Draft Problem Statement
Crowley Lake Nutrient TMDL

OVERVIEW

Excessive nutrient loading has stimulated accelerated algae growth and the reduction of dissolved oxygen (DO) within Crowley Lake and has detrimentally affected the fishery at the reservoir. Initial research findings show high natural phosphorus levels entering the reservoir from tributaries and internal nitrogen loading occurring within the reservoir as a result of nitrogen fixing algae. Additionally, land use disturbances within the Owens River watershed that contribute excessive silt and sediment to the system may increase nutrient loads and exacerbate the fishery disturbance at the reservoir.

PROJECT AREA DESCRIPTION

Geography
Crowley Lake, also known as Long Valley Reservoir, is located in Long Valley, which is situated in southern Mono County along the eastern Sierra Nevada, approximately 15 miles south of the town of Mammoth Lakes (Long Hydrologic Area of the Owens River Hydrologic Unit #603.100).

Water Body Description
The Crowley Lake watershed encompasses 1,947 square miles with 2,399 total river miles and 926 perennial river miles. The lake spill level volume is 183,743 acre feet, with a full maximum depth of 114.5 feet and mean depth of 34.85 feet. Relatively high total dissolved solids, combined with a shallow mean depth, result in a highly productive system. Tributaries to Crowley Lake include Upper Owens River, Leighton Springs, and McGee, Hilton, Whiskey and Crooked Creeks. Tributaries to the Upper Owens River include Hot, Mammoth, Deadman, and Glass Creeks.

Geology and Soils
The Long Valley is an area of significant historical volcanic activity and continued geothermal and seismic activity. In 1972, the US Geological Survey established the Mono-Long Valley Known Geothermal Resource Area. Its boundaries extend from the southern edge of the Mono Basin National Forest Scenic Area to Lake Crowley. Soils in the valley areas are primarily of volcanic origin with granitic soils occurring at higher elevations.

Climate and Hydrology
Crowley Lake lies within the rain shadow of the Sierra Nevada. Average annual precipitation at Crowley Lake is approximately 10 inches, in the form of both snow and rain. Average annual precipitation at higher elevations is greater and falls mainly as snow, although summer thunderstorms are common. Runoff from high elevation snow melt generally peaks in June; however, an earlier flow increase in Long Valley streams usually occurs from in-valley snowmelt.

Aquatic and Terrestrial Biological Resources
Crowley Lake is the dominant fishery in the eastern Sierra Nevada in terms of angler use and fish production. The fishery is managed for wild trout and "put and grow" hatchery trout. Game fish occurring in Crowley Lake include Coleman Rainbow Trout (RT), Eagle Lake RT, Kamloops RT, Crowley brown trout (BN), Whitney BN, and Sacramento perch. Non-game fish present in Crowley Lake include Owens sucker (*Catostomus fumeiventris*), Owens tui chub (*Gila bicolor snyderi*), and specled dace (*Rhinichthys osculus*).

Land Use
The region is largely publicly-owned with private lands located primarily along the upper reaches of the upper Owens River and parts of Hot Creek. The Los Angeles Department of Water and Power (LADWP) is the major owner of lands adjoining Crowley Lake and its lower elevation tributary waters. Crowley Lake is owned and operated by LADWP, and is used for domestic water export and recreation. The reservoir is the largest in the LADWP water system, providing 60 percent of the total storage capacity of the system. The Inyo National Forest and the Bureau of Land Management manage the remaining public lands in the project area. Land uses or facilities include livestock grazing, geothermal development, fish hatcheries, road development, water diversions, residential development, and summer and winter recreational activities.

LISTING BASIS

Beneficial Uses
Beneficial uses designated for tributaries to Crowley Lake (see Water Quality Control Plan for the Lahontan Region or "Basin Plan") page 3-46 and 3-48) include:

- Municipal and Domestic Water Supply (MUN),
- Agricultural Water Supply (AGR),
- Navigation (NAV),
- Hydro Power Generation (POW),
- Rec-1, Water Contact Recreation (REC-1),
- Rec-2, Non-contact Water recreation (REC-2),
- Commercial and Sports Fishing (COMM),
- Cold Freshwater Habitat (COLD),
- Wildlife Habitat (WILD), and
- Spawning, Reproduction and Development (SPWN).

Water Quality Standards
Water quality standards applicable to the nutrient TMDL and impairment of recreational and aquatic life beneficial uses of Crowley Lake include numeric objectives for ammonia (correlated to pH and temperature - see Tables 3-1 and 3-2 of Basin Plan) and narrative objectives for biostimulatory substances, dissolved oxygen, floating materials, and taste and odor.

Impairment
In 1994, the reservoir was listed as impaired for nutrients in accordance with Section 303(d) of the Clean Water Act (CWA). Nonpoint sources of pollution related to watershed disturbance were identified as probable causes. Potential sources of nutrients may include geothermal springs, cow manure, fertilizers, septic systems, stream bank erosion, and irrigation returns. De-oxygenation of bottom water (hypolimnion) and decreased water quality as indicated by objectionable taste and odor due to floating algal mats was noted in the lake. Aquatic life is affected by excess nutrient loading to the reservoir or internal loading, which leads to nuisance algae conditions and subsequently reduces oxygen levels in the hypolimnion. Desired conditions include reduced amounts of algae, and improved water quality and habitat for aquatic species and water recreation. The goal of the TMDL is to restore and sustain mesotrophic conditions (productive but not eutrophic) to support the fishery and recreational beneficial uses.

SCHEDULE/STATUS

The technical TMDL will be developed partly through research conducted by the UCSB Sierra Nevada Aquatic Research Laboratory (UC SNARL) to assess internal nutrient loading and nutrient sources from existing land uses. Other available information will also be compiled and incorporated into the TMDL, and potential load reductions using riparian exclusion fencing and other techniques for stream bank restoration will be evaluated. Stakeholder meetings will be held to disseminate information and discuss findings during the TMDL development.

Deliverable/Milestone	**Date**
Information/data review-field reconnaissance	August 2002
TMDL problem statement and introduction drafted	December 2002
Draft report due as deliverable from UC SNARL for internal nutrient loading study	December 2002
Final report due as deliverable from UC SNARL for internal nutrient loading study	February 2003
Final report due as deliverable from UC SNARL for riparian restoration project	February 2003
TMDL numeric target/indicators drafted	May 2003
Stakeholder meeting	June 2003
Additional TMDL sections drafted (source analysis, linkage analysis, load allocations)	February 2004
Stakeholder meeting	March 2004
Technical TMDL written and approved	December 2004
Draft implementation plan written and approved	December 2004
Stakeholder meeting	March 2005
Technical TMDL and implementation plan finalized and approved	June 2005
Basin plan amendment hearing	July 2005

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