BIG BEAR LAKE MANAGEMENT OPERATIONS

Summary of 2010 Activities

October 2010

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Big Bear Lake management operations, in support of the Districts mission, consist of four activities; lake level stabilization, limnological monitoring, aquatic plant control and carp removal. This summary report is the first time some of these activities have been carefully measured and documented. In the case of limnology reporting, the earliest records that have been processed are from 2004. Lake level data go back to the time the new dam was constructed in the early 1900's but for this report only the water year data ending September 30, 2010 are included.

Lake Levels

The Lake began the water year, October 1 through September 30, at a level 7.62 feet below full (6735.58 feet elevation) in October 2009. The lowest level was reached the first week of December when the level dropped to 8.2 feet below full (3739.99 feet elevation). The lake recovered to its highest level of 2.38 feet below full (6740.82 feet elevation) during the second week of June. The Lake level ended the year at 4.38 feet below full (6738.82 feet elevation). A Lake level graph for water year 2009-10 is shown as Figure 1. Lake level improved significantly compared to summer 2008 as a result of 43.73 inches of precipitation (rain and rain equivalent from snow) measured at the Dam. Historical lake levels can be viewed on the District web page.

In accordance with the Lake release policy and our in-lieu agreement with San Bernardino Valley Municipal Water District, a release was made in August, terminating shortly after Labor Day. The quantity of water released was small and will be computed and reported in the annual Watermaster Report. The four cubic feet per second (cfs) release had an insignificant impact on Lake Level. Typical August evaporation from the Lake is 40 cfs.

The cost to the District during fiscal year 2009-10 for the In-Lieu agreement, which maintains the level of the Lake, was $1,281,739.

Limnology

District Staff measure the limnological properties of the Lake weekly during the boating season at the locations shown on the map Figure 2. Measurements of Lake Temperature, dissolved oxygen content and water clarity using a Secchi disc data collected from 2004 to the present are shown on graphs in Appendix A.

Surface water temperatures peak in July and August with the east end of the lake typically warmer by three to five degrees than in the west. Summer temperatures reach the high sixties to low seventies.

Secchi readings vary widely year to year over the spring and summer months when the Lake is stratified. In 2010 Secchi depths maxed at 11 to 12 feet in June in the western part of Lake and 7.5 to 10 feet in the eastern end. By September water clarity is at its worst. In 2010 readings of four to five and one half feet are recorded in the western end of the lake and almost five feet in the east end. Historically the best water clarity was recorded in May and June of 2005 when readings of 12.5 feet and 13 feet were measured in the west and 8.5 to 11 feet in the east.

At the beginning of the boating season surface and Lake Bottom water temperatures are similar and the Lake water is mixed (Figure 3a). As the surface warms the Lake stratifies with cold, dense oxygen depleted water forming a layer below the relatively warmer, less dense, oxygenated water above as shown on Figure 3b. Later in the year surface and bottom water temperatures tend to equilibrate and the waters mix bringing oxygen depleted and nutrient laden water up into the water column to spur algae growth (Figure3c). Water clarity drops dramatically and water column oxygen is also diluted. Over the past 7 years late summer early fall mixing has occurred on the approximate dates as shown below. Secchi readings plotted on the Appendix A graphs clearly show the early fall Lake mixing by a reduction in water clarity.

Year	**Date Lake Mixed**
2010	September 3
2009	June 12 and August 12
2008	August 19
2007	August 20
2006	August 28
2005	September 6
2004	Lake did not stratify

Aquatic Plant Management

Activities associated with aquatic plant control have two components. Herbicides are used to treat areas infested with Eurasian Water Milfoil. Native aquatic plant species are typically controlled mechanically using a harvester. Cuttings are delivered to a composting facility operated by the City of Big Bear Lake. Harvesting operations are used to maintain navigation channels and boat dock lake access.

The District has made considerable progress in reducing the population of milfoil in the Lake compared to the baseline year 2000 when more than 1000 acres of the lake were infested (Figure 4). By 2008 the infestation was reduced to 450 acres (Figure 5) and by 2009 it was 314 acres (Figure 6). Milfoil mapped in 2010 occupied 177 acres (Figure 7). Also in 2010 there was a noticeable proliferation of native aquatic plants not observed for many years prior.

Herbicide Treatment

In 2010, 26,000 pounds of the name brand Renovate Max-G (Triclopyr 4.0%, 2, 4-Dichlorophenoxyacetic acid 14.0% and other ingredients 82.0%). Although there was sufficient product to treat 130 acres of milfoil, some areas had to be treated multiple times, in some cases four times, so the effective treatment area was only 97 acres.

Two methods of herbicide application are used. Large broadcast treatment is applied using the vortex physics of water pumped through a nozzle at pressure to draw dry product from a hopper. Nozzles installed on either side of the back of the weed harvester barge distribute product in swaths 30 feet wide as the barge moves through milfoil infested littoral zone. Metering of product delivery in this unit is based on the known delivery rate of the equipment and the speed of the barge moving through the infested area. The other method also employs vortex physics but uses air instead of water. The unit has a blower that moves air across the bottom opening of a funnel shaped hopper. The air draws the product out of the hopper and is then directed through a hose to a hand held control and nozzle. Metering with this unit is based on an even distribution of a preloaded quantity of product in the hopper and the known area to be treated. In both cases application rates are computed using label instruction for plant species, treatment area and water depth.

Treatment began on June 8 and was completed on July 26, 2010. The areas treated are shown on Figure 8, Map of 2010 Herbicide Weed Treatment and Milfoil Mapping. The map shows treatment areas were extensive in the western three-quarters of the Lake. The prevailing westerly winds moves weed fragments east. The strategy has been to focus the bulk of the treatment in the west so that as milfoil fragments are carried by wind and currents towards the east they do not take root in areas that are milfoil free.

Herbicide used treating docks and general lake areas totaled $42,515.18 and $57,438.42 respectively. Employee expenses and fuel for the 2010 program came to $7,093.80 for a 2010 total program cost of $107,047.40. Data collected to compute these values is included in Appendix B.

Harvesting

In areas where native aquatic plants restrict navigation in and out of private docks and marinas, mechanical means are used to clear paths for vessels. Harvesting efforts began on July 6, 2010 and continued through September 15. A total of 71 loads of weeds were removed, during 18 working days, to the City composting facility with a wet weight of about 560,900 pounds or about 280 tons. The dry weight of the material removed is estimated at 56,000 pounds assuming a percent dry weight of 10% for an average load.

Six 100 gram samples were collected and submitted to Physis Laboratories in Orange County. Two 100 gram samples each of Eurasian Water Milfoil, Common Elodea and Coon Tail were submitted for analysis of total Phosphorous, total Nitrogen and dry weight.

Laboratory Analysis Results	Total Phosphorous (ug/g dry)	Total Nitrogen (ug/g dry)	% Solids
Eurasian Water Milfoil	2999	25,400	9.89
Coontail	3488	24,600	11.52
Common Elodea	3799	20,100	9.83

Using these analyses total weight of Phosphorous and Nitrogen removed from the Lake by the weed harvester is approximately 147 pounds and 1400 pounds respectively.

Weed harvesting expenses, excluding depreciation, totaled $14,704.20 for 2010.

Carp Removal

After observing the effectiveness of electro-shock fishing for Carp by a District consultant in 2007 the District purchased its own electro-shock boat in 2008 and installed a commercial grinder placed over a sewer manhole in 2009. Shocked carp are netted and after the boat is filled they are ground up and disposed of in the sanitary sewer at the back of the District shop. The Big Bear Area Regional Wastewater Agency (BBARWA) charges the District $150 for every 1000 pounds of Carp discharged to the sewer.

Electro-shock fishing began July 16 and the efforts ended after 18 work days on September 8, 2010. The annual Carp Round-Up event also removes carp from the lake. Cash and prizes are awarded for winners in the various divisions. Bow hunters, 120 of them, came from California and the southwest to compete in this District sponsored event on the weekend of June 26-27, 2010.

Including the 10,128 pounds of carp shot during the Carp Round-Up the District electro-shock fishing efforts removed 49,478 pounds of carp during summer 2010. A map showing pounds of carp removed from the Lake by electro-shock fishing by area is included as Figure 9.

Excluding depreciation on the electro-shock boat and the grinder, wages, fuel costs and BBARWA charges for carp removal in 2010 totaled $14,551. Data used to compute these values are included in Appendix C. Fish surveys conducted by the California Department of Fish and Game indicate that the Districts' carp removal program has dramatically improved game fish populations. Future annual reports will incorporate details from California Department of Fish and Game surveys.

Summary of 2010 Lake Management Operations Expenses

In Lieu Agreement	$1,281,739
Herbicide Treatment	$ 107,047
Weed Harvesting	$ 14,704
Carp Removal and Disposal	$ 14,551

APPENDIX A – LIMNOLOGY GRAPHS

APPENDIX B – HERBICIDE APPLICATION COSTS AND WEED ZONE MAP

APPENDIX C – POUNDS OF CARP REMOVED AND COSTS