Lake education project: An environmental program for Lake Elsinore students

W. Arthur McMahon

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LAKE EDUCATION PROJECT:
AN ENVIRONMENTAL PROGRAM FOR LAKE ELSINORE STUDENTS

A Project
Presented to the
Faculty of
California State University,
San Bernardino

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts
in
Education: Environmental Option

by
W. Arthur McMahon
June 1994
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W. Arthur McMahon
June 1994
Approved by:

Dr. Darleen Stoner, First Reader

Dr. Thom Gehring, Second Reader

Date
DEDICATION

Dedicated with love to my wife Tamara,
My children Jesse and Sara,
The students of Lake Elsinore,
And, of course, to the God who made us all.
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ABSTRACT

One thousand and thirty two individuals from Lake Elsinore and nearby surrounding communities were surveyed about their opinions on the lake and the community of Elsinore. Respondents ranged from 4 to 76 years of age. The survey contained both open ended questions and rated statements. Results were tallied for the total sample as well as broken down by age groupings. Following this, Lake Elsinore's history, geology, hydrology and biology were researched using primary and secondary sources of information. The human use and impact to the area was also considered. Lastly, a one month curriculum was developed for junior high age students on Lake Elsinore's history, geology, hydrology, biology and the human use and impact factors.
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# TABLE OF CONTENTS

ABSTRACT.......................................................................................................................... v

ACKNOWLEDGEMENTS........................................................................................................ vi

INTRODUCTION......................................................................................................................... 1

LITERATURE REVIEW.............................................................................................................. 3

A SURVEY OF COMMUNITY ATTITUDES ABOUT LAKE ELSINORE............. 7

  Statement of the Problem..................................................................................................... 7
  Assumptions.......................................................................................................................... 7
  Hypothesis............................................................................................................................ 8
  Significance of the Study....................................................................................................... 8
  Instrumentation and Data Collection.................................................................................... 8
  Data Treatment Procedure................................................................................................... 9
  Presentation of Findings........................................................................................................ 10
  Conclusion of the Lake Survey.............................................................................................. 13

Limitations of the Design....................................................................................................... 14

Recommendations for Further Research............................................................................... 15

BACKGROUND RESEARCH FOR TEACHERS................................................................. 17

  Lake History......................................................................................................................... 17
  Geology................................................................................................................................. 26
  Hydrology.............................................................................................................................. 29
  Biology.................................................................................................................................. 37
  Human Use and Impact.......................................................................................................... 48
APPENDICES

Appendix A: Lake Education Project Curriculum........................................... 59
Appendix B: Graphs of Lake Survey Responses........................................... 93
Appendix C: Lake Attendance Graphs of CDP&R Data................................. 156
Appendix D: Graphs of Bacterial Data 1981-1993.................................... 172
Appendix E: Flora & Fauna of the Lake Elsinore Region.......................... 186
Appendix F: Algae Species & Water Quality Data.................................. 199
Appendix G: Selected Newspaper Articles From Lake Elsinore............... 212
Appendix H: Miscellaneous........................................................................ 234
  Lake Survey (Blank)............................................................................... 235
  List of Lake Owners................................................................................ 236
  Projected Population Figures................................................................. 238
  Indian Tribes in California.................................................................... 239
  Department of Fish and Game Memoranda........................................ 240
  Lake Management Project Construction Costs.................................. 244
  Lake Elsinore Parks.............................................................................. 245

REFERENCES......................................................................................... 246
INTRODUCTION

Teaching at Lake Elsinore Middle School, I not only drive by the lake every school day, but see it each time I step or look outside my classroom door. Some days the lake is calm and beautiful. Some days it is not. It caught my interest how this very natural body of water seemed to be at the same time the center of the community's scorn and the anchor of its identity. In an unusual way it is hated and loved by the students and parents alike.

As a teacher, I was curious about the perceptions of the community towards the lake itself. As an observer, I developed my own perceptions about the community's perceptions. In Elsinore, parents and students alike seemed to consider the lake to be little above a raw sewage spill, a virtual toilet around which the community had arisen. There seemed to be no pride in the lake and no understanding of it as a natural ecosystem, supporting varied organisms and popular recreational activities. Instead the lake is seen as an eyesore and an embarrassment, to be fixed or filled.

From these informal beginnings grew a curiosity about Lake Elsinore; about the community and its odd relationship to the lake it surrounded. As a scientist, I know that my perceptions might be misled, so I developed a survey to attempt to accurately assess the feelings of the community towards the lake. This survey was only the beginning, the springboard from which the rest of the project would be launched. I was not only curious about the community's opinions and perceptions, but also how well they matched the reality of the lake. So the next step of the project was to learn as much as I could about the area's geology, history, water quality, biology, use, and human dependence
and impact on the lake.

The final step was to develop curriculum. The purpose from the outset had been to help the students at Elsinore Middle School understand their lake. In the end, I became the collator of information from dozens of sources, and the designer of curriculum in order to pass that information on to them. It was an immense task of which I hope the end result is students who are aware and knowledgable about the environment and ecology of their own community. For some it may stir a greater sense of community pride; for others, a challenge to action. At the least I hope it awakens students to the variety of ways in which the wonder of nature exists, not always to our own human liking. It is also my hope that the final project is as unbiased as humanly possible. It is not my intention that the resulting curriculum be used either to sell or to malign the lake or the community.

For myself, it has been a time of unprecedented immersion in a topic much more vast than this brief project could cover. It has meant a time of growth and of awareness about both the lake and myself. It has built my respect for the lake and those that work with it in their many and varied capacities. It has led me to realize the incredibly complex ecological and political nature of Lake Elsinore and the difficult task for those that seek to "fix" it or to boost its image in the community.

I hope that the information gathered here is useful to other teachers, either as kindling for their own interests or for use directly in their own classrooms. The benefit of studying topics that are within the student's daily environment and experience cannot be overrated.
LITERATURE REVIEW

Recent research reports, anecdotal articles and commentaries suggest that environmental education and outdoor education are moving strongly forward. Some of the current educational trends are being met by environmental education and outdoor education programs, which have a host of positive educational outcomes.

The Science Framework for California Public Schools (1990, pp. vii, viii) sought to break down the compartmentalization that has occurred in science teaching in order for students to understand the interrelated nature of the study of science as well as the topics of science. Clifford Knapp (1989, p. 40) suggested that outdoor education is best suited to that educational goal. He writes that teaching students outside removes "the formality and compartmentalization of subject matter." The American Biology Teacher appealed to teachers to share the outdoors with their students (Wivagg, 1994, p. 131) because "it is the natural providence of biology." John Miles citing John Muir, and emphasizing the thoughts with his own commentary, suggested that in learning, experience is everything (Miles, 1991). Indeed education statewide has begun to emphasize more experiential learning (Science Framework, 1990, pp. 7, 156).

Science education in general, according to Nancy Griffen (1975, p. 26), should seek to foster an understanding and appreciation of the interrelationships in nature. In regards to outdoor education and environmental education, Phyllis Ford wrote that a primary goal should be to foster knowledge, skills, and awareness, specifically of the environment in
which we live (Ford, 1989, p. 31). These two goals go nearly hand in hand.

Maureen Hazelworth and Beth Wilson showed in their research that outdoor programs generated positive changes in moral and ethical attitudes towards the self (1990, p. 36). Also reviewing the research on the effectiveness of outdoor education programs, Louis Iozzi indicated that positive environmental attitudes are developed by such programs. The study showed that such attitudes appeared to be very long lasting (1989, pp. 6-7).

Researching the effects of environmental programs on attitude, John Ramsey concluded that it develops "independent, overt environmental behavior" (1993, p. 34). He went on to assert that responsible citizenship could be developed from environmental education programs. Underpinning these research results, the Bentler-Speckart Model pointed to a strong relationship between attitudes and behavior. It predicted that changes in behavior will consequently result in changes in attitude (Atkinson, 1990, p. 47). What this means is that engaging in responsible outdoor behavior - the very core of environmental education and outdoor education programs - will generate responsible attitudes towards the environment.

Outdoor and environmental education, then, seem to be best suited for teaching subjects and for effecting attitudinal and behavioral changes. Valentin Shaef er suggested in his research that it may be the only way. The phrase "think globally, act locally" has been a catch phrase for the environmental movement. Shaef er indicates that it may be better written as "think locally, act locally" (1992, p. 5). Local programs, developed, focused, and used at the local level have the greatest chance for success (1992, p. 5). Those that receive environmental instruction without stepping outdoors
usually do not change their actions (1992, p. 6). In summary, recent studies show that the best education is outdoors, and focused locally. This is true for more than just science. One of the guiding principles of outdoor education (Ford, 1989, p. 31) is that any subject can be taught outdoors.

Towards this aim, Wil Kalinowski, summarized recent research into outdoor education by compiling a list of what made effective environmental programs (1990-91, pp. 8,9). According to Kalinowski, an effective program should be developed and used locally, be interdisciplinary, be activity centered, and allow students to reflect on their learning and experiences.

A meta-research article (Leeming, Dwyer, Porter & Cobern, 1993) found that most environmental education research was poorly done. The authors suggested that in all but a few exceptions the data were poorly treated, the research design poorly considered, and the results highly questionable. They also found that most research did not consider changes in behavior, but only changes in attitudes. They stressed that much more research needs to go on in the areas of environmental and outdoor education (1993, p. 21).

Except for the article by Leeming, et al, the research was positive about the link between desirable outcomes and outdoor education. The recent research, suggested that outdoor education and environmental education meet many educational and state framework goals, but Leeming, et al, suggested that much more rigorous program analysis is needed before statistical support for such conclusions could verify the anecdotal reports.

Even without the rigorous analysis called for by Leeming, et al, much of the research already mentioned supports locally developed programs. The overall aim of this project is to develop a local curriculum for and about Lake
Elsinore. Towards this end a formal and analytical assessment of community attitudes and knowledge was deemed a crucial first step in this development. The results of the "Lake Survey" that follows served in evaluating knowledge levels, and overall attitudes; much as a unit pre-test. The information gathered was used to guide the direction and focus of the subsequent curriculum.
A SURVEY OF COMMUNITY ATTITUDES ABOUT
LAKE ELSINORE

This survey on community attitudes about the lake and community of Elsinore served as the precursor for a master's project, providing a factual basis from which to apply the subsequent research and to develop a lake curriculum. It was intended neither to comprehensively study the lake community nor to accurately reflect situations or conditions of the lake or of the community. Rather it served as a basic assessment of residents' attitudes, factual or not.

Statement of the Problem

In developing a curriculum specific to Lake Elsinore, the opinions and attitudes of residents became an issue needing specific research clarification. Beyond informal assessments of community attitudes, a single tool was needed that would give direct measurable evidence of opinions about the lake and lake related issues. A three-part, one page survey was developed and sent home with seventh and eighth grade science students from Elsinore Middle School. Students were encouraged to have as many relatives as possible complete the surveys. Results were then tabulated and grouped. Graphs were prepared for each age grouping as well as for the total sample.

Assumptions

For this study, the following assumptions apply:

- Survey responses accurately reflect the opinions and attitudes of the respondents.
- Respondents understood the survey questions and instructions.
• The survey responses are representative of the opinions of the larger community.

**Hypothesis**

It is believed that the survey will show that the community has unfavorable opinions about the lake and lake issues, but realizes the financial importance of the lake to the community.

**Significance of the Study**

Correctly assessing community attitudes and perceptions about the lake was fundamental to developing a curriculum which was the final aim of this project. Knowing the students' preconceived feelings about the lake helped to guide the content and presentation of the relevant material. The survey could be used to identify misperceptions towards which correct instruction could be directed. It could identify correct perceptions which would require less emphasis in the resulting lesson plan. Identifying positive as well as negative images of the lake and lake issues would also further serve to guide the development and presentation of the final lake curriculum. Students might also find the actual survey results interesting and informational and the results themselves could be used with the curriculum. More generally, community agencies may find useful, in part or whole, the information gathered here.

**Instrumentation and Data Collection**

A brief one page survey was developed consisting of three parts. Part one asked demographic questions of the respondent, including age, occupation, and length of residency. Part two contained eight open ended questions about the lake and the community. Respondents were asked to name the best feature of the lake and the community. They were asked to
name the biggest problem of the lake and the community. They were asked to
describe the lake in a single word. They were asked how often they used the
lake and what they used it for. They were also asked about how they felt the
community perceived the lake. With the exception of the lake use question, all
were open ended; no answer choices were suggested or given.

Part three consisted of nine aspects of the lake and the community. Respondents were asked to rate the subject from 1 (worst) to 10 (best). Aspects rated were: Lake Elsinore as a community, the lake's level of pollution, of general cleanliness, as a recreational area, its quality of fish, quality of water, scenic value, importance to the community of Elsinore, and the quality of the maintenance of the lake.

The survey was sent home with seventh and eighth grade science students from Elsinore Middle School. Students were encouraged to have as many relatives as possible complete the surveys. The surveys were distributed through the science classrooms during the week of November 14, 1993. Most surveys were collected within one week, but some were returned after the Christmas break during the week of January 3, 1994. Of the approximately 1500 surveys distributed, 1032 were returned. This represents a 68.8% return rate. The actual survey sheet titled "Lake Survey" can be found in Appendix H.

**Data Treatment Procedure**

The surveys were divided into four age groupings based on a preliminary difference in response styles. Those four classes were: Up to 14 years old, 15 to 30 years old, 31 to 49 years old, and over 50 years old. The responses from the different age groups were then individually tabulated on response sheets. Differently worded, but similar responses were grouped
under single headings, the number and variety of headings determined by the number and variety of actual responses.

Each question was then graphed. The open ended questions were graphed as pie charts. This showed the percentage of total respondents giving similar responses and the total number of different response categories. The rated questions were graphed as histograms. This showed the ten possible rankings for each question and the number of respondents choosing each ranking. The complete set of graphs may be found in Appendix B.

**Presentation of Findings**

The results for the total sample differed in several key areas from the individual age groups. Following will be a presentation of each of the key questions and a discussion of similarities and differences between the age groups.

**How many times a year do you visit or use the lake?** For the entire sample nearly two thirds (63.1%) said that they did not visit the lake even once per year. This was remarkably consistent across the age groups, though the younger groups visited slightly more than the older. Younger respondents tended to be more emphatic in their responses to this question, often punctuating their answers with multiple exclamation points or writing "never" in all capital letters.

**Do you regularly use the lake for boating, fishing, water-skiing, picnicking or swimming?** For all age groups, picnicking and swimming were the most common recreational uses of the lake. The answers occurred so frequently together that they were combined into one category. Other major uses occurring in almost equal proportions were fishing, water skiing, and
boating. Uses included in "other" were jet skiing, horseback riding, and bird watching. For the 15 - 30 year old group, boating was nearly as popular as swimming and picnicking (25.9% to 33.3%). For the 31 - 49 year olds and the over 50 group, the "other" category, consisting mostly of bird watching was very popular (24.2% and 22.2%).

What, as you see it, is the lake's best feature? The scenic aspect of the lake was seen by all age groups as its best feature, though the over 50 group was tied with recreational uses. Other features praised were the lake's financial benefits to the city, and its size. For several of the younger age groups, size was mentioned as a best feature (up to 8.1%). Without further information, which was not present on the survey responses, it was assumed that the present large size of the lake from the heavy rains that filled it in 1993 was being contrasted to the nearly dry state in 1992. For over one fourth of the total respondents, it was stressed that the lake had no best feature. Here the responses differed markedly by age group. Only 5.9% of the over 50 group felt that the lake had no best feature while 28.4% of the up to 14 age group felt that way.

What, as you see it, is the lake's biggest problem? For over one third of those responding the answer was algae. The next answer, pollution, was also equally popular as a second choice. Other responses included the smell, fish kills, poor management, lack of funds, lake level and stabilization, and lack of facilities. The biggest difference between the age groups, was that the up to 14 group felt that the smell was a serious problem (26.8%) while for most other groups it was much lower. Fish kills were noted by the 15 - 30 group as a major problem (15.7 %) but not by most other groups. The 31 - 49 year olds did
not mention fish kills at all. Overall fish kills came in at 3.6%.

**What, as you see it, is the community's biggest problem?** Crime (gangs, prostitution, lack of police protection, graffiti, vandalism) was far and away the top problem, with almost half of all respondents listing crime as the major problem in Lake Elsinore. The only major difference between groups was that the 31 - 49 year olds had a substantially higher response at 55.2% compared to most others around 40%. Other serious community problems reported were the lake (27.3%), city management (7.4%), and lack of facilities (5.0%). The over 50 group mentioned lack of facilities most (10.5%), but the up to 14 group explained most specifically what facilities they would like (movie theatres, water slides, golf/amusement parks). The "other" category had a wide variety of responses: homelessness, joblessness, too much growth, too little growth, road problems, and lack of community spirit.

The following nine statements were given with the instructions, "From 1 (worst) to 10 (best) rate each of the following."

**Lake Elsinore as a community...** The majority of responses fell directly in the center. The up to 14 group tended to have a greater percentage of responses in the 8 - 10 range than any other group. It was surprising to note that junior high age students, generally regarded as pessimistic, held higher opinions of the community than any other age group. All other groups peaked at 5 and fell off sharply at either end of the range.

**The lake's level of pollution, the lake's level of general cleanliness, the lake's quality of fish, the lake's quality of water, and maintenance of the lake...** These five questions drew very negative responses from all age groups. The overwhelming response was 1(worst), with nearly a third of the
respondents giving that rating for each of the above questions.

**The lake as a recreational area...** Again all age groups responded similarly. The responses tended toward the low end of the scale (less than 5), but were not weighted so heavily in the worst category. A substantial percentage of respondents (about 25%) gave ratings from 6 - 10.

**The lake's scenic value...** This brought a disparity of responses between the age groups. The up to 14 group itself seemed split on this aspect the most popular response being 1 (worst) and the second most popular response being 9. The other three age groups gave marks concentrated towards the "best" end of the scale. The over 50 group gave the highest ratings. Overall the responses are highest in the center and at both ends of the rating scale.

**The lake's importance to the community of Elsinore...** The up to 14 group had the highest response as 1 - meaning unimportant, but responses evenly covered 2 - 10. For the 15 - 30 year olds answers were highest at 10, but also peaked at 1 and 5. The older age groups rated the importance much higher, showing a clear skew towards the high end of the range. When totalled, the responses show a split, equally divided among 1 and 10 and scattered somewhat equally from 2 - 10. Clearly the older citizens consider the lake more essential than the younger residents.

**Conclusion of the Lake Survey**

Overall, residents seemed to be neither greatly pleased nor greatly displeased with the quality of the community, though they considered crime to be an overwhelming problem. Most residents felt strongly about the lake itself. Though they realized its importance generally, they considered it polluted, poorly cared for, and facing serious problems. Almost anything in regards to
the lake was rated poorly, except for its scenic beauty. Many residents wrote of the potential of the lake and felt that it needed to be "fixed." They expressed frustration that that was not taking place. Age seemed to play a factor in some opinions. Generally, the opinions about the community declined with age, while the opinions about the scenic qualities of the lake and understanding of its importance to the community increased with age. In current public opinion, the lake is not considered a community asset nor a positive influence towards community esteem.

**Limitations of the Design**

There were a number of flaws in the original design, as well as limitations in interpretation and graphic analysis. The survey itself should have asked the gender of the respondent. The survey also was open to confusion regarding some of the rating questions concerning "worst" and "best" and how it related to the questions asked. Open responses in the "other comments" section and elsewhere seemed to show that any confusion was minimal. The responses were not weighted according to actual community makeup, when totals were generated, so the graphs marked "all age groups" are heavily weighted for the up to 14 age group from whom most of the surveys came. In addition, the over 50 group was very small, which might have affected the accuracy of the collected data. In regards to data treatment, not all factors were used, nor were all questions tallied. Finally, many respondents did not answer all questions. Generally, these flaws seemed to be minor and insignificant to the results.
**Recommendations for Further Research**

The following recommendations are given:

- Cross correlations between opinions and length of residence, percentage of life spent in Lake Elsinore, type of work (white collar vs. blue collar) and distance from the lake itself.
- A revised survey form with clearer questions, and a question about gender.
- Balancing the graphical totals to match local demographics.
- Surveys given at various times during the year; when the lake smells and the algae has bloomed, and again when it is clearer.
- Surveying students after completing the Lake Education Project curriculum.

It would be interesting to see if distance from the lake, or gender, or length of residence has any type of effect - either positive or negative - on the attitudes towards Lake Elsinore. Finding such linkages might be helpful to those involved in lake management issues. As a post-test assessment of the Lake Education Project's effects, the Lake Survey could indicate changes in student attitudes. Such an assessment would be valuable in future curriculum development or for modifying the Lake Education Project.

The Lake Survey provided useful information about the level of knowledge about Lake Elsinore and the attitudes held. Once this was known, the next step of the project was to research as much primary source information about Lake Elsinore as possible. This would provide a basis for comparing current knowledge levels with the actual conditions and history of the lake. In the
following sections are found the results of the research. It is not intended to be exhaustive, but rather to provide a framework of understanding for teachers of the Lake Education Project materials. It is broken into four sections: history, geology, hydrology, biology, and human use and impact.
BACKGROUND RESEARCH FOR TEACHERS

LAKE HISTORY

Before white landowners, farmers and businessmen; before Mexican ranchers, and settlers; before any of the modern inhabitants and intruders into Lake Elsinore, native Indians freely roamed the length of the valley. The Pai-ah-che, the Gabrielino, the Luiseños, all hunting and gathering tribes, made the Elsinore Valley their home (Rawls, 1984, p. 10; Hudson, 1977, p. 11). By accounts from the first encounters with Europeans, the California Indians led a simple life with few tools and weapons (Rawls, 1984, pp. 46,47). Their skills in basketry, though, were immense (Rawls, 1984, p. 47) and their knowledge of plant lore and natural pharmacology is still being researched and understood today (Parkhurst, 1971, p. 1). Early coastal explorers, like Captain William Shaler and George Vancouver, thought little of the California Indians, but seemed pleased that they could easily be subdued and defeated (Rawls, 1984, pp. 46,47). For the Indians, famine and need had never been a problem. The nearby Ortega Mountains supported a variety of wildlife and Lake Elsinore supported a diversity of native plants and waterfowl (The Elsinore Valley News, 1886a). To the Pai-ah-che, though, it was not Lake Elsinore, but Etengvo Wumona (Hudson, 1977, p. 11). With the claiming of California by Mexico, however, the Indian's hold on the valley soon weakened.

On January 1, 1844, Manuel Micheltorena, the Governor of California (a part of Mexico), granted 20,000 acres of the Elsinore Valley to Julian Marquez (Eastlake Community Builders, 1992; List of lake owners, 1952). The Rancho La Laguna grant which included not only the valley, but the lake itself
- known to the Mexicans as Laguna Grande - remained the property of Julian Mandquez until 1851 when it was sold (Eastlake Community Builders, 1992; List of lake owners, 1952). Since the first owner the lake has been sold or transferred 23 times to various individuals, families, groups, agencies and organizations (List of lake owners, 1952). Currently the lake belongs to the City of Lake Elsinore to whom control was transferred on July 1, 1993 (Lake transfer, 1993; Next 3, 1993) and to the hundreds of private owners of lake front property (Staff, 1992; Beach spa, 1983). Among the lake's more famous owners are Franklin Heald, Donald Graham, William Collier, and Fredrick, Cecil, Charles, and Georgiana Sumner. In the early days especially, the lake seldom remained under the control of anyone for more than a few years. For example, between 1913 and 1920 the lake had no less than five different owners (List of lake owners, 1952).

The same year that Franklin H. Heald arrived in Elsinore and purchased the lake - 1883 - he also purchased a great deal of the surrounding lake front property (List of lake owners, 1952). To F. H. Heald, Elsinore held tremendous growth potential and he set out to make the most of it. On January 1, 1885, a Wednesday, Heald printed the first edition of the Elsinore Valley News of which he was owner and editor. The first edition ran news about the wonderful Elsinore climate and a story about how the town got its name. The name was selected after much care and deliberation. It was adopted not from the small city so named in Denmark, but rather from the immortality given it by Shakespeare and Campbell and because it has a splendid sound. Its correct pronunciation, according to Webster, is El-sin-ore; three syllables, accent on the third.

The paper ran only four pages, printed once a week on Wednesdays, but
with a strong editorial flare. In the early days, the front page usually ran a story gleaned from one of the eastern periodicals or larger papers, often with a west coast setting. Stories of Elsinore's mild climate and miraculously healing sulphur hot springs ran in almost every issue. The August 12, 1885 issue stated that a sample of hot springs water had been sent to a chemist in San Francisco for testing. "We only know that the water will cure rheumatism and all poisonous diseases," the paper boasted. From its inception it was designed to "show up the advantages of Elsinore" (Elsinore Valley News, 1885b) and to serve the interests of Franklin Heald.

Heald was harsh with those whom he disagreed, frequently using the paper to present not only his will for Elsinore, but to insult and attack his enemies. A meat market owner named Benjamin Rice did not agree with Heald or his politics and the feud made the paper for weeks. Heald at one point printed a thinly disguised "fable" about a fat butcher and the "pimple on his nose that grew until it was larger than the man himself (Elsinore Valley News, 1885b)." The feud ended with a lawsuit by Heald for $10,000 against Rice for "defamation and slander" (Elsinore Valley News, 1885b). Benjamin Rice closed up his shop and moved away, leaving Elsinore without a butcher shop for the next three years.

Near the end of 1885, the paper was in financial trouble. Heald appealed to the community to support the weekly. At only $2 a year he pleaded for those "faithful subscribers" to take a second subscription (Elsinore Valley News, 1885d). "Much of Elsinore's success depends upon her paper," he urged (Elsinore Valley News, 1885d). "With its success, Elsinore will gain the respect and influence due her" (Elsinore Valley News, 1885d). And the paper
did recover, continuing to publish the comings and goings of strangers and landowners, the names of travelers at the hotel, the yield of crops, and the multiple glories of the valley.

Not all of Heald's efforts to develop Elsinore, and to sell his vast landholdings, were entirely truthful. The following is portion of a flyer that Heald mailed to potential settlers as well as printed frequently in the Elsinore Valley News.

_Elsinore Lake which is halfway between Los Angeles and San Diego on the C.S.R.R., is a beautiful sheet of pure mountain water 7 mile long, 3 miles wide, and 80 feet deep. There are now 15 small sail boats, one large yacht, and a steamboat which will carry 60 passengers. This boat makes regular trips around the lake, stopping at the foot of every street to discharge and receive passengers and freight, answering every purpose of a street car._

In fact, the lake has never been 80 feet deep. Residents of the time reported willow trees at the 1240 foot elevation mark which would make the lake less than 20 feet when the flyer was printed (Water for, 1955). The steamboat of which Heald spoke, the Showboat, never did pick up and drop off passengers from the "foot of every street" (Elsinore Valley News, 1886, June 23). It was a dream that never became reality. The dreams were large in the early days; dreams that once Elsinore became recognized for all its amenities, it would become a major California city.

Even then, however, residents recognized that Elsinore and the lake itself had some serious problems to overcome. On June 23, 1886 the first mention was made that Lake Elsinore was in need of stabilization (Elsinore Valley News).

_It is proposed to lower the outlet at some point so that the lake will cover 4,000 acres and to fill the lake with well water waste._
On January 1, 1888 the Elsinore Valley News first discussed the possibility of incorporating. On that same day Paul B. Hay took over as the new owner and editor. Heald, still influential, pushed hard for cityhood as did Hay. That year, on August 20, Elsinore incorporated (City of Lake Elsinore, Community economic profile). Lake Elsinore is the oldest city in Riverside County (Bad spot, 1993). In fact, it is older than Riverside County itself which was formed in 1893 (Bad spot, 1993). When it was incorporated, Elsinore was part of San Diego County.

The desire for growth continued into the twentieth century. The Lake Elsinore Valley News (the paper's name changed in 1912) carried slogans like "the sun shines most everyday in Elsinore, come and see" (1912); or "the best little city in Southern California" (1925, January 15); or "California's most scenic health center" (1925, December 3).

Indeed, it was the healthful draw of the sulphur hot springs that founded Elsinore in the first place. Other early industries included the pottery works at Alberhill, and a variety of mining operations for gold, silver, galena (lead ore), tin, sinabar, black sand, salt lime, marble, keolin, iron, and granite (Elsinore Valley News, 1885c). Agriculture - grapes, olives and citrus fruits - was also a strong early industry. Each year the town collected the best of its offerings for the fair in San Diego in order to "show the advantage of Elsinore" (Elsinore Valley News, 1885b).

Growth was clearly a primary objective. Elsinore was touted as a health, agricultural and recreational center. Highways and railroad lines were actively sought and heavily praised. In 1911, a community booster group was formed with the catch phrase "ten thousand population for Lake Elsinore
Valley in 1915" (Elsinore Valley News, 1911). The phrase accurately caught the mood of the valley, though awkward on the tongue. The railroad line from San Bernardino, begun in 1885 (Elsinore Valley News, 1885c) was highly touted for bringing recognition and a bright future to the valley. The Elsinore-San Juan Highway (now the Ortega Highway) started in 1925 was lauded with the same hopes for future growth (Lake Elsinore Valley News, January 15, 1925).

For Elsinore, however, the success of the valley was tied to something more variable than the mild climate or the railroad and highway access. The fortune of the town consistently rose and fell with the level of the lake. Because of its shallow nature and high surface area and Southern California's drought prone climate, the lake level rose and fell like the "cardiograph of a man dying of heart trouble" (Water for, 1955).

During the twenties, when the lake level was high, and the water quality good, Elsinore was a boom town. Growth was dramatic (Ups and downs, 1975). Lake Elsinore Country Club was built along the west shore ([Lake Elsinore], 1975). A pier was built in 1925 ([Lloyd Brown], 1975). Health spas and hotels flourished. Fishing, boating, yachting, skiing, and other recreational activities brought the city huge revenues. By 1936, however, the erratic lake level had receded to about seven feet making it unusable for recreation (Elsinore Valley Municipal Water District [EVMWD], 1984a, p. 34). The first fish die offs were recorded and the combination of poor water quality and the Great Depression was dramatic. Much of Elsinore Valley was sold to the state to pay taxes (Water for, 1955).

A few wet years came, but by 1951 the lake was dry (EVMWD, 1984a, p.
In the 1920s and 1930s it was "the boating capitol of Southern California" (Familiar scene, 1952). In the 1940s and 1950s it would almost ruin the city of Elsinore. Property values declined and residents moved away. By 1959, land that had sold for $3,000 in 1927 was worth around $500. By 1959 the town had shrunk to 2,500 residents (Drilling of wells, 1959).

In 1957 the state purchased 2,900 acres of the dry lake bed to create a state park, but lack of water remained a problem (Many worked, 1962). A group of residents calling themselves "Water for Lake Elsinore" raised funds and hired a water diviner, Verne Cameron, to identify likely spots for drilling wells (Drilling of wells, 1959). Three wells sunk were successful and are still capable of pumping today, but that was only part of the solution. The city of Elsinore over a period of several years beginning in 1951 and culminating in 1964 turned control of the lake over to the state for development as a state park (Lake Elsinore filling, 1964; Many worked, 1962).

On Saturday, February 1, 1964, in a dramatic ceremony, 30,000 acre feet of water was purchased from the Metropolitan Water District for refilling Lake Elsinore and the valve was opened (Lake Elsinore filling, 1964). It would take nearly two months to complete, but the lake was usable once again. Residents and visitors made a holiday out of the lake filling.

The bridge over the San Jacinto River at Mission Trail was lined with persons sitting on the railings and watching the waters pass beneath them...Freddy Stokes in his 75 horse power Scott was the first motor boat to try the river... T.C. Morris was the first to ski in the new water turned on at Lakeview Saturday, while giant bulldozers were starting two marinas on Lake Elsinore (Lake Elsinore filling, 1964).

Drought again in the 1970s brought hard times to the city. The plan for lake stabilization was revived. Plan C was designed and involved diking the
lake into a smaller area, dredging the lake to improve water quality and to deepen it, and was estimated to cost about 12 million dollars (Plan C, 1974). It was never implemented.

By the 1980s, the lake level had increased and the city income rose correspondingly. In 1977 the lake was dry and taxable sales were at 20 million. By 1980, the year of the flood, taxable sales were at 40 million and climbing. Building permit issues had also risen sharply (EVMWD, 1984a, p. 6-2). The lake was so full that at the urging of the residents, pumping was begun to lower the level (City will drain, 1993). Unfortunately, years of drought followed again and the city began to look at ways to raise the water level. By 1990 the water depth was only five feet (Riverside County Department of Environmental Health [RCDEH], 1990). Another year of below normal rainfall would mean another dry lake.

Lake stabilization as a plan had never gone away. In 1984 the Elsinore Valley Municipal Water District applied for a grant to the Bureau of Reclamation (EVMWD, 1984a, p. 2). A massive undertaking, the initial loan and grant application reached over 600 pages with the subsequent addendum. Finally approved, a three-part construction project began in 1988 (Lake Elsinore Management Authority [LEMA], 1992; Otway, 1991). The lake inlet channel was to be moved and improved, a dike was to be added to halve the lake size and the outlet channel was to be lowered to prevent flooding and provide more circulation (EVMWD, 1984a, p. 3). The levee was completed in 1990 and the inlet channel in 1991. The outlet channel is expected to be done by early 1995 (LEMA, 1992; Otway, 1991; Outflow channel, 1993). The levee was designed to reduce evaporation and to provide flood protection. The lowered
outlet was designed to keep the lake maximum at 1260.5 feet or less surface elevation (LEMA, 1992).

Rains in 1991 and 1993 raised the level of the lake, but also raised some of its traditional problems. In addition to working on those problems, the city is in the midst of a massive redevelopment project: revamping the downtown, building parks, retaking control of the lake, building a minor league stadium (Staff, 1992). All of this so that what F. H. Heald wanted - "to show up the advantages of Elsinore" - might finally occur (Elsinore Valley News, 1885b).
GEOLOGY

Geologically, Elsinore Valley is a graben - a depression - that runs roughly northwest to southeast from Temescal to Temecula (EVMWD, 1984a, p. F-2; State of California Department of Natural Resources [CDNR], 1954, p. 23). The valley is bounded on the southwest by the sharply rising Elsinore (Ortega) Mountains that climb almost 1,500 vertical feet in less than a mile of width (EVMWD, 1984a, p. F-3). The Ortegas are the part of the Santa Ana mountain range that separates the Elsinore Valley from the coast. On the northeast rises the more gentle Temescal Mountains and the Perris fault block. The entire depression, from the lake to the southern Agua Tibia Mountains is known as the Elsinore-Temecula Trough (CDNR, 1954, p. 23).

It is believed from the geologic evidence that the valley floor was faulted downward at the same time that the Santa Ana range was being faulted upward (CDNR, 1954, p. 23). Though some folding of the rock has occurred (foliation) (CDNR, 1954, p. 8), particularly in the Corona area, most of the ground movement in the Elsinore Valley resulted in distinct fractures (CDNR, 1954, p. 23). This lowered the valley floor and provided a number of fault breaks at both the surface and subsurface (CDNR, 1954, p. 26). In fact, eight major fault blocks have been identified in the Elsinore Valley, all with steep angular fault lines and all running the same direction as the valley - northwest to southeast. The Glen Ivy and Sedco faults border the northeast shore of the lake, while the Wildomar Fault runs the length of the southwestern shore. At the base of the Ortegas can be found the Willard fault zone (CDNR, 1954, p. 26). Through the center of the valley, and the center of the lake, runs the
Burckhalter and Lake faults (EVMWD, 1984a, p. 6-8).

The faults appear to be moderately geologically active. Within the last 50 years, more than 600 earthquakes have been recorded within 25 miles of Lake Elsinore. Most were less than 4.0 in magnitude; however one 5.5 quake occurred in 1938, around 10 miles from the city. Geologic estimates are that a 4.0 to 6.0 earthquake is "likely" in the next 50 years (EVMWD, 1984a, p. 6-10).

Though the individual fault blocks range from sandstone to granite to metamorphic crystalline types to conglomerate to igneous basalt, most of the valley is overlaid with alluvium (CDNR, 1954, p. 9). Alluvium is loosely consolidated or unconsolidated sand, silt, gravel and clay, carried by water to the valley floor. Though in most cases the alluvium is less than 100 feet thick, in some places it extends downward as much as 3,000 feet in what is called the Pauba formation (CDNR, 1954, p. 9). Because of the alluvium, only one of the eight fault blocks that makes up the valley is exposed at the surface (EVMWD, 1984a, p. F-2). The alluvial thickness indicates that heavy erosion has taken place in the recent geologic past.

Beneath the alluvium is crystalline metamorphic sandstone, shale, or siltstone, and beneath that is bedrock of granite or basalt which is part of a huge Southern California batholith. This is referred to as basement rock and averages about 1,000 to 1,500 feet below the surface (CDNR, 1954, p. 9). In the mountain areas surrounding the valley, the batholith is exposed in numerous intrusions and is composed of metamorphic rocks, such as gabbro, diorite, and granodiorite. To the south the mesas of the Mesa Verde area are topped with basalt. This indicates that, at least in a geologic time scale, the valley has been very active (EVMWD, 1984a, p. 6-10). One odd formation is Rome Hill, an
uplifted chunk of conglomerate and sandstone (CDNR, 1954, p. 23).

On the east-northeast side of the valley rises the Perris fault block, which is part of the Southern California batholith and which is made of a variety of igneous rocks. Pale granite called granodiorite is exposed on the hills from Elsinore towards Perris. Closer to Perris are found darker rock outcroppings of various types of gabbro (CDNR, 1954, p. 26).

Much of the early geologic data came from well drilling, from mining, and from quarrying. In the Elsinore Valley, in the batholith formations, many small mines operated from the 1880s until the 1950s (CDNR, 1954, p. 21). Estimates of gold and silver by 1935 were about 2.5 million dollars (CDNR, 1954, p. 22). The slate found in the area also supported quarries that cut, sold, and shipped it across the country. Perhaps most successful, however, was the Alberhill mine. Initially it was worked for a type of coal called lignite which can be found less than 10 feet below the surface. Financial returns were small due to the low quality and high ash content of the coal. The alluvial deposits of the valley, though, are rich in clay and eventually it was the use of the clay that turned the Alberhill mine into a large and successful operation. Depending on the type of clay mined, it was used to make sewer pipes, terra cotta, firebrick, roofing materials, brick, and tile (CDNR, 1954, pp. 22, 23).
HYDROLOGY

The graben that forms the Elsinore Valley is the geologic low point for the 765 square mile San Jacinto watershed (EVMWD, 1984a, p. 6-1). Not only runoff from the local hills drains into Lake Elsinore, but the San Jacinto River itself is the single largest water source and forms the lake inlet. Before the construction of the Railroad Canyon Dam which formed both Canyon Lake the lake, and Canyon Lake the community, the river ran unobstructed into Lake Elsinore (Water for, 1955). Now the water flow is controlled, more at times and less at others.

Geologic evidence suggests that at one time the natural outlet for the lake was southwestward along the same path followed by the Santa Margarita River which lies to the south of Temecula and passes through the Temecula Gorge and on to the sea (CDNR, 1954, p. 8). In fact, at that time, Elsinore may have been less of a lake and more a broadening and shallowing of the San Jacinto River. With time, and continued fault block movement, the rising Santa Ana range and the lowering valley basin blocked this course of drainage (CDNR, 1954, p. 8). Evidence seems to indicate that the river for a time drained into the Temecula Creek, but with continued diastrophism (fault movement) even this course was eventually blocked (EVMWD, 1984a, p. F-3). Currently a slight rise near the Wildomar area prevents southern drainage. The San Jacinto River eventually turned northwestward and was captured by the Temescal Creek which flows into the Santa Ana River (CDNR, 1954, p. 8). The Santa Ana River skirts the northern end of the Santa Ana Mountains and reaches the sea along a gently sloping course. Presently this course is the one followed by
water which sometimes flows out of Lake Elsinore and into the Temescal Wash. It is the lake's only natural outlet, but a sporadic one (EVMWD, 1984a, pp. 6-1, 6-10). The mouth of the outlet at the present time is at elevation 1260 feet (Lake Elsinore Management Plan, 1989, pp. 8,9). The lowest point of the lake oasis is elevation 1223 feet. This means that when the lake depth falls below approximately 37 feet, which it does often, there is no lake outlet at all. Most of the time water leaves the lake by evaporation. Currently efforts are under way to lower the mouth of the outlet to elevation 1252 feet with one of the intended effects being that Lake Elsinore will have better water circulation. Estimates are that with the lowered outlet, total water will be replaced approximately every six years (Lake Elsinore as major, 1993).

The Elsinore Valley graben (depression) is a shallow one, with mild topographic features. Because of this, Lake Elsinore is very shallow with a substantial surface area. Though the surface area varies with the water volume, it has been as much as 7,000 acres (EVMWD, 1984a, pp. 4-12). With the completion of the levee in 1990, however, the surface area of the lake proper was more than halved to around 3,000 acres. The low volume to surface area ratio results in substantial evaporation of the lake, as much as 4.5 vertical feet a year; about 9,000 gallons a minute on a moderate summer day (Lake Elsinore as major, 1993). Partially for this reason, the levee was constructed; to reduce surface area and thus water loss due to evaporation (EVMWD, 1984a, pp. 1-8).

Lake Elsinore is an entirely natural lake fed almost exclusively by rainfall and snowmelt within the San Jacinto watershed (EVMWD, 1984a, p. 8,9). Because of this, its high evaporative loss, and the typically low rainfall in
Southern California, its water level is highly variable (EVMWD, 1984a, p. 6-1). It ranges from completely dry to around 60 feet in times of heavy seasonal rains. Local runoff precedes San Jacinto flows by about a day and a half during times of rain (EVMWD, 1984b, p. 37).

Other sources of water for the lake are human managed: water from wells drilled in the southern end of the lake bed, and water purchased from the Municipal Water District (Lake Elsinore filling, 1964). Lake Elsinore itself is not part of any California water projects. Lake Perris to the northeast is the terminal storage unit for the California State Water Project which diverts water southward from the Feather River tributaries in Plumas County, California (Water Education Foundation, p. 4). Lake Elsinore is unique among lakes in Southern California both for its shallowness and the fact that it was not created by damming.

Recorded in the local paper as early as 1885, numerous successful wells were sunk in the Elsinore Valley (Elsinore Valley News, 1885c). In the 1950s, when the lake was dry and the economy all but dead, hopes were high of refilling the lake with high capacity wells capable of pumping more than 7,000 gallons a minute (Drilling of wells, 1959). In the present lake management plan, ground water pumping is still listed as a viable option (Lake Elsinore Management Plan, 1989, p. 4).

The valley floor is made mostly of alluvial deposits carried by the San Jacinto River. To the northern end of the valley, periodic water flows down Rice Canyon, Leach Canyon, and McVickers Canyon have also deposited substantial alluvium onto the valley floor. The surrounding mountain geology is mostly crystalline rock and does not hold ground water (EVMWD, 1984a, p.
The alluvium, the underlying floodplain, and the Pauba formation beneath that are all capable of carrying ground water. In total, water bearing rock extends downward some 2,300 feet, nearly half a mile. Beneath this level the basement rock - mostly gabbro, basalt, diorite, and granodiorite - are all non-waterbearing (EVMWD, 1984a, p. F-4).

A ground water basin is not an underground lake or river; it is the water trapped between the grains and within the pores of the rock. Though the water does flow downgradient, it does so very slowly in inches or feet per day. Water flows out of the Elsinore basin at two key points. To the northeast water outflows occur near the Temescal Wash and presumably head towards the Santa Ana River. Because of the Glen Ivy fault zone, though, outflow is estimated to be minimal. Geologically, waterbearing rock is found all the way to Temecula. Outflows here should be more substantial, but actual outflows are not known (EVMWD, 1984a, pp. F-8,9).

The fault blocks that make up the valley complicate the ground water picture. Ground water does not move easily, if at all, between the fault blocks. To some degree this prevents the groundwater from leaving the Elsinore Valley, but it also prevents easy movement of water into the valley (EVMWD, 1984a, p. F-8). Recharge does occur, though. From the Elsinore Mountains, ground water flows across the Willard Fault and into the basin. To the north, ground water flows downgradient from Rice, Leach and McVickers Canyons. Subsurface water arrives from beneath the San Jacinto River through a geologic formation called the Sedco Cone. In all cases, though, subsurface inflow is reduced because of passage through the fault zones (EVMWD, 1984a, p. F-9).

During 1981, approximately 150 wells (mostly low capacity) extracted
about 8,000 acre feet of water (EVMWD, 1984a, p. F-2). Knowing the amount of water being recharged into the ground water table and the amount of extraction provides a method for estimating the total amount of ground water. By measuring the number of feet that the water table is lowered due to extraction, totals are approximated. In all, the Elsinore Ground Water Basin is estimated to cover 26 square miles (about 14,400 acres). In depth, the ground water basin is about 1,600 feet thick (about a third of a mile). The total capacity of the basin is approximately 1.8 million acre feet of water (EVMWD, 1984a, p. F-6-8).

Because of the nature of ground water, not all of it can be extracted. Agencies calculate a potential yield based on the amount of water and the type of rock present. For the Elsinore Valley alluvial deposits the extraction percentage is 12%. For the underlying Pauba formation yield is estimated at 8% (EVMWD, 1984a, pp. F-9,10). It should be noted that all of the above figures for ground water basin size and yield are calculated estimates. Different agencies have calculated differing figures. For instance the Elsinore Valley Municipal Water District estimates the total ground water at 2.2 million acre feet, and the yields at least 10% higher than state estimates (EVMWD, 1984a, p. F-10). In addition to ground water, surface water is the other aspect of the hydrology picture.

As mentioned, the lake itself is shallow and the depth is highly variable. By federal standards, much of the southeast basin and surrounding regions qualify as wetlands (California Department of Fish and Game, 1988). By international standards, much more would qualify. In 1971, at the city of Ramsar in Iran, an international convention on wetlands was held. As its
definition the convention holds as a "wetland" any area where the water depth does not exceed 20 feet (Dugan, 1993, p. 12). By this broader international definition, most of Lake Elsinore, and all of it at times, would be classified as a wetland. Wetlands, unfortunately, often suffer from particular water quality problems that deeper bodies of water do not face.

One of the problems is the high temperature of the lake water. The shallow nature of the lake also means that not only is there little thermal differentiation even when the lake reaches depths of 30 feet, but that the temperatures rise and fall sharply with seasonal air temperature changes. Temperature of the lake generally varies between 27°C and 10°C (80.6°F and 50°F) (Black & Veatch, 1993, p. 6). The high water temperature also adds to the evaporation problem.

Typically, as the level of Lake Elsinore has decreased due to evaporation the amount of total dissolved solids (TDS) has increased. TDS are the total of all substances dissolved in the water and includes substances such as calcium, magnesium, sodium chloride, and other naturally occurring elements and compounds. Evaporation leaves those substances behind in a decreased volume of water thereby increasing the TDS. A three year study conducted by the Santa Ana Watershed Project Authority (SAWPA) for the Elsinore Valley Municipal Water District (EVMWD) showed the TDS ranged between 1000mg/liter (1000 milligrams per liter) and 5500mg/liter. Levels above 2000mg/liter are considered excessive. During periods of rain, when water is released into Lake Elsinore from Canyon Lake, the levels of TDS decrease sharply. Levels can be reduced to a quarter of their previous measurements following heavy inflow (Black & Veatch, 1993, pp. 6,7).
pH is another aspect of water quality. pH is a measure of the acidity or alkalinity (basicity) of a substance. Values range from 0 to 14. Values less than 7 indicate increasing acidity as they approach 0. Values greater than 7 indicate increasing alkalinity as they approach 14. The scale is logarithmic. Seven is neutral, neither acid nor alkaline. For a healthy lake, pH levels should be between 6.5 and 8.5. Except at times of heavy inflow, when pH levels declined slightly for short periods of time, the pH level of Lake Elsinore ranged between 9 and 10. This level of alkalinity is very high for a natural lake and due primarily to the alkalinity of the dissolved solids and soil (Black & Veatch, 1993, p. 7).

The water quality study also examined the level of toxic metals within both the lake water and the bottom sediments. The ten toxic metals tested for in the study were barium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, silver, and zinc. Water was also checked for the presence of arsenic, hydrocarbons, boron, grease, and oil. Copper was the only metal detected that on average exceeded the water quality criteria of 17µg/L (micrograms per liter). The copper may be naturally occurring. Toluene was the only hydrocarbon detected and at levels of 7µg/L. In the bottom sediment samples, barium and zinc were detected in the highest concentrations, but no metal concentrations were considered excessive in the sediments (Black & Veatch, 1993, pp. 10, 13).

In total, the report concluded that Lake Elsinore's water quality was "highly variable." Algae levels, TDS, un-ionized ammonia levels, pH, and nitrogen levels all exceed water quality objectives. Total dissolved oxygen is less than ideal and also falls short of the standards (Black & Veatch, 1993, pp.
14-16). In terms of ground water, Lake Elsinore's reserves are substantial and of high quality.
BIOLOGY

There are a number of different environments to be considered when discussing the biology of Lake Elsinore. There is the life in the lake water itself. There is the life of the federally recognized wetlands areas at the lake edge, particularly at the southern end. There is the life found on the lake surface. Lastly, there is the life that surrounds the lake region.

The lake itself is a highly complex ecosystem. As mentioned before, Lake Elsinore is a natural lake fed primarily by the San Jacinto River and the watershed that drains into it. The topography of the Elsinore basin is very gentle with the result that Lake Elsinore is a large, shallow body of water. The shallow nature means that the water temperature rises quickly when days are warm, even in winter (Black & Veatch, 1993, p. 6). As the water warms, algae growth begins to accelerate (Black & Veatch, 1993, p. 11). Growth is exacerbated by high levels of nitrogen and phosphorous in the water which acts like fertilizer on a lawn (Black & Veatch, 1993, p. 8). In addition, warm water is less able to hold dissolved oxygen (DO) and biochemical oxygen demand (BOD) increases with water temperature. The result is that just when the organisms in the water need more oxygen, the water has less of it.

There are two chemical reactions that take place in plants that are notable. The light reaction of photosynthesis takes sunlight and carbon dioxide, and gives plant sugars and oxygen as products. The dark reaction does just the opposite, using up available oxygen. Rapidly growing plant cells tend to use more oxygen than they produce. When algal growth is intensive, called an algae bloom, dissolved oxygen (DO) present in the water is rapidly
depleted. When DO levels are reduced the algae itself begins to die (Black & Veatch, 1993, p. 6). As the algae dies decomposition pulls the remaining oxygen from the water leading to fish die offs that can weigh in the thousands of pounds (California Department of Parks and Recreation, 1989). The combination of decaying algae and dead fish can promote a powerful stench. The dead fish also attract hundreds of millions of flies, which from a human point of view is unappealing.

DO levels in Lake Elsinore fluctuate widely from 0mg/L to 20mg/L depending on the water temperature and subsequently the algae concentrations. Poor circulation in the lake tends to leave higher DO concentrations at the surface and DO levels near 0mg/L at the bottom (Black & Veatch, 1993, p. 6).

Algae growth requires not only oxygen, but phosphorous and nitrogen as well. The types of phosphorous that plants can use are called orthophosphates. The types of nitrogen that can be used are ammonia, nitrate and nitrite. When algae growth is intense, nitrogen and phosphorous may be depleted from the water column, but returned upon decomposition (Black & Veatch, 1993, pp. 8,9). Additionally, when phosphorous and nitrogen levels are low, they act as limiting agents for the growth of the algae.

Incoming water from the San Jacinto River contains high levels of both orthophosphates and nitrates which load Lake Elsinore and promotes continued algal growth (Black & Veatch, 1993, p. 11). The source of the orthophosphates and nitrates is not completely clear, but probably comes as runoff from the surrounding upstream watershed which is heavily farmed. Fertilizers used to increase crop yields are drained into the San Jacinto River
during rains which, when they reach Lake Elsinore, fertilize the algal growth. 

Actual orthophosphate levels in the incoming water were around 0.5mg/L (milligrams per liter) for nearly all samples. Actual nitrate levels from the San Jacinto inflow were around 0.59mg/L but did range as high as 1.0mg/L (Black & Veatch, 1993, p. 12).

Other than the algae the lake waters do not support a plant population, except at the edges and in the shallow wetland regions. Truly aquatic, large plants (macrophytes) are not present (Black & Veatch, 1993, p. 5). Of algae, Lake Elsinore has many different types. It has the highest concentration of types referred to as "polluted water algae," "taste and odor algae," "reservoir algae," and "filter clogging algae." Lake Elsinore also contains a substantial quantity and variety of blue-green algae (Associated Laboratories, 1993, pp. 1, 2). (For a complete list of algae species see Appendix F.) Bacterial organisms thrive as well in the warm lake waters.

The Riverside County Department of Environmental Health (RCDEH) is the agency charged with supervising the water quality of Lake Elsinore. The RCDEH is concerned with maintaining water that will not cause illness in people who use it for recreation. Swimmers, water skiers, and fisherpeople may come into "full body contact" with the lake water (Environmental Protection Agency, 1986, p. 7). The Federal government has set standards through the EPA (Environmental Protection Agency) for how clean water must be for recreational use (Environmental Protection Agency, 1986, p. 3).

Bacteria in water can cause diarrhea, stomach cramps, headaches, vomiting and more serious diseases like hepatitis (Environmental Protection Agency, 1986, p. 7). Each of these diseases can be caused by different bacteria.
A federal government sponsored study discovered that fecal coliform bacteria are primarily the type that endanger people. Fecal coliform bacteria are found in sewage, or in some varieties, in the human intestine. The presence of *Escheria coli* (*E. coli*) in fresh water in quantities greater than 126/100 mL (126 bacteria per 100 milliliters of water) indicates that the water is potentially dangerous to most of the people who come in "full body contact" with it. Enterococci in concentrations above 33/100 mL is another indicator of dangerous waters. *E. coli* cannot be used to indicate the safety of salt waters, but enterococci can. Which organism is used as an indicator is up to the agency doing the testing (EPA, 1986, p. 8). The RCDEH uses *E. coli* levels and also tests for total fecal coliform levels (RCDEH, 1981-1993).

According to the water standards set by the federal government for recreational use, 8 illnesses per 1000 people is an acceptable level. Also according to federal standards, statistically significant illnesses do not occur until the fecal coliform level exceeds 400/100 mL (EPA, 1986, p. 6). At Lake Elsinore between 3 and 18 locations are tested monthly for *E. coli* levels. Though most of the time most of the *E. coli* counts are within safe levels, sometimes the individual locations vary from less than 3/100 mL to greater than 2400/100 mL in water samples collected on a single day. When collecting samples, the biologist must be sure that the vials are iced for shipment to an outside lab for analysis (RCDEH, 1981-1993). (For complete graphs of bacterial samples from 1981 to 1993, see Appendix D.)

The federal manual regarding recreational water suggests that frequency of usage, type of usage, and consistency of data should be mitigating factors in deciding whether or not beach facilities should be left open or closed.
E. coli levels of 126/100mL are just guidelines and many other factors are involved (EPA, 1986, p. 9).

Heavy rains or flood conditions stress the abilities of the sewage treatment facilities sometimes resulting in the release of untreated waste into the lake. This increases the fecal coliform bacteria levels and decreases the safety and quality of the lake water. For example, on June 14, 1983 a break in a sewage line closed the lake to recreational activities, including fishing (California Department of Parks and Recreation, 1983) (RCDEH, 1983).

The lake’s gamefish are the responsibility of the California Department of Fish and Game (CDF&G). Due to the lake’s relatively warm waters (50-80°F) only warm water gamefish are suited. No native species exist in the lake because it dries up periodically (Guisti, 1994). The lake supports a tremendous tonnage of fish which is problematic when the algae blooms and the available oxygen is depleted. The result is fish die offs. Major fish die offs have occurred in 1933, 1936, 1940, 1948, 1966, 1972, 1976, 1977 and 1989 (Jones, 1988). Warm water, low lake level, high nutrient content, and algae blooms are conditions optimal for fish die offs. In 1972 just those conditions killed over 800 tons (1.8 million pounds) of fish, the largest fish kill ever recorded at Lake Elsinore (Jones, 1988). This tonnage may represent the total biotic potential of Lake Elsinore, since except in these extreme conditions, the total tonnage of fish in a body of water tends to remain nearly constant (State of California, 1968, p. 32).

The type, size, age, and total numbers of fish in the lake are estimated by the CDF&G by a technique called electrofishing. A boat equipped with a generator is taken out onto the lake. Electrodes are dropped into the water at
various depths and at various locations and an electric shock is emitted into the water stunning the fish and causing them to float to the surface. The fish are measured, weighed, counted, tallied and kept in a livewell. Electrofishing is not possible when the water is highly conductive, since the shock becomes too diffuse to stun the fish (CDF&G, 1993). Electrofishing on June 10, 1990 yielded only carp (Guisti, 1994). However, the latest electrofishing survey on September 15, 1993 yielded seven different species of fish: black bullhead, black crappie, bluegill, green sunfish, large mouth bass, threadfin shad, and yellow bullhead. Average lengths were 14.4cm, 15.0cm, 6.9cm, 7.7cm, 18.7cm, 9.9cm, and 12.4cm, respectively. The most common fish in the lake was large mouth bass, making up almost half of the fish survey. Bluegill made up over a quarter of the survey. Each of the rest were less than 10% (CDF&G, 1993).

Both the bass and the bluegill are considered "desirable gamefish" (State of California, 1968, pp. 6, 11). The green sunfish are the least desirable of the gamefish in the lake because of their tendency to remain small even under ideal conditions (State of California, 1968, p. 13). Bass are only predatory, whereas bluegill eat both plants and animals (State of California, 1968, pp. 6, 11). Threadfin shad are primarily fed on by the bass and provide a link in the food chain from the algae to the carnivores. In 1885 bluegill were first introduced into the lake, but did not survive (State of California, 1968, p. 11). Lake Elsinore was last stocked in 1992 by the CDF&G (Guisti, 1994).

The length and weight of a fish, though important to fisherpeople, does not indicate the age of a fish, because size can be greatly affected by water quality, fish density, food availability, and the length of time that the water is warm enough for fish growth (State of California, 1968, p. 34). Under the
microscope, fish scales exhibit growth bands similar to the rings in the cross section or coring of a tree. Each dark band on the scale indicates the end of one season of growth (State of California, 1968, pp. 34, 35).

Wetlands are protected by the federal government through the Environmental Protection Agency (EPA) under the National Wetland Policy. Basically, it attempts to preserve wetlands on an "acre for acre" basis, meaning that where wetlands are destroyed, they must be replaced with replanted wetlands of equal acreage (Dugan, 1993, p. 70). Wetland protection is particularly important in California which at one time had the largest acreage of wetlands in the nation. Presently, about 2% of the total remains (Dugan, 1993, pp. 45, 46). Wetlands serve a number of functions beneficial to humans, but only recently widely understood. Wetlands purify water, clean out contaminants, recharge ground water supplies, serve as nurseries for fish, and breeding and nesting areas for waterfowl (Dugan, 1993, pp. 22, 23).

"Wetland" is a catch-all term for more than 50 different habitats ranging from those permanently covered with water to those only wet beneath the surface (Dugan, 1993, p. 12). The Lake Elsinore basin has five different wetland classifications according to a 1991 report prepared for the City of Lake Elsinore (Sweetwater Environmental Biologists, 1991, pp. 15-21). All five are considered "sensitive" by the California Department of Fish and Game and the US Fish and Wildlife Service (USF&WS). They are:

- Alkali marsh
- Freshwater marsh
- Southern willow scrub
- Southern cottonwood-willow riparian forest
Non-native tamarisk

In addition to the wetlands found around the lake edge, over 300 acres of wetland exist behind the levee built in 1990 (LEMA, 1992). Within those wetlands 100 acres of islands were built to provide wildlife habitat and nesting areas. The wetlands will be planted by the City of Lake Elsinore as part of its agreement with the USF&WS and CDF&G (CDF&G, 1988). In addition, a conduit was added through the levee to facilitate the passage of fish from the wetlands (where many breed) to the lake proper.

The alkali marsh wetland is found along the lake shore line. Plant species here are salt grass, sedge, Mexican rush, frankenia, marsh fleabane, Russian thistle and tamarisk. Russian thistle and tamarisk are non-native species (Sweetwater Environmental Biologists, 1991, p. 19).

The freshwater marsh wetland is found on 5.5 private acres toward the southern end of the lake. Cattails are the dominant plant species there. This marsh is permanently flooded (Sweetwater Environmental Biologists, 1991, pp. 19, 20).

The southern willow scrub is a transitory wetland is dominated by willow and tamarisk and found on the west and southwest sides of the lake. It covers about 100 acres (Sweetwater Environmental Biologists, 1991, p. 20).

The southern cottonwood-willow riparian forest covers 44 acres. This is a streamside wetland found along the lake inlet. Cottonwood, willow, and eucalyptus trees thrive there. Bulrush and grasses are found beneath the forest canopy (Sweetwater Environmental Biologists, 1991, p. 21).

The non-native tamarisk wetland area is found at the north and south ends of the lake. The tamarisk is not a native plant and has replaced the native
wetland species at these two locations (Sweetwater Environmental Biologists, 1991, p. 22).

Within those marsh areas the following "sensitive" bird species have been observed (Sweetwater Environmental Biologists, 1991, p. 16).

- Golden eagle
- Cooper's hawk
- Northern harrier
- White pelican
- Black crowned night heron
- Great egret
- Yellow warbler

Golden eagles are predatory, feeding on small mammals and birds. They are not strong fliers and generally rely on stealth. They are about 39 inches long. They are a type of booted eagle so called because of the thick tufts of feathers that extend down the legs (Perrins, 1990, p. 104). Pairs of these have been sighted on Rome Hill (Sweetwater Environmental Biologists, 1991, p. 32).

Cooper's hawks are also active hunters, though only about half the size of a golden eagle. The female is larger than the male. They prefer to remain hidden in cover when possible (Perrins, 1990, p. 97). Those found in Elsinore are probably transitory migrants (Sweetwater Environmental Biologists, 1991, p. 32).

Northern harriers are predatory falconiformes about the size of the Cooper's hawk. They hunt for small mammals in a low skimming flight pattern (Perrins, 1990, p. 93). Those found in Elsinore, like the Cooper's hawk, are probably migrants (Sweetwater Environmental Biologists, 1991, p. 32).
American white pelicans are typically fish feeders and travel in flocks. They prefer to build their nests on the ground, unlike the falconiformes above. Juvenile birds are brown in color. Size is about 70 inches long (Perrins, 1990, p. 60). Groups of 30 or more winter in Elsinore on the lake (Sweetwater Environmental Biologists, 1991, p. 33).

The black crowned night heron is a night bird feeding on toads, frogs, and small fish. They nest colonially in trees. Size is about 25 inches (Perrins, 1990, p. 69). Those at Lake Elsinore probably have nests at the southeastern woodlands (Sweetwater Environmental Biologists, 1991, p. 33).

Great egrets and snowy egrets are from 25 to 40 inches tall. They are territorial within communities. They build nests in low trees (Perrins, 1990, p. 68). Snowy egrets may be seen feeding by the thousands along the lake marshlands or the open fields around town. Hundreds feed at the Elsinore Middle School athletic field in the late afternoon.

The yellow warbler is an insect eater that prefers to nest and live in foliage. They are small, only about 5 inches long. There are a variety of subspecies that differ in plumage coloration and in song (Perrins, 1990, p. 328). Interestingly, the way that biologists searched for the presence of the yellow warbler, and other songbirds in Lake Elsinore, was to walk through suitable habitat while the species call was played through a tape recorder. If present, the songbirds will respond vocally and come within visual observation range. Species such as Bell's least vireo, a "sensitive" species, were searched for, but never found on either Rome Hill or the lake edge area that provides suitable habitat (Sweetwater Environmental Biologists, 1991, p. 8).

Golden eagles, Cooper's hawks, northern harriers, yellow warblers,
black crowned night herons, and white pelicans are all considered "sensitive" bird species by the CDF&G (Sweetwater Environmental Biologists, 1991, p. 25). Other "sensitive" wildlife species known to occur in Lake Elsinore are the California red-legged frog, the Pacific pond turtle, the grabite spiny lizard, the greenest tiger beetle, the yellow billed cuckoo and the California mastiff bat (Sweetwater Environmental Biologists, 1991, p. 29). The San Diego horned lizard, found in Lake Elsinore is undergoing a population decline not related to habitat loss. Some groups consider it to be endangered, but the CDF&G lists it as a "species of special concern" (Sweetwater Environmental Biologists, 1991, p. 6). (A complete list of flora and fauna found in the Elsinore lake area is in Appendix E.)

Lake Elsinore provides extensive support for avian wildlife, especially for migratory birds for whom wintering grounds are disappearing. The lake itself supports a substantial fish population, but few plants other than various species of algae. The wetland areas, including those replanted, provide fish breeding habitat and support varied marsh plants. As far as bacteria, safe bacterial levels are often exceeded for a single sample, but rarely do the levels of a significant number of the samples warrant concern.
Though Lake Elsinore has probably had more impact over the years on its citizens - through its flood-then-dry personality - than the other way around, human impact is certainly significant, especially in recent years. As a town, Elsinore was founded in 1883 and incorporated in 1888 (Bad spot, 1993; City of Lake Elsinore, 1993). Early agriculture was extensive, and as early as 1886, the local paper speculated about climate changes. An editorial suggested that the climate of the Great Plains had been radically altered from nearly dry to presently suffering from the "terrible plight of unrelenting storms" because of the prevalence of agriculture (Elsinore Valley News, 1886a). The editorial wondered if the same fate might be in store for Elsinore, once the valley began to grow.

Other early articles speculated and reported the impact of humans. The August 12th, 1885 Elsinore Valley News reported this from the Valley Echo:

*So many deer have been slain in the valley during the present summer that it is feared that the next crop will be very light.*

The quote was presented somewhat in mockery and received the response, "there is no danger." The same issue reported that:

- *Waterfowl are coming on the lake in large numbers. They are more than a month early.*
- *Quail are an intolerable nuisance here. (The inference here was that hunting limits by the government were preventing the nuisance from being addressed).*
- *Dewitt Smith saw three real grey wolves between the lake and the mountains.*

The March 31, 1886 issue gave this rather concise listing of wildlife in Elsinore.

*On the lake is found countless numbers of duck, geese,*
swan, pelican, curlew, etc.; on the plains and on the hillsides such as quail shooting that we frequently read about, but seldom find; in the mountains are found deer, mountain goats, sheep, red, grey, and silver foxes, coyotes, grey wolves, wild cats, brown cinnamon, and grizzly bears, and the California lion.

It also gave a rather telling account of what the value was of some wildlife.

Peter Fugsang shot and killed four large pelican [sic] at one discharge of his gun and one got away that he did not get. They weighed in the neighborhood of 17lbs each, a fine lot of meat, if only good for anything.

The human impact cannot be denied when looking back at the numbers and variety of wildlife that inhabited the Elsinore Valley. Many of the species listed in 1886 can no longer be found in the valley or even in California (Sweetwater Environmental Biologists, 1991, p. B-1). Many others are threatened or endangered (Sweetwater Environmental Biologists, 1991, p. 25). The lake itself, however, still serves as a wintering grounds for tremendous numbers of bird species (Sweetwater Environmental Biologists, 1991, p. 23).

The impact on the surrounding valley could, however, have been much greater. The reason that it has not lies in the fact that Elsinore still has a small population. The 1990 figures put the population in Lake Elsinore at approximately 24,000 (Southern California Association of Governments, 1990). For wildlife and habitat impacts, increasing population means increasing stresses on wildlife. Lake Elsinore has grown slowly, and even declined in population at times. Estimates are, however, that by the year 2010 population will be 70,500, nearly three times the present (Southern California Association of Governments, 1990). Such growth will further impact the species that make the lake home. Besides this future impact, previous human events have
already affected the lake.

In 1928, Railroad Canyon Dam was built several miles upstream of where the San Jacinto River entered Lake Elsinore. The project had been a source of contention between Lake Elsinore land owners and the Temescal Water Company (TWC) which sponsored the project. Litigation was resolved with the signing of the Tilley Agreement on October 29, 1927. The agreement specified how much water TWC was allowed to retain based on water elevations in Lake Elsinore. In addition, it gave the Elsinore the right to store 3,000 acre feet of water behind the dam (EVMWD, 1984a, pp. 35-37, 2-2).

In 1955, when the lake had dried up, a newspaper article in the Lake Elsinore Valley Sun pointed out that lake levels declined drastically after the dam was built (Water for, 1955). Indeed, from the time the dam was completed the lake level began a steady decline that was the most dramatic in the century to date (EVMWD, 1984a, p. 4). Looking at both earlier and later records, however, it is apparent that the lake, due to its high surface area and low volume, had always suffered wild fluctuations. In fact, in this century, inflow has exceeded the rate of evaporation only 13 times (LEMA, 1992). What was probably altered permanently, though, was the water quality of the lake. With decreased inflow came decreased outflow. Most water began leaving Lake Elsinore through evaporation and not the Temescal Wash. This could result in increased alkalinity, salinity and concentrations of all dissolved solids.

In 1951 the lake dried up completely. Except for 1953, when three feet of water remained in it for the entire year, it dried up each and every summer until 1965. For 1960 through 1963 it had no water in it during any part of the year (EVMWD, 1984a, p. 33). Economically devastated, the city sought
solutions. One was to work towards giving the lake to the state in hopes that
the state would pay to refill it and maintain it, something the city could no
longer afford to do. In 1957 the California Department of Parks and Recreation
purchased 2,900 acres of the lake bed (Many worked, 1962).

A second solution involved sinking high capacity wells into the lake
bottom (Atherton, 1973; Drilling of wells, 1959). A group called Water for Lake
Elsinore raised money to hire a water diviner named Verne Cameron and to
pay for wells to be drilled. In 1959 the wells struck water (Drilling of wells,
1959). The state also drilled three wells capable of pumping 7,200 acre feet per
year (EVMWD, 1984a, p. 22). They belonged to the CDP&R until July 1, 1994
(Lake transfer, 1993; Staff, 1992). The depth of the wells is tremendous; around
1,600 feet (EVMWD, 1984a, 43). They were capped in 1969 (Wells capped,
1972). Currently they are being refurbished but are unneeded (City will drain,
1993; Lake Elsinore as major, 1993). During the floods of 1980, the wells were
submerged.

A third solution was to purchase water from the Metropolitan Water
District. This was finally done on February 1, 1964 when 30,000 acre feet of
purchased water begin running into Lake Elsinore (Lake Elsinore filling, 1964).
Left to nature it would not have been filled until 1969 (EVMWD, 1984a, p. 33).

The lake's importance to the town was, and still is, substantial.
Currently it is estimated that nearly 20 million dollars annually is brought to
the city by the presence of a usable lake (LEMA, 1992). When the lake was dry
in the 1950s, property values plummeted, and the city's population dropped to
2,500 (Drilling of wells, 1959).

The CDP&R operated two state park areas with records kept from July
1, 1979 to July 1, 1993. The parks were available for boat launches, picnicking, swimming, fishing and camping and charged fees. The attendance records (graphed in Appendix C) show that the July attendance ranged from as high as 79,620 people for 1986 to as low as 1,218 people in 1980. For all years the average for July, the highest attended month, was almost 28,000 people. The attendance records match up expectantly with the lake surface elevations. The lake level reached a high in 1983 and dropped steadily until 1991. The attendance records low in 1981 due to flooding, reached 35,000 for July of 1982, when depth was about 30 feet. By 1990 when the maximum depth was about six feet, attendance for July was only a little over 6,000 people. When the lake floods, attendance drops. When the lake level drops, and water quality suffers, attendance also drops (California Department of Parks and Recreation, 1979-1993; RCDEH, 1981-1993). The economic base of Elsinore is the lake and that economic base is maximized when the level is stabilized (EVMWD, 1984a, p. 6-1).

Stabilization was first mentioned on June 23, 1886 (Elsinore Valley News). It was mentioned again in 1916 (Tecca, 1993, p. 18). In 1974 Plan C was mailed to all the residents of Lake Elsinore (Plan for, 1974). Plan C involved diking the lake to reduce its surface area and thus reduce water loss due to evaporation, dredging the bottom and sides to make it deeper, and constructing a holding pond. The entire plan was estimated to cost 12 million dollars (Plan C, 1974). Plan C was never implemented. The idea itself, however, never evaporated, nor the promises that it held. A stabilized lake meant no flooding or drying up. It meant a consistent edge around which restaurants, marinas, hotels, and businesses could spring up. It meant a
consistent source of income for a boom and bust city (Lake transfer, 1993).

In 1984 began the largest project ever undertaken on Lake Elsinore. The EVMWD applied to the federal Bureau of Reclamation for a grant and loan package to implement the Lake Elsinore Management Project (LEMP). Under the Small Reclamation Projects Act, the grant and loan package was offered for a maximum of 40 million dollars (EVMWD, 1984a, p. 4-12). The original application spanned nearly 400 pages and the addendum that followed several months later was another 200 pages. It was a logical extension of the original Plan C proposal 10 years earlier. Three basic projects were proposed in the LEMP. A main levee 17,500 feet long was to be constructed to cut the size of the lake nearly in half, from 6,200 acres (at that time) to 3,270 acres (Why is EVMWD, 1991). The San Jacinto watercourse was to be changed, the inlet graded and lined with rip rap (rock). The outlet was to be lowered from its present 1260 feet elevation to 1255 feet elevation by the Army Corps of Engineers (EVMWD, 1984a, p. 4-12). As soon as the Corps was done, the Riverside County Flood Control District would come in and lower the elevation to 1252 feet. The lowering of the inlet was to control the flooding of the lake (Bids will be taken, 1993). The ultimate goal of the project was to stabilize the lake at approximately elevation 1240 feet, leaving the lake never any less than 17 feet deep (Construction of levee, 1993).

By cutting down on evaporation, drilling three new wells at the southeast end of the lake, refitting the existing wells, and using reclaimed waste water, the project hoped to be able to keep a minimum level of water in Lake Elsinore (EVMWD, 1984a, p. 1-6). Eventually the project would be put under the control of the Lake Elsinore Management Authority (LEMA) with
the city, EVMWD, CDP&R, the redevelopment agency, the county of Riverside and the Santa Ana Watershed Project Authority (SAWPA) as co-signers in a joint powers agreement (New agency to, 1988).

An early hitch was the original terms of the federal grant. It had to be for reclaiming land for agricultural use and could not be for flood control purposes (EVMWD, 1984b, p. 22). To that end, the eventual addendum to the original application became a bit of a farce. Originally, the loan calculated benefits to agriculture as 3% of the project and flood control benefits as 39% (EVMWD, 1984a, p. 4-23). After criticism, the EVMWD purchased the Temescal Water Company, which served more agricultural lands, and recalculated their benefits. Under the new calculations, agriculture benefits were 21% of the project and flood control aspects only 7% (EVMWD, 1984b, p. 45-49). In addition, keeping water in Lake Elsinore had always been a problem, the idea that the stabilized lake could provide more water for agriculture was hard to believe, especially since calculations by the EVMWD showed that agricultural use was declining in the area, not increasing (EVMWD, 1984a, 4-11).

There were other concerns as well. Concerns that EVMWD would not be able to repay the loan; that costs would exceed 40 million; that construction of the inlets and outlets were poorly designed, that there were errors and omissions in the original application and many other minor and varied criticisms (EVMWD, 1984b, pp. 11-21). In the end they were addressed well enough that the federal government sponsored 26 million dollars of the project in loans and grants. EVMWD agreed to repay the grants over 40 years, but interest free. The loans were signed at 10⁷/₈₀% interest (Lake Elsinore
Management Plan, 1989, p. 11)

The U. S. Fish and Wildlife Service (USF&WS), one of many agencies contacted for the project, initially called it "an unacceptable loss of habitat values for public fish and wildlife resources" (USF&WS, 1984). They made many recommendations, most about preserving wetland habitat. One of the major concerns was about disturbing species of birds in the Temescal Wash area during construction of the outlet channel (Fish, game meet, 1989), many of them classified as "sensitive," others like the least Bell's vireo as "endangered."

The CDF&G made a number of specific recommendations about the same issues. They were (EVMWD, 1984a, pp. 27, 28):

- Replacement of wetlands on an "acre by acre basis."
- "Viable connection between lake and wetland" with a maximum velocity of one foot per second.
- Maintenance of the wetlands at 1240 feet surface elevation.
- One hundred percent revegetation within five years.
- Wetlands to only be used for "passive recreation."
- Maintenance of DO levels at least five parts per million.
- Minimal disturbance during construction.

New wells were drilled 1988. The main levee begun in June 1989 was completed in March of 1990 (Lake Elsinore audit, 1991). The inlet and the old wells were rehabilitated from February 1990 to March 1991. The outlet was begun in December of 1993 and expected to be done by early 1995 (LEMA, 1992; Otway, 1991).

Features of the final design include a meandering levee 30 feet high with rip rap sides, an overflow weir at the north end of the levee to spill flood
waters into the back flood plain, a fish breeding habitat just behind the island wells, and redesigned bridges over the outlet channel. Wetlands features include 330 acres; 100 acres of islands, 200 acres of submerged wetland, 30 acres of buffer zone and 2 wells drilled to provide water for the wetlands area. Strangely enough, used tractor tires were tied together to create an artificial reef for the wetlands area. Most broke free and went bobbing around the lake after the heavy rains of 1993 causing numerous reports of alligators (Loux, 1993). Seventy five acres of the islands will be planted with black willows, cottonwoods and other native plants while 25% will be left unplanted. The area may be fenced to prevent human intervention. Aeration equipment will be provided to meet the standards (LEMA, 1992; EVMWD, 1984a, pp. 27, 28).

In the wake of this massive project, the city still faces problems with the lake itself. Algae growth is a continual problem exacerbated by nutrient run-off from upstream farmland. Two solutions to this have been attempted in the past. The lake has been treated by spraying copper sulfate which kills the algae, but also the fish (Jones, 1989). In 1992, the city first tried a bacterial solution called Aqua-treat along the lake shore (Lake shore sprayed, 1992). The bacteria eat the algae and produce oxygen in the process (Lake update, 1993). On June 30th, 1993, 36,000 pounds of bacteria were released into the lake with the promise that it would be a permanent solution (Banks, 1993b). Retreatments later proved necessary. Both solutions cost nearly the same, about $350,000 (Banks, 1993a).

The DO problem was first addressed in 1992. An aeration system at a cost of $117,000 per season was set up and tested. Unfortunately the results were less than hoped (Maxwell, 1992)
The fish die off problem would be solved if the aeration and algae problems could be solved, but unfortunately they have not. The CDF&G gets the brunt of the complaints and is responsible for most of the clean up when fish kills occur. They have tried several solutions in the past, none with complete success. One program, when it appeared fish kills were imminent, was to allow "no limit," "no license" fishing for the balance of the calendar year. Another option tried was commercial fishing of the lake. In 1977, 120 tons of fish were harvested. In 1989, another problem year, commercial carp fishing seemed the perfect solution (Jones, 1989). Unfortunately it never materialized, despite the intense interest of one company (Guisti, 1994).

Besides completion of the current Lake Elsinore Management Project, the future holds huge plans for the lake as well. The city has begun, but not adopted, the Lake Edge Specific Plan, a regulatory document to guide development around the city owned lake perimeter. The 1994 draft proposal explains that it is "intended to guide future development, not propose future development by the city." Still, it is a massive plan, affecting 1,600 acres of lake edge. If completed and adopted it would guide the architecture and style of city parks, marinas, wharfs, restaurants, and businesses within the lake edge area (City of Lake Elsinore, 1994, p. 1). The architecture in the draft is given as "1920's Southern California lakefront resort style" (City of Lake Elsinore, 1994, p. III-3).

A minor league baseball park was completed in the spring of 1994 (Staff, 1993). A seaport marina, with 322 boat slips, a boat hoist, marine retail stores, and concessions stands is in the planning stages (Seaport marina, 1993). A recreational island marine complex with 201 boat slips, boat hoist, fuel dock,
youth and group facilities, swim lagoon, ski beach take off area, restaurant and hotel is also in blueprint form (Recreational island, 1993). For the flood plain area a massive preplanned community, Eastlake, is also in planning stages (Eastlake Community Builders, 1992).

If all of these projects are completed it would mean the most intensive human impact on the lake in its entire history. Already, the changes in the last ten years have wrought unprecedented environmental and ecological impacts, some of which may not be undone. A biological survey for the Lake Edge Specific Plan could find no trace of the endangered bird Bell's least vireo (Sweetwater Environmental Biologists, 1991, p. 13). Federal changes are underway to change wetland classifications (Dugan, 1993, p. 70), which may remove any part of Lake Elsinore from the wetlands definition, rendering development, and thus environmental changes even to the guaranteed wetlands area, inevitable. In that sense the final chapter of this project will remain forever unfinished.

In the following section, the lake education curriculum can be found. It represents the culmination of this project and the means to convey the research information to junior high students. It is in this that the three-part project comes together. Prior knowledge and attitudes were assessed with the lake opinion survey. Accurate and extensive information about Lake Elsinore was gleaned from primary and secondary sources and presented in the background research section. Based on both of the first two sections, appropriate curriculum was designed. It is hoped that the complete Lake Education Project will enable students to experience first-hand the outdoor beauty and ecological struggle that surrounds them.
APPENDIX A

LAKE EDUCATION PROJECT CURRICULUM
USING THE LAKE EDUCATION MATERIALS

The Lake Education Project is divided into several parts. The first part is the summary of the lake opinion survey. This is intended to give general information about community perceptions of Lake Elsinore and guide the teacher's understanding of the students. Complete survey results are in Appendix B.

The second part of the project is a moderately extensive background report on various aspects of the lake; its history, geology, hydrology, biology, and human use factors. In order to make the best use of the lake curriculum it is very important that the teacher be familiar with the information and concepts in this section. Without a thorough understanding of Lake Elsinore, the lessons will lose their purpose and relevance, undoubtedly serving little educational purpose. The research presented in this section was not intended to be exhaustive, but to present fundamental ideas, relationships, motives, and knowledge about the lake. Those interested in further information on a given topic are referred to the source material listed in the References section.

The third part of the project is the actual Lake Education Project curricular materials. In all, 18 lessons are presented, teaching aspects covered in the research section. The lessons comprise an approximately five week unit and are meant to be taught in order. The unit may be shortened, provided that introductory and concluding lessons are used. Either shortened or full length, the teacher will need to make connections between topics for the students, and to have substantial background information on each topic in order to lead discussions and answer questions.
The lessons were designed to be simple and effective. To this end each lesson is constrained to a single page, followed by the appropriate supporting material. Approximate preparatory and teaching times are indicated, as well as extra materials required. Many of the lessons take place outdoors, at the lake itself when possible. The following suggestions can maximize the outdoor teaching experience.

- Visit the site ahead of time to identify potential problems and potential teaching aids.
- Discuss ahead of time appropriate outdoor behavior and the consequences for failing to behave appropriately.
- Discuss respect for natural areas and the organisms that live there.
- Identify the boundaries at the site and any special safety instructions.
- Have a signal that can be seen or heard by the entire class.
- Emphasize to students that they will be engaged in serious, scholarly inquiry and research and that they will be expected to complete the tasks assigned.

The Lake Education Project has the general aim of increasing student awareness, knowledge, and concern for the environment in which they live, Lake Elsinore. Each lesson has a specific objective and goal as listed below.

Lesson 1 - Positively Beautiful.

Goal - To familiarize students with outdoor lessons in general and local outdoor environments.

Objective - Students will be able to identify at least one outdoor location that they genuinely appreciate for its inherent beauty.
Lesson 2 - Lake Elsinore: The Game.

Goal - To provide a general overview of Lake Elsinore for the students and a framework for subsequent lessons.

Objective - Students will be able to relate at least three locations and significant events that occurred there.

Lesson 3 - Noteworthy History.

Goal - To familiarize students with the Lake Elsinore area; its past and present, including human effects.

Objective - Students will take comprehensive notes on at least one newspaper article and write a newspaper article from comprehensive notes.

Lesson 4 - Historic Moments.

Goal - For students to realize the historical fluctuations in Lake Elsinore's water level and the relation between water level and water quality.

Objective - Students will identify at what levels water quality is good, at what levels bacterial contamination is a potential problem, and at what levels Total Dissolved Solids are excessive.

Lesson 5 - A Day in the Life.

Goal - For students to be aware that Elsinore Valley supported a native population before the coming of the white man.

Objective - Students will be able to list at least five plants native to Lake Elsinore and identify how the Indians used them.
Lesson 6 - Who\'s Fault is It?

Goal - Students will become aware that Elsinore is an active fault valley and that human inhabitants need to plan with this in mind.

Objective - Students can list at least three of Elsinore\'s faults and identify two types of human structures that are in potential danger.

Lesson 7 - Digital Visions.

Goal - For students to become aware of the shallow nature of the Lake Elsinore Valley and how this affects the water flow.

Objective - Students will be able to name the lake inlet, outlet, and explain how the topography of the valley affects the size of the lake.

Lesson 8 - Lake Water Analysis.

Goal - For students to become aware of what substances are harmful or beneficial in the lake\'s water and how to test for them.

Objective - Students can define and explain dissolved oxygen, total dissolved solids, pH, nutrient contamination, and heavy metal toxicity.

Lesson 9 - Hydrolife.

Goal - For students to become acquainted with the microlife that inhabits Lake Elsinore.

Objective - Students will draw and identify at least five microorganisms from a sample of Lake Elsinore water.
Lesson 10 - Walking on the Wild Side.

Goal - For students to become familiar with the richness of animal and plant life that surround and use the lake.

Objective - Students will observe at least 25 different bird types, and identify at least 5 from their data sheets.

Lesson 11 - Catch of the Day.

Goal - For students to become familiar with the fish that inhabit Lake Elsinore and the methods used by local agencies to assess them.

Objective - Students will keep a tally sheet of fish caught, and identify at least five fish by species.

Lesson 12 - Scales & Tails.

Goal - For students to get a microscopic view of fish, and to become familiar with management techniques used by local agencies.

Objective - Students will make at least one microscopic view of a fish scale and be able to state the three factors affecting fish growth.

Lesson 13 - Graphic Evidence.

Goal - For students to realize that the present lake projects are efforts to control Lake Elsinore's historically varied water level.

Objective - Students will graph the lake levels for either a computer simulated model, or actual data, and state one goal of the lake management project.
Lesson 14 - Book 'em, Dano.

Goal - For students to realize how much Lake Elsinore's economy depends on the lake.

Objective - Students will be able to calculate the ratio of businesses that directly depend on the lake to businesses that do not.

Lesson 15 - On the Edge.

Goal - For students to become familiar with city zoning and planning around Lake Elsinore.

Objective - Students will be able to state and explain at least five different zones and correctly place human structures in those zones.

Lesson 16 - Who's Winning?

Goal - For students to understand the incredibly complex nature of lake management and the variety of agencies responsible for Lake Elsinore.

Objective - Students will be able to state two reasons why multiple agency responsibility makes lake management difficult.

Lesson 17 - News Hounds.

Goal - For students to become aware of the variety of agencies involved with the lake, and the basics of primary research techniques.

Objective - Students will be able to identify the role that their chosen agency or group plays in the management or use of
Lake Elsinore.

Lesson 18 - How Will You Manage Without Us?

Goal - For students to think about the purpose and aim of lake management and the human and environmental costs involved.

Objective - Students will write a one to two page paper intelligently supporting or not supporting lake management policies.

For nearly every lesson, reflection on the part of the students, and teacher, is an important aspect of the whole. The teacher will need to allow students the freedom to explore the various topics, but also be able to guide them in appropriate directions.
Positively Beautiful

Lesson Guide

Explain to the students that you are going to take them outside and you want them to do make written observations and look for things that they enjoy. Two rules:

- They may not make any negative, or derogatory statements either out loud or on paper during this lesson.
- During the time they are making written observations, or written commentary, they may not speak at all.

Take the students out to a scenic area on campus, direct their attention to the scene that you wish them to observe. Give them 4 to 5 minutes to describe the scene. They must describe it in one or two paragraphs without any personal commentary (either good or bad). They must describe the scene as carefully and accurately as possible including what they see, hear, and smell. Emphasize that they are to write objective descriptions using all their senses.

When time is up, stop the students and explain that now they are to choose one or more things that they like about the scene. In one or two paragraphs they are to explain what they like and explain why they like those things. Give the students another 4 to 5 minutes to complete this. As time allows, they may be taken to several scenic areas.

Leave about ten minutes for a positive classroom discussion at the end of this lesson. Have students share the positive things they enjoyed about each of the scenes they described. Try to bring out detailed observations and positive experiences. Be aware that different times of day at the same site can bring very different responses. You may want to collect the observation paragraphs as class assignments.

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Lake Education Project

Lesson

67
LAKE ELSINOR: The Game

**TOPIC:** Lake Overview

**PREP:** 1-2 Hours

**LESSON:** 1 Class Period

**MATERIALS & PREPARATION**

The following materials will be required for this lesson:
- enough maps of Lake Elsinore for each group of students. (The Lake Elsinore Chamber of Commerce will gladly donate them.)
- dice: one die for each group
- for the preparation you will need:
  - several hundred hole punches, some from white and most from another color of paper.
  - scissors, glue, index cards.

Copy one of each data sheet for each group. Cut out the information and glue it to the cards. Make sure that on the back of each card you write the location and location number.

From here on out, do one map-gameboard at a time. Once you’ve finished one, the rest will make more sense and be easier to do. Glue a white dot at each of the listed locations. In the center of each dot put the number of that location.

You are creating a board for a board game. Glue one white dot at the location of your school and label it “START.” All student’s markers will begin from here. Now it is up to you to create a game path between start and the locations on the rest of the board by connecting them with colored dots. The particular path doesn’t matter, nor how many spaces (colored dots) are between locations. I generally try to follow the roads, but it is not essential. I also try to have more than one path to a location. You may put special spaces if you like. Be as creative as you want.

The map-gameboards are a lot of work, but once they’re done, the prep time for this lesson is about 3 minutes. To protect your work, you should laminate the maps and the cards.

**LESSON GUIDE**

This lesson is an introductory one to various aspects of Lake Elsinore’s history, present, biology, hydrology and geology. Though disguised in the form of a game, the purpose is to get the students to read about, write about, and learn about Lake Elsinore.

Divide students into groups of three or four. They will need to be at a table. Pass out the maps. Explain to the students that they will need a sheet of paper and a pencil or pen. Pass out the die, and a complete set of cards face down on each table.

Students will need to use a space marker of some type. Instruct them to place their chosen markers at “START.” Explain that they will be attempting to collect five cards each from different locations, each with legitimate information about Lake Elsinore. The first to do so wins the game. Cards are to be drawn secretly from the stack, with the card number matching the location number. On their paper, they are to write down the contents of the card. They should not let anyone else see the card or what they have written, because some locations are bogus and have no information. Turns proceed clockwise with each player being able to move the number of spaces rolled on the die.

**RULES**
- Students may only move one direction per turn and must move all of the spaces they rolled.
- Students may backtrack on a new turn, but not within a turn.
- It takes an exact roll to land on a numbered space (white dot) and draw a location card.

Some confusion may be apparent at first. You may consider collecting their written work as an assignment, rewarding students who win, or modifying the rules to fit your particular situation.

Be sure to take at least 5-10 minutes after the game to discuss. A simple way to do this is to call on students at random and ask them to share one thing that they learned.

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Lesson 68
**Noteworthy History**

**Topic:** LOCAL HISTORY

**Prep:** 20 MINUTES

**Lesson:** 1-2 CLASS PERIODS

**Materials & Preparation**

You will need the following materials:

- a class set of the student handout "Notetaking Skills"
- a class set of newspaper articles on the lake. You may use the ones included, or some of your own. Be sure that there are at least five different articles.
- about 100 index cards per class.

**Lesson Guide**

The lesson will expose the students to local history as captured in the period newspapers. It will also teach the students an extremely valuable research skill that if done properly can reduce writing time, prevent plagiarism, and organize the research paper.

Begin by reading aloud part of one of the historical articles. Select an interesting paragraph or two. When you have read it pass out 3 notecards per student and the student handout. Either read it aloud or give the students a few minutes to read it. Take some time to verbally reinforce the importance of the skill they will be learning.

Have the students take one of their cards. Together have the students write the bibliographic information from the article you just read on the back of their card. Graphically display what they are to do on the board if it is necessary. Next, from the article section have students orally generate important pieces of information. Try to elicit a statement of the paragraph’s main topic. Make sure they write their responses on the front side of their index card.

Next, pass out assorted newspaper articles to the students. Ask them to read one article and using their remaining notecards, take proper notes. This usually takes twenty to thirty minutes and requires a high degree of monitoring and assistance. Grouping works well as students who “get it” right away can help those that don’t.

The third part of the notetaking activity is the most difficult. Collect the newspaper articles and the student notecards. Make sure that students names are on their cards. Now give the notecards to different students. Explain that they are reporters and they need to use the notecards to write a one page newspaper story without benefit of seeing the actual article. This takes about 20-30 minutes.

Be sure to leave time for students to share some of the more interesting information that they read. For discussion, 15-20 minutes is adequate.
The following materials will be needed for this lesson:
• one copy of the graphs of lake levels for each student.

Because Lake Elsinore is a shallow drainage basin with a very high surface area to volume ratio, evaporation is a major factor influencing water quality. The lake loses approximately 9000 gallons a minute to evaporation in the hot summer months, much less in the winter. Because of the shallow nature of the lake, water depth varies dramatically from year to year depending on the rainfall. With the variance of water depth comes an equal variance in water quality. As the lake level decreases, dissolved solids, salts and other contaminants are left behind. In short, the concentration of TDS (Total Dissolved Solids) increases as the water level decreases.

Times of heavy rain do nothing to improve the situation. Heavy rains actually increase the amount of some contaminants in the water by washing them from nearby farmlands and urban areas. In addition, flood conditions stress the abilities of the sewage treatment facilities sometimes resulting in the release of untreated waste into the lake. This increases the fecal coliform bacteria levels and decreases the safety and quality of the lake water.

The accompanying graph shows minimum and maximum lake levels from 1916 to 1980. On it students should indicate:
• five times when bacterial levels are likely to be high
• five times when TDS are likely to be high
• five times when water quality is likely to be good.

Once the students have completed that, spend 5-10 minutes discussing the graph and listening to student responses about the water quality in different years.
A day in the life...

**Materials & Preparation**

The following materials will be needed for this lesson:
- a copy of the handouts for each student

**Lesson Guide**

Students will be using the handouts on native plants and the handouts on plant lore to determine what local plants were used for by native Americans.

Students should compare the handouts on local plants to those used by the Gabrieliños. In this manner, students can compile a list of plants found in Lake Elsinore and their medicinal or cultural significance.

Following this, students will be writing a two page creative story detailing one day in the life of an early Indian. Students should write in the first person perspective as though they were an Indian boy or girl. The story should include when, where, why and how certain plants are gathered and explain how they are used.

Once completed, students should gather in groups of four or five and share their work with one another. Groups should choose one exemplary story for sharing with the entire class.
Who's Fault Is It?

Topic: Geology

Prep: 1/2 Hour
Lesson: 1 Class Period

Materials & Preparation

For this lesson you will need:

• a copy of the lake edge map and the Elsinore valley faults for each student.
• a map of Lake Elsinore for each group.

Lesson Guide

Students will be working as a team, using the three maps to identify communities and structures that are in the most serious danger from potential earthquakes along Elsinore's eight major fault zones.

Students should:

• make a list of structures (bridges, multistory buildings, roads).
• list their location.
• Explain the particular threat (liquefaction, on a fault, near a fault - be sure they name which fault-, beneath Railroad Canyon Dam, etc.).
• Students should divide the city up between the team members with each keeping track of their own work.
• In addition students should locate the fault nearest to their home and to their school.

Briefly discuss the geology of Elsinore with the students when they are done. Allow them to orally reflect on new information that they learned from this activity. Ask them what was most interesting. Ask them what some possible solutions, if any, there are to the threat of potential earthquakes.

Collect the assignments by group since each member will have done a different part of the city.

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Lesson Guide

Use the program to lead a discussion. If students have their own computer station with the program running, that is best, but not necessary. The topographic viewing mode offers several points for discussion.

- Using the pointer have the class discuss the mild elevation of the Elsinore Valley. Discuss what effect this has on the lake.

- Vista data is "dry," that is no lakes or oceans or rivers are present, only the land beneath them. Using the "Lake" function, fill up the lake to different realistic elevations. Let the students choose the depth. There will be time to do several. Discuss the size and shape of the lake at different water depths. Notice at what level water begins to flow out the Temescal Wash. Point out that most of the time water leaves Lake Elsinore by evaporation.

- Using the "River" function, add the San Jacinto River in its correct location. Point out how close it is to the lake outlet and that even when water is flowing out, the lake water does not get circulated much. These concepts may even be elicited from the students themselves with proper guiding questions.

If the computer you are using is fast enough you may wish to generate several first person views. Experiment ahead of time to see how detailed a resolution can be rendered in a minute or two. Let the students choose a few perspectives for rendering; perhaps from the top of Rome Hill, or from your school, or from the middle of the lake. If you can view the lake from your classroom, you may wish to generate a computer view from the same location and compare the digital vision with the real one.
Lake Water Analysis

**Topic:** Hydrology

**Prep:** 2 Hours

**Lesson:** 2 Class Periods

**Materials & Preparation**

The following materials will be needed for this lesson:

- samples of water from the lake surface and from near the bottom, or, if students are going to gather the samples themselves, field trip permission forms.
- 6 large test tubes, 3 stoppers, test tube rack, waste dish, dropper, filter paper (#3), funnel, and paper towels for each lab group of 2-3 students.
- methylene blue, pH paper or meters, pH scale, phosphate testing solution, lead testing paper or a pollution test kit such as The Environmental Test Lab #5500 available from The Science Source (207) 832 6344.
- Van Doren (or similar) tube for taking water samples at depth.
- distilled water.

If students will not be leaving the classroom then you need to get bottom water samples, and surface water samples for them. The fresher, the better. Students will be testing the dissolved oxygen (DO), the phosphate levels, the pH, and the lead content of the water.

If students are gathering their own samples, then they will need two stoppered test tubes. You may collect the bottom water sample yourself for the class to share or you may assign several students to use the Van Doren tube. If a tube is not available, simply wading out into three or four feet of water and filling a flask with bottom water is sufficient. Instruct students not to shake their samples.

**Lesson Guide**

- Students will need to filter the algae from their samples and separate them into 4 test tubes total. Tubes should be labelled "Surface" and "Bottom." Into one of each about 3-4 drops of methylene blue should be added. Methylene blue becomes colorless as dissolved oxygen (DO) levels decrease. The faster the color disappears the lower the DO levels. These tubes should be stoppered, and left undisturbed until the color is gone. Time will be recorded in days. For comparison, a sample of tap water and distilled water should be vigorously shaken, methylene blue added, and set aside with the others.

- Using pH test paper or electronic pH meters, students should test the pH of surface water, bottom water, tap water, and distilled water.

- Using lead test paper, test the lead levels of surface water, bottom water, tap water and distilled water. Follow the directions included with the paper, but generally it will give a bright pink color if lead levels are in excess of 5 parts per million (ppm).

- Using phosphate test powder, test the phosphate levels of surface water, bottom water, tap water, and distilled water.

Students should record all work neatly in data tables and make logical, informed conclusions. You may wish to discuss the factors affecting DO levels, pH, lead levels, and phosphate concentration. DO levels for Lake Elsinore are the most problematic, and the most complicated. Compare the class results to the results of the Lake Elsinore Water Quality Management Study conducted from 1990 to 1993. Explain differences and similarities.
This lesson will require the following materials:

- Samples of Lake Elsinore water or field trip permission slips if students will be collecting their own water.
- Class set of microscopes.
- 6 test tubes, depression slide, funnel, filter paper #3, dropper, glass slide, beaker, and test tube rack for each student team.
- Copies of student handouts for identifying algae and other organisms.
- Polyvinyl alcohol (optional)

If you collect samples for the students, two types should be collected: surface or near-surface water and scrapings from beneath subsurface logs or rocks. Collect the samples in large beakers. Make sure that the scrapings are covered in water to prevent drying once you are done collecting them.

If students are collecting, they should be divided into teams of two beforehand. One team member should collect surface water and the other should collect scrapings using the edge of a glass slide. Surface or subsurface water will give a variety of algae types and nektonic or drifting organisms. The scrapings will give an abundant sample of attached organisms.

Working in teams of two, students will observe their water samples in the depression slides. The two water samples should be filtered and kept separate. The filtrate should be put into individual test tubes and water should be added to prevent dehydration. The filtrate may provide a rich source of algae and multicellular organisms. Label the test tubes "water," "scrapings," "water filtrate," and "scraping filtrate." To slow organisms, a small amount of polyvinyl alcohol may be added to the depression slides. Too much will kill the organisms.

Students should draw as many different organisms as they find, labelling the type of water in which it was discovered and noting any behavioral characteristics (actions, photosensitivity, speed, etc.). Students should identify the organisms or a list of possibilities.

Monitoring during the examination phase is intensive and critical. Observe student work for accuracy and detail. Avoid adjusting microscopes settings personally. Give hints and suggestions, but allow the students to do the work.

Leave 5-10 minutes at the end for students to discuss their findings and share their personal successes and observations.
You will need the following materials for this lesson:
• copies of the student guide for each student team.
• field trip permission form for each student.
• copy of data sheet for each student.

Students will be walking near the lake shore and recording various species of observed birds, plants, and animals. The focus is on bird observation. As an alternative students may survey their own school site, however the naturalness of the setting will be very limited.

You will need to survey the walking route previous to the lesson. Make mental notes of particular plants, trees, or habitat that you may wish to point out later.

Before the lesson, divide the students into teams of 2 and supply them with the student guide. Students should be familiar with it before the day of the lesson. Suggest to students that if they have binoculars and it is acceptable to their parents, they should bring them for waterfowl observation.

Students will be led on a semi-guided walk, during which time they will observe nature. Students should bring paper and pencil, data sheet, and their student guide. Birds, animals, unusual or excessive plants and trees should be noted. When possible the organism should be identified immediately. If not, notes should be made about distinctive markings, size, and color, so that it may be identified later. Relative counts of bird species should be kept.

The second day students will be back in the classroom. Tally the results for all student teams and work together to identify significant unidentified organisms. Students should write a one to two page summary of the experience. Leave about 15 minutes to discuss student reflections, suggestions, and papers. Collect the tally sheets, field notes, and concluding paper as a classwork assignment.
This lesson will require the following materials:
• signed field trip permission forms for all students.
• three or four parent helpers.
• at least one fishing pole for every two students. Begin asking parents and students to loan some ahead of time.
• fishing tackle.
• metric measuring ruler or tape.
• metric scale.
• an ice chest filled with ice
• graph paper
• One copy of "Warmwater Game Fishes of California" for every two students.

Since students will be having "class" at the lake, you will need to be organized and efficient as time will be short. Be sure to call the city before the trip to find out if limits are in force, or if licenses are required for the adults. In times of predicted fish die-off, restrictions are lifted.

Be sure that students are mentally prepared and physically equipped to do serious research. Prepare teams of two ahead of time, to speed the lesson.

The California Department of Fish and Game (CDF&G) conducts regular fish surveys to determine the biotic makeup of the lake. Though they use a process called electrofishing, a fishing pole works nearly as well.

Students will be fishing with hook and line, weighing, measuring, and identifying the fish that they catch. All information is to be recorded on the team's data sheet. Fish may be kept in the ice chest or released. Catch and release tactics are not always beneficial at Lake Elsinore. Frequently, in warm weather the fish suffer die-offs in the hundreds of tons due to oxygen poor water. Removing the fish from the lake prevents them from decaying on the shore later and is encouraged by fish management agencies.

Teacher and parent helper monitoring is extensive during this part of the lesson. You will be constantly helping students identify fish, tie hooks, measure, weigh, and stay on task. Collect data sheets before students leave class.

Day two of this lesson is back in the classroom. As a class compile the fishing data. Determine the total numbers of each species, the relative percentages, the average weight, the average length, the weight range, and the length range. Compare your data to the latest electrofishing survey by the CDF&G. If desired, and if time allows, graph the length versus number caught of each species. In addition students should research at least one of the species caught, preferably the one they caught, from the fish guide.

Allow time for discussing the fish conditions of the lake. All fish are planted, or have washed down from Canyon Lake. Lake Elsinore has no native fish. Discuss any differences between your survey and the one performed by CDF&G. Allow students to reflect on their survey experience.
**Materials & Preparation**

The following materials will be needed for this lesson:

- A class set of microscopes and slides
- A class set of the student handout
- Enough fish scales for students to be able to study several different species. It is preferable for students to be able to remove the scales from the fish themselves if possible.

If possible, use fish from Lake Elsinore for this lesson, preferably the fish the students just caught in "Catch of the Day." Large scaled fish - bass or carp - are easier to study than small scaled fish, but you should have a variety of fish scales on hand. Students should be familiar with the use of a compound microscope.

**Lesson Guide**

Students will be studying fish scales under the microscope using the low power objective. Light from behind should illuminate the scale so that rings and darker bands are clearly visible. If students read the handout they will discover that the size and weight of a fish have very little to do with a fish's age. When wildlife agencies want to know how old a specimen is they look at scales under the microscope and count the number of dark bands. The dark bands are created at the end of a season's growth similar to the way the the rings on a tree are formed. In warmer regions like California, the rings are less pronounced and may be more difficult to see.

Have the students record on a data table the length and weight of the fish, the number of dark rings and the age of the fish. Have them draw one of the scales as they view it under the microscope. When done students should come to conclusions about the relationship between length, weight, and age. Students should be able to state the three factors that affect the rate of growth.

Take 5 minutes to discuss their conclusions and observations. Collect written work as a class assignment.
Divide students into groups of about 2-3. Explain to them that they will be graphing historical lake surface elevation data and data from a computer simulation. The computer data was generated for the city by an engineering firm assuming that the present levee, outlet and inlets had been in place since 1916. Pass out computer data to half of the groups and historical data to the other half.

With your guidance have them draw an x-axis, then a y-axis using the yardstick and marker. Make sure that they leave room on both edges for labels. Across the bottom they will number from 1916 to 1985 and label it “Year.” Have them use the calculators to figure out how to fit the values across the bottom of the graph. The y-axis will start at 1227 MSL (mean sea level) and run to 1273 MSL. It will be labeled “Lake Surface Elevation.” Again have the students use the calculators to figure out a correct numbering scheme that will fit all the data on the vertical axis. To this point all the students work has been the same, now the groups will begin using their separate data sheets.

Have the students carefully begin plotting data points. It seems easiest for the students if they plot maximum first and then minimum. Students should use a different color pen for each, and make a legend at the upper right when they are done. Once the points are plotted they need to connect the lines carefully with the yardstick. Every graph needs a title across the top. Students should use the title present on their data sheet. Once all the graphs are completed tape them up around the room.

A short discussion should follow about the effects of the stabilization project, as well as about the difference between the data used (i.e. one is actual and the other hypothetical). Before the lesson is over, make sure that all students have both data handouts.
"Book 'em, Dano"

**TOPIC:** Human Use & Impact - Fiscal Importance

**PREP:** 1/2 HOUR

**LESSON:** 2 CLASS PERIODS

**MATERIALS & PREPARATION**

For this lesson, the following materials are needed:

* one Lake Elsinore area phone book for each student.

You will need to be familiar with the roads and communities that are within Lake Elsinore's influence. You also need to be familiar with businesses found in Elsinore and what types owe their existence directly or nearly directly to the lake. Getting enough phone books requires that you begin asking students to bring them in about a week ahead of time.

"Independent." A boat rental business would be an example of dependent. A grocery store would be independent. At closest examination nothing would be completely independent, but some businesses are more removed than others from direct influence.

Students need not write down the names or types of businesses, but only to keep a running tally on their sheet. Significant monitoring on the part of the teacher is required.

Once students have completed their tallies, compile the entire class' data together. Calculate a ratio of businesses that directly depend on the lake to the total number of Elsinore businesses.

Discuss with the class their conclusions about the lake's importance to local business. Gather input from the students about the type of businesses that are dependent directly on the lake and those that are relatively independent. Discuss how no business is truly independent and compare this idea to the concept of food webs. Discuss how the lake quality affects the city's income.

**LESSON GUIDE**

You might want to begin this lesson by showing the photo "Bad spot for boating," and ask how much the city of Lake Elsinore depends on the lake for its economy.

Explain to the students that they will be informally assessing the dependence of local business on the lake by surveying the phone book's yellow pages. Pass out one phone book to each student. Assign a letter of the alphabet to each student. Large sections may be broken up between several students. Have the students divide a sheet of paper into two columns with the following headings: "Dependent" and "Independent."
ON THE EDG

TOPIC: HUMAN USE & IMPACT
USE & ZONING
PREP: 1 HOUR
LESSON: 2 CLASS PERIODS

MATERIALS & PREPARATION

The following materials will be needed:
• one copy of the city planning chart blown up to poster size for each group of 3-4 students.
• one copy of the land use descriptions for each student.
• scissors and glue sticks for each group
• one copy for each group of the structures to be placed.

Be familiar with the different zones of the city, and into which zones the buildings on the structures sheet can be placed.

LESSON GUIDE

Read through and familiarize students with the lake edge planning map, and the city zoning sheet. Explain to students that they are to place all of the structures on the structures sheet onto the lake edge plan area. All structures must be placed and all must be put into the correct zone. Commercial buildings may not be placed into residential areas and so on. In addition, students must give careful thought from an environmental point of view as to what structures are best put where.

When students are done they must be able to explain why their placement is the best for both human use and for the environmental stability of the lake edge. They must also be able to explain what problems will be inherent for wildlife, when the lake edge is developed, and what benefits will be realized for residents. This may either be done in oral or written form.

The clear goal here is that students realize that development is a solid loss for wildlife. It is difficult to balance the needs of wildlife with the goals of the city. Often, the best that can be hoped for is to minimize as much as possible the human impact.
Who’s Winning?

**Topic:** Human Use & Impact
**Agency Cooperation**

**Prep:** 20 MINUTES
**Lesson:** 1 CLASS PERIOD

**Materials & Preparation**

For this lesson you will need:
- one copy of “Win as much as you can” for every two people.
- room for groups of eight people to work together.

This lesson is quite deceptive, and while it appears to be teaching nothing at all it is a substantial and memorable experience.

Lake Elsinore is under the control of many different agencies: the city, the Elsinore Valley Municipal Water District, the Santa Ana Watershed Project Authority, the county of Riverside, the California Department of Fish & Game, the federal Fish & Wildlife Service, the city’s redevelopment agency, the California Department of Parks and Recreation, and other public and semi-public groups and agencies. Each have their own responsibilities and agendas that sometimes overlap and sometimes do not. Getting the groups to work together towards the common good of the lake is a very difficult task, even though they are usually interested in cooperating.

**Lesson Guide**

For this lesson, the class will need to be broken into large groups of eight, with each group being broken into teams of two. It is essential that a group have no more than four teams. If necessary make teams of one or three students to reach this configuration. It is better to have teams of one than too many teams of three.

Give each team a handout, and tell them to hide or fold it so that no other teams can see it. Explain that the goal is to win as much as they can. Explain that the payoff rules are printed right on their handout. The game proceeds in rounds.

Explain that for each round their team is to pick either the letter X or the letter Y and to enter it secretly into the “Choice” box for that round. Explain that there is only one way to win the game. (Explain this often, but do not explain too much.)

For round 1 let them choose, then go to each group and ask how many teams chose X. Reward the groups according to the payoff schedule. Confusion will reign. Do not explain too much. With each round the game will become clearer. Round 4 is different. This time they will discuss a strategy amongst their entire group. Once they have done this, however, they will still make final decisions secretly with their team mate.

By now, some teams will understand that they score more if they choose X, but other teams in their group choose Y. Deception, saying one thing and doing another, will become part of their strategy. Some will realize that if everybody picks Y then everybody wins, although a small amount. As the rounds continue, these two differing types of teams will become genuinely hostile to one another.

Before the last two rounds, write the names of one member of each group of 8 on the board, but don’t explain why. Emphasize that there is only one way to win the game.

By the last round some groups will have cooperated and every team in that group will have won a few points. Some groups will have ended the game in frustration and hostility. Explain that each group was really only one team and that their points will be tallied for the entire group. Calculate the last round for each group on the board. Except for those groups that cooperated with all teams choosing Y, every other group score will be zero. It is designed mathematically so that the only way for a group to get more than zero is when everybody cooperates.

Discuss how to win the game. Discuss the student’s feelings towards other teams as they played. Discuss that even when they knew how to win, doing what was best for the group was very difficult, when by deception or selfishness, they could come out farther ahead. Discuss that in matters of the lake, where the stakes are much higher than meaningless points, it is equally difficult for agencies to work together for the good of the whole. Reinforce the idea that when agencies do not cooperate - like teams who didn’t in the groups - everybody loses. This is a particularly powerful look into human nature. Do not neglect the discussion. It requires about 10-15 minutes.

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**Materials & Preparation**

There are no materials needed. However, students need to be given the chance to choose a research topic towards the end of a class period and then allowed several days to gather the information. Inform them that most agencies are closed on weekends and after 5 pm. Once the research has been done, students may be given one or two class periods to write, share, and rewrite their work.

**Suggested contacts include:**

- Lake Elsinore Library
- City Planning Office
- Riverside County Department of Environmental Health
- Department of Fish & Game
- California Department of Parks & Recreation
- Riverside County Flood Control
- Water Quality Control Board
- Federal Fish and Wildlife, local office
- Elsinore Valley Municipal Water District
- Eastern Municipal Water District
- Army Corps of Engineers
- Bureau of Reclamation
- Lake Elsinore Management Authority
- local Indian groups, historical groups, and property groups.

**Student Instructions**

Summarize your findings as a news story. Prepare to read it as though you were on the air to thousands of viewers.

Analyze your motives behind your work. Were you more concerned with getting the truth, finding something really exciting to report, or just getting the assignment done? Explain how your motives affected the way your story turned out.

Do not neglect allowing students time to share their work, perhaps as an informal discussion with the entire class. Collect the news stories as an assignment.
How Will You Manage Without Us?

**TOPIC:** CONCLUDING LESSON

**PREP:** NONE

**LESSON:** 1 CLASS PERIOD

**MATERIALS & PREPARATION**

The materials needed for this lesson are optional. If desired you will need the video "Lake Update," a television, and a video player. Other than this, there is no preparation needed.

**LESSON GUIDE**

Students, by this point, should be very familiar with the lake. They should understand its history, biology, geology, and the constant planning that goes on for and about it.

If desired you may show the video, or simply review the many and varied ways that the lake is handled. From the stabilization project, to the aeration, to the algae treatments, to the created wetlands, to the revegetating, to the fish stocking Lake Elsinore is heavily managed.

Students may or may not have thought about why the lake is managed or the possibility of doing nothing at all is an option. The following question posed to them, will give them a chance to clarify their own beliefs and understandings, and to identify what purposes lake management serves and why it has been aggressively pursued since 1883.

Mayor Gary Washburn has said that "the lake has never been managed properly." Do you think that a natural system ever needs to be "managed?" Using Lake Elsinore as an example support either side of this argument. What are the costs and benefits in both human and environmental terms of managing or not managing?

Give students time to write one or more pages that answer the above questions. Be sure to discuss with students their various answers. Emphasize both before and after that there is no right or simple answer to the question. You may wish to collect the papers as a class assignment.
APPENDIX B

GRAPHS OF LAKE SURVEY RESPONSES
Lake Survey
Age Group - Up to 14 (N=540)

Yearly Visits to Lake
Lake Survey
Age Group - Up to 14 (N=262)

Major Uses of Lake

- Boating: 41.2%
- Fishing: 16.8%
- Water Skiing: 16.8%
- Picnic/Swimming: 22.1%
- Other: 3.1%
Lake Survey
Age Group: Up to 14 (N=465)

Best Feature of the Lake
Lake Survey
Age Group: Up to 14 (N=639)

Major Lake Problems

- Algae
- Pollution
- Smell
- Fish Kills
- Management
- Lake Level
- Facilities
- Other
Lake Survey
Age Groups - Up to Age 14 (N=491)

Major Community Problems
Lake Survey
Age Group: Up to Age 14 (N=542)
Lake Survey
Age Group: Up to Age 14 (N=546)

Pollution of Lake
Lake Survey
Age Group: Up to Age 14 (N=541)

Worst Rating: 54

Rating Scale:
- 8
- 7
- 6
- 5
- 4
- 3
- 2
- 1

Lake Area Cleanliness
Lake Survey
Age Group: Up to Age 14 (N=561)

Recreational Quality of Lake

- Horst: 118
- 74: 74
- 66: 66
- 58: 58
- 78: 78
- 55: 55
- 58: 58
- 39: 39
- 21: 21
- 19: 19

# Responding

0 50 100 150 200 250 300 350 400
Lake Survey
Age Group: Up to Age 14 (N=543)

Quality of Lake Fish

- Worst: 249
- Next: 77
- Next: 33
- Next: 37
- Next: 49
- Next: 29
- Best: 9
- Best: 6
- Best: 9
- Best: 15

# Responding
Lake Survey
Age Group: Up to Age 14 (N=544)
Lake Survey
Age Group: Up to Age 14 (N=586)
Lake Survey
Age Group: Up to Age 14 (N=609)

Importance of Lake to Community

- Least Important: 161
- Worst: 43
- 3rd: 33
- 2nd: 38
- Rating: 72
- Scale: 26
- 5th: 51
- 4th: 58
- Best: 33
- Best: 68

Number of Responding
Lake Survey
Age Group: Up to Age 14 (N=545)
Lake Survey
Age Group: 15-30 year olds (N=41)

Yearly Visits to Lake
HiBoating
Age Group- 15-30 year olds (N=27)
BFishing
□Water Skiing
SPicnic/Swimming
3.7H
HOther
23.9M
33.3%
22.2V.

Major Uses of Lake

Lake Survey
Age Group- 15-30 year olds (N=27)
Lake Survey
Age Group- 15-30 year olds (N=36)

Best Feature of the Lake
Lake Survey
Age Group- 15-30 year olds (N=51)

Major Lake Problems
Major Community Problems
Lake Survey
Age Group 15-30 year olds (N=41)

Lake Elsinore as a Community

<table>
<thead>
<tr>
<th>Rating</th>
<th># Responding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worst</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Scale</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>
Lake Survey
Age Group- 15-30 year olds (N=41)
Lake Survey
Age Group- 15-30 year olds (N=41)

Lake Area Cleanliness

# Responding

<--- | Horst | Rating | Scale | Best | ---
--- | --- | --- | --- | --- | ---
22 | 4 | 2 | 2 | 1 | 8
Lake Survey
Age Group- 15-30 year olds (N=45)
Lake Survey
Age Group- 15-30 year olds (N=42)

Quality of Lake Fish

<table>
<thead>
<tr>
<th>Rating</th>
<th># Responding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worst</td>
<td>10</td>
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<td>4</td>
<td>4</td>
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<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

Scale: 1 - 5
Lake Survey
Age Group: 15-30 year olds (N=41)

Scenic Quality of Lake

# Responding

--- Worst ---

Rating Scale

--- Best ---
Lake Survey
Age Group: 15-30 year olds (N=41)

Importance of Lake to Community

- Best
- Rest
- Rating Scale
- Worst

# Responding

- 7
- 4
- 3
- 2
- 3
- 2
- 10
Lake Survey
Age Group: 15-30 year olds (N=41)
Lake Survey
Age Group- 31-49 year olds (N=196)

Yearly Visits to Lake
Lake Survey
Age Group: 31-49 year olds (N=75)

Major Uses of Lake

- Boating: 28.9%
- Fishing: 19.8%
- Water Skiing: 14.8%
- Picnic/Swimming: 18.5%
- Other: 34.9%
Lake Survey
Age Group: 31-49 year olds (N=186)

Best Feature of the Lake

- Scenic
- Recreation
- $ Benefits
- None
- Size
- Other
Lake Survey
Age Group- 31-49 year olds (N=199)

Major Lake Problems
Lake Survey
Age Groups- 31-49 year olds (N=165)

Major Community Problems
Age Group: 31-49 year olds (N=188)

Lake Survey
Age Group: 31-49 year olds (N=188)
Lake Survey
Age Group- 31-49 year olds (N=194)
Lake Survey
Age Group: 31-49 year olds (N=192)
Age Group: 31-49 year olds (N=195)

Lake Survey
Age Group: 31-49 year olds (N=195)
Lake Survey
Age Group- 31-49 year olds (N=174)
Lake Survey
Age Group: 31-49 year olds (N=184)
Lake Survey
Age Group - 31-49 year olds (N=194)
Lake Survey
Age Group: 31-49 year olds (N=193)
Lake Survey
Age Group: 31-49 year olds (N=179)

Quality of Lake Maintenance

# Responding
Lake Survey
Age Group - Over 50 years old (N=17)

Yearly Visits to Lake

- None
- 1 to 5
- 6 to 10
- 11 to 20
- More Than 20
Lake Survey
Age Group- Over 50 years old (N=9)

Major Uses of Lake

- Boating
- Fishing
- Water Skiing
- Picnic/Swimming
- Other
Lake Survey
Age Group- Over 50 years old (N=17)

Best Feature of the Lake
Lake Survey
Age Group - Over 50 years old (N=19)

Major Lake Problems
Lake Survey
Age Groups - Over 50 years old (N=17)

Major Community Problems
Lake Survey
Age Group- Over 50 years old (N=17)
Lake Survey
Age Group: Over 50 years old (N=17)

Pollution of Lake

<table>
<thead>
<tr>
<th>Response</th>
<th>Count</th>
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</thead>
<tbody>
<tr>
<td>Worst</td>
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</tr>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Best</td>
<td>2</td>
</tr>
</tbody>
</table>
Lake Survey
Age Group- Over 50 years old (N=17)

Lake Area Cleanliness

Responding

Least

Best
Lake Survey
Age Group - Over 50 years old (N=17)

Recreational Quality of Lake

# Responding

Worst  | 4
Ranking Scale  | 3
Best  | 2
Lake Survey
Age Group: Over 50 years old (N=17)
Lake Survey
Age Group: Over 50 years old (N=17)

Quality of Lake Water
Lake Survey
Age Group- Over 50 years old (N=17)

Scenic Quality of Lake

<table>
<thead>
<tr>
<th>Scenic Rank</th>
<th>Responding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best</td>
<td>4</td>
</tr>
<tr>
<td>Good</td>
<td>3</td>
</tr>
<tr>
<td>Fair</td>
<td>2</td>
</tr>
<tr>
<td>Poor</td>
<td>1</td>
</tr>
<tr>
<td>Worst</td>
<td>1</td>
</tr>
</tbody>
</table>
Lake Survey
Age Group: Over 50 years old (N=17)
Lake Survey
All Age Groups (N=794)

- None: 63.0%
- 1 to 5: 6.6%
- 6 to 10: 2.2%
- 11 to 20: 3.2%
- More Than 20: 28.8%

Yearly Visits to Lake
Major Uses of Lake

Lake Survey
All Age Groups (N=373)
Lake Survey
All Age Groups (N=704)

Best Feature of the Lake
Lake Survey
All Age Groups (N=908)

Major Lake Problems

- Algae
- Pollution
- Smell
- Fish Kills
- Management
- Lake Level
- Facilities
- Other
All Age Groups- (N=709)

City Management

Other

Major Community Problems

Lake Survey

Crime/Gangs

Lake

City Management

Lack of $

Lack of Facilities

Other
Lake Survey
All Age Groups (N=788)

Lake Elsinore as a Community
Lake Survey
All Age Groups (N=797)
Lake Survey
All Age Groups (N=792)

Lake Area Cleanliness

# Responding

- Worst: 124
- Ranking: 86
- Scale: 51
- Best: 13
Lake Survey
All Age Groups (N=819)

Recreational Quality of Lake
Lake Survey
All Age Groups (N=774)
Lake Survey
All Age Groups (N=838)
Lake Survey
All Age Groups (N=859)

Importance of Lake to Community

# Responding

- 188
- 68
- 61
- 49
- 37
- 75
- 82
- 57
- 169

<------ Worst --- Ranking --- Scale --- Best ---->
Lake Survey
All Age Groups (N=790)

Quality of Lake Maintenance

<table>
<thead>
<tr>
<th>Quality of Lake Maintenance</th>
<th># Responding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worst</td>
<td>95</td>
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<tr>
<td>Rank</td>
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<td>Scale</td>
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<td>Best</td>
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<tr>
<td>Worst</td>
<td>38</td>
</tr>
<tr>
<td>Best</td>
<td>16</td>
</tr>
</tbody>
</table>
APPENDIX C

LAKE ATTENDANCE GRAPHS OF CDP&R DATA

1979 - 1993
Average Attendance 1979-1993

(Data Source: CDP&E)
Average Boat Launches 1979-1993

(Data Source: CDP&R)
1979 Lake Attendance
(Data Source: CDP&R)

<table>
<thead>
<tr>
<th>Month</th>
<th># of Visitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>June</td>
<td>60,000</td>
</tr>
<tr>
<td>July</td>
<td>70,000</td>
</tr>
<tr>
<td>August</td>
<td>60,000</td>
</tr>
<tr>
<td>September</td>
<td>50,000</td>
</tr>
<tr>
<td>October</td>
<td>20,000</td>
</tr>
<tr>
<td>November</td>
<td>10,000</td>
</tr>
<tr>
<td>December</td>
<td>5,000</td>
</tr>
</tbody>
</table>

- **Boats Launched**
- **People**
1980 Lake Attendance
(Data Source: CDPR)

- Boats Launched
- People

(Flooded closed lake from 2/16 to 6/1...Boating closed until 9/30)
1981 Lake Attendance
(Data Source: CPAR)

<table>
<thead>
<tr>
<th>Month</th>
<th>Visitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td></td>
</tr>
<tr>
<td>Feb</td>
<td></td>
</tr>
<tr>
<td>Mar</td>
<td></td>
</tr>
<tr>
<td>Apr</td>
<td></td>
</tr>
<tr>
<td>May</td>
<td></td>
</tr>
<tr>
<td>Jun</td>
<td></td>
</tr>
<tr>
<td>July</td>
<td></td>
</tr>
<tr>
<td>Aug</td>
<td></td>
</tr>
<tr>
<td>Sep</td>
<td></td>
</tr>
<tr>
<td>Oct</td>
<td></td>
</tr>
<tr>
<td>Nov</td>
<td></td>
</tr>
<tr>
<td>Dec</td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- Boats Launched
- People
1982 Lake Attendance
(Data Source - CDP&R)

# of Visitors

<table>
<thead>
<tr>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May (No boat launch records until April)</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>People</td>
<td>500</td>
<td>700</td>
<td>800</td>
<td>1000</td>
<td>15000</td>
<td>1000</td>
<td>2000</td>
<td>2500</td>
<td>3000</td>
<td>3500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boats</td>
<td>200</td>
<td>300</td>
<td>400</td>
<td>500</td>
<td>1000</td>
<td>1500</td>
<td>2000</td>
<td>2500</td>
<td>3000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- Boats Launched
- People
1983 Lake Attendance
(Data Source: CDP&R)

1983 Lake Attendance
(Data Source: CDP&R)
1984 Lake Attendance

(Data Source: CD&R)

<table>
<thead>
<tr>
<th>Month</th>
<th>Visitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>0</td>
</tr>
<tr>
<td>February</td>
<td>0</td>
</tr>
<tr>
<td>March</td>
<td>1000</td>
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<td>April</td>
<td>1500</td>
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<td>May</td>
<td>20000</td>
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<td>June</td>
<td>35000</td>
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<td>July</td>
<td>15000</td>
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<tr>
<td>August</td>
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<td>September</td>
<td>5000</td>
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<td>October</td>
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<tr>
<td>November</td>
<td>1000</td>
</tr>
<tr>
<td>December</td>
<td>0</td>
</tr>
</tbody>
</table>

Legend:
- Boats Launched
- People
1985 Lake Attendance

(Data Source: CDP&R)

(Number of Visitors)

Number of Boats Launched and People from January to December 1985.
1986 Lake Attendance

(Data Source: CDP&R)

1986 Lake Attendance

<table>
<thead>
<tr>
<th>Month</th>
<th>Visitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>1000</td>
</tr>
<tr>
<td>February</td>
<td>1000</td>
</tr>
<tr>
<td>March</td>
<td>5000</td>
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<tr>
<td>April</td>
<td>4000</td>
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<tr>
<td>May</td>
<td>2000</td>
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<tr>
<td>June</td>
<td>3000</td>
</tr>
<tr>
<td>July</td>
<td>7000</td>
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<tr>
<td>August</td>
<td>6000</td>
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<td>September</td>
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<td>October</td>
<td>2000</td>
</tr>
<tr>
<td>November</td>
<td>1000</td>
</tr>
<tr>
<td>December</td>
<td>1000</td>
</tr>
</tbody>
</table>

- Boats Launched
- People
1987 Lake Attendance
(Data Source-CDP&R)

# of Visitors

Boats Launched  People
1988 Lake Attendance
(Data Source: CDP&E)

Boats Launched  People
1989 Lake Attendance
(Data Source: CDP&E)

[Chart showing attendance from January to December with high peaks in July and August.]
1990 Lake Attendance
(Data Source: CDP&R)

<table>
<thead>
<tr>
<th>Month</th>
<th># of Visitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>1000</td>
</tr>
<tr>
<td>February</td>
<td>2000</td>
</tr>
<tr>
<td>March</td>
<td>3000</td>
</tr>
<tr>
<td>April</td>
<td>4000</td>
</tr>
<tr>
<td>May (No boat launch records until July)</td>
<td>5000</td>
</tr>
<tr>
<td>June</td>
<td>6000</td>
</tr>
<tr>
<td>July</td>
<td>9000</td>
</tr>
<tr>
<td>August</td>
<td>8000</td>
</tr>
<tr>
<td>September</td>
<td>7000</td>
</tr>
<tr>
<td>October</td>
<td>6000</td>
</tr>
<tr>
<td>November</td>
<td>5000</td>
</tr>
<tr>
<td>December</td>
<td>4000</td>
</tr>
</tbody>
</table>

Legend:
- Boats Launched
- People

Note: May has no boat launch records until July.
1991 Lake Attendance

(Data Source - CDP&R)

# of Visitors

<table>
<thead>
<tr>
<th>Month</th>
<th># of Visitors</th>
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<tr>
<td>January</td>
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<tr>
<td>February</td>
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<td>March</td>
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<td>April</td>
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<tr>
<td>November</td>
<td>7000</td>
</tr>
<tr>
<td>December</td>
<td>8000</td>
</tr>
</tbody>
</table>

(No data available for March or September...January records probably in error)

Legend:
- □ Boats
- ■ People
1992 Lake Attendance
(Data Source: CDP&R)

Number of Visitors

January February March April May June July August September October November December

Boats Launched
People

(No boat launch records for June)
1993 Lake Attendance
(Data Source: CDP&R)

# of Visitors

15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0

January
February
March
April
May
June

(Boating closed January 16 due to flooding... Lake control returned to city July 1, records end)

[Boats Launched] [People]
APPENDIX D

GRAPHS OF BACTERIAL DATA 1981 - 1993
Bacterial Levels
1980-1993

Monthly (Approx.) Samples
(Federal Standard is 126/100 mL)

- Maximum
- Minimum
1980 Bacterial Levels

- Federal Standard
- Maximum
- Minimum

E. coli per mL

0  500 1000 1500 2000 2500

Sept22 Oct6 Nov19 Dec1 Dec8 Dec15

Monthly (Approx.) Samples
1980 Bacterial Levels

Monthly (Approx.) Samples
1981 Bacterial Levels

- Federal Standard
- Maximum
- Minimum

Monthly (Approx.) Samples


Approx. Jan 1

0 500 1000 1500 2000 2500

E. Coli per mL
1982 Bacterial Levels

- Federal Standard
- Maximum
- Minimum
1983 Bacterial Levels

Federal Standard    Maximum    Minimum
1984 Bacterial Levels

<table>
<thead>
<tr>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
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<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
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</thead>
</table>

- Federal Standard
- Maximum
- Minimum
1986 Bacterial Levels

![Graph showing bacterial levels from January to December 1986. The graph includes federal standards, maximum, and minimum levels. The levels fluctuated significantly during the year, with a peak in April and a drop in May.]
1987 Bacterial Levels
1988 Bacterial Levels

Monthly (Approx.) Samples

- Federal Standard
- Maximum
- Minimum
1991 Bacterial Levels

- Federal Standard
- Maximum
- Minimum
1992 Bacterial Levels

- Federal Standard
- Maximum
- Minimum

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<thead>
<tr>
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[Graph showing bacterial levels over time with specific dates and levels indicated.]
APPENDIX E

FLORA & FAUNA OF THE LAKE ELSINORE REGION
Appendix A

Floral Species List

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<th>FAMILY</th>
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<td>Amaranthus retroflexus/Rough Pigweed</td>
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<td>Xanthium strumarium var. canadense/Cocklebur</td>
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<td>Betulaceae - Birch Family</td>
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<td>Alnus rhombifolia/White Alder</td>
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Sweetwater Environmental Biologists

Biological Resources Study for the Lake Edge Specific Plan

August 1, 1991

Prepared for PBR
Boraginaceae - Borage Family
- *Amsinckia intermedia* - Yellow Fiddleneck
- *Harpagonella palmeri* - Palmer's Grappling-hook
- *Heliotropium curassavicum var. oculatum* - Chinese Pusley
- *Plagiobothrys californicus* - California Popcorn Flower

Brassicaceae (Cruciferae) - Mustard Family
- *Brassica geniculata* - Perennial Mustard
- *Brassica nigra* - Black Mustard
- *Raphanus sativus* - Wild Radish

Cactaceae - Cactus Family
- *Opuntia oricola* - Tall Coastal Prickly Pear
- *Opuntia prolifera* - Coast Cholla

Caprifoliaceae - Honeysuckle Family
- *Lonicera subspicata var. johnstonii* - Honeysuckle
- *Sambucus mexicana* - Elderberry

Chenopodiaceae - Goosefoot Family
- *Atriplex spp.* - Saltbrush
- *Bassia hyssopifolia* - Bassia, Fivehook
- *Chenopodium californicum* - California Pigweed
- *Salsola iberica* - Russian-Thistle

Convolvulaceae - Morning-Glory Family
- *Cressa truxillensis var. vallicola* - Alkali Weed
- *Cuscuta sp.* - Witch's Hair, Dodder
- *Cuscuta californica* - Witch's Hair, Dodder

Crassulaceae - Stone-Crop Family
- *Dudleya lanceolata* - Live-Forever

Cururbitaceae - Gourd Family
- *Cucurbita foetidissima* - Calabazilla

Euphorbiaceae - Spurge Family
- *Eremocarpus setigerus* - Turkey Mullein, Dove Weed
- *Euphorbia polyacarpa var. polyacarpa* - Fairy Mists
- *Ricinus communis* - Castor Bean

Fabaceae (Leguminosae) - Pea Family
- *Astragalus sp.* - Raffleweed, Locoweed
- *Astragalus sp.*
- *Lotus purshianus* - Spanish-Clover
- *Lotus scoparius* ssp. *scoparius* - Deerweed
- *Lupinus sp.* - Lupine

Sweetwater Environmental Biologists
August 1, 1991

Biological Resources Study for the Lake Edge Specific Plan
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*Melilotus albus*/White Sweet-Clover  
*Melilotus indicus*/Yellow Sweet-Clover  
*Trifolium sp./Clover*

Fagaceae - Oak Family  
*Quercus lobata*/Oak Valley*

Frankeniaceae - Frankenia Family  
*Frankenia grandifolia*/Alkali-Heath*

Geraniaceae - Geranium Family  
*Erodium cicutarium*/Red-Stem Filarée*

Hydrophyllaceae - Waterleaf Family  
*Nemophila menziesii* ssp. *menziesii*/Baby Blue-Eyes  
*Phacelia sp./Bell Phacelia, California Blue Bells  
*Phacelia parryi*/Parry Phacelia  
*Pholistoma spp.*

Juglandaceae - Walnut Family  
*Juglans californica*/Walnut*

Lamiaceae (Labiatae) - Mint Family  
*Marrubium vulgare*/Horehound  
*Salvia columbariae* var. *columbariae*/Chia  
*Stachys rigida* ssp. *quercetorum*/Hedge Nettle*

Lemnaceae - Duckweed Family  
*Lemma sp./Duckweed*

Lythraceae - Loosestrife Family  
*Lythrumsalicaria*/Wallow Poly*

Malvaceae - Mallow Family  
*Malva parviflora*/Cheeseweed  
*Sidalcea malviflora* ssp. *sparsifolia*/Wand Checker-Bloom*

Myrtaceae - Myrtle Family  
*Eucalyptus sp./Eucalyptus*

Nyctaginaceae - Four O'Clock Family  
*Mirabilis californica* var. *californica*/Wishbone Bush*

Onagraceae - Evening Primrose Family  
*Camissonia cheiranthifolia*/Beach Evening Primrose  
*Zauschneria californica*/California-Fuchsia*

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Sweetwater Environmental Biologists  
August 1, 1991  

Biological Resources Study for the Lake Edge Specific Plan  
Prepared for PBR  
A-3  

189
Papaveraceae - Poppy Family

*Eschscholzia californica* /California Poppy
*Phytolacca americana* /Common Pokeweed

Polemoniaceae - Phlox Family

*Gilia angustifolia* /Gilia

Polygonaceae - Buckwheat Family

*Chorizanthe* sp./Spineflower
*Eriogonum* sp./Eriogonum
*Eriogonum fasciculatum* sp. *fasciculatum* /California Buckwheat
*Rumex* sp./Dock
*Rumex crispus* /Curly Dock

Rubiaceae - Madder Family

*Galium* spp.
*Galium angustifolium* /Narrowleaf Bedstraw

Salicaceae - Willow Family

*Populus fremontii* /Fremont Cottonwood
*Salix gooddingii* var. varibilia /Black Willow
*Salix hindiana* /Gray Bark Willow, Sandbar Willow
*Salix lasiolepis* /Red Willow
*Salix lasiolepis* var. *brasiliensis* /Arroyo Willow

Saurniaceae - Lizard-Tail Family

*Anemopsis californica* /Yerba Mansa

Saxifragaceae - Saxifrage Family

*Jepsonia parryi* /Mesa Saxifrage

Scrophulariaceae - Figwort Family

*Knicksia antrrhoides* /Chaparral Beard-Tongue
*Mimulus guttatus* ssp. *guttatus* /Common Monkey-Flower

Solanaceae - Nightshade Family

*Datura meteloides* /Jimson Weed
*Nicotiana glauca* /Tree Tobacco

Tamaricaceae - Tamarisk Family

*Tamarix sp.* /Tamarisk
*Tamarix parviflora* /Small-Flowered Tamarisk

Urticaceae - Nettle Family

*Urtica holosericea* /Nettle
Violaceae - Violet Family

Viola pedunculata/Johnny Jump-Up

MONOCOTYLEDONEAE

Amaryllidaceae - Amaryllis Family

Dichelostemma pulchellum/Blue Dicks, Wild Hyacinth

Areaceae (Palmae) - Palm Family

Phoenix canariensis/Canary Island Date Palm
Washingtonia sp./Palm
Washingtonia filifera/California Fan Palm

Cyperaceae - Sedge Family

Carex sp./Sedge
Cyperus sp./Umbrella Sedge
Eleocharis acicularis/Spike-Rush
Scirpus acutus/Common Tule
Scirpus robustus/Prairie Bulrush

Juncaceae - Rush Family

Juncus mexicanus/Mexican Rush
Juncus textilis/Basket Rush

Lemnaceae - Duckweed Family

Lemma sp./Duckweed

Liliaceae - Lily Family

Caiochorus weedii var. weedii/Weed’s Mariposa
Chlorogalum parviflorum/Mariposa

Poaceae (Gramineae) - Grass Family

Avena barbata/Slender Wild Oat
Bromus diandrus/Ripgut Grass
Bromus mollis/Soft Chess
Bromus rubens/Red Brome
Cortaderia atacamensis/Pampas Grass
Cynodon dactylon/Bermuda Grass
Distichlis spicata/Saltgrass
Hordeum sp./Wild Barley
Leptochloa sp./Sparteetop
Oryzopsis miliacea/Bicegrass
Polypogon monspeliensis/Rabbitfoot Grass
Stipa coronata/Giant Stipa
Stipa lepida/Foothill Stipa
Stipa pulchra/Nodding Stipa
Ruppia maritima/Ditchgrass

Sweetwater Environmental Biologists
August 1, 1991

Biological Resources Study for the Lake Edge Specific Plan
A-5
Prepared for PBR

191
Typhaceae - Cattail Family

*Typha sp.* Cattail
*Typha latifolia* Soft-Flag, Tall Cattail

Appendix B
Lake Elsinore Wildlife Inventory List

<table>
<thead>
<tr>
<th>COMMON NAME</th>
<th>SCIENTIFIC NAME</th>
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Sweetwater Environmental Biologists
Biological Resources Study for the Lake Edge Specific Plan
August 1, 1991
Prepared for PBR

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Sweetwater Environmental Biologists
August 1, 1991

Biological Resources Study for the Lake Edge Specific Plan
B-2
Prepared for PBR

194
Family Tytonidae
   Barn-Owl    Tyto alba

Family Strigidae
   Great Horned Owl    Bubo virginianus

Family Trochilidae
   Anna's Hummingbird    Calypte anna
   Costa's Hummingbird   Calypte costae

Family Alcedinidae
   Belted Kingfisher    Ceryle alcyon

Family Picidae
   Nuttall's Woodpecker   Picoides nuttalli
   Northern Flicker      Colaptes auratus

Family Tyrannidae
   Pacific-slope Flycatcher    Empidonax difficilis
   Black Phoebe                Sayornis nigricans
   Say's Phoebe                 Sayornis saya
   Ash-throated Flycatcher     Myiarchus cinerascens
   Western Kingbird            Tyrannus verticalis

Family Hirundinidae
   Northern Rough-Winged Swallow    Stelgidopteryx serripennis
   Cliff Swallow                  Hirundo pyrrhonota

Family Corvidae
   Scrub Jay                  Aphelocoma coerulescens
   American Crow               Corvus brachyrhynchos
   Common Raven                Corvus corax

Family Aegithalidae
   Bushtit                    Psaltriparus minimus

Family Troglodytidae
   Bewick's Wren              Thryomanes bewickii
   House Wren                 Troglodytes aedon

Family Muscicapidae
   Ruby-crowned Kinglet   Regulus calendula
   California Gnatcatcher  Polioptila californica
   Hermit Thrush           Catharus guttatus
   Wrenit                   Chamaea fasciata

Sweetwater Environmental Biologists  Biological Resources Study for the Lake Edge Specific Plan
August 1, 1991  B-3
Prepared for PBR

195
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<td>MacGillivray's Warbler</td>
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<td>Golden-crowned Sparrow</td>
<td>Zonotrichia atricapilla</td>
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<td>Dark-eyed Junco</td>
<td>Junco hyemalis</td>
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Subfamily Ictenae
- Red-winged Blackbird
- Tricolored Blackbird
- Western Meadowlark
- Brewer's Blackbird
- Brown-headed Cowbird
- Hooded Oriole
- Bullocks Oriole

Family Fringillidae
- Purple Finch
- House Finch
- Lesser Goldfinch
- Lawrence's Goldfinch
- American Goldfinch

Family Passeridae
- House Sparrow

REPTILE AND AMPHIBIAN LIST
- California Bullfrog
- Western Fence Lizard
- Side-Blotched Lizard
- California Kingsnake

MAMMAL LIST
- Broad-Footed Mole
- Coyote
- Gray fox
- Domestic Dog

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<tr>
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<td>Neotoma</td>
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<td>Cricetidae</td>
<td>Harvest Mouse</td>
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<td>Leporidae</td>
<td>Black-tailed Jackrabbit</td>
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<td></td>
<td>Audubon's Cottontail</td>
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<td>Brush Rabbit</td>
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<td>Spermophilus beecheyi</td>
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<td>Thomomys bottae</td>
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<td>Sylvilagus audubonii</td>
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<td></td>
<td>Sylvilagus bachmani</td>
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APPENDIX F

ALGAE SPECIES & WATER QUALITY DATA
Three water samples, preserved in accordance with Standard Methods for the Examination of Water and Wastewater, were submitted for Algae speciation and Algae enumeration. Sixty milliliter portions from each of the samples were centrifuged and examined under a compound microscope. The speciation and enumeration are as follows:

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<th>Speciation</th>
<th>Enumeration/0.01 ml</th>
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<tbody>
<tr>
<td>Anacystis</td>
<td>2,000 (Taste &amp; Order Algae)</td>
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<tr>
<td>Palmella</td>
<td>500 (Filter clogging Algae)</td>
</tr>
<tr>
<td>Achnanthes</td>
<td>1,500 (Reservoir Algae)</td>
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<tr>
<td>Chlorococcum</td>
<td>2,500 (Polluted water Algae)</td>
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<tr>
<td>Gomphosphaeaeria</td>
<td>500 (Blue-green Algae)</td>
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<tr>
<td>Rivularia</td>
<td>750 (Blue-Green Algae)</td>
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<tr>
<td>Calothrix</td>
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<tr>
<td>Anabaena</td>
<td>3,000 (Surface water Algae)</td>
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<tr>
<td>Chrysococcus</td>
<td>60 (Flagellate Algae)</td>
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<table>
<thead>
<tr>
<th>Speciation</th>
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<tr>
<td>Navicula</td>
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<tr>
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<tr>
<td>Rivularia</td>
<td>600 (Blue-green Algae)</td>
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<tr>
<td>Modularia</td>
<td>200 (Blue-green Algae)</td>
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<td>Ceratium</td>
<td>80 (Flagellate Algae)</td>
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<td>Phacus</td>
<td>25 (Flagellate Algae)</td>
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Cont'd on Page 2
Composite Sample 10/29/93

<table>
<thead>
<tr>
<th>Speciation</th>
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<td>Botryococcus</td>
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<td>Tetraspora</td>
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<td>Palzella</td>
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<td>Anabaena</td>
<td>1,000 (Taste &amp; Order Algae)</td>
</tr>
<tr>
<td>Anacystis</td>
<td>5,000 (Taste &amp; Order Algae)</td>
</tr>
</tbody>
</table>

ASSOCIATED LABORATORIES, by:

[Signature]

Tite L. Parks

TLP/mrm
TEMPERATURE - AVERAGE OF ALL STATIONS

DATE SAMPLED

TEMPERATURE (C)

Top    Middle    Bottom

FIGURE 2
DISSOLVED OXYGEN - AVERAGE OF ALL STATIONS

DATE SAMPLED

DISSOLVED OXYGEN, mg/L

0 5 10 15 20 25

Top  Middle  Bottom

FIGURE 3
TOTAL DISSOLVED SOLIDS - AVERAGE OF ALL STATIONS

DATE SAMPLED

TOTAL DISSOLVED SOLIDS, mg/L

Thousands

Top · Middle · Bottom

FIGURE 4
pH - AVERAGE OF ALL STATIONS

FIGURE 5
NITROGEN SPECIES - AVERAGE OF ALL STATIONS

FIGURE 6
PHOSPHORUS - AVERAGE OF ALL STATIONS

FIGURE 7

DATE SAMPLED

PHOSPHORUS - mg/L-P

Ortho Phosphate  Total Phosphorus
### ANALYTICAL RESULTS - AVERAGE OF ALL STATIONS

<table>
<thead>
<tr>
<th>Date</th>
<th>Ammonium Nitrates</th>
<th>Alkalinity as CaCO₃</th>
<th>Orthophosphates</th>
<th>TotalPhosphates</th>
<th>Kjeldahl Nitrogen</th>
<th>Chlorophyll</th>
<th>Zinc (μg/l)</th>
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<tbody>
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**TABLE 2**

All values are in mg/L unless otherwise indicated. Values that are non-detected are included in the calculated average as equal to 0.5 times the detection limit. Chlorophyll values for 9/28/93 do not include the 470.0 μg/l observed at station 9.
## ANALYTICAL RESULTS - STORM EVENT

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<td>&lt;0.005</td>
<td>&lt;0.005</td>
<td>&lt;0.005</td>
<td></td>
</tr>
<tr>
<td>Silver</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>&lt;0.01</td>
<td>0.01</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 3**
## Concentration of Conventional Pollutants and SOD in Bottom Sediments

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Concentration mg/kg (dry weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Station 2</td>
</tr>
<tr>
<td>Ammonium as N</td>
<td>54</td>
</tr>
<tr>
<td>Nitrate as N</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Nitrite as N</td>
<td>4</td>
</tr>
<tr>
<td>Kjeldahl as N</td>
<td>4000</td>
</tr>
<tr>
<td>Sulfate as SO₄</td>
<td>60</td>
</tr>
<tr>
<td>Total Phosphorus as P</td>
<td>760</td>
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<tr>
<td>Biochemical Oxygen Demand</td>
<td>4000</td>
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<tr>
<td>SOD, grO₂/m²-Day</td>
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</tbody>
</table>

**TABLE 4**
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Concentration mg/kg (dry weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Station 2</td>
</tr>
<tr>
<td>Percent Solids</td>
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<tr>
<td>Arsenic</td>
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<tr>
<td>Barium</td>
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<tr>
<td>Cadmium</td>
<td>1</td>
</tr>
<tr>
<td>Chromium</td>
<td>10</td>
</tr>
<tr>
<td>Cobalt</td>
<td>10</td>
</tr>
<tr>
<td>Copper</td>
<td>10</td>
</tr>
<tr>
<td>Lead</td>
<td>8</td>
</tr>
<tr>
<td>Mercury</td>
<td>ND</td>
</tr>
<tr>
<td>Selenium</td>
<td>ND</td>
</tr>
<tr>
<td>Silver</td>
<td>ND</td>
</tr>
<tr>
<td>Zinc</td>
<td>56</td>
</tr>
</tbody>
</table>

ND = Not Detected at PQL
PQL = Practical Quantitation Limit

TABLE 5
APPENDIX G

SELECTED NEWSPAPER ARTICLES FROM LAKE ELSINORE
Elsinore Lake!

**ELSIONE LAKE** which is exactly half way between Los Angeles and San Diego on the C. S. R. R., is a beautiful sheet of pure mountain water, 7 miles long, 3 miles wide and 80 feet deep. It is 1,200 feet above the sea and 17 miles distant.

On the north shore is a wonderful little valley which contains 180 hot and cold mineral Springs of almost all kinds, and of wonderful curative qualities. SEND FOR TESTIMONIALS.

Around the Springs is a young city rapidly growing up, and around the Lake, a large and prosperous settlement, intelligent, orange, vine and fruit growers.

There are now 15 small sail boats, one large yacht, and a steamboat which will carry 60 passengers. This boat makes regular trips around the lake, stopping at the foot of every street to discharge and return passengers and freight, answering every purpose of a street car. The owner of the lake proposes to soon add two large steamboats for the better accommodation of picnic excursion parties.

The Lake is becoming quite a summer as well as a winter resort; because invalids and others can have the benefit of bathing in the lake, mineral springs, sailing, rowing and steamboating, driving, hunting and prospecting. Grand and sublime mountain scenery and all without the raw wind and fog of the ocean beach.

For reliable information relative to the Lake, Lands, Town lots, Hot Springs, Coal, Mines, Fire-clay, Mines, Vast mineral deposits of all kinds, Deer, Quail and Duck Shooting and for Maps, Circulars, Stereoscopic Views, Samples of the Local Paper and other information.

**F. H. HEALD**

**Take one.**

Elsinore, Cal.

Huntley, Heag Co., Print Los Angeles, Cal.
Drilling of Wells
Seen as Solution

ELSIOR, Oct. 17—This once-booming community's long and often-frustrating campaign to restore the lake as a boating paradise has finally "taken hold." Drilling has begun in the dry, sun-baked lake bed in an effort to locate water which will make sportsmen's dreams come true.

The dream is a brimming lake swarming with small craft which will restore to this parched area its eminence, enjoyed in the twenties and thirties, as the "boating capital of Southern California."

First in a series of steps aimed at this goal is the sinking of an 11-inch well in the southeast end of the seven-mile long bed.

It will be sunk to a depth of 600 feet in the hope of striking an artesian flow—to this community the equivalent of pure gold.

Such a strike would implement other efforts to fill and stabilize the lake.

Spearhead of the drive is Bill Cox, a comparative newcomer to Elsinore, under whose leadership money was raised for the well drilling.

Cox is one of a group of citizens incorporated under the name of Water for Lake Elsinore, Inc., which was organized to overcome nature's strangling device here—the dry cycle.

Except for the wet winter of 1958, which filled part of the lake, the one-time recreational haven has been unusable for most of the past 20 years.

With the principal attraction of this halfway junction between Los Angeles and San Diego gone, palatial homes, summer cottages and resorts were abandoned.

Property values decreased to the point, where lots selling for $3000 in 1927 sold this year for approximately $500.

Population has shrunk to 2500. Residents are mainly retired. Building has been at a standstill.

But now, new life is being pumped into the community, thanks to WLE.

The group has four basic objectives:

- WATER from wells.
- CLEANING the San Jacinto River below Railroad Canyon Dam to allow a greater flow of the river during the rainy season.
- WATER CONSERVATION and stimulation of a lake redevelopment spirit among residents of this area.
- Much of the group's hopes for the return to earlier prosperity is tied to its faith in one man—Verne Cameron, water diviner.

Cameron has successfully located wells in this area for years.

He believes the lake bottom is like a pan floating in water, a clay barrier of some 100 feet in depth under which there is a natural basin of water. It is this source that is expected to be tapped.

If the test well proves successful, two or three additional ones would ultimately be sunk. Water obtained from these sources might be produced for as little as $2 per acre foot, Cox believes.

The well water would be in addition to the 10,000 acre feet that is expected to be purchased from the Metropolitan Water District next year. It, however, will cost $13 per acre foot.

To be usable, local residents say, the lake must be 12 feet deep.

So stabilized, with water flowing in from all sources, it would draw 2,000,000 persons a year, they estimate.

Two years ago, 2900 acres of lake bed were purchased for a state park. But plans for its development have been stymied pending solution of the water problem. 
Credit for state park goes to many people

(Continued From Page B-1)

been lining up his colleagues for the vote.

The Senate approved the measure.

In presenting the amend­ment in the Senate, Dilworth explained the history of the Lake Elsinore project and the conditional recommendation depending on the $350,000 appropriation.

Actually, Dilworth's Senate bill for $350,000 included a re-­appropriation of $200,000 from the previous year. The new amount was $200,000.

MOST OF THE original $120,000 the two legislators got for Lake Elsinore in 1955 has recently been spent to make the attractive and usable park and camp grounds at the lake. Of the entire appropriation, approximately $105,000 still remains earmarked for land acquisition at Lake Elsinore.

With the passage of the $105,000 appropriation on March 29, 1956, in Sacramen­to, Lake Elsinore became a state park by announcement of the State Park Commis­sion.

THERE WAS TALK in Elsinore about closing out Lake Elsinore Recreation and Park District, the local tax district, but the Division of Beaches and Parks said it should not yet be done. It could be a liaison between the state and the people here. Lake Elsinore Recreation and Park District board has had four presidents since it was organized by the people in 1949 — W. F. Holmes, Victor Hefty, Galah Gough, and Richard Hibbert.

Four directors have acted as secretary — L. W. Wolf, the late Ralph Kilgore, Loyd Longe and lan Keegan. Other directors have been: T. A. Harrison, T. C. Likan, Robert Claxton, Harry Brewer, Lyle Hodges, John Edwards and Frank De Pasquale.

THE STORY of the mak­ing of Lake Elsinore State Park has been something toward making Elsinore a beautiful state park, other work, money, or food for workers.

UNDER THE current president, Richard Hibbert, the local park board has worked to secure a loan to purchase water to fill dry Lake Elsinore, which was hit by a 22-year drought in Southern California.

Hibbert and other board members have conferred many times with legislators in Sacramento.

One board member, Frank De Pasquale, for a time followed Governor Brown around with a band every time he came into the south. De Pasquale even crashed private banquet with his musicians to tell Governor Brown about getting water for Lake Elsinore.

THE CLEANING JOB took seven months with men working every weekend and holidays, but it made the channel a better place to run water when water comes and the dry lake bed and shore place to be proud of. Women, led by Mrs. Jack Gunderson, provided lunches for the workers. Who came out. Boy Scouts led by adults have gone over the entire lake for cans and other debris. Practically every organization and almost every per­son in the valley has contributed something toward making Elsinore a beautiful state park, other work, money, or food for workers.

Councilman seeks civic center lease

PERRIS — A freshman city councilman has volunteered to tackle a target that has eluded the city's legislators for more than a year — a civic center lease with the County Board of Supervisors.

The prospective tackler is Dwight Benton Minnich, who was elected last month along with Royce O. Bell.

Minnich told the council Tuesday night he will ask the county for an extension of lease of civic center facilities for county offices, as has been done in other county cities in recent years.

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Lake Elsinore filling draws large throngs

ELSINORE — The people of Southern California continue to be interested in the filling of Lake Elsinore. Colorado River water was turned Saturday from the aqueduct at Lakeview into the San Jacinto River to flow to Lake Elsinore.

At least 50 days are estimated for the 30,000 acre feet of water to reach the lake. (An acre foot is 325,000 gallons.)

Ten thousand persons must have converged on Lake Elsinore last Sunday to see the water. The State Park entrance was registered 5,304 sightseers passing the entrance gate. They came from Los Angeles, San Diego, San Bernardino and coastal areas, looking for the water which had not yet arrived in the park end of the lake. Picnicking fees were paid by 236 cars.

At least 3,000 more persons lined the banks of the San Jacinto River near the lake and the shores of the lake bed itself.

Two cafes, the Club Cafe and the Village Inn, had to lock their doors temporarily in the middle of the day until they could serve those inside and have space for others. Other Elsinore cafes also reported extra heavy crowds.

The people remained until after dark to see the water come under the bridges and flow toward the lake.

At midnight Sunday they could see from a state patrol car that the water had filled the river where it emptied into the lake.

The State Division of Beaches and Parks has installed a measuring device in order to measure the amount of water that actually enters the lake and thus determine the loss of water in its flow down the river.

In the state car we proceeded out into the lake over a specially bulldozed road for the purpose of the patrol.

William Weatherby, assistant supervisor for District Six of the State Division of Beaches and Parks, is remaining in the area with heavy equipment and operators from San Clemente, the headquarters of district six.

Operators are patrolling and standing by to repair any damage done to the dikes through which the new water will be released.

They rode their boat up and down the bulldozed channel through the middle of the lake bed that was made to route the water first to the western deep end.

Freddy Stokes in his 25 foot power boat was the first motor boat to try the river, also early yesterday morning.

T. C. Morris was the first to ski in the new water.

Hearings on zone changes on Hemet planners agenda

By FRANK ADAMS

HEMET — Public hearings on two applications for zone changes and two for permits were continued on Wednesday night.

The commission met at 7:30 in the Hemet City Council chambers.

Change of zone applications are from Herbert B. Adams and G. Myril Tibbitts. Both hearings are continued from Jan. 16.

The Adams property, located on the north side of Stetson between Santa Fe and La Venta, is new zone R-1. Adams is asking for rezoning to R-3.

Tibbitts is asking for a change from R-1 to R-3 on the southwest corner of Stetson and Santa Fe.

Hearing on application for conditional use permit from Dorothy Vosburg

HEMET — Dorothy Bailey Mrs. Vosburg is a veteran of local music in town. She is also a member of the Hemet planning commission and is responsible for two applications for zone changes and two for permits.

Dorothy Vosburg has been asked to allow an opera house in her property on the west side of Stetson Avenue from Jan. 16. Anderson, a developer, is asking for a change from R-1 to R-3.

Each marina must have a channel from the lake to the land and a large square boat parking space dug out. This work must be completed before water reaches the west end of the lake where the marinas are being established.

Not many days will pass before some water arrives. But Robert A. Skinner, chief engineer for Metropolitan Water District, said a full lake will not be achieved under 50 days.

Many builders were working yesterday — too many to count — on the two marina sites. Both marinas are being built by the Watkins Development Company, whose chief owners are Jess Watkins and Jerry Stanley.

One Marina is near the southwest corner of Lake Elsinore on property owned by the development company. The other is on state park lands somewhat below the picnic grounds.

John Hightower, chief of concessions for the State Division of Beaches and Parks, said negotiations had been made with the Watkins company for the marina on park lands, because no one had come forward with an acceptable bid. According to Robie Francesio, public relations manager for the Watkins interests.

Wattins has a contract with the Division of Beaches and Parks, which involves a portion of the income from the two marinas.

With the fees paid by boaters, the division will reimburse the State Small Craft Harbors for the $750,000 borrowed from that agency to bring the water to Lake Elsinore.

As the Colorado River water is turned Saturday over the San Jacinto River at Mission Trail was lined with persons sitting on the sidewalks and watching the water pass beneath.

Some of the young boating crowd of Elsinore voted with one another in being first to hit the water. Louis Guenther probably made it before anyone else when he went into the river near the bridge on Sunday night in a plastic boat.

Rollie Brown, in his Mercury outboard and with his companions Buzz Hennes and Tex Janice, early yesterday morning made it first into the lake waters.

They rode their boat up and down the bulldozed channel through the middle of the lake bed that was made to route the water first to the western deep end.

Freddy Stokes in his 25 foot power boat was the first motor boat to try the river, also early yesterday morning.

T. C. Morris was the first to ski in the new water.
tion. He condemned as they were in 1949 to 1951. The lake had dwindled during those years and went completely dry in 1951.

Engineer A. L. Sonderrregner of Los Angeles had been hired early in the formation of the park district to prepare a plan for the development and stabilization of Lake Elsinore. The Sonderrregner Plan is still referred to with great respect.

He planned a 300 foot wide main channel and a protective shelter for small boats in the yacht basin at the south west part of the lake.

He planned to deepen this end and build a dam to cut off the shallow east end of the lake bed. He said maintenance of the pool elevation of the yacht basin and channel would require provision for a supplemental water supply of 600 acre feet a season during extended droughts. (An acre foot is equal to 325,000 gallons of water.)

At a meeting of the commission on March 23, 1953 at Pacific Grove, the commission passed a resolution approving the plan and project of Lake Elsinore Park District. The commission said it would find Lake Elsinore suitable for a park when $500,000 could be appropriated — $200,000 for the site and $300,000 for the first part of development.

THE CRUCIAL State Park Commission meeting came on March 23, 1956 in Sacramento. President Joseph H. Knowl- lands presided. The commission had received Bookman's report seven days before. Nelson Dilworth, then State Senator for this county, was at the meeting. He was awaiting the decision to make Lake Elsinore a state park.

Later, at his home in Hemet, he told the story to this reporter.

BOOKMAN reported that in a 40-year study period, 1915-1955, the Son-ry. He wound up the lake. His report by pressing for a decision on Lake Elsinore would double and treble in price. He said the decision to make Lake Elsinore a state park should not long be delayed.

The State Legislature, the Park Commission, the Department of Natural Resources and its Division of Beaches and Parks all have been given approval to the Lake Elsinore State Park project and helped to set it up.

HOLIVAY, these bodies first had to be informed and convinced. That was the work local persons set out to do.

Galal Gough, president of the First National Bank of Elsinore, was president of Lake Elsinore Recreation and Park District Board during these years.

"He and members of his board made frequent trips to Sacramento to give information and confer with state officials. Two members of Elsinore Woman's Club, Mrs. John Edwards and Mrs. Harvey French also went to Sacramento in behalf of the lake park project.

The State Park Commission told the Elsinore park board in its meeting at Riverside on Oct. 27, 1951, that the acquisition and development of Lake Elsinore as a state park, would be in the public interest.

BEFORE acquisition, the state would have to be convinced that the lake could continue to have a permanent supply of water and also that sufficient upland area for camp and picnic grounds and parking of cars could be provided.

The park board bought the upland area in 1952 and '53 — altogether 72 acres between Riverside Street and the lake — for a total of $52,000.

The board got $10,000 together to pay the Department of Water Resources to make a survey of the lake area and provide a feasibility report. Of this the county gave $5,000, the State Water Resources Agency, $3,000, and the local park board $2,000.

Agency engineer Max Bookman made the report. It showed that stabilizing the lake with water was feasible.

GOUGH knew of the hur-ry. He wound up the lake.
Many worked to get
Elsinore state park

By EVALINE MORMISON

ELSINORE—When Lake
Elsinore State Park is dedi-
cated Saturday, it will mean
that many state agencies
have agreed that Lake Elsi-
nore is desirable for recrea-
tion.

The State Legislature, the
Park Commission, the De-
partment of Natural Re-
sources and its Division of
Beaches and Parks all have
been given approval to the
of Los Angeles had been hired
earlier in the formation of the
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great respect.

He planned a 300 foot
wide main channel and a pro-
ective shelter for small mas-
per success.

THE RESOLUTION waa
ready. It was whipped out and
put through. Senator Dil-
worth asked for a copy and
then Assemblyman L. M.
Backstrand (now senator)
left.

They had just seven min-
utes to get the three blocks to
the capital, have the amend-
ment formulated and ready
for present in the Senate.

Backstrand dashed into the
Legislative Counsel office to
get the amendment drafted,
Dilworth hurried to the Sen-
ate to explain it to the other
senators.

DILWORTH had already
Turn to CREDIT Page B-2

Hemet
CLASSIFIED
SERVICE
As Near As Your
Remember when the Showboat, located on the south side of Lake Elsinore was the place to take your best gal. for a soda, dancing or just to sit and talk? The evenings when the lights from this vessel reflected on the water and the music that was being played from the bandstand on the top level could be heard for miles around? That was yesterday, and now it sits, the wind rips through the broken windows and doors, the planks are rotted and the steps a danger to walk on. ghosts of the past linger there . . . in our memories.
Plan for stabilizing lake in mail to residents

LAKE ELSINORE — A brochure explaining the proposed Lake Elsinore Stabilization and Land Use Plan is being mailed this week to more than 10,000 valley residents. Three plans had been submitted to a task force composed of representatives of all entities concerned with the condition of Lake Elsinore by the planning firm, EDAW, Inc. Plan C, which will cost $12 million to implement, was accepted as the most feasible and recommended to the Lake Elsinore Recreation and Park District board, which will handle financing of the plan.

Plan C calls for dredging and recontouring the lake bottom and sides. Building a dike across the eastern end and constructing a holding (evaporation) pond for water circulation will insure stabilization of lake water level at 1,240 feet above sea level and also will improve water quality, the planning firm believes.

William Penn Mott Jr., director of state parks, requested "a feasible plan" as the preliminary step toward saving Lake Elsinore from drying up.

The lake level is now down to 1,231.2. It is dry at 1,225.

One of the three lake bed wells that supply fresh water to the lake will not be repaired for several weeks, another has been operating sporadically and only one has been in operation most of this summer.

The brochure explaining Plan C is hoped to rally support in the community toward obtaining the money from state and federal agencies to begin the implementation of the plan.
Lloyd Brown with pier built in 1925. Lake is now 250 feet away.

Ralph Casaccia, left, president of the Rotary and owner of Ralph’s Marine Supply with Ted Buchak.
Lake Elsinore Country Club overlooks the west end of Lake Elsinore.
This is one of three well installations at Lake Elsinore which furnish underground water for the lake. Each well pumps water into the lake from a depth of 1800 feet. (Photo courtesy of Dalton Atherton)
Crowds see officials open Lake Elsinore

By EVALINE MORRISON
Press-Enterprise Staff Writer

ELsinore — Thousands of recreation enthusiasts came to Lake Elsinore yesterday to celebrate its official opening. The water was smooth, the air still and the sun shone for the ribbon-cutting ceremonies of the renewed lake.

Officials from Sacramento in good numbers dignified the occasion, the culmination of several years' work on the part of local and state agencies and people.

The State Division of Beaches and Parks had fulfilled its promise to buy 30,000 acre-feet of water from Metropolitan Water District to fill Lake Elsinore, which had been dry since 1968.

The official ribbon cutting took place at 1 p.m. on April 12.

The Watkins Development Company, which built Lakeview Dam, received the first water on the lake.

DUE TO the March rains, the Watkins Company could not start building its marina on schedule. However, many marina facilities were ready by March 12, when boats were first allowed on the lake.

The student body of Elsinore Naval and Military School marched in their dress uniforms. Hugo Fisher, administrator of the State Resources Agency, the main speaker, spoke from a platform set up near the water.

FISHER is credited with pushing the Lake Elsinore project through in the accelerated pace it acquired after the recent legislature had acknowledged and approved the program.

Harry Dougherty, attorney for Lake Elsinore Recreation and Park District, introduced officials, each of whom said they approved of the Lake Elsinore project and were delighted at its culmination.

Those speaking were Charles A. DeTure, director of the Department of Parks and Recreation; Edward F. Dolder, chief of the Division of Beaches and Parks; Alfred J. Stern, chairman of the State Park Commission, and John Annan, president of Ski Club.
Major fish kill at Lake Elsinore predicted as water level drops

By PAULA KRINER
The Press-Enterprise
A state ranger predicts that tons of fish in Lake Elsinore could die next summer unless there is ample rain in the coming months to replenish the lake.

"Unless we get a phenomenal amount of rain in the next two months, and I don't see that, the conditions will be the same as they were in 1972," said Jeff Bovee, head ranger of the Lake Elsinore State Recreation Area.

"That year there were 800 tons of fish on the beaches. It took them 14 days to clean it up."

Two years of drought have taken a toll. A combination of low water volume and warmer temperatures can cause conditions that are lethal to the bass, catfish, shad and carp in the lake, Bovee said. As the water evaporates, salts, alkalines and other minerals become concentrated in toxic levels. Algae, which bloom abundantly in warmer temperatures, deplete the oxygen supply in the water.

The lake needs a large supply of fresh water to prevent those conditions from occurring, Bovee said.

It is not uncommon for fish to die in the lake, even in times

(See WATER, Page B-6)
when the water level is high. But when the water volume is low, more fish are likely to die. Major fish kills in Lake Elsinore were recorded in 1933, 1940, 1948, 1966 and 1972, according to a 1974 study by a Newport Beach consulting firm, EDAW, Inc.

Between last August and October, several hundred fish died when the water level of the lake dropped to about 1,237 feet above sea level and the water temperature rose to 82-84 degrees, Bovee said.

The situation will be worse next summer, he predicted. Bovee expects the water level to continue to decline. "Last month the lake level declined even with the rain and cold weather."

The lake elevation is currently just under 1,235 feet above sea level. Without sufficient rain, the water level could reach a low of 1,232 feet above sea level, the same level as in 1972, Bovee said.

Lake Elsinore is a natural basin for the run-off from the San Jacinto River watershed. Unlike other Riverside County lakes, Lake Elsinore was formed by nature in times of flooding. It is shallow, with a maximum depth of 17 feet. Most Riverside County lakes are man-made storage reservoirs, like Lake Perris, which is 165 feet deep.

Reservoirs don't face major fish kills because of their depth and their continuous supply of water. Lake Elsinore, like the Salton Sea in southeast Riverside County, does not have a regular inflow and outflow of water to flush the lake of mineral and nutrient concentrations.

Water that once flowed into Lake Elsinore from streams has been diverted by dams. The only time water flows into the lake now is when the elevation reaches 1,260 feet above sea level, Bovee said.

There have historically been wide fluctuations in Lake Elsinore's water level because of flooding and droughts. The lake dried up in 1951 for the first time since 1881. It dried up again in 1954, and would have remained dry, except for a few months, until the 1969 flood if the state Department of Parks and Recreation had not imported water to fill the lake, according to the EDAW study on lake stabilization.

Construction of a $39.6 million project to stabilize Lake Elsinore's water level and improve the lake's quality is expected to begin this spring and be completed in the fall of 1990. The project includes building a levee at the southeastern end of the lake, improving the lake's inflow and outflow channels and creating more recreation areas along the shore.

Bovee is bracing for the worst this summer. The fish kill is likely unless steps are taken to prevent it, such as aerating the water or treating it chemically to keep oxygen in it.

Although expensive, Bovee believes those options provide a better alternative than letting nature take its course. "I'd rather look at options of preventing it, rather than cleaning it up," he said.
Lake shore sprayed with algae eaters

In an effort to salvage Labor Day weekend tourism, the city is spraying the shore of Lake Elsinore with bacteria to eliminate its rotten-egg smell.

The city will pay Brach & Allard Inc. of Santa Ana about $5,000 to spray the beach and shore with algae-eating bacteria beginning today. The bacteria will continue to feed on pungent, rotting algae for up to one month, according to Bill Basham, the city’s special projects coordinator.

Algae has consumed so much oxygen that about 45 tons of fish suffocated in the lake a week ago. The carcasses were hauled to a dump near Corona.

The spray is not harmful to humans or animals and has been approved by the state, Basham said. Spraying will focus at Lake Elsinore State Recreation Area and along Lakeshore Drive.

The bacteria’s algae consumption will produce oxygen in the lake, which could help prevent future fish kills, Basham said.
LEMA board requests safety plan for lake aeration system

By LOWANNA MAXWELL
Assistant Managing Editor

Plans for an aeration system designed to help clean up algae in Lake Elsinore were presented last week to members of the Lake Elsinore Management Authority.

The City of Lake Elsinore presented its final design report and specifications for the aeration system, which is expected to be installed next spring, for the LEMA board’s review. The system, which would be removed at the end of each summer season, is expected to cost about $117,000, or $17,000 less than originally estimated, officials noted.

A report on the design and testing of the aerators, which would work to bring water from the depth of the lake. By doing so, officials hope to prevent algae growth, thus preventing fish kills, which keep boaters and swimmers from using the lake.

LEMA members, however, expressed concerns about boating safety. The State Department of Parks and Recreation also had requested a safety plan be submitted, the staff report noted.

Charles Cole, consultant on the project, said the the cables will be weighted to keep them on the lake bottom instead of floating up where they might be damaged by boat propellers.

While the buoys are planned as part of the system’s safety features, Don Monohan, state parks supervisor, questioned whether they might also serve as a hazard.

“I have serious concerns about boater safety,” noted George Cook, regional director for the state parks department.

Monohan told LEMA members he and other parks staff would set up markers at the same intervals proposed in the plan and measure them off in a boat to determine if the buoy placement would become a safety problem.

An aerator set up by the concessionaire at Lake Elsinore shows how a system officials plan to put in will work, bringing up water from the depth of the lake.
Bad spot for boating

Lake Elsinore was dry in 1964, driving recreational operations such as this out of business. A dirt road ran across it that year. It was also dry in 1810, 1830 and 1851. It has nearly overflowed as well, in 1841, 1922, 1937, 1938, 1941 and 1960. The history of the city by the lake, which was established about 1885, has been by deeply affected by these floods and droughts. Recently, steps have been taken to make the lake more stable.

Photo/The Press-Enterprise. Snapshots will be published regularly until Riverside County's centennial celebration in May.
Tractor tires are boater’s alligators

By Susan M Loux
The Press-Enterprise

Robert Vermillion remembered a recent excursion in his sailboat on Lake Elsinore in which the bow brushed up against a glistening, ridge-backed object. “I thought it was the back of an alligator,” the former Lake Elsinore City Councilman said yesterday.

Then he turned and saw more nearby. “I thought, ‘I’m up to my armpits in alligators,’” he said. “It spooked me.”

A couple of residents had reported seeing alligator-like creatures in the lake’s flood plain, but authorities have been unable to confirm they exist.

What Vermillion encountered were actually giant tractor tires that had broken free of an artificial reef, a shelter to protect small aquatic life from predators and encourage nesting and spawning. Dennis said as water rose, some of the more than 100 tires that form the reef were lifted by air trapped within them, he said. They drifted over a protective berm and into the 2,400 acres of flood plain that are now submerged.

Martin Kenney, a biologist with the U.S. Fish and Wildlife Service, said a 1989 study revealed there is potential for auto tires to release harmful chemicals over time if they are released in oceans. Those chemicals include hydrocarbons, which in high concentrations have been shown to cause cancer, he said.

Dennis said that study has no bearing on the district’s reef. Ocean currents and salts aggressively decay materials, he said, while the lake has comparatively low salts and virtually no currents.

Meanwhile, Vermillion has contacted the U.S. Environmental Protection Agency because he is concerned the tires may be polluting the lake with chemicals. Representatives will visit the lake next week to evaluate the situation, said James Romero, environmental scientist.

Dennis said state and federal regulatory agencies approved of the tire reef and it is not considered a health or safety hazard.
Help is on the way.

The city is expected to sign a $343,000 contract today with a Santa Ana biotechnology firm that will dump 36,000 pounds of algae-eating bacteria into Lake Elsinore.

City officials say it’s the first step toward restoring the lake to its former glory and attracting tourists back to town. The three forms of algae in the lake smell bad and turn bathers’ swimwear green.

Brach and Allard Inc. of Santa Ana is expected to begin treating the infested lake Monday with an organism that will eat the plants.

One councilman said the pioneering treatment is too risky.

“There’s no track record of treating a lake such as this,” said Councilman George Alongi, who voted against the treatment earlier this month.

Alongi said no one has ever treated three different forms of algae at one time with the bacteria.

“We’re taking a big gamble,” he said.

Richard Watenpaugh, the city’s special projects manager, said the 35 billion-gallon-lake will be the largest body of water treated for excessive algae growth with the organism, known by the trade name Aqua-treat.

The organism eats the nutrients that feed the algae and allow it to proliferate, said Duane Brach, president of Brach and Allard.

Then it eats the algae.

The five-day treatment will end July 3, two days after the city takes control of the lake from the state. Contractors will return the next two weeks to treat the lake.

Please see ALGAE, B-4

Eventually, the city plans to stock the lake with various algae-eating fish, Watenpaugh said. The organism will not affect the fish.

Last year, the city hired Brach and Allard to treat the dead algae that was causing a foul odor in the lake, Brach said.

But the scum and smell returned this year with a vengeance after winter rains dumped 30 feet of water in the lake, prompting a feeding frenzy by the algae.

In May, the city began treating the lake with weekly doses of copper sulfate to suppress growth. But the copper sulfate can kill fish and city officials wanted to use a quicker method because the recreational season was approaching.

Watenpaugh said cleaning the lake is crucial if tourists are to return.

He’s confident it will eliminate the problem.

“We have nothing to lose at this point. If we were to dust copper sulfate over the entire lake, it would cost us just as much. And we’d end up killing all the fish.”
Organisms released today against algae in Elsinore waters

By Zion Banks

LAKE ELSINORE

Biotechnology specialists plan to begin dumping 66,000 pounds of an organism into Lake Elsinore this morning to consume the algae which has covered the lake with a pea-soup-colored scum. The organism, a bacteria known by the brand-name Aquatreat, will first eat the nutrients that feed the algae and then will eat the plant itself.

The initial treatment will last five days. But the specialists will continue dumping the organism for two weeks, as needed. Ultimately, the city will stock the lake with fish that eat algae.

The city hired Brach and Allard Inc. of Santa Ana last week to eliminate the scum. Treatment was scheduled to begin Monday, but Brach and Allard didn't have the required bonds, permits and approvals to start. The documents still were not in hand nearly two weeks later.

The city needed permits and approvals from the State Department of Parks and Recreation, the U.S. Environmental Protection Agency and the Lake Elsinore Water District. Meanwhile, the city is racing the clock. Officials are trying to clean the algae from the lake before the July 4 activities near its shores.

And tomorrow, the city will take ownership of the lake from the state. The city hopes to boost tourism and recreation, which dropped this year after winter rains raised the lake's water level 10 feet. This created a feeding frenzy for the algae.

In May, the city began treating the lake with weekly doses of copper sulfate to control the algae's growth. But that was temporary, Vanco said. Now, Aquatreat will not affect the fish and is not harmful to humans, according to the state department's tests.
APPENDIX H

MISCELLANEOUS
Lake Survey

Occupation _______________ Age ______
# years in Lake Elsinore _____ Miles from the lake ____________

How many times a year do you visit or use the lake? ____________

Do you (circle all that apply) regularly use the lake for boating, fishing, water-skiing, picnicking or swimming?

What, as you see it, is the lake's best feature?

What, as you see it, is the community's best feature?

What, as you see it, is the lake's biggest problem?

What, as you see it, is the community's biggest problem?

What word best describes the lake?

How do you feel that the community perceives the lake?

From 1 (worst) to 10 (best) rate each of the following.

Lake Elsinore as a community.....
the lake's level of pollution.....
the lake's level of general cleanliness.....
the lake as a recreational area.....
the lake's quality of fish.....
the lake's quality of water.....
the lake's scenic value.....
the lake's importance to the community of Elsinore....
maintenance of the lake.....

Other comments:

235
The following is a list of the Lake owners, dating back more than 100 years. This appeared in the Lake Elsinore Valley Sun for Feb 26th, 1952, as the lake begins its existence with the 21st owner, The Elsinore Lake Foundation.

A chronicle of the various owners of the lake reads like a history of Elsinore Valley, and reaches back to the days when the valley, and reaches back to the days when the valley was a part of Mexico.

The first owner was Julian Manriquez who received a grant to Rancho La Laguna, embracing the lake, on Jan 1st, 1844, from Manuel Micheltorena, Governor of the Dept. of Cal., then a part of Mexico.

Since that time, not counting the various banking institutions which have held title for short periods, the lake has been vested in succession in the following persons:

First transfer. To Don Abel Stearns, 1851
Second: Augustin Machado 1858
Third: Ramona Sepulveda de Machado and her 11 children, and Juan Machado, son of Augustin Machado by a former wife 1865
Fourth: Charles Almon Sumner, 1873
Fifth: Augustus Jacob, Frederick M Sumner, Cecil C.R. Sumner, and Georgiana Sumner 1876.
Sixth: Franklin Heald, Donald Graham and William Collier 1883.
Seventh: Franklin Heald, 1885.
Eighth: S. V. Landt, 1890
Nineth: South Riverside Land and Water Do., (who opened what is known as Temescal ditch through Elsinore and Warm Springs Valley and ran water to Corona for irrigation) 1893
Tenth: Temescal Water Company 1895
Eleventh: George I. Lamy, 1908.
Twelfth: Consolidated Reservoir and Power Company 1908
Thirteenth: Elizabeth B Pedley 1913
Elsinore Lake -2-

Fourteenth: H. M. Stiles  1914  
Fifteenth: H. B. Allen,  1917  
Sixteenth: W. L. Pedley and E lizabeth B. Pedley, 1919  
Seventeenth: R . F. Sherman, 1920  
Eighteenth  Southern Cal. Athletic Club  1924  
Nineteenth:  Glen E . Conklin, 1933  
Twentieth: Elsinore Naval and Military School  1933  
Twenty-first: Elsinore Lake Foundation  1952
CITY OF LAKE ELSINORE
PROJECTED POPULATION FIGURES UP TO THE YEAR 2010
(July 1993)

<table>
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<th>Year</th>
<th>Population (Census and Riv. Co. Data)</th>
<th>Increase From Previous Year</th>
<th>% Growth</th>
<th>Assumed Growth (<em>,</em>,<em>,</em>,*)</th>
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<td>3000 =</td>
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* Projections based on the historical data for the current recession.
* Projections based on the annexation of the Laguna Heights project and associated areas in addition to the projected figure based on historic data for the current recession.
# Assumptions based on projected post-recession growth.
* Projections based on the steady buildout of approved projects within the city.
CULTURE AREAS
S = Southern
C = Central
NW = Northwestern
NE = Northeastern
GB = Great Basin
CR = Colorado River

Memorandum

Date: March 15, 1989

To: Fred Worthley, Regional Director
   California Department of Fish and Game
   Region 5
   130 Goldenshore, Suite 50
   Long Beach, CA 90802

From: Department of Parks and Recreation
       Southern Region Headquarters

Subject: Fish Management at Lake Elsinore

This memo is to apprise you of an extreme fishery problem at Lake Elsinore State Recreation Area and to seek your Department's assistance and cooperation in dealing with the issue. It is our opinion that this summer, Lake Elsinore will face a catastrophic fish die-off as a result of lake conditions. Circumstances by July 1989, will parallel those of 1972 when lake elevation, temperature, nutrient content, and marine algae blooms combined to kill over 800 tons of fish. That die-off required the expenditure of over 1,000 person days and thousands of dollars in equipment and operating costs to effect the clean-up.

The lake has had a long history of fish die-offs that relate directly to the aforementioned factors. Similar occurrences were recorded in 1933, 1936, 1940, 1948, 1966, 1972, 1976, and 1977. The period from 1977 to 1986 saw lake levels above 1240' level and no die-off occurred. Last year there was a minor occurrence. As stated, we expect a major event in 1989. We would like to meet with you and your staff in the near future to determine what if anything can be done to alleviate this problem.

Our staff has discussed the possibility of chemical treatment, an infusion of water, and possible aeration of the lake, but these solutions would be only temporary at best, and seem to be cost prohibitive. Department of Water Resources water quality experts have indicated that the chemical treatment solution, could in fact exacerbate the die-off problem.

Commercial fishing in the lake was done in 1977 and produced 120 tons of fish. Perhaps it would be possible to permit this activity to occur in the next few months to reduce the tonnage that will have to be cleaned up. Another program with the concurrence of your Department might be no license, no limit fishing of the lake for the balance of the calendar year. I believe that such a program could have a very positive public relations benefit for both of our Departments.

CC:
The Department of Parks and Recreation is currently working through a joint powers agreement with six other agencies which have formulated a lake management authority. This authority is working to stabilize Lake Elsinore to enhance recreational potential and water quality. When the lake management project is complete, the ongoing fishery problem will be abated through the stabilization of the lake at 1240' minimum elevation.

Although the future of the fishery will secure through lake management, we are in need of your assistance. Please advise as to when you might be available to discuss this urgent problem.

Kenneth B. Jones, Regional Director
Southern Region

cc: Jack V. Harrison
    George E. Cook
    Lake Elsinore Management Authority
ISSUE: Department's response to anticipated fish kills at Lake Elsinore, Riverside County

SUMMARY: We anticipate major fish kills this summer and fall at Lake Elsinore, Riverside County; due to low water elevation and poor water quality. Fish kills will result in a loss of gamefish and poor public relations directed against the Department by the news media. No reasonable/financially feasible corrective measures can be taken to prevent the anticipated fish kills.

POSSIBLE QUESTION: Can the DFG and Commission take pro-active measures to encourage harvest of gamefish prior to anticipated fish kills?

POSSIBLE ANSWER: In concert with "free fishing day", June 10th, and extending through November 15, 1989, the Commission could waive the black bass size limit and the bag limits on gamefish at Lake Elsinore to encourage harvest of the resource. DFG could promote the harvest of gamefish in releases to the news media. Such measures would be pro-active, positive steps to utilize the fishery resource and abate poor press associated with "no action".
To Regional Manager

From: Steven Bennin, Commercial Fisherman

Subject: Obtaining Permit

It has been brought to my attention that Big Bear Lake and Lake Elsinor have a large carp population.

I conduct a commercial fish operation out of Los Banos, Ca., and we harvest carp, suckers, blackfish, goldfish, and other non-game fish.

Our operation is low profile, mobile, and efficient. We use a 18 foot long flat bottom boat powered by a 25 horsepower outboard engine. On the bow of the boat we store a 600 foot long seine net that we catch the fish with. The net is 10 foot deep, and the mesh size is 3/8 in. stretched measurement.

The net is laid off from the shore and fed off in a large semi-circle. After pulling each side of the seine into the beach, the fish are pushed back into a pocket that is located near the center of the net. After the pocket is tied off, we open it up and sort the fish, with the game fish returned to the lake. This process usually takes about one to two hours, and we might repeat this up to 3 to 4 times a day.

We transport the fish live in small tank trucks and trailers. The fish are kept alive with oxygen and air pumps.

We are aware of all the obvious rules and regulations of the Fish and Game. I have personally been involved in the fish business for over 20 years, and my employees are experienced.

In my conversation with Chuck Marshall on May 10th., he mentioned that Big Bear Lake had an aquatic weed problem. In my experience with this, usually from the middle of summer to the middle of winter it is impossible to pull a seine through these weeds. With this in mind it is my hope you could process this request as soon as possible.

If you need any further information, feel free to call me or leave a message at my home number.
### Construction Costs

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<tr>
<td>Contingencies</td>
<td>3,698,000</td>
</tr>
<tr>
<td>Projected Cost Increase</td>
<td>4,536,000</td>
</tr>
<tr>
<td>Engineering and Administration</td>
<td>3,289,000</td>
</tr>
<tr>
<td>IDC</td>
<td>504,000</td>
</tr>
<tr>
<td>Rights-of-Way</td>
<td>2,700,000</td>
</tr>
<tr>
<td>Bureau Participation</td>
<td>250,000</td>
</tr>
<tr>
<td>Loan Application Report</td>
<td>135,000</td>
</tr>
<tr>
<td>CEQA-EIR</td>
<td>25,000</td>
</tr>
<tr>
<td><strong>TOTAL PROJECT COST</strong></td>
<td>$39,791,000</td>
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</table>

### O&M&P Cost Increases

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
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</thead>
<tbody>
<tr>
<td>O&amp;M Maintenance</td>
<td>$120,000</td>
</tr>
<tr>
<td>O&amp;M Administrative</td>
<td>40,000</td>
</tr>
<tr>
<td>O&amp;M Expenses</td>
<td>20,000</td>
</tr>
<tr>
<td>Replacement Reserve</td>
<td>20,000</td>
</tr>
<tr>
<td>Power Costs</td>
<td>913,000</td>
</tr>
<tr>
<td><strong>TOTAL O&amp;M&amp;P</strong></td>
<td>$1,113,000</td>
</tr>
</tbody>
</table>
Lake Elsinore offers extensive recreation activities. Boating, Camping, Water Skiing, Fishing, Wind Surfing, etc.

The following are some locations where you and your family may enjoy some of the many recreation activities offered:

**STATE PARK: RIVERSIDE DR. & LINCOLN ST.**
Camping
Day Use
Fishing
Swimming (Full hook-ups available)

**STATE PARK: RIVERSIDE AREA: S. LAKESHORE DR.**
Day Use Only
Picknicking
Swimming
Fishing

**LAKEVIEW WEST MARINA: 32799 RIVERSIDE DR.**
Boat Launching
Lake Use Permits
Camping
Swimming
Fishing
Day Use (Full hook-ups available)

**KAY JORDAN'S CAMPGROUND: 12111 RIVERSIDE STE.**
Boat Launching
Lake Use Permits
Camping
Swimming
Fishing
Day Use

**ROADRUNNER R.V. PARK: 32500 Riverside Dr.**
Boat Launching
Lake Use Permits
Fishing
Swimming
Camping
Day Use (Full hook-ups available)

**SHORE ACRES RESORT: 15712 Grand Avenue**
Boat Use
Boat Dock
R.V. Camping (Water & Electric)

**LAKE PARK RESORT: R.V. PARK & HOTEL**
32000 Riverside Drive
Day Use
Camping
Boat Dock
Fishing
Swimming (Full hook-ups available)

**IMPORTANT PHONE NUMBERS**
Chamber of Commerce
112 W. Graham Ave.
674-3577

City Hall
130 S. Main St.
674-3124

Fire Station
Graham & Pac
Brightman Street
3-800-327-5001

Police
Riverside County Sheriff Substation
117 S. Langstaff St.
911

1. State Park
2. State Park Camp Area
3. Elsinore Boat Marina
4. Roadrunner R.V. Park
5. Shore Acres Resort
6. Lake Park Resort
7. Kay Jordan's Campground
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