



NONPOINT SOURCE SUCCESS STORY

California

Improving Nutrients in Moro Cojo Slough Subwatershed

Waterbody Improved

The Moro Cojo Slough drains a 17-square-mile watershed that flows into Moss Landing Harbor in the center of Monterey Bay on California's Central Coast. The slough is on the Clean Water Act (CWA) section 303(d) list for nitrate and nutrient-related impairments, including low dissolved oxygen and un-ionized ammonia. Irrigated agriculture discharges were identified as the primary controllable source of nutrient pollution, with adjacent waters contributing to nutrient loading due to tidal mixing. With the implementation of nutrient treatment systems, total nitrogen concentrations have dropped below wet and dry season targets in recent years. However, data are needed to confirm that nutrients no longer drive eutrophic conditions (as measured by biostimulatory effect indicators, such as dissolved oxygen conditions and algal blooms).

Problem

The Salinas Valley is the largest watershed in the Monterey Bay area (Figure 1). Agriculture (including irrigated cropland and grazing lands) is the dominant land use in the Lower Salinas Valley. The approximately 10,000-acre Moro Cojo Slough subwatershed historically supported about 1,500 wetland acres. According to the U.S. Fish and Wildlife Service's National Wetlands Inventory, over 870 acres have been converted to agricultural use since the 1880s. The ditching and draining of thousands of acres of wetlands on the Moro Cojo Slough watershed has greatly reduced the natural capacity of the local landscape to improve water quality, store flood waters, and recharge aquifers.

In 1996, the Moro Cojo Slough was added to the CWA 303(d) list of impaired waters for violating its cold and warm freshwater habitat designated use standards for nitrogen, dissolved oxygen, and un-ionized ammonia. The Lower Salinas River Watershed Nutrient Total Maximum Daily Load (TMDL) was approved in May 2014.

Story Highlights

The *Moro Cojo Slough Management and Enhancement Plan* was established in 1996 to guide efforts. To date, project partners have restored 286 acres of wetlands, an increase of 41%, and they added bioreactors and treatment wetlands within the Lower Moro Cojo watershed. In 1996, cattle were excluded from a 2.6-acre grazing lot at Moonglow Dairy, which was then restored to native wetland that serves as a buffer zone; the wetland filters runoff from dairy operations on the

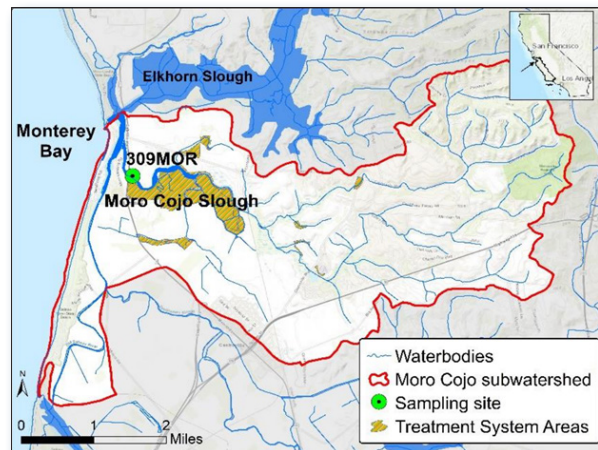


Figure 1. Moro Cojo Slough subwatershed.

surrounding hillsides, reducing turbidity and nitrate. In 1998, the Citizen Watershed Monitoring Network Project supported monitoring efforts, built infrastructure, and coordinated existing and emerging regional groups. In 1999, the Tottino Ponds Restoration Project converted 14 acres of frequently flooded land to treat farm and stormwater runoff from approximately 50 acres and directed water to the adjacent Castroville wetland restoration project before flowing to the Moro Cojo Slough. An additional wetland habitat pond was added in 2002.

In 2000, the Moro Cojo Slough: Nonpoint Source (NPS) Implementation Project restored freshwater wetlands to treat irrigation water, increase flood protection, and recharge groundwater. In 2005, the Restoring Natural

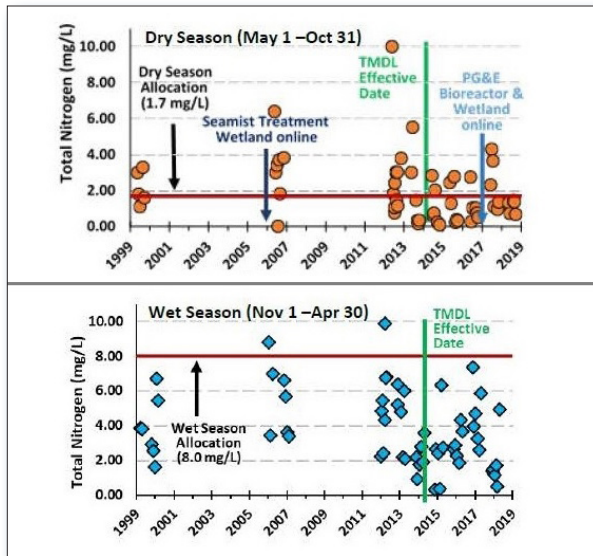


Figure 2. Total nitrogen at site 309MOR (1999–2019).

Water Systems in Rural Residential Landscapes Project developed a tax incentive system for rural residential landowners to participate in wetlands restoration. In 2006, a three-pond treatment wetland with connecting channels (over 21 acres of shallow freshwater habitat) was added at Sea Mist Farms to remove pollutants from 120 acres of adjacent farm runoff, which improves shallow groundwater infiltration connecting with the Moro Cojo Slough main channel. Later, a woodchip bioreactor treatment system was added to remove more nitrate from agricultural runoff.

In 2008, West Coast Estuary Initiative funds were used to restore and enhance 50 acres of wetland and upland habitat at 12 sites in the watershed to mitigate impacts on wetland resources and to develop restoration design plans for sites along the middle Moro Cojo Slough and other waters for the Greater Monterey County Integrated Regional Water Management Plan. In 2013, a California Water Boards grant funded several irrigation and nutrient management practices treating approximately 1,000 acres of farmland to reduce nitrogen levels in runoff, including a multichannel treatment system and 18-acre treatment wetland on Pacific Gas and Electric (PG&E) property and in partnership with the Resource Conservation District of Monterey County, the Monterey Bay Marine Sanctuary Foundation, Coastal Conservation and Research (CCR), Mosquito Abatement District and Monterey County Water Resources, landowners, and others. In 2019, the Lower Salinas

Water Quality Improvement Project installed wetland vegetation and woodchips in three linear treatment channels to maximize nutrient treatment.

Growers, the Central Coast Wetlands Group at Moss Landing Marine Labs (CCWG), and their partners have installed six nutrient treatment systems to treat runoff (e.g., tailwater, stormwater runoff, surface discharges) from 1,527 acres of irrigated lands. Growers have used on-farm management practices and technologies to manage nutrients and improve water quality.

Over 1,700 acres of wetland and adjacent upland are held in conservation by governmental, land trust, utilities, and resource management organizations, including 518 acres of existing and restored wetland/estuarine habitat and about 464 acres of estuarine marsh in private ownership. The TMDL seasonal load allocations for nitrate, ammonia, total nitrogen, and orthophosphate are implemented through the Central Coast Regional Water Quality Control Board (Central Coast Water Board) regulatory program addressing NPS pollution from irrigated agricultural land.

Results

Guided by the 1996 Moro Cojo Slough Management and Enhancement Plan, partners have constructed wetlands, reduced nutrient loading from runoff, and transformed barren fields adjacent to the main channel into fresh and brackish wetland ecosystems. Total nitrogen concentrations at the 309MOR monitoring location have dropped below the TMDL allocations of 1.7 milligrams per liter (mg/L) (dry season: May 1 to Oct. 31) and 8 mg/L (wet season: Nov. 1 to Apr. 30) (Figure 2). Recently, discharge concentrations from the bioreactor and wetland are below 1 mg/L, and monitoring samples routinely meet nitrate Water Quality Objectives in the Lower Salinas Valley Nutrient TMDL.

Partners and Funding

Restoration partners include CCWG, CCR, and the Elkhorn Slough Foundation. Landowners provided access via conservation easements or fee title purchase. Design and construction projects were funded by the U.S. Environmental Protection Agency, the California Water Boards, Coastal Conservancy, Central Coast Water Board, Ocean Protection Council, Wildlife Conservation Board, and Moss Landing Power Plant, and PG&E.



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