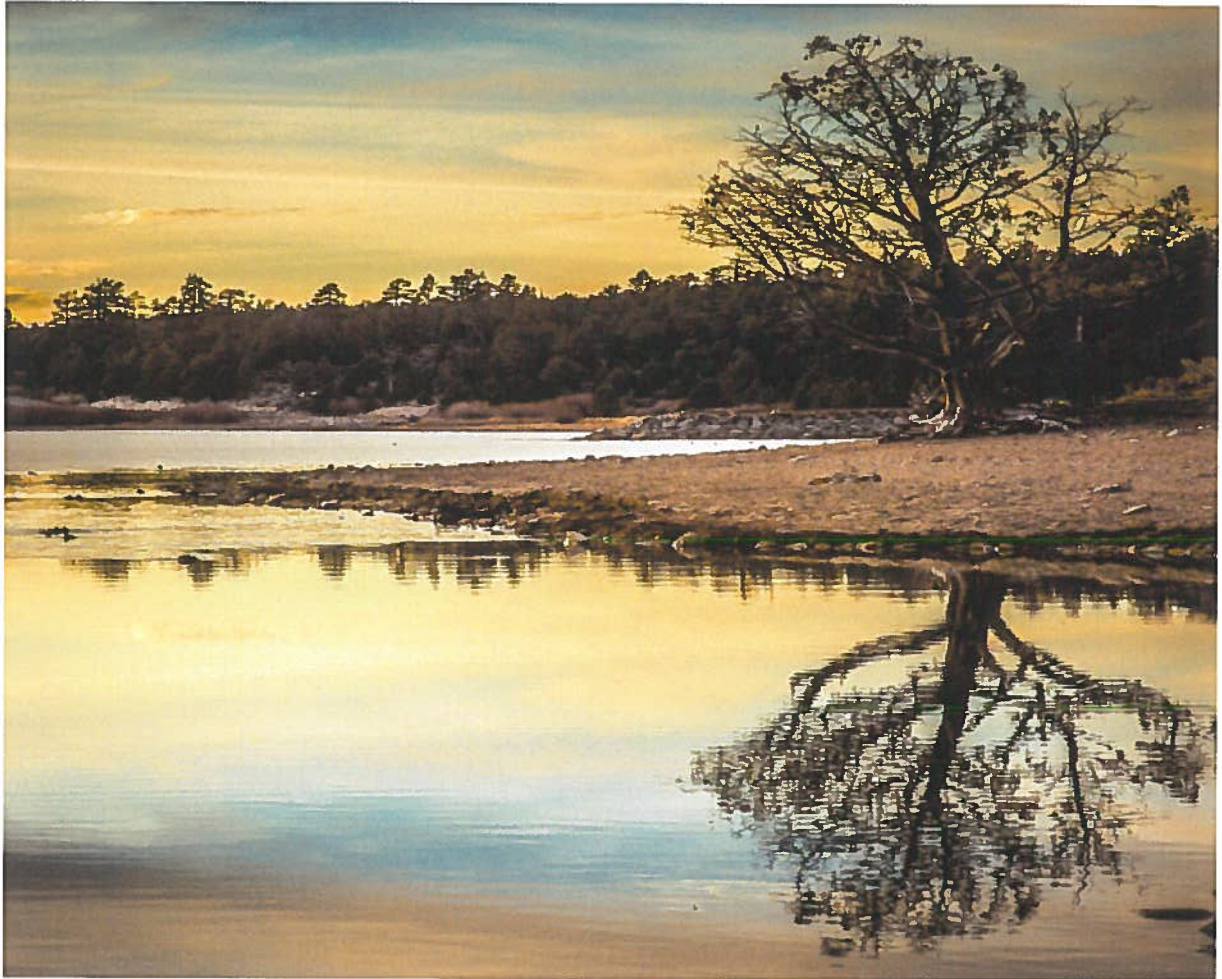


# Big Bear Watermaster Forty-First Annual Report

For Calendar Year 2017



Big Bear Municipal Water District vs. North Fork Water Company, et al.,  
Case No. SCV 165493 - County of San Bernardino



BEAR VALLEY MUTUAL WATER COMPANY



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**BIG BEAR WATERMASTER**  
**FOR**  
**BIG BEAR MUNICIPAL WATER DISTRICT VS NORTH FORK WATER CO. ET. AL**  
**CASE NO. 165493---COUNTY OF SAN BERNARDINO**

**WATERMASTER MEMBERS:**

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March 31, 2018

To: Clerk of the Superior Court of San Bernardino County and All Parties

Subject: Watermaster Report for Calendar Year 2017

Gentlemen:

We have the honor of submitting the Forty-First Annual Report of the Big Bear Watermaster for Calendar Year 2017.

Paragraph Twenty (20) of the Judgement requires that the Watermaster Report be submitted to the Court and the Parties before April 1 of each year on all significant Watermaster activities and provide an accounting of water deliveries for the proceeding calendar year as set forth in Section VI, Physical Solutions, of the Judgement.

We and each of us here by certify that this is a true and correct report of the Watermaster work performed by us and under our supervision during 2017 pursuant to the requirement of the Judgement.

Respectfully Submitted,

By: \_\_\_\_\_  
Donald E. Evenson

By: \_\_\_\_\_  
Daniel B. Cozad

By: \_\_\_\_\_  
Samuel H. Fuller

---

Big Bear  
Municipal Water District

San Bernardino Valley  
Water Conservation District

Bear Valley Mutual  
Water Company

# **FORTY-FIRST ANNUAL REPORT BIG BEAR WATERMASTER CALENDAR YEAR 2017**

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# FORTY-FIRST ANNUAL REPORT BIG BEAR WATERMASTER CALENDAR YEAR 2017

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# **I. INTRODUCTION**

The Big Bear Watermaster presents the Forty-First Annual Report of its activities for calendar year 2017. The Watermaster's activities ensure that the rights of all parties subject to the Judgment rendered in Case No. 165493 are protected. The Watermaster generally oversees watershed conditions that may affect the Judgment and attempts to improve the conditions to the benefit of all parties.

This report describes the 2017 activities of the Watermaster including the status of accounts and various tabulations as required by the Judgment.

Beginning in 2017, the Big Bear Watermaster Committee was composed of Donald E. Evenson, President, representing Big Bear Municipal Water District; Michael L. Huffstutler, representing Bear Valley Mutual Water Company; and Daniel B. Cozad, Secretary, representing San Bernardino Valley Water Conservation District.

On April 20, 2017, Bear Valley Mutual Water Company notified the Court that Michael L. Huffstutler had resigned as their Watermaster representative and they had appointed Samuel H. Fuller as their Watermaster representative. The notice of Mr Fuller's appointment is contained in Appendix C.

The Watermaster Committee met three times during 2017. These meetings were held on the following dates:

January 24, 2017 (cancelled)

• March 20, 2017

July 11, 2017

October 10, 2017

Appendix A contains the minutes of these meetings. Minutes of the meetings are also on file at the office of each of the agencies.

### **In Memory of Michael L. Huffstutler**

Michael L. Huffstutler served on the Big Bear Watermaster Committee from January 2000 until April 2017 as a representative for the Bear Valley Mutual Water Company.

Mr. Huffstutler was born and raised in Redlands California. Mr. Huffstutler's career revolved around the water resource of the Santa Ana River and Mill Creek. Mr. Huffstutler rose to the Chief of Water Resources at the City of Redlands and then from January 2000 until June 2017, he was the manager of the Bear Valley Mutual Water Company and Crafton Mutual Water Company.

Mr. Huffstutler studied water resources, water law, and water quality at San Bernardino Valley College, Crafton Hills College and University of California Riverside. He possessed extensive knowledge of the hydrology and water users in the Santa Ana watershed.

Mr. Huffstutler was known throughout the water industry for his patient, quiet unassuming character matched with a deep understanding and intelligence of the management of water resources of the region.

Mr. Huffstutler always approached each concern of the watershed with an open attitude. He was interested in exploring the possibilities and developing the concepts that would benefit the entire watershed.

Mr. Huffstutler was committed to service with honesty and integrity which lead to an enhanced spirit of cooperation among water agencies in our region. Mr. Huffstutler worked tirelessly to build productive relationships with other water agencies leading to more collegial relations throughout the region.

Mr. Huffstutler was influential in the negotiation and implementation of several regional collaborative programs such as Federal Energy Regulatory Commissions Relicensing and the Santa Ana Sucker.

The Big Bear Watermaster Committee extends its sincere appreciation and respect for the service of Michael L. Huffstutler. Michael L. Huffstutler passed away on January 4, 2018. Michael L. Huffstutler will certainly be missed.

## II. SUMMARY

### 2017 WATERMASTER ACCOUNTS

2017 was a below average precipitation year. Annual precipitation at the two gages in the Big Bear Lake watershed averaged 19.68 inches, which is 80 percent of the 24.45 inches of average annual rainfall since 1977. Precipitation at Bear Valley Dam was 24.55 inches, which is 70 percent of the 108-year (1910-2017) average of 35.01 inches.

Inflow to Big Bear Lake in 2017 was below average. The 2017 calculated lake inflow was 13,213 acre-feet, which is 87 percent of the average inflow since 1977. The average inflow for the 41 years since the Judgment was rendered is 15,259 acre-feet per year.

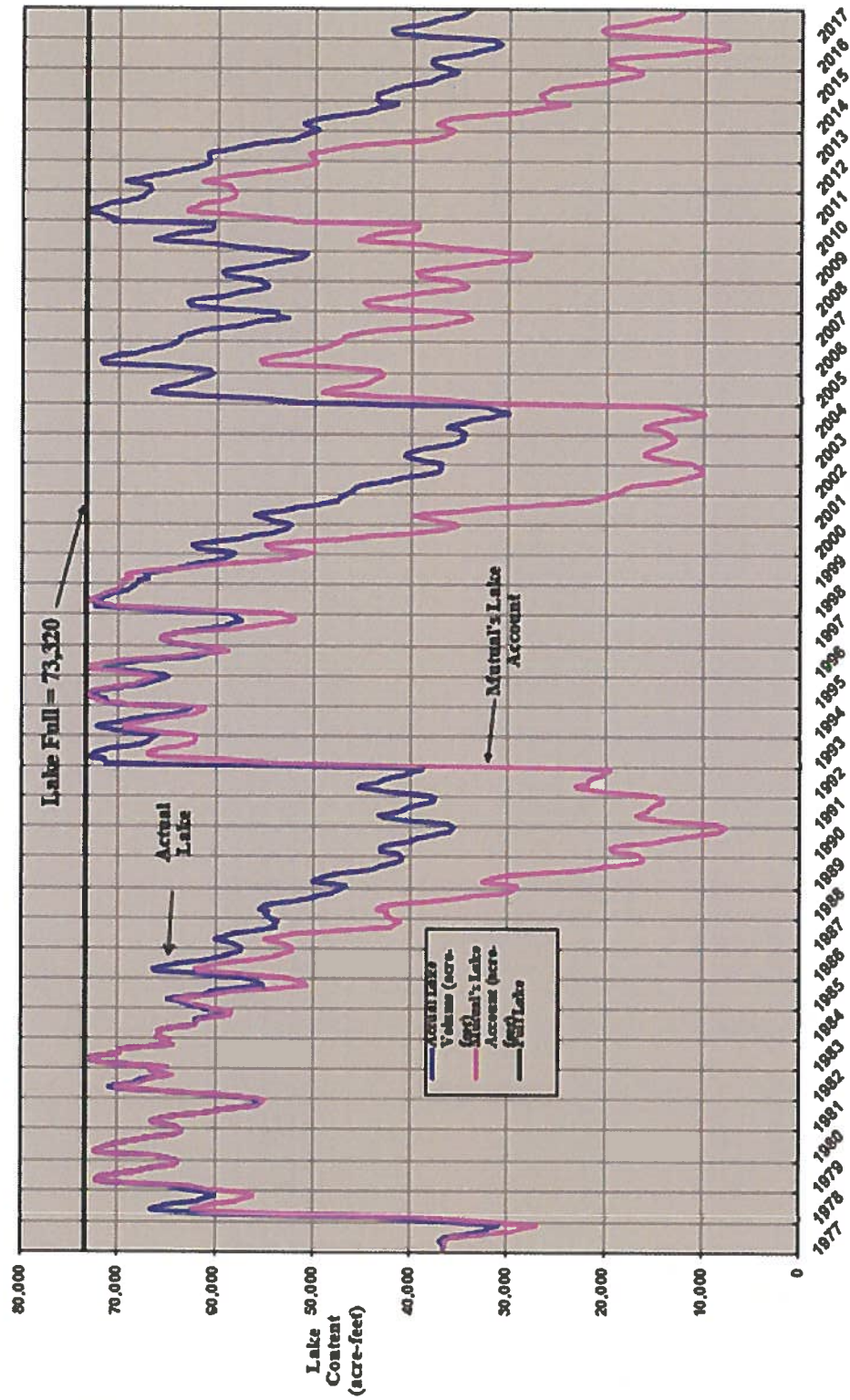
Actual lake levels rose 1.15 feet in 2017 and ended the year 15.20 feet below the top of the dam. Accordingly, lake contents increased by 2,359 acre-feet during the year. On December 31, 2017, the lake contained 34,206 acre-feet of water. When full, the lake level is 72.33 feet and it holds 73,320 acre-feet. **Figure 1** shows the history of the actual lake contents since the Judgment was rendered in 1977.

Mutual's lake account held 12,122 acre-feet at the end of 2017. Their lake account increased by 3,145 acre-feet during the year. **Figure 1** also shows the history of Mutual's lake account since 1977. Under a "Mutual Operation", lake releases would be made to meet Mutual's water demands and their lake account is credited with the net wastewater exported from the Big Bear Lake watershed. Under these conditions, the lake level would have ended the year at 44.20 feet or 28.13 feet below the top of the dam and 12.93 feet lower than the actual year-end lake level of 57.13 feet. If Mutual had not been credited with the net wastewater exports, their lake account balance would have been 6,290 acre-feet and the lake level would have been 38.90 feet or 33.43 feet below the top of dam, and 18.23 feet lower than it actually was.

In 2017, Mutual received 4,653 acre-feet of water from Big Bear MWD. Big Bear MWD has the option to provide in-lieu supplies or to release water from the lake. In 2017, Mutual received 4,147 acre-feet of in-lieu State Water Project (SWP) water. Also, Mutual was able to use 506 acre-feet of water from Big Bear Lake that was required for fish protection purposes as required under SWRCB Order No. 95-4.



**FIGURE 1**  
**ACTUAL LAKE CONTENTS AND MUTUAL'S LAKE ACCOUNT 1977 - 2017**  
 Calendar Year 2017 - Big Bear Watermaster



At the beginning of the year, Big Bear MWD had 22,870 acre-feet in their lake account. By the end of the year, their lake account had decreased by 786 acre-feet to 22,084 acre-feet. Big Bear MWD's lake account is the difference between the actual lake contents and Mutual's lake account as shown on **Figure 1**.

The Basin Make-up Account provides an estimate of the water supply impacts of the operation of Big Bear Lake under the Judgment on the San Bernardino Groundwater Basin. A positive account balance means there has been an increase in groundwater recharge as a result of the Big Bear MWD operation of the lake. If the account becomes negative, Big Bear MWD is required to correct the deficiency by providing additional water for groundwater recharge.

In 2017 the Basin Make-up Account balance increased by 50 acre-feet. The Basin Make-up Account began the year with a balance of 27,120 acre-feet and ended the year with a balance of 27,170 acre-feet. The increase resulted primarily as a result of increases from higher basin additions from lake releases made to meet the requirements of SWRCB Order 95-4 under a Big Bear MWD lake operation as compared to a Mutual Operation.

## **OTHER WATERMASTER ACTIVITIES**

The Watermaster has the responsibility to undertake studies and investigations, collect and maintain data and records, and monitor related activities necessary to implement the physical solution contained in the Judgment. In 2017, the Watermaster was involved in monitoring and discussing two issues. These issues are:

- Impacts of Seven Oaks Dam,
- Protecting Big Bear Lake from Quagga Mussels

These issues are discussed in Chapter V.

### III. BASIC DATA

#### BIG BEAR LAKE

##### Summary

The Watermaster conducts a water balance of Big Bear Lake for each month. This water balance is based on measurements of lake levels, releases, leakages and air temperature, as well as calculated values of spills, evaporation and inflows. For 2017, the overall water balance for the lake was:

Initial Storage (1-01-17)	31,847 acre-feet
Inflows	13,213 acre-feet
Evaporation	9,777 acre-feet
Releases for Mutual	-0- acre-feet
Releases for Valley District	-0- acre-feet
Releases & Leakage for SWRCB	664 acre-feet
Order 95-4	
Spills & Flood Control Releases	-0- acre-feet
Net Snowmaking Withdrawal	413 acre-feet
Ending Storage (12-31-17)	34,206 acre-feet
Change-in-Storage	2,359 acre-feet

In 2017, the volume of water in Big Bear Lake increased by 2,359 acre-feet. The following subsections of this chapter describe each of the components in this water balance.

##### Lake Levels and Storage

Water levels in Big Bear Lake are measured continuously based on a reference mark located on the upstream side of the dam. In July 1998, Big Bear MWD completed installation of a continuous lake level recorder. The lake level recorder is a Global Water Model WL300 and is enclosed in a stilling well, which is attached to the upstream face of the dam. Lake level data is continuously transmitted by a remote telemetry unit (RTU) in the control building at the dam. From there, data

are transmitted via radio to a central computer in the administrative offices of Big Bear MWD. The automatically recorded values have been used since July 1998. The recorder can only record lake levels when the lake is within 15 feet of the top of the dam (i.e. above a gage height of 57.33 feet). In 2017, the lake was within the top 15 feet between January 30 and December 18. For the balance of 2017, Big Bear MWD made manual measurements of the lake level at weekly intervals and at the end of every month.

The lake began the year at a gage height of 55.98 feet and ended the year at a gage height of 57.13 feet. Over the year, the lake level rose 1.15 feet. The lowest recorded lake level was 55.98 feet or 16.35 feet below the top of the dam, and it occurred on January 1, 2017. The highest recorded daily average lake level was 60.79 feet, which occurred on April 20, 21 and 22, 2017. The lake is full at a gage height reading of 72.33 feet (6,743.20 feet above msl) and is empty at a gage height of zero.

The Watermaster uses an established gage height-lake capacity table to estimate the volume of water in the lake from the measured gage heights. At the beginning of the year, the lake contained 31,847 acre-feet of water. At the end of the year, there were 34,206 acre-feet of water in the lake. The lake content increased by 2,359 acre-feet during 2017. When full, the lake contains 73,320 acre-feet of water.

## **Lake Evaporation**

The Watermaster calculates evaporation from the lake surface using the Blaney Criddle formula to estimate monthly evaporation rates. The 1977 Annual Watermaster report describes the formula as follows:

“The Blaney Criddle empirical formula, utilizing average temperatures and daylight hours, has been used. The constant K for each month was calculated based on float pan empirical data at Long Valley Reservoir in Mono County, California, which is at elevation 6,796 feet, compared to the elevation of Big Bear Lake which is 6,743 feet.”

Monthly lake evaporation is calculated using the estimated evaporation rate and the average surface area of the lake during the month. If a negative value for lake inflow is calculated, the

monthly evaporation rate is increased to achieve a zero lake inflow. Calculated negative lake inflows occurred twice in 2017. They occurred in June and September. The adjusted monthly evaporation rates totaled 4.357 feet (52.3 inches) for 2017. Total evaporation from the lake for 2017 was calculated to be 9,777 acre-feet.

### **Precipitation**

Precipitation in the Big Bear Lake watershed varies significantly from Bear Valley Dam to Big Bear City at the east end of the watershed. **Table III-1** shows the monthly precipitation at Bear Valley Dam and the Big Bear City Community Services District for 2017. 2017 precipitation at the two stations was 24.55 and 14.81 inches, respectively. June, October, November and December were the driest months with no precipitation. January was the wettest month with approximately 70 percent of the annual precipitation.

**Table III-1** also compares the 2017 precipitation at the two stations with their corresponding averages for the forty-one years since the Judgment was rendered. At the Bear Valley Dam station, precipitation was 71 percent of its forty-one year average, and at the Big Bear Community Services District station, precipitation was 103 percent of its forty-one year average. For both stations, 2017 precipitation averaged 80 percent of their forty-one year combined average.

**Table III-2** shows the annual precipitation for both stations for the forty-one years since the Judgment was rendered. As shown in **Table III-2**, 2017 was a below average year for precipitation. For the Bear Valley Dam station, precipitation was 70 percent of the 108-year (1910–2017) average of 35.01 inches.

### **Lake Inflow**

Inflows to Big Bear Lake are not measured. Consequently, inflows naturally tributary to Big Bear Lake above Bear Valley Dam are calculated for each month using a water balance on the actual operation of the lake. This calculation, which utilizes observed basic data along with the calculated evaporation losses described previously, creates a water balance for each month to determine the amount of natural flow into the lake. The formula used is:

TABLE III - 1

**MONTHLY PRECIPITATION FOR TWO STATIONS  
IN BIG BEAR AREA (Inches)**

Calendar Year 2017 - Big Bear Watermaster

Month	Bear Valley Dam*	Big Bear Community Services District**	Average	Percent of Annual Total
January	17.49	9.98	13.74	69.79%
February	3.71	1.87	2.79	14.18%
March	1.08	0.55	0.82	4.14%
April	0.20	0.03	0.12	0.58%
May	0.55	0.20	0.38	1.91%
June	0.00	0.00	0.00	0.00%
July	0.01	0.97	0.49	2.49%
August	1.48	1.17	1.33	6.73%
September	0.03	0.03	0.03	0.15%
October	0.00	0.00	0.00	0.00%
November	0.00	0.01	0.01	0.03%
December	0.00	0.00	0.00	0.00%
<b>2017 Totals</b>	<b>24.55</b>	<b>14.81</b>	<b>19.68</b>	<b>100.00%</b>
1977-2017 41-year Average	34.48	14.42	24.45	
2017 % of 41-year Average	71.2%	102.7%	80.5%	

Average of the 41-year Average for both stations	24.45
Average of the 2017 precipitation for both stations	19.68
2017 Average as a percent of the 41-year average	80.5%

Source:

\* Big Bear MWD

\*\* Big Bear Community Services District

Updated 1/25/18

D.Evenson

Table III-2

**FORTY-ONE YEARS OF PRECIPITATION DATA FOR  
TWO STATIONS IN BIG BEAR AREA (Inches)**

Calendar Year 2017 - Big Bear Watermaster

<b>Year</b>	<b>Bear Valley Dam*</b>	<b>Big Bear Community Services District**</b>
1977	31.95	13.35
1978	68.43	26.09
1979	34.87	15.84
1980	63.00	29.86
1981	16.67	8.42
1982	49.14	26.53
1983	56.97	24.29
1984	20.19	16.66
1985	22.40	14.11
1986	35.16	15.26
1987	27.49	12.52
1988	24.18	8.15
1989	17.32	6.85
1990	22.20	11.02
1991	38.47	19.81
1992	44.03	16.64
1993	73.81	19.45
1994	31.78	12.24
1995	49.00	15.89
1996	41.04	15.47
1997	27.00	12.92
1998	50.40	12.07
1999	13.22	6.06
2000	24.82	5.21
2001	30.62	9.10
2002	15.02	3.82
2003	32.44	12.70
2004	39.50	13.51
2005	54.74	19.56
2006	37.96	9.98
2007	16.11	4.89
2008	37.87	8.58
2009	30.70	14.81
2010	64.14	33.23
2011	27.25	14.81
2012	23.70	16.41
2013	14.38	14.53
2014	29.61	12.23
2015	19.72	8.17
2016	31.93	15.42
2017	24.55	14.81
<hr/>		
<b>41-Year Average</b>	<b>34.48</b>	<b>14.42</b>
<hr/>		
	<b>71.2%</b>	<b>102.7%</b>
<hr/>		
<b>108-Year Average</b>	<b>35.01</b>	<b>N/A</b>
<hr/>		
	<b>70.1%</b>	

Source:

\* Big Bear MWD

\*\* Big Bear City Community Services District

Updated 2/13/18 - D. Evenson

$$\text{Inflow} = \text{Evaporation} + \text{Releases} + \text{Spills} + \text{Leakage} + \\ \text{Net Withdrawals} - \text{Change in Storage}$$

If the calculated monthly inflow is a negative value, it is reset to zero, and the monthly evaporation rate is recalculated to achieve a lake water balance. Calculated negative lake inflows occurred two times in 2017. They occurred in June and September.

Total annual inflow for 2017 into the lake was calculated to be 13,213 acre-feet. The largest monthly inflow was 3,936 acre-feet, and it occurred in February. The average annual lake inflow for the 41 years since the Judgment was rendered (1977–2017) is 15,259 acre-feet. The median annual inflow for this same period is 9,497 acre-feet.

**Table III-3** lists the annual lake inflows for the period 1977–2017. This table also ranks the inflows from the lowest (1,717 acre-feet in 2002) to the highest (48,613 acre-feet in 1993). Inflow to the lake for 2017 was below the average inflow but well above the median inflow for the forty-one years since the judgment was rendered in 1977. Twenty-five years had lower lake inflows, and fifteen years had higher lake inflows.

#### **SWRCB Order No. 95-4**

On February 16, 1995, the State Water Resources Control Board (SWRCB) issued Order No. 95-4. This order directed the Big Bear MWD and Bear Valley Mutual Water Company to release enough water from the lake to maintain a minimum seven-day average flow of 1.2 cfs and a minimum average daily flow of 1.0 cfs in Bear Creek no more than 500 feet downstream of its confluence with West Cub Creek. This location is referred to as Station A. In 1998, Big Bear MWD completed construction of a continuous flow recording device at Station A to measure compliance with SWRCB Order No 95-4.

SWRCB Order No. 95-4 also required sufficient releases to maintain a minimum flow of 0.3 cfs at a location approximately 300 feet downstream from the toe of the dam. This location is referred to as Station B. In 1998, Big Bear MWD also completed construction of a continuous recording device at this location to measure compliance with SWRCB Order No. 95-4.



**Table III - 3**  
**Big Bear Lake Inflows 1977-2017**  
(acre-feet / year)  
Calendar Year 2017 - Big Bear Watermaster

Year	Lake Inflows (AF/year)		Rank	Plotting Position	Year	Lake Inflow (AF/year)	
1977	7,103		Min.	1	2.4%	2002	1,717
1978	40,743			2	4.8%	2007	2,841
1979	25,318			3	7.1%	2013	3,129
1980	42,336			4	9.5%	2015	3,677
1981	6,529			5	11.9%	1999	3,774
1982	25,310			6	14.3%	1988	4,551
1983	35,072			7	16.7%	1990	4,856
1984	10,569			8	19.0%	1989	4,967
1985	9,497			9	21.4%	2014	5,776
1986	13,812			10	23.8%	1981	6,529
1987	8,005			11	26.2%	2001	6,915
1988	4,551			12	28.6%	2000	6,930
1989	4,967			13	31.0%	2016	7,027
1990	4,856			14	33.3%	1977	7,103
1991	11,658			15	35.7%	1987	8,005
1992	15,543			16	38.1%	2012	8,175
1993	48,613	Max.		17	40.5%	2003	8,295
1994	11,015			18	42.9%	2004	8,404
1995	33,340			19	45.2%	1997	8,757
1996	13,119			20	47.6%	2009	9,212
1997	8,757		Median	21	50.0%	1985	9,497
1998	34,600			22	52.4%	1984	10,569
1999	3,774			23	54.8%	1994	11,015
2000	6,930			24	57.1%	1991	11,658
2001	6,915			25	59.5%	1996	13,119
2002	1,717	Min.		26	61.9%	2017	13,213
2003	8,295			27	64.3%	1986	13,812
2004	8,404			28	66.7%	2008	14,182
2005	39,600			29	69.0%	1992	15,543
2006	17,564			30	71.4%	2011	16,908
2007	2,841			31	73.8%	2006	17,564
2008	14,182			32	76.2%	1982	25,310
2009	9,212			33	78.6%	1979	25,318
2010	32,959			34	81.0%	2010	32,959
2011	16,908			35	83.3%	1995	33,340
2012	8,175			36	85.7%	1998	34,600
2013	3,129			37	88.1%	1983	35,072
2014	5,776			38	90.5%	2005	39,600
2015	3,677			39	92.9%	1978	40,743
2016	7,027			40	95.2%	1980	42,336
2017	13,213		Max	41	97.6%	1993	48,613
1977 - 2017			41				
Maximum	48,613						
Average	15,259						
Median	9,497						
Minimum	1,717						

Flow at Station B has been measured by a compound weir with a v-notch section and a rectangular section. It was attached to a reinforced concrete structure in the riverbed. The v-notch section had a flow range of 0 to 0.44 cfs and the rectangular section had a flow range of 0.44 to 5.03 cfs. A water level transmitter is located in a stilling well just upstream of the weir structure. The water level data are transmitted to a remote telemetry unit (RTU) located in the control building at the dam. From there, data are transmitted to a central computer at the administrative offices of Big Bear MWD where average daily flow rates at Station B were calculated based on the rating curve of the weir plate.

In October 2016, the Station B weir plate was replaced to improve the accuracy of the water level measurements and the calculated flow values. The weir plate was changed from the compound weir to a 90-degree, 12-inch v-notch weir. Big Bear MWD reprogrammed the SCADA/PLC for the new weir and the flow values at Station B showed improved accuracy.

However, in 2017 measurement problems at Station B continued so Big Bear MWD continued to rely on using releases from the 6-inch Bypass Pipe Line to maintain flows at Station B. Big Bear MWD has contracted with XiO, Inc. to install a new transducer probe and cloud SCADA system to record flows through the new weir plate at Station B. The new system is expected to be operational in early 2018.

On December 29, 2004, data transmission from Station A ceased. In January of 2005, major storms hit the Bear Creek watershed with significant snowfall. Consequently, Big Bear MWD staff could not access Station A until May. On their first visit to the site, they found the data transmission facilities destroyed, the stilling basin filled with sediment and the weir plate damaged. The staff estimated the flow in Bear Creek at this time to be in the range of 10 to 15 cfs, well above the 1.20 cfs requirement.

Beginning in June 2005, the staff visited the site every two weeks and made velocity and water depth measurements. From these measurements, they used two methods to estimate the flow at Station A. Flow estimates ranged between 11.8 cfs and 2.3 cfs. Consequently, in 2005 Station A was well in compliance with the 1.20 cfs, seven-day flow requirement.

During the summer and fall of 2005, Big Bear MWD repaired the weir plate, cleaned out the stilling basin, and installed a battery operated, pressure transducer to record weir water depth information. Since 2005, when weather conditions permit, Big Bear MWD retrieves the recorded information and calculates the flows at Station A.

In December 2010, major storms again hit the Bear Creek watershed, destroyed the data recording equipment and filled the stilling basin with sediment and rock at Station A. In November 2011, Big Bear MWD cleaned out the stilling basin and downstream creek bed and installed a new battery operated, pressure transducer to record weir water depth information. However, there was some damage to the weir plate that could not be repaired.

When weather conditions permit, Big Bear MWD staff retrieves the recorded information, which again allows the flow at Station A to be calculated.

To determine if Station A was determining flows accurately, Big Bear MWD retained a consultant, Jericho Systems, Inc., to manually measure the Bear Creek flows above and below Station A on two occasions. The consultant found that the measured flows were 0.5 to 1.0 cfs higher than the flows calculated from water level data applied to the damaged weir plate. In 2017, Big Bear MWD began discussing options for Station A with the State Water Resources Control Board. These discussions will continue in 2018.

During 2005, Big Bear MWD, working with State Water Resources Control Board (SWRCB) and the State Department of Fish and Game, developed a proposed plan to keep Station A in compliance with both the 1.0 cfs average daily flow requirement and the 1.2 cfs seven-day average flow requirement. This proposed plan involved increasing the Station B flow requirements to insure the Station A requirements would be met. The new Station B requirements vary by month and hydrologic year type. The monthly hydrologic year type is based on water year-to-date precipitation at Bear Valley Dam. Water years (October 1 to September 30) are used to determine the hydrologic year type. The adopted plan is referred to as the "Exhibit A Flow Compliance Plan" and is presented in the following table. The plan was approved by the SWRCB on January 08, 2009. The amended order also required Big Bear MWD to monitor the flows at Station A for ten years to confirm that the Exhibit A Flow Compliance Plan would satisfy the minimum flow

requirements at Station A. Starting in December of 2005, Big Bear MWD followed the Exhibit A Flow Compliance Plan for Station B.

Effective July 1, 2014, Big Bear MWD adopted a “Revised Flow Compliance Plan” that increased the minimum flow requirements at Station B in some months based on their experience over the six years since the SWRCB approved the Exhibit A Flow Compliance Plan. The Revised Flow Compliance Plan is shown on the following table. The Station B flow requirements for 2017 are highlighted in yellow.

Based on Revised Flow Compliance Plan and the actual water year-to-date precipitation at Bear Valley Dam, the plan for minimum daily average flows at Station B in 2017 were as follows:

<b>Month 2017</b>	<b>Hydrologic Condition WY To-Date</b>	<b>Minimum Daily Average Flow (cfs)</b>
January	Wet	0.85
February	Wet	0.30
March	Wet	0.30
April	Above Normal	0.40
May	Above Normal	0.55
June	Above Normal	0.75
July	Above Normal	0.95
August	Above Normal	1.25
September	Above Normal	1.20
October	Start Water Year	1.20
November	Dry Year	1.10
December	Dry Year	0.90

Flows at Station B normally consist of leakage from the dam and spillway gates, releases and leakage from the outlet works, spills from the lake, and inflows and consumptive losses between the Dam and Station B.

In late 2015, vandalism at Station B impaired the reliability and accuracy of the flow measurements at Station B. To confirm compliance with the Revised Flow Compliance Plan requirements listed

in the above table, Big Bear MWD used the measured flows from the 6-inch Bypass Pipeline plus the estimated leakage from the sluice gates.

In October 2016, Big Bear MWD replaced the weir at Station B with a 12-inch v-notch weir to improve the accuracy of the flow measurements in the range of flows covered in the Revised Flow Compliance Plan.

In 2017, the measurement problems at station B continued and Big Bear MWD continued the use of the measured flows from the 6-inch Bypass Pipeline plus the estimated leakage from the sluice gates to meet the Revised Flow Compliance requirements at Station B. However, there were about 32 days when the outflows from the lake were 0.1 cfs or less out of compliance. On those days, station A flows were in compliance, which indicates the conservative nature of the Revised Flow Compliance Plan.

To handle the SWRCB Order No 95-4 lake release and in-lieu delivery conditions, the Watermaster Committee, in 2002, clarified the accounting procedures. In 2003, the Watermaster made further improvements to these procedures. In 2005, they made a further change to better reflect actual lake management. This change was to include leakage with the flows from the outlet works in the accounting for flows to meet SWRCB Order 95-4. For the lake accounts, the accounting procedures are:

1. The outlet works flows and dam leakage will be deducted from both Mutual's and BBMWD's lake accounts in proportion to the amount of water in their respective lake accounts on days when Mutual is not fully utilizing all the flow in the Santa Ana River at the point of diversion to the forebay of SCE Power Plant No. 1.
2. The outlet works flows and dam leakage releases will be deducted entirely from Mutual's lake account on days when:
  - a) Mutual is fully utilizing all the flow in the Santa Ana River at the point of diversion to the forebay of SCE Power Plant No. 1,
  - b) Mutual is requesting releases from the lake and BBMWD is releasing water from the lake or providing in-lieu supplies, or
  - c) Mutual is purchasing SWP.

**Exhibit A Flow Compliance Plan**  
**Table to Determine Minimum Daily Flows at Station B**  
**Based Upon Water Year-to-Date Precipitation at Bear Valley Dam**

Date	Enter Water Year-to-date Precipitation at Bear Valley Dam (inches)	Dry Year		Below Normal Year		Above Normal Year		Wet Year	
		If year-to-date precipitation is less than (inches)	Station B Minimum Flow Is (cfs)	If year-to-date precipitation is between (inches)	Station B Minimum Flow Is (cfs)	If year-to-date precipitation is between (inches)	Station B Minimum Flow Is (cfs)	If year-to-date precipitation is more than (inches)	Station B Minimum Flow Is (cfs)
October 1		n.a.	0.95	n.a.	0.95	n.a.	0.95	n.a.	0.95
November 1		0.03	0.90	0.03 and 0.56	0.90	0.57 and 1.93	0.70	1.93	0.70
December 1		1.59	0.85	1.59 and 3.04	0.85	3.05 and 5.60	0.80	5.60	0.60
January 1		3.73	0.90	3.73 and 8.14	0.75	8.15 and 12.84	0.75	12.84	0.30
February 1		8.94	1.00	8.94 and 13.84	0.85	13.85 and 20.79	0.50	20.79	0.30
March 1		14.42	0.80	14.42 and 20.05	0.40	20.06 and 31.47	0.40	31.47	0.30
April 1		19.29	0.75	19.29 and 25.84	0.50	25.85 and 40.30	0.40	40.30	0.30
May 1		21.61	0.95	21.61 and 28.65	0.70	28.66 and 41.16	0.55	41.16	0.30
June 1		22.18	1.15	22.18 and 30.01	0.80	30.02 and 41.86	0.75	41.86	0.30
July 1		22.42	1.20	22.42 and 30.01	0.95	30.02 and 41.86	0.95	41.86	0.30
August 1		22.93	1.25	22.93 and 30.69	1.05	30.70 and 42.48	0.95	42.48	0.30
September 1		23.30	1.00	23.30 and 30.86	0.95	30.87 and 43.69	0.95	43.69	0.30

**Revised Flow Compliance Plan**  
**Table to Determine Minimum Flows at Station B for 2017**  
**Based Upon Year-to-Date Precipitation at Bear Valley Dam**

Date	Enter Year-to-date Precipitation at Bear Valley Dam (inches)	Dry Year		Below Normal Year		Above Normal Year		Wet Year	
		If year-to-date precipitation is less than (inches)	Station B Minimum Flow is (cfs)	If year-to-date precipitation is between (inches)	Station B Minimum Flow is (cfs)	If year-to-date precipitation is between (inches)	Station B Minimum Flow is (cfs)	If year-to-date precipitation is more than (inches)	Station B Minimum Flow is (cfs)
October 1	0.00	n.a.	1.20	n.a.	1.20	n.a.	1.20	n.a.	1.20
November 1	2.12	0.03	1.10	0.03 and 0.56	1.00	0.57 and 1.93	0.95	1.93	0.90
December 1	4.25	1.59	0.90	1.59 and 3.04	0.85	3.05 and 5.60	0.85	5.60	0.85
<b>2017</b>									
January 1	13.81	3.73	0.90	3.73 and 8.14	0.85	8.15 and 12.84	0.85	12.84	0.85
February 1	31.30	8.94	1.00	8.94 and 13.84	0.85	13.85 and 20.79	0.50	20.79	0.30
March 1	35.01	14.42	0.95	14.42 and 20.05	0.85	20.06 and 31.47	0.40	31.47	0.30
April 1	36.09	19.29	0.75	19.29 and 25.84	0.50	25.85 and 40.30	0.40	40.30	0.30
May 1	36.29	21.61	0.95	21.61 and 28.65	0.70	28.66 and 41.16	0.55	41.16	0.30
June 1	36.84	22.18	1.15	22.18 and 30.01	1.00	30.02 and 41.86	0.75	41.86	0.30
July 1	36.84	22.42	1.50	22.42 and 30.01	1.30	30.02 and 41.86	0.95	41.86	0.55
August 1	36.85	22.93	1.50	22.93 and 30.69	1.50	30.70 and 42.48	1.25	42.48	0.55
September 1	38.33	23.30	1.35	23.30 and 30.86	1.20	30.87 and 43.69	1.20	43.69	1.15
October 1	0.00	n.a.	1.20	n.a.	1.20	n.a.	1.20	n.a.	1.20
November 1	0.00	0.03	1.10	0.03 and 0.56	1.00	0.57 and 1.93	0.95	1.93	0.90
December 1	0.00	1.59	0.90	1.59 and 3.04	0.85	3.05 and 5.60	0.85	5.60	0.85

Note 1 Yellow highlighted values are the Flow Compliance values for CY 2017  
Note 2 Minimum flow values in blue are revised values used effective July 1, 2014

Prior to 2012, the term “fully utilized” was defined as days when the “net amount” of water the SBVWCD diverted from the forebay of SCE Power Plant No. 3 was less than the amount of the fish release. The “net amount” of water diverted from the forebay was defined as the actual amount diverted by SBVWCD for groundwater recharge less the amount of water delivered to the forebay by the Bear Valley Pick-up on the Santa Ana River below Seven Oaks Dam. In prior years, the Committee noticed there were some operational conditions when this definition did not accurately depict if Mutual was “fully utilizing” all the flow in the Santa Ana River at the point of diversion to the forebay of SCE Power Plant No. 1. When this occurred, adjustments were made in the accounting to better reflect actual operating conditions.

In 2012, the Committee reviewed the conditions and adopted a revised definition of the term “fully utilized.” The revised definition of when Mutual is “fully utilizing” all the flow in the Santa Ana River is when:

- Mutual’s Deliveries of Santa Ana River water are greater than or equal to the SCE Santa Ana River Diversions, and
- The SCE Santa Ana River Diversions are greater than the Outlet Works Flows and Dam Leakage used to meet SWRCB Order No. 95-4.

The daily values of Mutual’s Deliveries and the Santa Ana River Diversions will be made using the Daily Flow Reports prepared by the San Bernardino Valley Water Conservation District.

Mutual’s Deliveries of Santa Ana River Water will be determined as the sum of the following four deliveries:

- BVMWC Highline (B1)\* delivery,
- Northfork Canal Weir (G2) delivery,
- Edwards Canal (H2) delivery, and
- Redlands Aqueduct Weir (W1) delivery less the Redlands Tunnel (I1) inflow plus the Redlands Sandbox Spills (YI).

The daily SCE Santa Ana River Diversions will be determined as the sum of the following flows:

- PH#3 Penstock (CALC) (A1) flow,
- BVMWC Highline (B1) flow,
- Greenspot Spill (F1) to PH#3, and



- Deliveries to the Greenspot Pipeline (C1).

The daily Outlet Works Flows and Dam Leakage from Big Bear Lake used to meet SWRCB Order No. 95-4 are determined by the Watermaster Committee using measured releases and leakage estimates provided by Big Bear MWD.

In 2017 the estimated Outlet Works Flows and Dam Leakage was 664.0 acre-feet and Mutual was determined to have “fully utilized” the Santa Ana River Diversions, received in-lieu deliveries, or purchased SWP water on 222 days, which resulted in the following allocation:

1. 157.7 acre-feet was deducted from both Mutual’s and BBMWD’s lake accounts in proportion to the amount of water in their respective lake accounts on the 143 days when Mutual did not “fully utilize” the Santa Ana River Diversions and did not receive in-lieu deliveries or purchase SWP water, and
2. 506.3 acre-feet was deducted from Mutual’s lake account on the 222 days they “fully utilized” the Santa Ana River Diversions, received in-lieu water deliveries or purchased SWP water.

The Committee will continue to review these accounting methods in 2018 to make sure the determinations of the allocation of the “outlet works flows and dam leakage” accurately reflect actual operations.

The input data and allocation of releases under SWRCB Order No. 95-4 in **Table 2.C of Appendix B** reflect the above revised procedures.

For the Basin Make-up Account, the accounting procedures are:

1. Under a Big Bear MWD operation, the actual fish releases used by Mutual under Item 2 above will be considered a “release actually made under District Operation ( $R_d$ )” and the actual releases under Item 1 above will be treated as “spills which actually occurred under District Operation ( $S_d$ )”.
2. Under a Mutual operation, the fish releases used by Mutual under Item 2 above will be considered a “release which would have been made under a Mutual Operation ( $R_m$ )”, and the releases allocated to Mutual under Item 1 above will be considered a “spill which would have occurred under a Mutual Operation ( $S_m$ ).”

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\*The term in parenthesis refers to the site location used in the Daily Flow Reports (DFR’s) of the San Bernardino Valley Water Conservation District.

**Tables 4.A and 4.B of Appendix B** reflect these accounting procedures.

The Watermaster Committee will continue to work on these accounting procedures in 2018 to make sure they will be accurate for all possible river flow and diversion conditions that could occur in future years.

### **Dam and Spillway Gate Leakage**

Minor leakage through the spillway gates can occur in Bay 1 and Bay 10 if the lake level is above the spillway crest elevation. The structural reinforcement project completed in 2006 eliminated the dam leakage from cracks in the upper arches of Bays 5, 6 and 8. In 2017, the lake level was below the spillway crest (Elevation 6,731.00 feet which is 12.20 feet below a full lake) for most of the year. When the lake level is above the spillway crest elevation, Big Bear MWD estimates the leakage from Bays 1 and 10 by visual observations. The lake level was slightly above the spillway elevation between March 21 and June 12 and Big Bear MWD did not observe any leakage during this period. The 2017 estimated monthly leakages are shown in **Table III-4**. The estimated leakage through the spillway gates in Bays 1 and 10 for 2017 was zero acre-feet.

In late November 2009 during excavation of foundations for the new highway bridge below the dam, workers noticed water entering the excavation and seeping to the surface below. During meetings with Caltrans engineers and the District's engineer in January 2010, Caltrans indicated they were convinced the new seepage was not related to their blasting efforts but the result of the removal of overburden and bedrock resulting in the opening of new pathways for seepage water to move through the abutment rock. Caltrans promised to prepare a remedial grouting plan and submit it to the District for engineering review and approval.

**TABLE III-4**  
**ESTIMATES OF**  
**MONTHLY DAM LEAKAGE**  
 (acre-feet)  
 Calendar Year 2017  
 Big Bear Watermaster

<b>Month</b>	<b>Bay 1 and Bay 10 Leakage Estimates (AF)</b>	<b>Additional Foundation Leakage (AF)</b>	<b>Total Estimated Leakage (AF)</b>
January	-0-	-0-	-0-
February	-0-	-0-	-0-
March	-0-	-0-	-0-
April	-0-	-0-	-0-
May	-0-	-0-	-0-
June	-0-	-0-	-0-
July	-0-	-0-	-0-
August	-0-	-0-	-0-
September	-0-	-0-	-0-
October	-0-	-0-	-0-
November	-0-	-0-	-0-
December	<u>-0-</u>	<u>-0-</u>	<u>-0-</u>
<b>Annual Total</b>	<b>-0-</b>	<b>-0-</b>	<b>-0-</b>

In late 2011, Caltrans prepared a remedial grouting program to control seepage at the left abutment of the dam. After review and approval by the Big Bear MWD, the program was submitted for technical review to the Division of Safety of Dams, and Caltrans received their approval in concept. The Caltrans proposal included four rows of grout holes. Two parallel rows parallel to the edge of the lake beginning at the left abutment and two rows perpendicular to the first rows beginning at the left abutment. While the intent of Caltrans is to protect their new highway bridge foundation, the project should dramatically reduce seepage at the left abutment of the dam. In mid-2012, Caltrans conducted the left abutment grouting on the roadbed approach (now the parking area) of the old highway bridge. Two rows of holes were drilled and grouted during the process along with three verification holes. After completion of this effort in August 2012 observed downstream seepage at the left dam abutment was significantly reduced. As a result of this observation Caltrans determined that the second set of grout holes would be unnecessary and Caltrans closed the project.

The additional foundation leakage cannot be directly measured and has been estimated from flow measurements at Station B that are in excess of the measured releases and estimated spillway gate leakage from the lake. Beginning in September 2013, no additional foundation leakage has been identified which indicates the grouting program may have reduced or perhaps eliminated the foundation leakage. The Committee will continue to monitor this source of leakage before drawing any conclusions concerning the effectiveness of the grouting program.

There was no estimated dam leakage in 2017 and it did not contribute to the outflows from the Lake to meet the requirements of SWRCB Order 95-4.

### **Outlet Works Releases**

Water is released from the lake through the outlet works. These releases can be for flood control purposes, for Mutual, or for fishery protection in accordance with SWRCB Order No. 95-4.

Releases are made either through a 36-inch outlet works or a 6-inch bypass pipeline that is connected to the 36-inch outlet works. A 36-inch butterfly valve is the primary control mechanism on the outlet works. Flows in the outlet works are measured by an in-line 36-inch flow meter that

was installed on the outlet piping downstream of the butterfly valve in December 1993 to replace an older meter. The meter is an Electromatic Flow Meter Model 655 manufactured by Sparling Instruments, Inc. Downstream of the flow meter, the outlet works splits into a 24-inch pipeline and a 14-inch pipeline. Flows through these two pipelines are controlled by two motorized sluice gates. The two sluice gates are 24-inch by 24-inch and 14-inch by 14-inch. The 36-inch meter was calibrated with an accuracy of  $\pm 0.5$  percent between 7.07 and 212 cfs. When the sluice gates were fully opened and the lake was full, the meter measured a flow of 256 cfs, which is the maximum that can be discharged through the outlet works. When the lake is full and only the 14-inch sluice gate is open, the flow from the outlet works is estimated to be 68 cfs. When only the 24-inch sluice gate is open, the maximum discharge from the Outlet Works is estimated to be 195 cfs. The rate of flow and totalized flow are recorded at the flow meter and also at the control building. There is usually a small amount of leakage through the two sluice gates. In 2017, the leakage through the sluice gates was estimated to be 15.1 acre-feet.

There is also a 3-inch Relief Line, meter and valve on the 36-inch outlet pipeline. During the winter months this valve is usually opened to allow a small amount of flow (usually 4 to 6 gpm) to pass through the 36-inch pipeline and prevent water in the pipeline from freezing. The 3-inch Relief Line had been used to provide water for the construction of the new highway bridge downstream of the Dam that replaced the bridge that was on the top of Bear Valley Dam. The bridge construction was completed in November 2011, and Big Bear MWD is no longer releasing any water for the bridge construction project. The winter water releases through the 3-inch Relief Line were 1.6 acre-feet in 2017, and they flowed down Bear Creek and were measured as part of the flow at Station B. These releases are considered as part of the releases to comply with SWRCB Order N0. 95-4.

Flow through the 6-inch Bypass Pipeline was metered beginning in August 2006 when Big Bear MWD replaced a 4-inch Bypass Pipeline with a 6-inch Bypass Pipeline, valve and a Krohne IFS 400 flow meter. Releases to comply with SWCRB Order No. 95-4 are normally made through the 6-inch Bypass Pipeline. The total amount released through the 6-inch Bypass Pipeline in 2017 was 647.3 acre-feet.

In 2017, Big Bear MWD released water from the lake through the Outlet Works to comply with SWRCB Order No. 95-4. **Table III-5** summarizes the monthly amounts of water discharged from

the outlet works in 2017. The total from the Outlet Works in 2017 was estimated to be 664.0 acre-feet.

### **Mutual Releases**

There were no lake releases for Mutual in 2017.

### **San Bernardino Valley MWD Releases**

In 2017 San Bernardino Valley MWD did not request any lake releases from their storage account in Big Bear Lake for delivery of in-lieu lake water to Mutual.

### **Flood Control Releases**

There were no flood control releases in 2017.

**TABLE III-5**  
**MONTHLY DISCHARGES FROM**  
**THE OUTLET WORKS OF BEAR VALLEY DAM**  
 (acre-feet)  
 Calendar Year 2017  
 Big Bear Watermaster

Month	Flood Control Releases (AF)	Mutual Releases (AF)	SBVMWD		Total
			Releases (AF)	SWRCB Discharges (AF)	Outlet Works Discharges (AF)
January	-0-	-0-	-0-	61.3	61.3
February	-0-	-0-	-0-	19.3	19.3
March	-0-	-0-	-0-	15.6	15.6
April	-0-	-0-	-0-	22.2	22.2
May	-0-	-0-	-0-	44.1*	44.1
June	-0-	-0-	-0-	48.5*	48.5
July	-0-	-0-	-0-	69.4*	69.4
August	-0-	-0-	-0-	73.4*	73.4
September	-0-	-0-	-0-	75.2*	75.2
October	-0-	-0-	-0-	76.8*	76.8
November	-0-	-0-	-0-	78.1*	78.1
December	-0-	-0-	-0-	80.1*	80.1
<b>Total</b>	<b>-0-</b>	<b>-0-</b>	<b>-0-</b>	<b>664.0</b>	<b>664.0</b>

\* These releases were also used to partially or wholly meet Mutual's needs for lake water.

## **Spills**

Spills are flows that leave the lake over the spillway of the dam. They are calculated from lake gage height readings and spillway gate settings at the dam during the time of the spill. In 2017, there were no spills from the lake

## **Station B Flows**

Leakage estimates and outlet works flows are confirmed by comparing the sum of dam leakage plus the amount released from the lake through the outlet works with the flow measured at Station B, which is 300 feet downstream of the dam. The differences can be either gains or losses. Although small, these differences can illustrate the impacts of rainfall/snowfall and plant evapotranspiration between the dam and Station B. **Table III-6** shows this comparison. In 2017, the measured and estimated flow at Station B was 43.7 acre-feet more than the estimated amount leaving Big Bear Lake from releases, leakage and spills. In 2017 these differences were small and reflect the improved measurements at Station B. In October 2016, Big Bear MWD replaced the weir plate at Station B with a 12-inch v-notch weir to improve the accuracy of the measurements and replaced the communication line between the transducer and the SCADA system. These changes improved the accuracy of the Station B measurements. Big Bear MWD is continuing their efforts to improve the reliability and accuracy of the Station B measurements. The Watermaster Committee will continue to monitor this condition in 2018.

## **Lake Withdrawals for Snowmaking**

Big Bear MWD sells water from Big Bear Lake for use in snowmaking, fire protection and re-vegetation for ski areas within the watershed. In 2017, 734.5 acre-feet of water was withdrawn from the lake for these purposes. The withdrawals for snowmaking occurred in seven winter months (January, February, March, April, October, November and December). The withdrawals for fire protection and re-vegetation occurred in five summer and fall months (May, June, July, August and September).



**TABLE III-6**  
**COMPARISON OF FLOWS AT STATION B WITH**  
**ESTIMATED LEAKAGE AND FLOWS FROM OUTLET WORKS**  
**Calendar Year 2017 Big Bear Watermaster**

Month	Flows from Outlet Works (AF)	Dam Leakage (AF)	Spillway Gate Release (AF)	Total Flows From Lake (AF)	Flow at Station B (AF)	Gains/ (Losses) (AF)
January	61.3	-	-	61.3	72.6	11.3
February	19.3	-	-	19.3	33.0	13.7
March	15.6	-	-	15.6	33.7	18.1
April	22.2	-	-	22.2	25.3	3.1
May	44.1	-	-	44.1	45.4	1.3
June	48.5	-	-	48.5	52.0	3.5
July	69.4	-	-	69.4	79.8	10.4
August	73.4	-	-	73.4	79.6	6.2
September	75.2	-	-	75.2	69.2	(6.0)
October	76.8	-	-	76.8	69.5	(7.3)
November	78.1	-	-	78.1	72.9	(5.2)
December	80.1	-	-	80.1	74.7	(5.4)
<b>Total</b>	<b>664.0</b>	<b>-</b>	<b>-</b>	<b>664.0</b>	<b>707.7</b>	<b>43.7</b>

Big Bear MWD began selling water from the lake for snowmaking purposes in 1980 and the Watermaster accounting assumed 50 percent would return to the lake as snowmelt. In 1989, Big Bear MWD retained James M. Montgomery, Consulting Engineers to evaluate this assumption. Their report was completed in May 1989 and concluded the return flow factors would range between 0.48 and 0.52 depending on the air temperature during snowmaking. The report recommended the Watermaster continue using a return flow factor of 0.50. The Watermaster Committee adopted the recommendation in 1989.

Based on this report, Watermaster estimates that half of the monthly amount pumped from the lake for snowmaking in the winter months returns to the lake in the form of snowmelt during the same month. In 2017, the withdrawal from the lake for snowmaking was 643.3 acre-feet and 321.6 acre-feet returned to the lake. In the summer and fall months, 91.2 acre-feet of water was used and none was returned to the lake. The “net withdrawal” for all purposes was 412.8 acre-feet.

### **Net Wastewater Exports**

The Watermaster Committee calculates “net” wastewater exports as the difference between the wastewater that leaves the Big Bear Lake Watershed and the water supply that is imported into the Big Bear Lake Watershed from the Baldwin Lake Watershed. The methodology used to make these calculations is documented in a report entitled “Development of a Methodology for Estimating Gross Sewage Export from Upper Bear Creek Watershed”, prepared by James M. Montgomery, Consulting Engineers, Inc., in September 1989 for Big Bear Municipal Water District.

Wastewater is exported from the Big Bear Lake watershed to the Baldwin Lake watershed from the following three areas:

- City of Big Bear Lake
- San Bernardino County Service Area 53B
- Airport area served by Big Bear City CSD

Wastewater flows from the first two areas are measured by the Big Bear Area Regional Wastewater Authority (BBARWA). Wastewater flows from the airport area within the Big Bear Lake watershed are estimated based upon the number of sewer connections in the area.

Water is imported into the Big Bear Lake watershed from the Baldwin Lake watershed by the following three activities:

- City of Big Bear Lake imports groundwater from the Baldwin Lake watershed.
- Big Bear City CSD provides water to the airport area from the Baldwin Lake watershed
- Big Bear City CSD occasionally provides emergency water to the City of Big Bear Lake

The City of Big Bear Lake imported supplies and emergency supplies are both metered, while the airport area supplies are estimated based on the number of water service connections.

In 2017, the "net" wastewater exported from the Big Bear Lake Watershed was 1,279 acre-feet. **Table III-7** contains the 2017 monthly net exports.

## **SANTA ANA RIVER**

### **Bear Valley Mutual Water Company Water Needs**

Mutual meets the water needs of its shareholders primarily by diverting water from the Santa Ana River. When river flow is inadequate to meet their needs, Mutual can call upon water stored in Big Bear Lake, pump ground water from the San Bernardino ground water basin, buy State Water Project (SWP) water from San Bernardino Valley MWD, or reduce the delivery rate to its shareholders.

In 2017, Mutual reported they may need up to 6,500 acre-feet of water from Big Bear MWD including the portion of the SWRCB 95-4 outflows they could beneficially use. Their intent was to limit their deliveries from BBMWD to 6,500 acre-feet in 2017. Mutual met their overall 2017 water needs by in-lieu supplies from Big Bear MWD, diversions from the Santa Ana River, and local groundwater. Mutual also got some water from the lake releases and dam leakage for fish protection in Bear Creek.

**TABLE III-7**  
**NET WASTEWATER EXPORTS**  
 (acre-feet)  
 Calendar Year 2017  
 Big Bear Watermaster

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<b>Month</b>	<b>Net Wastewater Exports (acre-feet)</b>
January	170.7
February	247.5
March	176.8
April	100.6
May	81.3
June	73.3
July	84.9
August	73.4
September	62.4
October	59.6
November	64.3
December	<u>84.2</u>
<b>Total</b>	<b>1,279.0</b>

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## **Summary of Flows and Diversions at Mouth of the Santa Ana River Canyon**

Exhibit D, Section 1(f) of the Judgment calls for data to be included in each Watermaster annual report summarizing the river flows at the mouth of the Santa Ana River Canyon and diversions at the mouth of the Santa Ana River Canyon. Specifically, it requests quantities of water diverted into the following facilities:

1. Bear Valley High Line
2. Redlands Canal
3. North Fork Canal
4. Edwards Canal
5. San Bernardino Valley Water Conservation District Spreading Grounds

Exhibit D also requires the annual report to estimate the amount of Santa Ana River flow not diverted for beneficial use. **Table III-8** contains this information for 2017.

## **Flow of Santa Ana River at Mouth of Canyon**

The United States Geological Survey (USGS) reports flow in the Santa Ana River at the mouth of the Santa Ana Canyon under Station No. 11051501. This station is the combination of flow records from three gages (USGS Station No. 11049500, 11051499, and 11051502). Flow in the flume between the afterbay of SCE Power House No. 1 (SCE Power House No. 2 was removed due to the construction of Seven Oaks Dam) and the forebay of SCE Power House No. 3 is estimated by the USGS using a meter installed by SCE and reported as Station No. 11049500. Note that this metered flow includes the overflow from the old SCE Powerhouse No. 3 forebay as reported on the Daily Flow Report as the Greenspot Spill. In addition, the USGS maintains two gauging stations near the mouth of the Santa Ana River Canyon below Seven Oaks Dam. Station No. 11051499 measures the flow in the main river channel while Station No. 11051502 measures river flow diverted into the afterbay of SCE Power House No. 3 through the Bear Valley River Pick-up. The measured flows at this gage also includes the over-flow from the old SCE Powerhouse No. 3 forebay. The records from these three sources are summarized, adjusted for the overflow from the old SCE Powerhouse No. 3 forebay, and reported as the total flow in the Santa Ana River, USGS Station No. 11051501.

TABLE III-8

**SUMMARY OF DIVERTED FLOW AT MOUTH OF  
SANTA ANA RIVER CANYON  
(ACRE-FEET)**

Calendar Year 2017  
Big Bear Watermaster

Flow Component		Amount (AF)
<b>FLOW OF SANTA ANA RIVER AT MOUTH OF CANYON</b>		
Flow Reported for U.S.G.S. Gage 11051501-provisional		35,196
less BVMWC Canyon Well No. 1 Production		<u>-0-</u>
Estimated Santa Ana River Flow Below Seven Oaks Dam		<b>35,196</b>
Annual Storage Change in Seven Oaks Reservoir		<u>-1,340</u>
<b>Estimated Santa Ana River Flow at Mouth of Canyon</b>		<b>33,856</b>
<b>DIVERSIONS BY BEAR VALLEY MUTUAL WATER COMPANY</b>		
Diversions:	Greenspot Metering Station	-0-
	Edwards Line	363
	North Fork Canal	5,085
	Bear Valley Highline	2,924
	Redlands Aqueduct (includes Redlands Tunnel)	8,012
	SBVMWD Morton Canyon Connector Deliveries	-0-
	Redlands Sandbox Spreading (observed)	<u>137</u>
		16,521
Adjustments:	Water pumped from BVMWC Canyon Well No. 1	-0-
	Redlands Tunnel Diversion	<u>-248</u>
	<b>Total MUTUAL Diversions</b>	<b>16,273</b>
<b>DIVERSIONS BY SBVWCD</b>		
	Diversion by San Bernardino Valley Water Conservation District	18,961
	SBVMWD Morton Canyon Connector Deliveries to SBVWCD	<u>-0-</u>
	<b>Total SBVWCD Diversions</b>	<b>18,961</b>
<b>TOTAL DIVERSIONS FROM THE SANTA ANA RIVER</b>		
<b>Total Diversions by Mutual and SBVWCD</b>		<b>35,234</b>
<b>AMOUNT NOT DIVERTED</b>		
Santa Ana River Flow at Mouth of Canyon		33,856
Mutual and SBVWCD Diversions		<u>- 35,234</u>
Amount Released from Storage Behind Seven Oaks Dam		<u>- 1,340</u>
Estimated Not Diverted		38
<b>Estimated Flow Downstream of Diversions*</b>		<b>284</b>
<b>Estimated Losses and Measurement Errors **</b>		<b>-322 or 1.0%</b>

\* This value equals the amount observed at the Cuttle Weir (63 AF) plus spills from PH #3 (221 AF)

\*\* See written text for explanation

During 2017, the total river flow reported by the USGS, currently provisional, was 35,196 acre-feet. However, measurements at Station No. 11049500 include the amount of groundwater pumped by Mutual and discharged into the flume above the gage. Thus, to get the actual Santa Ana River Flow, the canyon well production must be deducted from the reported flows. In 2017, there was no canyon well production. Thus, the resulting estimated River flow was 35,196 acre-feet in 2017. However, this value does not reflect the storage change in the reservoir behind Seven Oaks Dam. In 2017, an estimated 1,340 acre-feet of water stored behind the dam prior to 2017 was released in 2017. Thus, the estimated flow of the Santa Ana River at the mouth of the canyon above Seven Oaks Dam was 33,856 acre-feet in 2017.

#### **Diversions by Bear Valley Mutual Water Company**

Amounts diverted by Mutual and associated prior right companies are reported to the State Water Resources Control Board under Recordation Numbers 36-00021, 36-00022 and 36-00028. In 2017, Mutual's diversions were estimated to be 16,521 acre-feet based on the Daily Flow Reports prepared by the San Bernardino Valley Water Conservation District (SBVWCD). The vast majority, 16,273 acre-feet, was water diverted from the Santa Ana River. They did not pump any groundwater from their well located in the Santa Ana Canyon above the major points of diversion, but they did produce 248 acre-feet of water from the Redlands Tunnel.

#### **Diversions by San Bernardino Valley Water Conservation District**

Water diverted by the San Bernardino Valley Water Conservation District for groundwater recharge is by virtue of licenses, pre-1914 rights and diversion rights of San Bernardino Valley MWD and Western MWD; all diversions are reported to the State Water Resources Control Board. In 2017, the diversions were estimated to be 18,961 acre-feet of Santa Ana River water for ground water recharge based on the Daily Flow Reports prepared by the SBVWCD.

#### **Amount Not Diverted**

The sum of the diversions mentioned above are subtracted from the total river flow, as reported by USGS Gage 11051501 plus the annual storage change in Seven Oaks Reservoir to determine the

"Amount Not Diverted". The "Amount Not Diverted" represents the amount of water that flows past the mouth of the Santa Ana River Canyon without being diverted for beneficial use.

### **Losses and Measurement Errors**

During preparation of the 1996 report, the Watermaster Committee discovered significant discrepancies between the value for "Amount Not Diverted", as calculated by the method contained in previous Watermaster Reports, and observed flows in the Santa Ana River just downstream from the last diversion point. Since 1994, San Bernardino Valley Water Conservation District staff have been estimating the amount of water flowing past the Greenspot Road Bridge at the Cuttle Weir, which is just downstream from the mouth of the Santa Ana River Canyon, on a daily basis. In past years the difference between the estimated flows at the Greenspot Road Bridge and the "Amount Not Diverted" were significantly different. The Watermaster has conducted extensive research with regards to the discrepancy and provided the following eight explanations:

1. Leakage Losses between Inflows and Outflows. The first explanation was unmeasured losses between the points where inflows and outflows are measured. These include:
  1. Leakage in the tailrace from SCE Power House No. 3 afterbay,
  2. Leakage in the Redlands Aqueduct between SCE Power House No. 3 afterbay and the Redlands Sandbox, and
  3. Leakage around the Redlands Sandbox weir.
2. Unmeasured Diversions. The second explanation was that Mutual can divert water for spreading at the Redlands Sandbox without it being measured. San Bernardino Valley Water Conservation District staff now observes and reports this diversion on a daily basis. These estimates are based on known flows delivered to the Redlands Sandbox and are fairly accurate. This possible source of error has been corrected and the amount diverted for spreading is included in Table III-8.
3. USGS Gage Accuracy. The third possible explanation for the disparity is the accuracy of the USGS flow records. The USGS reports that this combined flow measurement of the three gaging stations is considered to have an accuracy rating of "fair". A "fair" rating means that 95 percent of the daily discharge measurements are within 15 percent of the true value. According to Jeffrey Agajanian of the USGS, this means the error band for the entire year should be within



approximately 15 percent of the total measured flow. This value is a conservative estimate of the possible measurement errors and the flow is likely to be well within this error band, especially during the summer months when flows are generally constant and lower.

4. Water Delivery Flow Measuring Device Accuracy. A fourth reason for the difference could be inaccuracies in the diversion measuring devices, which should be less than +/- 10 percent at any given time. Most of these measurements are obtained through the use of stable, long-term weirs and parshall flumes, but small, though not insignificant, errors are possible. Some of the measurement devices provide daily readings and are equipped with totalizer equipment providing monthly data. The San Bernardino Valley Water Conservation District (SBVWCD) will continue to update totalizer equipment on any of the measurement devices that are not equipped with totalizer equipment.

5. Observed Flow at the Cuttle Weir. A fifth possible explanation was the accuracy of the flow estimates at the Cuttle Weir. These estimates are based on daily flow observations. Total flow quantities are difficult to determine because of the high degree of short-term variability in the river flows during storm events. For 2017, the flow over the Cuttle Weir was estimated to be 63 acre-feet.

The construction of the Seven Oaks Dam required the reconstruction of the SCE flume between the old Power House No. 2 and No. 3. This eliminated any losses in the flume from the old Power House No. 2 and No. 3 and required the USGS to move Station No. 11049500 to the old forebay of Power House No. 3. Flow at this station was initially estimated by using the Daily Flow Report provided by the San Bernardino Valley Water Conservation District and is reported as Station No. 11049500. As of August 2001, SCE has installed a new meter in their aqueduct above the forebay of Power House No. 3 and data from this flow meter is provided to the USGS. In addition, improved efforts were taken to monitor diverted water at the Redlands Sandbox for ground water recharge and observed flows at the Cuttle Weir. The Watermaster has concluded that these efforts have reduced the losses and measurement inaccuracies such that the large errors that occurred in the past should no longer occur.

6. Storage behind Seven Oaks Dam. There is, however, an additional factor that must be considered when the Watermaster Committee estimates the “amount not diverted”. This factor is the amount of water that has been stored behind Seven Oaks Dam (SOD) and not released by year-end. This stored water is Santa Ana River flow that has not yet been measured by the two USGS

stream gauges below the dam. In addition, water stored behind the dam from inflow in the previous year and released in the current year must also be taken into account. The amount stored behind SOD at the end of 2016 was 1,479 acre-feet (water surface elevation of 2,176.4 feet). The amount stored behind SOD at the end of 2017 was 139 acre-feet (water surface elevation of 2,135.9 feet). In other words, water that had been stored behind the dam from inflow in the prior year (2016) was released in 2017. This amount was 1,340 acre-feet and was included in the USGS provisional value of 35,196 acre-feet. Deducting the amount of SAR water stored behind SOD in 2016 and released in 2017 to the USGS provisional value decreases the estimate of Santa Ana River flow to 33,856 acre-feet for 2017.

7. Spills from SCE PH No. 3. In 2012, the Committee identified an additional location where Santa Ana River water that is not diverted is measured by the San Bernardino Valley Water Conservation District. This location is the afterbay of SCE Power House No. 3. On occasion, all of the water delivered to the afterbay is not diverted and some of it is spilled to a small channel that discharges to the Santa Ana River below Cuttle Weir. The Committee agreed that these spills should be added to the observed flows at Cuttle Weir to estimate the “Estimated Flow Downstream of Diversions” as reported in **Table III-8**. In 2017, the estimated spills from SCE PH No. 3 were 221 acre-feet.

8. Differences in Measurements. The USGS estimates of the Santa Ana River flow are based on stream gauges that record data at 15 minute intervals throughout the day. The estimates of diversions are based on the Daily Flow Reports prepared by the SBVWCD and these reports contain only a single value (usually in the morning) for each working day for each diversion point. Thus the diversion estimates are not as accurate as the USGS flow estimates and this could lead to significant errors in the “Estimated Not Diverted” value (38 acre-feet) as shown in Table III-8. The Watermaster Committee will review this item in 2018 to determine if Table III-8 should be revised to provide a better estimate of the amount of Santa Ana River water that is not diverted.

### **2017 Estimate of Amount Not Diverted**

In 2017, San Bernardino Valley Water Conservation District observed river flow past the Cuttle Weir at the Greenspot Road Bridge and the spills to the Santa Ana River from the afterbay of SCE Power House No. 3. Their estimate of these flows, which represents the amount not diverted, was

284 acre-feet. In other words, all except 284 acre-feet of the flow in the Santa Ana River was diverted in 2017.

In 2017, the estimated Santa Ana River flow at the mouth of the canyon was 33,856 acre-feet. The total diversion of Santa Ana River flow by Mutual and San Bernardino Valley Water Conservation District was 35,234 acre-feet. In total, an estimated 35,196 acre-feet of Santa Ana River water was available for diversions, which includes 1,340 acre-feet of flow that was stored in 2016 behind Seven Oaks Dam and released in 2017. The difference between estimated inflow and total diversions is minus 38 acre-feet. Comparing this difference with the observed flows past the Cuttle Weir at Greenspot Road Bridge and the spills from the afterbay of SCE PH No. 3 (284 acre-feet), results in unmeasured leakage losses and measurement errors of 322 acre-feet. These losses and errors represent only 1.0 percent of the estimated Santa Ana River flow (acre-feet).

### **Lake Releases/In-Lieu Water Deliveries**

Santa Ana River flows are often insufficient to meet Mutual's water needs; as a result, they frequently request lake releases from Big Bear MWD to meet their needs. Big Bear MWD has the choice of releasing water from the lake or providing an in-lieu supply. At their meeting on May 1, 1987, the Board of Directors of the Big Bear MWD voted unanimously to approve the following policy for providing in-lieu supplies.

*1. Adopt the following 1987 in-lieu policy:*

- A. When the lake is in the top 4 feet, the irrigation demands from the lake will be met by releasing water from Big Bear Lake.*
- B. When the lake is between 4 feet and 6 feet down, the District intends to purchase in-lieu water between the months of May 1st and October 31st from either wells or the State Water Project; between November 1st and April 30, water required would be released from Big Bear Lake.*
- C. When the lake is between 6 and 7 feet down, the Board shall determine whether to release from the lake.*
- D. In the unlikely event that the lake is more than 7 feet down, the District intends to buy in-lieu water throughout the year.*

*E. The General Manager shall inform the Board each time water is released.*

On November 16, 2006, the Board of Directors of Big Bear MWD modified their Lake Release Policy to eliminate items C, D and E and to use in-lieu water whenever the lake is more than 6 feet below full. The revised Lake Release Policy is:

- 1. When the Lake is within the top 4 feet, the water demands from Bear Valley Mutual will be met with Lake releases;*
- 2. When the Lake is between 4 and 6 feet below full, the District intends to obtain in-lieu water between the months of May 1 and October 31. Between November 1 and April 30, water required would be released from Big Bear Lake;*
- 3. When the Lake is more than 6 feet below full, the District intends to obtain in-lieu water throughout the year.*

In 2017, the lake level was more than 6 feet below full for the entire year. The lake ended the year 15.20 feet below full.

### **2012 In Lieu Lake Release Agreement**

In July 2012, Big Bear MWD and San Bernardino Valley MWD (Valley District) entered into a Memorandum of Understanding that allowed Valley District to deliver In Lieu Water to Mutual when the Lake Release Policy would normally call for lake releases, and, in return, Valley District would get credit for an equal amount of water stored in Big Bear Lake. The amount of water in their storage account would be reduced monthly by the amount of additional evaporation resulting from the increased surface area of the lake. This In Lieu Lake Release program began on July 1, 2012 and was scheduled to run through December 31, 2015. In 2015, the two agencies modified the existing In Lieu Agreement to extend the time Valley District could make In Lieu lake deliveries to Mutual and provide Valley District with the opportunity to reduce their In-Lieu SWP deliveries to Mutual during emergency years when their State Water Project (SWP) deliveries are significantly reduced. At the end of 2016, Valley District had stored 1,088 acre-feet of water in Big Bear Lake. In 2017, Valley District did not request any In Lieu Lake Releases. The additional evaporation losses in 2017 were 126 acre-feet. Valley District ended the year with 962 acre-feet

in their sub-account and the Lake was 0.51 feet higher than it would have been without the Memorandum of Understanding. **Table III-9** shows the account details of Valley District's portion of Big Bear MWD's lake account.

### **Water Deliveries to Mutual by Big Bear MWD**

Mutual received 4,653.1 acre-feet of water from Big Bear MWD in 2017. This year Mutual's needs were met by in-lieu deliveries of SWP water, and water discharged from the lake for fishery protection under SWRCB Order No. 95-4. **Table III-10** shows Big Bear MWD monthly water deliveries to Mutual during 2017. The amount of water delivered to Mutual consisted of 4,146.8 acre-feet of in-lieu SWP water, and 506.3 acre-feet of lake water they were able to use from the releases and leakage for fish protection.

The amount of water Big Bear MWD is obligated to deliver to Mutual is limited by the Judgment. According to the Physical Solution Agreement, Article III.A.1.(b), Mutual has the right to:

*“divert water, or cause water to be diverted, at such rate as may be reasonably necessary to meet the requirements of Mutual’s stockholders, not exceeding 65,000 acre-feet in any ten (10) year period, as determined by the Board of Directors of Mutual in its sole discretion.”*

**Table III-11** summarizes the deliveries to Mutual since the agreement went into effect. For the ten-year period ending with calendar year 2017, the amount of water delivered to Mutual by Big Bear MWD was 56,290 acre-feet. For the 41-year period the Judgment has been in effect, the average annual deliveries by Big Bear MWD to Mutual has been 4,556 acre-feet.

**TABLE III-9**  
**ALLOCATION OF BIG BEAR MWD LAKE ACCOUNT**  
 Calendar Year 2017  
 Big Bear Watermaster

LAKE ACCOUNTS (acre-feet)	Big Bear WM Account	Valley District Subaccount	Big Bear Subaccount
Initial Storage	22,870.0	1,087.5	21,782.5
Lake Inflows	-	-	-
In-Lieu Supplies to Mutual	4,146.8	-	4,146.8
Lake Releases (Mutual & BBMWD)	-	-	-
Releases & Leakage (SWRCB 95-4)	(97.7)	-	(97.7)
Net Snowmaking Withdrawals	(412.8)	-	(412.8)
Lake Spills & Flood Control Releases	-	-	-
Evaporation from Lake	(3,143.6)	(125.3)	(3,018.3)
Net Wastewater Exports	(1,279.0)	-	(1,279.0)
Advances and Repayment of Advances	-	-	-
Ending Storage	22,083.7	962.2	21,121.5

**TABLE III-10**  
**WATER DELIVERIES TO MUTUAL BY**  
**BIG BEAR MUNICIPAL WATER DISTRICT**  
(Acre-feet)  
Calendar Year 2017  
Big Bear Watermaster

<b>Month</b>	<b>Releases from Big Bear Lake for Mutual</b>	<b>Mutual's Use of Fish Releases*</b>	<b>"In-Lieu" State Water Project</b>	<b>"In-Lieu" Lake Releases</b>	<b>"In-Lieu" Groundwater</b>	<b>Total Deliveries to Mutual</b>
January	-0-	-0-	-0-	-0-	-0-	-0-
February	-0-	-0-	-0-	-0-	-0-	-0-
March	-0-	-0-	-0-	-0-	-0-	-0-
April	-0-	1.3	26.7	-0-	-0-	28.0
May	-0-	20.9	35.8	-0-	-0-	56.7
June	-0-	38.9	262.1	-0-	-0-	301.0
July	-0-	69.4	1,060.2	-0-	-0-	1,129.6
August	-0-	73.4	886.2	-0-	-0-	959.6
September	-0-	75.2	791.5	-0-	-0-	866.7
October	-0-	76.8	615.5	-0-	-0-	692.3
November	-0-	78.1	144.3	-0-	-0-	222.4
December	<u>-0-</u>	<u>72.3</u>	<u>324.5</u>	<u>-0-</u>	<u>-0-</u>	<u>396.8</u>
<b>Total</b>	<b>-0-</b>	<b>506.3</b>	<b>4,146.8</b>	<b>-0-</b>	<b>-0-</b>	<b>4,653.1</b>

\* Also required to comply with SWRCB Order No. 95-4

In 2018, Mutual can request up to 13,818 acre-feet of water from Big Bear MWD. This value is the amount that they are below the 65,000 limitation at the end of 2017 (which is 8,710 acre-feet), plus the deliveries made in 2008 (which was 5,108 acre-feet), that will be dropped from the ten-year period ending in 2018. The 13,818 acre-feet total includes in-lieu deliveries, lake releases, and fishery outflows that Mutual is able to divert.

### **Mutual's Equivalent Water Diversions**

**Table III-12** shows the amount of water that Mutual would have diverted from the Santa Ana River if the Judgment had not been rendered. This figure is determined by adding the in-lieu State Water Project water and in-lieu groundwater deliveries as reported in **Table III-10** to the river diversions by Mutual and Mutual's groundwater production from their Canyon Wells No. 1 and 2, as shown in **Table III-8**. The value for river diversions includes the supply from the Redlands Tunnel and the in-lieu lake release. This equivalent diversion is the amount of Santa Ana River water Mutual would have diverted if their demands for water from Big Bear MWD had been met by lake releases rather than in-lieu deliveries. In 2017, Mutual's equivalent diversions were 20,668 acre-feet.



**TABLE III-11**  
**SUMMARY OF WATER DELIVERIES TO MUTUAL 1977 - 2017**  
 (acre-feet)

Calendar Year 2017 Big Bear Watermaster

Calendar Year	Mutual Lake Releases	SWRCB Outflows to Mutual	In-lieu Wells	In-lieu SWP	In-lieu EVWD or VD Lake Rel	In-lieu Stock	Total In-lieu & Releases	10-year Total
1977	868.0		4,412.0	-	-	-	5,280.0	n.a.
1978	-		-	-	-	-	-	n.a.
1979	-		-	-	-	-	-	n.a.
1980	-		-	-	-	-	-	n.a.
1981	2,250.0		-	672.0	-	-	2,922.0	n.a.
1982	657.0		-	56.0	-	-	713.0	n.a.
1983	-		-	-	-	-	-	n.a.
1984	1,700.0		-	993.0	-	-	2,693.0	n.a.
1985	2,466.0		842.0	2,994.0	-	-	6,302.0	n.a.
1986	1,358.0		1,139.0	190.0	-	-	2,687.0	20,597.0
1987	-		3,301.0	4,762.0	-	84.0	8,147.0	23,464.0
1988	-		1,864.0	5,432.0	-	63.0	7,359.0	30,823.0
1989	-		1,593.0	8,555.0	-	-	10,148.0	40,971.0
1990	-		561.0	7,722.0	-	-	8,283.0	49,254.0
1991	79.0		-	-	151.0	-	230.0	46,562.0
1992	-		-	-	-	-	-	45,849.0
1993	-		-	-	-	-	-	45,849.0
1994	1,141.0		-	-	-	-	1,141.0	44,297.0
1995	88.0		-	-	-	-	88.0	38,083.0
1996	3,461.0		-	4,027.0	-	-	7,488.0	42,884.0
1997	364.0		-	6,780.0	-	-	7,144.0	41,881.0
1998	-		-	-	-	-	-	34,522.0
1999	124.2	146.5	-	10,436.0	-	-	10,706.7	35,080.7
2000	-	510.4	-	12,878.0	-	-	13,388.4	40,186.1
2001	46.3	492.7	48.0	14,212.0	-	-	14,799.0	54,755.1
2002	-	614.1	-	5,000.0	-	-	5,614.1	60,369.2
2003	-	484.0	-	-	-	-	484.0	60,853.2
2004	-	512.0	-	2,500.0	-	-	3,012.0	62,724.2
2005	-	146.0	-	2,218.0	-	-	2,364.0	65,000.2
2006	-	467.2	-	2,070.3	-	-	2,537.5	60,049.7
2007	-	486.0	-	6,500.0	-	-	6,986.0	59,891.7
2008	-	474.6	-	4,633.6	-	-	5,108.2	65,000.0
2009	-	510.0	-	5,990.0	-	-	6,500.0	60,793.3
2010	123.1	276.2	-	2,478.8	-	-	2,878.1	50,282.9
2011	-	384.5	-	789.2	-	-	1,173.7	36,657.6
2012	-	640.9	-	4,695.9	-	-	5,336.8	36,380.3
2013	-	653.1	-	6,454.4	-	-	7,107.5	43,003.8
2014	-	892.9	4,691.9	1,716.0	-	-	7,300.8	47,292.6
2015	-	661.9	648.0	5,170.9	484.8	-	6,965.6	51,894.2
2016	-	766.0	-	8,500.0	-	-	9,266.0	58,622.6
2017	-	506.3	-	4,146.8	-	-	4,653.1	56,289.7
1977-2017 Average	359	507	466	3,477	16	4	4,556	

**TABLE III-12**  
**EQUIVALENT WATER DIVERSIONS BY MUTUAL 1977-2017**  
(acre-feet)  
Calendar Year 2017  
Big Bear Watermaster

Calendar Year	Net Santa Ana River Diversion by BVMWC*	Groundwater Production From Wells No. 1 & 2	Big Bear MWD In-Lieu Deliveries	Equivalent Total Water Diversions
1977	14,420	1,546	4,412	20,378
1978	16,809	282	-	17,373
1979	19,470	114	-	19,584
1980	20,479	188	-	20,667
1981	20,449	1,130	672	22,251
1982	18,565	246	56	18,867
1983	19,209	53	-	19,262
1984	23,392	739	993	25,124
1985	19,837	872	3,836	24,545
1986	23,160	894	1,9	25,383
1987	16,373	947	8,147	25,467
1988	14,170	612	7,359	21,141
1989	11,449	672	10,148	22,269
1990	11,242	1,576	8,283	21,101
1991	13,715	368	151	14,234
1992	16,840	97	-	16,937
1993	26,591	-	-	26,591
1994	23,819	594	-	24,413
1995	30,794	60	-	30,853
1996	19,529	1,131	4,027	24,687
1997	19,490	1,559	6,780	27,829
1998	26,625	105	-	26,730
1999	21,336	484	10,436	32,256
2000	17,171	2	12,878	30,371
2001	12,355	140	14,260	26,755
2002	8,007	58	5,000	13,065
2003	13,301	114	-	13,415
2004	11,815	67	2,500	14,382
2005	13,615	-	2,218	15,833
2006	18,733	-	2,070	20,803
2007	12,445	182	6,500	19,127
2008	14,144	182	4,634	18,960
2009	11,022	-	5,990	17,012
2010	18,153	-	2,479	20,632.
2011	17,601	-	789	18,390
2012	15,560	-	4,696	20,250
2013	11,310	-	6,454	17,764
2014	9,572	-	6,408	15,980
2015	11,345	-	5,819	17,164
2016	9,453	-	8,500	17,953
2017	16,521	-	4,147	20,668

\* Includes 2013 Redlands Tunnel Diversions

## IV. DETERMINATIONS AND ACCOUNTS

### ACCOUNTING REQUIREMENTS

In accordance with Article 29 of the Judgment, "Watermaster shall maintain three basic accounts, in accordance with Watermaster Operating Criteria, as follows:

- (a) District's Lake Water Operation. A detailed account to reflect actual operation of the Lake by District shall be maintained.*
- (b) Mutual's Lake Water Operations. In addition, a corollary account shall be maintained to simulate the effect of Mutual's operations with regard to Lake water under the In-Lieu Water operations.*
- (c) Basin Make-up Account. An account of District's annual and cumulative obligation for Basin Make-up Water shall also be maintained."*

In 1986, the Watermaster Committee developed a computer program for keeping these accounts. This program was designed to operate on an IBM (or IBM compatible) personal computer using Lotus 1-2-3. To standardize all years of operations under the Judgment, all past accounts were recalculated using the program and were included in the 1986 Annual Report.

In 1990, the Watermaster Committee decided how to account for wastewater exports from the Big Bear Lake watershed and delivery of water on Mutual stock owned by Big Bear MWD. Only the Basin Make-up Account was affected by these decisions. Consequently, the 1990 Watermaster Report contained revised tables for the Basin Make-up Accounts for calendar years 1986, 1987, 1988 and 1989, as well as the status of all the 1990 accounts.

For the 1994 report, the Watermaster Committee updated the accounting procedures to reflect 1994 Watermaster decisions and to clarify the reports.

In 1995, the Watermaster made several additional revisions to the accounting procedures. However, in preparing the 1996 accounts, the Watermaster Committee discovered some errors in the changes made in 1995. These errors were corrected and, as a result, the 1995 accounts were recomputed and were included in the 1996 Annual Watermaster Report.

## **2017 ACCOUNT BALANCES**

**Appendix B** contains the 2017 accounts. The first four pages of the appendix present the input data used to calculate the various accounts. The fifth page summarizes the status of the various accounts. The remaining pages of **Appendix B** are the detailed monthly tables of the accounts.

### **Actual Lake Account**

**Figure 2** illustrates the water balance for the actual operation of Big Bear Lake in 2017. **Table 1** of **Appendix B** provides additional detail. This information shows that:

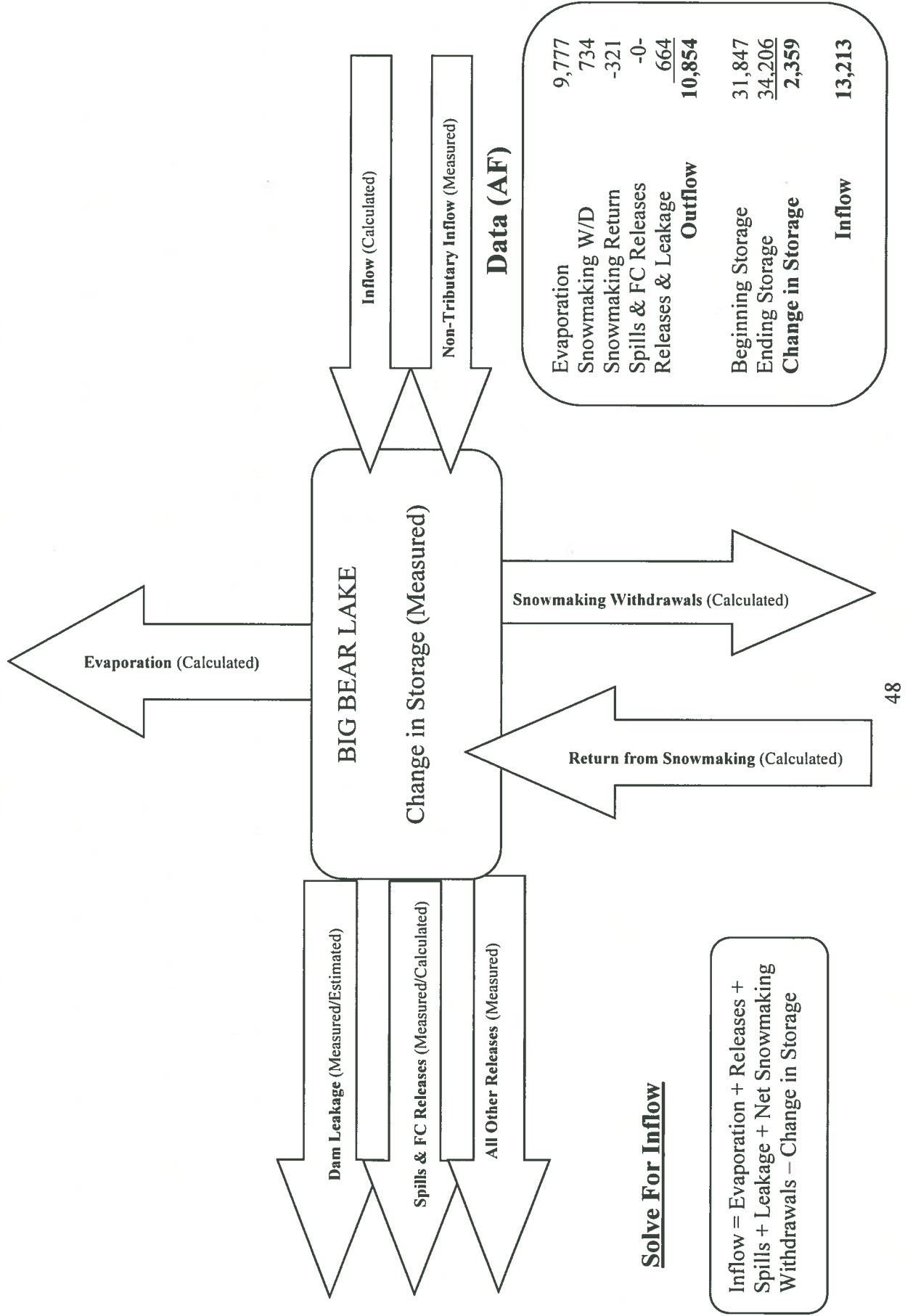
- 1) the lake level rose 1.15 feet, from a gage height of 55.98 feet to 57.13 feet; 72.33 feet is full;
- 2) lake storage increased by 2,359 acre-feet, it began the year with 31,847 acre-feet and ended the year with 34,206 acre-feet; when the lake is full, it contains 73,320 acre-feet of water;
- 3) lake surface area varied between 2,352 and 2,000 acres;
- 4) evaporation was 9,777 acre-feet;
- 5) lake inflow was 13,213 acre-feet,
- 6) the total of spills, releases, leakage and net lake withdrawals was 1,077 acre-feet.

**Tables 1A** through **1D** provide additional details to support **Table 1**.

### **Mutual's Lake Account**

**Figure 3** illustrates the water balance for Mutual's synthesized operation of Big Bear Lake in 2017. Mutual's operation shows what would have happened if:

**Figure 2**  
**Water Balance for 2017 Actual Lake Operations**



- 1) Mutual had owned the lake,
- 2) The in-lieu program was not in place, and
- 3) The net wastewater exported from Big Bear Lake watershed entered the lake as supplemental inflow.

In this synthesized case, Mutual's demands for lake water would have been met entirely from lake releases.

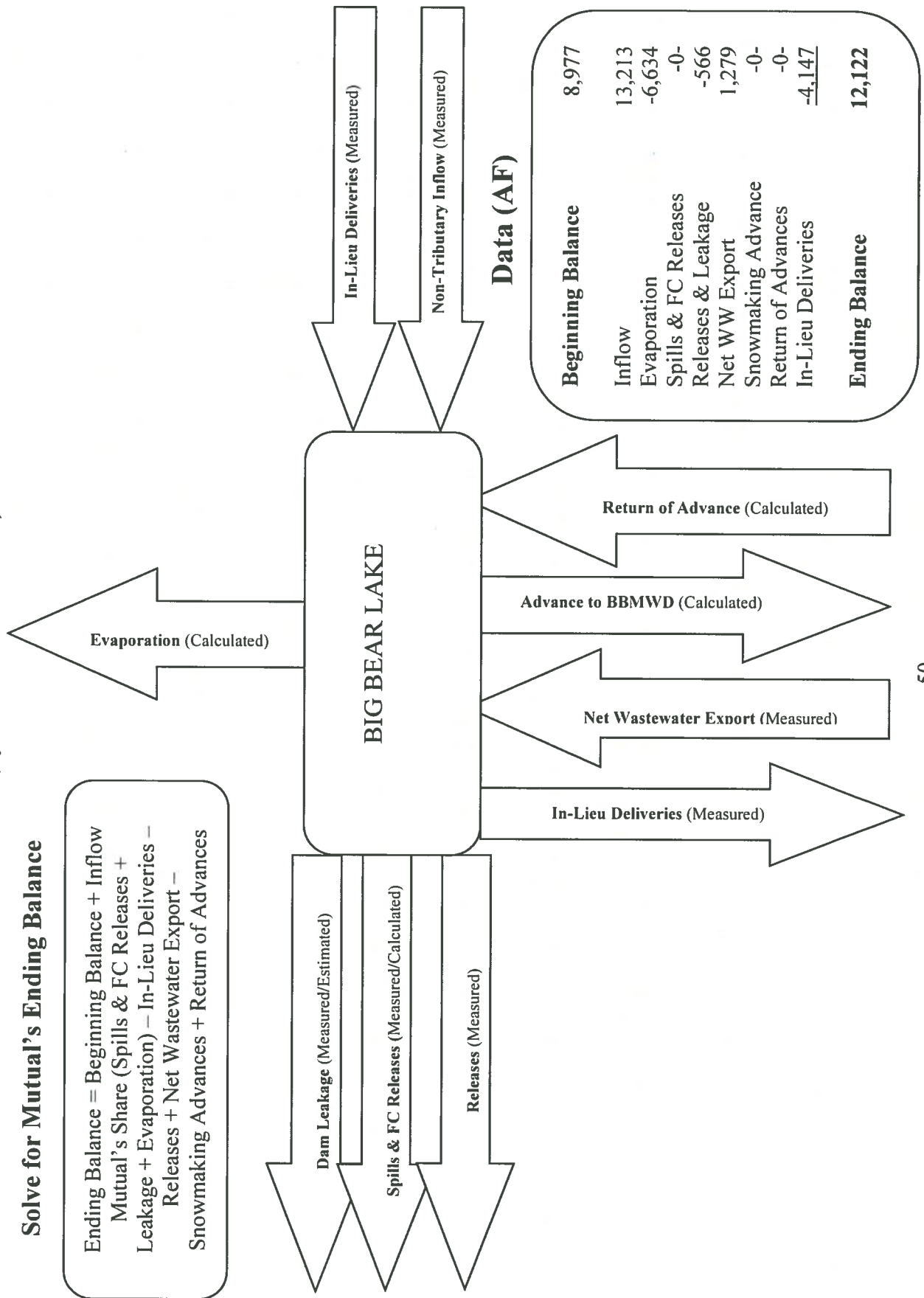
**Figure 3** and **Table 2** of **Appendix B** show that Mutual had 12,122 acre-feet in its lake account at the end of 2017. This account balance is 3,145 acre-feet more than was in their lake account at the end of 2016. **Table 2** also shows that in 2017 Mutual's lake account was credited with all the lake inflow (13,213 acre-feet), the total of their releases, spills and leakage was 566 acre-feet and their in-lieu deliveries were 4,147 acre-feet. In 2017, supplemental inflow of 1,279 acre-feet was added to Mutual's Lake Account for net wastewater exported from the basin. In 2017, there were no advances to Big Bear MWD for snowmaking within the watershed. Evaporation that would have taken place under a Mutual operation was 6,634 acre-feet.

The cumulative effect of changes in lake releases and supplemental inflows that would have taken place since 1977 under a "Mutual Operation" would be a lake level that would have been 44.20 feet at the end of 2017 or 28.13 feet below the top of the dam. This synthesized lake level is 12.93 feet lower than it actually was. This lower lake level reflects the impact of what Mutual's lake withdrawals would have been without the in-lieu program and with the credits they receive from the net wastewater exports. **Tables 2A** through **2C** of **Appendix B** provide additional details to support **Table 2**.

Article 4.(b) of the Watermaster Operating Criteria (Exhibit "D" of the Judgment discusses how to handle the export of wastewater from and the import of water to the Upper Bear Creek Watershed. Specifically, it says:

*In the event gross export from Upper Bear Creek Watershed to any area not tributary to the Santa Ana River Watershed within Upper Bear Creek Watershed, calculated inflow to the Lake shall be increased each year, beginning with the calendar year 1986 by the amount by which such gross export exceeds imports. If gross import exceeds gross export, said excess shall be credited against District's Basin Make-up Water obligation.*

**Figure 3**  
**Water Balance for 2017 Mutual's Lake Operation**  
 (Synthesized Conditions)



In 1986, the Watermaster Committee decided to handle the net wastewater exports (gross exports-gross imports) entirely in the District's Basin Make-up water obligations. This decision was contingent upon implementation of a wastewater reclamation project in the Upper Bear Creek Watershed by December 31, 1994. A reclamation project was not implemented by that date so the Watermaster Committee, in 1994, decided to add the net wastewater credits to the calculated lake inflows effective January 1990. This decision adds the net wastewater credits to Mutual's lake account. Essentially, it transfers the amount of the credit from Big Bear MWD's lake account to Mutual's lake account.

**Table IV-1** shows the impacts of crediting Mutual's lake account (and debiting Big Bear MWD's lake account) with the net wastewater exports. Since 1990, Mutual has been credited with 36,245 acre-feet of net wastewater exports. After 28 years of getting these credits, Mutual's lake account has 5,832 acre-feet more water than it would have had if it hadn't received the credits. This additional increase raised their simulated lake level by 5.30 feet. In other words, without the credits, Mutual's lake account would have been 6,290 acre-feet and their lake level would have ended the year at 38.90 or 33.43 feet down. In other words, it would have been 18.23 feet below the actual lake level of 57.13 feet and 5.30 feet lower than reported in Mutual's lake account tables (38.90 feet).

There are two primary reasons why the increase in their lake account (5,832 acre-feet) is less than the cumulative credits they have received (36,245 acre-feet). The first reason is spills. When the lake fills, Big Bear MWD's water spills first, and then Mutual's water spills. The credits they receive will spill during very wet years, like 1998. The second reason is evaporation. Mutual's lake level increases with the credits. With higher lake levels, their share of the evaporation losses increases. The end result is that at the end of 2017 Mutual's lake account had 5,832 acre-feet more and Big Bear MWD's lake account had 5,832 acre-feet less as a consequence of the net wastewater export credits.

### **Big Bear MWD's Lake Account**

Section 3(b), District's Water in Storage, of the Watermaster Operating Criteria of the Judgment describes the procedure to determine Big Bear MWD's storage account as follows:



**TABLE IV-1**  
**EFFECT OF WASTEWATER EXPORT CREDITS**  
**ON MUTUAL'S LAKE ACCOUNT**

Calendar Year 2017  
Big Bear Watermaster

End of Calendar Year	Net Wastewater Export Credit (AF)	w/Wastewater Credits		w/o Wastewater Credits		Differences	
		Storage Account (AF)	Lake Level (Feet)	Storage Account (AF)	Lake Level (Feet)	Storage Account (AF)	Lake Level (Feet)
1989	-	16,905	47.00	16,905	47.00	-	-
1990	857	7,627	40.30	6,864	39.50	763	
1991	940	14,226	45.75	12,772	44.65	1,454	1.10
1992	723	22,787	51.15	20,886	50.05	1,901	1.10
1993	2,223	62,165	68.40	58,271	67.00	3,894	1.40
1994	1,397	61,407	68.15	56,451	66.35	4,956	1.80
1995	2,012	66,308	69.90	65,019	69.45	1,289	0.45
1996	1,540	60,875	67.95	58,229	67.00	2,646	0.95
1997	1,427	52,407	64.80	48,663	63.35	3,744	1.45
1998	2,427	69,566	71.00	68,282	70.60	1,284	0.40
1999	1,339	51,390	64.40	48,922	63.45	2,468	0.95
2000	1,337	35,335	57.65	31,900	56.00	3,435	1.65
2001	1,317	19,898	49.45	15,732	46.75	4,166	2.70
2002	889	10,856	43.15	6,897	39.55	3,959	3.60
2003	1,044	13,718	45.35	9,695	42.20	4,023	3.15
2004	1,024	14,200	45.70	10,233	42.65	3,967	3.05
2005	1,750	43,041	61.05	37,900	58.85	5,141	2.20
2006	1,462	48,034	63.10	42,067	60.65	5,967	2.46
2007	997	34,655	57.35	28,588	54.30	6,067	3.05
2008	1,207	35,251	57.60	28,855	54.45	6,396	3.15
2009	1,074	30,034	55.05	23,496	51.55	6,538	3.50
2010	1,715	52,208	64.75	44,898	61.85	7,310	2.90
2011	1,781	58,121	66.95	49,683	63.75	8,438	3.20
2012	1,175	49,881	63.85	41,167	60.25	8,714	3.60
2013	883	36,058	58.00	27,657	53.80	8,402	4.20
2014	732	26,252	53.05	18,292	48.45	7,960	4.60
2015	846	16,437	47.25	8,968	41.55	7,469	5.70
2016	848	8,977	41.55	3,021	33.65	5,956	7.90
2017	1,279	12,122	44.20	6,290	38.90	5,832	5.30
<b>TOTAL</b>	<b>34,966</b>						

*“ Any water actually in storage in excess of Mutual’s water in Storage, as calculated above, shall be for the account of District. So long as District has water in storage, all spills from the Lake shall be deemed District Water.”*

**Figure 4** illustrates the water balance for Big Bear MWD’s lake account in 2017. Table 3 of **Appendix B** summarizes the results. This information shows the water actually in storage (from **Table 1** of **Appendix B**), Mutual’s water in storage (from **Table 2** of **Appendix B**), and the difference between the two, which is the amount in Big Bear MWD’s account. In 2017, Big Bear MWD’s account balance began with 22,870 acre-feet and ended the year with 22,084 acre-feet. The decrease in their account was 786 acre-feet. This decrease was because the in-lieu deliveries to Mutual during the year were less than the evaporation losses, SWRCB releases, net snowmaking withdrawals and net wastewater exports.

**Table 3** of **Appendix B** also shows the status of Big Bear MWD’s “Advance Account”. This account represents the net amount of water Big Bear MWD has “borrowed” from Mutual for snowmaking in the Big Bear Lake watershed. In 2017, Big Bear MWD’s advance account was zero throughout the year.

**Tables 3.A** and **3.B** of **Appendix B** provide supporting information to Table 3.

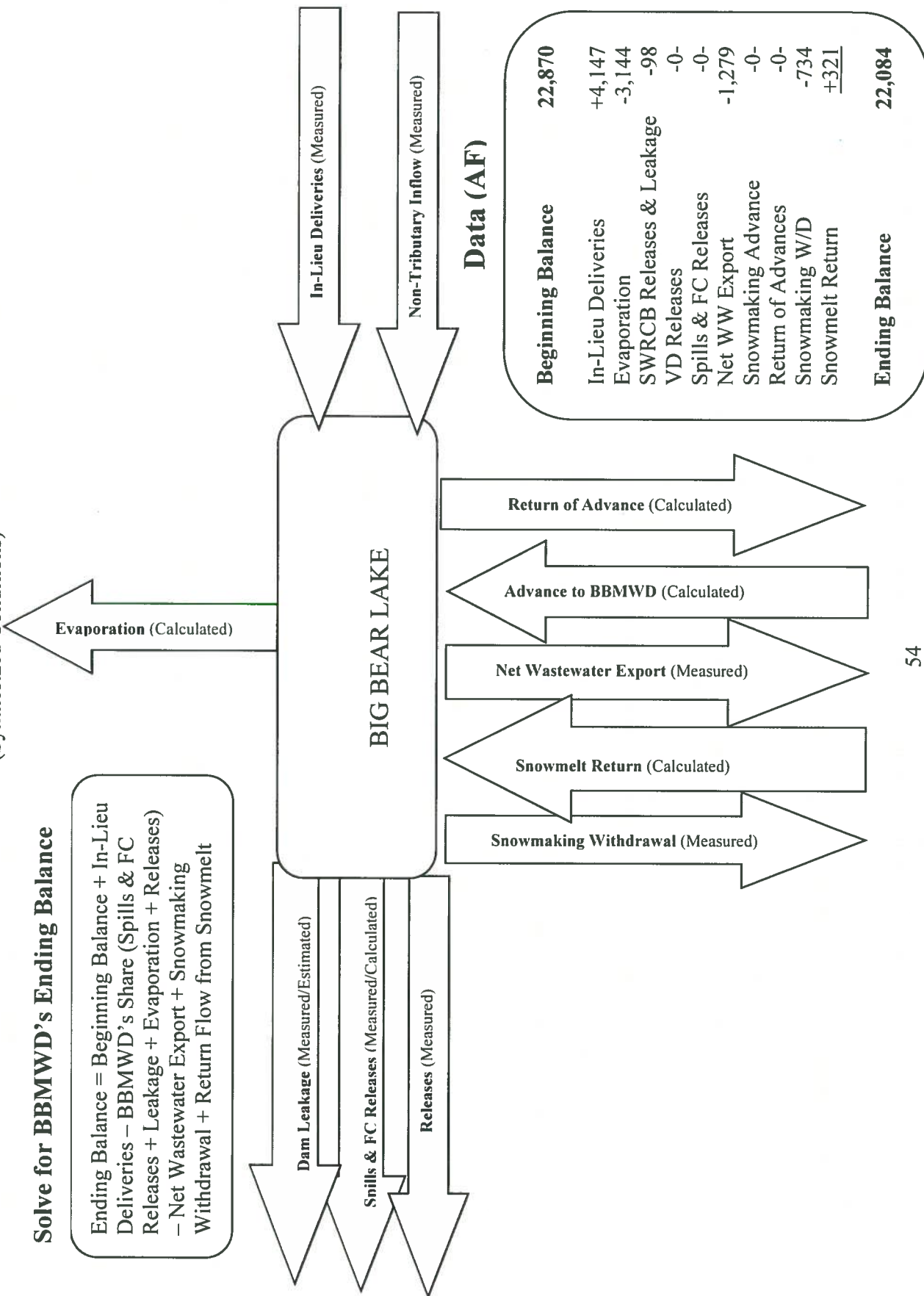
### **Basin Make-up Account**

Exhibit D of the Judgment contains a formula to be used for determination of the amount of Basin Make-up Water, if any, that is needed to offset deficiencies in the recharge supply to the San Bernardino Groundwater Basin. **Tables 4, 4A, 4B** and **4C** in **Appendix B** follow the formula presented in the Judgment for calculating the credit or deficiency in the Basin Compensation Account. The formula contained in the Judgment is:

Deficiency or Credit =

$$[(.50) (R_d) + (.51) (S_d) + (.50) (P_d)] - [(.50) (R_m) + (.51) (S_m)]$$

**Figure 4**  
**Water Balance for 2017 BBMWD's Lake Operation**  
 (Synthesized Conditions)



wherein:

$R_d$  = Releases actually made under District Operation.

$S_d$  = Spills which actually occurred under District Operation.

$P_d$  = In lieu water purchased by District from San Bernardino Valley MWD or the Management Committee of the Mill Creek Exchange and delivered under District Operation to Mutual for service area requirements.

$R_m$  = Releases which would have been made under a Mutual Operation.

$S_m$  = Spills which would have occurred under a Mutual Operation.

The first three terms in the equation represent the recharge that occurs under Big Bear MWD's lake operation. These are referred to as the "Big Bear's Basin Additions" in **Table 4**. **Table 4.A** shows the details of the calculations for these three terms.

The last two terms in the equation represent the recharge that would have occurred if Mutual had owned and operated the lake and met its supplemental water needs from lake releases. Collectively these terms are referred to as "Mutual's Basin Additions" in **Table 4**. **Table 4.B** shows the detailed calculations for these two terms.

The monthly net credit or deficiency in recharge to the San Bernardino Basin is shown in Column 5 of **Table 4**. These calculations are in accordance with the formula in the Judgment.

The Judgment also requires Big Bear MWD to make-up for deficiencies in recharge that would occur as a result of their lake operations. Column 7 of **Table 4** shows the amount of water recharged by Big Bear MWD in the San Bernardino Basin to correct (or prevent) deficiencies in recharge. **Table 4.C** presents details of the sources of water used to replenish the Basin Compensation Account.

**Table 4** of **Appendix B** presents the status of the Basin Make-up Account for 2017. The account balance began the year with a balance of 27,120 acre-feet and ended the year with 27,170 acre-

feet. There was a 50 acre-foot increase in the Basin Make-Up Account in 2017. The reason for the increase was a small recharge credit for the additional fish releases under a District operation.

## **V. OTHER WATERMASTER ACTIVITIES**

### **IMPACTS OF SEVEN OAKS DAM**

#### **Previous Activities**

Construction of Seven Oaks Dam by the U.S. Army Corps of Engineers (Corps) has been underway since 1990. The construction contract for the 550-foot high dam embankment was issued in 1994 and was completed in December 1998. Various clean-up and other miscellaneous contracts were completed in late 1999.

The plunge pool by-pass pipeline, which routes low flows through the dam, around the plunge pool and back to the river channel was completed in 2001. The low flows will be diverted for beneficial use by either Mutual through its “River Pick-up” or by SBVWCD at its main river diversion.

Subsequent to authorizing the project and beginning construction, the U.S. Fish and Wildlife Service (Service) listed the Slender Horned Spine Flower and the San Bernardino Merriam’s kangaroo rat as endangered species. This action generated new official biological mitigation consultations with the Service, as required by Section 7 of the Federal Endangered Species Act.

There are two features of Seven Oaks Dam that could affect future Watermaster activities. The first is that Seven Oaks Dam will prevent natural, subsurface flow of groundwater from leaving the Santa Ana River Canyon and will cause all groundwater coming from upstream of the dam to rise to the surface. This subsurface flow will then pass through the dam outlet structure. The plunge pool by-pass line will help to overcome the loss of these subsurface flows.

The second feature is related to impounding storm flows behind the dam. The San Bernardino Valley MWD and Western Municipal Water District of Riverside County provided funding to the Corps for a water conservation study, which began in November 1993, to evaluate Seven Oaks

Dam as a dual use structure for flood control and water conservation which continued through late 2013

In 1995, the San Bernardino Valley MWD and Western Municipal Water District of Riverside County filed a petition to revise the Declaration that the Santa Ana River Stream System is Fully Appropriated and an application to Appropriate Water by Permit with the State Water Resources Control Board. The petition and application is to give the two local agencies the right to impound water behind Seven Oaks Dam, subject to the operational directions of the dam for flood control.

The possible impoundment of waters of the Santa Ana River for other than flood control raises a number of water rights issues that are yet to be resolved. Several diversion points for SBVWCD, North Fork Water Company, Mutual, and Redlands Water Company (“Below the Dam Diverters”) are downstream of Seven Oaks Dam, and the operation of these historical diversion points will be altered by the dam. During 1998 and 1999, discussions between the water rights holders and the San Bernardino Valley MWD began with an attempt to understand what and how much water would be impounded at various times of the year, along with the manner in which releases of storm flows from Seven Oaks Dam would be made.

It was the intent of the “below the dam diverters” to have releases from Seven Oaks Dam approximate average annual natural flows, recognizing that flood control release flows are expected to have less silt at low release rates than previous flows and may be more evenly distributed. Their request is to have the amount of water to be impounded behind Seven Oaks Dam for other than flood control determined after the combined needs have been met for (1) the water supply agencies to provide direct delivery water and (2) the integrity of the groundwater basin is stabilized by assuring groundwater levels are maintained within an appropriate operating range. These are the primary elements of discussion between the agencies. These discussions did not result in any agreement prior to the State Water Resources Control Board public hearing on the petition on December 7 and 8, 1999.

A Biological Assessment (BA) by the Corps was submitted to the Service in June 2000; however, in a November 2000 letter, the Service rejected the BA, and requested additional information, with particular emphasis on the Corps’ position related to the future water conservation element that

had not been addressed by the Service. It is the apparent position of the Service that the biological mitigation requirements for operating the dam as a flood control facility must be negotiated before any attempt to address the biological impacts of the water conservation element of Seven Oaks Dam.

On September 21, 2000, the State Water Resources Control Board (SWRCB) adopted Order WR2000-12 to allow for processing the application filed by the San Bernardino Valley MWD and Western Municipal Water District of Riverside County. SWRCB Order WR2000-12 also allowed for processing a water right application filed by Orange County Water District. The Chino Basin Water Conservation District filed a petition requesting the SWRCB to reconsider its decision, but in November 2000 the State Board denied the petition and upheld its September order. This decision meant that the applications for appropriation of the right to use water that will be impounded behind Seven Oaks Dam could be processed.

### **2001 Activities**

The U.S. Army Corps of Engineers and U.S. Fish and Wildlife Service continued meeting during 2001, but most of their discussions were focused on flood control issues at Prado Dam. Neither the flood control nor biological issues related to Seven Oaks Dam had been resolved.

On March 21, 2001, the water rights application (A031165) filed by San Bernardino Valley MWD and Western Municipal Water District of Riverside County was accepted for processing by the State Water Resources Control Board. On April 20, 2001, the water rights application (A031174) filed by Orange County Water District was accepted.

In May and June 2001, respectively, the San Bernardino Valley MWD filed a second application, and the San Bernardino Valley Water Conservation District (SBVWCD) filed an application for the right to use Santa Ana River water that would initially be impounded behind Seven Oaks Dam, then released for downstream use. As with the prior applications, accompanying each of the new applications was a petition requesting the fully appropriated stream designation for the Santa Ana River be overturned. Combined with the petition and application received in September 2000 from the Chino Basin Watermaster, there were three additional petitions pending. The State Board indicated a preference to hold hearings on all of the water rights applications together.



## **2002 Activities**

On January 11, 2002, the SWRCB noticed the water rights applications filed by San Bernardino Valley MWD - Western Municipal Water District of Riverside County and Orange County Water District (Applications 31165 and 31174, respectively), which triggered a 60-day protest period. However, on March 4 the SWRCB extended the protest period until a hearing was conducted on additional filings for water rights and accompanying petitions to revise the fully appropriated stream designation for the Santa Ana River.

On March 19, 2002, a Pre-Hearing Conference and Public Hearing was noticed for the water rights applications filed by the Chino Basin Watermaster, San Bernardino Valley MWD - Western Municipal Water District of Riverside County (second application), San Bernardino Valley Water Conservation District, and the City of Riverside. During the Pre-Hearing Conference on April 16, 2002, all parties agreed to accept the evidence, which resulted in Order WR 2000-12 revising the fully appropriated stream designation for the Santa Ana River, as evidence that they would have presented again in their petitions. Consequently, the SWRCB adopted WR 2002-6 during its Public Hearing on July 2, 2002. Following the hearing on July 2, the protest period for Applications 31165 and 31174 was closed on July 17. Several protests were submitted and responses provided, but no further action occurred.

Also on July 2, 2002, the SWRCB staff notified all parties (all 6 applications) by letter that it was the SWRCB's intent to process all the applications in a similar time frame and requested each party to provide a schedule for completing its environmental documents for its respective application. A hearing on all the applications will be scheduled when the environmental analyses are completed.

The Corps and Service continued meeting during 2002. On December 19, 2002, a Biological Opinion outlining the mitigation requirements for Seven Oaks Dam was finalized and accepted. Various agencies in the San Bernardino Valley were given an opportunity to review the final draft and submit comments before it was finalized. With the Biological Opinion finalized, the Corps could complete any required environmental analyses for operating Seven Oaks Dam as a flood

control facility. When that work is completed, the issue of a conservation pool of water detained behind Seven Oaks Dam can be reviewed, and any needed biological consultations can be initiated. The impacts that a conservation pool may have on water rights remain unknown.

### **2003 Activities**

In 2003 the Corps and the Local Sponsors, (San Bernardino and Orange County Flood Control Districts) continued to operate the dam under the Interim Water Control Plan. When a storm event occurred, the gates were closed until the water behind the dam stabilized at which time large volumes of water were released until the water level behind the dam reached the dead pool elevation. There were four events when large amounts of water were accumulated and released from the dam, one in February, two in March and one in April. All but 616 acre-feet of Santa Ana River water was diverted for beneficial use by Bear Valley Mutual Water Company and SBVWCD in 2003. The Corps and the Local Sponsors continued to operate the dam under the Interim Water Control Plan until December 30<sup>th</sup>, at which time they adopted the final plan and began to develop a debris pool. The dam will be operated in 2004 under the Water Control Manual for the Seven Oaks Dam & Reservoir.

The dam has been in operation for several years, and the Watermaster has identified an issue with regards to the river flow data collection. All of the USGS gages are located downstream of the dam. The dam prevents the gages from recording the actual stream flow during a storm event. The Watermaster Committee has found it important enough to investigate the location of a stream flow gage upstream of the dam. This location will allow the Watermaster to correlate precipitation data with stream flow data and to estimate inflow to the reservoir. The gages downstream of the dam will provide the amount of water released from the dam. Watermaster Committee members have conducted a field trip to locate a gage upstream of the inundation pool and have initiated discussion with the USGS and the Corps for assistance.

The review of the water rights applications proceeded in 2003. As of the end of 2003, a hearing date had not been set and no environmental documents had been distributed for review. Parties continue to negotiate to find common ground and interest.

## **2004 Activities**

2004 started with the Army Corps of Engineers (ACOE) and the Local Sponsors releasing a base flow of approximately 3 cfs. The Water Control Manual required that during the storm season (October to May) a debris pool (water surface elevation of 2,200 feet) be formed for the purposes of protecting the intake tower from sediment intrusion. As of the beginning of May, the debris pool elevation had reached 2,180 feet and contained approximately 1,700 acre-feet of water. At this time, the ACOE began releasing water from the debris pool so they could begin their maintenance activities. As raw water was released, two water treatment plants, one owned by East Valley Water District (EVWD) and the other owned by the City of Redlands (COR), began to receive water from the debris pool. It was quickly noted that the raw water discharged from Seven Oaks Dam (SOD) was of poor quality and adversely impacted the ability of EVWD and the COR to successfully treat this water at their respective plants. This poor quality water is related to releases of water from the debris pool. If the upstream flow is diverted around the debris pool, such as when the Edison Facility is operational, there are no adverse impacts at their respective plants.

Because of this difficulty to treat water from SOD, EVWD hired a consultant, Camp Dresser & McKee, to perform a study on the treatability of the SOD discharges at their Plant 134. The report looked at two periods when water was released from SOD, May and November of 2004. The report concluded that local source water quality in November of 2004 showed significant degradation when it passed through the debris pool as compared to historical water quality. The results showed turbidity increasing from 2 NTU to between 5 to 80 NTU. Similar affects were noted with an increase in color units, iron, manganese, and TOC. All of these are indicative of poorer quality water than historical Santa Ana River water quality conditions. Limited source water quality sampling by the COR confirmed some of these adverse water quality trends during a period in May 2004 when discharges were also made from the debris pool. The water agencies impacted by the degradation of the water quality of the debris pool are meeting and working closely with the ACOE and the Local Sponsors to find a solution to the problem.

At the end of November 2004, the ACOE and the Local Sponsors completed their maintenance activities and began building the debris pool for the upcoming storm season. By the end of

December 2004, the debris pool was at a water surface elevation of 2,165 and contained approximately 900 acre-feet.

## **2005 Activities**

The 2005 year began with abnormal rainfall. Late rains in 2004 had begun to fill the debris pool behind the dam. By the first of the year, the debris pool had reached elevation 2,165. Heavy rains in January and February more than filled the debris pool and by the end of March there was approximately 40,000 acre-feet of water stored behind the dam. The flood pool was at an elevation of approximately 2,390. In accord with operational guidelines, the Corps and local sponsors began to make releases at a rate of approximately 500 cfs. As happened in 2004, the water quality was unsuitable for surface diversion to the two local water treatment facilities. The NTU's were in excess of 400 and the water had the look of liquid milk chocolate. The Edison facilities were off line due to the storms. Surface water diverters were again faced with unusable water for domestic treatment purposes. The Conservation District initially diverted some of the degraded water for groundwater percolation but ultimately had to greatly reduce diversions due to the excessive turbidity and poor water quality.

A group was formed by the Upper Santa Ana River Water Resources Association to take another look at the water quality situation. East Valley Water District engaged the services of Camp Dresser & McKee (CDM) to prepare a detailed report addressing the problem as well as identifying potential solutions. Representatives from the Basin met with Congressman Jerry Lewis to describe the situation and seek Federal assistance to solve the problem. Congress appropriated \$1,000,000 to study the issue. By the end of 2005, CDM and the working committee from the Upper Santa Ana River Basin had completed their study. The study was been distributed to the Corps, Local Sponsors and to Congressman Lewis' office.

Because of the large body of water contained behind the SOD, the Corps decided to test the operating valves for flood releases in mid-spring. During the test period when high velocity releases were taking place, a portion of the outlet tunnel failed and the tests were terminated. For the balance of the spring, summer and fall seasons the releases from the SOD were minimal and averaged between 3 and 80 cfs, until the debris pool was emptied. The repairs to the tunnel were

completed in November and it was anticipated that in early 2006, testing would again be resumed. However, rainfall after March 2005 was inadequate to retest the tunnel for several years.

Water quality remains a priority concern. While 2005 was one of the wettest years on record, local diverters, who normally rely on the flows from the Santa Ana River for their source of treatable water for domestic purposes, had to purchase State Water Project water. The saving grace for the local water users is that Edison was able to repair all their upstream facilities by early fall. Their diversions by-pass SOD and they were able to deliver good quality water to the two local water treatment facilities. However, by the end of 2005 the debris pool was non-existent and slowly beginning to rise. Water quality again became poor.

### **2006 Activities**

At their January 17, 2006 meeting, the Watermaster Committee received a copy of the “Seven Oaks Dam Water Impact Study” report prepared by Camp, Dresser & McKee, Inc. (CDM). This report identified the water quality and water supply impacts of Seven Oaks Dam on downstream water users, and recommended comprehensive alternatives to mitigate these impacts. Water quality impacts included longer durations and elevated levels of turbidity, total organic carbon, color, iron, manganese, algae, and taste and odor causing compounds. Water supply impacts included less supply in dry hydrologic years, reduced supplies in Fall through Winter as the Debris Pool behind the Dam is filled, and extended periods of time the SCE facilities are out of service after flood events. During these extended periods, the SCE facilities cannot be used to divert high quality Santa Ana River (and Bear Creek) water around Seven Oaks Dam.

The CDM report recommended long-term comprehensive alternatives and an interim solution. The long-term comprehensive alternatives included pretreatment of the water delivered from Seven Oaks Dam to achieve the water quality levels that existed before the Dam was constructed, and hardening of the SCE facilities so they would be more reliable and remain in-service for longer periods of time. The recommended interim solution is to purchase imported SWP water from San Bernardino Valley MWD to replace the water that could not be used because of water quality problems or that was not available due to dam operations and unavailability of SCE facilities.

At the May 16, 2006 meeting, the Watermaster Committee was advised that the ACOE was going to undertake a two-year \$3.5 million study of these issues. At the October 10, 2006 meeting, the Watermaster Committee was further notified that the ACOE staff had initiated their study, and they were in the data gathering phase.

The Watermaster Committee was concerned that the current operations of Seven Oaks Dam could restrict the operations of Big Bear Dam and the in-lieu program as described in the 1977 Judgment. These restrictions could include, at a minimum, reduced releases and increased in-lieu requirements when:

- SCE facilities are out of service and the quality of water behind Seven Oaks Dam is unacceptable to Mutual.
- SCE facilities are operating at capacity and the quality of water behind Seven Oaks Dam is unacceptable to Mutual.
- SCE facilities are out of service or operating at capacity in the fall and winter months when the Debris Pool is being filled and there are no releases from Seven Oaks Dam.

In addition, any reduction in releases from the Lake would increase lake evaporation and decrease the long-term average deliveries to Mutual. These restrictions could also constrain Big Bear MWD's opportunities to beneficially use the flood control releases they would make from Big Bear Lake in the late fall and winter months.

### **2007 Activities**

2007 began with a release of approximately 3 cfs from Seven Oaks Dam. USACOE slowly raised the reservoir elevation. As of January 9, 2007 the elevation was 2,157.25 feet. The debris pool's desired elevation is 2,200.00 feet. Due to the abnormally dry weather conditions in January and February, SBVWCD began spreading State Project Water in the Santa Ana River spreading basins. By the end of February, the debris pool elevation was 2,175.20 feet and rising.

During the last two weeks in April, USACOE and local sponsors had hoped to accumulate enough water to test the Seven Oaks Dam tunnel repairs which were completed in early 2006, but never

subjected to test flows. Unfortunately there was insufficient water behind the Dam and the “high flow” testing lasted only approximately six (6) hours.

Very little to no water was released from Seven Oaks Dam from summer through November 2007. Southern California Edison was offline due to repairs on their facilities and on the intake.

In the spring of 2007, the capacity of the Foothill Feeder was tested. San Bernardino Valley Municipal Water District (Valley) was building a pump station on the Foothill Pipeline at the interconnect between Valley’s and Metropolitan Water District’s (MWD) pipeline to help improve the water pressure towards the east end of the valley when making large deliveries to MWD. It would also be used by MWD until their Inland Feeder Project tunnels are completed. In the future, the pumping station will help increase the flow capacity to the east end of the valley and the San Gorgonio Pass Water Agency. The results of the capacity testing are unknown.

In late November and early December 2007, the Upper Santa Ana Integrated Regional Water Management Plan (IRWMP) was approved. A press release in October 2007 by San Bernardino Valley Municipal Water District (Valley) summarized the main goal of the IRWMP is to improve water supply reliability in the region. To improve water supply reliability, the region must reduce demands as much as possible and capture and store wet year supplies for use during drought periods and other emergencies. The Plan is designed to meet this objective, and it addresses the following topics: water conservation and recycling, surface water management, groundwater management, diversification of water supplies, disaster preparedness, protection of water quality, ecosystem restoration and environmental improvement, and climate change.

## **2008 Activities**

In 2008, the San Bernardino Valley Water Conservation District partnered with the San Bernardino Valley Municipal Water District in conducting a study of the capacity of the water spreading facilities downstream of the Seven Oaks Dam. The field work was conducted during March through December, collected and analyzed samples, performed flow testing of structures and assessed percolation capability and installed wells to identify enhancements to the facilities.

- Major conclusions of the study were that the area is ideal for recharge and not inhibited by clay or silt, faulting may interfere with recharge in the eastern end and very high flow years will saturate the spreading grounds. Additionally structure capacities limit regular use to 300cfs and further to the west the regular flows are limited to about 150CFS. This study would give rise to the Enhanced Recharge Project.

The missing upstream gaging station has not been replaced yet by the USACE. This is having a negative effect on the water flow monitoring capabilities of the Seven Oaks Dam as well as the downstream watershed.

The U.S. Army Corps of Engineers (USACE) has completed its draft study of the steps taken to address the degradation of the Santa Ana River water quality resulting from the construction of Seven Oaks Dam. That study has been reviewed by CDM, a consultant engineering firm hired by Bear Valley Mutual Water Company, Lugonia Water Company, Redlands Water Company, North Fork Water Company, San Bernardino Valley Conservation District, and the San Bernardino Valley Municipal Water District, and other interested water purveyors. The USACE report verifies original methodology used in calculating the effects of placing a dam interrupting the natural flow of the Santa Ana River for purposes of flood control and water retention to maintain a predictable daily controlled water flow for downstream users. The USACE report notes through modeling techniques based on field records data, that there appears to be no negative effect on the Santa Ana River water quality. The downstream users contend otherwise, that the very nature of the water being retained behind the dam for lengthy periods of time causes algae and bacterial growth, causes water to become stale and stagnant, and tends to plug up the pervious rock and soil layers of the downstream spreading basins. Several of the downstream water purveyors with water treatment facilities have difficulty, or cannot treat the stagnant water at all since the treatment facilities were not designed to treat water of this poor quality. The debate continues.

## **2009 Activities**

In May, the Seven Oaks Dam Orange County Flood Control district operators emptied the reservoir behind the dam. With the advent of a drought breaking rainy season that began in October, the dam is now about 30 percent full. To view a daily activities record of the SOD, as



well as information about other area dams, use the web address of:

<http://www.spl.usace.army.mil/cgi-bin/cgiwrap/zinger/slProjReport.cgi?allRes.in>.

The Corps continued to address degraded water quality of river runoff retained for long time periods behind the dam. At Congressman Lewis's urging, the US Army Corps of Engineers (USACE) resumed bi-monthly talks with interested downstream prior rights and permitted water users to reach a conclusion about the change in operation of the SOD to decrease the impact of dam retention on degradation of good quality stream water. A final study report was to be issued in April 2010. Two general conclusions have been offered on how to deal with the water quality problem: (1) do not fill the debris pool with runoff that is high in organic materials; with less organic material contained in the stored water, less contamination of the water will result, and (2) use the volume for long term water storage to form a lake, thereby reducing the impact of plant life on pooled water (weeds, bushes, other plants that have grown since the last reservoir filling) and there will be no dry land for the plants to regenerate on when the reservoir is drained each spring. The USACE was willing to change its method of operations if the downstream users agree to accept responsibility for downstream water quality.

Another issue of importance to Bear Valley Mutual Water Company and downstream water users, and to the water volume calculations of the Big Bear Watermaster Report is the upstream bypass of high quality water that is collected upstream of the SOD and conveyed past the dam in Southern California Edison Electric Company pipelines to the SCE Power Plant No. 3. There the water is used to power a 3 MW generator. This better quality water is then distributed to Redlands Water Company, East Valley Water District, and Bear Valley Mutual Water Company for their usage. The water is clean and easily treatable by the respective water purveyors' treatment plants. When the reservoir level surpasses the access road to the upstream valves controlling the SCE Highline, water cannot be directed to the downstream SCE Power Plant No. 3. Then the high quality upstream water flows into the SOD reservoir and the water stored behind the SOD is distributed to the above entities. Most of the time that water is not usable. The access to the upstream valves when the reservoir levels are higher than the access road is now an issue that has to be resolved. Although the debate continues, at least there is the beginning of a consensus of how the water above the SOD can best be utilized by the water users downstream of the dam.

## **2010 Activities**

For most of 2010 Seven Oaks Dam's reservoir was operated for flood control by the operators on behalf of Orange Flood Control District. The calendar year began with levels below the Debris pool level of 2200 based on telemetry data. Inflow was stored until high flow testing in April. This test flow and subsequent flows were discharged from the dam. A minimum flow of 3 CFS was discharged when significant rainfall and the reservoir level rose to approximately elevation 2,279 feet with 13,177 acre-feet in storage (based on telemetry) with 3 CFS outflow.

USACOE Reservoir Regulation branch maintains the referenced website as a public record or reservoir status: <http://www.spl.usace.army.mil/cgi-bin/cgiwrap/zinger/slProjReport.cgi?allRes.in>

The quality of the water impounded behind the dam was visually degraded but generally better quality when compared to 2005 conditions. The USACOE is still studying the quality of the water and changes that may make better quality water available in the future. Some participants feel this study should be combined with the reoperation of the reservoir for water conservation. The general result of the latter will be the discharge of 250-500 CFS average when water is impounded and there is room available in Prado Reservoir.

## **2011 Activities**

In December 2010 heavy rains began and the increased Santa Ana River flows were stored in the reservoir behind Seven Oaks Dam. In mid-February 2011 the USACOE and Orange County Flood Control District operators utilized the stored flows to complete testing of the high flow capability of the Dam, ultimately releasing approximately 7,000 cfs in March 2011 from the dual gates at the outlet works. The flow was reduced shortly thereafter and a flow of 1,000 cfs was maintained for several days, almost emptying the reservoir. At this time the flows were reduced further to facilitate water conservation and Santa Ana Sucker spawning. At the conclusion of successful testing, the facility was considered complete and operation was further transferred to the local sponsors. To view a daily activities record of the SOD, as well as information about other area dams, use the web address of:

<http://www.spl.usace.army.mil/cgi-bin/cgiwrap/zinger/slProjReport.cgi?allRes.in>.

A final study report on the degraded water quality was projected to be completed in 2012. Based on the draft report Orange County Flood Control District asked the USACOE to design a drained debris basin to reduce water held by the dam in low water conditions. This would improve water quality but slightly reduce the water conserved. Other conclusions could be rolled into the Water Conservation Study by the USACOE. No final project management plan schedule is available for this study. The USACOE was still conducting a study for water conservation, which may provide additional basin benefits and provide guidance on how the supplemental water supply can be best utilized.

### **2012 Activities**

In contrast to 2011, precipitation in 2012 was about 50% of normal and this reduction in rainfall was seen in the watershed for Seven Oaks Dam. Little water was stored behind SOD, and most outflow was clean and useable by surface diverters. Most water entering the dam was allowed to flow out at the same rate for use by surface diverters and for conservation.

Despite continued work, the US Army Corps of Engineers and the local sponsors of the SOD Project were not able to complete the documentation and environmental clearance for water quality improvements to the reservoir. While there was very little water, there was no issue of degraded water quality behind the dam as in earlier years. The final study report is now expected in late 2013 or 2014. As noted in 2010 the USACOE and Orange County Flood Control District continued design efforts for a drained debris basin to reduce water held by the dam in low water conditions. Environmental clearance for water conservation is expected to be separated from the study and provided by the local agencies through a river wide HCP.

### **2013 Activities**

Precipitation in 2013 was about 50% of a normal year, and the low precipitation had impacts throughout the watershed and impacted flows into Seven Oaks Dam. Little water was stored behind SOD in 2013, and the outflow has been clean and almost exclusively used by surface diverters. Most water entering the dam was allowed to flow out at the same rate for use by surface diverters and conservation.

Scheduled water quality improvement work by the US Army Corps of Engineers and the local sponsors of the SOD Project was not completed due to environmental clearances being delayed. Very little water was stored in the reservoir and there were no issues with degraded water quality behind the dam as there had been in earlier years.

The final water quality study report on this important topic is expected in 2014. Based on the draft report, Orange County Flood Control District and the USACOE are designing a drained debris basin to reduce the amount of water held by the dam in low water conditions. This change would improve water quality but slightly reduce the water conserved. The USACOE put the water conservation study on hold based on a request from San Bernardino Valley Municipal Water District, due to difficulties with the environmental planning related to the project. The environmental clearance for this project will be included in the Santa Ana River HCP by the local water agencies.

### **2014 Activities**

2014 Precipitation was very similar to 2013 and the region struggled with drought and the limitations caused by loss of State Project Water. The effect of the drought on the SOD and Operations was similar to that of 2013. Very little water was stored behind SOD during the year and almost all water was clean and mostly used by surface diverters, further reducing recharge and groundwater levels. Virtually all water entering the dam was allowed to flow out at the same rate for use by surface diverters. With significant delays in the work on conservation storage the local sponsors determined to stop work on the study and develop a River Habitat Conservation Plan to ensure the Santa Ana Sucker can be protected while water management and flood control is operated.

Despite work on the effort, water quality improvement work by the US Army Corps of Engineers and the local sponsors of the SOD Project was not completed due to environmental clearances being delayed and limited water flows. Very little water was stored in the reservoir and there were no issues with degraded water quality behind the dam as there had been in earlier years.

## **2015 Activities**

The long drought continued and worsened in 2015. The precipitation levels were around 50% of the average in much of the watershed. Again in 2015 imported water was very limited and significant basin groundwater had to be used to make up water needed or guaranteed to local uses.

April provided several days of significant flows from Seven Oaks Dam which was recharged into the groundwater basin. In the watershed of Seven Oaks Dam, the historic lake fire raged for several weeks and burned a significant portion of the easterly SOD drainage. With limited rain and slowly melting snow, most of the sediment that is expected to run off the mountain has not been seen. Some water with black charred wood and ash was recharged with limited impact. In general the impacts of the fire are yet to be felt in the lower watershed.



The water flows that were impacted by the fire have not moved significantly and not yet impacted water coming to SOD significantly. Water levels behind SOD have been near historic lows due to the drought. Surface water diverters were able to use the water most all the time through the year with little disruption. For the vast majority of the year water was at a free flow through the dam.

The work on the River Habitat Conservation Plan, which would address the impacts of water operations on the Santa Sucker and other habitat impacts continued. This effort will allow consideration of additional storage by the dam in the future for water conservation. No water quality improvements were made at the dam and little water was stored more than a few weeks so no water quality issues were experienced. Should the sediment laden water from the fire have flows high enough to push it toward the dam decreased water quality will likely be seen again. In 2015 no significant water quality issues were seen. All focus was on having adequate water for basin users, due to the drought.

## **2016 Activities**

As 2016 began it appeared that most needed relief from drought would not come. The only significant outflow from Seven Oaks Dam came in April when, as in previous years, the debris pool level was lowered and this water was recharged into the groundwater basin. Flow rates remained at historic lows for most of the year with on average 10 cubic feet per second or less from the Santa Ana River for the period of May through October. Fortunately the availability of imported water had greatly improved from 2015 and was used not only to make up for lack of local surface water supply, but was also recharged into the groundwater basin. Seven Oaks Dam remained 50 feet below the debris pool elevation for much of the year, which meant surface water users were able to use the water for most of the year with little disruptions. As with the previous two years virtually all water was at a free flow through the dam so water quality was not an issue.

Ultimately precipitation for the year was approximately 60% of normal. 2016 experienced some relief from the drought with larger storms in the end of November and continuing through December. The elevation for Seven Oaks Dam increased by 25 feet from the end of November to the end of December for a total increase of 1,094 acre-feet in that period. The Edison facilities were able to remain operational for most of November and December so users had access to the higher quality upstream water during this time period.

Work on the River Habitat Conservation Plan, which would address the impacts of water operation on the Santa Ana Sucker and other habitat impacts continued. This effort may allow consideration of additional water storage by the dam in the future for water conservation. No water quality improvements were made at the dam and little water was stored more than a few weeks so no water quality issues were experienced for most of the year. A lawsuit was filed by Endangered Habitats League and the Center for Biological Diversity related to the construction and operation of Seven Oaks Dam effects on the San Bernardino Kangaroo Rat and Santa Ana Sucker. No projection of changes in water supply or quality can be made at this stage of the lawsuit.

## **2017 Activities**

The beginning of 2017 finally brought near normal rainfall with moderate and sustained outflows from the Seven Oaks dam between 50-250 cfs through April. Dam operators worked with the spreading operators to keep outflows from the dam from exceeding 250 cfs. This prevented water from passing the diversion points for users and spreading and ensured that little to no water passed users. Water quality was not an issue in 2017 as water did not sit behind the dam for extended periods of time. Edison was also able to generate electricity for the entirety of the summer which allowed for higher quality water. Spreading operations began to tail off in June; however total river flows remained at or above 15 cfs for the rest of the year, which was a significant improvement over 2015 and 2016.

The second half of 2017 brought disappointing rainfall with little or no monsoonal storms as well as almost no rainfall between October and December. Thankfully, the availability of imported water increased greatly as Northern California had historic rainfall levels. These flows helped to relieve some pressure in the groundwater basin that has been caused by several years of drought, but by no means reversed the affects.

Construction of Phase 1A of the Enhanced Recharge Project began in September. This portion of the project includes construction of a sedimentation basin to help improve the water quality of spreading flows. It also includes a portion of the plunge pool pipeline which will increase the spreading flows from 300 cfs to 500 cfs. Construction for this phase of construction is anticipated to be completed by July 2019.

Work on the River Habitat Conservation Plan, which would address the impacts of water operation on the Santa Ana Sucker and other habitat impacts continued. This effort may allow consideration of additional water storage by the dam in the future for water conservation. No water quality improvements were made at the dam. A lawsuit was filed by Endangered Habitats League and the Center for Biological Diversity related to the construction and operation of Seven Oaks Dam and its effects on the San Bernardino Kangaroo Rat and Santa Ana Sucker. The parties and intervenors are persuing settlement discussions. No projection of changes in water supply or quality can be made at this stage of the lawsuit.

## QUAGGA MUSSEL PROTECTION PROGRAM

The invasive Quagga Mussel became a significant threat to Big Bear Lake in 2008. Big Bear Municipal Water District launched a ground breaking program at the beginning of the boating season to prevent the mussel from getting into the lake. While once only a problem east of the 100th meridian, the mussel reached western lakes, and most significantly Lake Mead in January 2007. By the fall of 2008 the mussel was pervasive in Lake Mojave, Lake Havasu, and boaters traveling to and from the lake were transporting the microscopic larvae in bilges and out drives creating a threat to Big Bear Lake. The California mussel population expanded via the Colorado River aqueduct turnout at Parker Dam into receiving reservoirs in San Diego County. Other southern California lakes became infested when infected boats transported the microscopic mussel larvae.

The Quagga mussel is a prolific reproducer and colonizes on every solid object it encounters. Fouled boat hulls, sinking buoys, clogged water pipes and screens are just some of the problems caused by the Quagga mussel. Also, because each mature mussel can filter feed about one liter of water daily, huge mussel masses significantly reduce concentrations of plankton that are an essential food supply for fisheries.

In our situation the potential impact of an infestation is great because Big Bear Lake is at the top of the Santa Ana River watershed. Every water body and stream below the lake could become infected, and the resulting impacts to Bear Creek fisheries, the pool behind Seven Oaks Dam, the Edison generating station, and the Santa Ana River could be disastrous.

In response to the threat the District imposed new rules on launching, installed traffic control structures to prevent unauthorized launching, and strictly regulated the launch ramp hours to provide constant staffing at the start of the boating season in 2008. All boats entering the lake at public launch ramps were required to complete a questionnaire to determine if and when they might have been in an infected lake. They were also checked for standing water in bilges, lockers, bait live wells, etc. All vessels deemed suspicious by District inspectors were decontaminated at no charge to the boat owner with pressurized hot (140 degree) water. Some limited training was



also provided to commercial ramp operators who were responsible for sending suspicious vessels to a District facility for decontamination.

Both the City of Big Bear Lake and Snow Summit Resort contributed funds to help defray the costs associated with unexpected burden on the financial resources of the District. Nearly \$100,000 was spent during the summer of 2008 for educational materials, signs, additional summer staffing and capital improvements to fund the Quagga Prevention Program.

Sampling at the end of the 2008 boating season revealed that Big Bear Lake was free of visible mussels. Beginning in 2009 sampling for the microscopic mussel larvae will begin as soon as the lake warms to 45 degrees, the minimum temperature at which the mussels can reproduce.

In 2009 a Quagga Prevention Program surcharge will be added to boat permits to defray the costs associated with the program. The surcharge will remain in place as long as a threat exists or as grant money becomes available from the State. With the number of Quagga mussel infested lakes in southern California increasing, and the proximity of recreational boating opportunities at the Colorado River, the threat of infestation becomes greater. New, more stringent protective measures will be instituted at the start of the 2009 boating season. These will include training the entire public and private marina work force operating on the lake, requirements for commercial marinas to staff launch ramps with certified Quagga mussel inspectors, significant limitations on the use of private launch ramps and an expanded program of boat decontamination with pressurized hot water at both public launch ramps and the District office.

## **2009 Activities**

Several new initiatives were launched in 2009 intended to keep Big Bear Lake Quagga Mussel free. Before the start of the boating season the BBMWD hosted a Level 1 Quagga Inspection training for all District and private marina workers. The 8 hour course was completed by nearly 50 workers who were then authorized by the District to perform boat inspections at all boat launching sites. The District also began collecting a boat permit surcharge of five dollars to help defray the costs associated with the Quagga Prevention Program. In an attempt to gain control of risks posed by privately owned launch ramps on single family properties, the District adopted strict

standards for their use. District regulation required each of these individual ramps to be secured from unauthorized use with a chain and lock attached to steel posts set in concrete footings. The owners were also required to meet personally with District personnel to educate them regarding Quagga mussel risks and transport mechanisms. At the two public launch ramps District ramp personnel used hot water to decontaminate more than 1,200 boats and sealed more than 10,000 boats to their trailers as they left the lake. Sealing boats to trailers allows the boater to return to the launch ramp at a later date without having to be inspected.

Static sample media suspended in the lake at each marina and the launch ramps were free of Quagga Mussels in November for the second full year of monitoring. Also lake water sampling conducted during the entire boating season did not find any Quagga larvae. Big Bear Lake continues to be Quagga Mussel free.

### **2010 Activities**

Lake water samples as well as inspection of static sample media suspended in the Lake at the conclusion of the 2010 boating season indicate Big Bear Lake remains Quagga Mussel free. The Big Bear Municipal Water District in conjunction with District trained private marina owners, continued to enforce pre-launch inspection of all registered vessels entering the Lake. Permits sold to non-registered vessels capable of being hand launched obligated the owners to assure the District that their vessels, mostly kayaks and canoes, were clean, drained and absolutely dry before entering the Lake. District personnel controlled the two public launch ramps and only fully inspected and/or decontaminated vessels were permitted to launch. Over the course of the 2010 summer, 6,504 vessel inspections were performed and 1,251 were decontaminated with hot water. Roughly another 10,000 boats were sealed to their trailers after recovery allowing them to launch without inspection at a later date.

### **2011 Activities**

In 2011 Big Bear MWD sent 3 employees to obtain their Level II Quagga Mussel training certification. This certification is to “train the trainer”. The entire United States only has 200 level 2 certified trainers. Currently, Big Bear MWD has 4 staff members trained to this level.

In the spring of each year, the Level II Quagga Mussel trainers conducted a Level I Quagga Mussel class to certify new and returning inspectors. The class was an all-day course taught by the Big Bear MWD Level II trained staff. The class was offered to marina employees and Big Bear MWD employees.

In 2011 Big Bear MWD employed 7 seasonal launch ramp attendants whose job was to inspect and decontaminate vessels as they arrive at the public launch ramps. In total, Big Bear MWD inspected 4,613 boats at the public launch ramps. Of this number 2,696 vessels were clean and no decontamination was necessary (58%), and about 1,917 vessels were decontaminated.

At the end of the season, Big Bear Lake remained Quagga Mussel free. The program of vessel inspection before launching on the Lake was continued in 2012.

## **2012 Activities**

Starting with the boating season of 2008, the Big Bear MWD has implemented a Quagga Mussel prevention program aimed at preventing the spread of Quagga Mussels in Big Bear Lake. The general policy is clean, drained and dry before a vessel can launch. If a vessel does not meet these criteria, the vessel will be decontaminated at one of the three public launch ramps. Private marinas along the lake are required to have a Level I certified Quagga Mussel inspector available to inspect boats prior to launch. If they encounter a vessel that does not meet the policy, the vessel is sent to one of the public launch ramps for decontamination.

Big Bear MWD has 3 decontamination stations. The East Ramp and West Ramp handle the bulk of the decontaminations. The third station is located at the District's main office and is only run on holidays or special events. The decontamination is conducted by flushing suspect areas of the vessel with hot water. The entire process can take 5 to 45 minutes depending on the size of the vessel and level of decontamination.

In the spring of 2012, Big Bear MWD's Level II Quagga Mussel inspection trainers conducted a Level I Quagga Mussel training class to certify new and returning inspectors. The class was free-of-charge and was an all-day course for both private marina employees and Big Bear MWD staff.

In 2012 Big Bear MWD employed 7 seasonal ramp attendants whose job was to inspect and decontaminate vessels as they arrived at the public launch ramps. In total, the Big Bear MWD inspected 5,018 boats at the public launch ramps. Of this number 2,672 vessels were clean and no decontamination was necessary, and 2,346 vessels were decontaminated.

At the end of the season, Big Bear Lake remained Quagga Mussel free. The program of vessel inspection before launching on Big Bear Lake was continued in 2013.

### **2013 Activities**

During the 2013 boating season the District employed 9 seasonal ramp attendants whose job was to inspect and decontaminate vessels as they arrive at the District's two public launch ramps. In total, the District inspected 4,843 boats at the public launch ramps. Of this number 2,482 vessels were clean and no decontamination was necessary and 2,278 vessels were decontaminated.

In addition to training new and returning District seasonal personnel the District conducted a Level 1 Quagga Mussel training class to certify new and returning inspectors for private marina employees. The training was provided free of charge by District Level II Certified Quagga Mussel inspection instructors.

### **2014 Activities**

During the 2014 boating season, the District employed 10 seasonal ramp attendants in addition to a Launch Ramp Supervisor. These ramp personnel inspected and decontaminated vessels as they arrived at the District's two public launch ramps. In total, the District inspected 4,834 vessels at the public launch ramps. Of this number, 2,503 were clean and no decontamination was necessary. 2,270 vessels were decontaminated. The graph below depicts 2010 through 2014 decontamination statistics.

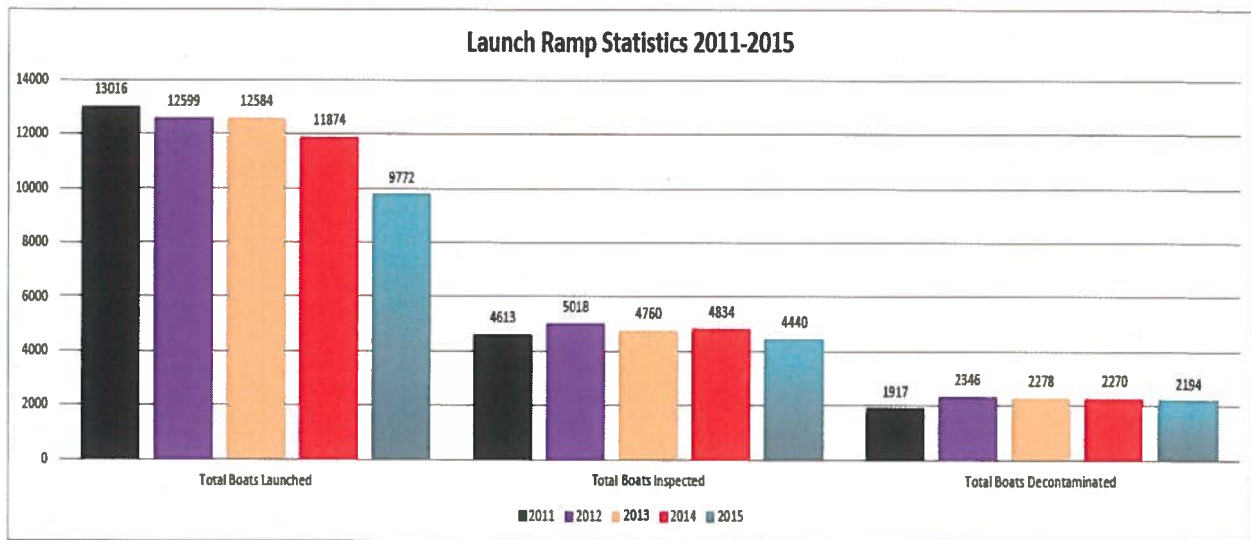
In 2014, the District had ten Quagga related incidents where mussels were found on inspected vessels prior to launch. In four of those incidents, what appeared to be live or viable mussels were discovered on the vessels. These vessels were impounded, stored at the District's main office and decontaminated prior to the vessels being allow to launch. The remaining six vessels contained shells or dead mussels and were decontaminated at the east launch ramp.

In addition to training new and returning District seasonal personnel, the District conducted two Level One Quagga Mussel Inspection training classes to certify new and returning inspectors for private marina employees. This training, conducted by District employees who are Level Two certified Quagga Inspectors, was provided free of charge.

### **2015 Activities**

During the 2015 boating season, the District employed 9 seasonal ramp attendants plus one Launch Ramp Supervisor. These ramp personnel inspected all vessels which entered District ramp facilities. Boats returning with intact "bands" were allowed to launch without further inspection. A total of 9,772 boats were launched at District launch facilities between April 1 and September 30, 2015. Of the 9,772 launched, 5,332 arrived with their bands intact and were allowed to launch. Inspections were required on 4,440 boats. Of the 4,440 boats requiring inspections, 2,194 were decontaminated; 22% of the boats launched on Big Bear Lake required decontamination.

The District continued to provide free Level I training to its staff, marina employees, and other interested lake management agencies. The District conducted two Level I Quagga Mussel Inspection training classes to certify new and returning inspectors. During the summer 2015 boating season, two employees were sent to receive a California State re-certification for Quagga Mussel Inspector Level I and II.



## **2016 Activities**

Starting with the boating season of 2008, the District implemented a quagga mussel prevention program aimed at preventing the spread of quagga mussels in Big Bear Lake. The general policy is clean, drained and dry before a vessel can launch. If a vessel does not meet these criteria, the vessel will be decontaminated at one of our public launch ramps. Private marinas along the lake are required to have a level 1 certified quagga mussel inspector available to inspect boats prior to launch. If they encounter a vessel that does not meet the policy, they are sent to one of the public launch ramps for decontamination.

The District has 3 decontamination stations. The East Ramp and West Ramp handle the bulk of the decontaminations. The third station is located at the District's main office and is only run on holidays or special events. The decontamination is conducted by flushing suspect areas of the vessel with hot water. The entire process can take 5 minutes up to 45 minutes depending on the size of the vessel and level of decontamination.

In the spring of each year, the District's Level III quagga mussel inspection trainers conduct a Level I quagga mussel training class to certify new and returning inspectors. The class is a free-of-charge all-day course for both private marina employees and District staff.

The District was awarded \$400,000 in grant money for a Quagga/Zebra Mussel Prevention grant through the Department of Boating and Waterways. This money will fund projects and costs for

2017 seasonal ramp personnel salaries, adding an additional decontamination pad at the East Public Launch Ramp, purchasing efficient and safer operating decontamination units, implementing a more robust and secure reciprocal banding program, upgrading the District's phone system to include a quagga hotline for the public, and training our inspection staff to be Level II quagga inspectors with the new training material and protocol.

The District applied for another two year rolling \$400,000 Quagga/Zebra Mussel Prevention grant through the Department of Boating and Waterways to continue our prevention efforts. Application approval will be determined in the spring of 2017.

The District employs 10 seasonal ramp attendants whose job is to inspect and decontaminate vessels as they arrive at the public launch ramps. In total, the District launched 10,825 boats in the 2016 boating season. Of these, 5,444 were inspected at the public launch ramps. Of this number 3,043 vessels were clean and no decontamination was necessary and 2,401 vessels were decontaminated. A total of 7,832 boats were banded.

### **2017 Activities**

The District was awarded \$345,000 in grant money for a Quagga/Zebra Mussel Prevention grant through the Department of Boating and Waterways. This money funded projects and operational costs for 2017 seasonal ramp personnel, purchases of replacement parts and equipment for decon units, updating and enhancing training and educational materials/ supplies, implementing a more robust and secure reciprocal banding program, and purchase of a Flow-Cam for improved early detection.

The District applied for another two year rolling \$400,000 Quagga/Zebra Mussel Prevention grant through the Department of Boating and Waterways to continue our prevention efforts and was awarded \$385,000 in the fall of 2017.

The District employs 10 seasonal ramp attendants whose job is to inspect and decontaminate vessels as they arrive at the public launch ramps. In total, the District launched 7,845 boats in the 2017 boating season. Of these, 5,175 were inspected at the public launch ramps. Of this number

3,049 vessels were clean and no decontamination was necessary and 2,426 vessels were decontaminated. A total of 2,369 boats were banded.



## **APPENDIX A**

### **MINUTES OF WATERMASTER MEETINGS**

#### **Dates**

**January 24, 2017**

**March 20, 2017**

**July 11, 2017**

**October 10, 2017**

# **BIG BEAR WATERMASTER**

FOR

BIG BEAR MUNICIPAL WATER DISTRICT VS NORTH FORK WATER CO. ET AL  
CASE NO. 165493--- COUNTY OF SAN BERNARDINO

## **WATERMASTER MEMBERS**

DONALD E. EVENSON

DANIEL B. COZAD

MICHAEL L. HUFFSTUTLER

## **MAILING ADDRESS**

1630 W. REDLANDS BLVD, A

REDLANDS, CA 92373

(909) 793-2503

## **NOTICE OF CANCELLATION OF BIG BEAR WATERMASTER MEETING**

Notice is hereby given that the Big Bear Watermaster Meeting of January 24, 2017 at 2:00 p.m. has been cancelled.

Dated: January 23, 2017

**BIG BEAR WATERMASTER**  
**MINUTES OF THE MEETING OF MARCH 20, 2017**

**PLACE:** San Bernardino Valley Water Conservation District  
1630 W. Redlands Blvd., Suite A  
Redlands, CA 92373

<b>PRESENT:</b>	<u>Watermaster Committee</u>	<u>Representing</u>
	Don Evenson	Big Bear MWD, Chair
	Daniel Cozad	SBV Water Conservation District
	Mike Huffstutler (via Skype)	Bear Valley Mutual Water Company
	<u>Others</u>	
	Mike Stephenson	Big Bear MWD
	Bob Ludecke	Big Bear MWD
	Vince Smith	Big Bear MWD
	James Bellis	Big Bear MWD
	David Raley	SBV Water Conservation District
	Athena Monge	SBV Water Conservation District
	Katelyn Scholte	SBV Water Conservation District

**1. WELCOME AND CALL TO ORDER**

The Big Bear Watermaster meeting was called to order by Don Evenson at 10:30 a.m.

**2. APPROVAL OF MINUTES**

The minutes of the October 11, 2016 meeting were approved with minor revisions to be incorporated.

**3. LAKE AND BEAR CREEK STATUS**

Mike Stephenson reported that the lake level was 12.5 feet below full. The flow rate at the Station B weir below the dam was 0.53 CFS and the lake release from the 6-inch Bypass Line was 0.12 CFS. There was no reading at Station A.

**4. SANTA ANA RIVER STATUS AND FLOW REPORT/EDISON FACILITIES**

Daniel Cozad provided a brief status of the river and operations of the spreading basins. The District is likely to recharge water year round due to import water. Seven Oaks Dam water quality has been good but SCE has been non-operational until two weeks ago. The District received 80 CFS of import water from Northern California and approximately 200 CFS from behind the dam. There has been approximately 13,000 AF spread in Santa Ana and 4,000 in Mill Creek this water year.

**5. SEVEN OAKS DAM OPERATION AND WATER QUALITY**

This item was discussed previously.

## 6. MUTUAL'S PROJECTION OF NEEDS FOR LAKE RELEASES/IN-LIEU WATER

Mr. Huffstutler projects that Mutual's estimated 2017 in-lieu needs are up to 8,500 AF.

## 7. ANNUAL WATERMASTER REPORT

Mr. Evenson reviewed a handout on the current version of the 2016 Summary of Accounts. The initial storage in the Lake was 35,478 AF. 19,041 AF was in Big Bear's lake account, and 16,437 AF was in Mutual's lake account. The ending lake storage was 31,847 AF; 22,884 AF was in Big Bear's lake account, and 8,963 AF was in Mutual's lake account. The ending balance in the Basin Make Up Account for calendar year 2016 was 27,113 AF. He continued his review of the handouts. The Summary Results table showed that the total inflow to the lake for the year were 7,027 AF; the lake evaporation was 9,309 AF; the lake releases for fishery protection was 904 AF; and the net lake withdrawal for snowmaking was 445 AF.

The 2016 Lake Levels were reviewed; they were well below the in-lieu policy. Consequently, there were no lake releases for Mutual; Mutual received 8,500 AF of in lieu deliveries of SWP water. The lake also stayed below the level of the spillway all year, which eliminated any leakage from the Lake. Bear Valley also purchased 5,209.2 AF of SWP water for direct use. In addition, there were SWP water purchases of 549.45 AF by the City of Redlands and 1,149.6 AF by East Valley Water District. Mr. Evenson also reviewed Table III-11, Summary of Water Deliveries to Mutual from 1977-2016; the ten-year total ending in 2016 was 58,641 AF. The total in-lieu deliveries and Mutual's use of the fishery releases was 9,285 AF in 2016.

Mr. Evenson noted corrections on Table III-8, Summary of Diverted Flow at the Mouth of the Santa Ana Canyon; the USGS gaged flow was 12,730 AF during the year plus 934 AF in flow that was stored during the year. The natural flow of the Santa Ana River was estimated to be 13,664 AF in 2016. The diversion by Bear Valley Mutual was 9,234 AF, and the diversion by SBVWCD was 3,473 AF.

Mr. Evenson reviewed the tables for the 2016 Daily Releases and Leakage for Fisheries in CFS; these tables are the daily breakdown of releases for fishery protection. Flows at Stations A and B on Bear Creek were in compliance with the fishery requirements all year. Mr. Evenson said that there are some minor edits and corrections to these tables. He also asked if anyone had any comments on the draft Annual Report to submit them as soon as possible. Mr. Cozad handed in his edits. The draft report will be distributed at the end of the week. Mr. Evenson thanked Ms. Scholte for her assistance with preparing data for the report.

## 8. DATE FOR NEXT MEETING

The next meeting will be on Tuesday, July 11, 2017 at 1:30 p.m., at the SBV Water Conservation District.

## 9. ADJOURN

There being no further business, the meeting was adjourned by acclamation.

  
Donald E. Evenson

  
Michael L. Huffstutler

  
Daniel Cozad

**BIG BEAR WATERMASTER**  
**MINUTES OF THE MEETING OF JULY 11, 2017**

**PLACE:** San Bernardino Valley Water Conservation District  
1630 W. Redlands Blvd., Suite A  
Redlands, CA 92373

**PRESENT:** Watermaster Committee  
Don Evenson  
Daniel Cozad  
Sam Fuller

Representing  
Big Bear MWD, Chair  
SBV Water Conservation District  
Bear Valley Mutual Water Company

Others

Mike Stephenson  
Bob Ludecke  
James Bellis  
Vince Smith  
Charlotte Van Eck  
David E. Raley  
Athena Monge

Big Bear MWD  
Big Bear MWD  
Big Bear MWD  
Big Bear MWD  
Bear Valley Mutual Water Company  
SBV Water Conservation District  
SBV Water Conservation District

**1. WELCOME AND CALL TO ORDER**

The Big Bear Watermaster meeting was called to order by Don Evenson at 1:30 p.m. The Committee welcomed Sam Fuller as the new Watermaster Committee representative for Bear Valley Mutual Water Company, replacing Mike Huffstutler, who retired.

**2. APPROVAL OF MINUTES**

The minutes of the March 20, 2017 meeting were approved with minor revisions.

**3. LAKE AND BEAR CREEK STATUS**

Mike Stephenson reported that lake level is at 59.52 feet, which is 12.81 feet below full. The current Lake release out of the 6 inch pipeline is 1.3 CFS or 508 gallons per minute. Currently, Big Bear MWD releases fluctuate in order to meet flow requirements at Station A. The required flow at Station A is 0.95 CFS based on the Revised Flow Compliance Plan; however Big Bear MWD is releasing 1.13 CFS currently to be certain they are in compliance.

Mr. Evenson reviewed a handout of 2017 Lake Levels for first six months of the year. He noted that if the lake level is below the spillway there is no leakage out of the spillway gates or out of Bays 1 and 10. Mr. Evenson reviewed the Preliminary Lake Account Results thru June 30, 2017. The year began with 31,847 AF of water in storage for actual operation and ended June at 39,914 AF. There was a gain of 8,067 AF of water in storage in Big Bear Lake. Mr. Evenson reviewed a handout on fishery release requirements and actual flows at Station B. He indicated that during the winter months there was enough side stream flows so that Big Bear MWD did not need to release the full flow requirement for Station B. Mr. Evenson also reviewed Table III-11 which shows the ten-year total BBMWD water delivery to Mutual was 58,623 AF for the period ending in year 2016.

#### **4. SANTA ANA RIVER STATUS AND FLOW REPORT/EDISON FACILITIES**

Daniel Cozad reported that the total water recharged to date is approximately 8,000 AF in Mill Creek and 31,000 AF in Santa Ana River Basins. SWP water accounts for an estimated 13,500 AF of total water recharged. The District implemented aggressive recharge program for this year. SCE has been operating continuously through spring. All of the presently flowing water in the Santa Ana River is being taken for use by Bear Valley Mutual Water Company.

#### **5. MUTUAL'S PROJECTION OF NEEDS FOR LAKE RELEASES/IN-LIEU WATER**

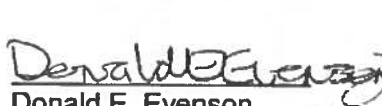
Sam Fuller said that the river flow dropped off around June 20<sup>th</sup> and there is a need for In Lieu water. He indicated that the projection of In Lieu water needs this year remains at up to 6,500 AF. Mr. Fuller said that SBVMWD has requested Mutual not operate wells; therefore they are using SWP water to the maximum extent practicable.

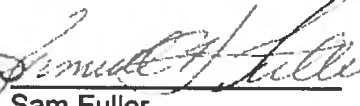
#### **6. DATE FOR NEXT MEETING**


The next meeting will be on Tuesday, October 10, 2017 with time to be determined at the Big Bear Municipal Water District.

#### **7. ADJOURN**

There being no further business, the meeting was adjourned by acclamation.

  
Donald E. Evenson

  
Sam Fuller

  
Daniel B. Cozad

**BIG BEAR WATERMASTER**  
**MINUTES OF THE MEETING OF OCTOBER 10, 2017**

PLACE: Big Bear Municipal Water District  
40524 Lakeview Dr.  
Big Bear Lake, California

PRESENT: Watermaster Committee  
Don Evenson  
Daniel Cozad  
Sam Fuller

Representing  
Big Bear MWD, Chair  
SBV Water Conservation District  
Bear Valley Mutual Water Company

Others

Mike Stephenson  
Bob Ludecke  
Frank Howes  
James Bellis  
Brittany Dupriest  
David E. Raley  
Athena Monge  
Katelyn Scholte

Big Bear MWD  
Big Bear MWD  
Big Bear MWD  
Big Bear MWD  
Big Bear MWD  
SBV Water Conservation District  
SBV Water Conservation District  
SBV Water Conservation District

**1. WELCOME AND CALL TO ORDER**

The Big Bear Watermaster meeting was called to order by Don Evenson at 12:15 p.m.

**2. APPROVAL OF MINUTES**

The minutes of the July 11, 2017, meeting were approved with minor revisions.

**3. LAKE AND BEAR CREEK STATUS**

Mike Stephenson reported that current release is 1.29 CFS. He said that BBMWD is researching the potential of obtaining an XIO Cloud SCADA to collect data at Station B. Mr. Stephenson said that the lake level is 14.42 AF feet below full.

Mr. Evenson reviewed a handout of 2017 Lake Levels from January 1 thru October 1<sup>st</sup> compared to lake release criteria. He noted that if the lake level is below the spillway, there is no leakage out of the spillway gates. Mr. Evenson reviewed the Preliminary Lake Account Results from January 1, 2017, thru -September 30, 2017. The year began with 31,847 AF of water in storage for actual operation and ended September at 36,229 AF. There was a gain of 4,382 AF of water in storage in Big Bear Lake. Mr. Evenson reviewed a handout on fishery release requirements and actual flows at Station B. He also reviewed Table III-11 which shows the ten-year total BBMWD water delivery to Mutual was 55,032 AF for the period ending in the year 2017.

**4. SANTA ANA RIVER STATUS AND FLOW REPORT/EDISON FACILITIES**

Daniel Cozad reported that the total water recharged water year to date is approximately in Mill Creek, and Santa Ana River Basins is 49,000 AF. Earlier this year nearly 300 CFS were being diverted for recharge in Santa Ana while State Project imported water was delivered at Santa

Ana Low. Over the summer SCE facilities have been operational. Recently the Enhanced Recharge Project has begun construction. The sedimentation basin is being developed. The District operations are out at the canal, below the Cuttle Weir and River Diversion. Water is being recharged in the upper SA River. The District is keeping track of the amounts of water. The facilities should be back operational by November 15<sup>th</sup>. When completed, the existing canal will discharge into the new sedimentation basin. Mr. Fuller added that the water will be taken through the Conservation District's headworks and canal to the sedimentation basin. The water will then flow back into the canal or be diverted into the Plunge Pool pipeline. The maximum combined flow would then be 500 CFS. Mr. Fuller stated that Phase 1 connects to Foothill Pipeline and can recharge the basins in the west of borrow pit from the Santa Ana Low Turnout.

#### **5. MUTUAL'S PROJECTION OF NEEDS FOR LAKE RELEASES/IN-LIEU WATER**

Sam Fuller said in-lieu water was discussed previously believing October and November to be similar. He indicated that the projection of In Lieu water needs this year is approximately 4,700 AF well below the 6,500 AF usually estimated. Mr. Fuller said that Mutual is not utilizing wells at this time; currently using SWP water.

#### **6. GROUNDWATER SUSTAINABILITY PRELIMINARY DISCUSSION**


Mr. Stephenson said that the Valley was looking into treating water from BBARWA's plant at the east end making it into high quality water to be discharged into the lake. The GSA has opened up opportunities for funding; the groundwater table seems to be fairly stable but SBVMWD would like a source to utilize for additional recharge. Mr. Stephenson reviewed map of potential project areas. The Groundwater Sustainability Plan is due by July 1, 2022. Mr. Evenson said that there are funds that are authorized but unappropriated. Discussion ensued. All parties to the Watermaster agreed that the development of this water source for the area was smart if it could be made economic. As plans develop the GSA will coordinate with SBVMWD and SBVWCD etc.

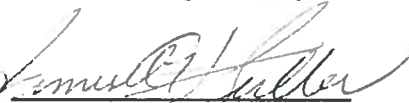
#### **7. DATE FOR NEXT MEETING**


The next meeting will be on Tuesday, January 23, 2018, with time to be determined at the Water Conservation District.

#### **8. ADJOURN**

There being no further business, the meeting was adjourned by acclamation.

  
Donald E. Evenson

  
Sam Fuller

  
Daniel B. Cozad



# APPENDIX B

## TABLE OF

### ACCOUNTS OF OPERATION OF BIG BEAR LAKE

#### ACCOUNTS FOR

#### CALENDAR YEAR 2017

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INPUT DATA  
BIG BEAR WATERMASTER REPORT  
CALENDAR YEAR  
2017

Calendar Year	2017	acre-feet	See Note 1
Mutual's Lake Account Balance on Jan.1	8,977	acre-feet	
Basin Make-Up Account Balance on Jan. 1	27,120	acre-feet	
Account Balance for Mutual's Advances to BBMWWD	-	acre-feet	
Repayment Premium for Mutual's Advances to BBMWWD	0%		
Recharge Factor for Lake Deliveries to Mutual	0.500		
Recharge Factor for Imported Water Deliveries to Mutual	0.500		
Recharge Factor for Lake Spills	0.510		
Snowmelt Return Factor	0.500		Jan, Feb, Mar, Apr, Oct, Nov, Dec
Snowmelt Return Factor	0.000		May, June, July, Aug, Sept
<u>Monthly Evaporation Rate Calculation Factors</u>			
	<u>C1</u>	<u>C2</u>	<u>C3</u>
January	7.09	0.42	1,200
February	6.90	0.50	1,200
March	8.36	0.74	1,200
April	8.82	0.87	1,200
May	9.73	1.02	1,200
June	9.72	1.10	1,200
July	9.90	1.13	1,200
August	9.34	1.22	1,200
September	8.36	1.25	1,200
October	7.89	1.22	1,200
November	7.01	1.07	1,200
December	6.91	0.50	1,200
Evaporation rate (feet/month)	=	Average air temperature x C1 x C2 / C3	

INPUT DATA  
BIG BEAR WATERMASTER REPORT  
CALENDAR YEAR  
2017  
(continued)

Month	Gage* Height 1st of Month (feet)	Actual Mutual Shareholder Releases (acre-feet)	Mutual Other Releases (acre-feet)	Actual Spillway Flood Control Releases (acre-feet)	Actual Outlet Works & Flood Control Releases (acre-feet)	Big Bear's Spreading Releases (acre-feet)	Big Bear's Other Releases (acre-feet)	Leakage (Not used, Included in Fish Releases) (acre-feet)
January	55.98	-	-	-	-	-	-	-
February	57.70	-	-	-	-	-	-	-
March	59.34	-	-	-	-	-	-	-
April	60.56	-	-	-	-	-	-	-
May	60.71	-	-	-	-	-	-	-
June	60.38	-	-	-	-	-	-	-
July	59.74	-	-	-	-	-	-	-
August	59.16	-	-	-	-	-	-	-
September	58.65	-	-	-	-	-	-	-
October	58.09	-	-	-	-	-	-	-
November	57.66	-	-	-	-	-	-	-
December	57.37	-	-	-	-	-	-	-
December	57.13	-	-	-	-	-	-	-
Change	1.15						0.00	
* Gage at Bear Valley Dam								

INPUT DATA  
BIG BEAR WATERMASTER REPORT  
CALENDAR YEAR  
2017  
(continued)

Month	Big Bear's Withdrawals for Snowmaking (acre-feet)	Big Bear's Releases for SBVMWD (acre-feet)	Mutual Spills of Wastewater Exports (acre-feet)	In-Lieu Imported Supplies (SBVMWD) (acre-feet)	In Lieu Supplies from SBVMWD's Contract Wells (acre-feet)	In Lieu Supplies from Mutual's Wells (acre-feet)	VD In Lieu Supplies (BB Lake) (acre-feet)
January	122.45	-	-	-	-	-	-
February	81.78	-	-	-	-	-	-
March	25.76	-	-	-	-	-	-
April	17.32	-	-	26.70	-	-	-
May	20.08	-	-	35.80	-	-	-
June	22.77	-	-	262.10	-	-	-
July	17.84	-	-	1,060.20	-	-	-
August	20.13	-	-	886.20	-	-	-
September	10.38	-	-	791.50	-	-	-
October	11.59	-	-	615.50	-	-	-
November	66.80	-	-	144.30	-	-	-
December	317.58	-	-	324.50	-	-	-
	<b>734.48</b>	<b>-</b>		<b>4,146.80</b>	<b>-</b>		<b>-</b>

**INPUT DATA**  
**BIG BEAR WATERMASTER REPORT**  
**CALENDAR YEAR**  
**2017**  
 (continued)

Month	SWRCB Order 95-4 Releases & Leakage (acre-feet)	Mutual's Direct Use of Order 95-4 Releases (acre-feet)	Basin Replenishment from SBVMWD (acre-feet)	Basin Replenishment from Others (acre-feet)	2017 Net Wastewater Exports (acre-feet)	Average Air Temperature (degrees F)
January	61.26	-	-	-	170.68	32.7
February	19.29	-	-	-	247.50	38.4
March	15.65	-	-	-	176.78	44.2
April	22.18	1.31	-	-	100.64	47.2
May	44.13	20.93	-	-	81.34	52.0
June	48.45	38.88	-	-	73.28	62.6
July	69.36	69.36	-	-	84.95	67.5
August	73.42	73.42	-	-	73.46	64.6
September	75.15	75.15	-	-	62.38	57.0
October	76.81	76.81	-	-	59.56	52.1
November	78.10	78.10	-	-	64.26	47.4
December	80.15	72.33	-	-	84.17	40.2
	663.95	506.29			1,279.00	

SUMMARY RESULTS  
CALENDAR YEAR  
2017

LAKE ACCOUNTS (acre-feet)	Big Bear	Mutual	Actual
Initial Storage	22,870	8,977	31,847
Lake Inflows	0	13,213	13,213
In-Lieu Supplies to Mutual	4,147	(4,147)	0
Lake Releases (Mutual & BBMWd)	0	0	0
Releases & Leakage (SWRCB 95-4)	(98)	(566)	(664)
Net Snowmaking Withdrawals from Lake	(413)	0	(413)
Lake Spills & Flood Control Releases	0	0	0
Leakage from Dam	0	0	0
Evaporation from Lake	(3,144)	(6,634)	(9,777)
Net Wastewater Exports	(1,279)	1,279	0
Advances & Repayment of Advances	0	0	0
Ending Storage	22,084	12,122	34,206
BASIN MAKE UP ACCOUNT (acre-feet)			
Beginning Balance	n.a.	n.a.	27,120
Recharge From Releases of Lake Water Used by Mutual	253	2,327	(2,073)
Recharge From In-lieu SWP Water Delivered to Mutual	2,073	n.a.	2,073
Recharge from Spills & Other Lake Releases	80	31	50
Account Credit (Debit)	2,407	2,357	50
Amount Replenished	0	n.a.	0
Ending Balance			27,170

CALENDAR YEAR  
2017  
BIG BEAR WATERMASTER

TABLE 1  
ACTUAL OPERATION OF BIG BEAR LAKE

Month	1 Gage Height 1st of Month (Input Data) (feet)	2 Volume in Storage (ac-ft)	3 Change in Storage (ac-ft)	4 Lake Surface Area (acres)	5 Spills Releases Leakage Withdrawals (see Table 1.A) (feet)	6 Estimated Lake Evaporation (see Table 1.D) (ac-ft)	7 Calc. Total Inflow (ac-ft)	8 Adjusted Lake Inflow * (ac-ft)	9 Adjusted Lake Evap * (ac-ft)	10 Adjusted Evap Rate * (feet/month)
January	55.98	31,847	3,525	2,000	122	168	3,815	3,815	168	0.081
February	57.70	35,372	3,633	2,138	60	243	3,936	3,936	243	0.110
March	59.34	39,005	2,765	2,263	29	525	3,318	3,318	525	0.228
April	60.56	41,770	351	2,343	31	709	1,090	1,090	709	0.302
May	60.71	42,121	(702)	2,352	64	1,008	370	370	1,008	0.430
June	60.38	41,419	(1,505)	2,335	71	1,291	(143)	0	1,434	0.620
July	59.74	39,914	(1,365)	2,293	87	1,429	151	151	1,429	0.629
August	59.16	38,549	(1,111)	2,249	94	1,368	350	350	1,368	0.613
September	58.65	37,438	(1,209)	2,211	86	1,087	(36)	0	1,123	0.513
October	58.09	36,229	(962)	2,169	83	899	20	20	899	0.418
November	57.66	35,267	(638)	2,134	112	629	102	102	629	0.296
December	57.37	34,629	(423)	2,109	239	243	59	59	243	0.116
TOTALS	57.13	34,206	2,359	2,094	1,077	9,598	13,033	13,213	9,777.2	4.357

\* NOTE: Evaporation adjusted to eliminate negative inflow

CALENDAR YEAR  
2017  
BIG BEAR WATERMASTER

TABLE 1.A  
ACTUAL OPERATION OF BIG BEAR LAKE  
Summary Details

1 Month	2 Actual Spillway Flood Control Releases (Input Data) (ac-ft)	3 Actual Outlet Works Flood Control Releases (Input Data) (ac-ft)	4 Actual Lake Releases (see Table 1.B) (ac-ft)	5 Actual Estimated Leakage (not used) (Input Data) (ac-ft)	6 Estimated Net Lake Withdrawal (see Table 1.C) (ac-ft)	7	8	9 Total Spills Releases Leakage Withdrawals (ac-ft)
January	-	-	61.3	-	61.2			122.5
February	-	-	19.3	-	40.9			60.2
March	-	-	15.7	-	12.9			28.5
April	-	-	22.2	-	8.7			30.8
May	-	-	44.1	-	20.1			64.2
June	-	-	48.5	-	22.8			71.2
July	-	-	69.4	-	17.8			87.2
August	-	-	73.4	-	20.1			93.6
September	-	-	75.2	-	10.4			85.5
October	-	-	76.8	-	5.8			82.6
November	-	-	78.1	-	33.4			111.5
December	-	-	80.2	-	158.8			238.9
TOTALS	-	-	664.0	-	412.8			1,076.8



CALENDAR YEAR  
2017  
BIG BEAR WATERMASTER

TABLE 1.B  
ACTUAL OPERATION OF BIG BEAR LAKE  
Release Details

Month	1 Mutual's Shareholder Releases (Input Data) (ac-ft)	2 Mutual's Other Releases (Input Data) (ac-ft)	3 Mutual's Total Releases (Col.1 + Col.2) (ac-ft)	4 Big Bear's Releases for SBVMWD (Input Data) (ac-ft)	5 Big Bear's Spreading Releases (Input Data) (ac-ft)	6 Big Bear's Other Releases (Input Data) (ac-ft)	7 Big Bear's Total Releases (Col.4+Col.5+Col.6) (ac-ft)	8 SWRCB Order NO. 95-4 Releases (Input Data) (ac-ft)	9 Total Actual Releases (Cols.3+ 7+ 8) (ac-ft)
January	-	-	-	-	-	-	-	61.3	61.3
February	-	-	-	-	-	-	-	19.3	19.3
March	-	-	-	-	-	-	-	15.7	15.7
April	-	-	-	-	-	-	-	22.2	22.2
May	-	-	-	-	-	-	-	44.1	44.1
June	-	-	-	-	-	-	-	48.5	48.5
July	-	-	-	-	-	-	-	69.4	69.4
August	-	-	-	-	-	-	-	73.4	73.4
September	-	-	-	-	-	-	-	75.2	75.2
October	-	-	-	-	-	-	-	76.8	76.8
November	-	-	-	-	-	-	-	78.1	78.1
December	-	-	-	-	-	-	-	80.2	80.2
TOTALS	-	-	-	-	-	-	-	663.95	664.0

CALENDAR YEAR  
2017  
BIG BEAR WATERMASTER

TABLE 1.C  
ACTUAL OPERATION OF BIG BEAR LAKE  
Lake Withdrawal Details

1 Month	2 Snowmaking Withdrawals (Input Data) (ac-ft)	3	4	5 Total Lake Withdrawals (ac-ft)	6	7 Return from Snow melt @ 50.0% (ac-ft)	8	9 Estimated Net Lake Withdrawals (ac-ft)
January	122.45			122.45		61.23		61.22
February	81.78			81.78		40.89		40.89
March	25.76			25.76		12.88		12.88
April	17.32			17.32		8.66		8.66
May	20.08			20.08		-		20.08
June	22.77			22.77		-		22.77
July	17.84			17.84		-		17.84
August	20.13			20.13		-		20.13
September	10.38			10.38		-		10.38
October	11.59			11.59		5.80		5.79
November	66.80			66.80		33.40		33.40
December	317.58			317.58		158.79		158.79
TOTALS	734.48			734.48		321.65		412.83

CALENDAR YEAR  
2017  
BIG BEAR WATERMASTER

TABLE 1.D  
ACTUAL OPERATION OF BIG BEAR LAKE  
Evaporation Details

1 Month	2	3 Lake Surface Area (acres)	4 Average Lake Area (acres)	5 Average Air Temperature (Input Data) (deg F)	6 Calculated Evaporation Rate (feet/month)	7	8	9 Estimated Lake Evaporation (ac-ft)
January		2,000	2,069	32.70	0.081			167.9
February		2,138	2,201	38.40	0.110			242.9
March		2,263	2,303	44.20	0.228			524.8
April		2,343	2,348	47.20	0.302			708.5
May		2,352	2,344	52.00	0.430			1,007.9
June		2,335	2,314	62.60	0.558			1,290.7
July		2,293	2,271	67.50	0.629			1,429.1
August		2,249	2,230	64.60	0.613			1,367.9
September		2,211	2,190	57.00	0.496			1,087.1
October		2,169	2,152	52.10	0.418			899.2
November		2,134	2,122	47.40	0.296			628.6
December		2,109	2,102	40.20	0.116			243.2
TOTALS		2,094			4.278			9,597.7

CALENDAR YEAR  
2017  
BIG BEAR WATERMASTER

TABLE 2  
SYNTHESIZED MUTUAL OPERATION OF BIG BEAR LAKE

Month	1 Gauge Height 1st of Month (feet)	2 Mutual's Lake Account (ac-ft)	3 Change in Storage (*) (ac-ft)	4 Lake Surface Area (acres)	5 Mutual's Lake Inflow (see Table 1) (feet)	6 Mutual's Net Wastewater Export Credit (see Table 2.A) (ac-ft)	7 Mutual's Lake Evap. (see Table 2.B) (ac-ft)	8 Mutual's Snowmaking Advances to Big Bear (see Table 3) (ac-ft)	9 Mutual's Credit for Return of Advances (see Table 3) (ac-ft)	10 Mutual's Releases Leakage Spills & In-lieu Del. (see Table 2.A) (ac-ft)
January	41.55	8,977	3,870	1,107	3,815.4	170.7	99.1	-	-	17.3
February	44.70	12,847	4,019	1,333	3,936.1	247.5	158.1	-	-	7.0
March	47.50	16,865	3,126	1,528	3,318.3	176.8	362.4	-	-	6.8
April	49.50	19,991	650	1,653	1,090.4	100.6	502.7	-	-	38.0
May	49.90	20,641	(335)	1,678	370.1	81.3	718.4	-	-	68.1
June	49.70	20,306	(1,249)	1,666	-	73.3	1,017.1	-	-	305.7
July	48.90	19,057	(1,887)	1,617	151.3	85.0	993.6	-	-	1,129.6
August	47.70	17,170	(1,461)	1,541	350.5	73.5	925.3	-	-	959.6
September	46.75	15,709	(1,542)	1,476	-	62.4	738.0	-	-	866.7
October	45.70	14,167	(1,186)	1,404	19.8	59.6	573.4	-	-	692.3
November	44.85	12,980	(450)	1,343	102.1	64.3	394.3	-	-	222.4
December	44.50	12,530	(408)	1,319	59.2	84.2	151.2	-	-	399.7
TOTALS	44.20	12,122	3,145	1,297	13,212.9	1,279.0	6,633.6	-	-	4,713.0

(\*) Col. 3 = Col. 5 + Col. 6 - Col. 7 - Col. 8 + Col. 9 - Col. 10

CALENDAR YEAR  
2017  
BIG BEAR WATERMASTER

TABLE 2.A  
SYNTHESIZED MUTUAL OPERATION OF BIG BEAR LAKE  
Lake Outflow Details

Month	1 Mutual's FC Releases from Table 2.C (ac-ft)	2 Mutual's Lake Releases from Table 1.B (ac-ft)	3 Mutual's Leakage from Table 2.C (ac-ft)	4 Mutual's Order No. 95-4 Releases from Table 2.C (ac-ft)	5 Big Bear's In-lieu Supply Deliveries (see Table 3.B) (ac-ft)	6 Mutual's Releases Leakage Spills & In-lieu Del. (to Table 2) (ac-ft)	7	8 Net Credit for Wastewater Exports (Input Data) (ac-ft)	9 Spilled from Mutual's Lake Acct. (Input Data) (ac-ft)	10 Net Wastewater Export Credit (to Table 2) (ac-ft)
January	-	-	-	17.3	-	17.3		170.7	-	170.7
February	-	-	-	7.0	-	7.0		247.5	-	247.5
March	-	-	-	6.8	-	6.8		176.8	-	176.8
April	-	-	-	11.3	26.7	38.0		100.6	-	100.6
May	-	-	-	32.3	35.8	68.1		81.3	-	81.3
June	-	-	-	43.6	262.1	305.7		73.3	-	73.3
July	-	-	-	69.4	1,060.2	1,129.6		85.0	-	85.0
August	-	-	-	73.4	886.2	959.6		73.5	-	73.5
September	-	-	-	75.2	791.5	866.7		62.4	-	62.4
October	-	-	-	76.8	615.5	692.3		59.6	-	59.6
November	-	-	-	78.1	144.3	222.4		64.3	-	64.3
December	-	-	-	75.2	324.5	399.7		84.2	-	84.2
TOTALS	-	-	-	566.2	4,146.80	4,713.0		1,279.0	-	1,279.0

CALENDAR YEAR  
2017  
BIG BEAR WATERMASTER

TABLE 2.B  
SYNTHESIZED MUTUAL OPERATION OF BIG BEAR LAKE  
Synthesized Evaporation Calculation

Month	1 Starting Volume (ac-ft)	2 Starting Area (acres)	3 Assumed Evap (ac-ft)	4 Estimated Ending Volume (ac-ft)	5 Estimated Ending Area (acres)	6 Average Area (acres)	7 Mutuals Lake Evap. (to Table 2) (ac-ft)	8 Big Bear's Lake Evap. (to Table 3.A) (ac-ft)	9 Revised Ending Volume Estimate (ac-ft)	10
January	8,977.0	1,107.0	89.8	12,856.0	1,336.0	1,221.5	99.1	68.8	12,846.7	
February	12,846.7	1,333.0	147.2	16,876.1	1,531.0	1,432.0	158.1	84.8	16,865.2	
March	16,865.2	1,528.0	348.2	20,005.3	1,653.0	1,590.5	362.4	162.4	19,991.1	
April	19,991.1	1,653.0	498.9	20,645.2	1,678.0	1,665.5	502.7	205.8	20,641.4	
May	20,641.4	1,678.0	721.7	20,303.1	1,663.0	1,670.5	718.4	289.5	20,306.3	
June	20,306.3	1,666.0	1,032.3	19,041.7	1,617.0	1,641.5	1,017.1	416.7	19,056.8	
July	19,056.8	1,617.0	1,017.5	17,146.0	1,541.0	1,579.0	993.6	435.5	17,169.9	
August	17,169.9	1,541.0	945.3	15,688.9	1,476.0	1,508.5	925.3	442.6	15,708.9	
September	15,708.9	1,476.0	757.2	14,147.5	1,401.0	1,438.5	738.0	385.5	14,166.6	
October	14,166.6	1,404.0	586.8	12,966.9	1,340.0	1,372.0	573.4	325.8	12,980.2	
November	12,980.2	1,343.0	397.9	12,526.3	1,319.0	1,331.0	394.3	234.3	12,529.9	
December	12,529.9	1,319.0	152.7	12,120.9	1,294.0	1,306.5	151.2	92.0	12,122.3	
TOTALS							6,633.6	3,143.6		

CALENDAR YEAR  
2017  
BIG BEAR WATERMASTER

TABLE 2.C  
SYNTHESIZED MUTUAL OPERATION OF BIG BEAR LAKE  
Mutual's Leakage, Spills & FC Releases, and SWRCB Releases

Month	1 Total Leakage from Input Data (ac-ft)	2 Mutual's Leakage to Table 2.A (ac-ft)	3 Big Bear's Leakage to Table 3.B (ac-ft)	4 Actual Spills & FC Releases from Input Data (ac-ft)	5 Big Bear's Spills & FC Releases to Table 3.B (ac-ft)	6 Mutual's Spills & FC Releases to Table 2.A (ac-ft)	7 SWRCB Order 95-4 Releases from Input Data (ac-ft)	8 Mutual's Order 95-4 Direct Use from Input Data (ac-ft)	9 Mutual's Order 95-4 Releases to Table 2.A (ac-ft)	10 Big Bear's Order 95-4 Releases to Table 3.B (ac-ft)
January	-	-	-	-	-	-	61.3	-	17.3	44.0
February	-	-	-	-	-	-	19.3	0.00	7.0	12.3
March	-	-	-	-	-	-	15.7	0.00	6.8	8.9
April	-	-	-	-	-	-	22.2	1.31	11.3	10.9
May	-	-	-	-	-	-	44.1	20.93	32.3	11.8
June	-	-	-	-	-	-	48.5	38.88	43.6	4.9
July	-	-	-	-	-	-	69.4	69.36	69.4	-
August	-	-	-	-	-	-	73.4	73.42	73.4	-
September	-	-	-	-	-	-	75.2	75.15	75.2	-
October	-	-	-	-	-	-	76.8	76.81	76.8	-
November	-	-	-	-	-	-	78.1	78.10	78.1	-
December	-	-	-	-	-	-	80.2	72.33	75.2	5.0
TOTALS	-	-	-	-	-	-	663.95	506.29	566.21	97.74

CALENDAR YEAR  
2017  
BIG BEAR WATERMASTER

TABLE 3  
DETERMINATION OF BIG BEAR'S LAKE ACCOUNT STATUS  
Lake Account and Advance Account

Month	1 Actual Lake Account (see Table 1) (ac-ft)	2 Mutual's Lake Account (see Table 2) (ac-ft)	3 Big Bear's Lake Account (calc.) (ac-ft)	4 Change in Big Bear's Lake Account (calc.) (ac-ft)	5	6 Big Bear's Advances From Mutual (calc.) (ac-ft)	7 Big Bear's Payments Against Advances (calc.) (ac-ft)	8 Big Bear's Advance Account Balance (calc.) (ac-ft)	9 Big Bear's 0% Repayment Premium (calc.) (ac-ft)	10 Mutual's Credit for Return of Advances (to Table 2) (ac-ft)
January	31,847	8,977	22,870	(344.7)						
February	35,372	12,847	22,525	(385.5)						
March	39,005	16,865	22,140	(360.9)						
April	41,770	19,991	21,779	(299.3)						
May	42,121	20,641	21,480	(366.9)						
June	41,419	20,306	21,113	(255.5)						
July	39,914	19,057	20,857	521.9						
August	38,549	17,170	21,379	350.0						
September	37,438	15,709	21,729	333.3						
October	36,229	14,167	22,062	224.4						
November	35,267	12,980	22,287	(187.6)						
December	34,629	12,530	22,099	(15.5)						
TOTALS	34,206	12,122	22,084	(786.3)						



CALENDAR YEAR  
2017  
BIG BEAR WATERMASTER

TABLE 3.A  
DETERMINATION OF BIG BEAR'S LAKE ACCOUNT STATUS  
Lake Inflow Details

Month	1 In-lieu SWP Water from SBVMWD (Input Data) (ac-ft)	2 In-lieu Water from Other's Wells (Input Data) (ac-ft)	3 In-lieu Supplies from Mutual's Wells (Input Data) (ac-ft)	4	5 Valley District In Lieu Lake Supplies (Input Data) (ac-ft)	6 Big Bear's In-lieu Deliveries to Mutual (calc.) (ac-ft)	7	8 Big Bear's Advances From Mutual (from Table 3) (ac-ft)	9	10 Big Bear's Total Lake Inflows (calc.) (ac-ft)
January	-	-	-	-	-	-	-	-	-	-
February	-	-	-	-	-	-	-	-	-	-
March	-	-	-	-	-	-	-	-	-	-
April	26.7	-	-	-	-	26.7	-	-	-	26.7
May	35.8	-	-	-	-	35.8	-	-	-	35.8
June	262.1	-	-	-	-	262.1	-	-	-	262.1
July	1,060.2	-	-	-	-	1,060.2	-	-	-	1,060.2
August	886.2	-	-	-	-	886.2	-	-	-	886.2
September	791.5	-	-	-	-	791.5	-	-	-	791.5
October	615.5	-	-	-	-	615.5	-	-	-	615.5
November	144.3	-	-	-	-	144.3	-	-	-	144.3
December	324.5	-	-	-	-	324.5	-	-	-	324.5
TOTALS	4,146.8	-	-	-	-	4,146.8	-	-	-	4,146.8

CALENDAR YEAR  
2017  
BIG BEAR WATERMASTER

TABLE 3.B  
DETERMINATION OF BIG BEAR'S LAKE ACCOUNT STATUS  
Lake Outflow Details

Month	1 Big Bear's Snowmaking Withdrawals (Input Data) (ac-ft)	2 Big Bear's Total Releases Table 1.B (ac-ft)	3 Return Flow from Snowmelt 50.0% (Table 1.C) (ac-ft)	4 Big Bear's Net Lake Withdrawal (calc.) (ac-ft)	5 Big Bear's Payments Against Advances (see Table 3) (ac-ft)	6 Big Bear's Spills & FC Releases from Table 2.C (ac-ft)	7 Big Bear's Leakage + SWRCB Rel. from Table 2.C (ac-ft)	8 Big Bear's Lake Evaporation from Table 2.B (ac-ft)	9 Net Wastewater Export Credit (from Table 2.A) (ac-ft)	10 Big Bear's Total Lake Outflows (calc.) (ac-ft)
January	122.5	-	61.2	61.2	-	-	44.0	68.8	170.7	344.7
February	81.8	-	40.9	40.9	-	-	12.3	84.8	247.5	385.5
March	25.8	-	12.9	12.9	-	-	8.9	162.4	176.8	360.9
April	17.3	-	8.7	8.7	-	-	10.9	205.8	100.6	326.0
May	20.1	-	-	20.1	-	-	11.8	289.5	81.3	402.7
June	22.8	-	-	22.8	-	-	4.9	416.7	73.3	517.6
July	17.8	-	-	17.8	-	-	-	435.5	85.0	538.3
August	20.1	-	-	20.1	-	-	-	442.6	73.5	536.2
September	10.4	-	-	10.4	-	-	-	385.5	62.4	458.2
October	11.6	-	5.8	5.8	-	-	-	325.8	59.6	391.1
November	66.8	-	33.4	33.4	-	-	-	234.3	64.3	331.9
December	317.6	-	158.8	158.8	-	-	5.0	92.0	84.2	340.0
<b>TOTALS</b>	<b>734.5</b>	<b>-</b>	<b>321.7</b>	<b>412.8</b>	<b>-</b>	<b>-</b>	<b>97.7</b>	<b>3,143.6</b>	<b>1,279.0</b>	<b>4,933.1</b>

CALENDAR YEAR  
2017  
BIG BEAR WATERMASTER

TABLE 4  
BASIN MAKE-UP ACCOUNT

Month	1 Big Bear's Basin Additions (see Table 4.A) (ac-ft)	2	3 Mutual's Basin Additions (see Table 4.B) (ac-ft)	4	5 Net Credit (Debit) (ac-ft)	6	7 Total Basin Replenishment (see Table 4.C) (ac-ft)	8	9 Basin Comp. Account Balance (ac-ft)
January	31.2		8.8		22.4		-		27,120
February	9.8		3.6		6.3		-		27,142
March	8.0		3.5		4.5		-		27,149
April	24.6		19.1		5.5		-		27,153
May	40.2		34.2		6.0		-		27,159
June	155.4		152.9		2.5		-		27,165
July	564.8		564.8		-		-		27,167
August	479.8		479.8		-		-		27,167
September	433.3		433.3		-		-		27,167
October	346.2		346.2		-		-		27,167
November	111.2		111.2		-		-		27,167
December	202.4		199.9		2.5		-		27,167
TOTALS	2,407.0		2,357.1		49.8		0.0		27,170

CALENDAR YEAR  
2017  
BIG BEAR WATERMASTER

TABLE 4.A  
BIG BEAR'S BASIN ADDITIONS

Month	SPILLS			LAKE RELEASES				IN LIEU SUPPLIES		Big Bear's Basin Additions (ac-ft)
	1 Actual Spills & FC Releases (ac-ft)	2 Actual SWRCB 95-4 Releases (ac-ft)	3 Basin Addition @ 51.0% (ac-ft)	4 Lake Release for Mutual (ac-ft)	5 SWRCB 95-4 Releases for Mutual (ac-ft)	6 Big Bear's Total Releases Table 1.B (ac-ft)	7 Basin Addition @ 50.0% (ac-ft)	8 Imported In Lieu Deliveries (ac-ft)	9 Basin Addition @ 50.0% (ac-ft)	
January	-	61.3	31.2	-	-	-	0.0	-	-	31.2
February	-	19.3	9.8	-	-	-	0.0	-	-	9.8
March	-	15.7	8.0	-	-	-	0.0	-	-	8.0
April	-	20.9	10.6	-	1.3	-	0.7	26.7	13.4	24.6
May	-	23.2	11.8	-	20.9	-	10.5	35.8	17.9	40.2
June	-	9.6	4.9	-	38.9	-	19.4	262.1	131.1	155.4
July	-	-	-	-	69.4	-	34.7	1,060.2	530.1	564.8
August	-	-	-	-	73.4	-	36.7	886.2	443.1	479.8
September	-	-	-	-	75.2	-	37.6	791.5	395.8	433.3
October	-	-	-	-	76.8	-	38.4	615.5	307.8	346.2
November	-	-	-	-	78.1	-	39.1	144.3	72.2	111.2
December	-	7.8	4.0	-	72.3	-	36.2	324.5	162.3	202.4
TOTALS	0.0	157.7	80.4	0.0	506.3	0.0	253.1	4,146.8	2,073.4	2,407.0

CALENDAR YEAR  
2017  
BIG BEAR WATERMASTER

TABLE 4.B  
MUTUAL'S BASIN ADDITIONS

Month	SPILLS & FISH RELEASES			LAKE RELEASES			7 Total Basin Additions (ac-ft)
	1 Mutual's Spills (ac-ft)	2 Mutual's SWRCB 95-4 Releases (ac-ft)	3 Basin Addition @ 51.0% (ac-ft)	4 Mutual's Lake Demands (ac-ft)	5 SWRCB 95-4 Releases for Mutual (ac-ft)	6 Basin Addition @ 50.0% (ac-ft)	
January	-	17.3	8.8	-	0.0	-	8.8
February	-	7.0	3.6	-	0.0	-	3.6
March	-	6.8	3.5	-	0.0	-	3.5
April	-	10.0	5.1	26.7	1.3	14.0	19.1
May	-	11.4	5.8	35.8	20.9	28.4	34.2
June	-	4.7	2.4	262.1	38.9	150.5	152.9
July	-	-	-	1,060.2	69.4	564.8	564.8
August	-	-	-	886.2	73.4	479.8	479.8
September	-	-	-	791.5	75.2	433.3	433.3
October	-	-	-	615.5	76.8	346.2	346.2
November	-	-	-	144.3	78.1	111.2	111.2
December	-	2.8	1.4	324.5	72.3	198.4	199.9
TOTALS	0.0	59.9	30.6	4,146.8	506.3	2,326.5	2,357.1

CALENDAR YEAR  
2017  
BIG BEAR WATERMASTER

TABLE 4.C  
BASIN REPLENISHMENTS

1 Month	2 Amount Replenished From SBVMWD (ac-ft)	3	4	5 Amount Replenished From Releases (ac-ft)	6 Amount Replenished From Others (ac-ft)	7	8 Total Amount Replenished (ac-ft)	9
January	-			-	-		-	
February	-			-	-		-	
March	-			-	-		-	
April	-			-	-		-	
May	-			-	-		-	
June	-			-	-		-	
July	-			-	-		-	
August	-			-	-		-	
September	-			-	-		-	
October	-			-	-		-	
November	-			-	-		-	
December	-			-	-		-	
	0.0			0.0	0.0		0.0	

## **APPENDIX C**

# **APPOINTMENT OF SAMUEL H. FULLER AS WATERMASTER REPRESENTATIVE FOR BEAR VALLEY MUTUAL WATER COMPANY**

REID & HELLYER, APC  
3880 LEMON STREET, FIFTH FLOOR  
RIVERSIDE, CALIFORNIA 92502-1300  
TELEPHONE (951) 682-1771

1 **REID & HELLYER**  
2 A Professional Corporation  
3 DAVID G. MOORE, State Bar No. 36078  
4 3880 Lemon Street, Fifth Floor  
5 Post Office Box 1300  
6 Riverside, California 92502-1300  
7 Telephone: (951) 682-1771  
8 Facsimile: (951) 686-2415

9 Attorneys for Defendant Bear Valley Mutual Water Company

FILED  
SUPERIOR COURT OF CALIFORNIA  
COUNTY OF SAN BERNARDINO  
SAN BERNARDINO DISTRICT

AUG 25 2017

BY C. A. H. NUNEZ  
CUAQUATEMOC NUNEZ, DEPUTY

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SUPERIOR COURT OF THE STATE OF CALIFORNIA  
FOR THE COUNTY OF SAN BERNARDINO

11 BIG BEAR VALLEY MUNICIPAL WATER )  
12 DISTRICT,, )

13 Plaintiff,

14 v.

15 NORTH FORK WATER COMPANY, et al., )

16 Defendants. )

CASE NO. SCV SS 165493

The Hon. Frank Gaskawski, Jr.  
Dept. S-37

**PROPOSED ORDER ON RESIGNATION  
OF REPRESENTATIVE AND  
APPOINTMENT OF REPLACEMENT**

17 TO ALL INTERESTED PARTIES OF RECORD:

18 PLEASE TAKE NOTICE that on April 21, 2017 Bear Valley Mutual Water Company filed  
19 a notice of resignation of representative and appointment of replacement appointing Samuel H.  
20 Fuller as the duly appointed by the Executive Board of Bear Valley Mutual Water Company as  
21 Watermaster.

22 After reviewing the notice, a copy of which is attached hereto, the court grants the  
23 appointment of Mr. Fuller as Watermaster in place of Michael Huffstatler.

24 DATED: AUG 25 2017

25 DAVID COHN

26 Judge of Superior Court



## **EXHIBIT A**

RIVERSIDE, CALIFORNIA 92502-1300  
TELEPHONE (951) 682-1771

1 **REID & HELLYER**  
A Professional Corporation  
2 **DAVID G. MOORE**, State Bar No. 36078  
3880 Lemon Street, Fifth Floor  
3 Post Office Box 1300  
Riverside, California 92502-1300  
4 Telephone: (951) 682-1771  
Facsimile: (951) 686-2415

**FILED**  
SUPERIOR COURT  
COUNTY OF SAN BERNARDINO  
SAN BERNARDINO DISTRICT

APR 21 2017

BY Sandra Ortega  
SANDRA ORTEGA DEPUTY

Attorneys for Defendant Bear Valley Mutual Water Company

8 SUPERIOR COURT OF THE STATE OF CALIFORNIA  
9 FOR THE COUNTY OF SAN BERNARDINO

11 **BIG BEAR VALLEY MUNICIPAL WATER**  
DISTRICT, ,

12 Plaintiff,

13 v.

14 **NORTH FORK WATER COMPANY, et al.,**

15 Defendants.

CASE NO. SCV SS 165493

The Hon. Frank Gaskawski, Jr.  
Dept. S-37

NOTICE OF RESIGNATION OF  
REPRESENTATIVE AND APPOINTMENT  
OF REPLACEMENT

17 TO ALL INTERESTED PARTIES OF RECORD:

18 YOU AND EACH OF YOU WILL PLEASE TAKE NOTICE that Michael Huffstatler has  
19 resigned as the Watermaster Representative for Bear Valley Mutual Water Company and Samuel H.  
20 Fuller has been duly appointed by the Executive Board of Bear Valley Mutual Water Company as  
21 Watermaster. A true and correct copy of the resume of Samuel H. Fuller is attached as Exhibit "A".  
22 If anyone objects to the appointment, any such objections must be served in writing upon counsel  
23 for Bear Valley Mutual Water Company within 15 days from the date of service of this notice.

24 DATED: April 20, 2017

REID & HELLYER  
A PROFESSIONAL CORPORATION

26 By: David G. Moore

27 **DAVID G. MOORE**  
Attorneys for Defendant Bear Valley  
28 Mutual Water Company

-1-

NOTICE OF RESIGNATION OF REPRESENTATIVE AND APPOINTMENT OF REPLACEMENT

**EXHIBIT 'A'**

**SAMUEL H. FULLER**  
**1605 Marjorie Crest**  
**Redlands, CA 92373-6419**  
**Telephone (909) 798-3074**  
**Cellular Telephone (909) 266-4002**  
**Email: samfuller12@aol.com**

**Certifications:** Registered Civil Engineer, California 24698

**Education:** California State University, San Bernardino, California  
Master of Public Administration, Water Resources Specialty, June 2006

University of California, Davis, California  
Bachelor of Science, Civil Engineering, June 1972

**Experience:**

November 1985 to December 2013: San Bernardino Valley Municipal Water District  
380 East Vanderbilt Way  
San Bernardino, California 92408

I started my employment with San Bernardino Valley Municipal Water District as the Water Resources Manager. I was responsible for acquisition of data, analyses and preparation of reports regarding hydrologic conditions, events, and operations within and associated with the District. I made public presentations of various aspects of the water resources conditions related to the District. I prepared draft documents for presentation by the court appointed Watermaster Committees to the courts regarding compliance with the terms and conditions of the settlements for Western Municipal water District et al. vs. East San Bernardino County Water District et al. Riverside County Superior Court Case Number 78426 April 17, 1969 as well as Orange County Water District vs. City of Chino et al. Orange County Superior Court Case Number 117628 April 17, 1969. I also represented the District at meetings of various organizations. I was promoted to Operations Manager in 1992. This promotion resulted in additional responsibilities including operations and maintenance of the equipment and facilities of the District which include buildings, wells, water conveyance and distribution facilities including 17 miles of 78 inch diameter pipeline and another 13 miles of smaller diameter pipeline in addition to supervisory, control and data acquisition equipment. I was promoted to Assistant Chief Engineer for the District in June 2001. I was promoted to Chief Engineer in January 2007. I reported directly to the General Manager. I continued to perform the responsibilities described above as well being involved in the finances and management of the District. I was also appointed by the courts to represent the District and serve on the Watermaster Committees for the settlements named above.

**September 1981 to November 1985**

**State Water Resources Control Board  
Division of Water Rights  
Sacramento, California**

**I was employed as an Associate Water Resources Engineer in the complaint section of the Division of Water Rights. My responsibilities included investigations necessary to present the physical conditions of applications to appropriate unappropriated water, resolution of complaints initiated by individuals and organizations alleging unauthorized use and diversions, waste and unreasonable use of the waters of the State of California. I prepared reports, recommendations, correspondence and maintained records. I was offered and accepted the opportunity to transfer to the hearing section. I investigated and prepared correspondence, reports and recommendations as staff engineer in numerous hearings before the State Water Resources Control Board. I was the hearing engineer for the controversial hearing before the State Water Resources Control Board which resulted in the authorization of storage of water in the New Melones reservoir on the Stanislaus River.**

**June 1971 to September 1981**

**James C. Hanson  
Consulting Civil Engineer  
Sacramento, California**

**I started working for James C. Hanson the year before I graduated from University of California, Davis. I started as an engineering assistant and performed many duties ranging from surveyor's aid and chainman to soil compaction technician. I performed water resources data acquisition and analysis and prepared summary reports of the analyses for various water resources projects. I acquired data performed analyses and prepared draft reports pursuant to the stipulated judgments for Western Municipal Water District et al. vs. East San Bernardino County Water District et al. Riverside County Superior Court Case Number 78426 April 17, 1969 and Orange County Water District vs. City of Chino et al. Orange County Superior Court Case Number 117628 April 17, 1969. I conducted site investigations, designed, estimated costs, obtained regulatory permits and supervised construction of various water resource works including; earthfill dams, canals, pipelines, water control structures and repairs and modifications of existing facilities. I also completed environmental documents of project and obtained appropriate permit for numerous water resource projects. I obtained my registration as a professional Civil Engineer in California while I was employed with James C. Hanson.**

REID & HELLYER APC  
3880 LEMON STREET, FIFTH FLOOR  
RIVERSIDE, CALIFORNIA 92502-1300  
TELEPHONE (951) 683-1771

1 **PROOF OF SERVICE**

2 **STATE OF CALIFORNIA, COUNTY OF RIVERSIDE**

3 I am employed in the County of Riverside, State of California. I am over the age of 18 and not  
4 a party to the within action; my business address is 3880 Lemon Street, Fifth Floor, Post Office Box  
1300, Riverside, California 92502-1300.

5 On April 20, 2017, I served the foregoing document described as **NOTICE OF**  
6 **RESIGNATION OF REPRESENTATIVE AND APPOINTMENT OF REPLACEMENT** on the  
interested parties in this action by placing true copies thereof enclosed in sealed envelopes addressed  
as stated on the attached mailing list.

7 ☒ **BY MAIL**

8 ☐ I deposited such envelope in the mail at Riverside, California. The envelope was mailed  
9 with postage thereon fully prepaid.

10 ☒ I am "readily familiar" with the firm's practice of collection and processing  
11 correspondence for mailing. It is deposited with U.S. postal service on that same day  
12 with postage thereon fully prepaid at Riverside, California in the ordinary course of  
business. I am aware that on motion of the party served, service is presumed invalid if  
postal cancellation date or postage meter date is more than one day after date of deposit  
for mailing in affidavit.

13 Executed on April 20, 2017, at Riverside, California.

14 ☒ (State) I declare under penalty of perjury under the laws of the State of California that the above  
15 is true and correct.

16 ☐ (Federal) I declare that I am employed in the office of a member of the bar of this court at whose  
17 direction the service was made.

18 Brenda M. Schenkkan  
19 Type or print name

  
Signature

REID & HELLYER APC  
3880 LEMON STREET, FIFTH FLOOR  
RIVERSIDE, CALIFORNIA 92502-1300  
TELEPHONE (951) 682-1771

SERVICE LIST

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4 T: 714-641-5100; F: 714-546-9035  
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5 Conservation District
- 6 Brendan W. Brandt, Esq.  
Varner & Brandt, LLP  
7 3750 University Avenue, Ste. 610  
Riverside, CA 92501  
8 Attorneys for Defendant San Bernardino  
Valley Municipal Water District
- 9 James Dilworth, Esq.  
10 1520 Country Club Drive  
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11 Attorney for North Fork Water Company
- 12 Steven M. Kennedy, Esq.  
Brunick, Alvarez & Battersby  
13 1839 Commercenter West  
P.O. Box 6425  
14 San Bernardino, CA 92412-6425  
Attorneys for Big Bear Municipal Water District
- 15 Wayne K. Lemieux, Esq.  
16 Lemieux & O'Neill  
2393 Townsgate Road, Ste. 201  
17 Westlake Village, CA 91361
- 18 Big Bear Municipal Water District  
Attn: Scott Heule, General Manager  
19 P.O. Box 2863  
Big Bear Lake, CA 92315
- 20 Bear Valley Mutual Water Company  
21 Attn: Michael Huffstutler  
101 East Olive Avenue  
22 Redlands, CA 92373
- 23 San Bernardino Valley Municipal Water District  
Attn: Randy Van Gelder  
24 P.O. Box 5906  
San Bernardino, CA 92412-5906
- 25 Lugonia Water Company  
26 101 E. Olive Avenue  
Redlands, CA 92333
- 27
- 28



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- 1 Daniel Cozak  
San Bernardino Valley Water Conservation District
- 2 Montgomery Watson  
2121 N. California Blvd., Ste. 600
- 3 Walnut Creek, CA 94596
- 4 Donald E. Evenson  
Watermaster Member
- 5 Montgomery Watson  
2121 N. California Blvd., Ste. 600
- 6 Walnut Creek, CA 94596
- 7 City of Redlands  
Attn: Dan McHugh, City Attorney
- 8 P.O. Box 3005  
Redlands, CA 92373
- 9 North Fork Water Company  
P.O. Box 3427
- 10 San Bernardino, CA 92413
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NEW & FELLIER, APC  
3880 LEMON STREET, FIFTH FLOOR  
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TELEPHONE (951) 882-1771

**PROOF OF SERVICE**

STATE OF CALIFORNIA, COUNTY OF RIVERSIDE

I am employed in the County of Riverside, State of California. I am over the age of 18 and not a party to the within action; my business address is 3880 Lemon Street, Fifth Floor, Post Office Box 1300, Riverside, California 92502-1300.

On July 27, 2017, I served the foregoing document described as **PROPOSED] ORDER ON RESIGNATION OF REPRESENTATIVE AND APPOINTMENT OF REPLACEMENT** on the interested parties in this action by placing true copies thereof enclosed in sealed envelopes addressed as stated on the attached mailing list.

☒ BY MAIL

☐ I deposited such envelope in the mail at Riverside, California. The envelope was mailed with postage thereon fully prepaid.

☒ I am "readily familiar" with the firm's practice of collection and processing correspondence for mailing. It is deposited with U.S. postal service on that same day with postage thereon fully prepaid at Riverside, California in the ordinary course of business. I am aware that on motion of the party served, service is presumed invalid if postal cancellation date or postage meter date is more than one day after date of deposit for mailing in affidavit.

Executed on July 27, 2017, at Riverside, California.

☒ (State) I declare under penalty of perjury under the laws of the State of California that the above is true and correct.

☐ (Federal) I declare that I am employed in the office of a member of the bar of this court at whose direction the service was made.

Brenda M. Schenkkan  
Type or print name

Brenda M. Schenkkan  
Signature

KEIJ & KELLY, APC  
3800 LEMON STREET, FIFTH FLOOR  
RIVERSIDE, CALIFORNIA 92502-1300  
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11 Attorney for North Fork Water Company
- 12 Steven M. Kennedy, Esq.  
Brunick, Alvarez & Battersby  
13 1839 Commercenter West  
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-4-

PROPOSED ORDER ON RESIGNATION OF REPRESENTATIVE AND APPOINTMENT OF  
REPLACEMENT