Chapter 1  
Introduction

This report provides the scientific data and analysis and the regulatory basis for revising the Total Maximum Daily Load (TMDL) for nutrients discharged to Canyon Lake and Lake Elsinore. The report includes the required information for the California Regional Water Quality Control Board, Santa Ana Region’s, consideration of the TMDL revisions proposed in this report.

Lake Elsinore first appeared on California's 303(d) list of impaired waterbodies in 1994. Canyon Lake was added to that list in 1998. The lakes were deemed to be impaired by low dissolved oxygen (DO) levels and excess algae growth. Elevated nutrient concentrations (e.g., phosphorus and nitrogen) were cited as the primary cause of poor water quality in both lakes.

The Santa Ana Regional Water Quality Control Board (Santa Ana Water Board) adopted a Total Maximum Daily Load (TMDL) for nutrient discharges to Canyon Lake and Lake Elsinore in 2004.[[1]](#footnote-1) The TMDL became effective when the United States Environmental Protection Agency (EPA) gave it final approval on September 30, 2005. The scientific data and analysis used to justify the TMDL is summarized in a detailed technical support document prepared by the Regional Board staff.[[2]](#footnote-2)

The TMDL specified numeric targets for DO, Chlorophyll *a*, Ammonia, Total Phosphorus (TP) and Total Nitrogen (TN) concentrations in both lakes (see Table 2-3). It also established Load Allocations (LA) and Waste Load Allocations (WLA) to govern the discharge of excess nutrients from non-point sources and point sources, respectively. The TMDL includes a detailed Implementation Plan which describes a variety of activities that must be undertaken to meet water quality standards in Canyon Lake and Lake Elsinore. In the decade following EPA's approval, stakeholders throughout the watershed initiated a large number of programs and projects to comply with the requirements set forth in the TMDL Implementation Plan.

* From 2002-2008, fisheries management was implemented as a means of enhancing water quality in the lake. Carp were periodically removed to reduce the impact of their feeding behavior of rooting through the sediments which increases turbidity and enhances the release of nutrients from the lake sediments. An assessment of the program in 2008 showed significant reductions in carp.
* In 2005, the stakeholders formed a Task Force to coordinate and share the cost of all implementation efforts. The Lake Elsinore Canyon Lake Task Force (“Task Force”) is comprised of all the dischargers identified in the TDML, including: Municipal Separate Storm Sewer System (MS4) permittees, wastewater treatment plants, agricultural operators, concentrated animal feeding operations (dairies), and a number of other state, federal, or tribal agencies that own land or operate facilities that discharge in the watershed.
* In 2006, the Task Force developed and submitted a water quality monitoring program for both lakes and the major tributary streams.[[3]](#footnote-3)
* In 2007, the Task Force developed and submitted a Sediment Nutrient Reduction Plan for Lake Elsinore.[[4]](#footnote-4)
* In 2008, the Lake Elsinore Aeration and Mixing System (LEAMS) project, designed to improve water quality in Lake Elsinore, began full-time operation.
* In 2010, the Santa Ana Water Board reauthorized the National Pollutant Discharge Elimination System (NPDES) permit governing stormwater discharges in Riverside County.[[5]](#footnote-5) That permit obligated the MS4 permittees to comply with the nutrient TMDL and required them to develop a Comprehensive Nutrient Reduction Plan (CNRP) for Canyon Lake and Lake Elsinore. The CNRP was prepared and submitted in 2012 and the Regional Board approved it 2013.[[6]](#footnote-6) Since then, the Task Force has been actively implementing the CNRP. Progress in implementation of the CNRP is summarized in the MS4 program’s annual reports; in addition, a Compliance Assessment Report, a CNRP reporting requirement, was submitted to the Santa Ana Water Board in November 2016.
* In 2013, the Western Riverside County Agricultural Coalition (WRCAC) submitted a final Agricultural Nutrient Management Plan (AgNMP) for agricultural operators in the watershed.[[7]](#footnote-7)
* In recent years the Task Force has initiated a large-scale alum application program in Canyon Lake. Aluminum sulfate ("alum") binds with phosphorus thereby preventing excess algae growth in the lake. To date, 840 tons of alum have been applied and more than 7,600 pounds of phosphorus have been neutralized in Canyon Lake. Water quality has improved dramatically since the program began.

The Task Force has supported a large number of supplemental scientific studies in the ten years since the TMDL was first approved. These studies were designed to aid the stakeholders in selecting the most effective and efficient management strategies to control nutrient loads in both lakes. The special studies were also intended support any necessary revisions to the TMDL as better information became available.

In 2010, the Task Force contracted with Tetra Tech, Inc. to update the runoff models used to estimate nutrient loads to both lakes.[[8]](#footnote-8) This same firm also developed the original watershed model that the Santa Ana Water Board relied on to support and justify the nutrient TMDL. Among the key improvements was a more accurate characterization of storage capacity in the Mystic Lake area and a more precise description of how rainfall and runoff vary in the region. At the Task Force's direction, Tetra Tech also developed a spreadsheet tool that could be used to estimate changes in nutrient loading based on changes in land use throughout the watershed.

Beginning in 2011, the Task Force contracted with Dr. Michael Anderson at University of California, Riverside (UCR) to develop more sophisticated dynamic models to predict water quality in both lakes. The Canyon Lake model was completed in 2012 and was instrumental in selecting alum applications as the most cost-effective nutrient control strategy for that lake.[[9]](#footnote-9) The new water quality model for Lake Elsinore was just recently completed.[[10]](#footnote-10) These models are designed to estimate the concentration of key water quality parameters under natural, pre-development conditions.[[11]](#footnote-11) The models are also used to predict how various nutrient management strategies will affect water quality and the time required to meet the response targets specified in the TMDL. Among Dr. Anderson's many key findings are the following:

1. Nutrients cycle in the lakes far longer and decay much slower than previously thought. This finding suggests that the previous water quality models may have underestimated the level of effort and length of time required to attain the water column targets for nitrogen and phosphorus specified in the current TMDL.
2. Canyon Lake is unlikely to achieve the current response targets for DO or Chlorophyll *a* even after the stakeholders achieve compliance with the LA and WLA specified in the TMDL. This is principally due to nutrient loads contributed by the lake-bottom sediments.
3. Elevated salinity concentrations, that occur naturally when lake levels decline, inhibit the zooplankton populations needed to constrain algae growth in Lake Elsinore. The interactions between salinity, biology and water quality were not considered when the current TMDL targets were originally developed.
4. The strong asymmetric pattern of precipitation and drought in the watershed indicate that the lakes would not be able to consistently comply with the current TMDL response targets under natural, pre-development conditions.
5. The natural hydrology of Lake Elsinore has been significantly altered by the construction of a large levee designed to reduce its size by 50% and by the addition of more than 50,000 acre-feet of recycled water to the lake. Both projects are intended to protect aquatic habitat and recreational uses by ensuring that the lake no longer dries up as it did during periodic droughts of the past. But, keeping the lake wet also alters some of the natural "reset" mechanisms that once governed water quality conditions in Lake Elsinore.

Dr. Anderson's findings indicate that important elements of the original TMDL, including the water quality targets and the LA/WLA, must be revisited to ensure that they are appropriate and achievable. It is also necessary to update the technical analysis to reflect current land use conditions which have changed significantly since the original TMDL was developed. And, finally, the TMDL should be revised to account for the large nutrient load reductions that have resulted from Best Management Practice (BMP) implementation, low-impact development (LID) requirements, restrictions on dairy discharges, changes in certain water quality standards (e.g., ammonia), and the in-lake remediation projects that have occurred over the last 10 years.

None of this is intended to imply that the original TMDL was deficient or defective. It was not; it was based on the best data available at the time. Today, however, we know a great deal more about how the lakes actually work than we did just a decade ago. We also know considerably more about which nutrient control strategies are most effective at improving water quality. And, we know that many critical factors (especially source loads from changing land use) are now quite different from what was assumed when the TMDL was first approved.

According to EPA, updating the TMDL to reflect all of this new information will "facilitate better watershed planning and adaptive implementation."[[12]](#footnote-12) In fact, the Regional Board believed that regular review and revision is so critical to ultimate success that it adopted an Implementation Plan specifying that the TMDL be "re-evaluated at least once every three years to determine the need for modifying the load allocations, numeric targets or implementation schedule."[[13]](#footnote-13) Doing so provides reasonable assurance of continued progress toward attainment of water quality standards and protection of beneficial uses in Lake Elsinore and Canyon Lake.

1. Resolution No. R8-2004-0037 was adopted by the Santa Ana Water Board on December 20, 2004. The TMDL was subsequently approved by the State Water Resources Control Board on May 19, 2005 and by the California Office of Administrative Law on July 26, 2005. [↑](#footnote-ref-1)
2. Lake Elsinore and Canyon Lake Nutrient TMDL Technical Report. Santa Ana Water Board. Original report dated March 26, 2004; revised report dated May 21, 2004. [↑](#footnote-ref-2)
3. The Santa Ana Water Board approved the water quality monitoring plan as Resolution No. R8-2006-0031 on March 3, 2006. [↑](#footnote-ref-3)
4. The Santa Ana Water Board approved the CNRP as Resolution No. R8-2007-0083 on November 30, 2007. [↑](#footnote-ref-4)
5. NPDES No. CS618033; Santa Ana Water Board Resolution No. R8-2010-0033; approved January 29, 2010. [↑](#footnote-ref-5)
6. Santa Ana Water Board Resolution No. R8-2013-0044; approved July 19, 2013. [↑](#footnote-ref-6)
7. Agricultural Nutrient Management Plan for the San Jacinto Watershed, WRCAC, April 30, 2013. [↑](#footnote-ref-7)
8. Tetra Tech, Inc. San Jacinto Watershed Model Update - Final (2010). October 7, 2010. [↑](#footnote-ref-8)
9. Anderson, M.A. Evaluation of Alum, Phoslock and Modified Zeolite to Sequester Nutrients in Inflow and to Improve Water Quality in Canyon Lake. May 17, 2012. [↑](#footnote-ref-9)
10. Anderson, M.A. Water Quality in Lake Elsinore under Selected Scenarios: Model Predictions for 1916-2014 with Current (post-Lake Elsinore Management Plan) Basin. February 21, 2016. [↑](#footnote-ref-10)
11. Anderson, M.A. Evaluate Water Quality in Canyon Lake under Pre-Development Conditions and TMDL-Prescribed External Load Reductions. June 14, 2012. [↑](#footnote-ref-11)
12. EPA. Considerations for Revising and Withdrawing TMDLs. March 22, 2012. [↑](#footnote-ref-12)
13. Attachment to Resolution No. R8-2004-0037 (see Task #14 on page 21 of 22); December 20, 2004. [↑](#footnote-ref-13)