Annual Water Quality Report

ENGLEBRIGHT LAKE

Water Year 2002

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Englebright Lake

I. Purpose

This report is part of an environmental monitoring program that began at Englebright Lake in May 1991. The monitoring program was implemented to ensure a continuous level of water quality in the lake for both recreation and environmental, and to satisfy the Department of Army Engineering Regulation 1110-2-8154, "Water Quality and Environmental Management for Corps Civil Works Projects".

II. Brief Description of Englebright Lake

Englebright Lake is located in central California, 21 miles east of Marysville. It is nestled in the Sierra Nevada foothills and is surrounded by grasslands and blue oaks. Englebright Lake was constructed for the storage of hydraulic gold mining debris. Englebright Dam is a concrete arch structure that spans 1,142 feet across and is 260 feet high. The dam is in the steep Yuba River gorge known as the Narrows, holding back a 9-mile long lake with a surface area of 815 acres. The lake has become a popular destination for recreation and has camping areas only accessable by boat.

Some characterization sampling was performed between 1975 and 1976 prior to the newer monitoring program. Generally there are two sample events a year, spring (April) and late summer (August). Since the start of the monitoring program, a water quality report is produced yearly to list results and address any concerns of the previous water year.

Generally Englebright Lake has a depth of greater than 150 feet during the sampling events, and is considered an oligotrophic lake when characterized by its clarity. Oligotrophic lakes are characterized by their higher and limited nutrient availability. An example of an oligotrophic lake is Lake Tahoe. On the opposite end of the spectrum are eutrophic lakes, which are characterized by their low clarity and higher nutrient concentrations. Mesotrophic lakes are those that have characteristics in between oligotrophic and eutrophic lakes. Most of the lakes monitored by the USACE are either eutrophic or mesotrophic, Englebright Lake is the only oligotrophic lake. Englebright Lake can has relatively high dissolved oxygen conditions (>5mg/L) at its bottom depths during warm late summer months. Because of its depth, Englebright Lake has the ability to stay cool (<20°C) in the late summer. Due to the low late summer temperatures and the sustained high concentration of dissolved oxygen, coldwater fish species could reliably survive in the lake year round. Coldwater fish various species of trout and salmon. Although clearer than eutrophic (nutrient rich) lakes, oligotrophic lakes can occationally have low water clarity due to algal blooms and suspended sediments. Water clarity is often measured in terms of Secchi Disc depth or SD (Appendix A). Historically, the water clarity in Englebright Lake is good with only ~ 4.8 % of the samples not meeting the recreational goal of 4 feet or greater (Figure 1). In 2001 the Spring SD measure was 16.08 feet and the late summer sample SD value was better at 16.75 feet.

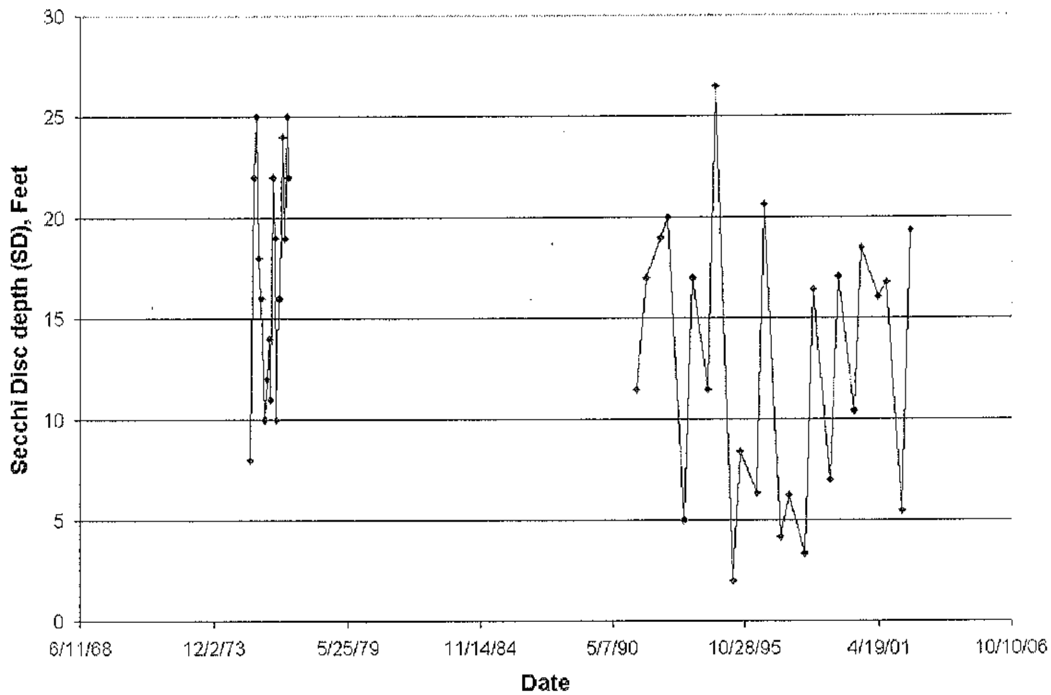

Figure 1. Historical Secchi Depth Values at Pine Flat Lake (2002 values included).

In 1999 the United States Geological Survey (USGS) began studies in and around Englebright Lake to examine levels of mercury contamination in fish. While they found most fish with mercury concentrations above the California Office of Environmental Health Hazard Assessment's (OEHHA) screening level of 0.3 ppm, none of the twenty-one fish they tested were above the FDA criteria for a fish advisory (1 ppm). The highest concentration found was 0.96 ppm mercury in one small mouth bass. The USGS has continued to monitor mercury at Englebright Lake, and are a good resource for future information.

In response to public concern about mercury, a regional television station (KOVR 13, Sacramento, Stockton, and Modesto) performed some investigative sampling for mercury in fish from Englebright Lake. While the trout they captured had relativlely low concentrations of mercury (0.2 ppm mercury), the two bass caught had a concentration of 1.2 ppm. Results from their bass tissue analysis exceed the FDA criteria for a fish advisory (1 ppm).

Fish monitored by the USACE in 2000 and 2001 resulted in concentrations below the OEHHA's screening level to continue monitoring (0.3 ppm mercury). Due to the findings by the USGS and local media, a more detailed sampling program is recommended.

The 2001 Water Quality Report listed only manganese concentrations at the bottom of the lake as a contaminant of concern at Englebright Lake. Since manganese has no fish criteria limit and only a secondary human MCL based on taste and water stains, manganese shouldn't have been listed as a contaminant of concern in previous reports.

III. Sample Summaries for this year.

Introduction

The following general summaries are split into their respective sample types. Each type of sample summary includes a discussion of both the spring (April) and late summer (August) samples to better examine trends within the current year. The types of parameters monitored this year include: Secchi Disc depths, water column profiles (temperature, DO and pH), phytoplankton characterization, metals concentrations, MTBE concentrations, and Inorganic characterization (alkalinity, phosphorous, nitrogen, etc..). Fish mercury concentrations were not obtained in 2002 due to the inability to successfully collect fish. For a more detailed explanation of the importance for each type of sample, please see Appendix A.

SECCHI DEPTH

The Secchi Disc depth (SD) values found during the spring sampling event were lower than the historical mean, while and late summer SD were higher (historical mean SD = 14.63 feet). More often the clarity is better in the late summer than in the spring. In spring the water clarity was low and the SD was 5.5 feet, which was worse than the previous year (2001 Spring SD = 16.08 feet). The late summer SD of 19.33 feet was above the previous years value (Summer 2001 SD = 16.75 feet) (Appendix B).

TEMPERATURE VALUES

The temperature profiles for Englebright Lake are indicative of a well stratified lake. Due to being deep, Englebright Lake is able to retain a cooler bottom water layer (hypolimnion) that buffers the lake from atmospheric temperature shifts. The difference in the depth of the lake between the spring and late summer sampling events was small (spring depth = 190.3 feet, late summer depth= 196.9 feet). Although the temperature of the water near the surface was considerably different (at 1 ft depth: Spring Temp. = 13.70 °C, Summer Temp. = 20.30 °C), the average temperatures were similar (spring average temp. = 8.3 °C, late summer average temp.= 10.3 °C). Due to having the ability to maintain a cool average temperature during the late summer, Englebright Lake is well suited to support coldwater fish species. For detailed results obtained during the sampling events, please see Appendix B.

DISSOLVED OXYGEN

The dissolved oxygen (DO) concentration don't greatly differ from spring to late summer. In spring, DO concentrations are 11.19 mg/L near the surface and 9.50 mg/L at the bottom of the lake. DO concentrations near the surface are above saturation, which is 10.46 mg/L at 13.7 °C. The concentration of oxygen near the surface of the lake is above saturation due to aquatic plant photosynthesis. DO concentrations in the late summer are lower than the spring values, but are still at high values (>5 mg/L). During the summer the DO concentration near the surface was 7.82 mg/L and lowered towards the bottom of the lake to a minimum of 7.03 mg/L. Fish species that require greater than 5 mg/l DO at cooler water temperatures (< 20°C) should be able to survive year-round at Englebright Lake. For detailed results obtained during the sampling events, please see Appendix B.

PH LEVELS

In the spring sample event, pH values in the lake were slightly basic (pH = ~7.7) throughout the water column. The pH values in the late summer profile varied widely. The pH was basic towards the upper waters (max pH = 8.41) and less basic at the bottom (pH bottom = 7.53). The lower pH values at the bottom of the lake increase the likelihood that higher soluble metal concentrations will be seen. For detailed results obtained during the sampling events, please see Appendix B.

PHYTOPLANKTON

In the spring sample, the algal.biomass within the lake was similar (Biomass = 165.73 ug/L) to spring 2001 (2001 Spring biomass = 224.56 ug/L). In spring 2001 cryptomonads were the most dominants species and in Spring 2002 diatoms were the most dominant. The late summer phytoplankton biomass was similar in 2002 (2002 Summer Biomass = 44.05 ug/L) and 2001 (2001 Summer Biomass = 63.88 ug/L). Several species were visible in the summer sample with the dinoflagellates the most numerous. For detailed results obtained during the 2002 sampling events, please see Appendix C.

METALS

Two samples exceeded the maximum contaminant level (MCL) or the freshwater fishery criteria for dissolved lead and manganese during either the 2002 spring and summer sampling events. An elevated concentration of lead (2.6 ppb) was found in a sample of water flowing into the lake. The concentration of lead in the sample was estimated to be greater than the suggested aquatic life continuous concentration of 2.5 ppb. Manganese concentrations continue to remain high near the bottom of the lake. A value of 100 ppb Mn was found at the bottom of the lake during the 2002 late summer sampling event. Since manganese has no fish criteria limit and only a secondary human MCL (50 ppb) based on taste and water stains, manganese isn't a contaminant of concern in Englebright Lake.

Contaminants will continue to be monitored in the coming year for any changes. For detailed results obtained during the sampling events, please see Appendix D.

MTBE

Concentrations for MTBE around the lake increased from the spring to the late summer sampling events. MTBE concentrations around the lake were found to be 3 ppb during the spring, but then increased to 10 ppb during the late summer. No health impacts have been associated with concentrations of MTBE similar to those found in the lake. For detailed results obtained during the sampling events, please see Appendix F.

INORGANIC ANALYSIS

The spring and summer sample results were within expected ranges and levels. For detailed results obtained during the 2002 sampling events, please see Appendix E.

IV. Conclusions

Englebright Lake is a deep stratified oligotrophic lake that can comfortably support many fish species. Coldwater fish that require temperatures below 20°C and dissolved oxygen concentrations greater than 5 mg/L should do well in the lake. Water clarity in Englebright Lake during the 2002 sampling events was well above the 4 feet recreational goal.

In the 2002 Englebright Lake sampling events lead was found to exceed the aquatic health limit for fish. A high lead concentration (2.6 ppb) was found in water flowing into Englebright Lake.

During the late summer sampling event, higher concentrations of MTBE (10 ppb) were found in lake samples. While no health issues are associated with the concentration, the value is worth noting for future concerns.

Due to the recent concerns about mercury within Englebright Lake, an increased effort will be made to collect fish out of the lake for analysis. Although the USACE aquatic mercury concentrations over the last several years have been low, USGS and local media results have indicated an ongoing problem. A more detailed fish monitoring program is recommended for Englebright Lake. Additionally, greater effort should also be made to coordinate with USGS personnel doing research at the lake.

V. References

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May, J.T., R.L. Hothem, C.N. Alpers, and M.A. Law. (2000) *Mercury Bioaccumulation in Fish in a Region Affected by Historic Gold Mining: The South Yuba River, Deer Creek, and Bear River Watersheds, California, 1999.* USGS open file report 00-367

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Welch, E.B. (1992) *Ecological Effects of Wastewater: Applied limnology and pollutant effects,* Chapman and Hall, Cambridge University Press, Great Britain.

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VI. Appendices

Appendix A: Glossary of Sample Types

Glossary of Sample Types

This glossary of sample types is intended to provide a general background and indicate the importance of each sample in determining water quality. These are meant to be brief and basic. If a further explanation is desired please refer to the list of references provided in this report.

Secchi Depth

One of the oldest and easiest methods to determine lake clarity is the Secchi depth (SD). The Secchi depth is determined by dropping a Secchi disc into a water body and determining the depth that it is last visible from the surface of the water. Secchi discs are generally white and 20 cm in diameter. Secchi depth values are most impacted by the light intensity at the time of sampling and the scattering of light by solid particulates within the water column. Algal growth (phytoplankton) and sediment re-suspension are often major constituents of solid particulates within the water column. Secchi depth values can be used to estimate the Trophic state or the nutrient levels within the lake. The more nutrients are available, the larger likelihood of algal blooms that limit water clarity. Due to recreational concerns for safety, the goal for Secchi depth values is four feet or greater.

Temperature Profiles and Data Points

The temperature profile of a lake provides information how a lake is operating and the potential for aquatic biota to live within the lake. The temperature profile is a direct indicator if a lake is stratified. Stratification in lakes is created generally by temperature affecting the density of water molecules. Stratification is usually indicated by a region of similar temperature nearer the surface of the water (epilimnion), then a region of temperature transition (metalimnion), to another layer of nearly constant temperature at the bottom of the lake (hypolimnion). Each layer in a stratified lake is important, but the existence of a hypolimnion can drastically impact how well a lake can handle warmer temperatures such as those found in northern California during the summer. The hypolimnion acts as a buffer against large temperature shifts. The nature of dam operation is that water is discharged near the bottom, releasing the hypolimnion, and eliminating stratification. This operation limits the ability of reservoirs to regulate their temperature during the summer months. Stratification isn't always desirable. When a lake isn't stratified and is instead well mixed, the required nutrients near the bottom of the lake become available to phytoplankton for growth. Temperatures within lakes also indicate which species of fish will survive within a lake. Coldwater species of fish require temperatures below 20 degrees C in order to spawn and survive. If a lake is often above 20 degrees C, then only warmwater fish species will survive.

Dissolved Oxygen (DO) Concentration Profiles

DO is required by organisms for respiration and for chemical reactions within lake waters. The recommended level for DO for most aquatic species survival is 5mg/L. In lakes, biota waste (detritus) falls to the bottom of the lake to be utilized by bacteria. The bacteria need oxygen and will deplete levels near the bottom of a lake, especially during warm temperature, high respiration conditions. For nutrient rich (eutrophic) lakes more organisms will grow, create wastes, and cause oxygen depleted regions at the lowest areas. Under these conditions only aquatic species that can survive low DO conditions in warm water near the surface will survive.

PH Profiles

The pH profiles of the lakes indicate the potential for certain chemical reactions to occur. In high pH (greater than pH = 7 or basic) aquatic systems, metal pollutants tend to form into insoluble compounds that fall onto the lake floor. In low pH (less than pH = 7 or acidic) systems or areas metal ions become soluble and available for uptake into aquatic organisms. Other compounds like ammonia that are introduced into a low pH aquatic environment will transform into soluble nitrate and be utilized by organisms.

Phytoplankton Analysis

Phytoplankton analysis indicates the health, nutrients, and biodiversity within a lake. Lakes that have few nutrients available (Oligotrophic) will generally have a much lower quantity of phytoplankton (high Secchi depth) but the number of phytoplankton species seen will be large. In a lake that is nutrient rich (eutrophic) there are generally large phytoplankton blooms (low Secchi depth), but they are made up of a couple of phytoplankton species. Certain species of phytoplankton are preferred food sources for zooplankton (small invertebrates). Generally species like diatoms and green algae can be consumed by the filter-feeding zooplankton, but species like bluegreen algae are low in nutrients and are difficult to consume. Some species like the dinoflagellates can grow horn like points to discourage potential predators. In nutrient rich waters where there is plenty of phosphorous, nitrogen can be limited for biological growth. While most species can't grow due to the lack of nitrogen, bluegreen algae (cyanobacteria) have the ability to utilize nitrogen from the atmosphere when required. This gives bluegreen algae the ability to dominate in many eutrophic lakes.

Soluble Metals Analysis

The soluble metals analysis indicates the exposure of humans and aquatic organisms to toxic metals. These metals often build up as they are consumed through the food chain. Water samples provide an indicator for additional problems. Soluble forms of metal ions are more prevalent in low pH (pH <7, or acidic) environments.

MTBE Analysis

MTBE (methyl tertiary-butyl ether) is a chemical additive to gasoline to improve combustion. Due to its high solubility, MTBE travels and blends into aquatic systems rapidly. While not found to be extremely hazardous at low levels, the offensive smell and taste is detectible by humans at extremely low concentrations. The effect of MTBE on humans and aquatic systems is still under investigation.

Inorganic Analysis

Alkalinity

Alkalinity is measured in terms of mg/L of calcium carbonate. It indicates a lakes ability to buffer incoming acidic pollution and situational changes.

Ammonia

Ammonia is a gas that is toxic to fish and is more visible at a higher pH. Ammonia is created through anthropogenic inputs, bacteria cell respiration, and the decomposition of dead cells. Due to being a gas, given time ammonia will volatilize from the water. At a lower pH, much of the ammonia is converted to ammonium (a nutrient for root bound plant life) and utilizes DO in the nitrification process.

Chloride

The chloride ion is an indicator of any salinity increases within a lake. Most fresh water aquatic species are sensitive to salinity changes.

Nitrate

Nitrate is the nitrogen product created through the nitrification of ammonium. Nitrate is a soluble form of the nutrient nitrogen and is utilized by phytoplankton.

Total Phosphorous

The total phosphorous provides a measure of both utilized and soluble phosphorous within water samples. Phosphorous is a required nutrient for plant growth and development.

Ortho Phosphorous

Ortho phosphorous is the soluble form of phosphorous that is utilized by free-floating aquatic plants (phytoplankton).

Kjeldahl N

Kjeldahl nitrogen or total Kjeldahl nitrogen (TKN) is a measure of the total concentration of nitrogen in a sample. This includes ammonia, ammonium, nitrite, nitrate, nitrogen gas, and nitrogen contained within organisms.

COD

Chemical Oxygen Demand (COD) is a measure of the total oxygen required to complete the chemical and biological demands of a sample.

Fish Tissue Analysis

Fish tissue is analyzed to examine potential exposure of humans to toxicants as well as the health of the aquatic food chain. In aquatic systems toxic contaminants can build up (or bioaccumulate) within animals at the top of the food chain. Contaminants (especially organic pollutants) are retained within the fat tissue of an organism, therefore in fish samples the lipid content is often measured.

Lake Code Designation

Laboratory Reports are provided in the previous sections.

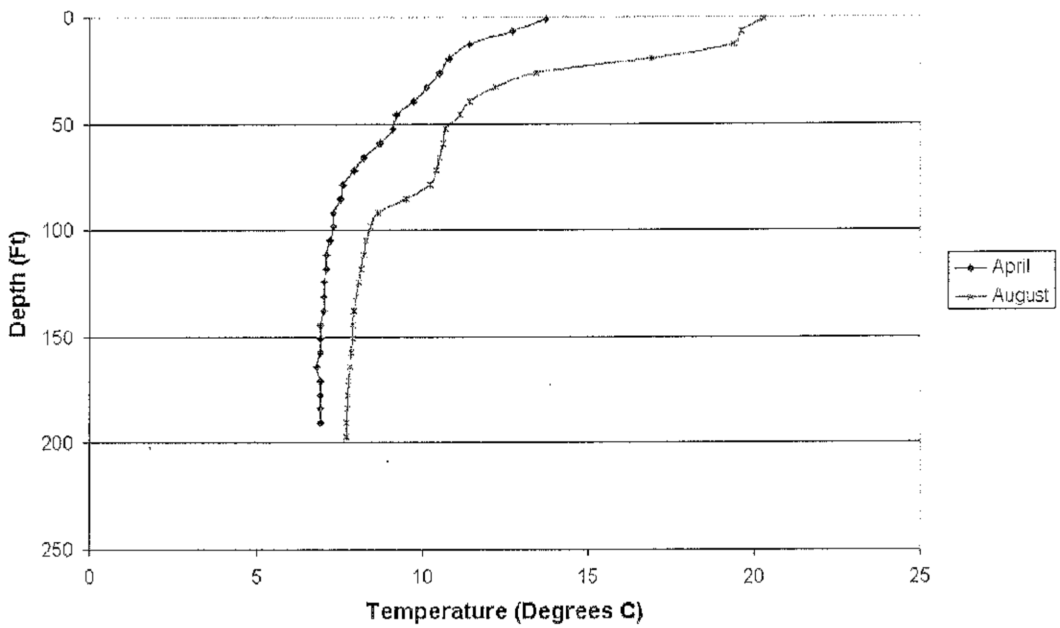
Sample ID is "XX-YY-ZZ" where

XX designation:	YY designation	ZZ designation
BB for Black Butte	SP for Spring	S for surface of Lake
EA for Eastman	SU for Summar	B for bottom of Lake
EN for Englebright		I-1 for inflow1
HE for Hensley		I-2 for inflow 2
IS for Isabella		O for outflow
KA for Kaweah		
ME for Mendocino		
MC for Martis Creek		
NH for New Hogan		
PF for Pine Flat		
SO for Sonoma		
SU for Success		

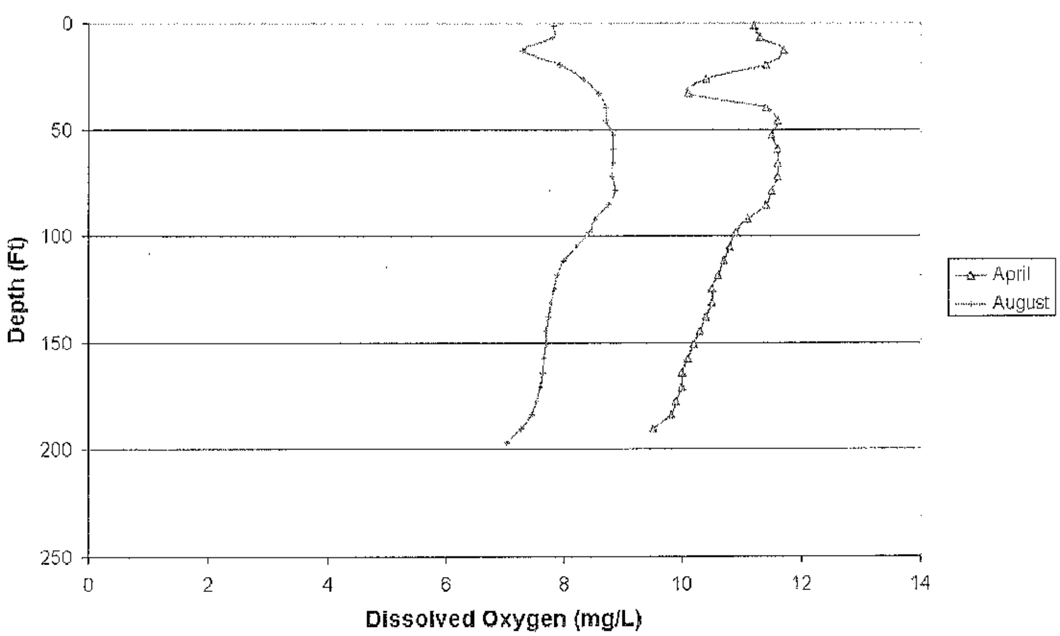
Example: BB-SU-S is for a water sample taken from Black Butte in the Summer on the Lake's Surface.

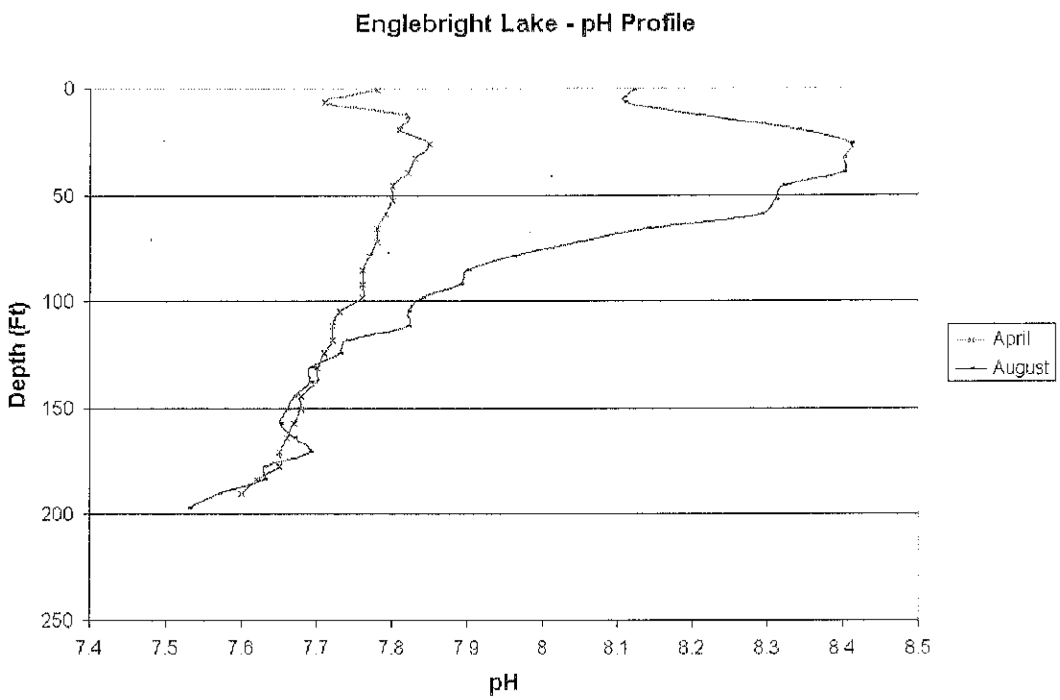
Appendix B: Profile Data and Charts (Secchi Disc, Temperature, DO, and pH)

Englebright Lake - Temperature Profile



Englebright Lake - Dissolved Oxygen Profile

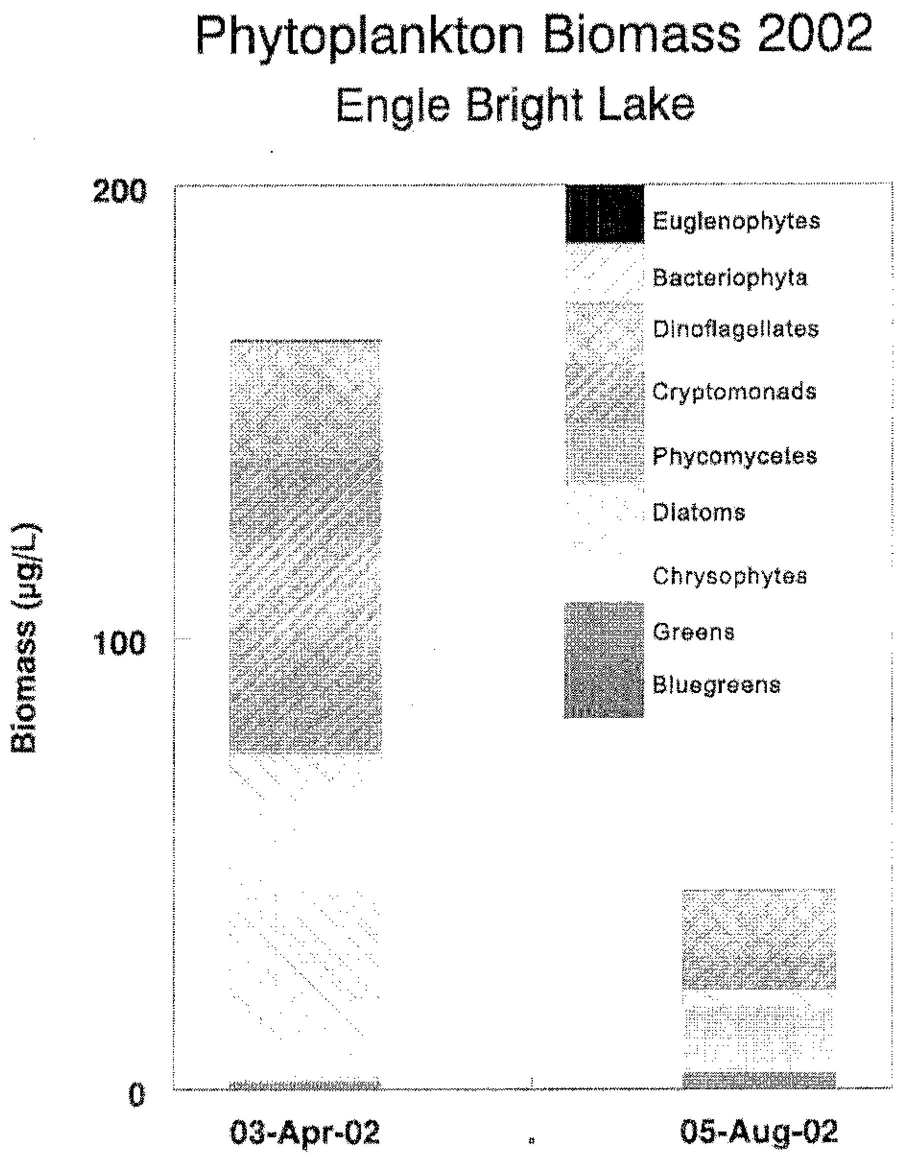



Englebright Lake - pH Profile
Depth (Ft)
0
50
100
150
200
250
7.4
7.5
7.6
7.7
7.8
7.9
8
8.1
8.2
8.3
8.4
8.5
pH
April
August

ENGLEBRIGHT					
Sample Location: Behind dam				**Date:** 4/03/02	
Observers: Tim McLaughlin				**Time:** 10:45 am	
Lake Elevation:					
Weather Conditions:					
Wind Speed: 0		**Precipitation:** 0		**Temp (F):** 75	
SECCHI Depth: 5 feet and 6 inches					
Depth-M	**Depth-F**	**Temp-C**	**Cond**	**DOmg/L**	**pH**
58.3	190.3	6.90	58	9.50	7.60
56	183.7	6.90	47	9.80	7.62
54	177.2	6.90	47	9.90	7.65
52	170.6	6.90	47	10.00	7.65
50	164.1	6.80	47	10.00	7.66
48	157.5	6.90	47	10.10	7.67
46	150.9	6.90	47	10.20	7.68
44	144.4	6.90	47	10.30	7.68
42	137.6	7.00	47	10.40	7.70
40	131.2	7.00	46	10.50	7.70
38	124.7	7.00	46	10.50	7.71
36	118.1	7.10	46	10.60	7.72
34	111.5	7.10	45	10.70	7.72
32	105.0	7.20	45	10.80	7.73
30	98.4	7.30	43	10.90	7.76
28	91.9	7.30	44	11.10	7.76
26	85.3	7.50	43	11.40	7.76
24	78.7	7.60	43	11.50	7.77
22	72.2	7.90	43	11.60	7.78
20	65.6	8.20	41	11.60	7.78
18	59.1	8.70	43	11.60	7.79
16	52.5	9.10	43	11.50	7.80
14	45.9	9.20	43	11.60	7.80
12	39.4	9.70	43	11.40	7.82
10	32.8	10.10	43	10.10	7.83
8	26.2	10.50	43	10.40	7.85
6	19.7	10.80	43	11.40	7.81
4	13.1	11.40	44	11.70	7.82
2	6.6	12.70	43	11.30	7.71
0.03	1.0	13.70	44	11.19	7.78
NORTH FORK YUBA (Inflow)					
Temp (F)	**pH**		**DOmg/L**	**EC**	**flow rate (cfs**
46.9	7.52		-	-	-
SOUTH FORK YUBA (Inflow)					
Temp (F)	**pH**		**DOmg/L**	**EC**	**flow rate (cfs**
57.3	7.68		-	-	-
VISUAL OBSERVATIONS: Water very cloudy.					

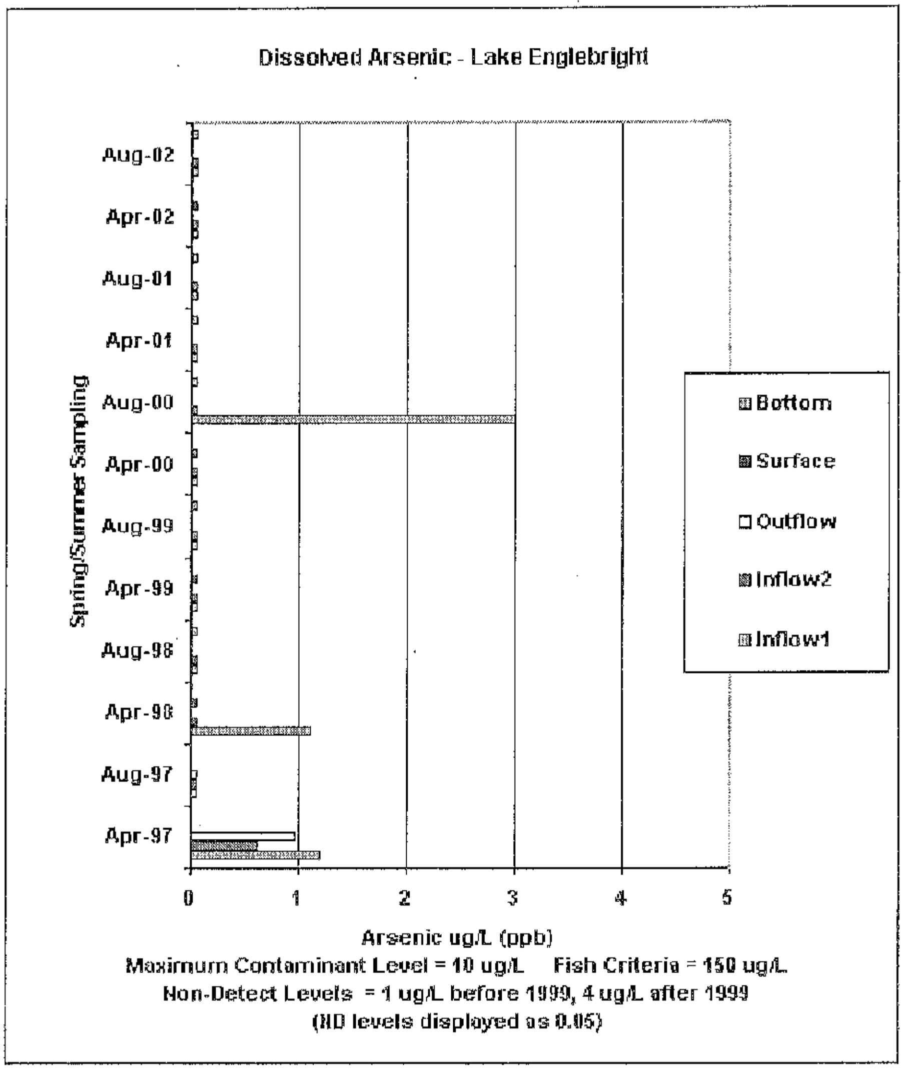
ENGLEBRIGHT					
Sample Location: Behind dam				**Date:** 8/05/02	
Observers: Tim McLaughlin				**Time:** 10:35 am	
Lake Elevation: 518.95					
Weather Conditions:					
Wind Speed: 5		**Precipitation:** 0		**Temp (F):** 80	
SECCHI Depth: 19 feet and 4 inches					
Depth-M	**Depth-F**	**Temp-C**	**Cond**	**DOmg/L**	**pH**
59.9	196.9	7.7	83	7.03	7.53
58	190.3	7.70	82	7.27	7.57
56	183.7	7.72	81	7.46	7.63
54	177.2	7.75	80	7.54	7.63
52	170.6	7.78	80	7.60	7.69
50	164.1	7.80	80	7.64	7.67
48	157.5	7.84	80	7.65	7.65
46	150.9	7.86	80	7.69	7.66
44	144.4	7.88	80	7.70	7.67
42	137.6	7.91	80	7.73	7.69
40	131.2	7.99	79	7.78	7.69
38	124.7	8.05	79	7.83	7.73
36	118.1	8.12	79	7.88	7.74
34	111.5	8.21	79	8.00	7.82
32	105.0	8.26	79	8.19	7.82
30	98.4	8.40	79	8.43	7.84
28	91.9	8.62	77	8.53	7.89
26	85.3	9.49	77	8.74	7.90
24	78.7	10.20	77	8.86	7.96
22	72.2	10.40	76	8.81	8.05
20	65.6	10.50	76	8.82	8.14
18	59.1	10.60	76	8.83	8.29
16	52.5	10.70	76	8.83	8.31
14	45.9	11.10	76	8.70	8.32
12	39.4	11.40	76	8.70	8.40
10	32.8	12.20	76	8.58	8.40
8	26.2	13.40	77	8.31	8.41
6	19.7	16.90	78	7.92	8.34
4	13.1	19.40	80	7.29	8.21
2	6.6	19.60	80	7.79	8.11
0.03	1.0	20.30	80	7.82	8.12
NORTH FORK YUBA (Inflow)					
Temp (F)	**pH**		**DOmg/L**	**EC**	**flow rate (cfs**
48.8	8.17		-	-	-
SOUTH FORK YUBA (Inflow)					
Temp (F)	**pH**		**DOmg/L**	**EC**	**flow rate (cfs**
69.8	8.04		-	-	-
VISUAL OBSERVATIONS: Water clear.					

Appendix C: Phytoplankton Data and Charts

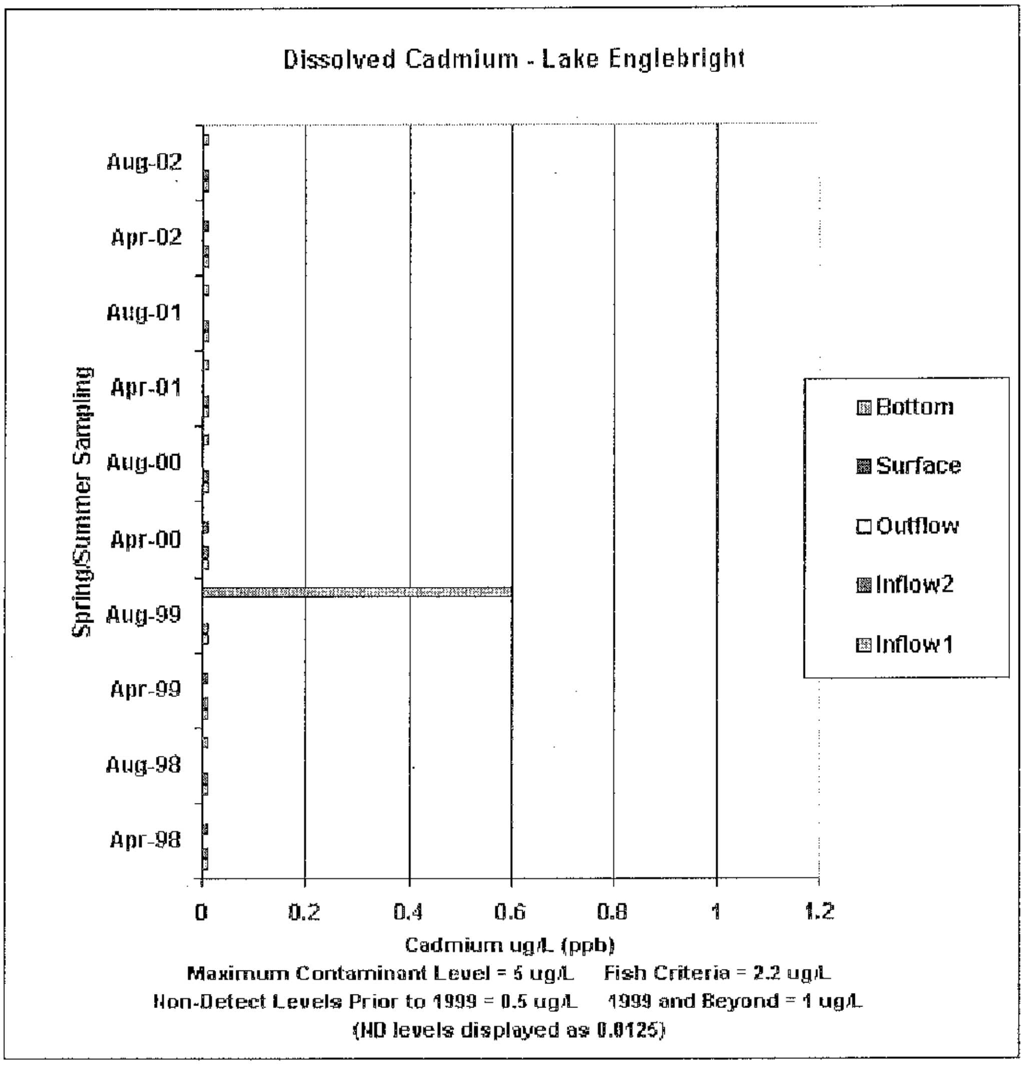


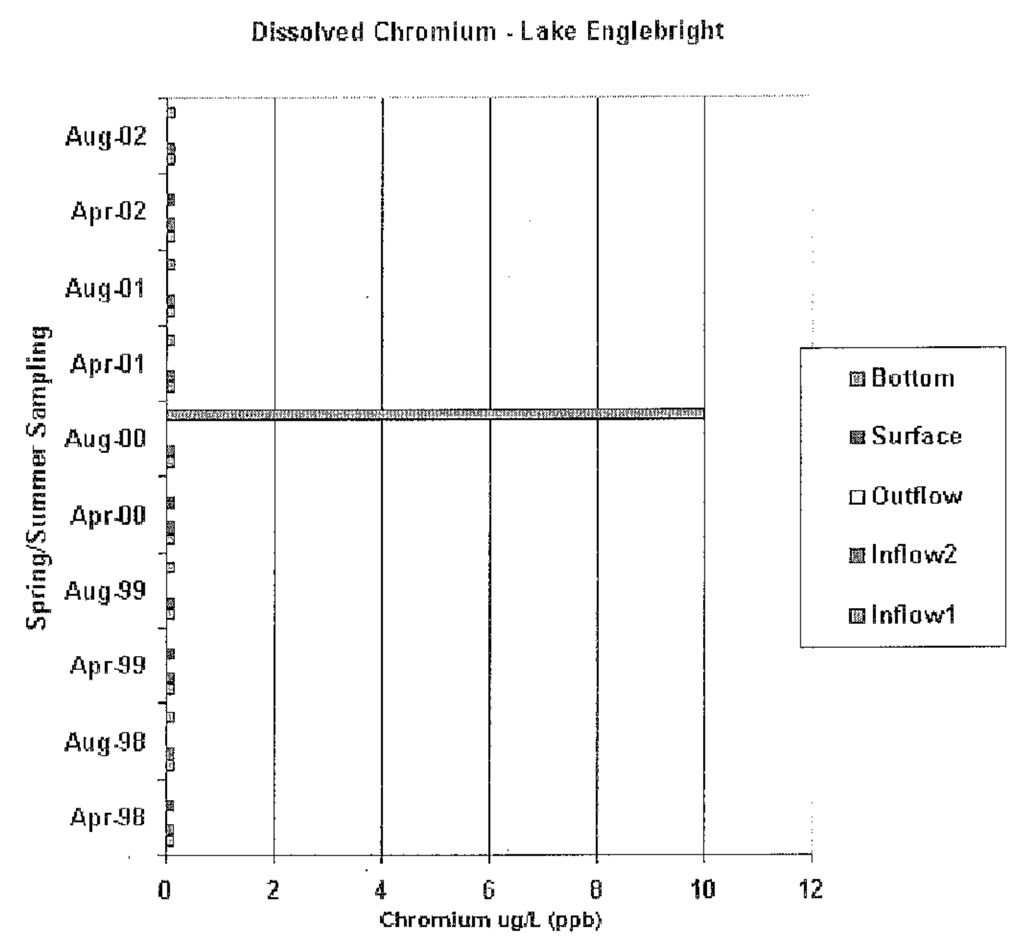
Phytoplankton Biomass 2002
Engle Bright Lake
200
100
0
Biomass (µg/L)
Euglenophytes
Bacteriophyta
Dinoflagellates
Cryptomonads
Phycomycetes
Diatoms
Chrysophytes
Greens
Bluegreens
03-Apr-02
05-Aug-02

Appendix D: Metals Data and Charts

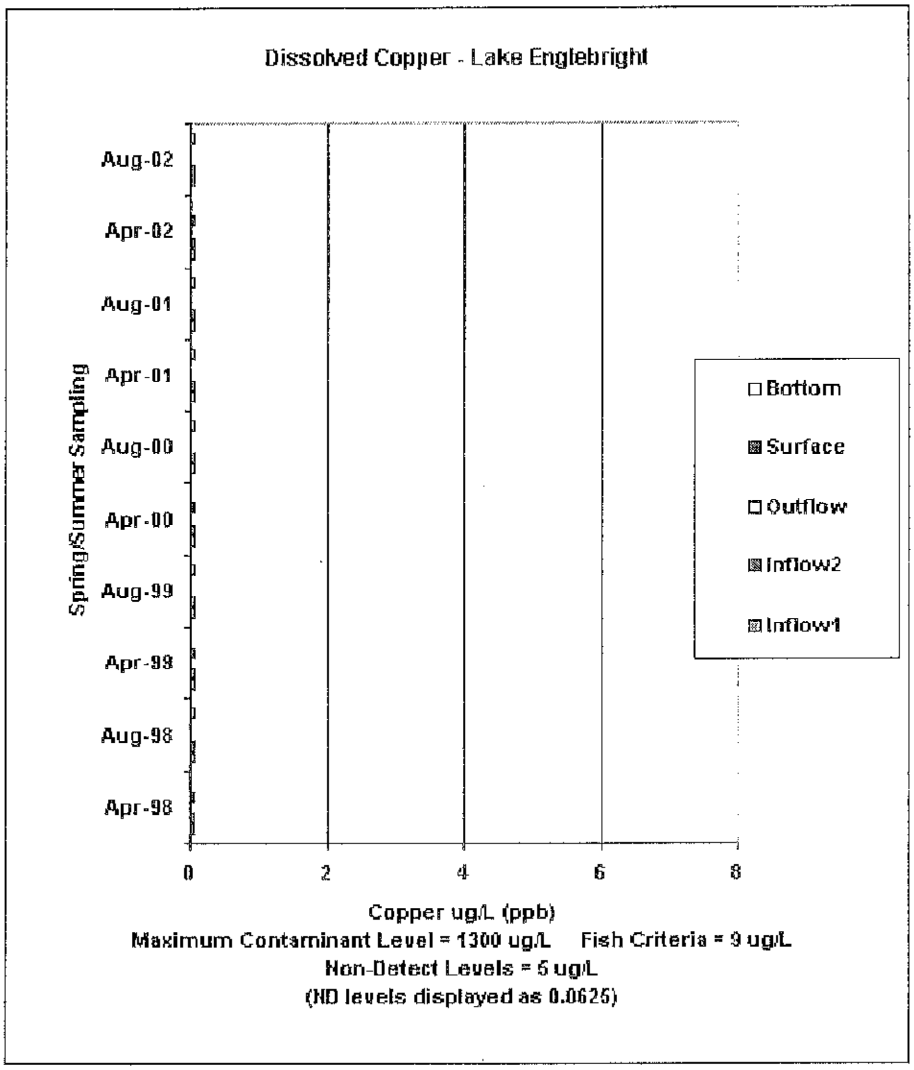


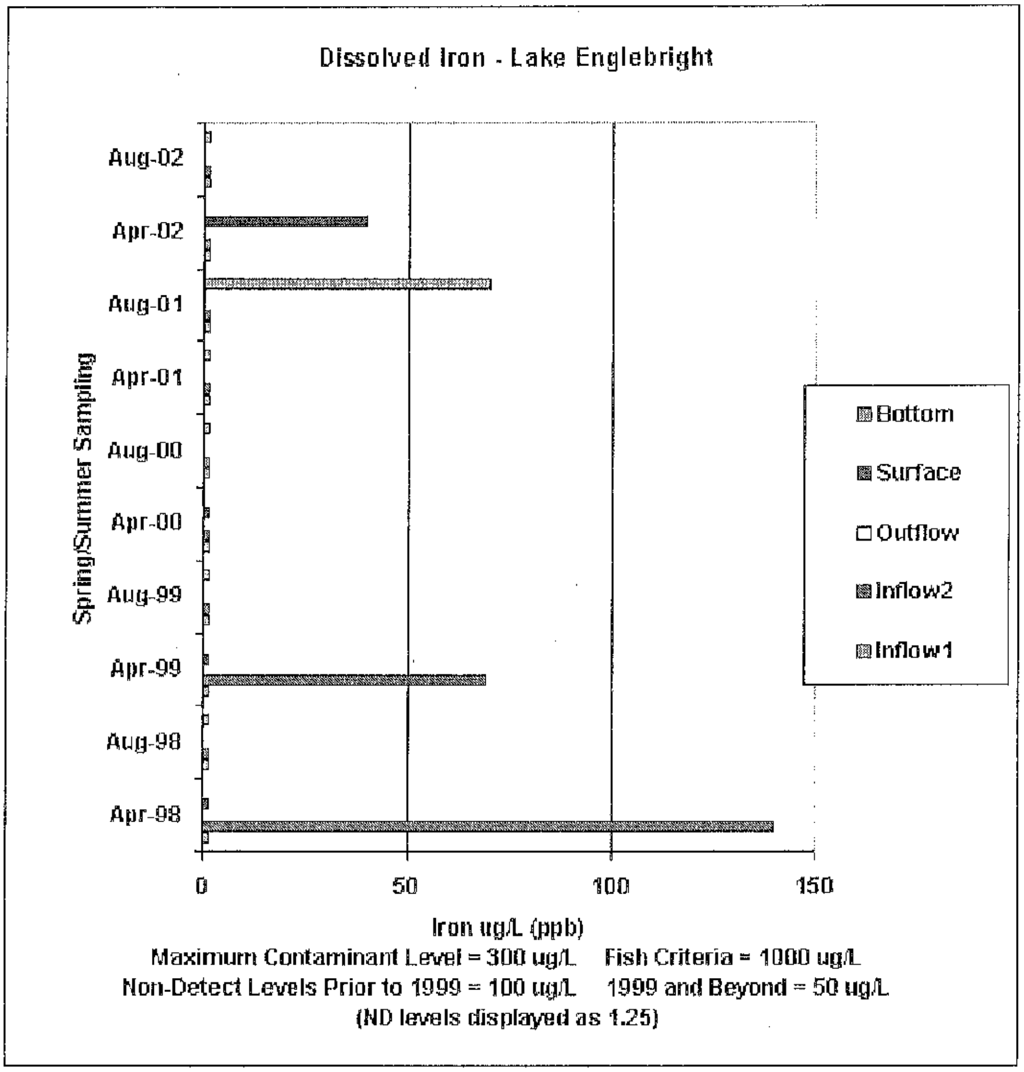
Dissolved Arsenic - Lake Englebright
Aug-02
Apr-02
Aug-01
Apr-01
Aug-00
Apr-00
Aug-99
Apr-99
Aug-98
Apr-98
Aug-97
Apr-97
Spring/Summer Sampling
Bottom
Surface
Outflow
Inflow2
Inflow1
0
1
2
3
4
5
Arsenic ug/L (ppb)
Maximum Contaminant Level = 10 ug/L Fish Criteria = 150 ug/L
Non-Detect Levels = 1 ug/L before 1999, 4 ug/L after 1999
(ND levels displayed as 0.05)

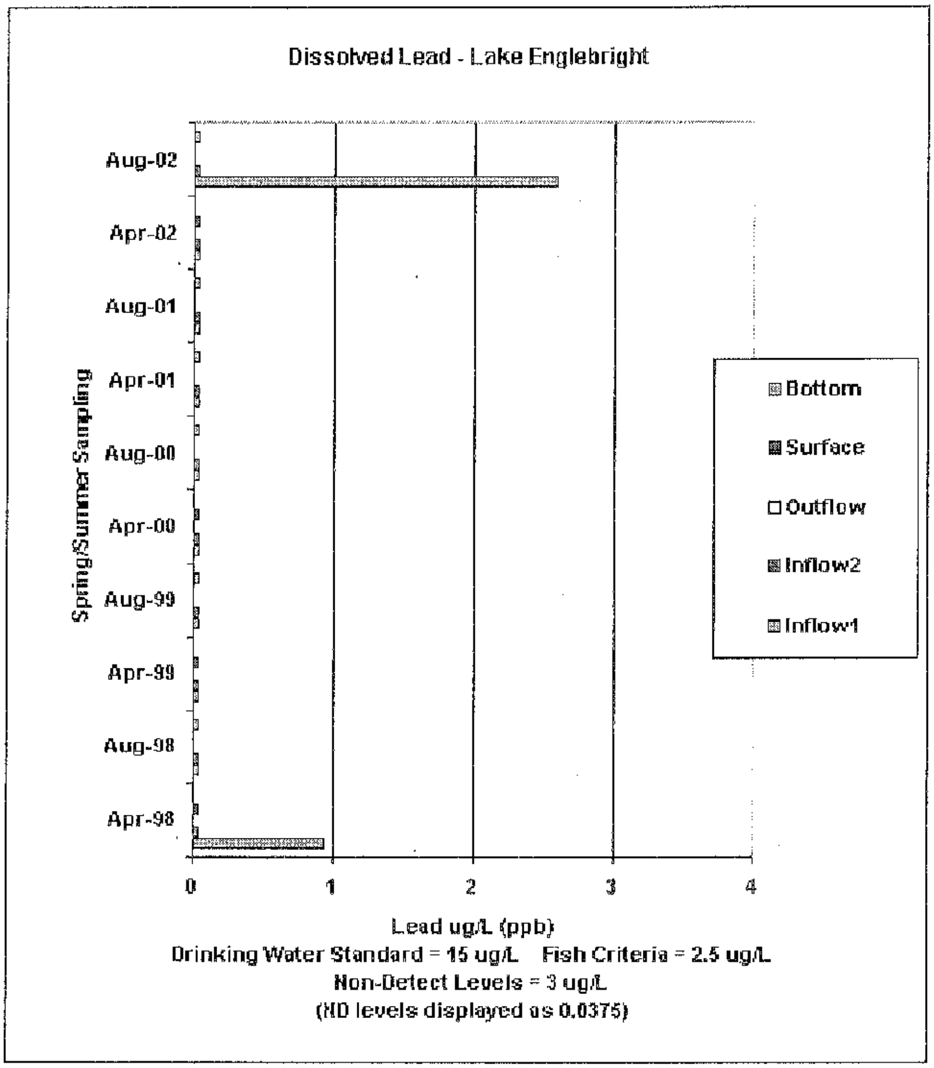

Dissolved Cadmium - Lake Englebright
Spring/Summer Sampling
Aug-02
Apr-02
Aug-01
Apr-01
Aug-00
Apr-00
Aug-99
Apr-99
Aug-98
Apr-98
0
0.2
0.4
0.6
0.8
1
1.2
Bottom
Surface
Outflow
Inflow2
Inflow1
Cadmium ug/L (ppb)
Maximum Contaminant Level = 5 ug/L Fish Criteria = 2.2 ug/L
Non-Detect Levels Prior to 1999 = 0.5 ug/L 1999 and Beyond = 1 ug/L
(ND levels displayed as 0.0125)

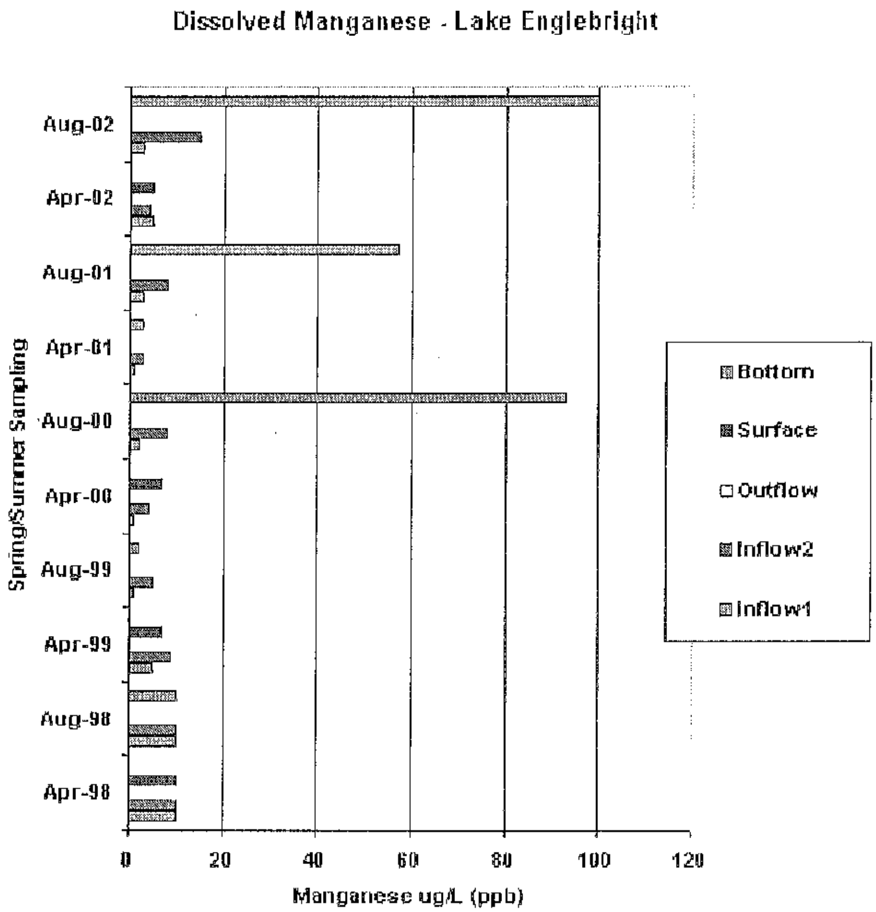


Maximum Contaminant Level = 50 ug/L   Fish Criteria = 11 ug/L
Non-Detect Levels Prior to 1999 = 10 ug/L   1999 and Beyond = 5 ug/L
(ND levels displayed as 0.125)

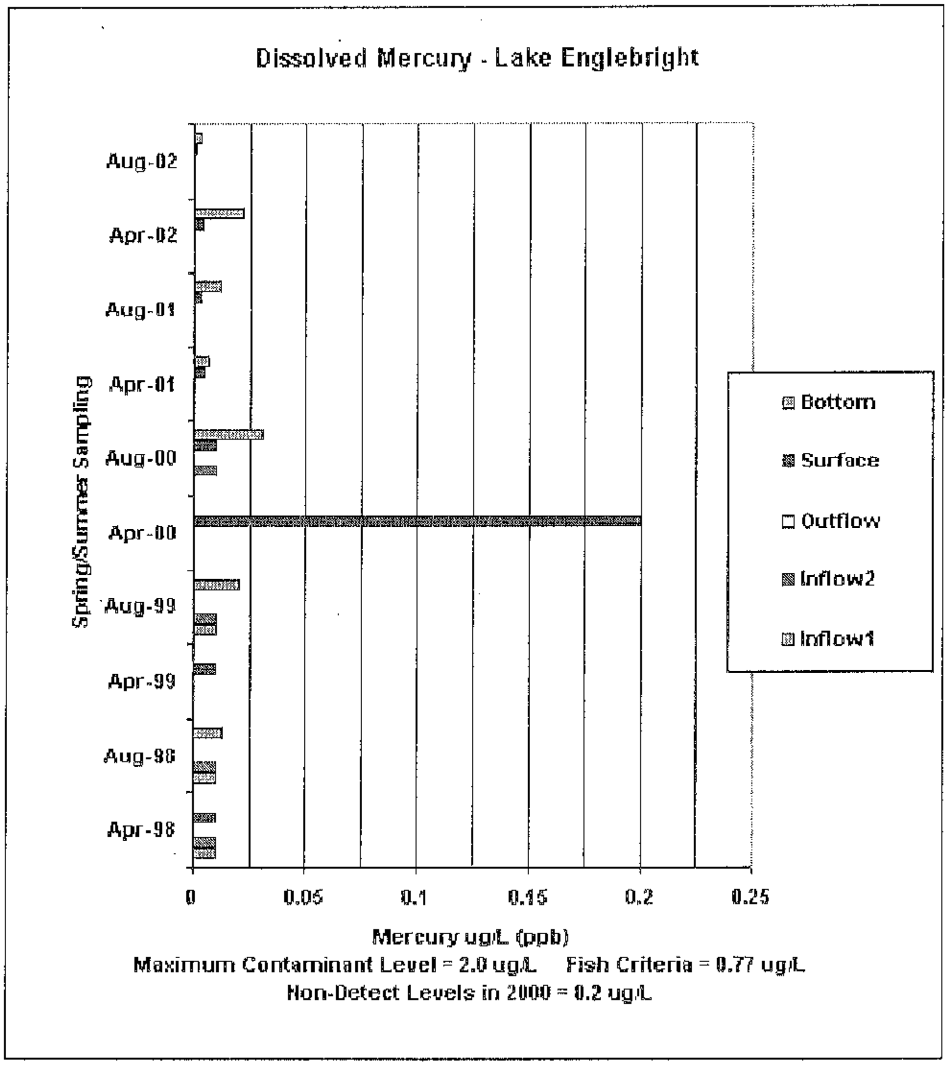

Dissolved Copper - Lake Englebright
Spring/Summer Sampling
Aug-02
Apr-02
Aug-01
Apr-01
Aug-00
Apr-00
Aug-99
Apr-99
Aug-98
Apr-98
0
2
4
6
8
Bottom
Surface
Outflow
Inflow2
Inflow1
Copper ug/L (ppb)
Maximum Contaminant Level = 1300 ug/L Fish Criteria = 9 ug/L
Non-Detect Levels = 5 ug/L
(ND levels displayed as 0.0625)


Dissolved Iron - Lake Englebright
Aug-02
Apr-02
Aug-01
Apr-01
Aug-00
Apr-00
Aug-99
Apr-99
Aug-98
Apr-98
Spring/Summer Sampling
0
50
100
150
Iron ug/L (ppb)
Bottom
Surface
Outflow
Inflow2
Inflow1
Maximum Contaminant Level = 300 ug/L Fish Criteria = 1000 ug/L
Non-Detect Levels Prior to 1999 = 100 ug/L 1999 and Beyond = 50 ug/L
(ND levels displayed as 1.25)

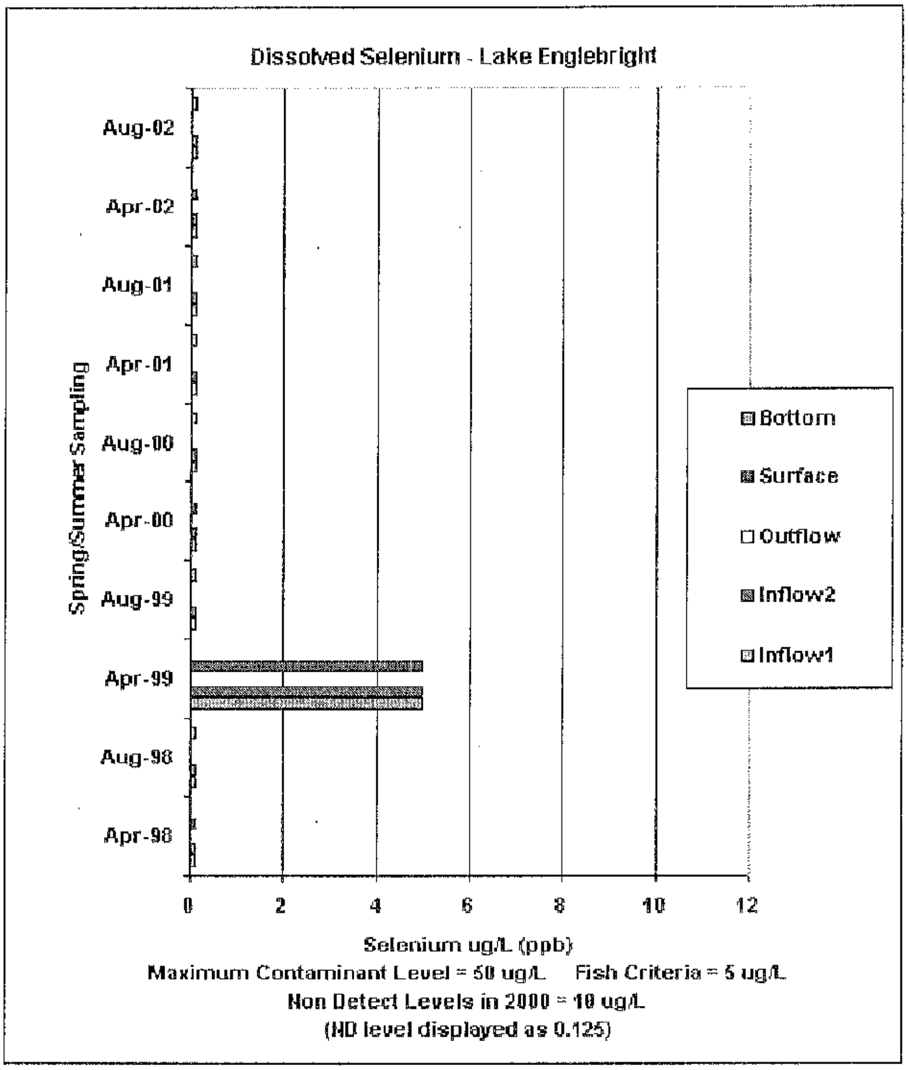

Dissolved Lead - Lake Englebright
Aug-02
Apr-02
Aug-01
Apr-01
Aug-00
Apr-00
Aug-99
Apr-99
Aug-98
Apr-98
Spring/Summer Sampling
0
1
2
3
4
Bottom
Surface
Outflow
Inflow2
Inflow1
Lead ug/L (ppb)
Drinking Water Standard = 15 ug/L Fish Criteria = 2.5 ug/L
Non-Detect Levels = 3 ug/L
(ND levels displayed as 0.0375)



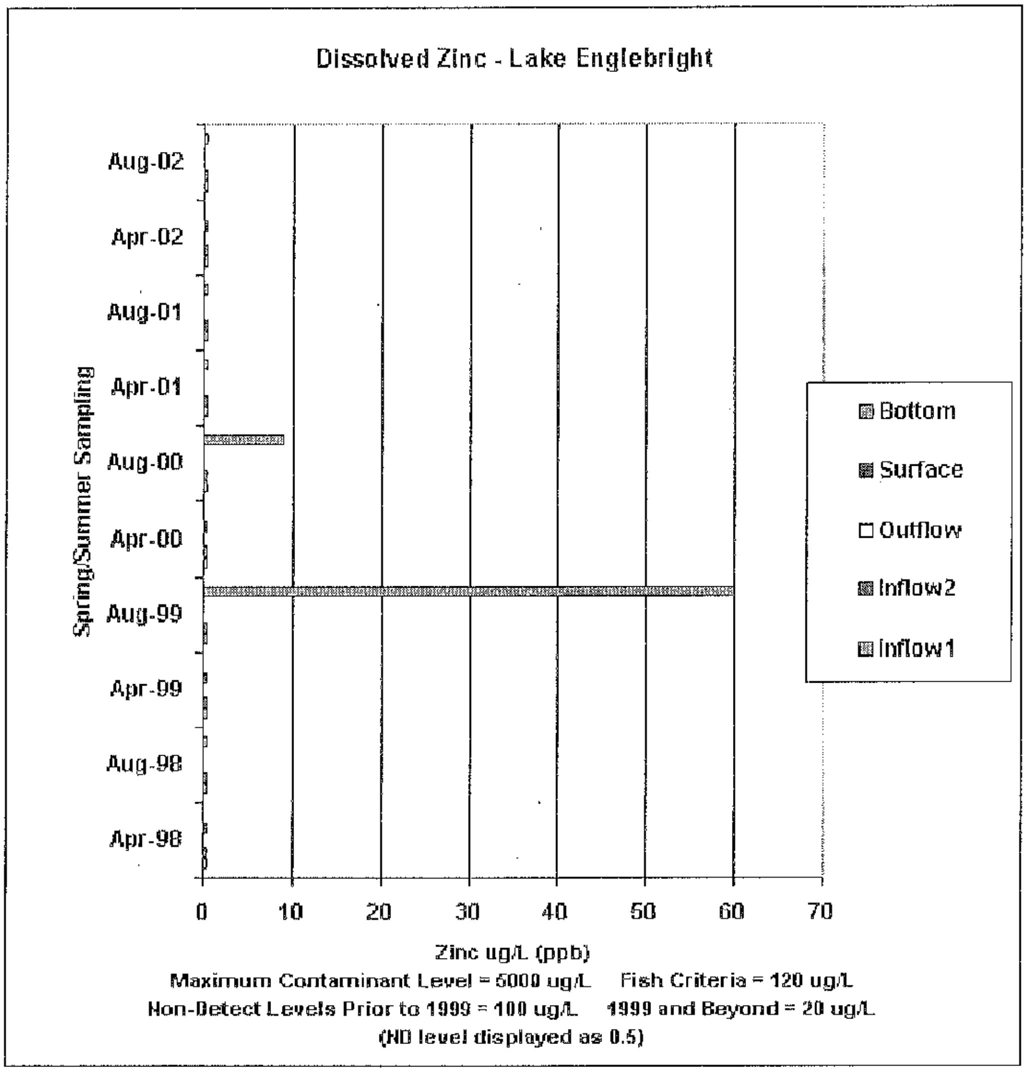
Maximum Contaminant Level = 50 ug/L   Fish Criteria = none
Non-Detect Levels = 5 ug/L
(No modification of scale)



Dissolved Mercury - Lake Englebright
Aug-02
Apr-02
Aug-01
Apr-01
Aug-00
Apr-00
Aug-99
Apr-99
Aug-98
Apr-98
Spring/Summer Sampling
0
0.05
0.1
0.15
0.2
0.25
Bottom
Surface
Outflow
Inflow2
Inflow1
Mercury ug/L (ppb)
Maximum Contaminant Level = 2.0 ug/L Fish Criteria = 0.77 ug/L
Non-Detect Levels in 2000 = 0.2 ug/L



Dissolved Selenium - Lake Englebright
Spring/Summer Sampling
Aug-02
Apr-02
Aug-01
Apr-01
Aug-00
Apr-00
Aug-99
Apr-99
Aug-98
Apr-98
Bottom
Surface
Outflow
Inflow2
Inflow1
0
2
4
6
8
10
12
Selenium ug/L (ppb)
Maximum Contaminant Level = 50 ug/L Fish Criteria = 5 ug/L
Non Detect Levels in 2000 = 10 ug/L
(ND level displayed as 0.125)


Dissolved Zinc - Lake Englebright
Aug-02
Apr-02
Aug-01
Apr-01
Aug-00
Apr-00
Aug-99
Apr-99
Aug-98
Apr-98
Spring/Summer Sampling
0
10
20
30
40
50
60
70
Zinc ug/L (ppb)
Maximum Contaminant Level = 5000 ug/L Fish Criteria = 120 ug/L
Non-Detect Levels Prior to 1999 = 100 ug/L 1999 and Beyond = 20 ug/L
(ND level displayed as 0.5)
Bottom
Surface
Outflow
Inflow2
Inflow1

Appendix E: Inorganic Sample Data

Inorganic Results (mg/L) For surface lake waters (spring)												
	BB	EA	EN	HE	IS	KA	MC	ME	NH	PF	SO	SU
Alkalinity		60	40	50	60	30	40	70	80	20		100
Ammonia		<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1
Chloride		21	2	21	4	4	3	<1	6	5		4
Nitrate		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1		<0.1
Total P		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1
Ortho P	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1
Sulfate		5.3	2.6	4.2	8.9	2	1	8.2	9	2.1		4.7
Kjeldahl N		0.6	0.1	0.4	0.2	<0.1	0.3	0.2	0.2	0.2		<0.1
COD					<50							
Tot Solids		120	70	100	110	60	78	100	120	21		150

Inorganic Results (mg/L) For inlet waters to the lakes (spring) (I-1 only)												
	BB	EA	EN	HE	IS	KA	MC	ME	NH	PF	SO	SU
Alkalinity	100	70	40	50	20	30	40	80	90	10	100	50
Ammonia	<0.1	<0.1	<0.1	<0.1	<0.1.		0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chloride	13	25	3	21	<1	<1	4	<1	6	4	3	2
Nitrate	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1
Total P	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ortho P	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	
Sulfate	18	2.1	2.3	3	2.8	1.9	0.8	8.8	11	1.6	11	3.5
Kjeldahl N	<0.1	0.2	<0.1	0.3	<0.1	<0.1	0.2	0.2	0.1	0.1	0.1	<0.1
COD	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Tot Solids	170	130	59	110	60	60	90	110	150	30	130	90

Inorganic Results (mg/L) For surface lake waters (summer)												
	BB	EA	EN	HE	IS	KA	MC	ME	NH	PF	SO	SU
Alkalinity	140	70	40	50	50	40	70	90	80	10	80	110
Ammonia	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	0.1	<0.1
Chloride	16	26	4	19	6	5	5	5	9	3	5	8
Nitrate	<0.1	1.5	<0.1	1.3	0.7	<0.1	<0.1	<0.1	<0.1	0.6	<0.1	<0.1
Total P	<0.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ortho P	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sulfate	16	4.1	3.6	3.5	5.9	2	0.7	7.4	14	1.6	6.4	4.4
Kjeldahl N	<0.1	2.7	<0.1	0.4	0.4	0.3	<0.1	0.2	<0.1	<0.1	0.2	0.6
COD	<50	60	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Tot Solids	200	190	50	120	98	80	80	120	120	52	100	170

Inorganic Results (mg/L) For inlet waters to the lakes (summer) (I-1 only)												
	BB	EA	EN	HE	IS	KA	MC	ME	NH	PF	SO	SU
Alkalinity	150	90	40		60	40	80	100	130	20	110	180
Ammonia												
Chloride	16	490	5		10	8	3	5	14	4	5	22
Nitrate												
Total P												
Ortho P												
Sulfate	16	4.5	3		9.8	3.2	<0.5	6	14	2.7	5.4	8.7
Kjeldahl N												
COD												
Tot Solids	200	1300	50		140	100	100	150	200	50	140	280

Appendix F: MTBE Table

2002 MTBE Results
Units are ug/L (ppb)

The following table provides an overview of the lab results for the 2002 MTBE monitoring program.

Lake	Spring S	Spring S-1	Spring S-M	Spring S-C	Summer S	Summer S-1	Summer S-M	Summer S-C	Remarks
Black Butte	2		2		<2		<2		
Eastman	5				<2				
Englebright	3		3		10		10	10	
Hensley	3		3		3		3		
Isabella	<2	<2	<2	<2	<2	<2	<2	<2	
Kaweah	2		2	<2	8		6	6	
Martis Cr.	<2				<2				
Mendocino	<2				<2				
New Hogan	<2				3				
Pine Flat	<2		<2		2		2		
Sonoma		3	<2		<2		2		
Success	4		4	4	11	12	11	11	

Notes:

1. Non-Detect is indicated by "<2" since the Reporting Limit is 2 ppb or 0.002 ppm.
2. No enforceable acceptance criteria has been established for MTBE. See EPA Fact sheet.
3. Maps are provided to illustrate the sampling locations for samples: S / S-1, S-M, and S-C. Sample S and sample S1 are located near the dam; sample S-M is located within 50 ft of the Marina; and sample S-C is located near the center of the lake.
4. For 2002, the number of MTBE water sampling at each lake is based on last year's lab results.
5. 2 samples were taken from Eastman, Martis Creek, Mendocino, and New Hogan because MTBE was historically non-detectable. The 2002 results of non-detectable levels were similar except Lake Eastman and New Hogan now reported low, detectable levels of MTBE.
6. 4 samples were taken from Black Butte, Hensley, Pine Flat and Sonoma because of historically low detectable levels of MTBE.
7. 6 to 8 samples were taken from Englebright, Isabella, Kaweah and Success because of historically higher MTBE being found. The 2002 results were similar except Isabella now reported non-detectible levels.
8. In 2001, very high MTBE levels were reported at Lake Isabella during the Spring (18 ug/L near the marina) . During Spring 2000, Lake Isabella reported 21 ug/L. The 2002 results indicate that the previous MTBE problem near the marina was not visible during the Spring 2002 sampling event, and may have been rectified.

G. Fish tissue analysis table

2002 Fish Tissue Results

The following table provides an overview of the lab results for the 2002 fish tissue program. N/A indicates data is not available due to lack of fish collection. Sample Preparation, filleting and Extraction were in accordance with EPA 823-R-95-007, Sep 95, Volume I, Section 7.2 (Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisory) which requires the following: Only the edible portion of the fillet shall be analyzed (i.e no skin, tail, fin, head). Tissue digestion shall be accomplished by adding concentrated nitric acid and heating the tube in an aluminum block to reflux the acid. The digestate shall be cooled, diluted to a final volume of 25 ml and analyzed by CVAA. The laboratory conductng the preparation and analysis was Toxscan, Inc in Watsonville, CA and the laboratory mercury analysis was in accordance with CVAA per EPA 7471. The Percent Lipids were per EPA 1664. The FDA criteria for a fish advisory is 1 ppm. The California OEHHA's action level to continue fish tissue monitoring is 0.3 ppm.

Lake	Type of Fish	Type of Analysis (number of fish)	Date collected	Percent Lipids	Mercury Total ppm	FDA Criteria
Black Butte	Sm M Bass	Composite (3)	6/12/02	0.24	0.26	1 ppm
Eastman	Note 4	---------------------	------------	-----------	------------	< Mon 00
Englebright	Note 5	N/A	N/A	N/A	N/A	
Hensley	Black Bass	Composite (3)	4/23/02	<0.10	0.72	1 ppm
Isabella	Black Bass	Composite (3)	6/4/02	0.20	0.21	1 ppm
Kaweah	Sm M Bass	Composite (3)	7/14/02	0.11	0.53	1 ppm
Martis Cr	Note 4	---------------------	------------	-----------	------------	< Mon 00
Mendocino	Note 6	N/A	N/A	N/A	N/A	
New Hogan	Lg M Bass	Single (1)	6/3/02	<0.10	0.34	1 ppm
Pine Flat	Note 4	---------------------	------------	-----------	------------	< Mon 01
Sonoma	Note 6	N/A	N/A	N/A	N/A	
Success	Black Bass	Composite (3)	4/15/02	<0.10	0.18	1 ppm

Notes:

9. Non-Detect is indicated by "<0.02". The lab Detection Limit for mercury is 0.02 ppm.
10. Total Mercury was reported in mg/g or ppm.
11. Total Mercury was conducted instead of Methyl Mercury since EPA 832 allows Total Mercury analysis for an initial screening program. When specific problem areas are identified, methyl mercury analysis are normally performed later as part of the actual health risk assessment.
12. The fish tissue program was terminated at Eastman and Martis Creek in 2001 and in Pine Flat in 2002 due to low total mercury results. In 2000, the total mercury was only 0.089 ppm for Eastman (Catfish) and the total mercury was <0.02 ppm for Martis Creek (Brown Trout). For Pine Flat total mercury was 0.21 ppm in 2000 (composite of three Sacramento Sucker fish) and 0.23 in 2001 (composite of three spotted bass).
13. Due to seasonal conditions, a fish could not be successfully collected at Lake Englebright. Another attempt will be accomplished for the 2003 report.
14. Fish were not collected at Mendocino or Sonoma due to communication difficulties.

The above 2002 total mercury results indicate only Hensley is higher than average. However, in 2001, the total mercury results were only 0.30 ppm for Hensley (small mouth bass). The 2003 fish tissue program should provide additional data. EPA fact sheet on fish advisories (EPA-823-F-99-016) indicates that the mean average mercury results from numerous lakes in the Northeast United States were found to be 0.46-0.51 ppm for largemouth bass and 0.34-0.53 for smallmouth bass.