

SURFACE WATER

Brown, David L. Cherokee Watershed Project Report: Water Quality. California State University, Chico: February 2005.¹⁹

Due to the minimal existing water quality data for surface water in the Cherokee Watershed, a sampling of the main Cherokee Canal and four tributaries was conducted. Sampling sites include Dry Creek at the Highway 149 bridge, Clear Creek at the Highway 149 bridge, Cottonwood Creek on private property, Gold Run Creek at the Highway 99 bridge, and the Cherokee Canal at the Highway 162 bridge. Sampling began in November 2003 and ended in December 2004 with monthly sampling occurring from December 2003 through June 2004. The relevant water quality objectives of the monitoring program included: (1) priority metals; (2) general constituents in water (solids, alkalinity, hardness) in water; (3) pesticides; (4) mercury and chlorinated pesticides in fish tissue; (5) nutrients; (6) pathogens (fecal coliform bacteria); (7) toxicity in water; and (8) benthic invertebrates.

The results of the samplings were:

- relatively high fecal coliform bacteria of local creeks
- low concentration levels of nitrogen and phosphorus nutrients
- metals generally found in trace amounts
- mercury concentration similar to local creeks
- virtually no pesticides detected
- general stream chemistry and physical conditions comparable to other regional streams
- sediment and turbidity closely linked to storm events
- no observable survival toxicity with only some reproductive toxicity noted
- aquatic macroinvertebrate populations indicated reasonably healthy conditions
- Dry Creek and Clear Creek had generally better bioassessment metrics scores than the Cherokee Canal, Cottonwood Creek, and Gold Run Creek.

The report indicated that overall the observed water quality in the Cherokee water appears to be in generally good condition. However, an overall water quality survey should be repeated every three to five years or as significant changes occur. The focus of future monitoring should be: mercury constituents, sediment and turbidity, pesticides and bioassessment.

A citizen-level water quality monitoring program has been conducted parallel to the Research Foundation's sampling program and at the same monitoring sites. Citizens have collected and tested water for nutrients, pathogens (coliform bacteria), and general constituents.

California Department of Water Resources, Northern District: Water Quality Section. Referenced in Literature Review of Water Quality for Cherokee Watershed. Brown David L. and Morgan, Tara. Unpublished data. California State University-Chico, June 2003.²⁰

A phone interview with Jerry Boles, Head of the Water Quality Section, indicated that the California Department of Water Resources had not collected any data for the Cherokee Watershed. Mr. Boles was not aware of any other sources or studies.

Analytical Environmental Services. Mechoopda Indian Tribe: Chico Casino Fee-to-Trust Acquisition Environmental Assessment. Analytical Environmental Services: December 2003.²¹

Editorial Comment: This site is part of the greater Butte Creek Watershed that is part of the Sacramento River Watershed.

This site is located within the Feather River watershed and generally drains toward private agricultural lands and the Thermolito Afterbay below Lake Oroville to the south. Clear Creek and an unnamed intermittent tributary to Clear Creek flow through the southeastern portion of the site from northeast to southwest. According to USGS Topographic Quadrangles, Clear Creek is a perennial stream, although it appears shallow and flashy and may in fact run dry during the summer months. There is also a small intermittent drainage in the northwest portion of the large parcel along with numerous natural swales, vernal pools, and other drainage features located east (above) Clear Creek. Further analysis of biological and wetland habitat and potential impacts from the Proposed Action are found in Appendix A.

Dry Creek, also identified as a perennial stream, is located just south of the site and forms a floodplain in conjunction with Clear Creek. The stream channels have not been substantially modified by previous agricultural development of the site. However land leveling, irrigation ditching, and erosion from cattle ranching have reduced the flow capacity and volume of flood storage naturally available along the stream channels.

Flooding: According to the Federal Emergency Management Agency Flood Insurance Rate Map for the area (Community and Panel Numbers 060017 0760 C, dated June 8, 1998), portions of the southeast corner of the site are within the 100-year flood zone also described as Zone A. Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. This flood zone extends from Clear Creek to Dry Creek south of the site (Figure 3-4). The remainder of the site is located outside of the 500-year floodplain and is designated as Zone X. Development within the 100-year flood zone would be permitted by Butte County if a Floodplain Development Permit were obtained. This permit would require a development setback of at least 50 to 100 feet from the top of the bank of Clear Creek.

Water Quality: Surface waters within the site are impaired and beneficial uses are limited due to extensive use of the site by cattle. According to the preliminary water investigation performed for the site by HydroScience Engineers, local groundwater quality is generally good. Some localized pockets of water containing relatively high levels of iron and manganese were reported. Iron and manganese do not present a health risk, but they do affect the taste and increase the staining potential of water.

Bradshaw, Ken. Paradise Urban Watershed Surface Water Quality. Spring 1998. Referenced in Literature Review of Water Quality for Cherokee Watershed. Brown David L. and Morgan, Tara. Unpublished data. California State University-Chico, June 2003.²²

This project was a reconnaissance study of nutrient concentrations within and downstream of Paradise, California. The objective was to investigate whether the large population using on-site sewage disposal (septic) systems was causing elevated nitrate concentrations in small headwaters creeks. Surface water samples were collected from 13 stations on Dry Creek and 4 stations on Clear Creek in March and April 1998. Samples were analyzed using a Lachat Autoanalyzer. Nitrate concentrations never exceeded 3.0 mg/L in any of the samples obtained.

Domalgalski, J. L. 2000. Occurrence and transport of diazinon in the Sacramento River, California and selected tributaries during three winter storms, January-February 2000. Water Resources Investigations Report 02-4101. Referenced in Literature Review of Water Quality for Cherokee Watershed. Brown David L. and Morgan, Tara. Unpublished data. California State University-Chico, June 2003.²³

The document referenced is a U.S. Geological Survey conducted in cooperation with California Department of Pesticide Regulation and Sacramento River Watershed Program. As part of a larger study of diazinon occurrence in the Sacramento River Watershed, two storms were monitored in the main Cherokee Canal at Gridley Road. The January 2000 storm showed diazinon concentrations of 207 ng/L to 237 ng/L. During the two February 2000 storms, concentrations ranged from 65 ng/L to 78 ng/L and 111 ng/L to 126 ng/L, respectively.

U.S. Geological Survey Water Quality Database. <http://waterdata.usgs.gov/nwis/qwdata>. Referenced in Literature Review of Water Quality for Cherokee Watershed. Brown David L. and Morgan, Tara. Unpublished data. California State University-Chico, June 2003.²⁴

Suspended and bedload sediment data was collected on Dry Creek near Nelson (USGS Station 11390210) for the period 1970 to 1974. On one sampling date in September 1998, general inorganic chemistry and trace metals were sampled on the main Cherokee Canal near Gridley Road above the Butte Sink (USGS Station 39212612523701). Of the metals above detection limits, the zinc concentration was the highest at 12µg/L. Arsenic was present at 5.0 µg/L and mercury was at or below detection limits of 0.10 µg/L.

Butte County Resource Conservation District. Long Range Plan. Butte County: July 2003.⁴

To work for the protection of the quality, supply and availability of surface water to insure the economic and environmental future of Butte County's citizens is identified as one of the plan's priority objectives for water quality and water quantity development.

The plan recommends holding stakeholder meetings in flood prone areas of Butte County to determine the existing problems; research and apply for grants that address issues in flood prone areas.

Cherokee Canal Watershed. P.I. Sediment/Flood Analysis. January 23, 2003.²⁵

Sediment aggradation in the Cherokee Canal is resulting in increased levee failure that results in crop damage. The canal and channels have altered water and sediment discharge. The changes to the stream system increased sediment aggradation in the canal. The problem is due to a lack of maintenance in the system. Thus, the following alternatives were proposed: 1) Maintenance of the existing system – Periodic and storm clean out of the existing canal will allow the system to function as designed. The previous report dated December 2, 2002 provides data to determine clean out costs. 2) Recommends that funds be found for a Watershed Assessment that would help planners and decision makers to weigh trade off and increase benefits in determining future watershed actions.

California Department of Fish and Game. Notice of Exemption. California Department of Fish and Game: May 2002.²⁶

A proposed streambed alteration project along the Cherokee Canal can proceed as planned and agreed to by the Department of Fish and Game and the Department of Water Resources if the parties have obtained necessary permits. The agreement describes the plan to remove beaver dams and much of the dense vegetation that has reduced floodwater carrying capacity of the Cherokee Canal. It indicates that minor grading will also take place within the project area extending from Nelson Shippee Road to the Gridley Colusa Highway in five phases over two to three years with work to take place from July 1 to October 1 of each year.

Miller, Michael. The Butte College Wildlife Refuge. Butte College Facilities and Management. Oroville: June 1991.²⁷

There are nine ponds on the wildlife refuge that are fed by a combination of fresh spring water and watershed runoff. Five of the ponds have the potential to be supported by the campus water system. Clear Creek and its tributaries are the primary sources of surface water on the campus and provide a rich riparian habitat.

California Hydrologic Research Laboratory. Butte County Watershed Model Review. Final Report. Davis: March 2004.²⁸

The models referenced groundwater processes, surface water processes such as snowmelt, channel flow, overland flow, land use changes, and sediment, nutrient and pesticide transport. Also addressed is the interactivity between these two processes, specifically infiltration, channel seepage, aquifer recharge and subsurface storm flow.

California State University-Chico Research Foundation. Butte Creek Watershed Existing Conditions Report. Chico: April 2000.²⁹

In this report, Dry Creek, Cottonwood Creek, Gold Run Creek, and Clear Creek are described as tributary streams to Butte Creek and ephemeral drainages in their lower reaches. Each of these streams drains into the Cherokee Canal. Gold Run Creek receives water from the Lower Miocene Canal. Gold Run and Cottonwood Creeks also have on-stream storage in the form of irrigation ponds, regulating flows on these streams.

The Cherokee Canal was originally constructed to protect the towns of Biggs, Nelson, and Richvale and adjacent farmland from flooding associated with sediment from mining operations in the Cherokee area. Current Cherokee Canal uses are now irrigation, drainage, and flood protection for 35,000 acres of agricultural land, related buildings, and homes.

The 14 mile long Western Canal begins at the northwest corner of the Thermalito Afterbay and extends under the Cherokee Canal and Butte Creek to a sink area near Seven Mile Lane.

The Thermalito Afterbay delivered annual averages of 226,500 acre-feet of water from 1968 through 1992; a period that reflected restricted planting due to the Federal Farm Program for rice.

Camp Dresser & McKee, Inc. Basin Management Objective Development Packet, Cherokee. Technical Memorandum. Butte County: May 2004¹³

Dry Creek is cited as running through the central portion of the Cherokee Sub-inventory Unit.

Camp Dresser & McKee, Inc. Basin Management Objective Development Packet, Pentz. Technical Memorandum. Butte County: May 2004¹⁴

The Pentz area is described as being bounded by Little Dry Creek on the Southeastern side and Butte Creek on the Northwestern side, with a creek in Hamlin Canyon running through the middle of the area.

Camp Dresser & McKee, Inc. Basin Management Objective Development Packet, Western Canal. Technical Memorandum. Butte County: May 2004¹⁵

Little Dry Creek and Butte Creek flow through the Western Canal area, while the Western Canal flows from east to west through the middle of the area.

Camp Dresser & McKee, Inc. Butte County Department of Water and Resource Conservation. Agricultural Water Demand Forecast. Technical Memorandum. Butte County: October 2003.³⁰

This document was developed to describe the process used to forecast agricultural water demand for Butte County. The purpose of this forecast is to facilitate water resource planning and to develop a set of reasonable scenarios for agricultural use in the future.

The model includes components that Butte County's growers use to make cropping and water use decisions such as crop type, geographic region, and forecast scenarios. The scenarios each predict decreases in surface water usage. Crop categories included: field crops, forage, grain, rice safflower and orchards. Geographic regions covered include East Butte comprising Cherokee, Pentz, Richvale, and Western Canal, among others. The forecasting scenarios include: land conversion, crop idling, crop prices, water conservation, and a combination scenario for average and dry years.

Each scenario and the associated crop adjustments made on the basis of water usage specific to the East Butte region is discussed and the data is displayed in chart and spreadsheet formats.

The analysis concluded that most of the reasonably foreseeable changes evaluated would not result in significant long-term changes in agriculture water demand in Butte County. The predicted maximum water demand reduction for the East Butte Region would be 8.75%.

Camp Dresser & McKee, Inc. County Department of Water and Resource Conservation. Integrated Water Resources Plan, Volumes I, II and Executive Summary. Report. Butte County: June 2004.¹⁰

Current and future water demands and options that may help Butte County to meet its' objectives are described. Ridge water supply options include diverting water from the Miocene and Hendricks canals to supply the ridge, build the Lime Saddle pipeline to deliver water to the Ridge, strengthen Magalia

Dam and raise Paradise Dam to increase storage capacity at both. Coordinated management options include deepening wells, building a canal to deliver surface water to Cherokee and Esquon, and build the Oro-Chico Conduit for in-lieu and direct recharge of the Cherokee and Esquon aquifers, among others. Policies and State Water Project (SWP) Allocation Management round out the options.

Gordon, Glen. Cherokee Canal Sedimentation Problem. Unpublished report prepared for Dr. D. Brown GEOS 310 Watershed Hydrology class. California State University-Chico. June 2000.³¹

The history of hydraulic mining conducted at the Cherokee Mine and resulting debris deposition and flooding along Dry Creek and the Cherokee Canal are discussed. The author identifies the flood-flow problems and associated solutions. He concludes that the rate of sediment deposition needs to be determined to help determine the most cost-effective way of limiting or removing the deposition within the canal.

URS Corporation. Cherokee Canal Sedimentation Study, Summary of Findings. URS Corporation: December 2, 2002.³²

The three primary streams (Cottonwood Creek, Dry Creek, and Gold Run Creek) that supply sediment to the Cherokee Canal and the average annual sediment load contributed by Dry Creek and Gold Run Creek to the sedimentation problem are identified. The study suggests that the reach between Highway 99 and the Gold Run confluence would be the best location for a 25-acre sedimentation basin. This area could be excavated down to a level approaching that of the existing channel invert, creating a local wide spot in the river, where the velocities would slow and material would drop out.

US Army Corps of Engineers. Data Collection Report (draft) Cherokee Canal Section 1135 Ecosystem Restoration Project. URS Corporation: April 2004.³³

The sedimentation problem in the Cherokee Canal as well as the loss of riparian and fish habitat caused by dredging is discussed. The report recommends that surveys completed in 1969 be repeated, using up-to-date hydrologic information, measured suspended sediment records, and the 30 years of canal performance as a guide.

Butte County. Cherokee Canal, A Sediment Removal, Streambed Alteration Project. Butte County: February 1999.³⁴

The historical basis for the problem of sedimentation in the Cherokee Canal System and its impacts including flooding, crop damage, and destruction of riparian habitat are outlined. The report includes three proposed actions and a request for (1) a General Interest Study involving the Department of Water Resources and the Army Corps of Engineers initiated by the Reclamation Board; and (2) the involvement of the California Department of Fish and Game and the Regional Water Quality Control Board in the General Interest Study initiated by the Reclamation Board.

California Department of Water Resources. Debris Deposition in the Cherokee Canal Flood Control Project. Memorandum Report: February 1970.³⁵

This memorandum report identifies problems associated with the deposition of large amounts of debris in the Cherokee Canal and resulting reduction in the flood-carrying capacity of the waterway. It makes a series of conclusions and two recommendations: (1) returning the canal to its full design flood-carrying capacity; and (2) raising the levees in the reach between the Western Canal crossing and Southern Pacific Railroad crossing as a more economical alternative than debris removal to restore the design capacity.

California Department of Water Resources, Division of Design and Construction. Designers' Memorandum for the Cherokee Canal Capacity Restoration Project Specification No. 74-09. Technical Memorandum. July 1974.³⁶

Historical information on the Cherokee Canal and the problem of sedimentation is provided.

The purpose of the restoration project was to elevate the top of the levee to obtain a capacity and freeboard comparable to the rest of Cherokee Canal. The memorandum gives a general sequence of work including relocation of fences and gates, extension of culverts, establishment of borrow areas, raising of embankments, and resurfacing of levee roadways.

Camp Dresser & McKee, Inc. Butte County Department of Water and Resource Conservation. Urban Water Demand Forecast. Technical Memorandum. Butte County: October 2003.³⁷

This document was developed to provide a method to forecast future demand for water in the urban areas of Butte County. Forecasting models, methods, and data input sources for Biggs, Chico, Gridley, Oroville, Paradise and unincorporated areas are discussed. Other factors addressed in forecasting are housing, employment, population, income, persons per household, and housing density projections. In addition, weather data, marginal price for water and un-metered water losses are utilized in forecasting.

According to the Urban Water Demand Forecast, the water demand projection for Paradise will grow from 2,431.3 million gallons in 2000 to 2,701.2 million gallons in 2030, an increase of 11%. The unincorporated areas of the county are projected to grow from 8,322.3 million gallons in 2000 to 9,736.4 million gallons in 2030, and increase of 17%. Countywide, a water demand increase of 51% is predicted from 2000 to 2030.

Camp Dresser & McKee, Inc. Butte County Water and Resource Conservation. Lime Saddle Water Supply Reconnaissance Study Letter Report. Butte County: March 8, 2001.³⁸

The Lime Saddle area, its water sources, the geology and population are described. The current population consists of about 900 persons, including 100 who are not served by the piped water supply system. It is projected that by 2020 the served population will increase to 1,050. Water demand by single-family, residential and commercial/multi-family housing is discussed and projected increases for 2020 are presented. In addition, school enrollment figures for Spring Valley School are presented, as are the minimum firefighting requirements for the facility. The water supply and wastewater facilities for Lime Saddle, Paradise and Spring Valley School are also discussed.

Problems, issues, and options for improvement included: the unlikely increase in groundwater for the Lime Saddle area due to excess of demands over replenishment; the utilization of water from the Miocene Canal; increased surface water storage, and providing Spring Valley School improved water sources by a pipeline from the Del Oro Water Company Lime Saddle system.

Four system options (Concept A, B, C and D) for Ridge water supplies from Lake Oroville, their associated costs, feasibility, and comparative total and unit costs, excluding distribution costs are outlined.

Butte County Department of Water and Resource Conservation. Paradise Ridge Memorandum of Understanding Summary Status Report. Butte County: May 31, 2001.³⁹

The operation of the State Water Project (SWP) and how the SWP contract with Butte County is managed regarding the Lake Oroville water supply is outlined in this memorandum. Operational requirements for Oroville Dam and the water supplies available from Lake Oroville and Lime Saddle areas in normal and drought years, the storage capacity, and water quality are discussed.

The Ridge contains the city of Paradise and surrounding urban developments. The water supply is a mix of surface water and groundwater. Del Oro Water Company (DOWC) and Paradise Irrigation District (PID) provide water to these urban areas. DOWC has an agreement with PID to receive treated surface water in the north, and water drawn from Lake Oroville in the south. DOWC also serves the Paradise Pines District utilizing 5 groundwater wells. Discussed are the potential for minimizing water service costs to Lime Saddle, the water needs of Spring Valley School, and alternatives to water pumping from Lake Oroville.

Current water demand must be augmented to meet the projected population increase. Source options described include the Miocene Canal, surface water storage, a new source for Spring Valley School water, and Ridge supplies from Lake Oroville.

PSOMAS. Preliminary Engineering Feasibility Report for Butte County: Study of Miocene and Hendricks Canals as Potential Sources of Water for the Paradise Ridge. Sacramento: June 26, 2002.⁴⁰

The Paradise Irrigation District (PID), Del Oro Water District (DOWD), and the Miocene and Hendricks canals are potential sources of water for the Paradise Ridge. The canals are owned and operated by Pacific Gas & Electric Company for power generation and either canal could be diverted for water use. Replacement water for each canal is discussed in detail in addition to environmental issues and cost estimates.

The Hendricks canal could easily be used to convey additional water to Paradise Pines.

California Department of Water Resources. Memorandum from G. Donald Meixner, Retired Annuitant, Department of Water Resources to George T. Qualley, Chief, Division of Flood Management. Memo. October 12, 1989.⁴¹

This memorandum provides a history and background information on the problems of sedimentation and flooding in the Cherokee Canal and provides opinions and recommendations for (1) acquisition of funding to restore the flood-carrying capacity of the Cherokee Canal; (2) hydraulic analyses of the flood-carrying capacity of the canal from the vicinity of the Sacramento Northern Railroad alignment to below the Southern Pacific Railroad crossing before the winter flood season arrives; and (3) studying the potential for damage to public and private properties to provide a basis for evaluation of the benefits that accrue because of continued project maintenance.

Camp Dresser & McKee, Inc. Butte County Department of Water and Resource Conservation. Butte County Water Inventory and Analysis. Butte County: 2001.³

The Western Canal Water District was formed by landowners to provide water for agricultural uses. The District includes 30,700 acres in the East Butte Inventory Unit and 14,000 in the West Butte Inventory Unit. The sources of the District's water are from surface water from the North Fork of the Feather River and from Butte Creek. Although the District does not own any irrigation wells, many private landowners have developed deep irrigation wells at their own expense.

Some surface water is utilized within the Cherokee Inventory Sub-Unit. The Miocene Canal passes through Cherokee Inventory Sub-Unit as it transports water from PG&E to the California Water Service Company, Oroville. In the past, farmers along the canal have purchased water from the California Water Service Company, but urban users in Oroville have a higher priority in drought years.

The Ridge Inventory Sub-Unit includes the City of Paradise and nearby residential development which are supplied a mix of surface water and groundwater by the Paradise Irrigation District and Del Oro Water Company.

U.S. Army Engineer District. Cherokee Canal General Design 27. Design Memorandum. Corps of Engineers: November 15, 1958.⁴²

Cherokee Canal Levee Project is to include levee construction and channel improvement on the Cherokee Canal and its principal tributaries. The project, as designed, would provide flood protection to 22,000 acres of improved agricultural land, highways, railroads and irrigation canals. The proposed project work would begin at the Lower Butte Basin and run northeasterly to high ground about 13 miles north of Biggs for a total distance of approximately 22 miles. In addition to work on the Cherokee Canal, backwater levee construction is described for Cottonwood Creek and lower Gold Run Creek.

LAND USE

Analytical Environmental Services. Mechoopda Indian Tribe: Chico Casino Fee-to-Trust Acquisition Environmental Assessment. Analytical Environmental Services: December 2003.²¹

The Proposed Action consists of the transfer of a 650-acre site into federal trust status for the Mechoopda Tribe of the Chico Rancheria and the subsequent development of a portion of the site into a gaming facility. The site consists of the Butte County Assessor's Parcels identified in Table 1-1.

Placing land in "Trust" status refers to the process of transferring privately owned fee land to land held in trust by the United States for an Indian tribe or an individual tribal member. This means that the United States holds legal title to that land while the tribe or individual tribal member holds beneficial title – which means that they have the right to use the property and derive benefits from it. Because trust land is owned by the United States, state and local laws regarding matters such as taxation, zoning, land use and the like have no application to these lands.

California Department of Forestry and Fire Protection Butte Unit. Fire Management Plan 2003. CDF Butte: 2003.⁴³

The Butte Unit Fire Management Plan documents the assessment of the fire situation within the unit; includes stakeholder contributions and priorities; identifies strategic areas for pre-fire planning and fuel treatment as defined by the people who live and work with the local fire problem.

The population of Butte Valley is mostly in the Clark Road and Durham Pentz Road area including the Butte Community College with a population of 15,000.

Commercial structures served by Battalion 6 are scattered in a few areas but do include some large industries, care homes, churches, schools, markets, small offices and one casino with associated bowling alley.

Giller, Joseph Anthony. Hydrogeochemistry of the Cherokee Creek Watershed. Thesis, California State University-Chico: Summer 1998. 61 pp.²

Almond orchards are present at the head of the Cherokee Strip where the soils are more permeable and mostly composed of gravely sand. Toward the middle and the end of the strip rice is grown.

Camp Dresser & McKee, Inc. Butte County Department of Water and Resource Conservation. Agricultural Water Demand Forecast. Technical Memorandum. Butte County: October 2003.³⁰

This document provides information about agricultural land use within the East Butte region. The main crop is rice, along with orchards and forage crops. Most crops are irrigated with surface water, with 20% coming from groundwater sources.