Big Bear Watermaster

Fortieth Annual Report

For Calendar Year 2016

Spring runoff Kidd Creek

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

Bear Valley Mutual Water Company

Big Bear Municipal Water District — Est. 1964

SBV Water Conservation District — Our Name is Our Mission

Watermaster Members:
Donald E. Evenson
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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:
DONALD E. EVENSON
DANIEL B. COZAD
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March 31, 2017

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

Subject: Watermaster Report for Calendar Year 2016

Gentlemen:

We have the honor of submitting the Fortieth Annual Report of the Big Bear Watermaster for Calendar Year 2016.

Paragraph Twenty (20) of the Judgment 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 preceding calendar year as set forth in Section VI, Physical Solution, of the Judgment.

We and each of us hereby certify that this is a true and correct report of the Watermaster work performed by us and under our supervision during 2016 pursuant to the requirements of the Judgment.

Respectfully submitted,

By: _____
Donald E. Evenson

By: _____
Daniel B. Cozad

By: _____
Michael L. Huffstutler

FORTIETH ANNUAL REPORT
BIG BEAR WATERMASTER
CALENDAR YEAR 2016

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I. INTRODUCTION

The Big Bear Watermaster presents the Fortieth Annual Report of its activities for calendar year 2016. 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 2016 activities of the Watermaster including the status of accounts and various tabulations as required by the Judgment.

In 2016, 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.

The Watermaster Committee met four times during 2016. These meetings were held on the following dates:

January 19, 2016
March 10, 2016
July 12, 2016
October 11, 2016

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

II. SUMMARY

2016 WATERMASTER ACCOUNTS

2016 was an average precipitation year. Annual precipitation at the two gages in the Big Bear Lake watershed averaged 23.68 inches, which is 96 percent of the 24.58 inches of average annual rainfall since 1977. Precipitation at Bear Valley Dam was 31.93 inches, which is 91 percent of the 107-year (1910-2016) average of 35.11 inches.

Inflow to Big Bear Lake in 2016 was below average. The 2016 calculated lake inflow was 7,027 acre-feet, which is 46 percent of the average inflow since 1977. The average inflow for the 40 years since the Judgment was rendered is 15,310 acre-feet per year.

Actual lake levels dropped 1.77 feet in 2016 and ended the year 16.35 feet below the top of the dam. Accordingly, lake contents decreased by 3,631 acre-feet during the year. On December 31, 2016, the lake contained 31,847 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 8,977 acre-feet at the end of 2016. Their lake account decreased by 7,460 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 41.55 feet or 30.78 feet below the top of the dam and 14.43 feet lower than the actual year-end lake level of 55.98 feet. If Mutual had not been credited with the net wastewater exports, their lake account balance would have been 3,021 acre-feet and the lake level would have been 33.65 feet or 38.68 feet below the top of dam, and 22.33 feet lower than it actually was.

In 2016, Mutual received 9,266 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 2016, Mutual received 8,500 acre-feet of in-lieu State Water Project (SWP) water. Also, Mutual was able to use 766 acre-feet of water from Big Bear Lake that was required for fish protection purposes as required under SWRCB Order No. 95-4.

At the beginning of the year, Big Bear MWD had 19,041 acre-feet in their lake account. By the end of the year, their lake account had increased by 3,829 acre-feet to 22,870 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 2016 the Basin Make-up Account balance increased by 39 acre-feet. The Basin Make-up Account began the year with a balance of 27,081 acre-feet and ended the year with a balance of 27,120 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.

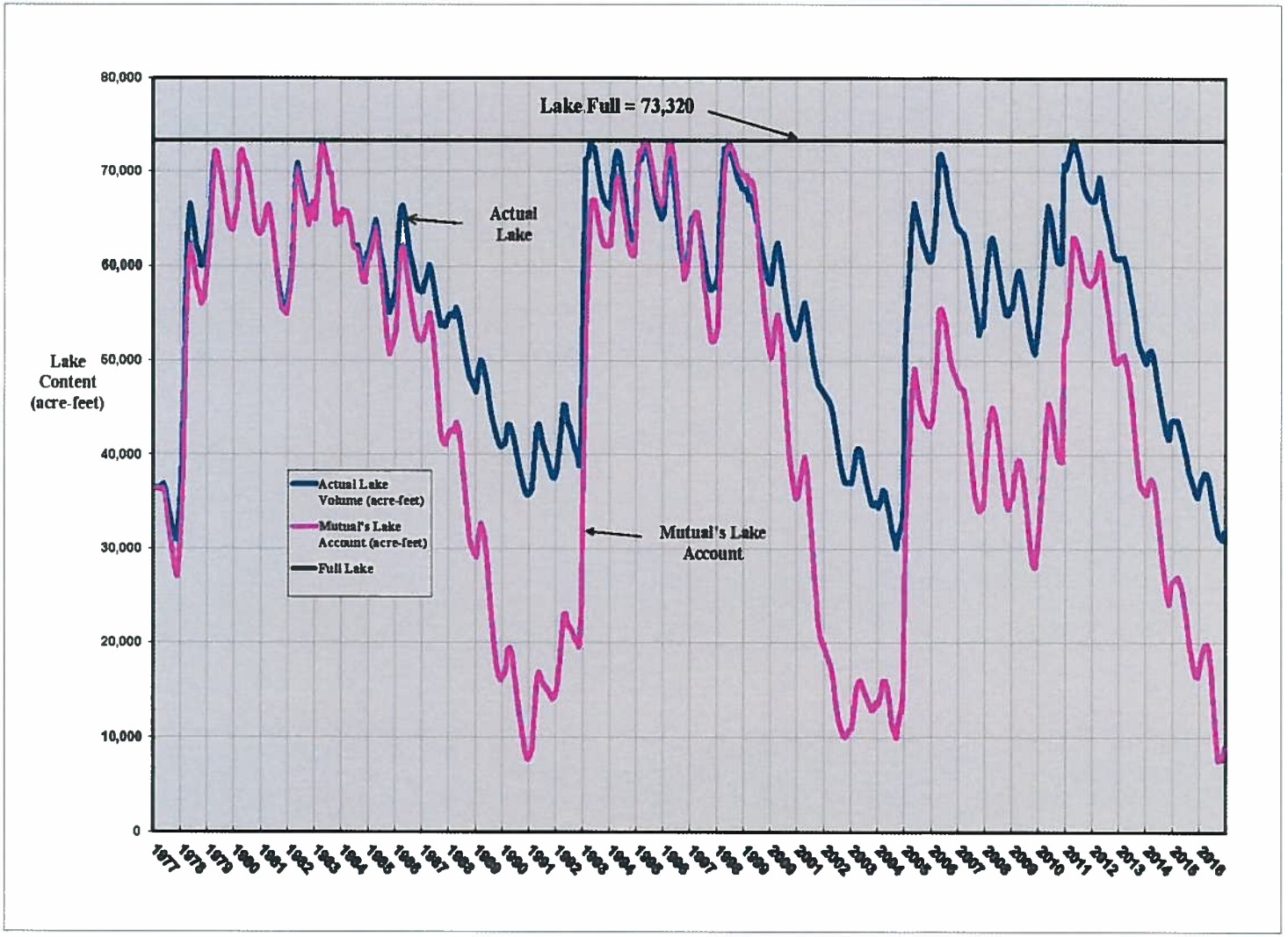
OTHER WATERMASTER ACTIVITIES

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 2016, 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.

FIGURE 1
ACTUAL LAKE CONTENTS AND MUTUAL'S LAKE ACCOUNT 1977 - 2016
Calendar Year 2016 - Big Bear Watermaster



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 2016, the overall water balance for the lake was:

Initial Storage (1-01-16)	35,478 acre-feet
Inflows	7,027 acre-feet
Evaporation	9,309 acre-feet
Releases for Mutual	-0- acre-feet
Releases for Valley District	-0- acre-feet
Releases & Leakage for SWRCB Order 95-4	904 acre-feet
Spills & Flood Control Releases	-0- acre-feet
Net Snowmaking Withdrawal	445 acre-feet
Ending Storage (12-31-16)	31,847 acre-feet
Change-in-Storage	-3,631 acre-feet

In 2016, the volume of water in Big Bear Lake decreased by 3,631 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 2016, the lake was within the top 15 feet until the end of July. For the balance of 2016, 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 57.75 feet and ended the year at a gage height of 55.98 feet. Over the year, the lake level dropped 1.77 feet. The lowest recorded lake level was 55.38 feet or 16.95 feet below the top of the dam, and it occurred on December 12, 2016. The highest recorded lake level was 59.01 feet, which occurred on April 12, 2016. 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 35,478 acre-feet of water. At the end of the year, there were 31,847 acre-feet of water in the lake. The lake content decreased by 3,631 acre-feet during 2016. 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 three times in 2016. They occurred in June, July and August. Total evaporation from the lake for 2016 was calculated to be 9,309 acre-feet. This amount is equivalent to an annual evaporation rate of 53.0 inches.

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 2016. 2016 precipitation at the two stations was 31.93 and 15.42 inches, respectively. August was the driest month with only 0.01 inches of precipitation. January and December were the wettest months with approximately 63 percent of the annual precipitation.

Table III-1 also compares the 2016 precipitation at the two stations with their corresponding averages for the forty years since the Judgment was rendered. At the Bear Valley Dam station, precipitation was 92 percent of its forty year average, and at the Big Bear Community Services District station, precipitation was 107 percent of its forty year average. For both stations, 2016 precipitation averaged 96 percent of their forty year combined average.

Table III-2 shows the annual precipitation for both stations for the forty years since the Judgment was rendered. As shown in **Table III-2**, 2016 was a little below average year for precipitation. For the Bear Valley Dam station, precipitation was 91 percent of the 107-year (1910–2016) average of 35.11 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 2016 - Big Bear Watermaster

Month	Bear Valley Dam*	Big Bear Community Services District**	Average	Percent of Annual Total
January	11.18	4.56	7.87	33.24%
February	1.12	1.12	1.12	4.73%
March	3.33	1.63	2.48	10.48%
April	2.18	0.94	1.56	6.59%
May	0.16	0.34	0.25	1.06%
June	0.11	0.01	0.06	0.25%
July	0.00	0.41	0.21	0.87%
August	0.00	0.01	0.01	0.02%
September	0.04	0.11	0.08	0.32%
October	2.12	0.93	1.53	6.44%
November	2.13	0.99	1.56	6.59%
December	9.56	4.37	6.97	29.42%
2016 Totals	31.93	15.42	23.68	100.00%
1977-2016 40-year Average	34.73	14.43	24.58	
2016 % of 40-year Average	91.9%	106.9%	96.3%	

Average of the 40-year Average for both stations	24.58
Average of the 2016 precipitation for both stations	23.68
2016 average as a percent of the 40-year average	96.3%

Source:
* **Big Bear MWD**
** **Big Bear Community Services District**

Table III-2

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

Calendar Year 2016 - Big Bear Watermaster

Year	Bear Valley Dam*	Big Bear Community Services District**
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	15.42
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
40-Year Average	34.73	14.43
	91.9%	106.9%
107-Year Average	35.11	N/A
	90.9%	

Source:
* **Big Bear MWD**
** **Big Bear City Community Services District**

Inflow = Evaporation + Releases + Spills + Leakage +
Net Withdrawals - 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 three times in 2016. They occurred in June, July and September.

Total annual inflow for 2016 into the lake was calculated to be 7,027 acre-feet. The largest monthly inflow was 1,491 acre-feet, and it occurred in January. The average annual lake inflow for the 40 years since the Judgment was rendered (1977–2016) is 15,310 acre-feet. The median annual inflow for this same period is 9,355 acre-feet.

Table III-3 lists the annual lake inflows for the period 1977–2016. 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 2016 was well below average for the forty years since the judgment was rendered in 1977. Twelve other years had lower lake inflows, and twenty-seven 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 1977-2016
(acre-feet / year)
Calendar Year 2016 - 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	4.9%	2007	2,841
1979	25,318			3	7.3%	2013	3,129
1980	42,336			4	9.8%	2015	3,677
1981	6,529			5	12.2%	1999	3,774
1982	25,310			6	14.6%	1988	4,551
1983	35,072			7	17.1%	1990	4,856
1984	10,569			8	19.5%	1989	4,967
1985	9,497			9	22.0%	2014	5,776
1986	13,812			10	24.4%	1981	6,529
1987	8,005			11	26.8%	2001	6,915
1988	4,551			12	29.3%	2000	6,930
1989	4,967			13	31.7%	2016	7,027
1990	4,856			14	34.1%	1977	7,103
1991	11,658			15	36.6%	1987	8,005
1992	15,543			16	39.0%	2012	8,175
1993	48,613	Max.		17	41.5%	2003	8,295
1994	11,015			18	43.9%	2004	8,404
1995	33,340			19	46.3%	1997	8,757
1996	13,119		Median	20	48.8%	2009	9,212
1997	8,757		Median	21	51.2%	1985	9,497
1998	34,600			22	53.7%	1984	10,569
1999	3,774			23	56.1%	1994	11,015
2000	6,930			24	58.5%	1991	11,658
2001	6,915			25	61.0%	1996	13,119
2002	1,717	Min.		26	63.4%	1986	13,812
2003	8,295			27	65.9%	2008	14,182
2004	8,404			28	68.3%	1992	15,543
2005	39,600			29	70.7%	2011	16,908
2006	17,564			30	73.2%	2006	17,564
2007	2,841			31	75.6%	1982	25,310
2008	14,182			32	78.0%	1979	25,318
2009	9,212			33	80.5%	2010	32,959
2010	32,959			34	82.9%	1995	33,340
2011	16,908			35	85.4%	1998	34,600
2012	8,175			36	87.8%	1983	35,072
2013	3,129			37	90.2%	2005	39,600
2014	5,776			38	92.7%	1978	40,743
2015	3,677			39	95.1%	1980	42,336
2016	7,027		Max	40	97.6%	1993	48,613

1977 - 2016	
Maximum	42,336
Average	15,310
Median	9,355
Minimum	1,717

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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 and 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 valves. 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 have shown improved accuracy.

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 will be discussing options for Station A with the State Water Resources Control Board.

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 2016 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 2016 were as follows:

Month 2016	Hydrologic Condition WY To-Date	Minimum Daily Average Flow (cfs)
January	Below Normal	0.85
February	Above Normal	0.50
March	Below Normal	0.85
April	Below Normal	0.50
May	Below Normal	0.70
June	Below Normal	1.00
July	Below Normal	1.30
August	Below Normal	1.50
September	Below Normal	1.20
October	Start Water Year	1.20
November	Wet Year	0.90
December	Above Normal	0.85

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. These flows from the lake were in compliance with the flow requirements throughout WY 2015-16.

On 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.

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

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 2016
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	1.81	0.03	1.10	0.03 and 0.56	1.00	0.57 and 1.93	0.95	1.93	0.90
December 1	3.88	1.59	0.90	1.59 and 3.04	0.85	3.05 and 5.60	0.85	5.60	0.85
2016									
January 1	6.53	3.73	0.90	3.73 and 8.14	0.85	8.15 and 12.84	0.85	12.84	0.85
February 1	17.71	8.94	1.00	8.94 and 13.84	0.85	13.85 and 20.79	0.50	20.79	0.30
March 1	18.83	14.42	0.95	14.42 and 20.05	0.85	20.06 and 31.47	0.40	31.47	0.30
April 1	22.16	19.29	0.75	19.29 and 25.84	0.50	25.85 and 40.30	0.40	40.30	0.30
May 1	24.34	21.61	0.95	21.61 and 28.65	0.70	28.66 and 41.16	0.55	41.16	0.30
June 1	24.50	22.18	1.15	22.18 and 30.01	1.00	30.02 and 41.86	0.75	41.86	0.30
July 1	24.61	22.42	1.50	22.42 and 30.01	1.30	30.02 and 41.86	0.95	41.86	0.55
August 1	24.61	22.93	1.50	22.93 and 30.69	1.50	30.70 and 42.48	1.25	42.48	0.55
September 1	24.61	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	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	4.24	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 2016

Note 2 Minimum flow values in blue are revised values used effective July 1, 2014

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.

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 2016 the estimated Outlet Works Flows and Dam Leakage was 904.3 acre-feet and Mutual was determined to have "fully utilized" the Santa Ana River Diversions, received in-lieu deliveries, or purchased SWP water on 303 days, which resulted in the following allocation:

1. 137.8 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 63 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. 766.5 acre-feet was deducted from Mutual's lake account on the 303 days they "fully utilized" the Santa Ana River Diversions, received in-lieu water deliveries or purchased SWP water.

*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.

The Committee will continue to review these accounting methods in 2017 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)."

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 2017 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 2016, the lake level was below the spillway crest (Elevation 6,731.00 feet which is 12.20 feet below a full lake) for the entire year so no spillway gate leakage occurred in Bays 1 and 10. 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 estimated monthly leakages are shown in **Table III-4**. The estimated leakage through the spillway gates in Bays 1 and 10 for 2016 was zero acre-feet.

TABLE III-4
ESTIMATES OF
MONTHLY DAM LEAKAGE
(acre-feet)
Calendar Year 2016
Big Bear Watermaster

Month	Bay 1 and Bay 10 Leakage Estimates (AF)	Additional Foundation Leakage (AF)	Total Estimated Leakage (AF)
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	-0-	-0-	-0-
Annual Total	**-0-**	**-0-**	**-0-**

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.

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 total estimated dam leakage in 2016 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 ± 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 2016, the leakage through the sluice gates was estimated to be 41.4 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 1.1 acre-feet in 2016, 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 meter. Releases to comply with SWCRB Order No. 95-4 are normally made through the 6-inch Bypass Pipeline. In 2016, no releases were made for San Bernardino Valley MWD from water they had stored in Big Bear Lake. The total amount released through the 6-inch Bypass Pipeline in 2016 was 861.8 acre-feet.

In 2016, 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 2016. The total from the Outlet Works in 2016 was estimated to be 904.3 acre-feet.

Mutual Releases

There were no lake releases for Mutual in 2016.

San Bernardino Valley MWD Releases

In 2016 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 2016.

TABLE III-5

MONTHLY DISCHARGES FROM THE OUTLET WORKS OF BEAR VALLEY DAM

(acre-feet)
Calendar Year 2016
Big Bear Watermaster

Month	Flood Control Releases (AF)	Mutual Releases (AF)	SBVMWD Releases (AF)	SWRCB Discharges (AF)	Total Outlet Works Discharges (AF)
January	-0-	-0-	-0-	81.4*	81.4
February	-0-	-0-	-0-	49.2*	49.2
March	-0-	-0-	-0-	56.0*	56.1
April	-0-	-0-	-0-	46.9*	46.9
May	-0-	-0-	-0-	56.0*	56.0
June	-0-	-0-	-0-	69.4*	69.4
July	-0-	-0-	-0-	94.1*	94.1
August	-0-	-0-	-0-	104.0*	104.0
September	-0-	-0-	-0-	99.9*	99.9
October	-0-	-0-	-0-	89.0*	89.0
November	-0-	-0-	-0-	80.9*	80.9
December	-0-	-0-	-0-	77.5*	77.5
Total	**-0-**	**-0-**	**-0-**	**904.3***	**904.3**

* 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 2016, 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 2016, the measured and estimated flow at Station B was 30.4 acre-feet more than the estimated amount leaving Big Bear Lake from releases, leakage and spills. In 2016 these differences also reflect problems with the measurements at Station B. In late 2015 there were a couple of events that damaged the stilling basin and communication lines at Station B. Following these events, Big Bear MWD estimated the flows at Station B, made some repairs, and collected data to improve the calibration of the Station B weir. 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 2017.

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 2016, 772 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).

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 2016, the withdrawal from the lake for snowmaking was 653.4 acre-feet and 326.7 acre-feet returned to the lake. In the summer and fall months, 118.5 acre-feet of water was used and none was returned to the lake. The "net withdrawal" for all purposes was 445.2 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

TABLE III-6
COMPARISON OF FLOWS AT STATION B WITH
ESTIMATED LEAKAGE AND FLOWS FROM OUTLET WORKS
Calendar Year 2016 - 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	81.4	-	-	81.4	67.6	(13.7)
February	49.2	-	-	49.2	43.7	(5.4)
March	56.1	-	-	56.1	51.8	(4.2)
April	46.9	-	-	46.9	38.8	(8.1)
May	56.0	-	-	56.0	49.4	(6.6)
June	69.4	-	-	69.4	69.7	0.3
July	94.1	-	-	94.1	108.8	14.7
August	104.0	-	-	104.0	121.9	17.9
September	99.9	-	-	99.9	118.4	18.5
October	89.0	-	-	89.0	94.7	5.7
November	80.9	-	-	80.9	83.7	2.8
December	77.5	-	-	77.5	86.1	8.6
Total	904.3	-	-	904.3	934.8	30.4

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 2016, the "net" wastewater exported from the Big Bear Lake watershed was 848 acre-feet. **Table III-7** contains the 2016 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 2016, Mutual reported they would need at least 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 2016. Mutual met their overall 2016 water needs by in-lieu supplies from Big Bear MWD, diversions from the Santa Ana River, and local groundwater, and purchases of SWP water. 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 2016
Big Bear Watermaster

Month	Net Wastewater Exports (acre-feet)
January	97.6
February	124.7
March	94.3
April	61.5
May	59.4
June	57.7
July	67.9
August	55.9
September	40.6
October	44.7
November	50.4
December	93.5
Total	**848.2**

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 2016.

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 2016
Big Bear Watermaster

Flow Component		Amount (AF)
FLOW OF SANTA ANA RIVER AT MOUTH OF CANYON		
Flow Reported for U.S.G.S. Gage 11051501-provisional		12,730
less BVMWC Canyon Well No. 1 Production		-0-
Estimated Santa Ana River Flow Below Seven Oaks Dam		**12,730**
plus Annual Storage Change in Seven Oaks Reservoir		934
Estimated Santa Ana River Flow at Mouth of Canyon		**13,664**
DIVERSIONS BY BEAR VALLEY MUTUAL WATER COMPANY		
Diversions:	Greenspot Metering Station	-0-
	Edwards Line	367
	North Fork Canal	1,537
	Bear Valley Highline	3,022
	Redlands Aqueduct (includes Redlands Tunnel)	4,399
	SBVMWD Morton Canyon Connector Deliveries	-0-
	Redlands Sandbox Spreading (observed)	128
		9,453
Adjustments:	Water pumped from BVMWC Canyon Well No. 1	-0-
	Redlands Tunnel Diversion	-219
	Total MUTUAL Diversions	**9,234**
DIVERSIONS BY SBVWCD		
	Diversion by San Bernardino Valley Water Conservation District	3,473
	SBVMWD Morton Canyon Connector Deliveries to SBVWCD	-0-
	Total SBVWCD Diversions	**3,473**
TOTAL DIVERSIONS FROM THE SANTA ANA RIVER		
Total Diversions by Mutual and SBVWCD		**12,707**
AMOUNT NOT DIVERTED		
Santa Ana River Flow at Mouth of Canyon		**13,664**
Mutual and SBVWCD Diversions		**- 12,707**
Amount Released from Storage Behind Seven Oaks Dam		**- 934**
Estimated Not Diverted		**23**
Estimated Flow Downstream of Diversions*		**79**
Estimated Losses and Measurement Errors **		**56 or 0.4%**

* This value equals the amount observed at the Cuttle Weir (-0- AF) plus spills from PH #3 (79 AF)

** See written text for explanation

During 2016, the total river flow reported by the USGS, currently provisional, was 12,730 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 2016, there was no canyon well production. Thus, the resulting estimated River flow was 12,730 acre-feet in 2016. However, this value does not reflect the storage change in the reservoir behind Seven Oaks Dam. In 2016, an estimated 934 acre-feet of river flow was stored behind the dam. Thus, the estimated flow of the Santa Ana River at the mouth of the canyon above Seven Oaks Dam was 13,664 acre-feet in 2016.

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 2016, Mutual's diversions were estimated to be 9,453 acre-feet based on the Daily Flow Reports prepared by the San Bernardino Valley Water Conservation District (SBVWCD). The vast majority, 9,234 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 219 acre-feet of water from the Redlands Tunnel. Mutual's diversions were used for agricultural and domestic purposes. In 2016, domestic deliveries were made to the City of Redlands for their Horace P. Hinckley Water Treatment Plant and to East Valley Water District's water treatment plant.

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 2016, the diversions were estimated to be 3,473 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.

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 Sand Box 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 gages 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 2015 was 545 acre-feet (water surface elevation of 2,156.5 feet). The amount stored behind SOD at the end of 2016 was 1,479 acre-feet (water surface elevation of 2,176.4 feet). In other words, additional water has been stored behind the dam from inflow in the current year (2016). This amount was 934 acre-feet and was not included in the USGS provisional value of 12,730 acre-feet. Adding the amount of SAR water stored behind SOD in 2016 to the USGS provisional value increases the estimate of Santa Ana River flow to 13,664 acre-feet for 2016.

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 2016, the spills from SCE PH No. 3 were 79 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 (23 acre-feet) as shown in Table III-8. The Watermaster Committee will review this item in 2016 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.

2016 Estimate of Amount Not Diverted

In 2016, 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 79 acre-feet. In other words, all except 79 acre-feet of the flow in the Santa Ana River was diverted in 2016.

In 2016, the estimated Santa Ana River flow at the mouth of the canyon was 13,664 acre-feet. The total diversion of Santa Ana River flow by Mutual and San Bernardino Valley Water Conservation District was 12,707 acre-feet. In total, an estimated 12,730 acre-feet of Santa Ana River water was available for diversions, which excludes 934 acre-feet of flow that was stored in 2016 behind Seven Oaks Dam. The difference between estimated inflow and total diversions is 23 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 (79 acre-feet), results in leakage losses and measurement errors of 56 acre-feet. These losses and errors represent only 0.4 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 Municipal Water District 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 BBMWD 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 2016, the lake level was more than 6 feet below full for the entire year. The lake ended the year 16.35 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 2015, Valley District had stored 1,237 acre-feet of water in Big Bear Lake. In 2016, Valley District did not request any In Lieu Lake Releases. The additional evaporation losses in 2016 were 149 acre-feet. Valley District ended the year with 1,088 acre-feet in their sub-account and the Lake was 0.58 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 9,266 acre-feet of water from Big Bear MWD in 2016. 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 2016. The amount of water delivered to Mutual consisted of 8,500 acre-feet of in-lieu SWP water, and 766 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 2016, the amount of water delivered to Mutual by Big Bear MWD was 58,623 acre-feet. For the 40-year period the Judgment has been in effect, the average annual deliveries by Big Bear MWD to Mutual has been 4,554 acre-feet.

TABLE III-9

ALLOCATION OF BIG BEAR MWD LAKE ACCOUNT

Calendar Year 2016

Big Bear Watermaster

LAKE ACCOUNTS (acre-feet)	Big Bear WM Account	Valley District Subaccount	Big Bear Subaccount
Initial Storage	19,041	1,237	17,804
Lake Inflows	-	-	-
In-Lieu Supplies to Mutual	8,500	-	8,500
Lake Releases (Mutual & BBMWD)	-	-	-
Releases & Leakage (SWRCB 95-4)	(76)	-	(76)
Net Snowmaking Withdrawals	(445)	-	(445)
Lake Spills & Flood Control Releases	-	-	-
Evaporation from Lake	(3,302)	(149)	(3,153)
Net Wastewater Exports	(848)	-	(848)
Advances and Repayment of Advances	-	-	-
Ending Storage	22,870	1,088	21,782

In 2017, Mutual can request up to 13,363 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 2016 (which is 6,377 acre-feet), plus the deliveries made in 2007 (which was 6,986 acre-feet), that will be dropped from the ten-year period ending in 2017. The 13,363 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 2016, Mutual's equivalent diversions were 17,953 acre-feet. Mutual's 2016 net Santa Ana River diversions were the twelfth smallest amount over the 40 years since the 1977 judgement was approved.

TABLE III-10
WATER DELIVERIES TO MUTUAL BY
BIG BEAR MUNICIPAL WATER DISTRICT
(Acre-feet)
Calendar Year 2016
Big Bear Watermaster

Month	Releases from Big Bear Lake for Mutual	Mutual's Use of Fish Releases*	"In-Lieu" State Water Project	"In-Lieu" Lake Releases	"In-Lieu" Groundwater	Total Deliveries to Mutual
January	-0-	19.1	-0-	-0-	-0-	19.1
February	-0-	21.9	-0-	-0-	-0-	21.9
March	-0-	28.9	3.8	-0-	-0-	28.9
April	-0-	44.1	8.3	-0-	-0-	44.1
May	-0-	56.0	236.6	-0-	-0-	292.6
June	-0-	69.4	1,438.0	-0-	-0-	1,507.4
July	-0-	94.1	2,444.8	-0-	-0-	2,538.9
August	-0-	104.0	2,457.5	-0-	-0-	2,561.5
September	-0-	99.9	1,911.1	-0-	-0-	2,011.0
October	-0-	83.4	-0-	-0-	-0-	83.4
November	-0-	75.7	-0-	-0-	-0-	75.7
December	-0-	70.0	-0-	-0-	-0-	70.0
Total	**-0-**	**766.5**	**8,500.0**	**-0-**	**-0-**	**9,266.5**

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

TABLE III-11
SUMMARY OF WATER DELIVERIES TO MUTUAL 1977 - 2016
(acre-feet)
Calendar Year 2016 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		4,412	-	-	-	5,280	n.a.
1978	-		-	-	-	-	-	n.a.
1979	-		-	-	-	-	-	n.a.
1980	-		-	-	-	-	-	n.a.
1981	2,250		-	672	-	-	2,922	n.a.
1982	657		-	56	-	-	713	n.a.
1983	-		-	-	-	-	-	n.a.
1984	1,700		-	993	-	-	2,693	n.a.
1985	2,466		842	2,994	-	-	6,302	n.a.
1986	1,358		1,139	190	-	-	2,687	20,597
1987	-		3,301	4,762	-	84	8,147	23,464
1988	-		1,864	5,432	-	63	7,359	30,823
1989	-		1,593	8,555	-	-	10,148	40,971
1990	-		561	7,722	-	-	8,283	49,254
1991	79		-	-	151	-	230	46,562
1992	-		-	-	-	-	-	45,849
1993	-		-	-	-	-	-	45,849
1994	1,141		-	-	-	-	1,141	44,297
1995	88		-	-	-	-	88	38,083
1996	3,461		-	4,027	-	-	7,488	42,884
1997	364		-	6,780	-	-	7,144	41,881
1998	-		-	-	-	-	-	34,522
1999	124	147	-	10,436	-	-	10,707	35,081
2000	-	510	-	12,878	-	-	13,388	40,186
2001	46	493	48	14,212	-	-	14,799	54,755
2002	-	614	-	5,000	-	-	5,614	60,369
2003	-	484	-	-	-	-	484	60,853
2004	-	512	-	2,500	-	-	3,012	62,724
2005	-	146	-	2,218	-	-	2,364	65,000
2006	-	467	-	2,070	-	-	2,538	60,050
2007	-	486	-	6,500	-	-	6,986	59,892
2008	-	475	-	4,634	-	-	5,108	65,000
2009	-	510	-	5,990	-	-	6,500	60,793
2010	123	276	-	2,479	-	-	2,878	50,283
2011	-	385	-	789	-	-	1,174	36,658
2012	-	641	-	4,696	-	-	5,337	36,380
2013	-	653	-	6,454	-	-	7,108	43,004
2014	-	893	4,692	1,716	-	-	7,301	47,293
2015	-	662	648	5,171	485	-	6,966	51,894
2016	-	766	-	8,500	-	-	9,266	58,623
1977-2016 Average	368	507	477	3,461	16	4	4,554	

TABLE III-12

EQUIVALENT WATER DIVERSIONS BY MUTUAL 1977-2015

(acre-feet)
Calendar Year 2015
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

* 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 re-calculated 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.

2016 ACCOUNT BALANCES

Appendix B contains the 2016 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 2016. **Table 1** of **Appendix B** provides additional detail. This information shows that:

1) the lake level dropped 1.77 feet, from a gage height of 57.75 feet to 55.98 feet; 72.33 feet is full;

2) lake storage decreased by 3,631 acre-feet, it began the year with 35,478 acre-feet and ended the year with 31,847 acre-feet; when the lake is full, it contains 73,320 acre-feet of water;

3) lake surface area varied between 2,230 and 1,976 acres;

4) evaporation was 9,309 acre-feet;

5) lake inflow was 7,027 acre-feet,

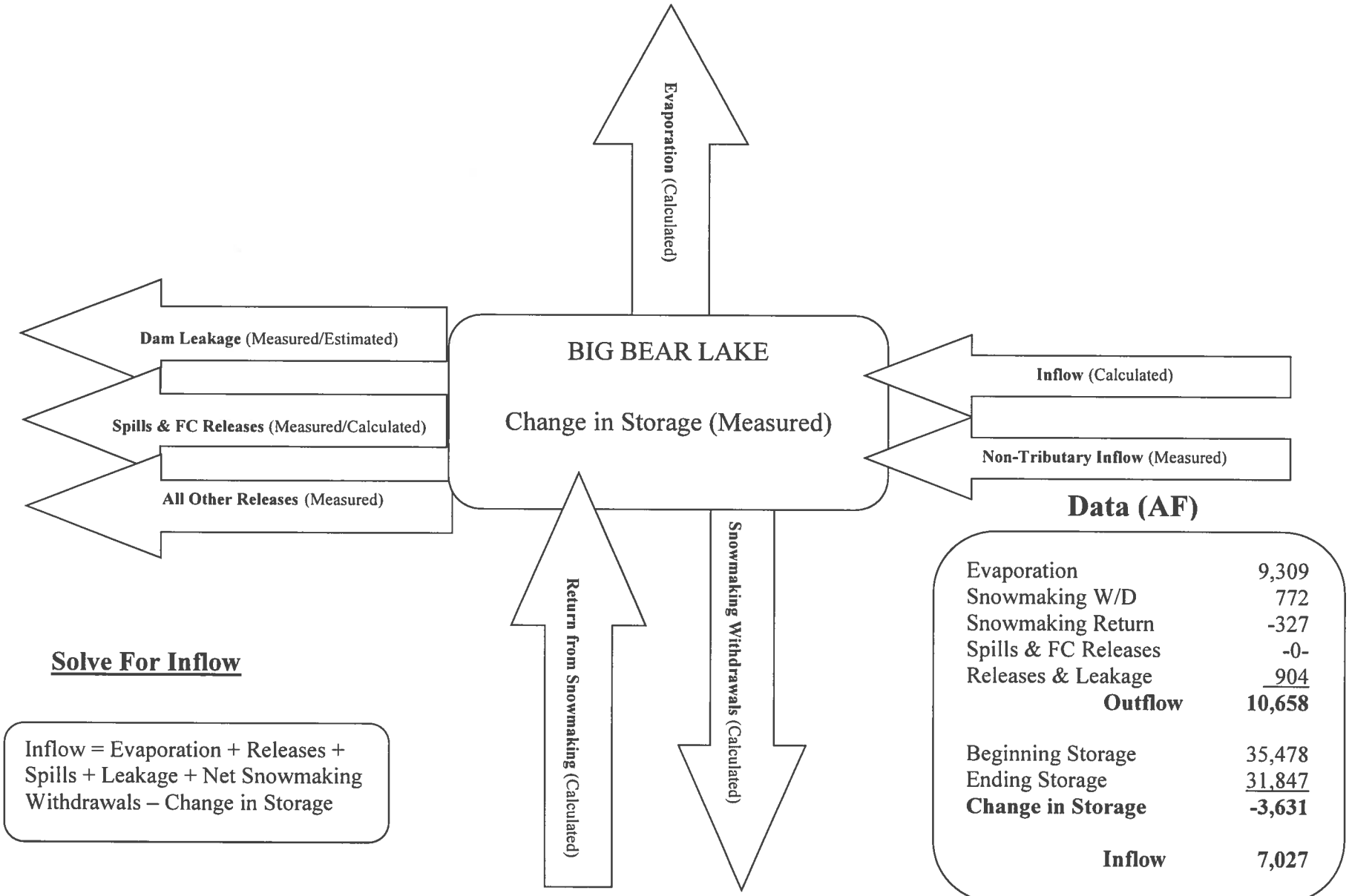
6) the total of spills, releases, leakage and net lake withdrawals was 1,349 acre-feet.

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 2016. Mutual's operation shows what would have happened if:

Figure 2
Water Balance for 2016 Actual Lake Operations



Solve For Inflow

Inflow = Evaporation + Releases + Spills + Leakage + Net Snowmaking Withdrawals – Change in Storage

Data (AF)

Evaporation	9,309
Snowmaking W/D	772
Snowmaking Return	-327
Spills & FC Releases	-0-
Releases & Leakage	904
Outflow	**10,658**
Beginning Storage	35,478
Ending Storage	31,847
Change in Storage	**-3,631**
Inflow	**7,027**

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.

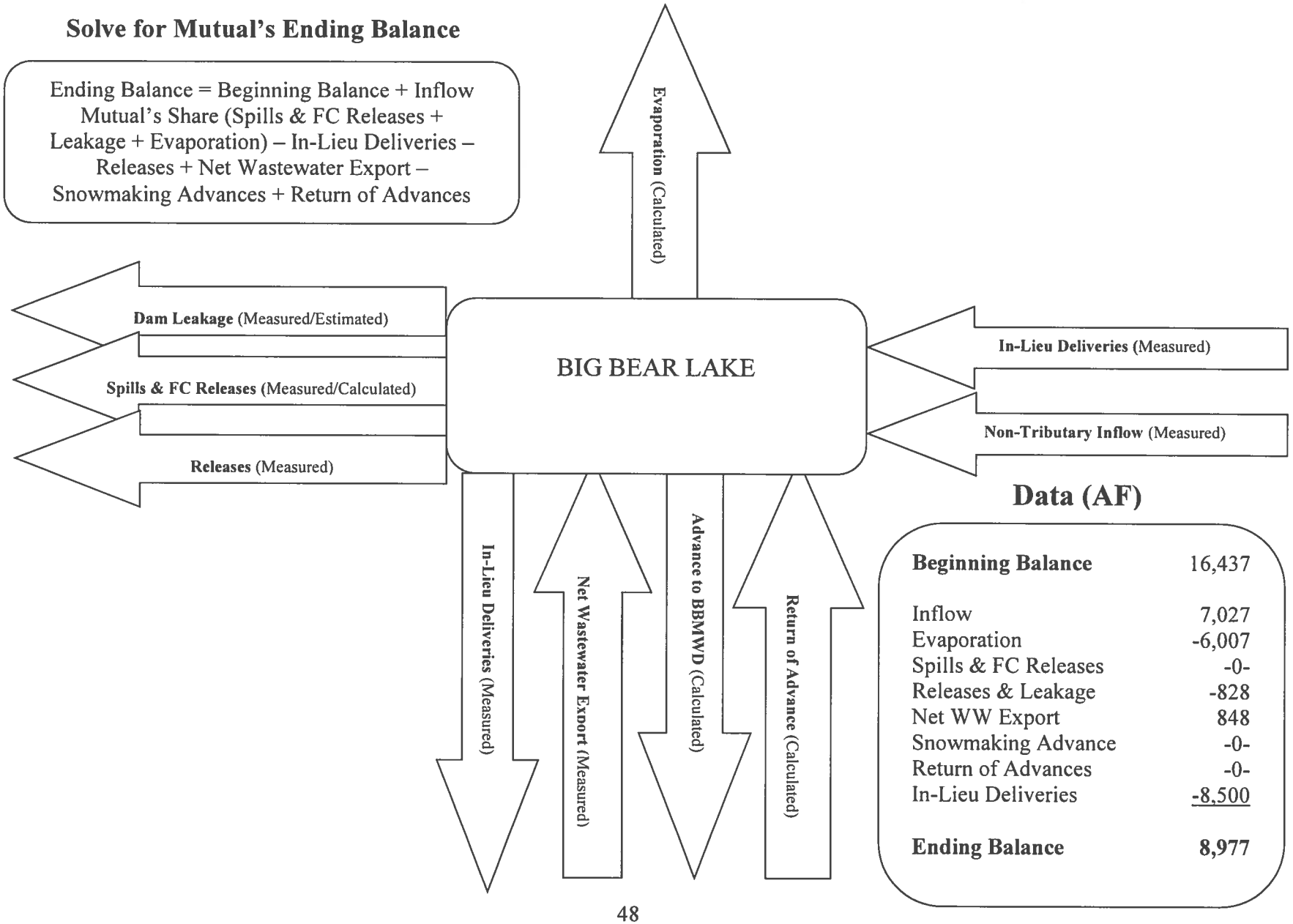
Figure 3 and **Table 2** of **Appendix B** show that Mutual had 8,977 acre-feet in its lake account at the end of 2016. This account balance is 7,460 acre-feet less than was in their lake account at the end of 2015. **Table 2** also shows that in 2016 Mutual's lake account was credited with all the lake inflow (7,027 acre-feet), the total of their releases, spills and leakage was 828 acre-feet and their in-lieu deliveries were 8,500 acre-feet. In 2016, supplemental inflow of 848 acre-feet was added to Mutual's Lake Account for net wastewater exported from the basin. In 2016, there were no advances to Big Bear MWD for snowmaking within the watershed. Evaporation that would have taken place under a Mutual operation was 6,007 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 41.55 feet at the end of 2016 or 30.78 feet below the top of the dam. This synthesized lake level is 14.43 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** 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 2016 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 34,966 acre-feet of net wastewater exports. After 27 years of getting these credits, Mutual's lake account has 5,960 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 7.90 feet. In other words, without the credits, Mutual's lake account would have been 3,021 acre-feet and their lake level would have ended the year at 33.65 or 38.68 feet down. In other words, it would have been 22.33 feet below the actual lake level of 55.98 feet and 7.90 feet lower than reported in Mutual's lake account tables (33.60 feet).

There are two primary reasons why the increase in their lake account (5,956 acre-feet) is less than the cumulative credits they have received (34,966 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 2016 Mutual's lake account had 5,956 acre-feet more and Big Bear MWD's lake account had 5,956 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 2016
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	49683	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
TOTAL	**34,966**						

"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 2016. 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 2016, Big Bear MWD's account balance began with 19,041 acre-feet and ended the year with 22,870 acre-feet. The increase in their account was 3,829 acre-feet. This increase was because the in-lieu deliveries to Mutual during the year were more than the evaporation losses, SWRCB releases, VD in-lieu lake 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 2016, 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.

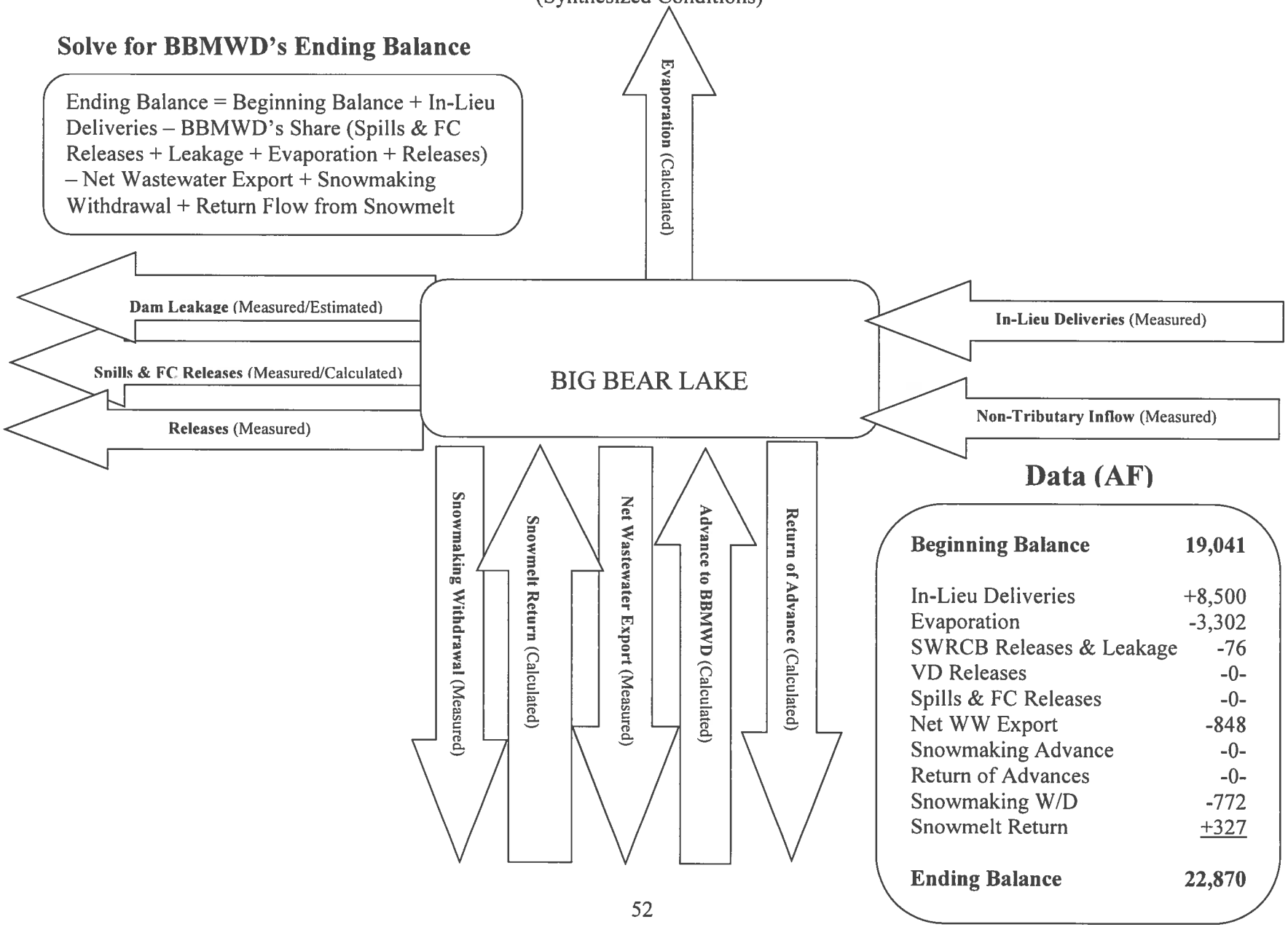
Basin Make-up Account

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 2016 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 2016. The account balance began the year with a balance of 27,081 acre-feet and ended the year with 27,120 acre-

feet. There was a 39 acre-foot increase in the Basin Make-Up Account in 2016. 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 (AO31165) 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 (31174) 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 steam 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 Corp and the Local Sponsors continued to operate the dam under the Interim Water Control Plan until December 30th, 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 Corp 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 2004 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 Mutual 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 uses 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/cgibin/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/cgibin/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 flows 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/cgibin/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.

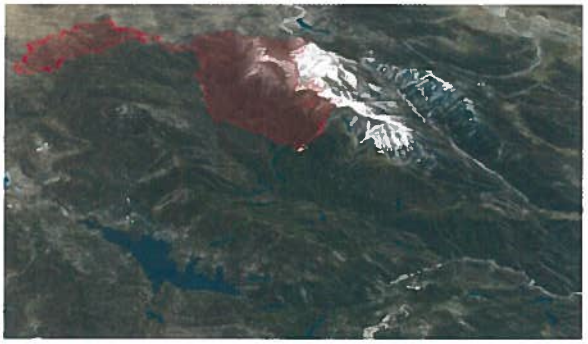
2014 Activities

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 chard 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 ladened 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.

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 1 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

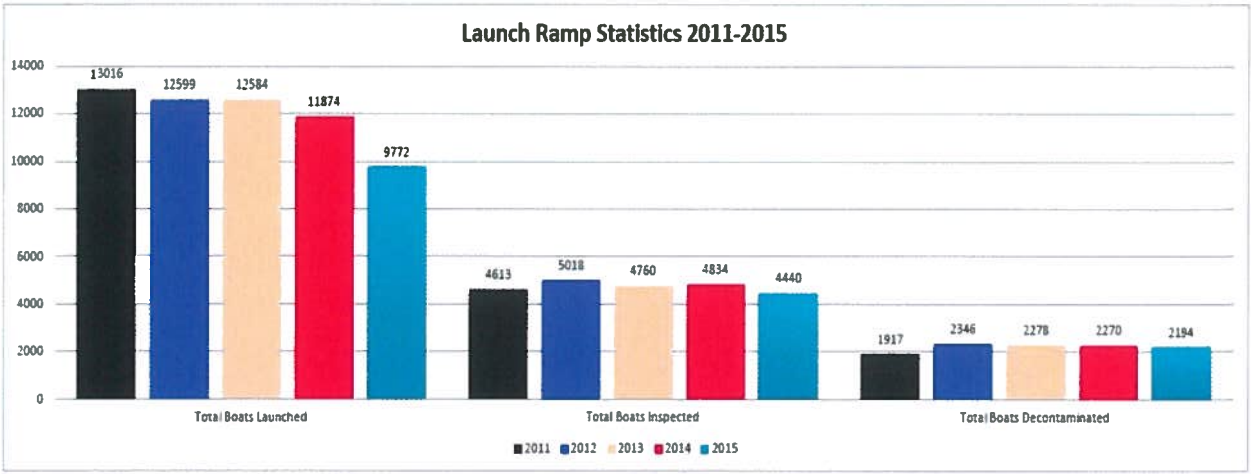
discovered on the vessels. These vessels were impounded, stored at the District's main office and decontaminated prior to the vessels being allow to launch. The remaining six vessels contained shells or dead mussels and were decontaminated at the east launch ramp.

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 decon 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.

APPENDIX A

MINUTES OF WATERMASTER MEETINGS

Dates

January 19, 2016

March 10, 2016

July 12, 2016

October 11, 2016

BIG BEAR WATERMASTER
MINUTES OF THE MEETING OF JANUARY 19, 2016

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

PRESENT:	Watermaster Committee	Representing
	Don Evenson	Big Bear MWD, Chair
	Daniel Cozad	SBV Water Conservation District
	Mike Huffstutler	Big Bear Mutual Water Company
	Others	
	Mike Stephenson	Big Bear MWD
	Bob Ludecke	Big Bear MWD
	James Bellis	Big Bear MWD
	Vince Smith	Big Bear MWD
	David E. 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 1:30 p.m.

2. APPROVAL OF MINUTES
The minutes of the October 19, 2015 meeting were approved.

3. LAKE AND BEAR CREEK STATUS

Mike Stephenson reported that as of January 4th the lake level was at the record low for the season of 11.58; 7 in., 14 ft. down from full. There were 3.33 inches of precipatation measured at the dam. Inflow to the dam between January 5th and 6th was 850 AF. Another storm occurred on January 9th bringing the total inflow up to 1070 AF and brought the lake up 4 inches. BBMWD measured 20.5 inches of snow at the office. The lake level is at 14.3 feet down from full. Mr. Stephenson advised that as of January 1st ski resorts have 675 AF of use on the slopes. The release is currently 1.4 CFS.

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

Daniel Cozad reported that SAR water is being held behind dam trying to get the debris pool level up. Recharge is occurring on both Santa Ana and Mill Creek facilities when water is available. He indicated there have been no significant flows until the last set of storms. Since the beginning of the storms 371 AF has been diverted for recharge which is equivalent to 121 million gallons; 0.68% of a wet year. There has been an estimated 924 AF recharged since the beginning of the water year. Mr. Ludecke asked how much water COE will hold in debris pool. Ms. Scholte indicated until it is at elevation 2,200. Mr. Huffstutler explained that the COE uses an elevation level. Brief discussion on debris pool ensued.

Mr. Cozad stated that both SCE facilities are online.

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

Mike Huffstutler reported that there has been no change and the projection remains at 6,500 AF.

6. INITIAL CALCULATION OF LAKE RELEASES FROM SBVMWD STORAGE ACCOUNT

Don Evenson introduced this item for discussion and provided handouts. He provided a summary of estimates of lake release from SBVMWD storage sub-account in the lake. It explains how it was estimated. Mr. Evenson reviewed the 2015 Lake Level Below Full where it shows that leakage was reduced last year because the lake drawdown was below the spillway level.

Mr. Evenson reported on preliminary results and indicated that the lake level was 43,543 AF at the beginning of 2015. The lake inflows were estimated to be 3,752 AF. The total amount of in-lieu deliveries to Mutual is 6,282 AF and that is debited from Mutual's account and credit to BBMWD's account. Lake releases were 721 AF and were debited from BBMWD's account. Other than the water being released for SBVMWD, there was 750 AF that was released to meet fisheries requirements deducted from Mutual's account. The number debited from Mutual's account may be reduced depending upon whether they were able to use all of the water released or not. Snowmaking withdrawals were 561 AF deducted from BBMWD's account. The evaporation from the lake for the year was 9,785 AF; 2,418 AF debited from BBMWD and 7,367 debited from Mutual. Net wastewater exports that came out of BBMWD's account were 732 AF which was credited to Mutual's account. This number is from last year but should be roughly the same. Based on these preliminary numbers the ending storage in the lake is 35,478 AF; 19,141 AF in BBWMD's Account and 16,337 in Mutual's Account.

Mr. Evenson indicated that the SBVMWD releases began on October 12th at 9 am where it went up by 5 CFS phased out at 2 day periods ending on December 24th. The total amount released was 721.2 AF. He reviewed the procedure used to estimate how much of the releases during the SBVMWD releases that were made from the lake were distributed to Mutual. Mr. Evenson relied on data from the following gaging stations: Big Bear Lake from 6" bypass line, Station A, SCE PH #1 SAR Intake, SCE PH#3 River Pick Up, and USGS Gaging Station. He indicated that SBVWCD was recharging when Mutual could not use the water therefore it cannot be considered in-lieu. Mr. Evenson estimated losses between each data point. He said that once SBVMWD water was released there were no releases for fisheries because the fisheries needs were met by SBVMWD's releases. Prior to SBVMWD releases the fisheries releases was 1.3 CFS. When the SBVMWD releases concluded the fisheries resumed at 1.1 CFS. The 721.2 AF discharged by SBVMWD came out of the lake account and their subaccount. During SBVMWD releases the DFR reported that Mutual's use of the SAR water dropped significantly. The assumption was that Mutual did not receive any of the water released during the SBVMWD releases. On the 25th of October water was being diverted at PH #1 where the river pick up diversion was closed and for a period of 8-9 days the data was erroneous. The data reported for that time fluctuated inconsistently, but beginning on November 4th data was corrected. Mr. Evenson reviewed how he estimated the calculations of water received by Mutual using the three periods as listed: 1) When SCE was diverting at river pick up at PH #1, 2) When they were having start up issues and 3) The last two month period where the releases were made at the diversion to PH #1 at the confluence to Bear Creek and SAR. These were the periods used for data analysis where conditions were different.

Mr. Evenson provided a handout on Initial Estate of In Lieu Releases Delivered to Mutual. The first column shows the releases out of the lake in cfs and af, the next column shows the point where SCE was diverting their releases and third were the losses occurring between the dam and point of diversion.

Analysis explanation continued. Mr. Evenson estimated how of the in-lieu water being diverted by SCE Mutual was actually able to use. He indicated that the data from the DFR's also helped with his analysis. During storms SCE would stop diverting based on the analysis; total 534 AF was diverted through December 24th. The total amount that reached released from the dam was 721 AF, the amount that reached the point of diversion was 623.5 AF, of that total SCE diverted 534 AF; which left Mutual with 463 AF of in-lieu water for use. Mr. Evenson indicated that he is waiting for date from SBVWCD related to weekend spreading and head breaker gaging data. Mainly relied on data which showed how much was in conduit than diverted. Mr. Evenson reviewed the Comparison of 6 inch releases and Station A Flows handout; 6 inch release averaged 4.97 CFS and Station A Flow averaged 4.72 CFS from October 1st – December 10th. This is an average loss of 5%. He then reviewed SCE Diversions to PH #1 + Releases to SAR; Before Increase the total flow was 11.2, During Increase it was 18.5 and After Decrease it was 15 CFS. This is an average of 10% loss.

Mr. Evenson reviewed "Precip at Bear Valley Dam" handout which estimates the loss of SBVMWD releases between Bear Valley Dam and SAR3 River Pick Up at SCE PH #1. He estimated the base flow of the river without the storm flow and how much of the releases were being diverted at that point. There was a 4.7 CFS increase in non-storm flow and base flow was 1.7 CFS. This is an average loss of 20% between the dam and river pick up. Mr. Evenson reviewed the 2015 In-Lieu Deliveries to Mutual handout: Groundwater In-Lieu, 648 AF; SWP Water In-Lieu, 5,170.9 AF; Big Bear Lake In-Lieu, 463.5 AF which totals to 6282.4 delivered to Mutual from SBVMWD. The ten year total for this is 51,210 AF; well below the 65,000 AF ten year total for Mutual deliveries. These are initial numbers BBMWD is still waiting to receive finalized data from partner agencies but it is not anticipated to change significantly. Mr. Evenson asked if there were any questions on his analysis. Mr. Cozad asked what the low peaks were related to the SCE PH#1 handout. Mr. Evenson stated that the lows were due to releases at SAR. Brief discussion ensued. Mr. Huffstutler inquired as to if any diversions were made by SBVWCD near Hinckley Plant. Mr. Cozad said that there were none made but he will double check with Staff. Mr. Huffstutler asked how we measure when it gets down below diversion point. Mr. Evenson indicated that there were only minor spills at Redlands Sandbox and assumptions were that a tenth of a CFS was the loss. Ms. Scholte indicated that there was a loss but it was due to a leakage. Discussion on variations continued. Mr. Evenson stated that this analysis was reviewed with Bob Tincher of SBVMWD. Mr. Cozad stated that SBVWCD Staff will look into weekend delivery calculations for DFR and Redlands Sandbox spills.

7. UPDATE ON NEW STORAGE AGREEMENT WITH SBVMWD

This item was covered under previous discussion.

Mr. Stephenson said he believes the assumptions to be accurate. This will be the last discussion on this item no future negotiations are anticipated so we can remove from the agenda for the next meeting.

8. ANNUAL WATERMASTER ACCOUNTING, TASKS AND DEADLINES

Mr. Evenson said that most data has been received and a draft should be ready at the next meeting in March.

9. DATE FOR NEXT MEETING

The next meeting will be on Thursday, March 10, 2016 at 1:30 PM, at the SBV Water Conservation District.

10. ADJOURN

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

Donald E. Evenson Michael L. Huffstutler Daniel Cozad

BIG BEAR WATERMASTER
MINUTES OF THE MEETING OF MARCH 10, 2016

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

PRESENT:	Watermaster Committee	Representing
	Don Evenson	Big Bear MWD, Chair
	Daniel Cozad	SBV Water Conservation District
	Mike Huffstutler	Big Bear Mutual Water Company
	Others	
	Mike Stephenson	Big Bear MWD
	Bob Ludecke	Big Bear MWD
	James Bellis	Big Bear MWD
	John Eminger	Big Bear MWD
	David E. 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 1:30 p.m.

2. APPROVAL OF MINUTES

The minutes of the January 19, 2016 meeting were approved.

3. LAKE AND BEAR CREEK STATUS

Mike Stephenson reported that the release from the dam is 0.85 cfs. The lake level is at 58.83 feet which is 13.5 feet down from full. The total annual inflow as of March 7th is 2290 AF.

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

Daniel Cozad reported SCE has been operational for most of the year. For the year to date the District has received 5.5 inches of precipitation. So far this water year the District has recharge approximately 1800 AF.

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

Mike Huffstutler reported that there has been no change and the projection remains at 6,500 AF.

6. REVIEW OF WATERMASTER ACCOUNTING AND ANNUAL REPORT

Don Evenson introduced this item for discussion and provided handouts. He provided a table of the Summary Results for Calendar Year 2015 that has been updated from the draft previously distributed. Mr. Evenson made revisions to the accounting process of the Basin Make Up Account to account for SBVMWD's releases from their storage subaccount in Big Bear Lake. There will be notes in the final report that will explain the revisions made to the Basin Make Up

Account; including Table 1.B, Table 3.B and Table 4.A. Releases from SBVMWD's Lake Subaccount are now shown as a separate line item in Table 1.B. In the 2013 Summary Results Table, the amount added to the Basin Make Up Account in from the 2013 SBVMWD Test Release Program was not included in the calculations. The amount was 302 AF for the Test Release Program which, when included, will bring the Basin Make Up Account Ending Balance in the Summary Results Table for Calendar Year 2015 to 27,083 AF (ending balance).

Mr. Evenson also noted revisions that need to be made to the table that shows Days Mutual is Fully Utilizing the Flow of the Santa Ana River; this table is used to calculate Mutual's use of the releases and leakage for fisheries. Preliminary results indicate there were 319 days Mutual was fully utilizing the flow of the SAR; if the table indicates a zero, it means that Mutual was not fully utilizing the flow in the River. On the days that Mutual is taking In Lieu SWP Water, it could add an additional 27 days when Mutual is taking in-lieu water but not fully utilizing the SAR. Mr. Evenson will finalize the determination of when these days occur before the final Watermaster accounts are completed. Mr. Cozad said that an accumulating category will be added to DFR to keep track of fully utilized water so the data is already in the report. Mr. Evenson said that it is also important to determine if the SWP water deliveries are purchased or are In Lieu deliveries to Mutual.

Mr. Evenson indicated that upon his review of last year's Annual Report, he found that it did not include the final version of the Watermaster Accounts. There were minor revisions to the fisheries allocations in the final Watermaster Accounts that were not in the draft accounts that were in the Annual Report. Mr. Evenson suggested that we put the final versions in this year's annual report under Appendix C to document that this error has been corrected.

Additionally discussed was Table III-8: Summary of Diverted Flow at the Mouth of Santa Ana River Canyon. Brief discussion ensued on data collection.

7. ANNUAL WATERMASTER REPORT APPROVAL

The Annual Watermaster Report was approved by Committee including incorporating the suggested revisions.

8. DATE FOR NEXT MEETING

The next meeting will be on Thursday, July 12, 2016 at 1:30 PM, at the SBV Water Conservation District.

9. ADJOURN

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

Donald E. Evenson | Michael L. Huffstutler | Daniel Cozad

BIG BEAR WATERMASTER
MINUTES OF THE MEETING OF JULY 12, 2016

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

PRESENT:	Watermaster Committee	Representing
	Don Evenson	Big Bear MWD, Chair
	Daniel Cozad	SBV Water Conservation District
	Mike Huffstutler	Big Bear Mutual Water Company
	Others	
	Mike Stephenson	Big Bear MWD
	Bob Ludecke	Big Bear MWD
	James Bellis	Big Bear MWD
	John Eminger	Big Bear MWD
	David E. 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 1:30 p.m.

2. APPROVAL OF MINUTES
The minutes of the March 10, 2016 meeting were approved.

3. LAKE AND BEAR CREEK STATUS

Mike Stephenson reported that lake level is at 57.58 feet, which is 14 feet 9 inches down from full. Station A is holding between 1.25-1.30 CFS.

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

Daniel Cozad reported that Mill Creek is at 7.8 CFS in Mill Creek. All flows are going through SCE which had an outage briefly. SWP water has become available; all in-lieu water will be SWP. Discussion ensued regarding GSC and flows. There is no SWP water being recharged this week it is going to direct use.

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

Mike Huffstutler reported that there has been no change and the projection remains at up to 6,500 AF. The numbers are subject to change depending on Crafton's operations.

Mr. Evenson provided handouts. He reviewed the lake levels for this year; it is over 15 feet down presently. BBMWD's need will be met by in-lieu water. The level of the lake is below the elevation of the spillway. The only water being released is from the 6 inch release since spillway leakage has been fixed. He provided a preliminary estimate for lake accounts. The lake accounts started out the year at: Actual 35,478 AF, Mutual's 16,437 AF and BBMWD's 19,041 AF. The increased storage as of July 11th is Actual 319 AF, Mutual's 217 AF and

BBMWD's 102 AF. There is no change in basin makeup account. There is typically 4 feet of evaporation per year.

6. DATE FOR NEXT MEETING

The next meeting will be on Tuesday, October 11, 2016 at 2:00 PM, at the SBV Water Conservation District.

7. ADJOURN

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

Donald E. Evenson | Michael L. Huffstutter | Daniel Cozad

BIG BEAR WATERMASTER
MINUTES OF THE MEETING OF OCTOBER 11, 2016

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

PRESENT:	Watermaster Committee	Representing
	Don Evenson	Big Bear MWD, Chair
	Daniel Cozad	SBV Water Conservation District
	Mike Huffstutler	Bear Valley Mutual Water Company
	Others	
	Mike Stephenson	Big Bear MWD
	Bob Ludecke	Big Bear MWD
	James Bellis	Big Bear MWD
	John Eminger	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 2:00 p.m.

2. APPROVAL OF MINUTES

The minutes from the July 12, 2016 meeting were approved by acclimation.

3. LAKE AND BEAR CREEK STATUS

Mike Stephenson reported that the lake level is at 55.89 feet; which is 16.44 feet below full. The current release is between 1.2 and 1.3 CFS. Current storage is 31,551 AF or 45% of capacity. Big Bear MWD is working on calibrating the weir to be able to monitor the release from the dam to Station B. BBMWD would like to eliminate the need for Station A due to problems keeping the equipment operating in the remote location.

Don Evenson provided handouts to the Committee. The first handout reviews the water level for this calendar year through October 1st. He said the lake is down just under 16 feet and lake releases are only to meet downstream fishery requirements; Mutual is getting their water from in-lieu deliveries. Water levels for the year-to-date have been below the spillway, which eliminates any spillway gate leakage. There is some leakage from the sluice gates on the outlet works, which is estimated at 20 gallons per minute. Table 3 shows the current status of the lake accounts thru September. At the end of September, the Actual Lake Account was at 31,452 AF, Mutual's Lake Account was at

10,946 AF, and Big Bear's Lake Account was at 20,506 AF. Data in two areas that are not updated until end of year are 1) Net waste Water Export sand 2) Fishery Release allocations; currently the lake accounts are based on assumptions similar to last year. Mr. Evenson reviewed the Preliminary Lake Account Results. The next handout reviewed was Table III-11 Summary of Water Deliveries to Mutual 1977-2106 (thru 9-30-16); the ten-year total delivery to Mutual (thru 9-30-16) is 54,558 AF and the average delivery for the 1977 – 2016 period is 4,452 AF/Year. Mr. Evenson reviewed Table 4-Basin Make-Up Account, which currently has a balance of 27,100 AF.

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. There has been minimal flows; typically 6-10 cfs out of SAR. Most are taking SWP water for the most part. Ms. Scholte reported that SCE has not been operational for the past three months except for Powerhouse #3 which was on for a day. She said most of the flows diverted at highline are going to East Valley Water District and some are going to Redlands. Mr. Cozad noted that the projections for SWP will likely come out in November.

5. MUTUAL'S PROJECTION OF NEEDS FOR LAKE RELEASES\IN-LIEU WATER

Mike Huffstutler indicated that the number may change this year to 8000 AF. He will know for sure later in the year.

6. DATE FOR NEXT MEETING

The next meeting will be on Tuesday, January 24, 2017 at 2:00 p.m., at the San Bernardino Valley Water Conservation District.

7. ADJOURN

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

Donald E. Evenson Michael L. Huffstutler Daniel Cozad

APPENDIX B

TABLE OF
ACCOUNTS OF OPERATION OF BIG BEAR LAKE

ACCOUNTS FOR
CALENDAR YEAR 2016

INPUT DATA
BIG BEAR WATERMASTER REPORT
CALENDAR YEAR
2016

Calandar Year		2016		
Mutual's Lake Account Balance on Jan.1	=	16,437	acre-feet	
Basin Make-Up Account Balance on Jan. 1	=	27,081	acre-feet	See Note 1
Account Balance for Mutual's Advances to BBMWD	=	-	acre-feet	
Repayment Premium for Mutual's Advances to BBMWD	=	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	

Monthly Evaporation Rate Calculation Factors	C1	C2	C3
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
2016
(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	57.75	-	-	-	-	-	-	-
February	58.29	-	-	-	-	-	-	-
March	58.67	-	-	-	-	-	-	-
April	58.95	-	-	-	-	-	-	-
May	58.91	-	-	-	-	-	-	-
June	58.54	-	-	-	-	-	-	-
July	57.91	-	-	-	-	-	-	-
August	57.13	-	-	-	-	-	-	-
September	56.57	-	-	-	-	-	-	-
October	55.92	-	-	-	-	-	-	-
November	55.69	-	-	-	-	-	-	-
December	55.57	-	-	-	-	-	-	-
	55.98							
Change	-1.77							
	* Gage at Bear Valley Dam						0.00	

INPUT DATA
BIG BEAR WATERMASTER REPORT
CALENDAR YEAR
2016
(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	69.39	-	-	-	-	-	-
February	38.75	-	-	-	-	-	-
March	27.55	-	-	3.80	-	-	-
April	6.51	-	-	8.30	-	-	-
May	13.32	-	-	236.60	-	-	-
June	21.39	-	-	1,438.00	-	-	-
July	24.40	-	-	2,444.77	-	-	-
August	35.64	-	-	2,457.48	-	-	-
September	23.71	-	-	1,911.05	-	-	-
October	37.98	-	-	-	-	-	-
November	124.76	-	-	-	-	-	-
December	348.46	-	-	-	-	-	-
	771.86	-		8,500.00	-		-

INPUT DATA
BIG BEAR WATERMASTER REPORT
CALENDAR YEAR
2016
(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)	2016 Net Wastewater Exports (acre-feet)	Average Air Temperature (degrees F)
January	81.36	19.08	-	-	97.60	34.2
February	49.19	21.94	-	-	124.71	40.7
March	56.05	28.92	-	-	94.31	42.0
April	46.94	44.07	-	-	61.54	45.1
May	55.99	55.99	-	-	59.45	49.4
June	69.41	69.41	-	-	57.71	63.5
July	94.11	94.11	-	-	67.87	67.2
August	103.97	103.97	-	-	55.89	64.2
September	99.94	99.94	-	-	40.56	56.8
October	89.05	83.39	-	-	44.71	52.1
November	80.88	75.72	-	-	50.41	42.8
December	77.45	69.95	-	-	93.50	37.5
	904.34	766.49			848.26	

SUMMARY RESULTS
CALENDAR YEAR
2016

LAKE ACCOUNTS (acre-feet)	Big Bear	Mutual	Actual
Initial Storage	19,041	16,437	35,478
Lake Inflows	0	7,027	7,027
In-Lieu Supplies to Mutual	8,500	(8,500)	0
Lake Releases (Mutual & BBMWD)	0	0	0
Releases & Leakage (SWRCB 95-4)	(76)	(828)	(904)
Net Snowmaking Withdrawals from Lake	(445)	0	(445)
Lake Spills & Flood Control Releases	0	0	0
Leakage from Dam	0	0	0
Evaporation from Lake	(3,301)	(6,007)	(9,309)
Net Wastewater Exports	(848)	848	0
Advances & Repayment of Advances	0	0	0
Ending Storage	22,870	8,977	31,847
BASIN MAKE UP ACCOUNT (acre-feet)			
Beginning Balance	n.a.	n.a.	27,081
Recharge From Releases of Lake Water Used by Mutual	383	4,633	(4,250)
Recharge From In-lieu SWP Water Delivered to Mutual	4,250	n.a.	4,250
Recharge from Spills & Other Lake Releases	70	31	39
Account Credit (Debit)	4,704	4,665	39
Amount Replenished	0	n.a.	0
Ending Balance			27,120

CALENDAR YEAR
2016
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)
	57.75	35,478		2,142						
January	58.29	36,669	1,191	2,185	116	184	1,491	1,490.66	184	0.085
February	58.67	37,438	769	2,211	69	257	1,095	1,094.75	257	0.117
March	58.95	38,098	660	2,233	70	481	1,211	1,210.94	481	0.217
April	58.91	37,988	(110)	2,230	50	644	584	583.74	644	0.288
May	58.54	37,219	(769)	2,204	69	906	206	206.09	906	0.409
June	57.91	35,797	(1,422)	2,154	91	1,233	(98)	0.00	1,331	0.611
July	57.13	34,206	(1,591)	2,094	119	1,331	(142)	0.00	1,472	0.693
August	56.57	32,969	(1,237)	2,045	140	1,262	164	164.22	1,262	0.610
September	55.92	31,649	(1,320)	1,995	124	999	(197)	0.00	1,196.4	0.592
October	55.69	31,255	(394)	1,984	108	831	545	545.49	831	0.418
November	55.57	30,958	(297)	1,976	143	530	376	375.96	530	0.268
December	55.98	31,847	889	2,000	252	215	1,355	1,355.32	215	0.108
TOTALS			(3,631)		1,349	8,871	6,590	7,027.2	9,308.7	4.415
* NOTE: Evaporation adjusted to eliminate negative inflow					846.5			4,750.4	7,732.9	

CALENDAR YEAR
2016
BIG BEAR WATERMASTER

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

Month	1	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		-	-	81.4	-	34.7			116.1
February		-	-	49.2	-	19.4			68.6
March		-	-	56.1	-	13.8			69.8
April		-	-	46.9	-	3.3			50.2
May		-	-	56.0	-	13.3			69.3
June		-	-	69.4	-	21.4			90.8
July		-	-	94.1	-	24.4			118.5
August		-	-	104.0	-	35.6			139.6
September		-	-	99.9	-	23.7			123.7
October		-	-	89.1	-	19.0			108.0
November		-	-	80.9	-	62.4			143.3
December		-	-	77.5	-	174.2			251.7
TOTALS		-	-	904.3	-	445.1			1,349.5
				656.96		189.54			

CALENDAR YEAR
2016
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	-	-	-	-	-	-	-	81.4	81.4
February	-	-	-	-	-	-	-	49.2	49.2
March	-	-	-	-	-	-	-	56.1	56.1
April	-	-	-	-	-	-	-	46.9	46.9
May	-	-	-	-	-	-	-	56.0	56.0
June	-	-	-	-	-	-	-	69.4	69.4
July	-	-	-	-	-	-	-	94.1	94.1
August	-	-	-	-	-	-	-	104.0	104.0
September	-	-	-	-	-	-	-	99.9	99.9
October	-	-	-	-	-	-	-	89.1	89.1
November	-	-	-	-	-	-	-	80.9	80.9
December	-	-	-	-	-	-	-	77.5	77.5
TOTALS	-	-	-	-	-	-	-	904.34	904.3

CALENDAR YEAR
2016
BIG BEAR WATERMASTER

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

Month	1	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		69.39			69.39		34.70		34.69
February		38.75			38.75		19.38		19.37
March		27.55			27.55		13.78		13.77
April		6.51			6.51		3.26		3.25
May		13.32			13.32		-		13.32
June		21.39			21.39		-		21.39
July		24.40			24.40		-		24.40
August		35.64			35.64		-		35.64
September		23.71			23.71		-		23.71
October		37.98			37.98		18.99		18.99
November		124.76			124.76		62.38		62.38
December		348.46			348.46		174.23		174.23
TOTALS		771.86			771.86		326.72		445.14

CALENDAR YEAR
2016
BIG BEAR WATERMASTER

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

Month	1	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			2,142						
				2,164	34.20	0.085			183.6
February			2,185						
				2,198	40.70	0.117			257.2
March			2,211						
				2,222	42.00	0.217			481.1
April			2,233						
				2,232	45.10	0.288			643.5
May			2,230						
				2,217	49.40	0.409			905.8
June			2,204						
				2,179	63.50	0.566			1,232.8
July			2,154						
				2,124	67.20	0.626			1,330.6
August			2,094						
				2,070	64.20	0.610			1,261.6
September			2,045						
				2,020	56.80	0.495			999.2
October			1,995						
				1,990	52.10	0.418			831.5
November			1,984						
				1,980	42.80	0.268			529.7
December			1,976						
				1,988	37.50	0.108			214.6
			2,000						
TOTALS						4.205			8,871.3

CALENDAR YEAR
2016
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)
	47.25	16,437		1,511						
January	48.15	17,847	1,410	1,571	1,490.7	97.6	130.8	-	-	47.9
February	48.80	18,845	998	1,611	1,094.8	124.7	186.2	-	-	35.2
March	49.35	19,751	906	1,644	1,210.9	94.3	352.4	-	-	46.4
April	49.40	19,868	117	1,647	583.7	61.5	474.5	-	-	53.9
May	49.00	19,173	(695)	1,623	206.1	59.5	668.0	-	-	292.6
June	47.45	16,762	(2,411)	1,524	-	57.7	961.3	-	-	1,507.4
July	45.05	13,293	(3,469)	1,358	-	67.9	997.6	-	-	2,538.9
August	42.60	10,179	(3,114)	1,181	164.2	55.9	773.0	-	-	2,561.5
September	40.20	7,559	(2,620)	1,013	-	40.6	649.7	-	-	2,011.0
October	40.30	7,639	80	1,021	545.5	44.7	425.0	-	-	84.7
November	40.35	7,715	75	1,024	376.0	50.4	273.9	-	-	77.0
December	41.55	8,977	1,262	1,107	1,355.3	93.5	115.0	-	-	71.8
TOTALS			(7,460)		7,027.2	848.3	6,007.4	-	-	9,328.2
(*) Col. 3 = Col. 5 + Col. 6 - Col. 7 - Col. 8 + Col. 9 - Col. 10					4,750.4	659.64	5193.5			

CALENDAR YEAR
2016
BIG BEAR WATERMASTER

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

Month	1 Mutual's Spills & 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)	9 Spilled from Mutual's Lake Acct. (Input Data) (ac-ft)	10 Net Wastewater Export Credit (to Table 2) (ac-ft)
January	-	-	-	47.9	-	47.9		97.6	-	97.6
February	-	-	-	35.2	-	35.2		124.7	-	124.7
March	-	-	-	42.6	3.8	46.4		94.3	-	94.3
April	-	-	-	45.6	8.3	53.9		61.5	-	61.5
May	-	-	-	56.0	236.6	292.6		59.5	-	59.5
June	-	-	-	69.4	1,438.0	1,507.4		57.7	-	57.7
July	-	-	-	94.1	2,444.8	2,538.9		67.9	-	67.9
August	-	-	-	104.0	2,457.5	2,561.5		55.9	-	55.9
September	-	-	-	99.9	1,911.1	2,011.0		40.6	-	40.6
October	-	-	-	84.7	-	84.7		44.7	-	44.7
November	-	-	-	77.0	-	77.0		50.4	-	50.4
December	-	-	-	71.8	-	71.8		93.5	-	93.5
TOTALS	-	-	-	828.2	8,500.00	9,328.2		848.3	-	848.3
				594.69	8,500.0			659.6		

CALENDAR YEAR
2016
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	16,437.0	1,511.0	128.2	17,849.1	1,571.0	1,541.0	130.8	52.8	17,846.5	
February	17,846.5	1,571.0	183.8	18,847.0	1,611.0	1,591.0	186.2	71.0	18,844.6	
March	18,844.6	1,611.0	348.8	19,754.6	1,644.0	1,627.5	352.4	128.7	19,751.1	
April	19,751.1	1,644.0	474.1	19,868.4	1,647.0	1,645.5	474.5	169.0	19,868.0	
May	19,868.0	1,647.0	672.9	19,168.0	1,623.0	1,635.0	668.0	237.8	19,172.9	
June	19,172.9	1,623.0	991.5	16,731.7	1,524.0	1,573.5	961.3	369.9	16,761.9	
July	16,761.9	1,524.0	1,056.5	13,234.4	1,354.0	1,439.0	997.6	474.9	13,293.3	
August	13,293.3	1,358.0	827.9	10,124.1	1,178.0	1,268.0	773.0	488.6	10,179.0	
September	10,179.0	1,181.0	699.5	7,509.1	1,013.0	1,097.0	649.7	546.7	7,558.9	
October	7,558.9	1,013.0	423.4	7,641.0	1,021.0	1,017.0	425.0	406.5	7,639.3	
November	7,639.3	1,021.0	273.1	7,715.6	1,027.0	1,024.0	273.9	255.8	7,714.8	
December	7,714.8	1,024.0	110.6	8,981.2	1,107.0	1,065.5	115.0	99.6	8,976.8	
TOTALS							6,007.4	3,301.3		

CALENDAR YEAR
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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 Releases 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	-	-	-	-	-	-	81.4	19.1	47.9	33.4
February	-	-	-	-	-	-	49.2	21.94	35.2	14.0
March	-	-	-	-	-	-	56.1	28.92	42.6	13.5
April	-	-	-	-	-	-	46.9	44.07	45.6	1.4
May	-	-	-	-	-	-	56.0	55.99	56.0	-
June	-	-	-	-	-	-	69.4	69.41	69.4	-
July	-	-	-	-	-	-	94.1	94.11	94.1	-
August	-	-	-	-	-	-	104.0	103.97	104.0	-
September	-	-	-	-	-	-	99.9	99.94	99.9	-
October	-	-	-	-	-	-	89.1	83.39	84.7	4.3
November	-	-	-	-	-	-	80.9	75.72	77.0	3.9
December	-	-	-	-	-	-	77.5	69.95	71.8	5.6
TOTALS	-	-	-	-	-	-	904.34	766.49	828.23	76.11
								537.43	594.69	62.27

CALENDAR YEAR
2016
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	35,478	16,437	19,041.0					-		
February	36,669	17,847	18,822	(218.5)		-	-	-	-	-
March	37,438	18,845	18,593	(229.1)		-	-	-	-	-
April	38,098	19,751	18,347	(246.5)		-	-	-	-	-
May	37,988	19,868	18,120	(226.9)		-	-	-	-	-
June	37,219	19,173	18,046	(74.0)		-	-	-	-	-
July	35,797	16,762	19,035	989.0		-	-	-	-	-
August	34,206	13,293	20,913	1,877.6		-	-	-	-	-
September	32,969	10,179	22,790	1,877.3		-	-	-	-	-
October	31,649	7,559	24,090	1,300.1		-	-	-	-	-
November	31,255	7,639	23,616	(474.5)		-	-	-	-	-
December	30,958	7,715	23,243	(372.5)		-	-	-	-	-
	31,847	8,977	22,870	(373.0)		-	-	-	-	-
TOTALS				3,829.2		-	-		-	-

CALENDAR YEAR
2016
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	3.8	-	-		-	3.8		-		3.8
April	8.3	-	-		-	8.3		-		8.3
May	236.6	-	-		-	236.6		-		236.6
June	1,438.0	-	-		-	1,438.0		-		1,438.0
July	2,444.8	-	-		-	2,444.8		-		2,444.8
August	2,457.5	-	-		-	2,457.5		-		2,457.5
September	1,911.1	-	-		-	1,911.1		-		1,911.1
October	-	-	-		-	-		-		-
November	-	-	-		-	-		-		-
December	-	-	-		-	-		-		-
TOTALS	8,500.0	-	-		-	8,500.0		-		8,500.0

CALENDAR YEAR
2016
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	69.4	-	34.7	34.7	-	-	33.4	52.8	97.6	218.5
February	38.8	-	19.4	19.4	-	-	14.0	71.0	124.7	229.1
March	27.6	-	13.8	13.8	-	-	13.5	128.7	94.3	250.3
April	6.5	-	3.3	3.3	-	-	1.4	169.0	61.5	235.2
May	13.3	-	-	13.3	-	-	-	237.8	59.5	310.6
June	21.4	-	-	21.4	-	-	-	369.9	57.7	449.0
July	24.4	-	-	24.4	-	-	-	474.9	67.9	567.2
August	35.6	-	-	35.6	-	-	-	488.6	55.9	580.1
September	23.7	-	-	23.7	-	-	-	546.7	40.6	610.9
October	38.0	-	19.0	19.0	-	-	4.3	406.5	44.7	474.5
November	124.8	-	62.4	62.4	-	-	3.9	255.8	50.4	372.5
December	348.5	-	174.2	174.2	-	-	5.6	99.6	93.5	373.0
TOTALS	771.9	-	326.7	445.1	-	-	76.1	3,301.3	848.3	4,670.8
	260.66			189.54				2,539.4		

CALENDAR YEAR
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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	41.3		24.3		17.0		-		27,081
February	24.9		17.7		7.1		-		27,098
March	30.2		23.3		6.9		-		27,105
April	27.6		26.9		0.7		-		27,112
May	146.3		146.3		-		-		27,113
June	753.7		753.7		-		-		27,113
July	1,269.4		1,269.4		-		-		27,113
August	1,280.7		1,280.7		-		-		27,113
September	1,005.5		1,005.5		-		-		27,113
October	44.6		42.4		2.2		-		27,113
November	40.5		38.5		2.0		-		27,115
December	38.8		35.9		2.9		-		27,117
TOTALS	4,703.5		4,664.7		38.8		0.0		27,120

CALENDAR YEAR
2016
BIG BEAR WATERMASTER

TABLE 4.A
BIG BEAR'S BASIN ADDITIONS

Month	SPILLS			LAKE RELEASES				IN LIEU SUPPLIES		
	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)	10 Big Bear's Basin Additions (ac-ft)
January	-	62.3	31.8	-	19.1	-	9.5	-	-	41.3
February	-	27.3	13.9	-	21.9	-	11.0	-	-	24.9
March	-	27.1	13.8	-	28.9	-	14.5	3.8	1.9	30.2
April	-	2.9	1.5	-	44.1	-	22.0	8.3	4.2	27.6
May	-	-	-	-	56.0	-	28.0	236.6	118.3	146.3
June	-	-	-	-	69.4	-	34.7	1,438.0	719.0	753.7
July	-	-	-	-	94.1	-	47.1	2,444.8	1,222.4	1,269.4
August	-	-	-	-	104.0	-	52.0	2,457.5	1,228.7	1,280.7
September	-	-	-	-	99.9	-	50.0	1,911.1	955.5	1,005.5
October	-	5.7	2.9	-	83.4	-	41.7	-	-	44.6
November	-	5.2	2.6	-	75.7	-	37.9	-	-	40.5
December	-	7.5	3.8	-	70.0	-	35.0	-	-	38.8
TOTALS	0.0	137.9	70.3	0.0	766.5	0.0	383.2	8,500.0	4,250.0	4,703.5

CALENDAR YEAR
2016
BIG BEAR WATERMASTER

TABLE 4.B
MUTUAL'S BASIN ADDITIONS

Month	SPILLS & FISH RELEASES			LAKE RELEASES			
	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)	7 Total Basin Additions (ac-ft)
January	-	28.9	14.7	-	19.1	9.5	24.3
February	-	13.3	6.8	-	21.9	11.0	17.7
March	-	13.7	7.0	3.8	28.9	16.4	23.3
April	-	1.5	0.8	8.3	44.1	26.2	26.9
May	-	-	-	236.6	56.0	146.3	146.3
June	-	-	-	1,438.0	69.4	753.7	753.7
July	-	-	-	2,444.8	94.1	1,269.4	1,269.4
August	-	-	-	2,457.5	104.0	1,280.7	1,280.7
September	-	-	-	1,911.1	99.9	1,005.5	1,005.5
October	-	1.4	0.7	-	83.4	41.7	42.4
November	-	1.3	0.6	-	75.7	37.9	38.5
December	-	1.9	1.0	-	70.0	35.0	35.9
TOTALS	0.0	61.7	31.5	8,500.0	766.5	4,633.2	4,664.7

CALENDAR YEAR
2016
BIG BEAR WATERMASTER

TABLE 4.C
BASIN REPLENISHMENTS

Month	1	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	