

1. Introduction

The Clean Water Act (CWA) is the dominant law governing water quality in the United States. The goal of the CWA is to restore and protect the chemical, physical, and biological integrity of water bodies. The CWA was originally enacted in 1948 as the Water Pollution Control Act, then rewritten, by means of numerous amendments, in 1972. The 1972 amendments gave the Act its present form and name, and established the goal that all the nation's waters should be made safe for fish, shellfish, wildlife, and humans. Numerous amendments since 1972 have further refined and expanded the CWA; among these, Section 319 (enacted in 1987) directs that states must institute monitoring and control of nonpoint source pollution (sources: U.S. Environmental Protection Agency (USEPA), 1997; NCSU Water Quality Group, 1997; Copeland, 2001).

Nonpoint source pollution is diffuse in origin, with no readily identifiable source, and arises from land uses such as agriculture, urban areas, forestry, construction, and mining. Nonpoint source pollution may be responsible for up to 50 percent of water quality problems at the present time. The U.S. Environmental Protection Agency (USEPA) estimates costs of management of nonpoint source pollution to be approximately \$1 billion per year (Copeland, 2001). Requiring implementation of nonpoint source pollution reduction without financial aid was recognized as unproductive; therefore, under various programs, including Section 319, the USEPA provided grant funding for monitoring and control of nonpoint source pollution. Grants under Section 319 typically cover 60 percent of costs. The study reported here has been funded through a 319h grant.

The National Estuary Program (NEP), a companion to the Morro Bay National Monitoring Program (NMP) in the sense that it addresses the Morro Bay estuary and its watershed, is funded through CWA Section 320. The NEP is part of the Water Quality Act of 1987, under which the USEPA recognizes estuaries of national importance (USEPA, 1997). Other agencies including the Natural Resources Conservation Service, the California Coastal Conservancy, and the Coastal San Luis Resource Conservation District, have worked with private and public landowners in the watershed to implement Best Management Practices. Many aspects of the NMP would not have been possible without the coordination with these partners.

The Morro Bay estuary, on the California central coast (Figure.1.1), supports a variety of commercial fisheries and recreational activities. The estuary, though impacted by pollution, is probably the least disturbed of the very few estuaries on the California coast. The watershed supplying the estuary encompasses two urban areas, cropland, rangeland, and a variety of natural habitats including estuarine, marsh, oak woodland, riparian, and dunes. Chorro and Los Osos Creeks are the waterways flowing into Morro Bay. In 1993, the USEPA selected the Morro Bay watershed for a ten-year program of water quality monitoring and evaluation of Best Management Practices (BMPs). The Morro Bay estuary was designated a National Estuary in 1995 and incorporated within the U.S. National Estuary Program.

The watershed and estuary have been impacted by pollutants, including sediment, bacteria, metals, and nutrients, originating from cropland, urban areas, rangeland, abandoned mines, eroding streambanks, poorly maintained roads, and other sources. The Morro Bay estuary and Chorro and Los Osos Creeks are listed as “impaired waterbodies” by the Central Coast Regional Water Quality Control Board (Regional Board). Total Maximum Daily Loads (TMDLs) are being established for the watershed for many of these pollutants. Sediment is of particular concern. A comprehensive study estimated that 25 percent of the estuary's volume has been lost as a result of accelerated sedimentation during the last century (Haltiner, 1988). At present sedimentation rates, the bay could be lost as an open-water estuary within 300 years.

Several public agencies and private individuals are implementing BMPs aimed at reducing non-point source pollution in the watershed. The main goal of this study is to monitor the impacts of selected BMPs on water and habitat quality in the Morro Bay watershed. This will be accomplished through characterization of water quality and habitat conditions before, during, and following implementation of BMPs.

The Central Coast Regional Water Quality Control Board manages the National Monitoring Program at Morro Bay, under a Section 319 grant. In addition to project administration and management, regular interval water quality sampling, rapid bioassessment, and stream profile monitoring throughout the Morro Bay watershed are conducted by the CCRWQCB. The California Polytechnic State University Foundation (Cal Poly) has served as the subcontractor for certain tasks in the monitoring program, including several facets of the paired watershed study, the Maino Ranch study, and upstream and downstream water quality monitoring of Chorro Flats (Fig. 1.1).

This project focuses on:

- a) Characterization of current sedimentation and water quality conditions in a portion of the Chorro Creek Watershed. This is being accomplished through sediment and water sample analyses in a paired watershed study (using Walters Creek and Chumash Creek).
- b) Evaluation of the effectiveness of a set of selected BMPs in improving water and habitat quality in one of the paired watersheds (Chumash Creek).
- c) Evaluation of the effectiveness of systems of BMPs in improving water and habitat quality in several locations in the Chorro Creek Watershed.
- d) Evaluation of overall water quality at select sites in the Morro Bay Watershed to establish a database, prioritize problem areas, and aid in future monitoring efforts.
- e) Evaluation of hydrologic and water quality indicators to document the health and stability of selected streams in the Morro Bay Watershed through annual monitoring practices.

The objectives of the paired watershed study were to evaluate and demonstrate (1) improvement in water quality resulting from implementation of BMPs in one of the two watersheds, (2) improvement in rangeland quality and habitat from implementation of BMPs (i.e., reduction in bare ground, increase in nonpersistent litter, improvement in forage quality), and (3) improvement in streambank stability resulting from BMP implementation. The objective of the upper Chorro and the Dairy Creek studies was to monitor water quality in response to exclusion of cattle from the riparian corridor. The Maino Ranch study was designed to monitor water quality, rangeland and habitat, and streambank stability in response to intensive rotational cattle grazing. The focus of the Chorro Flats monitoring study was to monitor water quality of Chorro Creek in response to floodplain restoration. The objective of the Watershed-wide characterization was to monitor water quality and riparian habitat in several creeks on an even-interval basis in order to prioritize areas for further BMP implementation.

This nonpoint source monitoring project is one of very few on the west coast of North America, and the only study of its kind supported by the USEPA in California at the time of this writing. The diversity of studies addressing the Morro Bay watershed, the Mediterranean climate with its strong seasonal distribution of rainfall, and the predominant agricultural rangeland use, all combine to make this study unique among Section 319 projects in the United States.

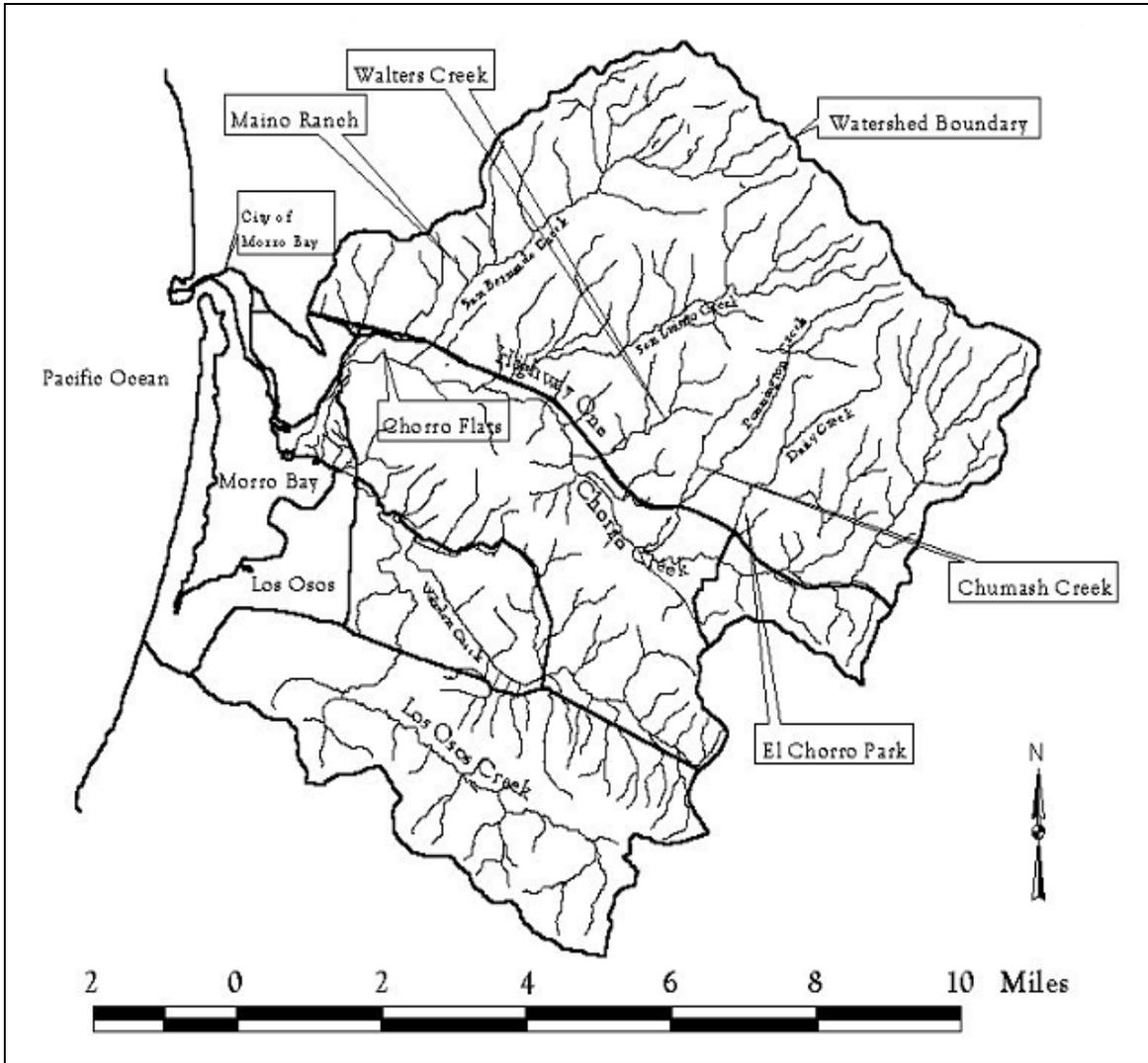


Figure 1.1. Map of the Morro Bay watershed, with specific study sites shown.