facility, and over 120 miles of distribution mains. In 2005, a water master plan was developed during the housing boom when growth projections were much more optimistic than they are today. Since the development of the 2005 Ebbetts Pass Water Master Plan, the housing market has crashed, water demands have receded, and the District budget for capital improvement projects has been drastically reduced. With these changes, many of the policies adopted in 2005 for planning needed to be revisited. Most of the capital improvement projects identified in 2005 remain outstanding and review of the 2005 Water Master Plan reveals little or no changes in development. Table 1-1 summarizes the differences in planning criteria between the 2005 Water Master Plan and this System Evaluation.

Table 1-1. Comparison of 2005 and 2013 Planning Criteria

Criteria	2005	2013
Growth Projections		
Growth Rate	1.60%	0.60%
Existing Connections	5,446	5,820
Estimated Future Connections	1,925	1,551
Total Buildout Connections	7,371	
Water Demand Projections		
Existing WTP Annual Production (Mgal/yr)	620	552
Existing WTP Maximum Day Production (mgd)	3.4	3.5
Actual Water Demand (gpd/conn)	270	251
Projected Overall Water Demand @ Buildout (gpd/conn)	500	250
MDD:ADD Peaking Factor	2	2.3
PHD:MDD Peaking Factor	1.5	1.5
Projected Regional Water Demand (gpd/conn)	All Regions 500	360 for Region 1 240 for Region 2 190 for Region 3
Projected WTP Production @ Buildout (mgd) Average Day Maximum Day Peak Hour	 4.0 8.1 12.2	 2.5 5.5 7.5
System Evaluation		
WTP Raw Water Supply	Maximum Day	
WTP Treatment Capacity	Maximum Day	
Treated Water Storage Capacity	4 hours Fire Flow + 4 hours Maximum Day + 20% Maximum Day	
Booster Pump Station Capacity	Maximum Day with largest pump out of service	

1.2 RECOMMENDATIONS

Recommended improvements have been divided into five-year planning phases to facilitate implementation and to assist CCWD in planning and funding the water system improvements. Table 1 summarizes the recommended improvement cost per phase. Detailed tables of the costs are included in Appendix A.

Table 1-2. Summary of Capital Improvement Costs

Recommended Improvement	Phase I Year 1 to 5	Phase II Year 6 to 10	Phase III Year 11 to 15	Phase IV Year 16 to 20
Water Supply		$500,000		
Water Treatment		$2,250,000		
Piping	$3,200,000	$3,200,000	$3,200,000	$3,200,000
Storage Tanks	$2,788,000	$2,879,000		
Booster Pumping	$277,000			$479,000
Standby Generators	$293,000	$68,000		
Subtotal Cost	**$6,558,000**	**$8,897,000**	**$3,200,000**	**$3,679,000**
Contingency (25%)	$1,640,000	$2,224,000	$800,000	$920,000
Engineering, Administration, CM (20%)	$1,312,000	$1,779,000	$640,000	$736,000
Total Cost	**$9,510,000**	**$12,900,000**	**$4,640,000**	**$5,335,000**
Total Improvement Cost = $32,400,000				

2 EXISTING SYSTEM

2.1 EXISTING SERVICE AREA

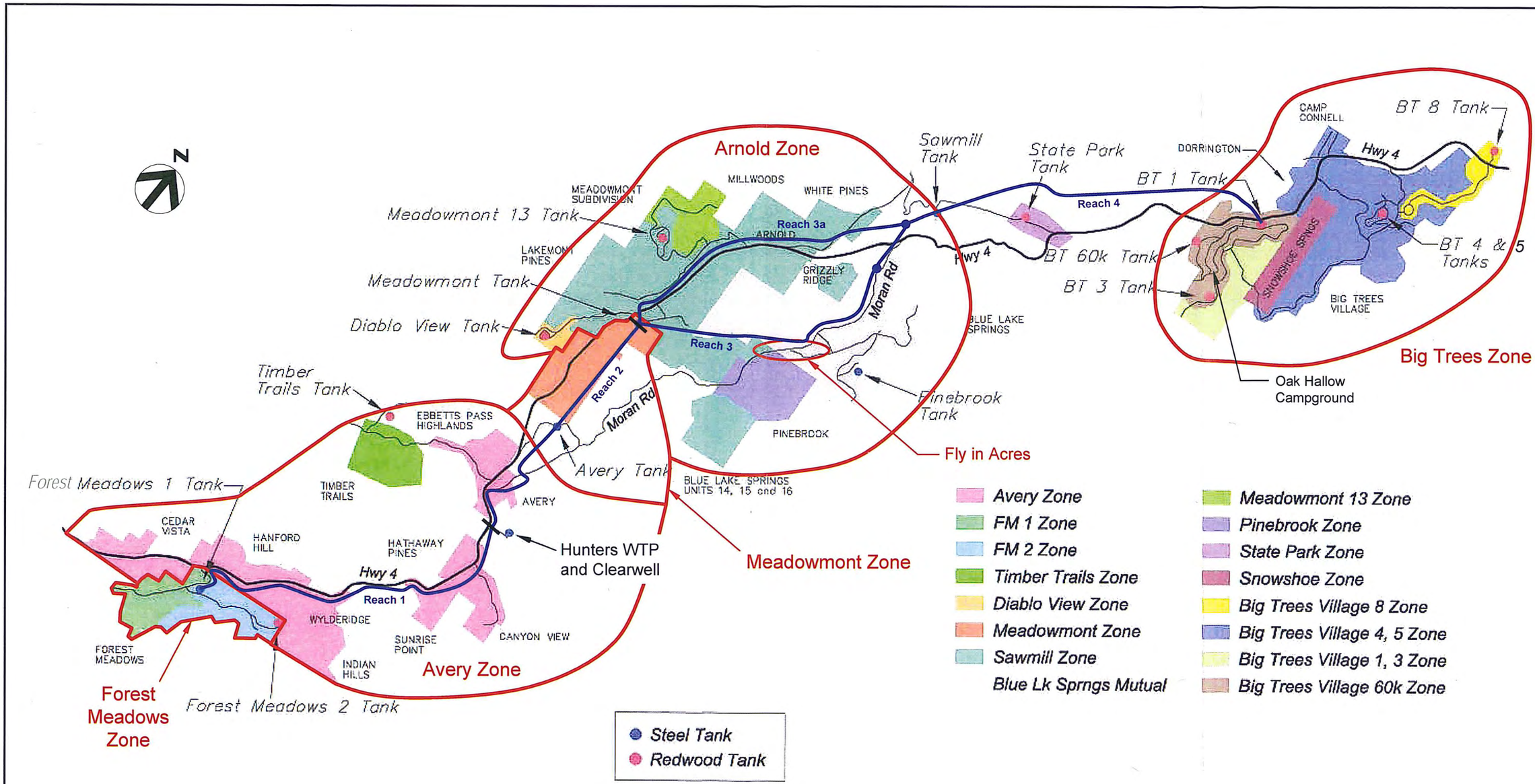
Calaveras County Water District's (CCWD's) Ebbetts Pass Water System supplies treated water to businesses and residents along the Ebbetts Pass/Highway 4 corridor. The service area ranges in elevation from approximately 3,000 feet to over 5,300 feet and encompasses the communities of Forest Meadows, Hathaway Pines, Avery, Arnold, White Pines, Dorrington, Camp Connell, and the Calaveras Big Trees State Park. The existing service area is defined by the limits of the Stanislaus National Forest. An overview of the Ebbetts Pass Water Distribution System is shown in Figure 2-1.

The existing water supply is drawn from the Collierville Tunnel and transported via a 20 inch pipeline to the 4 million gallon per day (mgd) Hunters Water Treatment Plant (WTP). According to CCWD records, the existing water system supplies 5,820 retail connections within the Ebbetts Pass service area. Included in these connections are two schools: Hazel Fischer School (approximately 300 elementary school students) and Avery Middle School (approximately 300 junior high students). The system also serves six wholesale connections: Timber Trails, State Park, Oak Hollow Campground, Snowshoe Springs, Fly in Acres, and Blue Lake Springs Mutual. Table 2-1 presents a summary of service area connections.

Table 2-1. Service Area Connections

Service Area	No. of Connections	Commercial	School
Big Trees 1,3	248	No	No
Big Trees 60K	303	No	No
Big Trees 4,5	920	No	No
Big Trees 8	107	No	No
Subtotal — Big Trees	**1,578**	**No**	**No**
Sawmill	2,274	Yes	Yes
Meadowmont 13	259	No	No
Pinebrook	292	No	No
Diablo View	72	No	No
Meadowmont	93	Yes	No
Subtotal — Meadowmont-Sawmill	**2,990**	**Yes**	**Yes**
Avery	624	Yes	Yes
Forest Meadows 1 (Larkspur)	270	No	No
Forest Meadows 2 (Heather)	358	No	No
Subtotal – Avery-Forest Meadows	**1,252**	**No**	**No**
Wholesale Connections	6	No	No
System Total	**5,826**		

Figure 2-1. Ebbetts Pass Water Distribution System



Ebbetts Pass Water
Main Distribution System

*Figure provided by CCWD

FIGURE 2-1

2.2 WATER SUPPLY

Raw water for the Ebbetts Pass water system is drawn from the Collierville Tunnel, which is part of the North Fork Stanislaus River Hydroelectric Development Project, and transported via a 20-inch pipeline to the Hunters Water Treatment Plant. An overview of the Hunters WTP is shown in Figure 2-2.

Figure 2-2. Overview of Hunters WTP

Image © 2007 DigitalGlobe

The Collierville granite tunnel delivers water from McKay's Point diversion dam on the Stanislaus River to the Collierville power station located east of Forest Meadows. The tap to the tunnel, called Mill Creek tap, is located about a mile from the Hunters WTP. The McKay's Point diversion dam is owned and operated by Northern California Power Association (NCPA). The NCPA is a cooperative formed by several cities that own the diversion dam and the power plant, while CCWD and Pacific Gas and Electric (PG&E) own the water rights. Under the agreement between CCWD and PG&E, the NCPA is required to deliver a minimum of 80 cfs to the Mill Creek tap and maintain a minimum of 16.5 cfs in the North Fork of the Stanislaus River. Of the 80 cfs delivered to the tap, CCWD uses between 3 to 6 cfs and the remaining water goes to PG&E for power generation.

The Mill Creek tap off of the Collierville tunnel is designed to provide greater than 4 MGD flow by gravity. The McKay's Point diversion dam reservoir has approximately 2,000 acre-feet of storage capacity.

CCWD relies on Hunters Reservoir for water supply when the McKay's Point diversion dam is removed from service for maintenance (approximately once per year for about 4-7 days as needed). During maintenance, the dam is drained to clean debris off of the screens at the entrance to the Collierville tunnel. Hunters Reservoir receives water from the North Fork of the Stanislaus River via the Utica Ditch. Hunters Reservoir is owned and operated by the Utica Power Authority.

2.3 WATER TREATMENT FACILITIES

The Hunters Water Treatment Plant is located east of State Route 4 and West of Hunters Reservoir along Hunters Dam Road in Arnold, California. The Hunters WTP, originally constructed in 1965, was expanded to 4.0 MGD in 1992. The WTP uses a one million gallon clearwell and pumping station with firm capacity of 2,800 gpm to supply treated water to the Ebbetts Pass Water System.

The Hunters WTP facilities currently include two 2-MGD-capacity treatment units, two backwash/filter-to-waste sedimentation basins, a treated water pump station, chemical storage and metering equipment for the coagulant polymer, sodium hypochlorite and zinc orthophosphate. The finished water is stored in an on-site clearwell with a storage capacity of 1 million gallons, for chlorine contact, before it is delivered the distribution system.

The treatment processes provided at the Hunters WTP includes coagulation, upflow contact clarification and mixed media gravity filtration using Microfloc alternative treatment technology, post chlorination and addition of a corrosion control chemical. The treatment system consists of two treatment units each having a nominal design capacity of 2 MGD.

As part of the WTP expansion in 1992, the Hunters Pumping Station was constructed with three vertical turbine pumps (two duty, one standby) with provisions for installing a fourth pump to increase the pumping capacity to 5 mgd. Each pump is rated for 1,400 gpm at 380 feet TDH. The pumps are housed with the filter backwash pump in a prefabricated metal building. A diesel generator is located outside the building and provides standby power for both the pumping station and water treatment plant. A summary of the Hunters WTP facilities is shown in Table 2-2.

Table 2-2. Summary of Hunters WTP Facilities

Hunters Water Treatment Plant	
Facility Nominal Capacity	4 mgd
Old Hunters Raw Water Booster Pumps (Hunters Reservoir)	
Number	3
Capacity	2,500 gpm (total all three)
Treatment Units	
Number	2
Type	Factory Built, Adsorption Clarification, Mixed Media Filtration
Nominal Capacity, Each	2 mgd (1400 gpm)
Length (each)	39'-10"
Width (each)	11'-11"
Height (each)	10'-1"
Filter Area (each)	280 ft^2
Adsorption Clarifier Area (each)	140 ft^2
Filter Design Rate	5.0 gpm/ft^2
Filter Type	Gravity
Filter Media	Tri-mixed
Backwash Flow @ 15 gpm/ft^2	4,200 gpm
Clarifier Design Rise Rate	10 gpm/ft^2
BW/FTW Sedimentation Basins	
Number	2
Nominal Capacity	138,000 gallons (each)
Length	140 ft
Width	62 ft
Depth	10.5 ft total, 5.0' nominal, 5.5' freeboard
Steel Clearwell	
Number	1
Volume	1,000,000 gallons
Diameter	90 ft
Sidewall Height	24 ft
High Service (Treated Water) Pumps	
Number	3 (space for 1 future)
Type	Vertical Turbine, Canned
Number of Stages	6
Capacity	1,400 gpm each
Rated Head	380 ft
Horsepower	200
Motor	480 V, 60 Hz, 3 Phase, Constant Speed, 1,800 rpm,
Control	Soft Start

Reference - CCWD Hunters WTP Operations Plan[2]

2.4 DISTRIBUTION SYSTEM

The Ebbetts Pass service area spans over several subdivisions and small towns along Highway 4 from Utica Grade, past the town of Murphy's, up to Camp Connell in the Big Trees Park area.

Water distribution is accomplished through a series of pumping stations and storage tanks along the Highway 4 corridor. The existing water system supplies 5,820 retail connections and six wholesale connections within the Ebbetts Pass service area. The Ebbetts Pass Water system consists of 65 pressure zones, 16 storage tanks, 9 pumping stations, over 120 miles of distribution lines, and over 100 pressure reducing stations.

There are five main service zones within the Ebbetts Pass Water System:

- Big Trees
- Sawmill
- Avery
- Meadowmont
- Forest Meadows

Water in each pressure zone is pumped from the tanks serving the zone below, up to the tanks serving that zone. System demands are met by a combination of pumped flow and gravity flow from the tanks.

2.4.1 Storage Facilities

Table 2-3 is a summary of the storage tanks available in each zone. These storage tanks equalize the demands during normal operations, provide emergency storage during power outages and provide fire fighting storage. Figure 2-3 shows a schematic of the tank and pump station layout.

Table 2-3. Summary of Existing Storage Facilities

TANK	Elevation (FT)	Volume (GAL)	Tank Material
Hunters WTP Clearwell	3,200	950,900	Steel
Timber Trails	3,830	52,800	Redwood
Forest Meadows 1 (Larkspur)	3,441	147,900	Steel
Forest Meadows 2 (Heather)	3,691	458,000	Redwood
Avery	3,515	712,700	Steel
Meadowmont	3,925	264,000	Steel
Pinebrook	4,305	1,000,000	Steel
Meadowmont 13	4,265	101,000	Redwood
Sawmill	4,470	2,840,000	Steel
State Park	--	42,300	Redwood
Big Trees 1	4,920	98,300	Redwood
Big Trees 3	4,930	98,300	Redwood
Big Trees 4 & 5 (2 Tanks)	5,245	186,000	Redwood
Big Trees 8	5,355	98,300	Redwood
Big Trees 60k	5,210	55,600	Redwood
System Total		**7,106,100**	

2.4.2 Pumping Stations

Table 2-4 presents a summary of the pumping stations available in each zone.

Table 2-4. Summary of Existing Pumping Station Facilities

Pumping Station	Total Capacity GPM	Firm Capacity GPM	Pump 1 HP	Pump 1 GPM	Pump 2 HP	Pump 2 GPM	Pump 3 HP	Pump 3 GPM
Hunters WTP	4200	2800	200	1400	200	1400	200	1400
Timber Trails	195	95	15	100	15	95	--	--
Forest Meadows 1	900	450	40	450	40	450	--	--
Avery	5100	3400	200	1700	200	1700	200	1700
Meadowmont	5400	3600	350	1800	350	1800	350	1800
Sawmill	610	320	25	175	25	145	50	290
Dorrington	200	100	15	100	15	100	--	--
Big Trees 1	195	95	15	95	15	100	--	--
Big Trees 4 & 5	96	46	3	50	3	46	--	--

Figure 2-3. Ebbetts Pass Water System Schematic Tank and Pump Station Layout

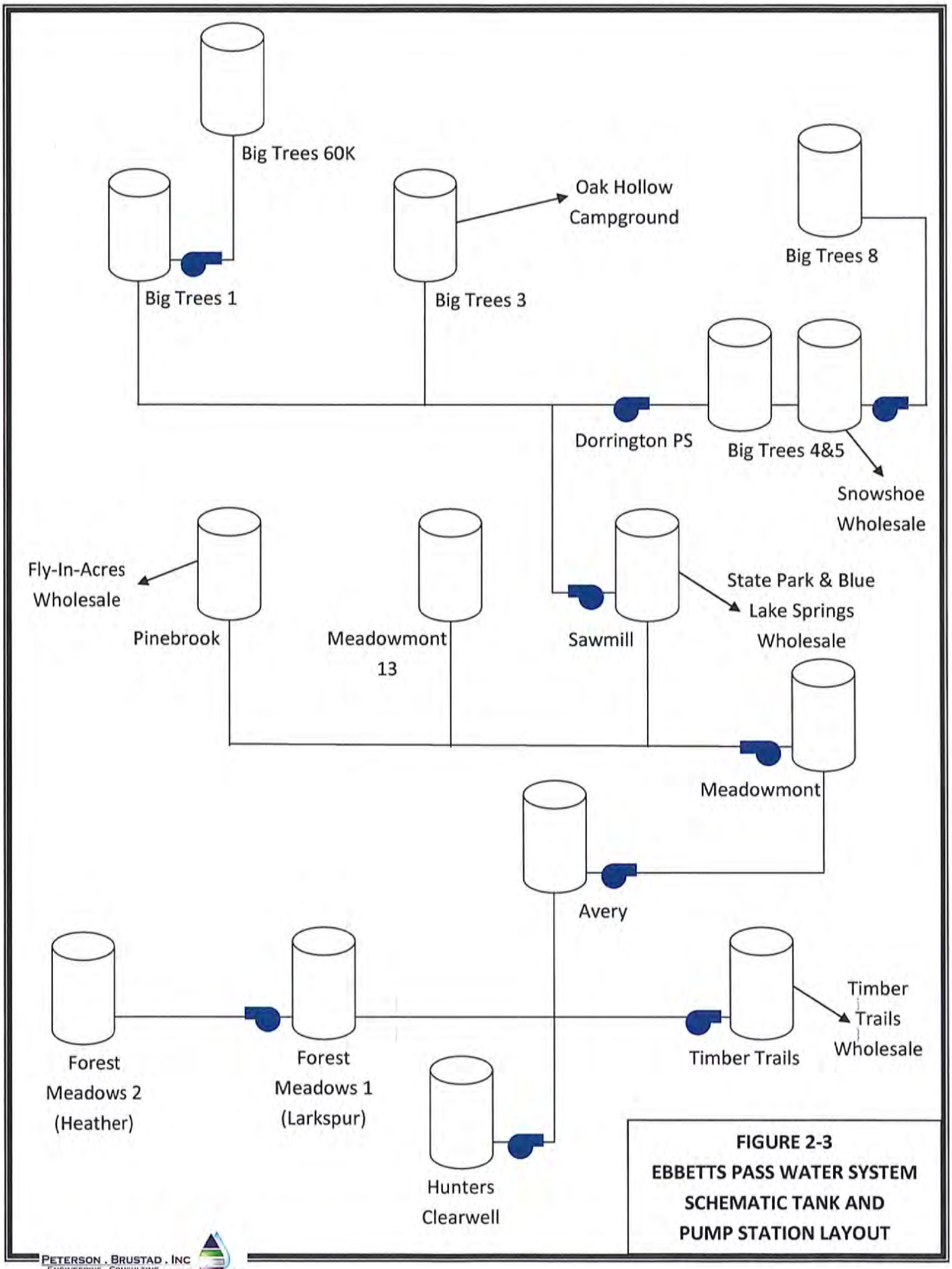


FIGURE 2-3
EBBETTS PASS WATER SYSTEM
SCHEMATIC TANK AND
PUMP STATION LAYOUT

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Several of the pumping stations have been equipped with a standby power generator system. Table 2-5 summarizes generator information at the various water facilities in the system.

Table 2-5. Summary of Existing Standby Power Generator Systems

Pumping Station	KW	RPM	HP	Amps	Generator Model	KVA	Volts	Fuel Tank Size
Hunters WTP and Booster Pumping Station	275	1800	435	954	275DFBF40038F	344	120 / 480	500 Diesel
Avery Tank and Pumping Station	500	1800	750	752	500C2	625	120 / 480	1000 Diesel
Meadowmont Tank and Pumping Station	800	1800	1340	1203	900CB2	1000	120 / 480	1000 Diesel
Sawmill Tank and Pumping Station	80	1800	156	301	6GA01639	100	240	500 Diesel

2.4.3 Pipelines

The distribution system supplies both fire demands and the peak usage demands of the Ebbetts Pass Water system. The distribution pipelines vary in diameter from four to 14 inches. The Ebbetts Pass system water mains are summarized in Table 2-6.

Table 2-6. Summary of Ebbetts Pass System Water Mains

Material	Amount	Size	Class/Gage	Condition
A.C.	40%	6"-12"	150 psi	Good to Poor
PVC	10-15%	4"-12"	C900	Good
Ductile Iron	<5%	8"	N/A	Good
Steel	40%	8"-14"	N/A	Poor
Techite	1%	14"	N/A	Poor

Reference - CCWD Hunters WTP Operations Plan

3 PLANNING AREA DESIGNATIONS AND GROWTH PROJECTIONS

3.1 FUTURE GROWTH AREAS

Facility maps provided by CCWD showed the existing service areas of the Ebbetts Pass water system. A breakdown of the existing number of connections for each tank zone was provided by CCWD. The number of connections for each zone was needed to estimate the existing water demands for each zone and to appropriately size the system's storage facilities.

A summary of the existing and projected future build out connections is shown in Table 3-1.

Table 3-1. Number of Existing and Projected Build-Out Retail Connections in the Ebbetts Pass Service Area

Service Area	Basis of Growth	Existing Connections	Estimated Future Connections	Total Build Out Connections[a]
Big Trees Village 1 & 3	Infill of Available Lots	248	46	294
Big Trees Village 60k	Infill of Available Lots	303	48	351
Big Trees Village 4 & 5	Infill of Available Lots	920	162	1,082
Big Trees Village 8	Infill of Available Lots	107	6	113
Subtotal - Big Trees		**1,578**	**262**	**1,840**
Sawmill	Proposed Development (Lake Meadows)	2,274	32	2,306
Meadowmont Zone	Proposed Development (Ellis Project)	93	341	434
Meadowmont 13	Infill of Available Lots	259	18	277
Pinebrook	Infill of Available Lots	292	59	351
Diablo View	Infill of Available Lots	72	12	84
Subtotal – Meadowmont-Sawmill		**2,990**	**462**	**3,452**
Avery Zone	Proposed Development (Red Apple)	624	25	649
Forest Meadows 1 (Larkspur)	Proposed Development	270	400	670
Forest Meadows 2 (Heather)	Proposed Development	358	402	760
Subtotal – Avery-Forest Meadows		**1,252**	**827**	**2,079**
System Total		**5,820**	**1,551**	**7,371**

(a) Per the Ebbetts Pass Water System Master Plan (May 2005)

Future growth areas were identified by overlaying the land use maps from the existing general plans (Ebbetts Pass Highway Special Plan, Arnold Community Plan, and the Avery-Hathaway Pines Community Plan) onto the existing system maps.

It is important to note that the Calaveras County General Plan and associated Community Plans are currently in the process of being updated. The County's General Plan update is currently scheduled to be complete by December, 2014. Because the existing Community Plans have not changed since 2005, no updates were made to the anticipated number of future connections as previously identified in the 2005 Water Master Plan. The following section describes the process used in the 2005 Master Plan for estimating the future number of connections.

The areas that are not currently developed were identified as future growth areas in accordance with the land use classifications provided in the general plans. For the Forest Meadows, Sawmill, Meadowmont and Avery areas, more detailed development plans were used to identify the future growth areas. Future residential growth is primarily anticipated within both the Meadowmont and Forest Meadows (Forest Meadows 1 and 2) pressure zones per the general plans and proposed development plans. Growth within the remaining service areas will be accomplished through infill.

The Ebbetts Pass Highway Special Plan (General Plan) identifies two substantial growth areas: one between Big Trees Village and Arnold and one between Forest Meadows and Murphys. The growth area south of Big Trees Village encompasses approximately 880 acres and is zoned as single family residential. At this point in time, growth in this area is considered unlikely and is not considered in this study.

The second growth area between Forest Meadows and Murphys is designated single family residential with five acre minimum lot size. The General Plan further identifies five acre minimum density areas to be served by well and septic. Therefore, this growth area will not be served by the Ebbetts Pass Water System and will not be considered in determining future demands.

The review of the Arnold Community Plan identified several smaller future growth areas. These areas lie within the Sawmill and Meadowmont existing pressure zones and are designated as either single family residential, multi-family residential, or rural residential.

The Avery-Hathaway Pines Community Plan noted that all areas designated for single family residential zones have been developed. The growth areas presented in the community plan were designated for rural residential with a five acre density. Again, the community plan further identifies five acre minimum density areas to be served by well and septic. Therefore, this growth area will not be served by the Ebbetts Pass Water System and will not be considered in determining future demands. No future growth areas are identified within the Avery-Hathaway Community Plan that will impact the Ebbetts Pass Water System.

The final growth area is associated with the Forest Meadows area, and this area is included in the Ebbetts Pass Community Plan. However, the development community has a detailed plan for build-out of the Forest Meadows area. The development plans provided and communicated by the development community will be used to determine

future connection and demands associated with the Forest Meadows area, which includes 930 future connections.

Several of the service areas have developments proposed that will be used to determine future connections in lieu of the general and special plans. These service areas include Sawmill, Meadowmont and Avery.

Within each Ebbetts Pass community, the evaluation assumed infill development would occur within the existing services built out areas.

For the 2005 Water Master Plan, the growth areas were expanded up to build-out conditions (7,371 connections) using an annual growth rate of 1.6%. Growth projections for the Ebbetts Pass water service area were recently reevaluated by CCWD as part of the 2010 *Urban Water Management Plan (UWMP)*[3] to coincide with California Department of Finance population projections and the County's General Plan Update. The UWMP uses an average annual growth rate of about 0.6% for the Ebbetts Pass water service area for the next 20 years. Therefore, a growth rate of 0.6% will be used for this System Evaluation.

A breakdown of total undeveloped lots for each service was provided by CCWD. Service areas without immediate development plans were assumed to develop 50 to 70 percent of the available lots at build-out. This assumption was based on the inability to develop several lots due to severe topography changes. These areas include Big Trees, Pinebrook and Diablo View.

The growth projections will be addressed in five year increments (Phases) up to the year 2033 and buildout. Table 3-2 presents the projected number of connections by Phase. Build-out conditions will not occur until about 2050, using the growth rate of 0.6%.

Table 3-2. Projected Number of Future Retail Connections by Phase

Service Area	Existing Connections	Phase I Total Connections (2018)	Phase II Total Connections (2023)	Phase III Total Connections (2028)	Phase IV Total Connections (2033)
Big Trees Village 1 & 3	248	253	259	264	270
Big Trees Village 60k	303	308	314	320	326
Big Trees Village 4 & 5	920	938	957	977	997
Big Trees Village 8	107	108	108	109	110
Subtotal – Big Trees	**1,578**	**1,607**	**1,638**	**1,670**	**1,703**
Sawmill	2,274	2,278	2,281	2,285	2,289
Meadowmont	93	132	172	213	256
Meadowmont 13	259	261	263	265	268
Pinebrook	292	299	306	313	320
Diablo View	72	73	75	76	78
Subtotal – Meadowmont-Sawmill	**2,990**	**3,043**	**3,097**	**3,152**	**3,211**
Avery	624	627	630	633	636
Forest Meadows 1 (Larkspur)	270	316	363	411	461
Forest Meadows 2 (Heather)	358	404	451	499	549
Subtotal – Avery-Forest Meadows	**1,252**	**1,347**	**1,444**	**1,543**	**1,646**
TOTAL:	**5,820**	**5,997**	**6,179**	**6,365**	**6,560**

4 DEMAND CHARACTERIZATION

Historical water production records from the Hunters WTP were utilized to determine the existing average day and maximum day water demands for the entire Ebbetts Pass water system. In addition, the Ebbetts Pass water system was broken up into three different sub-regions in order to further refine the existing demands. The system was broken up for further analysis since historical water meter records show that demands vary from lower elevations to higher elevations within the system.

This section describes the existing system wide demands, the existing regional demands, and the projected future demands that are utilized for this 2013 update. The capacity of the water treatment facilities will be sized to meet the projected maximum day demands in five year phasing intervals and at build-out. According to CCWD's *Design and Construction Standards*[4], the distribution facilities (storage tanks and pumping stations) will be sized to meet anticipated maximum day demand plus fire flow.

4.1 EXISTING SYSTEM WIDE WATER DEMANDS

4.1.1 Average Water Demand

The existing Hunters WTP has a maximum capacity of 4 mgd and a firm capacity of 3.7 mgd. Per the 2005 Master plan, firm capacity is equal to 92.5 percent of the maximum capacity, which accounts for losses during backwash events. Firm capacity needs to meet the water system's maximum day demand.

Table 4-1 presents a summary of the annual production at the Hunters WTP from 2005 through 2012. The average retail water demand during economic boom years (2005-2007) is 260 gallons per day per connection (gpd/conn), while the recent (2010-2012) average retail water demand is only 243 gpd/conn. The difference in average retail water demand between these two different economic periods is only 7%.

Table 4-1. Ebbetts Pass Average Daily Demand per Retail Connection, 2005 - 2012

Year	Total Annual Production (Mgal)	Wholesale Connections Annual Demand (Mgal)	Total Annual Retail Demand (Mgal)	Number of Retail Connections	Average Daily Demand per Retail Connection (gpd/conn)
2005	620	84	536	5,590	263
2006	572	53[a]	519	5,716	249
2007	615	53[a]	562	5,730	269
2008	594	53[a]	541	5,738	258
2009	560	53[a]	507	5,749	242
2010	537	48	489	5,757	233
2011	538	26	512	5,759	244
2012	584	53[1]	531	5,761	253
Average	**578**	**53**	**525**	**--**	**251**

Notes: (a) Data not available, assume average of 2005, 2010 and 2011.

In determining the average demand per connection, six wholesale services had to also be considered. The Ebbetts Pass water system provides water to six wholesale services at Timber Trails, State Park, Oak Hollow Campground, Snowshoe Springs, Fly in Acres, and Blue Lake Springs Mutual. The demand from these wholesale services is not representative of demand from the remaining pressure zones served by the water system. Therefore, to determine the Ebbetts Pass water system's average demand per connection, the average annual demand for the wholesale services was deducted from the water system's average annual production.

The District's current *Design and Construction Standards* (2009) requires an average day demand of 500 gpd/conn for retail connections in the Ebbetts Pass system, which is approximately twice the actual average water demand from 2005 to 2012. Based upon the historical demand records, using an average daily demand of 500 gpd/conn for planning purposes will result in future water facilities that are larger than needed. Consequently, the connection fees for future customers may be higher than necessary.

To better reflect the actual operating conditions for the Ebbetts Pass water system, district staff has elected to use the existing historical average demand per connection (250 gpd/conn) for future demand planning purposes.

4.1.2 Maximum Day Water Demand

Table 4-2 presents a summary of the maximum day water production at the Hunters WTP from 2005 through 2012. This table also presents the historical ratio of maximum day demand to average day demand, which is known as the maximum day peaking factor. The maximum day water demand during economic boom years (2005-2007) is 549 gpd/conn, while the recent (2010-2012) average retail water demand is only 517 gpd/conn.

Table 4-2. Hunters WTP Maximum Day Water Production, 2005 – 2012 (WTP Production Data)

Year	Average Day Production (Mgal/Day)	Maximum Day Production (Mgal/Day)	Maximum Day Demand (gpd/conn)	Maximum Day Peaking Factor
2005	1.70	3.40	526	2.0
2006	1.57	3.55	564	2.3
2007	1.68	3.49	557	2.1
2008	1.62	3.47	552	2.1
2009	1.53	3.92[a]	618[a]	2.5
2010	1.47	3.51	555	2.4
2011	1.47	2.98	492	2.0
2012	1.60	3.18	504	2.0
Average	**1.58**	**3.44**	**546**	**2.2**

Notes: (a) The days prior to this maximum day were nearly half the production of the peak day (2.0 vs 3.9 mgd). It appears that the WTP production increase lagged behind the increase in demand, causing increased demand for production at the WTP. The day following the maximum day dropped to 3.5 mgd.

The District's *Design and Construction Standards* (2009) require a maximum day peaking factor of 2.0, which results in a maximum water demand of 1,000 gpd/conn for retail connections in the Ebbetts Pass system when combined with the 500 gpd/conn

standard. This value is nearly twice the actual maximum day water demand from 2005 to 2012.

To better reflect the actual operating conditions for the system, the average actual maximum day peaking factor (2.2) will be used in conjunction with the proposed average water demand (250 gpd/conn). This results in a maximum day water demand for the Ebbetts Pass water system of 550 gpd/conn. Using the historical peaking factor rather than 2.0 from the District's standards better reflects the actual system operation; vacation homes, with intermittent occupancy, lower the annual average usage and increase the peaking factor for the maximum day demand.

The maximum day demand observed in the past 8 years was 618 gpd/conn on September 5, 2009 (Saturday of Labor Day weekend), however, this value may have been artificially high.

4.2 EXISTING REGIONAL WATER DEMANDS

Historical water demand shows that demand varies from the lower elevations to the higher elevations within the Ebbetts Pass system. For planning purposes, the Ebbetts Pass water system was broken into three regions based on location:

- Region 1, Avery-Forest Meadows represents the western most and lowest elevations in the Ebbetts Pass water system. This region currently has 1,252 retail connections and is projected to have 2,079 retail connections at build-out.

- Region 2, Meadowmont-Sawmill represents the intermediate area of the Ebbetts Pass water system. This region currently has 2,990 retail connections and is projected to have 3,452 retail connections at build-out. This region also includes Blue Lake Springs, which could potentially add another 1,840 retail connections at buildout.

- Region 3, Big Trees represents the eastern most and highest elevations of the Ebbetts Pass water system. This region currently has 1,578 retail connections and is projected to have 1,840 retail connections at build-out.

Table 4-3 presents the average water usage for each region of the Ebbetts Pass water system based on water meter readings for 2010 through 2012. Table 4-3 also presents the demands to be used for future planning purposes based on the overall average demand per retail connection of 250 gpd/conn.

Table 4-3. Ebbetts Pass Annual Demand by Region, 2010 – 2012 (Water Meter Data)

Water System Region	Average Demand per Connection (gpd/conn)	Average Day Demand per Connection for Planning Purposes (gpd/conn)
Region 1 – Avery-Forest Meadows	346	360
Region 2 – Meadowmont-Sawmill	229	240
Region 3 – Big Trees	183	190
Average	**242**	**250**

4.3 PROJECTED BUILDOUT WATER DEMANDS

Table 4-4 summarizes the projected build-out water demands for the various Ebbetts Pass Water service areas. These demands will be used to estimate the WTP and distribution system build-out capacities. Future connections are identified using the 0.6 percent growth rate compounded annually. The wholesale connections were also addressed for growth. Five of the six wholesale connections were identified as being built-out at existing conditions and only Blue Lake Springs was identified for growth, which was projected using the 0.6 percent growth rate compounded annually.

Blue Lake Springs Mutual is an independent water system equipped with its own sources of supply that use interties with CCWD's Ebbetts Pass water system to supplement their supplies during peak demand events. Blue Lake Springs Mutual has 1,640 existing connections and anticipates an additional 200 connections at build-out.
Table 4-5 summarizes the projected demands for Blue Lake Springs.

Limited data is available for the individual wholesale water demand. Therefore, the previous assumptions for wholesale water demand in the 2005 Master Plan will be used with the following exception – Blue Lake Springs will be deleted from the existing demand and referenced as an emergency intertie only. Table 4-6 presents the values for existing and buildout wholesale water demand. A summary of the projected demands for the Ebbetts Pass water system is shown in Table 4-7.

Table 4-4. Existing and Buildout Retail Water Demands by Service Area

Service Area	Planning Region	No. of Existing Conn.	Total Build Out Conn.	EXISTING DEMANDS			BUILDOUT DEMANDS		
				Avg. Day (MGD)	Max Day (MGD)	Peak Hour (MGD)	Avg. Day (MGD)	Max Day (MGD)	Peak Hour (MGD)
Big Trees Village 1 & 3	3	248	294	0.05	0.10	0.14	0.06	0.12	0.17
Big Trees Village 60k	3	303	351	0.06	0.13	0.17	0.07	0.15	0.20
Big Trees Village 4 & 5	3	920	1,082	0.17	0.38	0.52	0.21	0.48	0.62
Big Trees Village 8	3	107	113	0.02	0.04	0.06	0.02	0.05	0.06
Subtotal - Big Trees	**3**	**1,578**	**1,840**	**0.30**	**0.66**	**0.90**	**0.35**	**0.77**	**1.05**
Sawmill	2	2,274	2,306	0.55	1.20	1.64	0.55	1.22	1.66
Meadowmont	2	93	434	0.02	0.05	0.07	0.10	0.23	0.31
Meadowmont 13	2	259	277	0.06	0.14	0.19	0.07	0.15	0.20
Pinebrook	2	292	351	0.07	0.15	0.21	0.08	0.19	0.25
Diablo View	2	72	84	0.02	0.04	0.05	0.02	0.04	0.06
Subtotal - Sawmill Zone	**2**	**2,990**	**3,452**	**0.72**	**1.58**	**2.16**	**0.82**	**1.82**	**2.48**
Avery	1	624	649	0.22	0.49	0.67	0.23	0.51	0.70
Forest Meadows 1 (Larkspur)	1	270	671	0.10	0.21	0.29	0.24	0.53	0.72
Forest Meadows 2 (Heather)	1	358	759	0.13	0.28	0.39	0.27	0.60	0.82
Subtotal - Forest Meadows	**1**	**1,252**	**2,079**	**0.45**	**0.99**	**1.35**	**0.74**	**1.64**	**2.24**
Total Retail Demand		**5,820**	**7,371**	**1.5**	**3.2**	**4.4**	**1.9**	**4.2**	**5.8**

Table 4-5. Projected Buildout Demands for Blue Lake Springs

Service Area (By Tank Zone)	Planning Region	No. of Existing Conn.	Total Build Out Conn.	EXISTING DEMANDS			BUILDOUT DEMANDS		
				Avg. Day (MGD)	Max Day (MGD)	Peak Hour (MGD)	Avg. Day (MGD)	Max Day (MGD)	Peak Hour (MGD)
Blue Lake Springs	2	1[(a)]	1,840	-	-	-	0.44	0.97	1.32

Notes: (a) Emergency Intertie Only

Table 4-6. Wholesale Average Water Demand, Existing and Buildout

Wholesale Connection	Associated Service Area	Existing Average Water Demand (MGD)	Buildout Average Water Demand (MGD)
Blue Lake Springs	Sawmill	Emergency Intertie Only	0.44
Fly In Acres	Pinebrook	0.02	0.02
Oak Hollow Campground	Big Trees 60k	0.01	0.01
Snowshoe Springs	Big Trees 4&5	0.05	0.05
State Park	Sawmill	0.03	0.03
Timber Trails	Avery	0.02	0.02
Total	--	**0.14**	**0.57**

Table 4-7. Combined Retail and Wholesale Demands by Planning Phase

Planning Phase	Avg. Day Demand (MGD)	Max Day Demand (MGD)	Peak Hour Demand (MGD)
Existing Demands	1.6	3.5	4.8
Phase I	1.7	3.6	5.0
Phase II	1.7	3.7	5.1
Phase III	1.8	3.9	5.3
Phase IV	1.8	4.0	5.5
Buildout	2.1	4.5	6.2
Buildout w/ Blue Lake Springs	2.5	5.5	7.5

5 EXISTING AND FUTURE REGULATIONS

5.1 DRINKING WATER REGULATIONS

The Safe Drinking Water Act (SDWA) of 1974 gave the United States Environmental Protection Agency (EPA) the authority to set standards for contaminants in drinking water supplies. The EPA established primary regulations for the control of contaminants that affect public health and secondary regulations for compounds that affect the taste, odor or aesthetics of drinking water. Under the provisions or the SDWA, the California Department of Public Health (CDPH) has the primary enforcement responsibility. Title 22 of the California Administrative Code establishes CDPH authority, and stipulates State drinking water quality and monitoring standards.

The SDWA drinking water regulations are summarized in Table 5-1 along with their potential impacts on the Ebbetts Pass water system.

Table 5-1. Regulatory Summary

Regulation	Key Provisions	Potential Impacts	Mitigating Action
Total Coliform Rule (TCR)	• Ensure absence of coliform bacteria in distribution system • Violations of rule lead to public notification	• Maintain disinfectant residual throughout distribution system • Operate storage tanks to maintain residual	• Disinfection strategies could increase disinfection byproduct formation
Groundwater Disinfection Rule (GWDR)	• Maintain minimum disinfectant residual of 0.2 mg/L in distribution system.	• Not applicable to Ebbetts Pass system	• None
Disinfectants/ Disinfection Byproduct Rule (D/DBPR)	• Stage 1 sets the MCLs for TTHM and HAA5 for system wide annual average • Stage 2 sets the MCLs for TTHM and HAA5 for individual sample location running annual average	• Ebbetts Pass system currently operated in compliance with Stage 1 • Expected to be in compliance with Stage 2, which starts in October 2013	• CCWD has successfully implemented disinfection, storage tank, and distribution system flushing plans to deal with DBP formation
Filter Backwash Recycle Rule	• Reduce potential risks posed from disinfectant resistant pathogens in the plant's recycle flows	• Requires minimum water quality requirements for recycled water • Limits volume of recycled water returned to the start to treatment	• Ebbetts Pass system currently operated in compliance with this rule
Arsenic Rule	• Lowers MCL to 5 ug/L	• Not applicable to Ebbetts Pass system	• None
Phase I, II, V Inorganics and SOCs	• Sets MCLs for a long list of organic compounds and several inorganics	• Current water sources meet MCLs	• None
Lead and Copper Rule (LCR)	• Requires treatment technique for optimal	• Stanislaus River Water is slightly corrosive	• Corrosion protection

Regulation	Key Provisions	Potential Impacts	Mitigating Action
	corrosion control treatment based on lead and copper Action Levels at consumers' water taps	• However, both lead and copper measured at homes are below the MCLs.	chemical already being added
Long Term Enhanced Surface Water Treatment Rule 2 (LT2SWTR)	• Treatment requirements for virus, giardia and cryptosporidium with specific log removals	• Cryptosporidium testing has placed the Ebbetts Pass system in "Bin 1" for treatment techniques	• Requires watershed controls, optimized pretreatment and high quality filter performance
Sulfate Rule	• Sets MCL for sulfate.	• Current water sources meet MCLs	• None
MTBE	• Sets Primary and Secondary MCLs for MTBE	• Current water sources meet MCLs	• None
Perchlorate	• Sets MCL for Perchlorate	• Current water sources meet MCLs	• None
NDMA	• Sets Action Level for NDMA	• Current water sources meet MCLs	• None

5.1.1 Regulatory Issues

The only issue the Ebbetts Pass system has dealt with in the past is coordinating compliance with the Total Coliform Rule and the D/DBP Rule. The Total Coliform Rule requires maintaining disinfectant residual throughout the large Ebbetts Pass distribution system. The D/DBP Rule limits the formation of disinfection byproducts and requires minimizing the chlorine residual and the contact time between the chlorine and the drinking water.

A study of the Ebbetts Pass water system Haloacetic Acid (HAA5) problems was performed in December 2003. The study identified treatment and distribution system modifications applicable to the Ebbetts Pass water treatment system for the reduction of haloacetic acid levels in the distribution system.

The recommendations of the December 2003 HAA5 study were:

- Continue to use chlorine as the primary and secondary disinfectant. Lower booster chlorine addition in the distribution system at the Sawmill Pumping Station.
- Continue to operate treatment plant for optimum TOC removal.
- Decrease water age by reducing the working volume of storage tanks in areas with excess storage capacity after considering all water demands, including fire along with adjusting PRV zones.
- Replace redwood storage tanks over time as needed for efficiency of operation and increased capacity

5.2 RECOMMENDATIONS

All of the recommendations above have been implemented except the replacement of redwood storage tanks. Therefore, this System Evaluation and associated capital improvement program will consider the replacement of all the redwood tanks with steel tanks over the next 10 years (Phases I and II). In addition, to allow for operational flexibility to reduce water age, a dual-tank system will be considered for each tank location requiring modification.

6 WATER SUPPLY

6.1 WATER SOURCE

The North Fork of the Stanislaus River is the source of water for the Ebbetts Pass system. Table 6-1 is a summary of the current consumptive water rights that are available.

Table 6-1. Summary of CCWD Water Rights for Consumptive Use on the Stanislaus River

Source	Direct Diversion (CFS)	Storage (AFA)	Point of Diversion/Storage Facility	Application No. (Permit No.)	Permitted Place of Use
North Fork Stanislaus	7[(b)] 3	-	McKays Point Dam, Utica Canal System	A012910 (15015)[(b)(c)]	Ebbetts Pass System, Slurry Pipeline
North Fork Stanislaus	7	-	Ramsey	A012912 (15017)[(b)]	Ebbetts Pass System
North Fork Stanislaus	3	-	McKays Point Dam	A012912A (14769)[(b)]	Ebbetts Pass System
North Fork Stanislaus		37,000	Spicer Meadow Reservoir	A019149 (15024)[(a)(b)]	Ebbetts Pass, Copper Cove System
North Fork Stanislaus		2,200	McKays Point Dam	A011792B (15013)[(a)(b)]	Ebbetts Pass, Copper Cove System
North Fork Stanislaus		350	North Fork Diversion	A019149 (15024)[(a)]	Ebbetts Pass, Copper Cove System
Highland Creek		152,000	Spicer Meadow Reservoir	A011792B (15013)[(a)(b)] A013091 (15018)[(a)(b)] A019149 (15024)[(a)]	Ebbetts Pass, Copper Cove System

(a) – Total amount of water is limited for use within the Copper Cove System to 6,000 acre-feet per annum under these permits.
(b) – CCWD may divert or re-divert up to 7 cfs for use in the Ebbetts Pass and 3 cfs (limited to 1,000 afa) to the Utica System for delivery to the slurry pipeline. The total amount of water, from all permits, is limited to 8,000 afa for the Ebbetts Pass system under these permits.
(c) – Permit No. 15015 grants a diversion right of 65 cfs but currently allows only 7 cfs to be diverted from March to July.

Together, these water rights allow 8,000 acre-feet annually (AFA) to be delivered to the Ebbetts Pass system for consumptive use. Permit No. 15015 restricts the amount of direct diversion to 7 cubic feet per second (CFS) in the Ebbetts Pass area during March 1 to July 1 of each year. Permit No. 14769 allows 3 CFS to be diverted all year round for use in Ebbetts Pass. Release from storage provides the water supply that is needed when direct diversions are insufficient during the other months of the year.

6.2 SUPPLY AND DEMAND COMPARISON

The water use per connection varies throughout the District and is reflective of the area demographics. The Ebbetts Pass system is a mixture of commercial, seasonal and fulltime occupancy use, which results in varied water consumption rates throughout the year.

The number of connections is anticipated to increase at an average rate of 0.6% annually over the next 20 years. This rate considered the geologic boundaries, type of development, and potential to expand beyond the current service area. For water supply planning purposes, the existing and future average day demand projections were compared to the existing available water supply.

Table 6-2 shows the supply and demand comparison for existing and projected future conditions. The District's water supplies, at the projected build-out of the service area as projected by the System Evaluation, are projected to be sufficient.

Table 6-2. Current and Projected Water Demand and Supply

Planning Phase	Avg. Day Demand (MGD)	Annual Demand (acre-feet)	Available Supply (acre-feet)
Existing Conditions	1.6	1,792	8,000
Phase I (2018)	1.7	1,904	8,000
Phase II (2023)	1.7	1,904	8,000
Phase III (2028)	1.8	2,016	8,000
Phase IV (2033)	1.8	2,016	8,000
Buildout	2.1	2,352	8,000
Buildout w/ Blue Lake Springs	2.5	2,800	8,000

7 SYSTEM EVALUATION

The Ebbetts Pass Water System was evaluated for its ability to meet existing and future water demands along with existing and future water quality requirements. Four different scenarios were analyzed as part of this Ebbetts Pass System Evaluation:

1. Existing System
2. Future System 20-year Projection (evaluated in 5-year phases)
3. Future System (at build-out) without Blue Lake Springs
4. Future System (at build-out) with Blue Lake Springs

The Ebbetts Pass water system facilities were divided into five categories for this evaluation: water supply, water treatment, distribution piping, water storage, booster pumping, and standby power generation facilities. A system-wide hydraulic model was developed for the 2005 Water Master Plan to analyze the system's distribution facilities, including storage, pumping, and piping. The model has not been updated for the 2013 System Evaluation. It is recommended that the model be updated with the new demand criteria in the future, prior to installing any new or replacement water mains, to ensure that the replacement water mains are adequately sized to meet future build out conditions.

7.1 WATER SUPPLY

Raw water is drawn from the Collierville Tunnel, which is part of the newly constructed North Fork Stanislaus River Hydroelectric Development Project, and transported via a 20-inch pipeline to the Hunters WTP. A prior study completed in 1986[6] that focused on water supply for Ebbets Pass concluded that an in-line booster station will be required prior to the end of Phase II. Drastic fluctuations in the reservoir level can reduce the head so that future demand will not be adequately conveyed to the WTP. It is recommended that the reservoir levels and water supply infrastructure needed to meet max day demand be re-evaluated as part of the recommended future water treatment plant upgrades. All capital improvement costs associated with the recommended water supply improvements are considered growth driven.

7.2 WATER TREATMENT FACILITIES

The Hunters WTP was expanded in 1992 to replace the old filtration plant that served the system since 1965. The WTP includes two contact clarification/filtration treatment trains, each with a production capacity of 2 mgd or 1400 gpm. With both trains in service, the WTP has a total production capacity of 4 mgd or 2,800 gpm.

Each train's treatment process includes coagulation, flocculation and clarification through a Microfloc Trident upflow clarifier, filtration through a Microfloc Trident Advent packaged mixed media gravity filter, and chlorination with sodium hypochlorite. Contact time for disinfection inactivation is provided in an on-site one million gallon circular clearwell storage tank.

The coagulated raw water flows through two adsorption clarifiers at a flow rate of 8.4 gpm/sf. Each clarifier has a total surface area of 140 square feet. The maximum hydraulic loading rate is 10 gpm per square ft. Each mixed media filter has an inside dimension of 25'-10" by 10'-10" (approximately 280 square feet footprint). The filter media consists of anthracite, silica sand, and garnet sand over support gravel. The filters are operated at 5 gpm per square feet. The average filter run is 24 hours or 5-feet of head loss, whichever occurs earlier. The clarifier and filter backwash water are discharged into one of two concrete backwash settling basins that are designed to recycle the washwater. After one-hour settling time, backwash water is recycled to the headworks. The average recycling rate is 3.57 percent (maximum 7.5 percent in 2001). Average reclaimed water turbidity ranged from 1.05 to 2.06 NTU with an average of 1.43 NTU during 2001.

The Hunters Pumping Station at the Hunters WTP has a pumping capacity of 2,800 gpm (4 mgd). The pumping station was constructed with three vertical turbine pumps (2 duty, 1 standby) with provisions for installing a fourth pump to increase the pumping capacity to 3,675 gpm (5.3 mgd). The pumps are housed along with the filter backwash pumps in a prefabricated metal building. A diesel generator, located outside the building, provides standby power for the pumping station and water treatment plant.

7.2.1 Future Water Demands

Table 7-1 summarizes the maximum day demands for each improvement phase.

Table 7-1. Ebbetts Pass Water System Maximum Day Demands and WTP Capacity

Planning Phase	Maximum Day Demand (MGD)	Actual WTP Firm Capacity (MGD)	Required WTP Nominal Capacity (MGD)
Existing	3.5	3.7	4
Phase I (5-Year)	3.6	3.7	4
Phase II (10-Year)	3.7	5.5	6
Phase III (15-Year)	3.9	5.5	6
Phase IV (20-Year)	4.0	5.5	6
Buildout	4.5	5.5	6
Buildout with Blue Lake Springs	5.5	5.5	6

7.2.2 Recommended Treatment Improvements

To meet the future maximum day demands, the Hunters WTP will require additional expansion. During Phase II, a third treatment train sized for 2 mgd is recommended to increase the WTP maximum capacity to 6 mgd and provide firm capacity of 5.5 mgd. This expansion would provide capacity that will last through buildout, including the addition of the Blue Lake Springs service area.

Since the WTP original trains (installed in 1992) will be approximately 30 years old at the time of expansion, an alternative to adding a third train would be to replace the

original treatment trains with a membrane microfiltration treatment system sized for 5 mgd.

A more detailed evaluation of the alternative treatment possibilities is recommended prior to expansion and is beyond the scope of this System Evaluation. All capital improvement costs associated with the expansion of the water treatment facilities are considered growth driven.

7.3 DISTRIBUTION FACILITIES

The Ebbetts Pass water system includes approximately 120 miles of distribution pipe. The pipe is summarized by size in Table 7-2.

Table 7-2. Existing Ebbetts Pass Distribution Pipe

Diameter (inches)	Total Length (miles)
2	0.5
4	2.0
6	79.0
8	29.5
10	2.8
12	5.5
14	1.5
16	0.6
18	1.2
20	0.2
Total	**122.8**

For budgetary planning purposes, a recommended amount of $640,000 per year has been identified for pipeline replacement projects within the Ebbetts Pass service area. This amount is based upon the replacement of 1% of the distribution system (~6,400 linear feet) each year, at a cost of $100 per linear foot. Per AWWA Manual of Practice M54[6], typical asset management policies for distribution systems state that approximately 1% to 2% should be replaced each year in order to adequately maintain the existing system. In addition, the 2005 Water Master Plan identified various sections of existing pipe that will need to be replaced in order to meet buildout conditions.

Because the distribution piping will be sized and replaced per buildout conditions, the capital improvement costs for the piping improvements are considered to be both growth driven and standard operation & maintentance (O&M). The growth driven component of the cost includes the effort of updating the hydraulic model (to determine appropriate piping size) and upsizing lines as necessary to meet future buildout demands.

In order to determine the appropriate distribution of cost between the growth driven and standard O&M components, an approach is needed that will achieve capital equity between existing and new customers. The formula outlined below presents the portion of the buildout pipeline that is attributable to the new connections:

$$\frac{7{,}371\ Buildout\ Connections - 5{,}820\ Existing\ Connections}{7{,}371\ Buildout\ Connections} = 0.21$$

Based upon the formula above, 21% of the piping replacement costs shall be considered growth driven, and 79% of the costs shall be considered standard O&M. Therefore, the recommended pipeline replacement budget shall be split as follows:

- $640,000/year total
- $134,000/year growth driven
- $506,000/year standard O&M

Note that these costs do not include improvements for Blue Lake Springs. The hydraulic model will need to be run to determine the specific improvements and the associated costs for the addition of the Blue Lake Springs connections.

7.3.1 Hydraulic Model Criteria

CCWD has an existing H20Map hydraulic model of the Ebbetts Pass distribution system. The model was last updated as part of the work performed for the 2005 Water Master Plan. Since the demands identified in the 2005 Water Master Plan have changed, it is recommended that the existing hydraulic model be updated to incorporate the demands identified in this 2013 update. It is recommended that the hydraulic modeling updates be performed prior to any future pipeline replacement work in order to adequately size the replacement pipelines for future build out conditions. In addition, it is recommended that a the hydraulic analysis include future scenarios both with and without Blue Lake Springs in order determine the direct hydraulic impacts of incorporating the Blue Lake Springs development into the existing system.

The paragraphs below summarize the criteria to be used for future hydraulic model updates.

CCWD's existing H20Map hydraulic model of the Ebbetts Pass water system includes approximately 1,050 pipe segments, approximately 900 junction nodes, and 16 storage tanks. The existing H2OMap model also includes several different model scenarios, each intended to represent a different set of demands, initial settings, pipe sizes, pump settings, and tank levels. The following 12 scenarios are recommended to be analyzed as part of future hydraulic model updates:

1) Existing Conditions – Average Day Demand
2) Existing Conditions – Max Day Demand
3) Existing Conditions – Peak Hour Demand
4) Existing Conditions – Max Day Demand plus Fire Flow
5) Buildout Conditions (w/out Blue Lake Springs) – Average Day Demand
6) Buildout Conditions (w/out Blue Lake Springs) – Max Day Demand

7) Buildout Conditions (w/out Blue Lake Springs) – Peak Hour Demand
8) Buildout Conditions (w/out Blue Lake Springs) – Max Day Demand plus Fire Flow
9) Buildout Conditions (w/ Blue Lake Springs) – Average Day Demand
10) Buildout Conditions (w/ Blue Lake Springs) – Max Day Demand
11) Buildout Conditions (w/ Blue Lake Springs) – Peak Hour Demand
12) Buildout Conditions (w/ Blue Lake Springs) – Max Day Demand plus Fire Flow

Table 7-3 summarizes the existing and projected buildout demands for the Ebbetts Pass Water System.

Table 7-3. Existing and Projected Buildout Demands for the Ebbetts Pass Water System

Planning Phase	Avg. Day Demand (MGD)	Max Day Demand (MGD)	Peak Hour Demand (MGD)
Existing Demands	1.6	3.5	4.8
Buildout w/ Blue Lake Springs	2.5	5.5	7.5

An important function of a water distribution system is to provide water to fight fires. The Ebbetts Pass Fire District has established fire flow requirements for the system. The fire is assumed to occur during maximum day demand conditions. The requirements vary for different types of development, and are summarized in Table 7-4.

Table 7-4. Fire Flow Requirements (per Ebbetts Pass Fire District Fire Code, Sec. 13, August 2003)

Development	Required Fire Flow (gpm)
Residential Districts and/or Individual Dwellings < 3600 Sq. Ft.	1,000
Commercial/Industrial Districts and/or Individual Dwellings > 3600 Sq. Ft.	1,500
Undeveloped Commercial/Industrial Districts	1,500

The required fire flow should be assigned to each node in the model, based upon the development in that area. To meet CCWD requirements, pressure must not drop below 20 pounds per square inch (psi) in any part of the system during the fire flow event. The system was originally designed for a residential fire flow demand of 500 gallons per minute (gpm). Therefore, upgrades may be needed to meet the increased fire flow requirements.

Per CCWD standards, future piping systems shall also utilize the following design criteria:

- Transmission Lines: Hydraulic capacity sized to pass Peak Hour Demand (PHD) at a maximum velocity of 5 feet per second (ft/s) and or Maximum Day Demand (MDD) plus fire demand while maintaining 20 psi residual pressure in the system
- Hazen Williams "C" Factor: Pipes shall use a "C" factor of 130 for new pipe and 110 for existing pipe.
- Fire Flow Requirements: A maximum velocity of 12 ft/s shall apply to fire flow conditions and the minimum velocity shall be 2 ft/s.

7.4 Booster Pump Facilities

CCWD standards state that a pump station should be able to deliver its design flow with the largest pump out of service. This is known as the "firm capacity" of the pump station. The standards also state that typically a pump station will be designed to deliver the maximum day demand. Peak hour demands are expected to be supplied by storage without additional pumping.

The expected future demands were used to calculate booster pumping requirements at the existing pump stations. These requirements are summarized in Table 7-5.

Table 7-5. Booster Pumping Requirements

Booster Pump Station	Number of Existing Pumps	Existing Firm Pumping Capacity (GPM)	Required Pumping Capacity (GPM)		
			Existing	Buildout	Buildout w/ Blue Lake Springs
Hunters WTP	3	2,800	2,411	3,142	3,817
Timber Trails	2	95	31	31	31
Forest Meadows 1	2	450	197	417	417
Avery	3	3,400	1,722	1,968	2,643
Meadowmont	3	3,600	1,688	1,809	2,483
Sawmill	3	320	550	626	626
Dorrington	2	100	375	423	423
Big Trees 1	2	95	88	102	102
Big Trees 4&5	2	46	31	33	33

Only two pump stations, Sawmill and Dorrington, require additional pumping capacity to meet existing conditions. In addition, the Hunters WTP and Big Trees 1 booster pump stations require additional pumping capacity at buildout conditions, beyond the 20 year planning period for this System Evaluation. Note also that the addition of Blue Lake Springs requires additional booster pump capacity at the Hunters WTP.

7.4.1 Recommended Improvements

Table 7-6 presents the recommended booster pump station improvements discussed above. In addition, a new booster pump station was required in the 2005 Master Plan based on the model results to meet existing conditions. This booster pump station (Gold Hill Circle) is also included in Table 7-6 since the requirement was based on meeting existing conditions.

Table 7-6. Recommended Booster Pumping Improvements

Booster Pump Station	Additional Firm Pumping Capacity Required (gpm)			Improvements
	Existing Conditions	Buildout Conditions	BLS Only	
Hunters WTP	-	342	675	Replace 3-1400 gpm pumps with 3-1575 gpm pumps in Phase IV; Add 1-675 gpm pump for BLS
Timber Trails	-	-	-	No change required
Forest Meadows 1	-	-	-	No change required
Avery	-	-	-	No change required
Meadowmont	-	-	-	No change required
Sawmill	230	76	-	Replace 3-160 gpm pumps with 3-315 gpm pumps
Dorrington	275	49	-	Replace 2-100 gpm pumps with 3-215 gpm pumps
Big Trees 1	-	7	-	Replace 2-95 gpm pumps with 2-105 gpm pumps in Phase IV
Big Trees 4&5	-	-	-	No change required
Gold Hill Circle	250	-	-	Add 2-250 gpm pumps

7.5 STORAGE FACILITIES

The storage requirements for the Ebbetts Pass system will be different for the different tank zones based on the regional water demand and fire flow requirements. Ideally, storage should be provided at a high enough elevation so that water can flow by gravity to customers in the case of power outage or fire. The existing and buildout demands were summarized by pressure zone. Each storage tank serves one pressure zone directly, and most serve additional pressure zones through PRVs. This analysis assumes that fire flow capacity for each tank zone includes capacity of all tanks that can gravity feed that zone. The analysis also incorporates available pumping capacity for each tank zone in determining available fire flow capacity.

CCWD standards state storage capacity will be equal to the sum of the following three components:

1. Fire flow storage, a minimum of four hours times the appropriate fire flow demand.
2. System peaking storage, equal to 20 percent of the maximum day flow.
3. Emergency storage, equal to four hours of the maximum day demand.

The maximum day demands at existing, buildout, and buildout with Blue Lake Springs conditions were used to determine the System Peaking and Emergency storage volumes. Fire Flow storage volume determination took into account the capacity of water that could be pumped into the tank's pressure zone. If this pumping capacity was sufficient to meet the fire flow requirements listed in Table 7-4, no additional storage was required for

fire flow. If the pumping capacity was less than the fire flow requirement, storage for 4 hours of the fire flow not met by the pumping capacity was added to the tank. Table 7-7 presents the existing and required storage volumes for existing, buildout, and buildout with Blue Lake Springs operating conditions.

Table 7-7. Required Storage Volumes

TANK	Existing Volume (GAL)	Tank Material	Required Storage Volume (GAL)		
			Existing	Buildout	Buildout w/ Blue Lake Springs
Hunters WTP Clearwell	950,900	Steel	1,529,000	1,899,000	2,255,000
Timber Trails	52,800	Redwood	233,000	233,000	233,000
Forest Meadows 1 (Larkspur)	147,900	Steel	182,000	415,000	415,000
Forest Meadows 2 (Heather)	458,000	Redwood	236,000	352,000	352,000
Avery	712,700	Steel	1,091,000	1,228,000	1,584,000
Meadowmont	264,000	Steel	909,000	1,039,000	1,395,000
Pinebrook	1,000,000	Steel	73,000	84,000	84,000
Meadowmont 13	101,000	Redwood	50,000	54,000	54,000
Sawmill	2,840,000	Steel	755,000	801,000	1,157,000
State Park	42,300	Redwood	264,000	264,000	264,000
Big Trees 1 & 3	196,600	Redwood	255,000	197,000(1)	197,000(1)
Big Trees 4 & 5 (2 Tanks)	186,000	Redwood	414,000	439,000	439,000
Big Trees 8	98,300	Redwood	245,000	246,000	246,000
Big Trees 60k	55,600	Redwood	263,000	271,000	271,000

(1) Required storage volume decreases once the buildout capacity of the Sawmill pump station is provided.

For future consideration when the distribution system storage is modeled, modifications to the distribution system could allow water from the Sawmill Tank to backfeed into the Medowmont Tank and then the Avery Tank. The modifications could be tested with the hydraulic model and if feasible, the storage volume in the new tanks at Meadowmont and Avery could be reduced.

7.5.1 Water Quality versus Fire Flow Storage

Four tanks (Timber Trails, State Park, Big Trees 8 and Big Trees 60K) have fire flow storage requirements that greatly exceed their operational requirements, which increases the amount of time the water spends in the tank. This additional time has a negative effect on water quality by increasing the formation of disinfection byproducts and decreasing the disinfectant residual in the distribution system.

The State Park tank can be fed by gravity from the Sawmill tank to provide the necessary fire flow for its tank service area (assuming the distribution system piping can deliver the fire flow). This reduces the required volume for the each tank to its current storage

volume. It has also been identified in the 2005 Master Plan that the Meadowmont 13 tank will be abandoned and replaced by installing a new PRV.

At the Timber Trails tank site, it is recommended to maintain the size of these existing three tanks to avoid water quality issues. To maintain the existing tank size, the Timber Trails tank will require additional booster pumping to provide additional fire water into the service area. Thus, it is recommended to provide emergency fire flow pumps at Timber Trails to provide the necessary fire flow for this tank. Table 7-8 presents the recommended booster pump station improvements.

At the Big Trees 8 and Big Trees 60K tank sites, it is recommended to size the tanks for full fire flow storage. During design of these tanks improvements will be required to reduce water age and minimize the formation of disinfection byproducts.

Table 7-8. Additional Booster Pumping Improvements for Fire Flow

Booster Pump Station	Additional Firm Pumping Capacity Required (gpm)			Improvements
	Existing Conditions	Buildout Conditions	BLS Only	
Timber Trails	750	-	-	Add 1-750 gpm pumps

7.5.2 Redwood Storage Tanks

CCWD tested the influent and effluent of one of its redwood storage tanks in 1999. The testing showed that HAA5 increased from 29 ug/L to 48 ug/L just by passing through the redwood storage tank. Therefore, removal of the redwood tanks should provide a reduction in HAA5 formation in the Ebbetts Pass Water System.

7.5.3 Recommended Improvements

CCWD has requested the installation of two tanks at each storage facility (if possible) that currently has a redwood tank or that was identified as needing additional storage. The two tank facility is preferred to accommodate maintenance of the tanks. Table 7-9 presents the recommended storage improvements discussed above.

Table 7-9. Recommended Storage Improvements

Storage Tank	Additional Storage Capacity Required (gal)				Improvements
	Replace Existing Redwood	Existing Conditions	Buildout Conditions	BLS Only	
Hunters WTP Clearwell	--	578,000	370,000	356,000	Add 1-1,300,000 gal tank
Timber Trails	53,000	1,000	--	--	Replace redwood tank with existing volume
Forest Meadows 1	--	34,000	233,000	--	Add 1-270,000 gal tank
Heather	352,000	--	--	--	Replace redwood tank with 2-175,000 gal tanks
Avery	--	378,000	137,000	356,000	Add 1-870,000 gal tank
Meadowmont	--	645,000	130,000	356,000	Add 2-565,000 gal tanks
Pinebrook	--	--	--	--	No change required
Meadowmont 13	--	--	--	--	Replace with PRV
Sawmill	--	--	--	--	No change required
State Park	42,000	--	--	--	Replace redwood tank with existing volume
Big Trees 1&3	197,000	--	--	--	Replace redwood tanks with 2-100,000 gal tanks
Big Trees 4&5	186,000	162,000	14,000	--	Replace redwood tanks with 2-180,000 gal tanks
Big Trees 8	98,000	147,000	1,000	--	Replace redwood tanks with 2-125,000 gal tanks
Big Trees 60K	56,000	207,000	31,000	--	Replace redwood tanks with 2-135,000 gal tanks

7.6 Emergency Standby Power

CCWD design standards require standby power for each of the booster pump stations. Currently, only four of the ten sites have diesel standby generators. Table 7-10 presents the recommended standby power improvements for the Ebbetts Pass Water System.

Table 7-10. Recommended Standby Power Improvements

Booster Pump Station	Planning Phase	Motor Size for Firm Capacity (HP)	Existing Generator Size (kW)	New Generator Size (kW)	Improvements
Hunters WTP	--	435[a]	275	--	No change required in next 20 years
Timber Trails	II	15	--	30	Add 30 kW diesel generator
Forest Meadows 1	II	40	--	60	Add 60 kW diesel generator
Avery	--	400	500	--	No change required
Meadowmont	--	700	800	--	No change required
Sawmill	I	100	80	150	Replace 80 kW generator with 150 kW generator when booster pump station is modified[c]
Dorrington	I	80	--	120	Add 120 kW diesel generator
Big Trees 1	I	90[b]	--	120	Add 120 kW diesel generator when fire pump is added
Big Trees 4&5	I	80[b]	--	120	Add 120 kW diesel generator when fire pump is added
Gold Hill Circle	I	25	--	50	Add 50 kW diesel generator when booster pump station is installed

[a] Includes motors at both Hunters WTP and booster pump station
[b] Includes new fire pump
[c] Existing 80 kW generator may be able to be relocated, depending on age and condition

8 CAPITAL IMPROVEMENT PLAN

This section presents the recommended Capital Improvement Plan (CIP) for the Ebbetts Pass water system based on the evaluation in the previous chapters. The recommended improvements have been divided into four five-year planning phases to facilitate implementation, and to assist CCWD in planning and funding the water system improvements. Table 8-1 summarizes the recommended improvement cost per phase. Detailed tables of the costs are included in Appendix A for the Storage Tanks and Booster Pump Stations.

Table 8-1. Summary of Capital Improvement Costs

Recommended Improvement	Phase I Year 1 to 5	Phase II Year 6 to 10	Phase III Year 11 to 15	Phase IV Year 16 to 20
Water Supply		$500,000		
Water Treatment		$2,250,000		
Piping	$3,200,000	$3,200,000	$3,200,000	$3,200,000
Storage Tanks	$2,788,000	$2,879,000		
Booster Pumping	$277,000			$479,000
Standby Generators	$293,000	$68,000		
Subtotal Cost	**$6,558,000**	**$8,897,000**	**$3,200,000**	**$3,679,000**
Contingency (25%)	$1,640,000	$2,224,000	$800,000	$920,000
Engineering, Administration, CM (20%)	$1,312,000	$1,779,000	$640,000	$736,000
Total Cost	**$9,510,000**	**$12,900,000**	**$4,640,000**	**$5,335,000**
Total Improvement Cost = $32,400,000				

8.1 Cost Estimates

The planning level cost estimates are based upon recent similar projects, recent available bid prices and historical trends. The cost estimates are not based upon detailed engineering design and analysis; therefore, they should be considered to range from +/- 25 percent.

Projects selected for Phase 1 are the projects that are needed to meet CCWD's most critical needs. Specific piping improvements will require the hydraulic model to be updated. Piping improvements contained in the CIP are limited to annual pipe replacement costs that are needed to update the pipe over the 100 year life of the installed piping.

The projects that are needed to meet future demands are distributed throughout the four planning phases to make the costs per phase more feasible based upon projected growth areas. It is important to note that the 20-year CIP proposed is not designed to bring the system up to current build-out standards by the year 2033. At the current average annual growth rate of 0.6%, actual build-out conditions will not be realized until the year 2053.

Since knowledge about site-specific conditions of each proposed project is limited at the planning stage, a 25 percent contingency is applied to the baseline construction cost to

account for unforeseen events and unknown conditions. A cost equal to 20 percent of construction cost (including contingencies) will be applied to account for additional items such as engineering, administration, construction management, and inspection costs.

Cost for new tanks are based on above-ground, dual, steel tanks. Costs for booster pumping stations will vary depending on the features designed into the station such as number of pumps, control features, surge protection features, buildings, architectural treatment, etc. For the Ebbetts Pass Water System, the costs for booster pumping stations are based primarily on replacing existing pumps or extending existing slabs to accommodate new pumps.

The estimated unit costs for pipelines are based on ductile iron piping and include trenching (minimum cover), installation, backfill fittings, service connections, pavement restoration, testing, traffic control, and appurtenances.

The Phase I cost estimate for the Hunters WTP expansion is based on the addition of a third treatment train in the existing facility. The third treatment train would have a capacity of 1,400 gpm (2 mgd).

9 SCHEDULE

Tables 9-1, 9-2, and 9-3 present the schedule for the Phase 1 capital improvements for storage tanks, booster pump stations, and standby generators.

Table 9-1. Ebbetts Pass Phase 1 Storage Tank Improvements

Project	Phase I Cost	Year 1	Year 2	Year 3	Year 4	Year 5
Forest Meadows 1: Add 1-270,000 gal tanks	$337,500	$337,500				
Avery: Add 1-870,000 gal tanks	$870,000		$870,000			
Meadowmont: Add 1-565,000 gal tank	$565,000			$565,000		
Meadowmont: Add 1-565,000 gal tank	$565,000				$565,000	
Big Trees 4&5: Replace redwood tanks with 2-180,000 gal tanks	$450,000					$450,000
Total Cost Per Year		$337,500	$870,000	$565,000	$565,000	$450,000

Table 9-2. Ebbetts Pass Phase 1 Booster Pumping Improvements

Project	Phase I Cost	Year 1	Year 2	Year 3	Year 4	Year 5
Sawmill: Replace two smaller pumps with 3-315 gpm pumps (40 HP each)	$92,000	$92,000				
Dorrington: Replace 2-100 gpm pumps with 3-215 gpm pumps (25 HP each)	$63,000		$63,000			
Gold Hill Circle: Add 2-250 gpm pumps (25 HP each)	$49,000			$49,000		
Timber Trails: Add 1-750 gpm pumps (75 HP)	$73,000				$73,000	
Sub-Total Cost Per Year		$92,000	$63,000	$49,000	$73,000	$ -

Table 9-3. Ebbetts Pass Phase 1 Standby Generator Improvements

Pumping Station	Recommended Generator Size (KW)	Total Cost	Year 1	Year 2	Year 3	Year 4	Year 5
Sawmill: Replace 80 kW generator with 150 kW generator	150	$75,000	$75,000				
Dorrington: Add 120 kW diesel generator	120	$60,000		$60,000			
Big Trees 1: Add 120 kW diesel generator	120	$60,000			$60,000		
Big Trees 4&5: Add 120 kW diesel generator	120	$60,000				$60,000	
Gold Hill Circle: Add 50 kW diesel generator	50	$37,500					$37,500
Total Cost Per Phase			$75,000	$60,000	$60,000	$60,000	$37,500

10 REFERENCES

1. *Calaveras County Water District Ebbetts Pass Water Master Plan*, HDR Inc., May 2005

2. *Calaveras County Water District Hunters Water Treatment Plant Operations Plan*, Peterson Brustad Inc., September 2008

3. *Urban Water Management Plan 2010*, Calaveras County Water District, June 2011

4. *Design and Construction Standards,* Calaveras County Water District, January 2009

5. *Evaluation of Water Supply Alternatives for Ebbetts Pass Improvement District No. 5*, K.S. Dunbar and Associates, July 1986.

6. *Developing Rates for Small Systems, Manual of Water Supply Practices M54, First Edition*, American Water Works Association, 2004

7. *Ebbetts Pass Fire District Code, Sec. 13*, August 2003

8. *Principles of Water Rates, Fees, and Charges, Manual of Water Supply Practices M1, Sixth Edition,* American Water Works Association, 2012

11 APPENDIX A

CCWD Ebbetts Pass Water Master Plan

For CIP Tables

Capital Improvement Costs

Recommended Improvements	Phase I *Yr 1 to 5*	Phase II *Yr 6 to 10*	Phase III *Yr 11 to 15*	Phase IV *Yr 16 to Buildout*
Water Supply		$500,000		
Storage Tanks	$2,788,000	$2,879,000	$0	$479,000
Booster Pumping	$277,000	$0	$0	$0
Standby Generator	$293,000	$68,000	$0	$0
Piping	$3,200,000	$3,200,000	$3,200,000	$3,200,000
WTP Expansion		$2,250,000		
Surge Anticipation Facility				
Sub-Total Cost Per Phase	**$6,558,000**	**$8,897,000**	**$3,200,000**	**$3,679,000**
Contingency (25%)	$1,639,500	$2,224,250	$800,000	$919,750
Engineering, Adminstration, CM (20%)	$1,311,600	$1,779,400	$640,000	$735,800
TOTAL COST PER PHASE	**$9,509,100**	**$12,900,650**	**$4,640,000**	**$5,334,550**

TOTAL IMPROVEMENT COST	**$32,384,300**

Phase I Capital Improvement Costs

Recommended Improvements	Year 1	Year 2	Year 3	Year 4	Year 5
Storage Tanks	$337,500	$870,000	$565,000	$565,000	$450,000
Booster Pumping	$92,000	$63,000	$49,000	$73,000	$0
Standby Generator	$75,000	$60,000	$60,000	$60,000	$37,500
Piping	$640,000	$640,000	$640,000	$640,000	$640,000
WTP Expansion					
Surge Anticipation Facility					
SUBTOTAL COST PER YEAR	$1,144,500	$1,633,000	$1,314,000	$1,338,000	$1,127,500
Contingency (25%)	$286,125	$408,250	$328,500	$334,500	$281,875
Engineering, Adminstration, CM (20%)	$228,900	$326,600	$262,800	$267,600	$225,500
TOTAL COST PER YEAR, PHASE 1	**$1,659,525**	**$2,367,850**	**$1,905,300**	**$1,940,100**	**$1,634,875**

Storage Tank Evaluation

Tank Zone	Total Existing Storage Volume (gal)	Tank Material	Existing			2033			Buildout			Buildout with Blue Lake Springs		
			Max Day Demand (gpm)	Required Volume (gal)	Storage Shortfall (gal)	Max Day Demand (gpm)	Required Volume (gal)	Storage Shortfall (gal)	Max Day Demand (gpm)	Required Volume (gal)	Storage Shortfall (gal)	Max Day Demand (gpm)	Required Volume (gal)	Storage Shortfall (gal)
Hunters WTP Clearwell	950,900	Steel	2,442	1,529,166	578,266	2,776	1,705,528	754,628	3,142	1,898,926	948,026	3,817	2,255,150	1,304,250
Timber Trails	52,800	Redwood	31	53,333	533	31	53,333	533	31	53,333	533	31	53,333	533
Forest Meadows 1	147,900	Steel	345	182,371	34,471	556	293,304	145,404	787	415,272	267,372	787	415,272	267,372
Heather	458,000	Redwood	197	235,963	-	302	291,430	-	417	352,414	-	417	352,414	-
Avery	712,700	Steel	2,066	1,090,662	377,962	2,190	1,156,090	443,390	2,325	1,227,521	514,821	3,000	1,583,745	871,045
Meadowmont	264,000	Steel	1,722	909,452	645,452	1,840	971,396	707,396	1,968	1,039,051	775,051	2,643	1,395,275	1,131,275
Pinebrook	1,000,000	Steel	138	72,665	-	148	318,085	-	159	324,087	-	159	324,087	-
Meadowmont 13	101,000	Redwood	95	50,142	-	98	291,885	-	102	293,627	-	102	293,627	-
Sawmill	2,840,000	Steel	1,429	754,701	-	1,471	776,764	-	1,517	801,052	-	2,192	1,157,276	-
Big Trees 1&3	196,600	Redwood	175	200,583	3,983	188	198,771	2,171	203	196,737	137	203	196,737	137
Big Trees 4&5	186,000	Redwood	375	347,857	161,857	398	354,545	168,545	423	361,902	175,902	423	361,902	175,902
Big Trees 8	98,300	Redwood	31	245,360	147,060	32	245,819	147,519	33	246,279	147,979	33	246,279	147,979
Big Trees 60k	55,600	Redwood	88	263,640	208,040	95	267,165	211,565	102	270,997	215,397	102	270,997	215,397
State Park	42,300	Redwood	46	264,200	-	46	264,200	-	46	264,200	-	46	264,200	-
Total	7,106,100			6,200,095										

Tank Zone	Recommendation	Tank Zone	Total Design Storage Volume (gal)	Unit Storage Cost ($/gal)	Total Storage Cost	Phase 1	Phase 2	Improvement Cost			Shortfall (gallons)				% Improvement Cost		
								Existing	Buildout	Buildout w/ BLS	Existing Redwood	Existing	Buildout	Buildout w/ BLS	Existing	Buildout	Buildout w/ BLS
Hunters WTP Clearwell	Add 1 - 1,300,000 tank	WTP	1,300,000	$ 1.00	$ 1,300,000		1,300,000	$ 576,382	$ 368,555	$ 355,063	-	578,266	369,760	356,224	44%	28%	27%
Timber Trails	Replace w/ 53k tank	Hunters WTP Clearwell	53,000	$ 1.75	$ 92,750		$ 92,750	$ 92,750	$ -	$ -	52,800	533	-	-	100%	0%	0%
Forest Meadows 1	Add 1 - 270k tank	Forest Meadows 1	270,000	$ 1.25	$ 337,500	$ 337,500		$ 43,513	$ 293,987	$ -	-	34,471	232,901	-	13%	87%	0%
Heather	Replace w/ 2 - 175k tanks	Heather	350,000	$ 1.25	$ 437,500		$ 437,500	$ 437,500	$ -	$ -	352,414	-	-	-	100%	0%	0%
Avery	Add 1 - 870k tank	Avery	870,000	$ 1.00	$ 870,000	$ 870,000		$ 377,508	$ 136,695	$ 355,797	-	377,962	136,859	356,224	43%	16%	41%
Meadowmont	Add 2 - 565k tanks	Meadowmont	1,130,000	$ 1.00	$ 1,130,000	$ 1,130,000		$ 644,725	$ 129,453	$ 355,822	-	645,452	129,599	356,224	57%	11%	31%
Pinebrook		Pinebrook			$ -			$ -	$ -	$ -	-	-	-	-			
Meadowmont 13	Replace w/ PRV	Meadowmont 13			$ 25,000		$ 25,000	$ 25,000	$ -	$ -	PRV	-	-	-	100%	0%	0%
Sawmill		Sawmill			$ -			$ -	$ -	$ -	-	-	-	-			
Big Trees 1&3	Replace w/ 2 - 100k tanks	Big Trees 1&3	200,000	$ 1.50	$ 300,000		$ 300,000	$ 300,000	$ -	$ -	196,600	3,983	-	-	100%	0%	0%
Big Trees 4&5	Replace w/ 2 - 180k tanks	Big Trees 4&5	360,000	$ 1.25	$ 450,000	$ 450,000		$ 432,536	$ 17,464	$ -	186,000	161,857	14,045	-	96%	4%	0%
Big Trees 8	Replace w/ 2 - 125k tanks	Big Trees 8	250,000	$ 1.25	$ 312,500		$ 312,500	$ 311,333	$ 1,167	$ -	98,300	147,060	920	-	100%	0%	0%
Big Trees 60k	Replace w/ 2 - 135k tanks	Big Trees 60k	270,000	$ 1.25	$ 337,500		$ 337,500	$ 328,338	$ 9,162	$ -	55,600	208,040	7,357	-	97%	3%	0%
State Park	Replace w/ 42k tank	State Park	42,000	$ 1.75	$ 73,500		$ 73,500	$ 73,500	$ -	$ -	42,300	-	-	-	100%	0%	0%
					$ 5,666,250	$ 2,787,500	$ 2,878,750	$ 3,643,085	$ 956,483	$ 1,066,682	984,014	2,157,624	891,440	1,068,672	5,101,749		

Booster Pump Station Evaluation

Booster Pump Station	Number of Existing Pumps	Firm Pumping Capacity (gpm)	Total Pumping Capacity (gpm)	Existing		2033		Buildout		Buildout with BLS	
				Max Day Demand (gpm)	Required New Capacity (gpm)	Max Day Demand (gpm)	Required New Capacity (gpm)	Max Day Demand (gpm)	Required New Capacity (gpm)	Max Day Demand (gpm)	Required New Capacity (gpm)
Hunters WTP	3	2,800	4,200	2,442	-	2,776	-	3,142	342	3,817	1,017
Timber Trails	2	95	195	31	-	31	-	31	-	31	-
Forest Meadows 1	2	450	900	197	-	302	-	417	-	417	-
Avery	3	3,400	5,100	1,722	-	1,840	-	1,968	-	2,643	-
Meadowmont	3	3,600	5,400	1,688	-	1,746	-	1,809	-	2,483	-
Sawmill	3	320	610	550	230	586	266	626	306	626	306
Dorrington	2	100	200	375	275	398	298	423	323	423	323
Big Trees 1	2	95	195	88	-	95	-	102	7	102	7
Big Trees 4&5	2	46	96	31	-	32	-	33	-	33	-
		10,906	16,896	7,123							

Booster Pump Station	Recommendation	Total Design Capacity to Buildout (gpm)	Total Design HP	Unit Cost ($/HP)	Total Pump Station Cost	Phase 1	Phase 4	Improvement Cost			Shortfall			% Improvement Cost		
								Existing	Buildout	Buildout w/ BLS	Existing	Buildout	Buildout w/ BLS	Existing	Buildout	Buildout w/ BLS
Hunters WTP	No change required for next 20 years; Replace 3-1400 gpm pumps with 3-1575 gpm pumps after 2033; Add 1-675	4,725	459	$ 1,000	$ 459,000		$ 459,000	$ 408,000	$ 51,000	$ -	-	342	675	89%	11%	NIC
Timber Trails	No change required										-	-	-			
Forest Meadows 1	No change required										-	-	-			
Avery	No change required										-	-	-			
Meadowmont	No change required										-	-	-			
Sawmill	Replace 3-160 gpm pumps with 3-315 gpm pumps	945	92	$ 1,000	$ 92,000	$ 92,000		$ 46,730	$ 45,270	$ -	230	76	-	51%	49%	
Dorrington	Replace 2-100 gpm pumps with 3-215 gpm pumps	645	63	$ 1,000	$ 63,000	$ 63,000		$ 19,535	$ 43,465	$ -	275	49	-	31%	69%	
Big Trees 1	No change required for next 20 years; Replace 2-95 gpm pumps with 2-105 gpm pumps after 2033	210	20	$ 1,000	$ 20,000	$ -	$ 20,000	$ 18,571	$ 1,429	$ -	-	7	-	93%	7%	
Big Trees 4&5	No change required					$ -					-	-	-			
				Subtotal	$ 634,000	$ 155,000	$ 479,000	$ 492,836	$ 141,164	$ -						

Fire Flow Pump Stations

Gold Hill Circle	Add 2-250 gpm pumps	500	49	$ 1,000	$ 49,000	$ 49,000	
Timber Trails	Add 1-750 gpm pumps	750	73	$ 1,000	$ 73,000	$ 73,000	
				Subtotal	$ 122,000	$ 122,000	$ -
				Total	**$ 756,000**	**$ 277,000**	**$ 479,000**