CHAPTER 1. INTRODUCTION TABLE OF CONTENTS

1.1 Overview and Geographic Scope of Elk River TMDL

The Elk River Total Maximum Daily Load (TMDL) for Sediment is being established in accordance with Section 303(d) of the Clean Water Act (CWA). The North Coast Regional Water Quality Control Board (Regional Water Board) determined that excessive sediment loads in Elk River and its tributaries resulted in the impairment of beneficial uses of water and the non-attainment of water quality objectives (collectively water quality standards). In accordance with federal Clean Water Act section 303(d), the State Water Resources Control Board (State Water Board) periodically identifies those waters that are not meeting water quality standards. The United States Environmental Protection Agency (USEPA) reviews and approves the State Water Board 303(d) list of impaired waterbodies, and consistent with the recommendations by the Regional Water Board, added Elk River to California's 303(d) impaired waters list in 1998 on the basis of excessive sedimentation/siltation. Water quality problems cited under the listing include: sedimentation, threat of sedimentation, impaired irrigation water quality, impaired domestic supply water quality, impaired spawning habitat, increased rate and depth of flooding due to sediment, and property damage. The Elk River watershed has continued to be identified as impaired in subsequent 303(d) listing cycles. For 2008, California is integrating the 303(d) List of Impaired Waters and the 305(b) Water Quality Assessment Report into a single report. This report is called the 2008 Integrated Report, and it satisfies the requirements of both CWA Sections 303(d) and 305(b).The impaired listing of the Elk River watershed applies from its confluence with Humboldt Bay to its tributary headwater streams.

Elevated sediment loads in the Elk River and its tributaries have resulted in the impairment of designated beneficial uses of water and the non-attainment of water quality objectives. The primary adverse impacts of elevated sediment loads in the Elk River and its tributaries are associated with impacts to domestic and agricultural water supplies and cold water fish habitat. The cold freshwater habitat beneficial use includes migration, spawning, reproduction, and early development of cold water fish. Numerous sensitive species of fish, including State-and federally-listed, and California species of special concern (SSC) occur in Elk River. Anadromous salmonids utilizing the watershed include: coho salmon (*Oncorhynchus kisutch*), State- and federally-listed as threatened; Chinook salmon (*Oncorhynchus tshawytscha*), federally-listed as threatened; Coastal cutthroat trout (*Oncorhynchus clarki clarki*), listed as SSC; and Steelhead (*Oncorhynchus mykiss*), federally-listed as threatened. Elevated sediment loads may also adversely affect contact and non-contact recreational use.

The purposes of the Elk River Sediment TMDL are to:

1. Evaluate the mechanisms that cause sediment impairment in Elk River.
2. Estimate the assimilative capacity of the system by identifying the total loads of sediment that can be delivered to Elk River and its tributaries without causing exceedence of water quality standards.

3. Identify the major sources of sediment delivery to Elk River and its tributaries.
4. Develop a strategy to recover Elk River's beneficial uses of water, achieve water quality objectives and abate nuisance conditions.

1.2 Report Organization

The Elk River TMDL is comprised of two distinct components:

1. *Staff Report for the Action Plan for the Elk River Watershed Sediment Total Maximum Daily Load* (Staff Report); which describes the TMDL and provides the technical and scientific support to inform the Regional Water Board during their consideration process. It also supports and justifies the Action Plan.
2. *Action Plan for the Elk River Sediment Total Maximum Daily Load* (Action Plan). The Action Plan is the regulatory expression of the TMDL and is based on information contained in the Staff Report.

The contents of each chapter in this Staff Report are outlined below:

Chapter 1- Introduction
- Regulatory framework
- Overview of the Elk River watershed

Chapter 2 - Problem Statement
- Historic and existing instream conditions

Chapter 3 - Source and Linkage Analysis
- Factors affecting sediment loads in of the Elk River watershed
- Quantification of sediment loads in the Elk River watershed
- Linkage of sediment loads with instream conditions relevant to beneficial uses and water quality standards

Chapter 4 - Analytical Approach and Method
- Describes the analytical methods used to quantify the TMDL load allocations

Chapter 5 - Sediment TMDL Load Allocations
- Assigns (allocates) sediment loads to specific landowners, sub-basins, or land use activities.

Chapter 6 - Implementation
- Describes the implementation program and actions necessary to ensure that the purpose of the TMDL is achieved.

Chapter 7 – Monitoring
- Describes the types of monitoring applicable to the Elk River watershed.
- Describes the monitoring requirements of the TMDL Action Plan.

Chapter 8 – Reassessment

- Describes the process the Regional Water Board will take to review, reassess, and possibly revise the Elk River TMDL Action Plan.

Chapter 9 - Antidegradation Analysis

- Describes the state and federal antidegradation policies and how they apply to the Elk River TMDL Action Plan.

Chapter 10- Environmental Analysis

- Evaluates the impacts of the proposed Elk River TMDL Action Plan as a Basin Plan amendment in conformance with California Environmental Quality Act (CEQA).

Chapter 11 - Economic Analysis

- An analysis of the potential economic benefits and costs that may result from the adoption and implementation of the proposed Elk River TMDL Action Plan.

Chapter 12- Public Participation Process

- Describes some of the opportunities made available to the public for comment on and to participate in the development of the Elk River TMDL Action Plan.

The Elk River TMDL Action Plan would be amended into the North Coast Basin Plan, following the formal Basin Plan amendment process. The Basin Plan amendment process includes approval by the Regional Water Board, the State Water Board, the Office of Administrative Law, and the USEPA.

1.3 Regulatory Framework and Purpose

The North Coast Regional Water Board is one of nine Regional Water Boards that function as part of the California State Water Board system within the California Environmental Protection Agency. As part of this responsibility, the Regional Water Board is the California State agency responsible for the protection of water quality in the Elk River watershed. The Regional Water Board implements both the Porter-Cologne Water Quality Control Act, part of the California Water Code, and the federal Clean Water Act. Water quality standards for waters of the North Coast Region are contained in the Water Quality Control Plan for the North Coast Region (Basin Plan).

1.3.1 Clean Water Act Section 303(d)

Under CWA Section 303(d), states are required to develop a list of water bodies where technology based effluent limits or other legally required pollution control mechanisms are not sufficient or stringent enough to meet water quality standards applicable to such waters. The 303(d) List also identifies the pollutant/stressor causing the impairment, and establishes a prioritized schedule for addressing the water quality impairment. Placement of a water body on the 303(d) List acts as the trigger for developing a

pollution control plan, called a Total Maximum Daily Load (TMDL), for each water body-pollutant/ stressor combination and associated pollutant/stressor on the 303(d) List. The TMDL serves as the means to attain and maintain water quality standards for the impaired water body. The specific requirements of a TMDL are described in the United States Code of Federal Regulations (CFR) Title 40, Sections 130.2 and 130.7 (40 CFR § 130.2 and 130.7), and Section 303(d) of the CWA.

In California, the authority and responsibility to develop TMDLs rests with the Regional Water Boards. The USEPA has federal oversight authority for the CWA Section 303(d) program and may approve or disapprove TMDL developed by the State. USEPA Region 9 is responsible for the North Coast region of California. If the USEPA disapproves a TMDL developed by the State, the USEPA is then required to establish a TMDL for the subject water body.

1.3.2 California Porter-Cologne Water Quality Control Act

In California, the Porter-Cologne Water Quality Control Act (California Water Code, Division 7, Water Quality) requires a program of implementation for a TMDL to be included in the Basin Plan (CWC § 130500)(3)). This program of implementation must include a description of actions necessary to achieve Basin Plan water quality objectives, a time schedule for specific actions to be taken, and a description of monitoring to determine attainment of objectives.

1.3.3 Endangered Species Act Consultation

Section 7 of the Endangered Species Act (16 U.S.C. 1536) requires all federal agencies to consult with the U.S. Fish and Wildlife Service and/or NOAA Fisheries regarding any action that is authorized, funded, or carried out by a federal agency that may jeopardize listed species or adversely modify their critical habitat. For most water quality issues, the appropriate agency for consultation is NOAA Fisheries.

Section 7 of the Endangered Species Act does not apply to basin planning activities unless there is a federal nexus, such as when USEPA approval of an amendment is required. It is the federal agency's (i.e., USEPA's) responsibility to conduct the consultation with NOAA Fisheries.

Should the federal agency action not jeopardize listed species, the federal agency may request in writing a determination by NOAA Fisheries that the action will result in no adverse affect on the listed species.

Should the federal agency action jeopardize listed species or adversely modify their critical habitat, NOAA Fisheries is required to prepare a Biological Opinion. The Biological Opinion assesses the impact of the action and recommends reasonable and prudent measures to avoid jeopardy.

If a formal consultation requires a Biological Opinion, the USEPA will be unable to approve a Basin Plan amendment until the consultation process is complete. It is likely that such a consultation will require changes and additions to the amendment. Any changes would require that the amendment go through the entire Basin Plan Amendment process again. Informal consultation early in the Basin Planning process with NOAA Fisheries by Regional Water Board staff is helpful to minimize the need for changes.

Informal consultation with NOAA Fisheries by Regional Water Board staff on the Elk River TMDL consists primarily of keeping NOAA Fisheries staff informed of the amendment and soliciting and incorporating their comments as appropriate.

1.3.4 What is a TMDL?

A TMDL is a planning and management tool intended to identify, quantify, and control the sources of pollution within a given watershed such that water quality objectives are achieved and the beneficial uses of water are fully protected. A TMDL is defined as the sum of the individual waste load allocations to point sources, load allocations to non-point sources and natural background loading. The amount of pollutant that a water body can receive without violating the applicable water quality objectives is the loading or assimilative capacity of the water body, and is calculated as the TMDL. Loading from all pollutant sources must not exceed the loading or assimilative capacity (TMDL) of a water body, including an appropriate margin of safety.

1.3.5 Purpose and Goals of the Elk River TMDL Action Plan

The purpose of the Elk River Sediment TMDL is to estimate the assimilative capacity of the system with respect to the total sediment loads that can be delivered to the Elk River and its tributaries without causing an exceedence of water quality standards, including beneficial uses of water and water quality objectives. The TMDL then allocates the total loads among the identified sources of these pollutants in the watershed.

The Action Plan component of the TMDL outlines a strategy to meet the TMDL loading allocations. The goal of the Elk River TMDL Action Plan is to achieve the sediment-related water quality objectives, and restore and protect the beneficial uses of water in the Elk River watershed.

1.3.6 Public Participation

Regional Water Board staff involved the public during the development of the Elk River TMDL in several ways, including the following, which are described in greater detail in Chapter 12 of this Staff Report.

- Developed a website which offered updates on the Elk River TMDL process and posted relevant reports.
- Developed mailing list based upon Humboldt County Tax Assessor information for parcels within the Elk River watershed.
- Sent newsletters and held public meetings in the Eureka area and expanded the mailing list to include interested parties including agency and industry staff.
- Developed a short survey to the mailing which gave the opportunity to describe observations of beneficial uses, events, and impairments, offer ideas for implementation, and indicate if someone wanted to participate in a more in-depth interview.
- Eight (8) residents participated in in-depth interviews conducted by Redwood Community Action Agency, under contract with the Regional Water Board. These interviews were posted on the Elk River TMDL website and are included as Appendix A of this Staff Report.
- Met individually with numerous stakeholders including, Pacific Lumber Company, Humboldt Redwood Company, Green Diamond Resource Company, Bureau of Land Management, Salmon Forever, Elk River Resident Association, and California Department of Fish and Game. These meetings offered updates on TMDL development, exchange of watershed information, vetting technical and regulatory approaches, and trust building.
- Regularly attended the meetings of the Humboldt Bay Watershed Advisory Committee and the Humboldt Bay Ecosystem Based Management Program, and the Pacific Lumber Company Habitat Conservation Plan Aquatic Monitoring Workgroup.
- Made presentations of relevant information at Regional Water Board meetings and received input from stakeholders.

These public participation opportunities have ensured that staff is aware of public concerns regarding watershed conditions and regulatory actions needed to recover conditions.

1.4 Watershed Overview

The Elk River watershed is located in the coastal temperate rain forest of Humboldt County, California, and approximately 3.8 air miles from the heart of the City of Eureka to the mouth of Elk River. Elk River is one of the largest freshwater tributaries of Humboldt Bay. Humboldt Bay is an important economic resource for the local community including its port and marinas, recreation opportunities, the numerous shellfish rearing operations as well as providing important habitat for aquatic species.

The Elk River watershed is located in the Eureka Plain Hydrologic Unit 110.00 (NCRWQCB, 2007). It originates from the relatively steep forested headwater slopes and flows across the primarily grassland coastal plain into the central portion of Humboldt Bay, across from the bay inlet.

1.4 Watershed Characteristics

This section describes the geophysical and social characteristics important to the Elk River TMDL analyses.

1.4.1 Location and Area

Elk River drains a 58.3 square mile (mi^2) watershed in Humboldt County, California. The Elk River watershed is drained by six main hydrogeographic areas (Figure 1.1): Martin Slough (5.9 mi^2), Lower Elk River (10.4 mi^2), Lower North Fork Elk River (14.1mi^2), Upper North Fork Elk River (8.4 mi^2) and the Lower South Fork Elk River (7.7 mi^2), and Upper South Fork Elk River (11.7 mi^2).

1.4.2 Climate and Hydrology

The Mediterranean climate of the Elk River basin is characterized by mild, wet winters and a prolonged summer dry season. Mean surface air temperature at the coast fluctuates from 48 ℉ (9℃) in January to 55 ℉ (13 ℃) in June, with summer temperature moderated by fog. Winter rainfall intensity and storm runoff are highly variable due to orographic lifting of moisture-laden, frontal air masses as they encounter the outer Coast Range. Roughly 90% of the annual precipitation occurs as rainfall between October and April. The period of record for rainfall record-keeping began in 1879 in Eureka on Humboldt Bay[1]. Rainfall totals are higher in the Elk River watershed than at the bay, as rainfall increases with elevation (Figure 1.2). Mean annual precipitation ranges from 39 inches at Eureka to 60 inches near the top of the watershed at Kneeland; Kneeland is located 12 miles inland at 2,657 feet elevation.

As described in a staff report titled, *Preliminary Assessment of Flooding in Lower Elk River* (Patenaude, 2004), the United States Geologic Survey (USGS) in cooperation with California Department of Water Resources established stream gage station 11-479700 on the mainstem of Elk River. The USGS gage station was located just downstream of the confluence of Elk River's main tributaries, North Fork and South Fork, where the river egresses from uplands onto the coastal plain (Figure 1.3). The drainage area above this gage station is 44.2 mi^2. Railroad Gulch and Clapp Gulch, two small, steep tributaries are located upstream and downstream of the historic gage site, respectively.

This station maintained monthly gage records for ten water years[2] (1958 – 1967). Staff compiled and analyzed available gage records to illustrate hydrologic and hydraulic conditions in Elk River during the 10-year period of record; these data offer a baseline of conditions on Mainstem Elk River. Among staff evaluations were estimation of

[1] NOAA National Weather Service at Woodley Island. http://www.wrh.noaa.gov/eka/
[2] The term water year refers to the period starting on October 1 of the year previous to the year cited and ending on September 30 of the cited year (e.g. water year 1958 starts October 1, 1957 and ends September 30, 1958).

instantaneous annual peak flows, as measured by the USGS. The estimated recurrence interval of various discharge events are presented in Table 1.1. Additional staff evaluations of the baseline data are provided in Chapter 2 of this staff report.

Table 1.1. Summary of Recurrence Interval of Various Discharge Events as measured by USGS at mainstem Elk River just downstream of the confluence of North and South Fork Elk River.

Recurrence Interval (years)	Estimated Discharge (cfs)
1.5	2,483
2	2,713
5	3,191
10	3,456
25	3,748
50	3,942
100	4,119
200	4,284
500	4,486

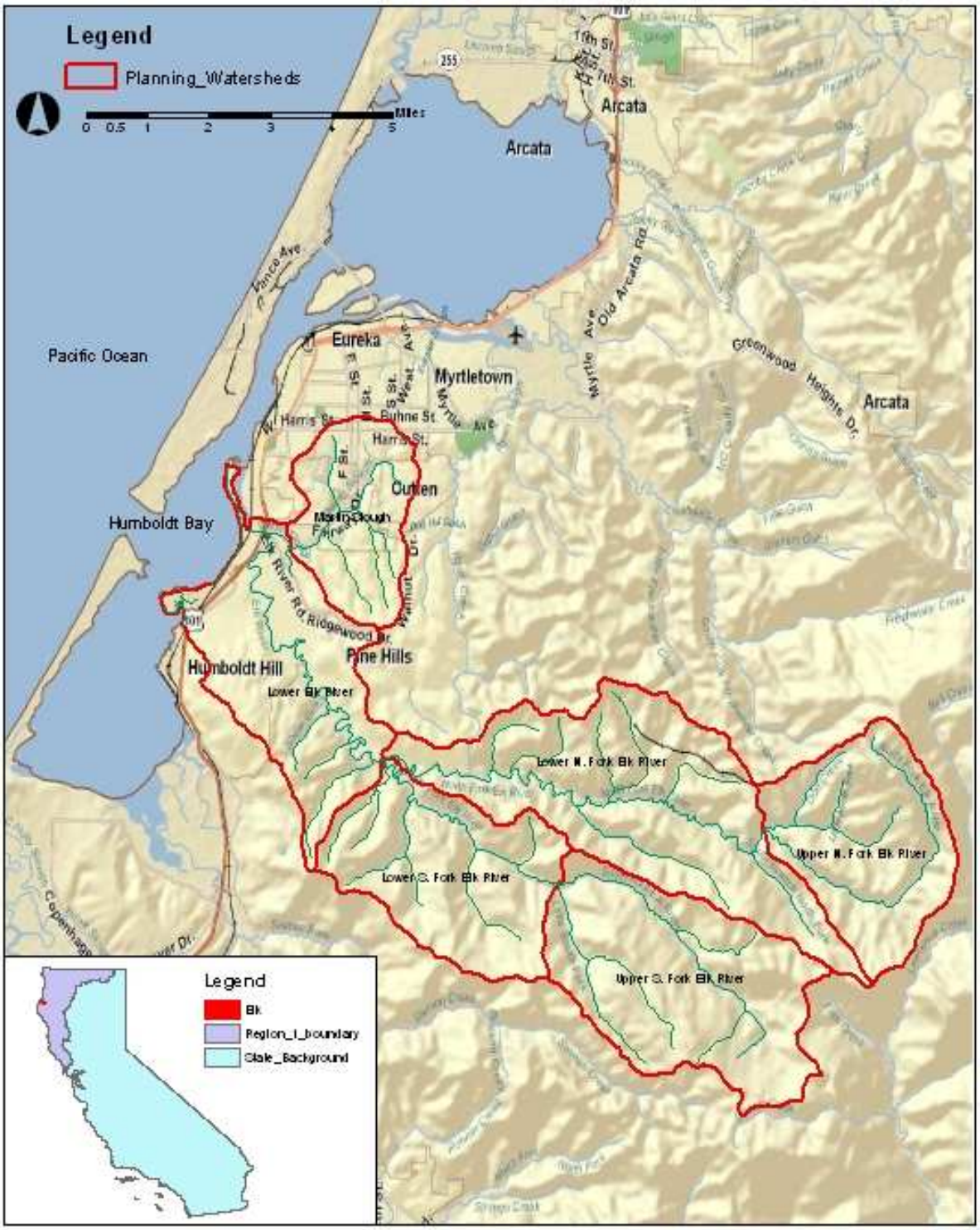

Figure 1.1 Location of the Elk River watershed

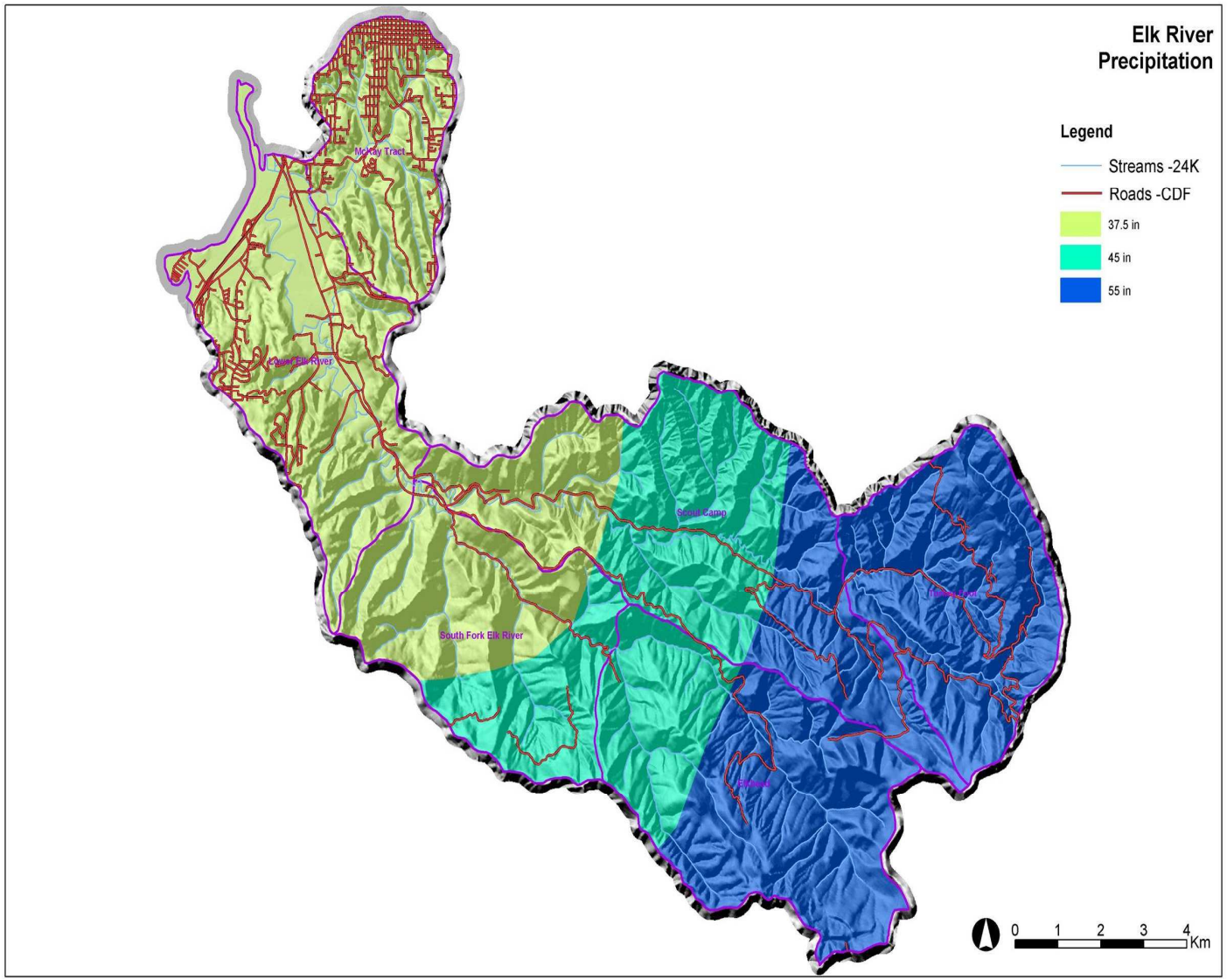

Figure 1.2 Average annual rainfall variation in the Elk River watershed.

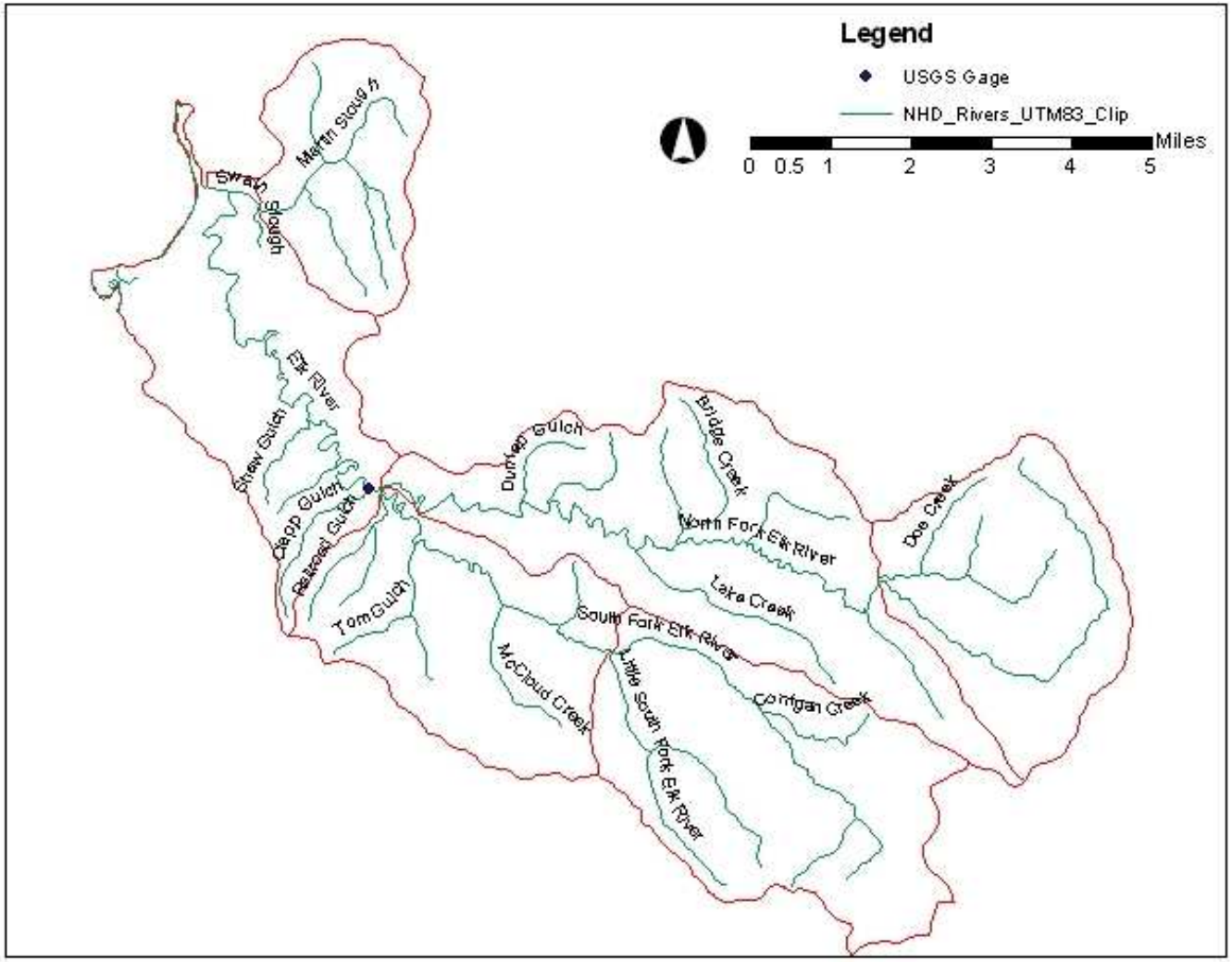

Figure 1.3 Location of former USGS gaging station.

1.4.3 Topography

The hillshade relief view of the Elk River watershed, as derived from a 1-meter Digital Elevation Model (DEM) generated from LiDAR[3] data developed for this project, is shown in Figure 1.4. Hillslope gradients in the Elk River watershed were stratified into six (6) hillslope terrain categories based on slope gradients (Figure 1.5). Slope categories include: 0-5%, 5-15%, 15-35%, 35-50%, 50-65%, and >65%. These categories were selected based on values that have either been mandated in regulation or have emerged as practical thresholds to aid in the identification and management of landslide hazards (Stillwater, 2007). Approximately nine (9) percent of the watershed is in the 0-5% slope category, thirteen (13) percent is in the 5-15% slope category, twenty-eight (28) percent is in the 15-35% slope category, twenty (20) percent is in the 35-50% slope category, fifteen (15) percent is in the 50-65% slope category, and fourteen (14) percent is in the >65% slope category.

[3] Light Detection and Ranging (LiDAR) is a remote sensing technique in which a sensor is attached to an airplane; laser pulses are released. As the pulses hit hard surfaces, the beam "bounces" back to the sensor in a return pulse. The elevation difference between the sensor and the hard-hit surface is recorded. GPS coordinates of the plane allow the determination of the x, y, and z coordinates of the hard-hit surface. Multiple returns can be registered from one laser pulse, thus characterizing the canopy and the ground surface at one Cartesian location. Subsequent data processing can separate the different returns and generate a bare earth DEM that has trees and buildings stripped away. Further information about the LiDAR collection effort in Elk River can be found in Appendix B.

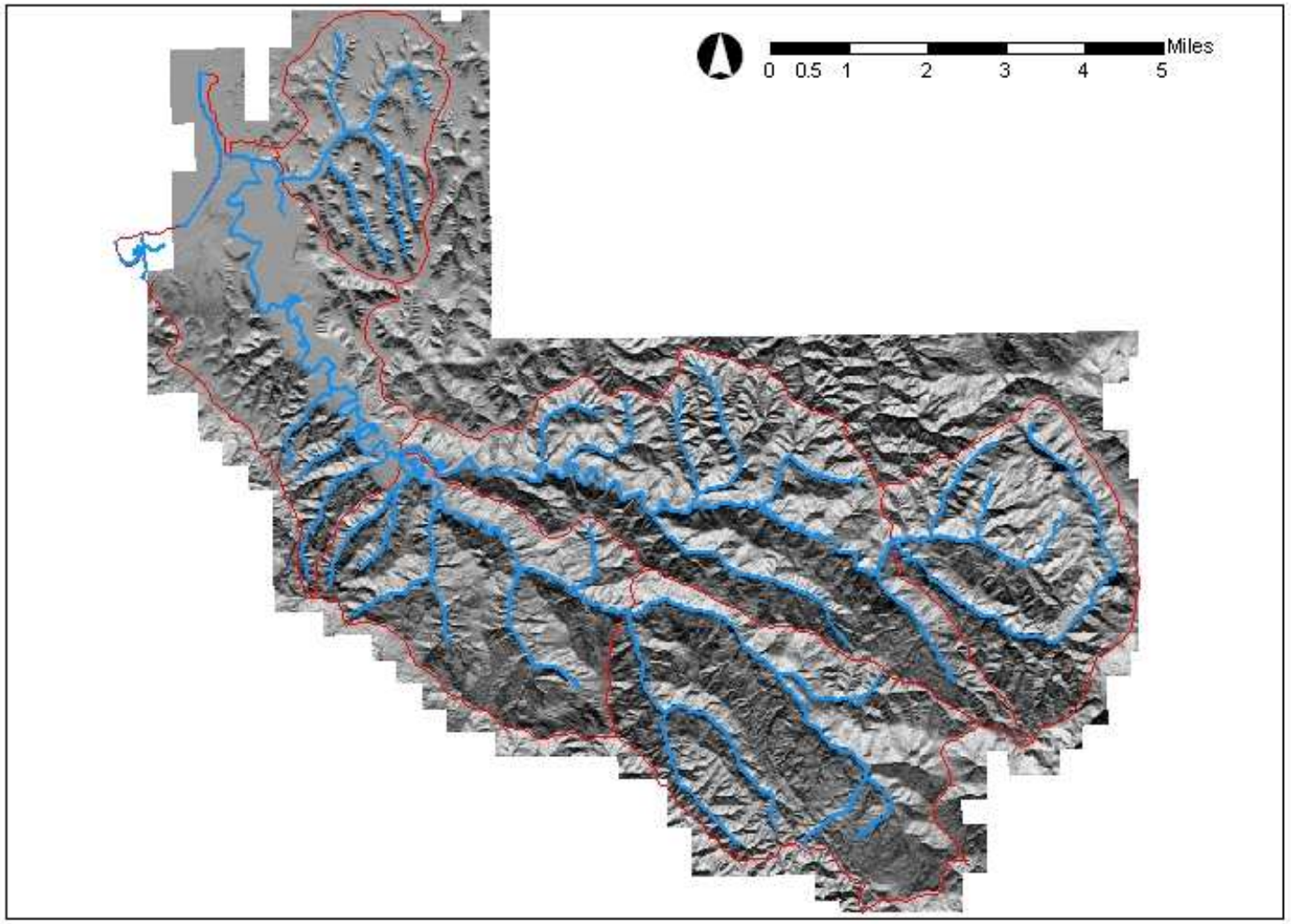

Figure 1.4 Elk River hillshade-relief derived from LiDAR-based 1-m resolution DEM.

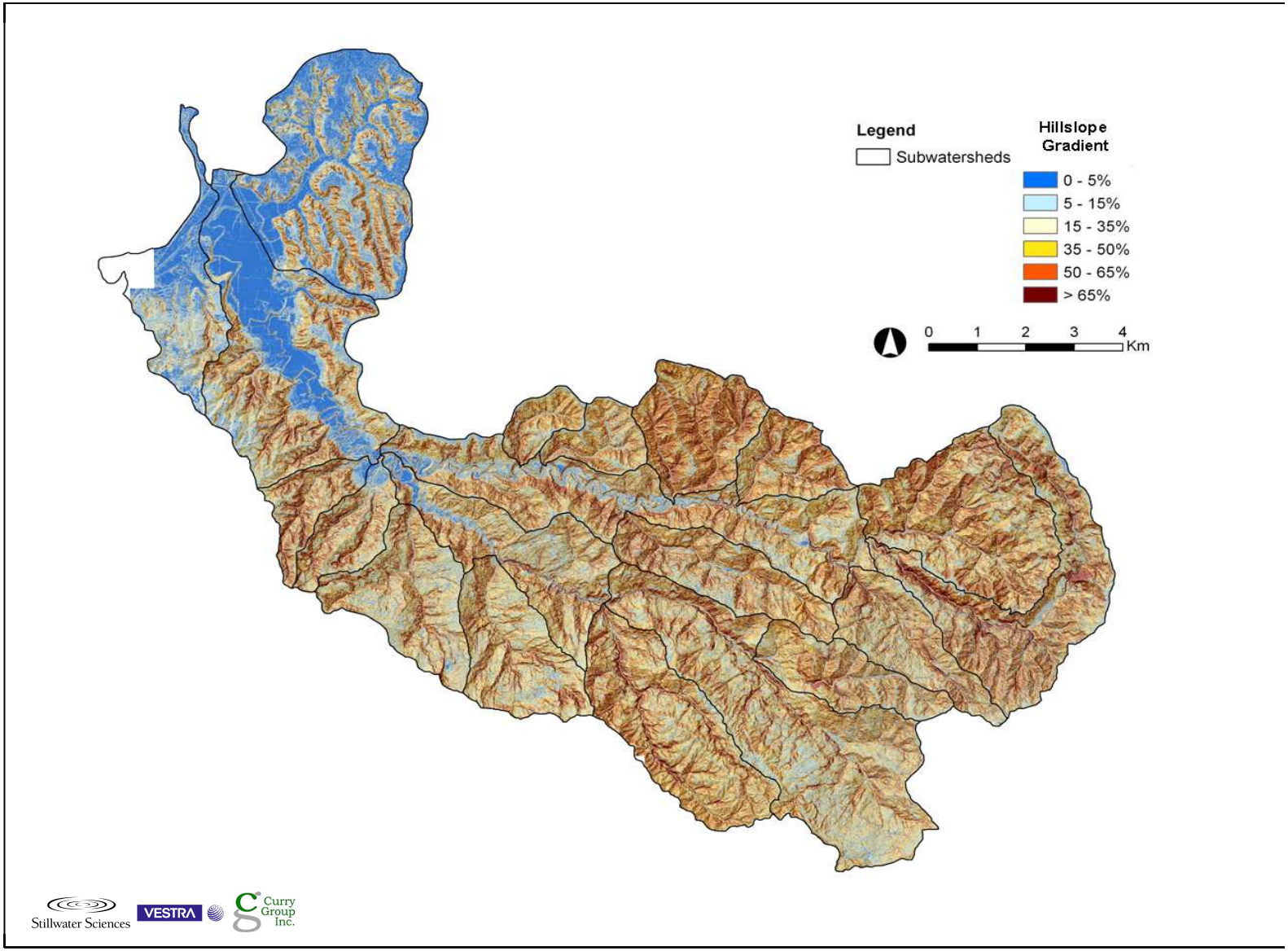

Figure 1.5 Hillslope gradient, as derived from 1-m LiDAR DEM.

1.4.4 Geology

The geology underlying a landscape is a major factor in determining the amount of sediment delivery to stream channels. The rocks that underlie the sub-watersheds form the source material for substrate, including spawning gravels. Recent geologic history, uplift, and the intensity of erosion combine to regulate how much of this material enters the streams. These geologic materials and processes control slope stability and limit the intensity of land use that can be accommodated without overloading the stream through excess sediment. Geologic formations in the Elk River watershed were mapped by McLaughlin et al. (2000) and Marshall and Mendes (2005) and modified by Stillwater Sciences (2007) as part the TMDL analyses (Figure 1.6). These formations include Quaternary alluvium, dune sand deposits (Q-Qds), Hookton Formation and related Quaternary terrace deposits (Qh-Qrt-Qmts), Wildcat Group (Quaternary age) (Qtwu), and Yager terrane (Tertiary age) (Qtwu).

The Franciscan Complex Central Belt (Kjsf) underlies 4.7% of the Elk River watershed, all within the Upper North Fork and North Branch North Fork subwatersheds, where it is in contact with the Yager terrane along the Freshwater fault. The Central Belt Franciscan Complex is a mélange – a disorganized, highly deformed body of varied rock types – of late Jurassic to Cretaceous age. This mélange was formed when tectonic forces shoved ocean floor crust beneath the continental crust of North America, scraping off, deforming, and mixing together rocks of several different ages and origins. This accretionary mélange consists of meta-sandstone and meta-argillite (partly metamorphosed mudstones, siltstones, and shales) enclosing blocks of more competent sandstone, greenstone, and chert. In many places, the more competent blocks stand in relief, without apparent arrangement or system, where they have been left standing high as weaker surrounding rocks were eroded away. Large, deep-seated landslides and earthflows enclosing competent blocks are common in the Central Belt Franciscan complex (Marshall and Mendes 2005). Blocks of competent sandstone commonly create steep slopes and weather to soils that have little strength and are susceptible to debris slides and debris flows (Marshall and Mendes 2005).

The Yager terrane (Ty) of the Franciscan Complex Coastal Belt makes up 12.5% of the Project Area, predominantly in the watersheds of the Upper South Fork, Upper North Fork, and North Branch North Fork (Stillwater 2007). The Yager terrane is a Paleogene marine deposit formed on the slopes of marine trenches and typically consists of highly folded and commonly sheared dark gray argillite, sandstone, and conglomerate. In the North Fork Elk River, argillite underlies 70% of the area; sandstones 25%, and conglomerate less than 5% (PWA 1998). The sandstone-dominated rock units commonly form cliffs and exert local base level control where streams have cut down through younger, less resistant deposits upslope. The argillite-dominated rock units are typically deeply weathered and sheared and subject to deep-seated flow failures on moderate slopes (Marshall and Mendes 2005).

The dominant geologic unit in the Elk River Basin is the Wildcat Group (Qtwu), which underlies 57.5% of the Elk River watershed, a thick transgressive-regressive sequence of late Miocene to middle Quaternary age, consisting of marine and non-marine deposits that thin to the east (Ogle 1953; McCrory 1989; Clarke 1992). The Wildcat Group typically consists of poorly to moderately consolidated siltstone and fine-grained silty sandstone that weather to become granular, non-cohesive, non-plastic, clayey silts and clayey sands (Marshall and Mendes 2005). The area underlain by the Wildcat Group is characterized by steep and dissected topography sculpted by debris sliding, and is known for high historical erosion rates from such slope failures. Shallow landslides in the Wildcat Group are commonly associated with headwall swales, inner gorges, and hollows. These are areas where weathered soil and colluvium accumulate over bedrock that is more resistant than the colluvium, but nonetheless only loosely consolidated. This bedrock has low permeability, which means it can become saturated with water, and this combines with bedding planes subparallel to the hillslope to make it prone to landsliding (PWA 1998).

Capping broad, accordant ridge crests in the western part of the Elk River basin are undifferentiated shallow-water marine and fluvial deposits (gravel, sand, and silt) of the Hookton formation (Qh). These deposits and similar Quaternary marine terrace (Qmts) and Quaternary river terrace (Qrt) deposits of poorly consolidated sand and gravel are prone to shallow landsliding on steep slopes and terrace risers. Combined, these deposits underlie 17.4% of the Elk River watershed. Shallow landsliding and deep-seated bedding plane failures are common in Hookton terrane (Marshall and Mendes 2005).

The remaining 7.3% of Elk River are comprised of Quaternary alluvium, dune sand deposits (Q-Qds). These geologically young deposits are poorly consolidated, have relatively high infiltration rates but are extremely erodible if vegetative cover or runoff patterns are altered.

1.4.5 Vegetation

The presence (or the absence of) and density of vegetative cover is directly related to surface and hillslope erosional processes. Increase in both surface erosion (e.g. sheet wash, gully formation) and hillslope mass wasting events (e.g. debris torrents, rotational landslides) can occur following alteration of the canopy cover, specifically resulting from changes in rainfall interception, and the effects of root distribution and strength on slope stability. Five vegetation cover types were defined in the Elk River watershed (Figure 1.7): (1) mixed conifer-hardwood, (2) shrub, (3) herbaceous, (4) agricultural, and (5) urban and barren ground.

These five categories were aggregated from vegetation data compiled as part of the Land Cover Mapping and Monitoring (LCMMP) program conducted by the USDA Forest Service Region 5 Remote Sensing Lab and the California Department of Forestry and Fire Protection's Fire and Resource Assessment Program (FRAP). Approximately 85% of the Elk River basin is in mixed conifer and hardwood forests. The remainder of the watershed is distributed evenly among herbaceous, agricultural, and urban cover types

located predominantly in the lower watershed.

The maritime coastal climate supports a coniferous lowland forest community dominated by redwood *(Sequoia sempervirens),* western hemlock *(Tsuga heferophylla),* Sitka spruce *(Picea sifchensis),* grand fir *(Abies grandis),* and Douglas-fir *(Pseudotsuga menziesii).*

Land uses that alter vegetation and land cover result in 1) reduction of rainfall interception, 2) compaction of permeable soils, and/or 3) covering of permeable soil on vegetated land with impervious surfaces such as structures, streets, sidewalks, and parking lots. These concentrate surface flows, decrease the time for rainfall to reach a watercourse, and increase the magnitude and intensity of runoff. This typically results in increased peak flows and higher runoff volumes and velocities. The altered flow regime results in increased bank instability, erosion, channel incision, more severe flooding, and the discharge of fine sediment. Further, due to increased peak runoff (rainfall moving off the landscape without having a chance to permeate into the soil horizon), groundwater recharge is reduced. Low flow conditions are likely to occur earlier in the year and with greater severity under these altered hydrologic regimes. These impacts can significantly impair aquatic function through alteration of instream habitat features such as filling of pools and loss of undercut bank habitat, decrease in the spatial and temporal extent of the stream's wetted channel, and loss of large diameter woody tree species, an important component in the formation of complex habitat structures.

1.4.6 Land Use and Ownership

The current land uses in Elk River are largely determined by county zoning (Figure 1.8):

- Most of the North Fork Elk River basin (98 percent) is privately managed for industrial timber harvest by Humboldt Redwood Company, with private residential properties occupying only the lower 2 percent of the watershed.
- 65% percent of the South Fork Elk River watershed is privately managed for industrial timber operations, 15 percent is owned by Green Diamond Resource Company, and 50% is owned by Humboldt Redwood Company. 30 percent of the South Fork Elk River watershed lies within the Headwaters Forest Reserve, managed by Bureau of Land Management[4]. The remaining 5 percent is private residential property in the lower South Fork Elk River valley.
- Mainstem Elk River comprises mixed private ownership, with approximately 24 percent zoned for timber production.
- Today, agricultural lands include the land along the Elk River valley. Prime agricultural lands along Elk River exist mostly on the south side of the river and on the gentle slopes of the Humboldt Hill area. Cattle grazing dominates streamside landuse along the lower mainstem Elk River and lower Martin Slough.

[4] Information on the Headwater Forest Reserve can be found on BLM's website at: http://www.blm.gov/ca/st/en/fo/arcata/headwaters.html

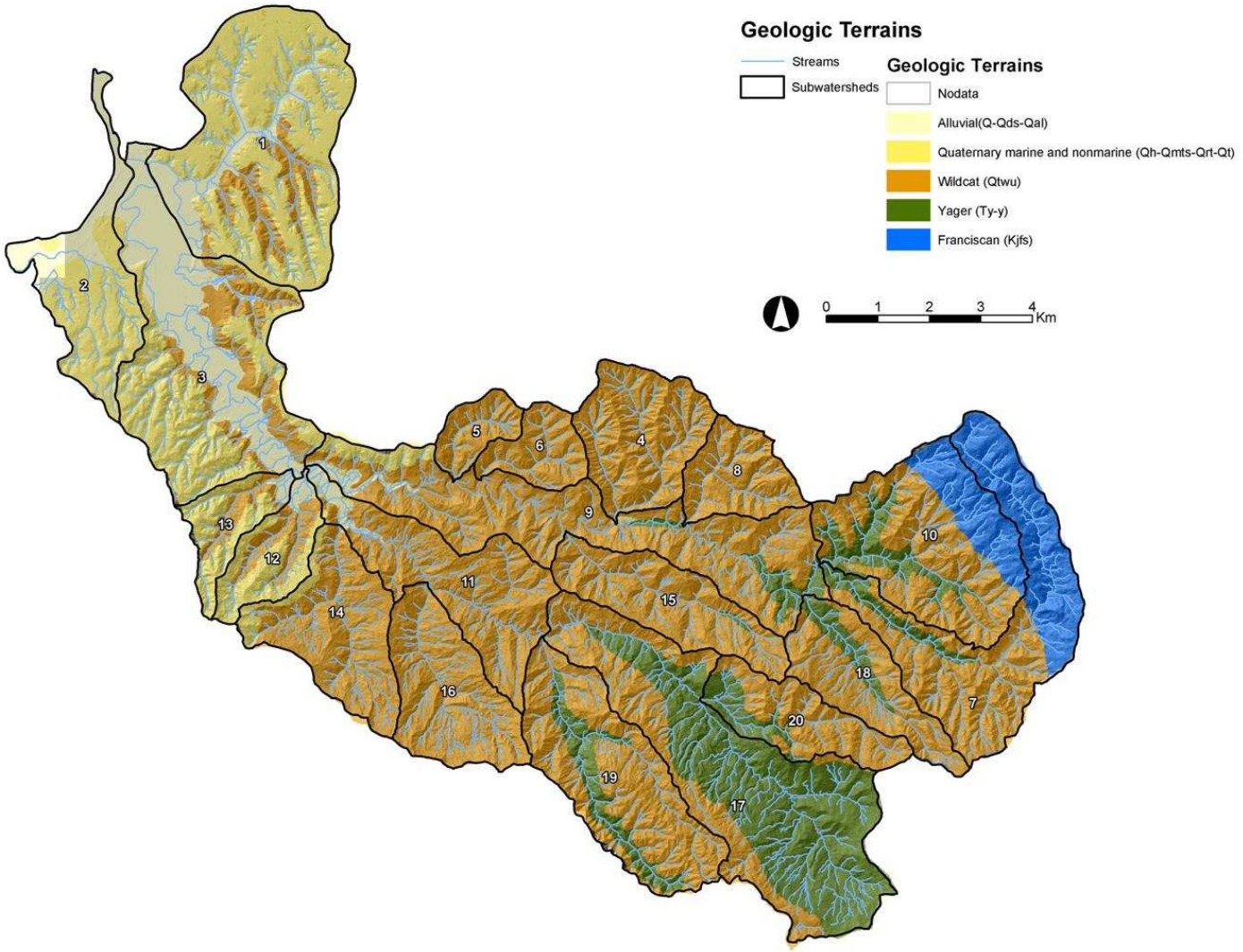

Figure 1.6. Geologic Formations in the Elk River watershed as mapped by McLaughlin at al. (2000) and Marshall and Mendes (2005) and modified by Stillwater Sciences (2007) as part of the Elk River TMDL analyses.

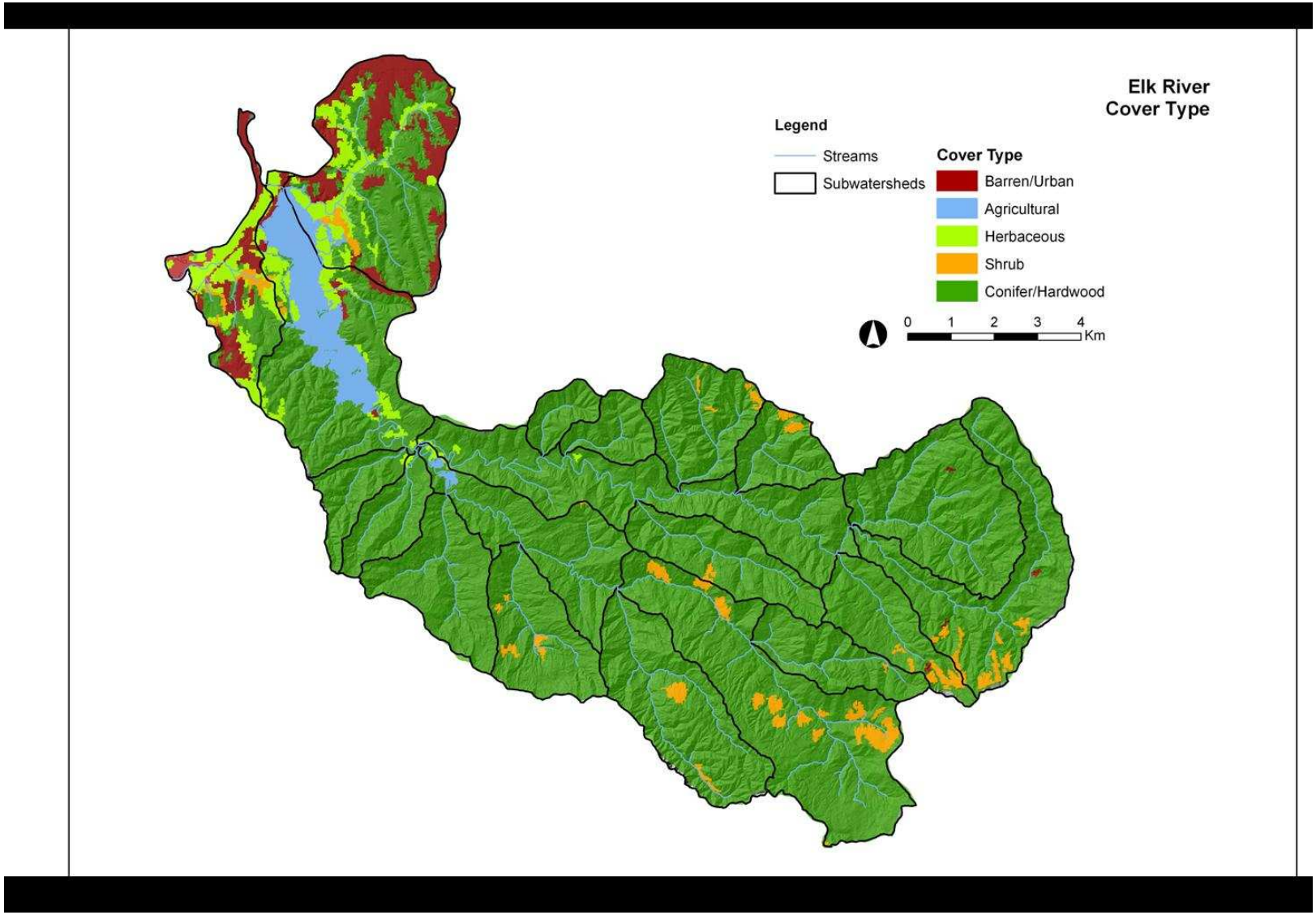

Figure 1.7 Vegetation cover type in the Elk River watershed (modified from CDF-LCMMP vegetation mapping).

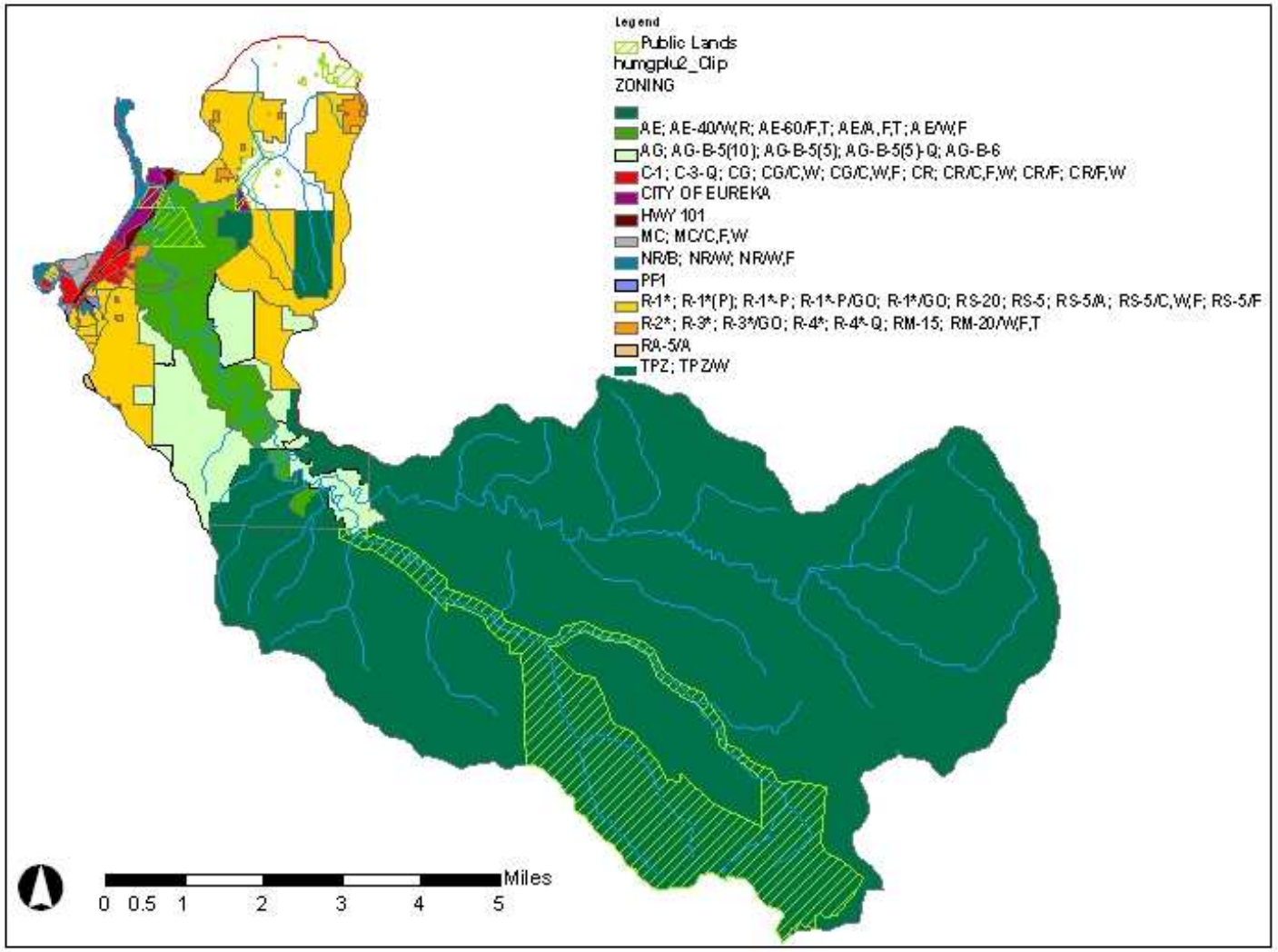

Figure 1.8 Landuse Zoning in the Elk River watershed (data based on Humboldt County General Plan Update Zoning).

Lower Elk River

Wiyot people, the original inhabitants of the Humboldt Bay watershed, call the Elk River area *Iksori* (NRCS, 2001). Their ancestors once lived in *Iksori* in redwood plank homes and traveled Elk River and Humboldt Bay in redwood dug-out canoes. Fresh food such as crabs, clams, eel, salmon and shellfish were gathered from the estuary and bay. In 1850, a Wiyot village was recorded on the sand spit at the mouth of Elk River. A Wiyot camp was located next to the old Elk River school house on the Mainstem Elk River, where they caught and dried salmon. Wiyot people navigated by canoe up Elk River on their way to Kneeland Prairie. (HBWAC 2005).

Elk River was settled by Europeans in the late 1800s. Soon afterwards, the lowlands were cleared of timber for pastures. The lands along Elk River Road, from the edge of Eureka to the northwest just upstream of the confluence of North and South Forks, are in residential landuse. Humboldt Hill is primarily residential, and the County expects that it will become further developed.

The Elk River Wildlife Sanctuary comprises 294.6 acres at the mouth of the Elk River, includes the City of Eureka's wastewater treatment facility, and serves for outdoor recreation as well as wildlife area. The Wildlife Sanctuary is managed through a partnership between California Department of Fish and Game (CDFG) and the City of Eureka. Additionally, just upstream, CDFG owns and manages the 104-acre Elk River Wildlife Area.

Martin Slough

Ridgewood Heights is a major residential area in the Elk River watershed, characterized by both urban and rural land uses. According to the Humboldt County General Plan update, currently underway, the Martin Slough subwatershed is to be the focus of growth for the City of Eureka, potentially growing by up to 8,000 new residences. According to CDFG (2008) Martin Slough currently has 10% impervious area.

North Fork and South Fork Elk River

The upper watershed was recognized early on for its valuable redwood. The town of Falk, settled in 1884 on South Fork Elk River at the mouth of McCloud Creek, was a logging mill town and the center of activity for logging in the South Fork Elk River for nearly 50 years. The mills and the town of Falk were dismantled and removed by the early 1970s by the landowner, Sierra Pacific Industries. There was at least one small mill and several lumber camps along the North Fork Elk River. Historic articles indicate that the predominant means of transporting timber was via the river through the use of splash dams (HBWAC 2005). Figure 1.9 demonstrates the location and timing of the first entrance for timber harvest activities in the North and South Fork Elk River drainages. Generally, South Fork Elk River was harvested prior to North Fork.

On the North Fork Elk River, the railroad went past the South Branch on the North Fork and up Dunlap and Browns Gulches. On the South Fork Elk River, lines went all the way to the Little South Fork (HBWAC 2005). Timber in the Upper South Fork of the Elk River was accessed by railroad above the mill at Falk, requiring nearly a dozen large wooden trestles (Gates 1983; HBWAC 2005). Remnants of the railroad system remain in the watershed in the form of trestles and fills.

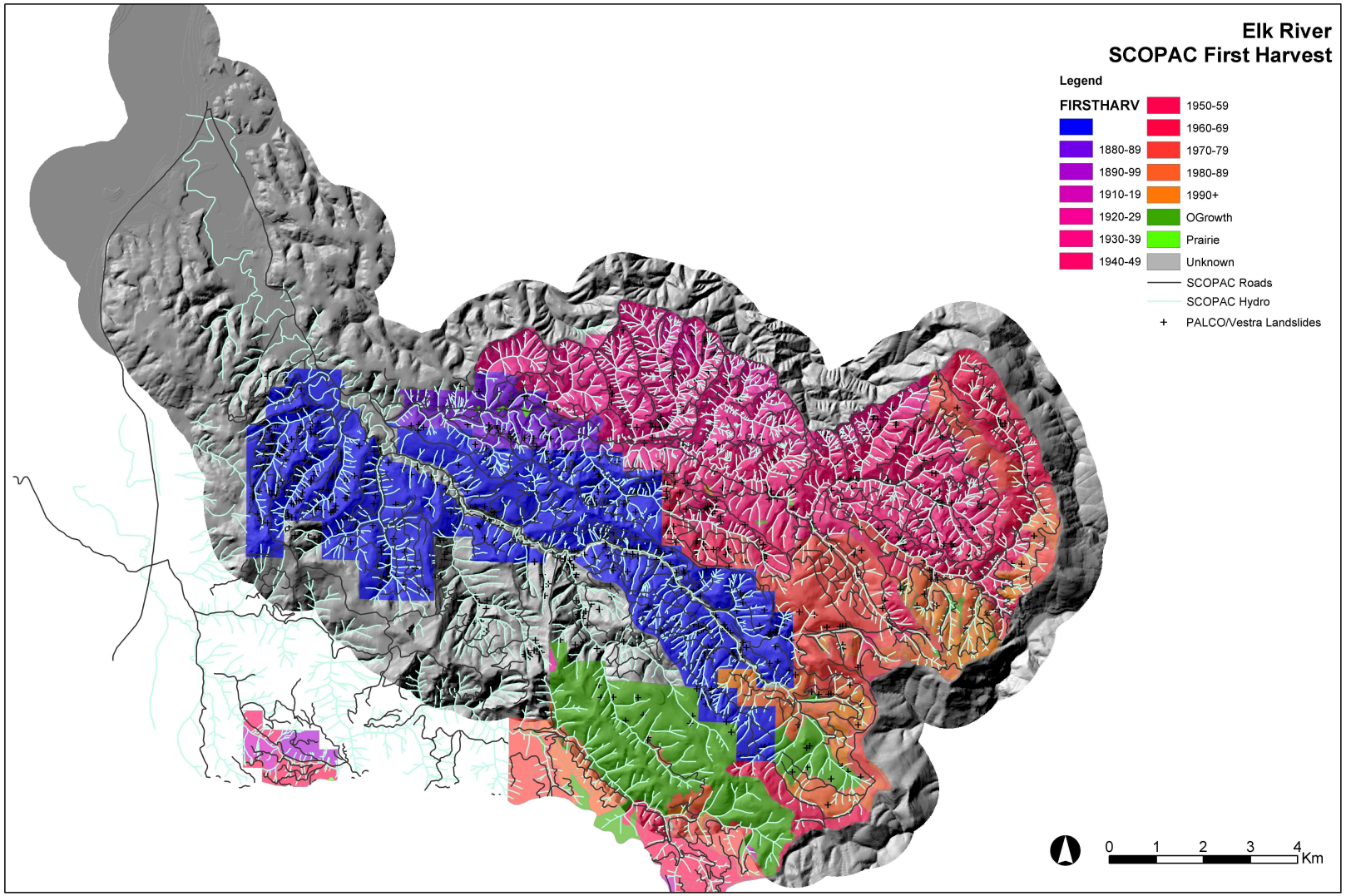

Figure 1.9 Approximate time period of first harvest entries into the North Fork and South Fork Elk River drainages (data from Palco).

By the 1970's, the primary timberland owners in North and South Fork Elk River were as follows:

- Pacific Lumber Company owned approximately 98 percent of North Fork Elk River, and approximately 14 percent of the South Fork (upper South Fork Elk River and upper Little South Fork Elk River).
- Elk River Timber Company, owned by Sierra Pacific Industries, owned approximately 65 percent of the South Fork (the lower Little South Fork Elk River and the lower South Fork Elk River), and the mainstem tributaries Clapp Gulch and Railroad Gulch.
- Simpson Timber Company owned approximately 15 percent of the South Fork Elk River watershed (McCloud Creek).

In 1972, the Z'berg/Nejedly Forest Practice Act was passed by the California legislature. This act provided the first real regulation of forest harvest practices in California, including some level of protection for some streams and riparian areas.

In 1986, the Pacific Lumber Company, the dominant timber landowner in the watershed was taken over by the Maxxam Corporation. Maxxam then split the Pacific Lumber Company into three companies: The Pacific Lumber Company, Scotia Pacific Corporation, and Salmon Creek Corporation (collectively referred to as Palco). The new owner accelerated the harvest rate, including harvesting of old-growth redwood trees. Numerous Forest Practice Act and Basin Plan violations occurred. Coincident with this period of accelerated harvesting, the Regional Water Board began receiving complaints from residents living in the Elk River watershed that the water quality and beneficial uses of Elk River were being degraded and the magnitude and frequency of flooding had increased. Figure 1.10 demonstrates the annual average harvest rate in North Fork Elk River for aerial photo periods available since 1954 through 1997.

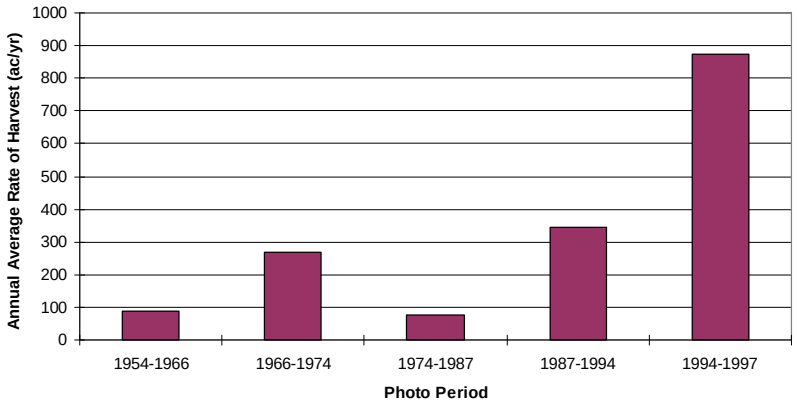

Figure 1.10 Annual average harvest rate in North Fork Elk River for different available aerial photo periods.

In response to intense public outcry and in an effort to protect endangered species and some of the last remaining privately-owned old-growth redwood groves in the world, the Headwaters Agreement was made. Under the Headwaters Agreement, lands lands in the South Fork Elk River watershed and the Salmon Creek watershed (adjacent watershed to the south) were purchased by the state and federal governments from Maxxam and transferred into public ownership and management by BLM. Further, the

Headwaters Agreement purchased all lands owned by Elk River Timber Company, a subsidiary of Sierra Pacific Industries, and transferred the majority of those lands to Maxxam as partial payment, with 1,845 acres transferred to the public to act as a buffer for the newly formed Headwaters Forest Reserve. Figure 1.11 shows the industrial timberland ownership and the location of the Headwaters Forest Reserve, depicted as BLM ownership on this map.

As a result of the Headwaters Deal, the Headwaters Forest Reserve was created and Palco and the state[5] and federal[6] governments signed a Habitat Conservation Plan (HCP) and Sustained Yield Plan (SYP) that described future timber management for endangered species protection and sustainable forestry on the Palco lands, including those in Elk River. The HCP is an incidental take permit for endangered species (as long as the provisions of the HCP are implemented, the take of an endangered species is incidental to that otherwise legal activity). It does not cover all beneficial uses of water but does address some aquatic species. The SYP projected decadal timber harvest over the 50-year life of the HCP permit.

The creation of the Headwaters Forest Reserve and the signing of the Palco HCP/SYP in 1999 did not resolve public concern over timber harvest operations nor did it resolve water quality issues in the Elk River watershed. California Department of Forestry and Fire Protection (formerly CDF now known as CalFire) imposed a moratorium on new THP approvals in Elk River in 1999 pending submission of specific watershed information. However, in 2001, Calfire began approving timber harvest plans even though not all information had been submitted. Timber harvest rates remained elevated over historical rates (Figure 1.12 and 1.13). Records indicate a marked increase in harvest using clearcut silviculture in North Fork Elk River and South Fork Elk River since 1994. Figure 1.14 shows the location of the timber harvest plans since 1986, the first available year of electronic records of harvesting.

On January 18, 2007, Palco filed for Chapter 11 bankruptcy. On July 8, 2008, the bankruptcy court issued its Judgment and Order confirming a reorganization plan proposed by Marathon Bank Structured Finance Fund L.P. (Marathon) and Mendocino Redwood Company, LLC (MRC). Among other components, this plan consolidated the Scotia sawmill and approximately 210,000 acres of commercial timberlands operations in Humboldt County to be managed by a new company, Humboldt Redwood Company, LLC, consistent with the forestry practices demonstrated by MRC in Mendocino County. On July 30, 2008, MRC/Marathon took legal possession of the timberlands and mill, and renamed the new timber company Humboldt Redwood Company, LLC (HRC).

[5] California Department of Forestry and Fire Protection and California Department of Fish and Game
[6] National Oceanic and Atmospheric Administration and US Fish and Wildlife Service

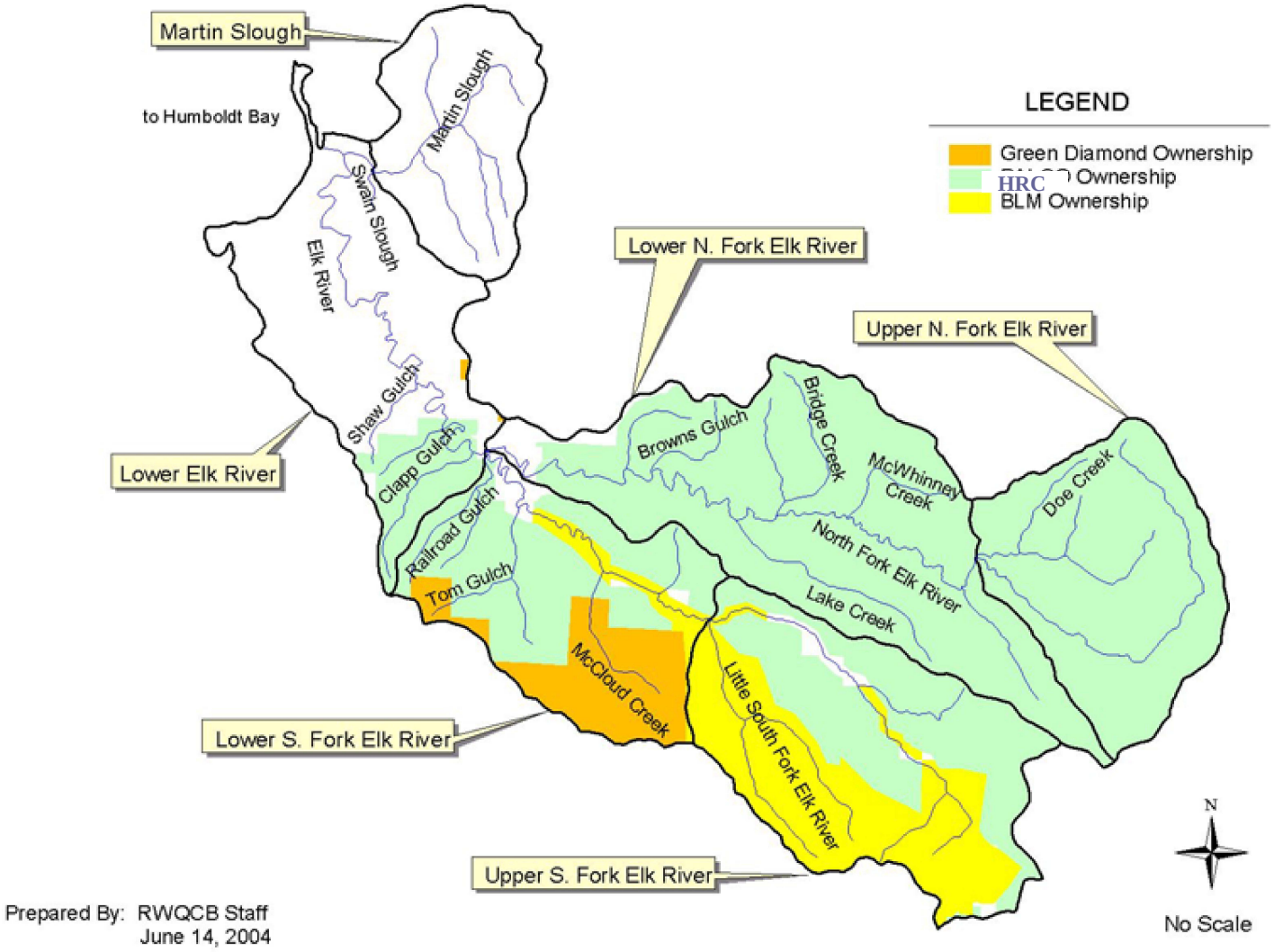

Figure 1.11 Industrial timber and BLM ownership in the Elk River watershed.

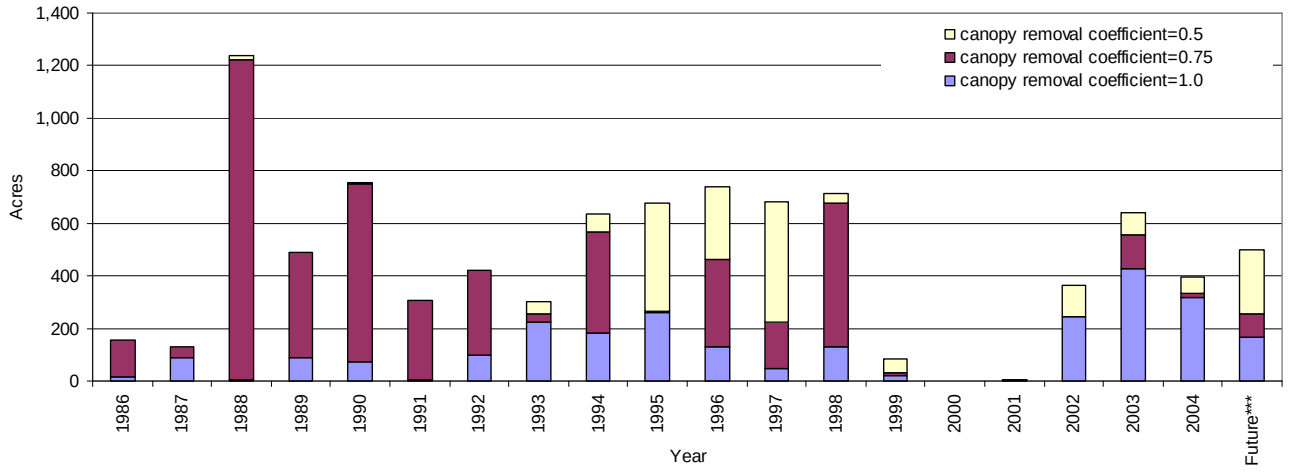

Figure 1.12 Annual harvest acreage for North Fork Elk River (all ownerships) as expressed in clear-cut equivalent acres (canopy removal coefficient of 1.0 for clear cutting, 0.75 for intermediate steps, and 0.5 for selection and commercial thin).

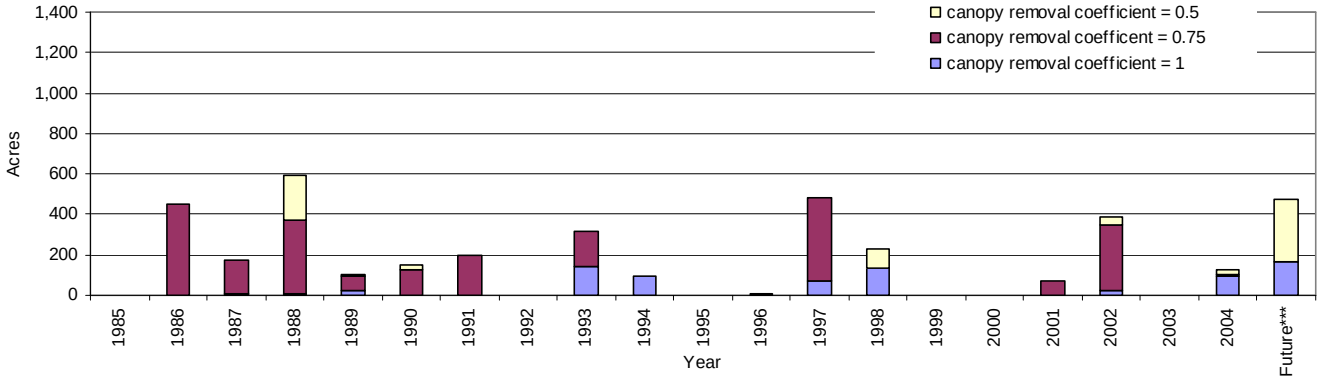

Figure 1.13 Annual harvest acreage for South Fork Elk River (all ownerships) as expressed in clear-cut equivalent acres (canopy removal coefficient of 1.0 for clear cutting, 0.75 for intermediate steps, and 0.5 for selection and commercial thin).

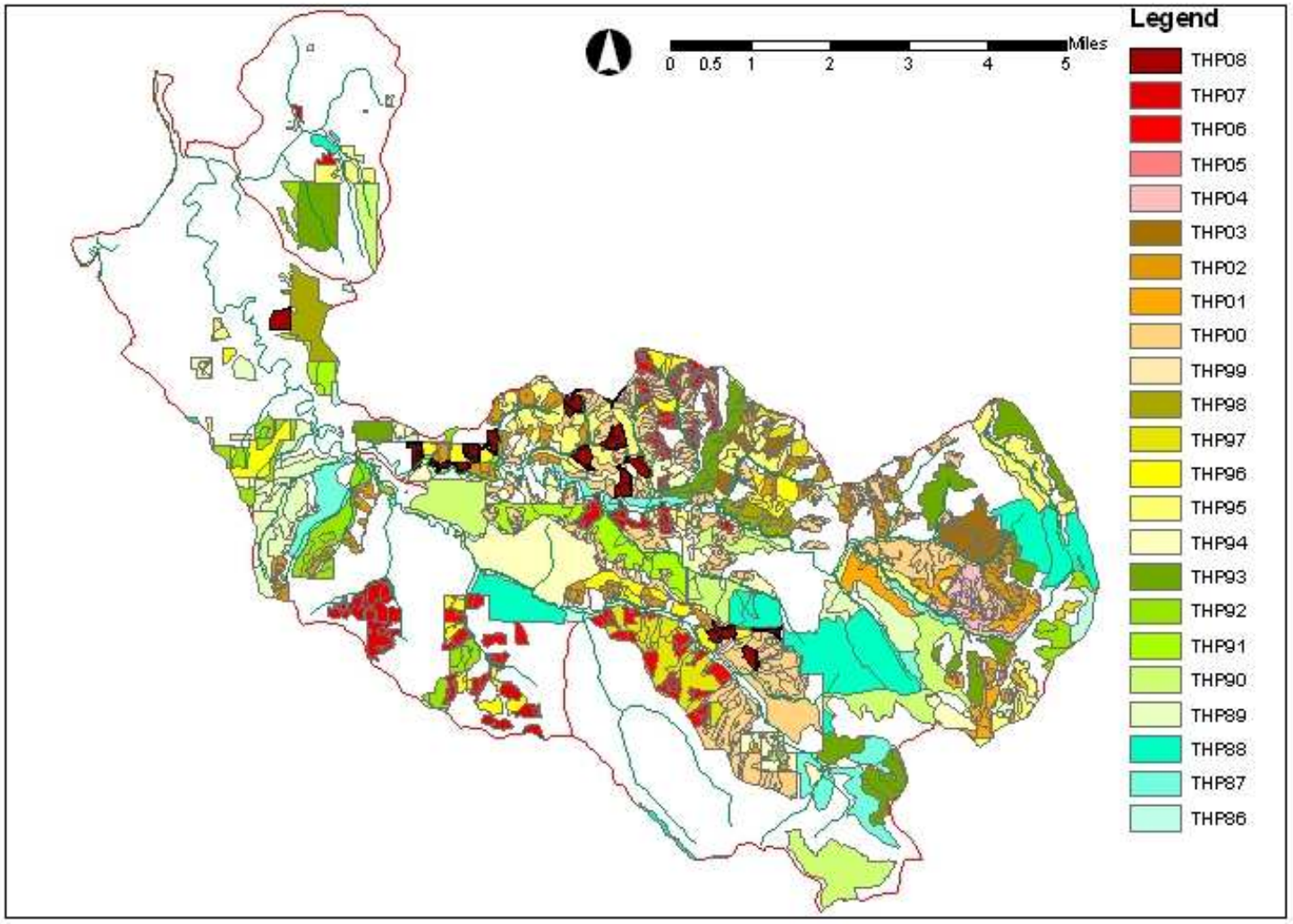

Figure 1.14 Location of timber harvest plan activities in the Elk River watershed since 1986 (based on CDF data).

1.5 History of Regional Water Board Regulatory and Non Regulatory Actions

As described in the previous section, timber harvest operations in the Elk River watershed were significantly accelerated in 1986. Subsequent winter storms between 1995 and 1998 triggered discharge of landslide-generated sediment (discussed further in Chapter 3: Source and Linkage Analysis of the Staff Report). Complaints from Elk River residents, verified by Regional Water Board staff field inspections, identified these discharges as coinciding with channel filling, degraded beneficial uses, and increased frequency and magnitude of flooding. Increased extent and frequency of flooding has affected residents along the Elk River Valley and upstream of the confluence of North Fork and South Fork. Ingress and egress to residences on Humboldt Hill is restricted during flood events due to flooded roadways.

Due to water quality and beneficial use impairments, discussed in Chapter 2 of this Staff Report, the Regional Water Board Executive Officer, and staff have taken a variety of regulatory and non-regulatory actions in Elk River to protect and restore beneficial uses of water. Appendix C contains greater detail of the proceedings that took place between 1997 and 2006.Following an intensive period of petitions, hearings, investigations, and analyses between 1997 and 2006, the Regional Water Board then undertook a series of actions including the inclusion of Elk River on the 303(d) List, the issuance of Cleanup and Abatement Orders and Monitoring and Reporting Programs (MRPs), undertaking TMDL development, and the development and adoption of watershed-wide Waste Discharge Requirements (WDRs) for timberland owners in Elk River.

The Cleanup and Abatement Orders (CAOs)[7] provide a valuable foundation for the sediment source inventory necessary to conduct the source assessment as described in Chapter 3. Further, under the CAOs, Regional Water Board and Palco staff developed a site prioritization scheme, treatment schedule, and monitoring program. This program has served as early TMDL implementation to reduce sediment loads. .

On May 8, 2006, after a long period of development and input from representatives of the public, agencies, and landowners, the Regional Water Board adopted Order No. R1-2006-0039, *Watershed-wide WDRs (WWDRs) for lands owned by Pacific Lumber*

[7] December 17, 2002, Cleanup and Abatement Order No. R1-2002-0114 for Scotia Pacific Holding Company, The Pacific Lumber Company, North Fork Elk River (requires identification, prioritization, and cleanup of controllable sediment source sites identified in 1998 sediment source inventory);
April 2, 2004, Cleanup and Abatement Order No. R1-2004-0028 for Scotia Pacific Holding Company, The Pacific Lumber Company, South Fork and Mainstem Elk River (requires identification, prioritization, and cleanup of controllable sediment source sites)
May 5, 2006, Cleanup and Abatement Order No. R1-2006-0055 for Scotia Pacific Holding Company, The Pacific Lumber Company, North Fork Elk River (requires identification, prioritization, and cleanup of controllable sediment source sites; replaces Order No. R1-2002-0114).

Company in Elk River. The WWDRs set harvest rate limitations based on ensuring that: a) harvest-related landslides did not create landslide discharges that would, in total, exceed 125 percent of background landslide rates, and b) that peak flows resulting from canopy removal did not exceed a nuisance threshold defined by floodwaters limiting access and egress at one location on North Fork Elk River where the management induced increase in peak flows could easily be quantified and linked to flooding over a public roadway. A MRP associated with these WWDRs requires Palco to continue monitoring turbidity, suspended sediment, and stream flow throughout the basin, as well as maintain an updated landslide inventory and monitor stream channel conditions.

Additionally, on August 8, 2006 the Regional Water Board adopted WWDRs for Green Diamond Resource Company's timber harvesting operations in the South Fork Elk River watershed (Order No. R1-2006-0043). This Order incorporated elements of the process used in the Palco CAOs for identification, scheduling, treatment, and monitoring of sediment discharge sites. An MRP was issued in concert, requiring similar monitoring to that by Palco. The development of consistent approaches to redressing sediment sources, including monitoring protocols, across the Elk River watershed is resulting in a robust data set that will be extremely useful in making management decisions and documenting compliance with the TMDL.

On September 11, 2008, following the transfer of Palco assets to HRC, the Regional Water Board adopted Order No. R1-2008-0100. This Order transferred all of the standing Regional Water Board Orders from Palco to HRC.

1.6 Watershed Monitoring Efforts

Over the past decade, various groups have been conducting monitoring in the Elk River watershed (Figure 1.15). A brief summary of watershed monitoring efforts follows.

Palco began trend monitoring under order of the Regional Water Board in 1997[8]. The trends network was then expanded in purpose to satisfy the requirements of the Palco HCP. In 2002, Palco began installation of turbidity, suspended sediment, and streamflow monitoring stations under Order of the State Water Board[9]. The monitoring network was expanded again in 2003 to more comprehensively measure suspended sediment in the watershed. Initially, this was under Order of the Regional Water Board[10] however, after that

[8] October 8, 1998, Letter requiring technical and monitoring program reports, pursuant to California Water Code section 13267(b) (describes association between harvesting and landslides and requires monitoring in Bear Creek and North Fork Elk River)

[9] October 18, 2001, State Water Board issued Order # WQ 2001-14 for the Pacific Lumber Company, Scotia Pacific Company LLC, and Salmon Creek Corporation, Elk River (for stage, streamflow, turbidity, and suspended sediment water quality data and visual observations to evaluate the impacts to water quality from THP 1-97-520 HUM located in South Fork Elk River)

[10] August 15, 2002, Regional Water Board executive officer issued California Water Code section 13267(b) Monitoring and Reporting Program: Order Requiring Technical Information Monitoring and

Order expired, Palco voluntary continued the monitoring with modifications.

Salmon Forever began collection of suspended sediment and turbidity grab samples and stream discharge measurements in Elk River in 1999. In 2003, they installed turbidity threshold sampling (TTS) stations and began continuous data collections in lower North Fork and lower South Fork Elk River. Salmon Forever also established stream cross-sections associated with these stations. The Salmon Forever monitoring efforts have largely utilized trained volunteers. In 2004, Redwood Community Action Agency (RCAA) received a Proposition 13 grant from the State Water Board[11] that helped to support the monitoring efforts. In 2007, RCAA received a second State Water Board grant, funded by Proposition 50, that further supported Salmon Forever's monitoring and data processing efforts[12].

Green Diamond Resources Company (formerly Simpson Resource Company) installed a TTS station in McCloud Creek under a cooperative agreement with the Regional Water Board[13]; it was operated for hydrologic year (HY) 2003. In HY 2006, Green Diamond Resources Company reinstalled the monitoring station under Order by the Regional Water Board[14].

In addition, void monitoring associated with excavation work to treat controllable sediment discharge sites is conducted by Palco, Green Diamond Resources Company, and Bureau of Land Management. Void monitoring quantifies the volume of sediment discharged following excavation during replacement and decommissioning of sediment source site (e.g. road and skid trail stream crossings.)

Much of the TMDL analyses are dependent on the monitoring data generated by the hard work of these various dedicated groups.

Reporting Program No. R1-2002-0088 for the Pacific Lumber Company, Scotia Pacific Company LLC, and Salmon Creek Corporation, Elk River (for stage, streamflow, turbidity, and suspended sediment water quality data to support TMDL development).

[11] SWRCB Agreement Number 03-212-551-0: Humboldt Bay Water Quality Improvement Program: Water Quality Monitoring and NPS Pollution Education. The term of the agreement was June 1, 2004-March 31, 2006.

[12] SWRCB Agreement Number Humboldt Bay Watershed Sediment Reduction, Monitoring and Salmon Habitat Implementation Program (Agreement No. 06-289-551-0). The term of the agreement is July 2007-March 2010.

[13] Cooperative Agreement. September 24, 2002. Monitoring and reporting Program for Simpson Resource Company, Elk River, Humboldt County.

[14] Regional Water Board issued Monitoring and Reporting Program No. R1-2006-0043 For Timber Harvesting Plan Activities Conducted By, Or On Land Owned By The Green Diamond Resource Company in the South Fork Elk River Watershed.

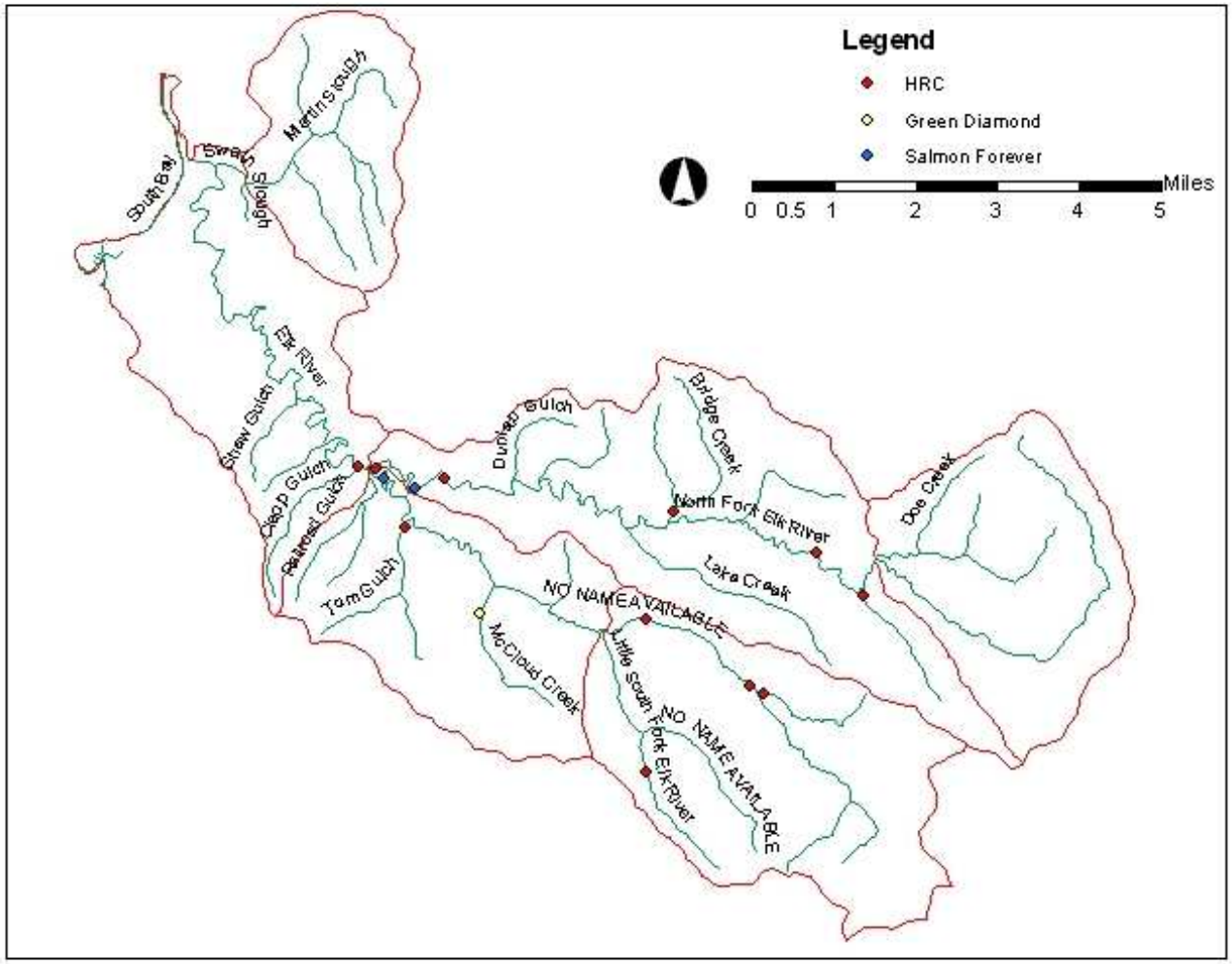

Figure 1.15 Instream monitoring station locations in the Elk River watershed.

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