1 Water Resources

This chapter presents Humboldt County's water resources, including rivers (and their watersheds) and groundwater. This chapter is divided into sections on watersheds and surface water, groundwater, stormwater, the regulatory framework, and policy issues.

1.1 WATERSHEDS AND SURFACE WATER

A watershed is an area of land within which all rain and snowfall drains or seeps into a particular stream, water body, or aquifer. Ten of Humboldt County's 12 planning watersheds each drain to a single stream or river, all of which either drain directly to the Pacific Ocean or to another river that empties into the Pacific. Eureka Plain and Trinidad are drained by many smaller streams, which terminate in Humboldt Bay or the Pacific Ocean, respectively. Watershed mapping allows for the environment to be studied along its natural lines of division, particularly in the case of water, biological, forest, agricultural, and even some cultural resources.

LOCAL WATER BASINS

Humboldt County is part of the Klamath-North Coast Hydrologic Basin Planning Area, which includes all basins draining into the Pacific Ocean from the Oregon border southerly through the Russian River Basin. The County's 12 planning watersheds, covering between 73,000 and 333,000 acres each (see Table 1-1), are displayed in Figure 1-1. These can be grouped into four larger basins: Klamath-Trinity, Mad-Redwood, Eel, and Mattole.

Table 1-1: Humboldt County Planning Watershed Areas

Watershed	*Basin*	*Total Acres within County*	*Total Acres*
Lower Klamath	Klamath-Trinity	332,787	493,453
Lower Trinity	Klamath-Trinity	192,286	654,967
South Fork Trinity	Klamath-Trinity	73,205	596,497
Redwood Creek	Mad-Redwood	187,788	187,819
Trinidad	Mad-Redwood	83,684	83,684
Mad River	Mad-Redwood	221,337	322,143
Eureka Plain	Mad-Redwood	124,617	124,617
Van Duzen	Eel	234,899	274,083
Lower Eel	Eel	191,052	191,052
Middle Main Eel	Eel	138,509	333,345
South Fork Eel	Eel	200,395	441,213
Cape Mendocino	Mattole	311,774	319,628
Total		**2,292,332**	**4,039,132**

Source: Humboldt County GIS, 2002.

River run-off, or the amount of water discharged through surface streams, is determined by a combination of factors, including local geology, topography, drainage area, and rainfall patterns. The hydraulic basins in Humboldt County, like most of Northern Coastal California, provide large surface water volumes (30 percent of the runoff in the entire State of California), 80 percent of which is deposited between November and March. Flooding is covered in Chapter 11 of this document.

The current Humboldt County Framework Plan, adopted in 1984, notes that the County's water quality is "relatively high." The Framework Plan also states that advances in sewage treatment plant technology coupled with the Federal Clean Water Grant Program (which has since been phased out in favor of state-based programs) had, by the Plan's writing, substantially reduced riverine and bay pollution problems from previous levels.

The state and Federal wild and scenic rivers programs and total maximum daily load designations are today the strongest measures being taken toward waterway protection and rehabilitation, respectively.

WILD, SCENIC, AND RECREATIONAL RIVERS

Subject to a declaration that rivers with "extraordinary scenic, recreational, fishery, or wildlife values" should be preserved in their free-flowing state as the "highest and most beneficial use,"[1] the California State Legislature created a California Wild and Scenic Rivers System in 1972, now administered by the California Resources Agency. While the U.S. Congress had created a national system designating the same rivers in 1968, the California system is intended to enhance local coordination of riparian management.

Under the California system, rivers were classified as wild, scenic, or recreational, according to the following criteria as stated in the California Public Resources Code § 5093.53:

- Wild rivers are those "free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted."
- Scenic rivers are those "free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads."
- Recreational rivers are those "readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past."

Sections of rivers in the Klamath-Trinity and Eel River basins were classified as wild, scenic, or recreational by the California State Legislature, as summarized in Table 1-2 and illustrated in Figure 1-2.

[1]California Public Resources Code § 5093.50.

Figure 1-1: Humboldt County Watersheds and Major Streams

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Table 1-2: Wild, Scenic, and Recreational Rivers of Humboldt County

River	*Section*	*Designations*
Klamath River, Mainstem	From 100 yards below Iron Gate Dam to the Pacific Ocean	Recreational
Trinity River, Mainstem	From 100 yards below Lewiston Dam to the river mouth at Weitchpec	Scenic, Recreational
Trinity River, South Fork	From the junction of the river with State Highway Route 36 to the river mouth near Salyer	Wild, Scenic
Eel River, Mainstem	From 100 yards below Van Arsdale Dam to the Pacific Ocean	Wild, Scenic, Recreational
Eel River, South Fork	From the mouth of Section Four Creek near Branscomb to the river mouth below Weott	Wild, Recreational
Eel River, Middle Fork	From the intersection of the river with the southern boundary of the Middle Eel-Yolla Bolly Wilderness Area to the river mouth at Dos Rios	Wild, Scenic, Recreational
Van Duzen River	From Dinsmores Bridge downstream to the river mouth near Fortuna	Scenic, Recreational

Source: California Public Resources Code § 5093.545.

TOTAL MAXIMUM DAILY LOAD (TMDL) DESIGNATIONS

TMDL Studies are pollution control plans drafted by the US Environmental Protection Agency (EPA) to meet the requirements of Section 303(d) of the Federal Clean Water Act. The TMDL serves as the means to attain and maintain water quality standards for impaired water bodies. In Humboldt County, TMDLs are most often applied because of pollution related to sedimentation and siltation, whereas in most other regions of the state they are necessary to control chemicals and nutrient imbalances (see Table 1-3).

Current Designations

Under Section 303(d) of the Federal Clean Water Act, California is required to develop a list of water bodies where industrial and technological waste limits or other legally required mechanisms for pollution control are not sufficient or stringent enough to meet water quality standards applicable to such waters. In such cases, the water body is deemed "impaired."

Placement of a water body on the 303(d) List requires the development of a pollution control plan, called a Total Maximum Daily Load (TMDL), for each water body and associated pollutant or stressor[2] on the list. The TMDL serves as the means to attain and maintain water quality standards for the impaired water body. The Van Duzen River in Humboldt County was an EPA TMDL pilot area.

[2] A stressor is a nonpollutant factor that negatively affects riverine ecology, such as excessive sedimentation, high temperatures, or low levels of dissolved oxygen.

Table 1-3: Total Maximum Daily Load (TMDL) Designations in Humboldt County

Water Body	*Basin*	*Stressor Requiring TMDL*	*Size Affected*	*Priority*
South Fork Trinity	Klamath-Trinity	Sedimentation/Siltation, Temperature	80 miles	Low
Trinity River	Klamath-Trinity	Sedimentation/Siltation	170 miles	Medium
Klamath River	Klamath-Trinity	Nutrients, Organic Enrichment/Low Dissolved Oxygen, Temperature	190 miles	Medium
Mattole	Mattole	Sedimentation/Siltation, Temperature	56 miles	Medium
Redwood Creek	Mad-Redwood	Sedimentation/Siltation	63 miles	Low
Mad River	Mad-Redwood	Sedimentation/Siltation, Turbidity	90 miles	Low
Freshwater Creek	Mad-Redwood	Sedimentation/Siltation	72.7 miles	Medium
Elk River	Mad-Redwood	Sedimentation/Siltation	87.5 miles	Medium
Eel River Delta	Eel	Sedimentation/Siltation, Temperature	6,350 acres	Low
South Fork Eel River	Eel	Sedimentation/Siltation, Temperature	85miles	Low
Middle Main Fork Eel River	Eel	Sedimentation/Siltation, Temperature	1,075 miles	Low
Van Duzen	Eel	Sedimentation/Siltation	63 miles	Low

Source: 1998 California 303(d) List and TMDL Priority Schedule.

The most recent 303(d) List was published in 1998. A revision process is currently underway and a new list will be published later in 2002.

A water body may be listed once any of the following criteria are met:

- Pollution control requirements are not stringent enough to assure protection of beneficial uses (such as drinking, recreation, aquatic life, and irrigation),
- There is a fishing, drinking water, or swimming advisory currently in effect,
- Beneficial uses are impaired or are expected to be impaired within the listing cycle,
- The water body is on the previous 303(d) List and has not improved,
- Concentrations of pathogens in consumable body parts of fish or shellfish exceed applicable guidelines, or
- Overall water quality is of such concern that the Regional Water Board determines the need for 303(d) Listing.

Figure 1-2 shows TMDL priorities, as determined by the State Water Resources Control Board, generalized by watershed.

Figure 1-2: Wild and Scenic Rivers and TMDL Priorities by Watershed

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Recommended New Designations

Updates to the 303(d) List include adding or removing waters and indicating priorities and schedules for developing TMDLs. The North Coast Region Water Quality Control Board states that "ideally, this process should involve review of information such as monitoring data, scientific literature, or resource management agency files that document water quality conditions and trends" in accordance with the US EPA's inclusionary directive, and in 2001 submitted a list of recommended updates for the 2002 revision to the North Coast 303(d) List (see Table 1-4).

Table 1-4: Recommended Updates to 303(d) List in Humboldt County

Water Body	*Basin*	*Potential Action*	*TMDL Category*
Jacoby Creek	Mad-Redwood	Add to List	Sediment
Mad River	Mad-Redwood	Add to List	Temperature
Redwood Creek	Mad-Redwood	Add to List	Temperature
Humboldt Bay	Mad-Redwood	Add to Watch List	Sediment, PCBs and Dieldrin
Mad River Slough	Mad-Redwood	Add to Watch List	PCBs
Klamath River	Klamath-Trinity	Add to Watch List	Sediment

Source: North Coast Region Water Quality Control Board, 2001.

A water body and pollutant combination will be recommended for a Watch List if information regarding water quality impairment is ambiguous or insufficient. This action does not require the development of a TMDL, but does highlight the need to obtain information for determining the condition of a water body prior to future 303(d) List updates.

Evidence that watershed conditions are declining in at least some areas can be found in the 303(d) List update recommendations: while three rivers in Humboldt County are recommended for new listings and three more are recommended for placement on watch lists, there is no mention of de-listing any Humboldt County waterways. All that is necessary for a water body to be de-listed is demonstration that objectives are being met and beneficial uses are not impaired; objectives are revised; or control measures are put in place resulting in protection of beneficial uses.

SURFACE WATER DISTRIBUTION

Four water districts serve Humboldt County: Alderpoint County, Hydesville County, Jacoby Creek County, and Humboldt Bay Municipal Water Districts. The largest of the water suppliers is Humboldt Bay Municipal Water District (HBMWD) serving the greater Humboldt Bay Area, including Eureka, Arcata, and Blue Lake as well as community service districts serving the unincorporated areas of McKinleyville, Cutten, Fairhaven, Fieldbrook, and Manila. HBMWD serves about 65,000 people a day and can deliver up to 20 million gallons daily. The rest of the county's unincorporated areas are served by community service districts. The water for the systems comes from rivers and wells.

1.2 LOCAL PLANNING WATERSHED FEATURES

This section provides an inventory of Humboldt County's planning watersheds. Each is described in terms of the rivers and streams that characterize it; its size (acreage of land drained) and the main waterway's volume of flow; the locations of the headwaters and discharge point, where applicable; the type and volume of sediment runoff; any problems (natural or human-induced) affecting the watershed's flow, ability to support anadromous fish, or water quality; the dominant land cover or vegetation in the area; overall water quality; and anadromous fish present in local waterways. (Chapter 2: Biological Resources examines vegetative covers and special status species in each planning watershed; further detail of each planning watershed is provided in Volume II of this report.)

Sedimentation and temperature are the chief watershed management issues in Humboldt County; the following is a brief description of their importance.

- Sedimentation is a natural process but can be greatly accelerated by land use activities which modify drainage patterns or remove vegetative cover in highly erosive areas. Increased erosion and sedimentation may alter runoff characteristics and destroy aquatic and terrestrial wildlife habitat. Stream sedimentation from various activities limits coldwater aquatic uses—including the migration, spawning, reproduction, and development of cold water fish—and contributes to flooding.
- Temperature is such an important requirement of fish that coho and chinook salmon, and steelhead are known as "cold water fish." Many physiological processes of salmon are affected by temperature including metabolism, food requirements, growth rates, developmental rates of embryos and young, timing of life-cycles such as adult migration, emergence from gravel nests, proper life stage development and sensitivity to disease. In general, the types of effects are usually divided into lethal and sublethal effects. These effects are relevant for all the life stages of salmon.

KLAMATH-TRINITY BASIN

The Klamath-Trinity Basin includes the Lower Klamath, Lower Trinity, and South Fork Trinity planning watersheds, and covers the northeastern quarter of Humboldt County. A large portion of this area is under the jurisdiction of the Six Rivers National Forest and the Hoopa Indian Reservation.

LOWER KLAMATH PLANNING WATERSHED

The Klamath is California's second largest river, draining a watershed of approximately 979,816 acres in three counties. The Lower Klamath River planning watershed, draining 332,787 acres in Humboldt County, has 1,832 miles of waterways, all but 53 miles of which are naturally occurring. Records indicate that flows have ranged from 7,432 cubic feet per second (cfs) to 39,830 cfs.

The Lower Klamath planning watershed encompasses that portion of the Klamath River and its tributary watershed downstream from the Scott River to the Pacific Ocean (excluding the

Trinity River), and is 2,564 square miles in area. Included in the watershed are the Salmon River, Blue Creek, numerous smaller perennial streams, and the Klamath River delta/estuary. The area is largely rugged, steep forest land with highly erodible soils. The population of the area is small and scattered. Its discharge point in is Del Norte County near the town of Klamath, approximately 10 miles north of the Humboldt County border.

Rivers and Streams

The Klamath River is the main waterway in the Lower Klamath planning watershed, which covers northernmost Humboldt County; its main tributaries are the Shasta, Scott, Salmon, and Trinity Rivers. Numerous other, smaller tributaries enter the Lower Klamath River along its entire length. The Shasta, Scott, and Salmon rivers do not flow through Humboldt County and are not studied separately here.

Land Cover Type

The Lower Klamath planning watershed is dominated by montane hardwood forest (to the west) and Douglas fir (to the east), with montane chaparral and Klamath mixed conifer forest present in the central watershed. The U. S. Forest Service manages the majority of the forest lands in the basin. Six Rivers National Forest was created in 1947 from parts of the Klamath, Trinity, and Siskiyou national forests. Public ownership of forest land in the basin was centered in the remote areas, especially on the upper watersheds of the many full-flowing streams. Private timberlands originally developed on the more accessible tracts, which were nearest the two ends of the Klamath Basin with access to interstate highways or railroads. Each of the three tribes of the area has some forest land within its jurisdiction, ranging from 76,000 acres for the Hoopa Valley Tribe, to 3,840 acres on the Yurok Reservation, to about 100 acres for the Karuk Tribe. Most of these sites were logged in recent decades.

Water Quality

The Water Quality Control Plan for the North Coast Region (Basin Plan) and the Watershed Management Initiative recognize that the Klamath watersheds are culturally, climatically, and geologically diverse. The watershed provides some of the highest-quality water resources of the Region, yet it simultaneously produces some of the most-challenging water-resource conflicts. The Basin Plan contains specific water quality objectives for many index points within the Basin and it provides implementation programs to protect and enhance identified beneficial uses of water. The over-arching regulatory provision of the Basin Plan is its discharge prohibitions section, which prohibits direct waste discharge to all freshwater surface waters in this management area. The one exception to this prohibition results from the situation of City of Tulelake at a place that was once submerged by the waters of Tule Lake.

Current Sediment Runoff

The Watershed Management Council states that pools in the lower Klamath River and its estuary have been filled in by sediment. No information on ongoing runoff is available.

Temperature Problems

Summer temperatures (reaching a high of 80 degrees Fahrenheit) and low dissolved oxygen have combined to form an environment often lethal to riparian salmon. Some cold-water regions have ameliorated the conditions for local fish.

Watershed Management Problems

The US Bureau of Reclamation's (BOR) Klamath Project controls most of the flow in the Klamath River, and has typically provided water for irrigation without regard to downstream deliveries during below-average water years. Due to the BOR's diversions, the minimum flows mandated by the Federal Energy Regulatory Commission have frequently not been met.

Fish

According to the California Department of Fish and Game (DFG), the Lower Klamath River supports a number of anadromous[3] fish species including spring, fall and late fall-run chinook salmon, coho salmon, fall, winter and summer-run steelhead trout and coastal cutthroat trout. The mainstem Lower Klamath River provides habitat for all life stages of chinook salmon, coho salmon, and steelhead trout.

The Six Rivers National Forest portion of the Lower Klamath planning watershed includes several important spawning tributaries for salmon and steelhead. The DFG estimates that an escapement of as much as 106,000 fall-run chinook salmon are needed to adequately occupy the currently available spawning habitat in the Klamath-Trinity River system. Although both quality and quantity of available spawning habitat have declined, the low number of fall chinook salmon returning to spawn is presently the dominant constraint upon recovery of this population. The reasons for the decline of Klamath fall chinook have been conjectured to be flow reductions caused by drought conditions, reduced ocean productivity, over-harvest, and high-seas drift net fisheries.

Coho occur in low numbers in forest tributaries of the Lower Klamath planning watershed. The coho population in the Klamath is primarily supported by a hatchery program. The available habitat for naturally spawning coho currently is very under utilized.

LOWER TRINITY PLANNING WATERSHED

The Lower Trinity planning watershed lies within the area known as the Klamath Province, including headwater reaches of the Trinity Alps and the Trinity Mountains. The highest point in the analysis area is in the northern headwaters in the Trinity Alps on Sawtooth Mountain, elevation 8,888 feet. The lowest point at the confluence of the North Fork Trinity River is approximately 1,475 feet in elevation. Virtually the entire watershed area is mountainous, with steep V-shaped valleys formed by the tributaries. Only 5.1 percent of the whole Trinity Basin is farmland, most of which occurs in the Hayfork Valley. Most ridgetop elevations range from 4,000 to 5,000 feet.

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[3] Anadromous refers to the predisposition of salmonids (salmon and trout) to swim upstream in order to spawn.

Approximately 29 percent of the watershed lies within Humboldt County. The largest single private land owner is Simpson Timber; however, much of the watershed is under the management of the U. S. Forest Service, which accounts for the land use of open space/parks as being the dominant land use.

The Trinity River, flowing 172 miles, drains approximately 1,304,179 acres of watersheds in Humboldt and Trinity counties. Seventy (70) percent of water in the Trinity Watershed is exported to the Central Valley Project by the Bureau of Reclamation (BOR), leaving 30 percent of the available inflow above Trinity Dam to be allocated for in-river purposes. The DFG estimates that minimum releases during the year total 340,065 acre-feet.

The current minimum flow requirements adopted by the BOR are 300 cfs in winter, rising to a peak of 2000 cfs in late spring and falling to 450 cfs in summer. The U.S. Fish and Wildlife Service has recommended that instream flows be increased to 47 percent of inflow (from the current 30 percent), but no action will be taken until a conclusive EIR is prepared.

Rivers and Streams

The major tributaries to the Trinity River are the South Fork Trinity River, New River, French Creek, North Fork Trinity River and Canyon Creek, though many smaller tributaries enter the Trinity throughout its reach.

The Trinity River flows east to west and is the largest tributary to the Klamath River, joining the Klamath 40 river miles from the ocean. The Trinity basin as a whole is among the three largest California anadromous river systems north of San Francisco, second to the Klamath and similar to the Eel River in volume and drainage area. The portion within Humboldt County comprises approximately 14 percent of the entire Trinity River Basin.

The headwater streams originate in the Trinity Alps and Trinity Mountains in eastern Trinity County; the Trinity joins the Klamath River at Weitchpec, about 40 river miles from the Pacific Ocean.

Land Cover Type

A highly diverse plant community flanks the Trinity due to the extreme range of altitudes and microclimates. The upland landscape is characterized by three major forest types. The mixed evergreen conifer forest with chinquapin, madrone, black oak and canyon live oak includes a portion of the Rush Creek drainage and upper sections of Grass Valley Creek, Indian Creek, Reading Creek, and Browns Creek. The Klamath montane mixed conifer forest includes higher elevations north of the Trinity mainstem. The Oregon white oak forest is typical throughout lower elevations along the mainstem. Extensive south slope areas of the watershed are shrub-dominated.

The northern extent of the watershed is noted for its diversity of conifer species, with the center of this richness located just north of the Trinity Alps in the Klamath Mountains. Characteristic influences include boreal, maritime, continental, and Mediterranean, with aspect and elevation determining the location and extent of these influences.

In sum, conifers dominate the upland areas; the main corridor is dominated by hardwood trees (willow and alder) and grasses. A sizable portion of the easternmost county is almost wholly white fir forest.

Water Quality

While designated a wild and scenic river, this area has experienced hydraulic mining in the past. Current mine practices consist of small placer sluicing and hard rock milling operations. An assessment of abandoned mines, and past and present mining activities needs to be conducted. A formal inventory needs to be compiled with exploratory site information on the disposition of acid mine drainage, sedimentation, waste handling and remediation as appropriate, to meet long-term water quality standards.

There are several contaminated mining sites in the area. The Copper Bluff Mine continues to emit toxins. Celtor Chemical Works, located on the Hoopa Valley Reservation, is a US EPA Superfund site. A remedial action plan has been implemented. Twelve sites are being investigated in the Hoopa/Willow Creek area where known releases from underground storage tanks occurred. A possible release from underground fuel tanks located at a closed gas station in Salyer needs to be investigated. There are PG&E electrical substations in Hoopa and Willow Creek being investigated for historic releases of mineral oil that may have contained PCBs. Storm water discharges from these facilities are also being investigated. An unknown number of aboveground storage tanks exist in the area. There are also a number of lumber mills (such as the Burnt Ranch Mill) that have a history of using wood preservatives (including pentcholorophenol) that may be the source of soil and groundwater contamination. These sites need to be investigated. A burn dump at Burnt Ranch was operated for years and closed. It needs to be investigated and assessed for hazardous materials and impacts on water quality.

Current Sediment Runoff

Due to insufficient flows to transport sediments, the Trinity has been classified by the EPA as sediment impaired. Large amounts of decomposed granite from highly erodible soils enter the Trinity due to environmental disturbances. Soils in the Trinity River Watershed are generally thin and well drained.

Geology and soils interact with vegetation, climate, various land disturbances and stream channel sediment transport characteristics to produce sediment. Highly erosive granitic soils constitute 17 percent of the analysis area and are distributed over eight tributaries. Estimates indicate that these areas produce 72 percent of the sediment reaching the Trinity main stem. Land use activities that modify drainage patterns or remove vegetative cover in these highly erosive areas can greatly accelerate erosion and sedimentation. Efforts to curb sediment production and delivery are concentrated in these geographic areas.

Granitic sediment produces the size fraction that is most detrimental to the aquatic habitat in the Trinity river. Granitic soils contain a high percentage of sand, a sediment that becomes embedded in the river bed, destroying aquatic habitat. It is the major particle constituent of the sediment berms deposited on natural gravel bars along the river. Non-granitic soils

dominantly have very gravelly loam and very gravelly clay loam soil textures, which produce a bimodal distribution of sediment. The fine size sediment component remains suspended and is transported down the river. The coarse size sediment component constitutes the gravel fraction, which is beneficial to the aquatic ecosystem. This coarse sediment is currently in deficit, an indirect result of the Lewiston and Trinity dams.

Temperature Problems

The Department of Fish and Game rates the Trinity as fair in terms of temperature; in the upper 40 miles, temperatures rarely exceed 70 degrees Fahrenheit, though lower river stream temperatures typically exceed 70 degrees during the summer months.

Watershed Management Problems

The Department of Fish and Game reports that the upper 40 miles between the North Fork and Lewiston Dam has lost its ability to effectively transport sediment and consequently the upper Trinity has become channelized and aggraded (meaning the channel bed has risen due to deposited sediment).

Large, severe wildfire events destroy vegetation and leave the soil susceptible to severe erosion. Erosion following fire can produce large sediment influxes to the tributary streams, which may be transported and deposited in the main stem Trinity River. The suppression of wildfire has resulted in the buildup of fuel throughout the analysis area and has increased the potential for large fires, which burn with greater intensity than under "natural" conditions and generally result in greater resource damage. Large scale watershed disturbance such as wildfire can result in soil hydrophobicity, loss of vegetative cover, increased runoff and severe erosion and sediment production, which may damage aquatic habitat.

Fish

According to the Department of Fish and Game, the Trinity supports several anadromous fish populations, including chinook salmon, coho salmon, steelhead trout, and Pacific lamprey. Resident fish species also include rainbow trout, three-spined stickleback, speckled dace, and Klamath small-scale sucker. Eastern brook trout and brown trout have been introduced as sport fish. The Klamath-Trinity Watershed supports the second largest run of chinook salmon in the State, second only to the Sacramento River watershed. Historic accounts of huge salmonid runs are typical of the rivers of the Pacific Northwest and are described anecdotally as having spooked horses at river crossings.

Major reductions in anadromous fish populations have occurred in the river. By 1980, it is estimated that in comparison to a 1950 base, the upper river steelhead population had declined by 90 percent and the lower river by 80 percent. According to the Six River National Forest Draft Environmental Impact Statement for the National Forest Plan, the natural chinook salmon populations have declined by 85 percent. The hatchery at Lewiston has mitigated for some loss, especially with regard to spring-run chinook. Some of the major factors commonly cited as possible causes of salmonid reductions include the construction of

Trinity Dam (and subsequent reduced stream flows), the 1964 flood, overharvest of salmon, and intensive logging practices.

SOUTH FORK TRINITY PLANNING WATERSHED

The South Fork Trinity is the planning watershed with the smallest area within Humboldt County; the Humboldt County portion also represents a small portion of the entire watershed. The 1998 U.S. EPA Total Maximum Daily Load (TMDL) Study summarizes the physical and biological setting in the watershed as follows.

"The South Fork originates in the North Yolla Bolly Mountains about 50 miles southwest of Redding, and runs northwest for approximately 90 miles before reaching its confluence with the Trinity River near Salyer. It flows mostly through Trinity County, forming the boundary between Trinity and Humboldt Counties in its lower 12 miles. The South Fork Trinity River is the largest undammed river in California, and constitutes 31 percent of the Trinity River sub-basin, and 6 percent of the Klamath basin (USDA FS 1998). The 56 mile stretch from Forest Glen to the mouth is protected by the California Wild and Scenic Rivers Act."[4]

Rivers and Streams

Using the Strahler stream order classification system,[5] there are 2,522 miles of streams in the South Fork Trinity planning watershed with 2,310 miles in Trinity County and 212 miles in Humboldt County. In Humboldt County, approximately 78 percent of the streams fall in orders 1 or 2 (the smallest tributaries). Only 13 percent of the streams are classified in orders 4-7. For comparison, the largest planning watershed in Humboldt County, the Lower Klamath River planning watershed, has 920 miles of streams in Humboldt County with 75 percent of the streams in orders 1 and 2, and 12 percent in orders 4-8.

Land Cover Type

Vegetative cover within the watershed in Humboldt County consists primarily of timberlands and oak woodlands: (73 percent in fir, redwood and pine, and 19 percent in oak woodland). the remaining vegetative cover is in chaparral (6 percent) and other vegetative cover types (2 percent).

Water Quality

The 1998 U.S. EPA study summarized water quality concerns in the South Fork Trinity planning watershed as follows.

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[4] U.S. Environmental Protection Agency, Region 9, *South Fork Trinity River and Hayfork Creek Sediment Total Maximum Daily Loads*, December 1998.

[5] In this stream classification system, as an order 1 stream connects with another order 1 stream, the stream becomes an order 2 stream; as an order 2 stream connects with another order 2 stream, the stream becomes an order 3 stream, and so on.

"Past and present land use practices have accelerated natural erosion processes in the South Fork Trinity River basin, resulting in increased sedimentation in the river channels and decreased support of the cold water fishery, evidenced by significantly decreased runs of spawning salmonids. In particular, available data and anecdotal observations indicate that, following the December 1964 flood, numerous landslides and debris flows delivered considerable quantities of sediment to the stream channel in some reaches, resulting in formation of river deltas in some locations, channel aggradation (i.e., filled with sediment) and widening, decreased depths and numbers of pools, decreased numbers of fish, increases in fine sediments in the bed material, and, apparently, increases in temperatures associated with decreased depths and loss of riparian canopy (Haskins & Irizarry 1988, PWA 1994, Matthews 1998). The overall quantity of sediment delivery to the stream has decreased since then, but chronic inputs of sediment from roads as well as episodic inputs from washouts and mass wasting continues."[6]

Water quality problems from accelerated erosion rates have been worst in the more erodible portions of the basin in the Upper and Lower South Fork sub-basins, particularly west of the mainstem, and in areas where land management practices are most intense. Smaller tributaries generally have been affected less severely than mainstem lower gradient reaches. The impacts have been most notable in the Hyampom Valley, with most of the sediment being delivered from South Fork Mountain tributaries, which have been heavily logged since the 1940s.

Current Sediment Runoff

The South Fork Trinity River drains an area containing steep, unstable slopes adjacent to some of the most rapidly eroding terrain in the United States. Rivers to the south and west, such as the Eel, have some of the highest recorded suspended sediment loads in the world.

While many of the past and present effects of the December 1964 flood are part of the natural variation in sediment supply, it is clear that additional stresses have been caused by management activities. The oversupply of sediment in the South Fork basin resulted in pool filling, decreased spawning habitat, lowered invertebrate production, and increased temperatures.

Land management activities that historically and currently contributed to the decline in the cold water fishery include: timber operations, with road building on erodible terrain likely being the greatest cause of concern; agricultural operations such as ranching, with bank erosion contributing to excess sediment and diversion of water leading to higher water temperatures and nutrient contributions; and mining operations, although there are very few mining operations in the basin. Residential land uses probably do not contribute significant amounts to the problem.

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[6] U.S. Environmental Protection Agency, Region 9, *South Fork Trinity River and Hayfork Creek Sediment Total Maximum Daily Loads*, December 1998.

Roads generate about twice the levels of sediment loading as timber harvesting. Roads are the most significant component of management-related sediment production. In the Hayfork Creek sub-basin, roads and bank erosion are the most significant components of the overall sediment production, largely due to the fact that mass wasting is a much less significant process in that sub-basin.

Watershed Management Problems

The logging boom expanded through the basin in the 1960s, and probably exacerbated the detrimental effects of the 1964 flood. In particular, many logging practices on the erodible geology of the western basin altered the natural hillslope hydrology—e.g., through construction of roads and stream crossings—causing additional erosion and sediment impairment. Continued accelerated sediment production is found in many of these areas, particularly where large-scale forest fires have further exacerbated the problems. Some continued in-channel changes are also part of the natural cycle of adjustments to natural and management-induced events that would be expected following a major disturbance such as the 1964 flood.

Fish

The US EPA TMDL study of 1998 summarized the status of the fishery in the South Fork Trinity River as follows.

"Six known stocks and runs of anadromous fish utilize the South Fork Trinity River watershed. The most abundant historically is the spring-run chinook salmon (*Oncorhyncus tshawytscha*). The second most abundant, historically and currently, is the fall-run chinook, which is also a significant indicator of the fish population in the basin. Other cold-water species include winter and summer steelhead (*O. mykiss*), coho salmon (*O. kisutch*), and pacific lamprey (*Lampetra pacifica*). Chum salmon (*O. keta*) have been infrequently observed in the watershed (PWA 1994).

"The fishery in the South Fork has declined dramatically since the flood of December 1964. Unstable geology and erosion-producing land use practices have been blamed for the many mass wasting events triggered by that flood, which resulted in dramatic instream changes, including channel widening, aggradation, and loss of pool depth, all of which adversely affect the fishery. Since that time, further channel changes suggest improvements in some locations, while continued, chronic sediment inputs may be hindering a more complete or faster recovery overall. The chinook salmon spawning run has increased slightly in the last several years, and sediment slugs continue to move downstream, which may suggest the beginnings of a trend toward recovery."[7]

[7] Ibid.

MAD-REDWOOD BASIN

The Mad-Redwood Basin includes the Mad River, Redwood Creek, Eureka Plain, and Trinidad planning watersheds. The average annual runoff for the combined basin is estimated to be 1,000,000 acre-feet. These watersheds lie completely within the Coast Ranges geologic province, mainly composed of highly unstable and easily eroded rock units, which contribute a large amount of sediment to the streams. Combined with timber harvest, road construction, and grazing activity, the region has one of the highest erosion rates in the United States.

REDWOOD CREEK PLANNING WATERSHED

Redwood Creek planning watershed is a narrow, elongated fault-controlled basin that drains an area of approximately 282 square miles, from the center of Humboldt County to its northwestern corner. The creek flows for 65 river miles from its headwaters, located near Board Camp Mountain in central Humboldt County, to the Pacific Ocean near the town of Orick. Redwood National Park occupies the northern half of the watershed. Streamflow averages 255 cfs near Blue Lake and 1,290 cfs as it passes Orick near its outlet to the Pacific Ocean.

The 1998 U.S. EPA TMDL Study summarizes the physical and biological setting in the Redwood Creek watershed as follows.

"The Redwood Creek watershed consists mostly of mountainous, forested terrain from sea level to about 5,300 feet elevation. Primary land uses are tourism and fishing on parklands and timber and livestock production on lands upstream of Redwood National Park. The watershed is narrow and elongated, about 65 miles in length, from 4 to 7 miles wide. The lower basin includes the Park area and the middle and upper basin are located upstream from the Park."[8]

Rivers and Streams

Redwood Creek is the main waterway in the watershed; it is fed along its length by a few dozen smaller creeks. Streamflow in Redwood Creek is highly variable from year to year as a result of annual rainfall variations. Streamflow also varies seasonally, owing to the highly seasonal distribution of rainfall. Winter flood flows can be as much as four orders of magnitude higher than summer low flows.

Floods are critical events for the resources of Redwood Creek because they erode hillslopes, reshape channels, and transport large proportions of fluvial sediment loads. Recent large floods occurred in 1953, 1955, 1964, 1972 (two floods), and 1975. The 1964 storm was a regionally significant event that caused major damage to towns, highways, and other structures, as well as significant hillslope erosion and channel changes.

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[8] U.S. Environmental Protection Agency, Region 9, *Total Maximum Daily Load for Sediment Redwood Creek, California*, December 30, 1998.

No large floods occurred after 1975, until the recent 11-year return period flood in January of 1997. During January 1997, the relatively small 11-year return period flood initiated debris torrents of mud, boulders, and whole trees directly into Redwood Creek adjacent to Tall Trees Grove; the effects of a major storm would probably be much more severe.

Using the Strahler stream order classification system, there are 544 miles of streams in the Redwood Creek planning watershed. Approximately 79 percent of the streams fall in orders 1 or 2 (the smallest tributaries). Only 13 percent of the streams are classified in orders 4 and 5. For comparison, the largest planning watershed in Humboldt County, the Lower Klamath River watershed, has 920 miles of streams in Humboldt County with 75 percent of the streams in orders 1 and 2, and 12 percent in orders 4-8.

Land Cover Type

Coniferous forest covers nine-tenths of the watershed, the rest accommodating oak woodland and prairie. The coast redwood is the dominant tree, usually found alongside Douglas fir, Sitka spruce, big leaf maple, tan-oak and red alder. The redwood forest is also home to many types of ferns.

The County's GIS shows vegetative cover within the watershed consists primarily of timberlands and oak woodlands: (56 percent in fir, redwood and pine, and 31 percent in oak woodland). The remaining vegetative cover is in annual grass (6 percent), riparian (4 percent) and other cover types (3 percent). The EPA TMDL Study states that the distribution of plant communities in the watershed depends primarily on water availability and fire regime.

Old-growth forest currently covers 24,315 acres in the watershed, equivalent to 14 percent of its total area. Near the coast, the most common forest tree is the Sitka spruce. Coast redwoods, however, dominate most of the lower basin forest. Farther inland, where summer temperatures are higher and fog is less frequent, Douglas fir is more common than redwood. Several hardwood species grow in association with both redwood and Douglas fir, including bigleaf maple, red alder, tanbark oak, madrone, and bay. Prairies and oak woodlands occur on south and west-facing ridgetops and hillslopes on the east side of Redwood Creek.

Water Quality

The EPA does not state concern about water quality in the Redwood Creek planning watershed, noting that water chemistry and oxygen dissolution are within the normal and expected range for salmonid habitat and human consumption. Suspended sediment loads appear to have been lessening over the past 30 years, which is considered beneficial to native fish species.

The 1998 U.S. EPA Total Maximum Daily Load (TMDL) Study[9] and the draft North Coast Watershed Assessment Program (NCWAP) Redwood Creek Watershed Synthesis Report[10]

[9] For more information on the program, see the sections titled "Other Total Maximum Daily Load Watersheds" and "Regulatory Framework" later in this chapter.

summarized water quality concerns in the Redwood Creek Watershed. In general, stream channels in the Redwood Creek basin are wider, shallower, and more homogeneous than is desirable or were historically present.

The draft NCWAP reports that the Redwood Creek estuary provides an important transition between marine and freshwater environments. Because of their high productivity and isolation from predators, the estuary normally provides a very productive environment for fish. Sediment supply to the estuary is naturally high due to its position near the mouth of Redwood Creek. As discussed later in this chapter, land management practices upstream and the adjacent flood control levee have accelerated the natural processes.

Stream channel structure along the mainstem of Redwood Creek and its tributary watersheds has changed substantially over the last 50 years. Key changes in the mainstem of Redwood Creek include: (1) increases in the volume of stored sediment, (2) decreases in pool numbers and depth, (3) increases in stream width and decreases in stream depth, (4) reduced amounts of large woody debris, and (5) deposition of high levels of fine sediments on the stream bottom.

Temperature Problems

Tributary water temperatures are generally suitable for salmon and steelhead, but are too high along much of the mainstem for optimal fish habitat conditions.

Current Sediment Runoff

Tectonic action has crumbled the bedrock underlying the watershed, making it relatively weak and susceptible to landsliding and erosion. With the addition of heavy rainfall, widespread landsliding and high sediment streamloads have naturally resulted. Frequent landslides contribute a large portion of sediment to the Redwood Creek planning watershed.

More sediment has been supplied to the low gradient reaches of the mainstem than it can effectively transport. Low gradient reaches of the mainstem Redwood Creek have acted as long term repositories of eroded sediment that originated in upstream areas.

The NCWAP assessment found that intensive fine and suspended sediment problems arose in the Prairie Creek subbasin during and after the construction of the Highway 101 bypass in 1988-90. Studies indicated that impacts to salmonid habitat occurred as a result and that the habitat may not yet be fully recovered.

Sediments born primarily by the 1964 flood, and to a lesser extent by other high magnitude events between 1954 and 1975, filled most mainstem pools. Pool frequency and mean depth appeared to increase since 1975 as the creek began to move out previously deposited sediment

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[10] The interagency North Coast Watershed Assessment Program produces assessments of watershed conditions to determine factors affecting fish production and recommend measures for watershed improvements.

loads, and pool recovery is more apparent in the upper basin. However, following the moderate 1997 storm season, sediments again filled many pools. Reduced pool frequency and depth impairs rearing habitat by reducing availability of cool water refuges and increasing predation.

The EPA report concludes that Redwood Creek is particularly prone to storm-induced erosional events; however, land management activities have accelerated this natural process, overwhelming the stream channel's ability to efficiently move the delivered sediment.

Watershed Management Problems

Land management patterns and practices have contributed to increased erosion beyond natural rates through landsliding and gullying and stream bank erosion. The resultant erosion causes sediment to enter the stream, filling deep pools and depositing silt in spawning gravels.

A flood control project constructed by the U.S. Army Corps of Engineers in 1968 impaired the physical and biological functions of the Redwood Creek estuary, according to the Department of Fish and Game, by "confining the river channel, removing streamside riparian vegetation and tree cover, reducing adjacent wetlands, altering valley drainage patterns, decreasing instream woody debris structures, and reducing pool depths along the lower creek."[11] Sediment has filled half the lower estuary, blocking salmon from their spawning grounds.

Most of the likely future erosion potential in the basin caused by human activity is associated with logging roads and skid trails, although roads constructed for other purposes also pose significant erosion potential.

The EPA TMDL Study states that past studies indicate that streamside landsliding and gullying on hillslopes may be the most significant processes delivering sediment to Redwood Creek. A large proportion of observed erosion is associated with an extensive road network (7.3 miles of road per square mile of land) on private lands, improperly designed and maintained roads and skid trails, and timber harvesting.

Fish

Redwood Creek supports chinook salmon, coho salmon, and steelhead and cutthroat trout. Except for cutthroat trout, these species are all federally protected in Redwood Creek. The US EPA TMDL study of 1998 summarized the status of the fishery in Redwood Creek as follows.

"The cold water fishery is identified by the Regional Water Board as a beneficial use of the Redwood Creek watershed. In 1965, the DFG roughly estimated spawning escapement of 5000 chinook, 2000 coho, and 10,000 winter steelhead."

[11] http://www.dfg.ca.gov/nafwb/cohoEIR_final/EIR_coho11_fnl.pdf

Sedimentation due to natural geologic instability, past and present land use practices, and other factors has contributed to the reduction and loss of habitat necessary to support cold water fish including salmonids. The second most abundant, historically and currently, is the fall-run chinook, which is also a significant indicator of the fish population in the basin.

The EPA TMDL Study points out that in recent years, spawning habitat is improving slowly as gravels are cleaned of fine sediment. Anadromous and resident salmonid populations in Redwood Creek are much reduced in comparison to historic levels. Habitat conditions are probably still quite degraded relative to pristine conditions, but are showing signs of improvement. Although channel deepening and pool development have been observed in all but the lower few miles of the Creek, the mainstem generally lacks an adequate pool-riffle structure and cover.

TRINIDAD PLANNING WATERSHED

The Trinidad Planning Watershed covers 83,684 acres, making it the smallest watershed in Humboldt County next to South Fork Trinity (seven-eighths of which lie outside the County; see Table 1-1). Patricks Point State Park occupies a small area of the watershed north of the City of Trinidad.

Maple Creek and Little River arise at the foot of the Coast Ranges, the latter in a crook between the Mad and Redwood watersheds. Little River discharges to the Pacific Ocean three miles south of the city of Trinidad, while Maple Creek empties to an estuary north of Trinidad Head. Patricks Point State Park occupies a small area of the watershed north of the City of Trinidad.

Rivers and Streams

Maple Creek, extending 18.3 river miles (with a north fork of 7.8 river miles), and Little River, extending 19.6 river miles, are the main waterways in the Trinidad Watershed, which is spread along the northern Humboldt County coast.

Land Cover Type

The Trinidad planning watershed is predominantly redwood forest (57 percent) with significant amounts of oak woodlands (14 percent), riparian areas (10 percent) and some pine forest (8.5 percent).

Water Quality

Trinidad is the only watershed in Humboldt County for which no TMDLs have been instituted. However, the watershed could still be subject to development impacts that increase sediment loading in streams and rivers. Protective measures under local government control identified in other watersheds in the County would serve to address these concerns in the Trinidad watershed as well.

Current Sediment Runoff

Due to the low-volume, slow-moving streamflow through the Trinidad Watershed, sedimentation is negligible.

Watershed Management Problems

No problems are in evidence. The vast majority of the watershed is zoned TPZ, but no timber-related problems are in evidence.

Fish

The anadromous salmon and trout present in neighboring watersheds are can also be found in the Trinidad planning watershed. However, for the most part, the watershed consists of smaller coastal streams that do not have the inland reach of other watersheds. Much of this coastal fisheries habitat is protected as parks and open space.

MAD RIVER PLANNING WATERSHED

The Mad River flows through Trinity and Humboldt Counties 100 miles to the Pacific Ocean, draining a watershed area of 497 square miles. The easternmost portion of the watershed is part of Six Rivers National Forest; Mad River County Park occupies a small area in the northwest. Average flows in the Mad River range from less than 300 cfs to flood stages of up to 81,000 cfs. Mean discharge is 1,381 cfs, ranging from 45 cfs in late summer to 3,646 cfs midwinter.

Headwaters of the Mad River originate at the southeast end of the watershed at an elevation of 6,070 feet; the watershed runs diagonally across the county from the central eastern border northwest to the Pacific Ocean just north of the Humboldt Bay area.

Rivers and Streams

The Mad River is the main waterway in the Mad River planning watershed and has numerous tributaries throughout its run.

Land Cover Type

Vegetation in the Mad River planning watershed varies with location: upland regions are predominately prairie, Douglas fir, and oak grassland; lower elevation areas near the coast are dominated by redwood and Douglas fir. Forested areas predominate over 85 percent of the watershed, with fir (36 percent), redwood (22.9 percent), oak woodlands (19.8 percent), and pine forest (6.2 percent) being most common.

Water Quality

The EPA describes the Mad River as having "less serious problems: low vulnerability" overall. Its most serious problems are wetlands loss and estuarine pollution susceptibility.

Freshwater streams in this unit support production of anadromous salmonids, including steelhead and cutthroat trout, coho, and chinook salmon. The Mad River is the drinking water and industrial supply for the Humboldt Bay Area, and other coastal streams provide drinking water for local communities and individual homes.

The upper hillslope areas of the Mad River planning watershed, while populated to varying degrees, are primarily occupied by timber production and harvesting activities. Coast redwood is the predominant species harvested. Past practices and continued problems with harvesting techniques and road construction have added to stream sedimentation, in varying degrees, in all the drainages in the watershed.

Current Sediment Runoff

The Mad River is on the EPA's 303(d) List of waterways for which sedimentation is a point of concern requiring the implementation of a total maximum daily load. Stream sedimentation from rural subdivisions is an issue with regard to aquatic habitat, especially for salmonids. Logging roads are a concern because of the potential to increase runoff and delivery of sediment to local waterbodies on private and federal lands.

Watershed Management Problems

The Department of Fish and Game reports that Sweasey Dam was built in 1938 upstream of the mouth of the Mad River to provide water to Eureka. High sediment load accumulation caused the dam to fill in by 1960, after which it was removed; it is estimated that it will take 35 to 40 years for the channel to recover downstream of the dam. Ruth Dam, further upstream, is a barrier to adult salmonids, and has a considerable influence on streamflow for 80 miles below the dam.

Fish

The Mad River supports runs of anadromous salmonids including chinook salmon, coho salmon, and steelhead and cutthroat trout. Except for cutthroat trout, all anadromous salmonids in the Mad River are federally protected.

Anadromous fish spawning takes place in the main channel and in several main tributaries. Downstream from the Mad River Hatchery, the main spawning tributaries are Warren Creek, Lindsay Creek, Mill Creek, and the North Fork of the Mad River. Lindsay Creek appears to be extremely important for both coastal cutthroat and coho salmon. The coldwater fishery, specifically trout, steelhead, and salmon, is of concern regarding sedimentation and other potential impacts to habitat and water quality.

EUREKA PLAIN (HUMBOLDT BAY) PLANNING WATERSHED

Humboldt Bay is the largest estuary in California north of San Francisco. The planning watershed is 223 square miles in area, though the Bay's smaller tributaries only drain a total of approximately 35 square miles. Public landholdings are the Headwater Forest Reserve,

Humboldt Bay National Wildlife Refuge, Mad River Wildlife Area, and Lanphear Dunes. Eureka Plain is also host to more urban land than any other watershed in the county.

Streamflow in the Humboldt Bay planning watershed peaks in the winter (November through March) and is lowest during the summer. Maximum flow at the Jacoby Creek inlet is approximately at 737 cfs, with a range of peaks between 380 cfs and 2,510 cfs.

Sand spits separate the Humboldt Bay from the ocean; the Bay (officially categorized as a multi-watershed coastal lagoon) is split into the South Bay, Entrance Bay, and North Bay. The headwaters of the Bay's tributaries originate in nearby hills, which separate the watershed from the Eel and Mad River watersheds to the south and north. This plain consists of both tidal marshes and stream floodplain surrounding the Bay's edge.

Rivers and Streams

The four major streams of the Eureka Plain are Jacoby Creek (draining 17 square miles), Freshwater Creek (draining 31 square miles), Elk River (draining 29 square miles), and Salmon Creek (draining 17 square miles). Jacoby and Freshwater Creeks drain into Arcata Bay to the north, Elk River into Entrance Bay near Eureka, and Salmon Creek into South Bay. Smaller streams flow primarily into the North Bay. Although the Mad River delta is cradled in its own planning watershed to the north, its floodplain and slough extend south to Arcata Bay.

Land Cover Type

At least two-thirds of the total watershed is steep and heavily forested; the lower end is dominated by tidal marshland.

The Eureka Plain is the most developed of the Humboldt County watershed areas, with about 7 percent of the watershed characterized as urban. Nonetheless, redwood forest make up over 61 percent of the watershed, and agriculture-crop lands account for 8.6 percent.

Water Quality

The Department of Fish and Game describes the Eureka Plain as "known for its unpolluted water and diverse biotic community."

The Pacific Lumber Company (PALCO) has been required by State and Regional Water Board orders to monitor water quality in association with some timber harvesting activities. Regional Board staff believes that the interim prescriptions of the habitat conservation plan may not be adequate to restore, protect or maintain water quality objectives and beneficial uses in 303(d)-listed waterbodies.

Potential ground water contamination, such as nutrient loading via ground water to streams, is of concern. Problem sites should receive progressive enforcement per the Nonpoint Source Pollution Control Program.

Current Sediment Runoff

Freshwater Creek and the Elk River are on the State 303(d) List, requiring medium-priority TMDLs for sedimentation and siltation. Other waterbodies in the Humboldt Bay watershed may be added to the list for excessive sediment in the near future.

Stream sedimentation from rural subdivisions is an issue with regard to aquatic habitat, especially for salmonids. Logging roads are a concern because of the potential to increase runoff and delivery of sediment to local waterbodies on private and federal lands.

Watershed Management Problems

Flooding in Freshwater Creek and Elk River has increased in frequency. The increased flood frequency may be related to stream aggradation and sediment discharges. Humboldt Bay tributaries have experienced problems from urbanization and agricultural uses in addition to timber harvest issues. Additionally, they flow into Humboldt Bay and can impact uses there. Local concerns include sedimentation of Freshwater Creek and Elk River and subsequent flooding and domestic water supply degradation. Some industrial timberland owners are developing Sustained Yield Plans that will address sensitive watershed issues to some degree.

The majority of the population in this watershed basin lives in the Humboldt Bay area and the cities of Eureka and Arcata. Suburban growth is occurring in the unincorporated community of McKinleyville, north of Arcata. Flat land areas around the bay are predominantly pastureland with some limited cultivation, primarily lily bulb farms. Humboldt Bay is an important commercial and recreational shellfish growing area, as well as deep-water port. Discharge of treated wastewater to Humboldt Bay is permitted from the Arcata treatment plant and marsh complex in Arcata Bay (north Humboldt Bay) and the Elk River plant, which serves the greater Eureka area. The Arcata plant discharges to a constructed marsh/pond complex prior to discharge to Arcata Bay. The Elk River plant times its discharges to out-going tidal flow so that effluent promptly exits the bay. The College of the Redwoods operates a small sewage treatment plant that discharges indirectly to south Humboldt Bay. Contamination from collection system overflows of raw sewage during high intensity rainfall events is a continued threat to commercial and recreational uses of the Bay.

Fish

There are five species of salmon and trout found in the Eureka Plain planning watershed: coho salmon, chinook salmon, chum salmon, steelhead trout, and coastal cutthroat trout. Steelhead trout and cutthroat trout are found in all streams capable of supporting salmonids. All of the main streams of the Eureka Plain planning watershed that flow into Humboldt Bay support wild populations of salmon, steelhead trout, and cutthroat trout.

The deltas of the Elk River and Mad River Slough support commercial and sport shellfish production and harvesting. The coldwater fishery, specifically trout, steelhead, and salmon, is of concern regarding sedimentation and other potential impacts to habitat and water quality.

EEL RIVER BASIN AND WATERSHEDS

The Eel River is the third largest river system in California, encompassing approximately 3,684 square miles and 3,488 miles of streams within Humboldt, Mendocino, Trinity, and other Northern California counties. The Eel Basin covers much of the southern half of Humboldt County, excepting the southwestern coast. Within the county, the Eel River system contains four major planning watersheds (from north to south): the Van Duzen (367 square miles), Lower Eel (298.5 square miles), Middle Main Eel (216.4 square miles), and South Fork Eel (313.1 square miles). The Lower Eel River begins at the confluence of the Middle Main Eel and South Fork Eel; the Van Duzen River flows into the Lower Eel at approximately halfway to the Pacific Ocean.

Mean annual discharge for the Eel River is approximately six million acre-feet. Ninety-three percent of this streamflow is discharged between November and April. Discharges normally range from 145 cfs in September to 19,560 cfs in February, with a record low flow of 54 cfs recorded in September 1994 and a record high of 752,000 cfs measured in December 1964. Headwaters arise at elevations between 6,000 and 8,000 feet in the neighboring counties of Trinity, Lake, and Mendocino. Waters from the Eel River flow through alluvial valleys and tidal plains to its estuary to the Pacific Ocean, 14 miles south of the City of Eureka.

High seasonal rainfall combined with a rapid runoff rate on unstable soils delivers large amounts of sediments to the river. As a result, the Eel River may transport more sediments than any other river of its size in the world, due to heavy winter rainfall running through highly unstable soils. These sediments are deposited throughout the lower gradient reaches of the system.

VAN DUZEN RIVER PLANNING WATERSHED

The Van Duzen River (VDR) planning watershed is located in California's North Coast Range, primarily in Humboldt County, and encompasses a total area of approximately 428 square miles: 367 square miles in Humboldt County and 61 square miles in Trinity County. The watershed is southeast of Eureka and approximately 50 miles east of the "triple junction" of the North American, Pacific, and Gorda tectonic plates near Cape Mendocino (see Chapter 10 for further information on tectonic plates).

Rivers and Streams

Using the Strahler stream order classification system, there are 808 miles of streams in the VDR planning watershed in Humboldt County and 128 miles in Trinity County. In Humboldt County, approximately 79 percent of the streams fall in orders 1 or 2 (the smallest tributaries). Only 13 percent of the streams are classified in orders 4, 5 and 6. For comparison, the largest planning watershed in Humboldt County, the Lower Klamath River watershed, has 920 miles of streams in Humboldt County with 75 percent of the streams in orders 1 and 2, and 12 percent in orders 4-8.

Land Cover Type

Vegetative cover within the Humboldt County portion of the planning watershed consists primarily of timberlands and oak woodlands (55 percent in fir, redwood and pine, and 25 percent in oak woodland). The remaining vegetative cover is in grasslands (15 percent) and other vegetative cover types (5 percent).

Water Quality

For purposes of characterizing watershed conditions and water quality concerns, the U.S. EPA has divided the watershed into three distinct areas: lower basin, middle basin, and upper basin. The lower basin encompasses approximately 129 square miles from the confluence with the Eel River to the confluence with Grizzly Creek, including the lower Yager Creek and Lawrence Creek tributary, but excluding the North, Middle, and South Fork of Yager Creek. The middle basin encompasses approximately 202 square miles ranging from the upper Yager Creek Basin to the confluence of Grizzly Creek. The upper basin encompasses approximately 98 square miles and includes the remainder of the upper portions of the watershed.

The 1999 U.S. EPA study summarized water quality concerns based on the three identified basins.

"Lower Basin: Intensive management activities, particularly timber harvest and road-related, have exacerbated delivery rates and pose a continued threat, particularly in critical spawning and rearing reaches such as Lawrence Creek, Grizzly Creek and Cummings Creek. Continued sediment reduction efforts in the lower basin, particularly road storm-proofing and less intensive management on steep unstable areas, could yield beneficial results for anadromous fish habitat more quickly than in other areas of the basin.

"Middle Basin: Although natural sediment sources contribute the majority (84 percent) of sediment from the middle basin, certain road and timber related management activities have historically represented a risk to water quality and fish habitat. Continued sediment reduction efforts, particularly road inventories, storm-proofing and maintenance, would reduce the risk of sediment delivery to low gradient spawning reaches in the middle and lower basin.

"Upper Basin: Fine sediment levels, as indicated by embeddedness measurements, may potentially be impacting spawning gravel and pool habitat for steelhead in the South Fork VDR. The steep headwater areas of the South Fork VDR and West Fork VDR are capable of supplying large volumes of sediment to the lower depositional reaches thereby impacting steelhead-spawning habitat. The main concern in the upper basin is to avoid additional disturbance of sensitive hillslope areas and to correct potential sediment delivery problems associated with existing roads, thereby protecting downstream resources."[12]

[12] U.S. Environmental Protection Agency, Region 9, *Van Duzen River and Yager Creek Total Maximum Daily Load for Sediment*, December 16, 1999.

Fish

The VDR planning watershed maintains an aquatic habitat that supports coho and chinook salmon, steelhead trout, particularly summer stocks, rainbow trout, Pacific lamprey, West coast three-spined stickelback, Sacramento sucker, Coast Range sculpin, prickly sculpin, Coastal Cutthroat trout, California roach (introduced), speckled dace (introduced), and Sacramento pike minnow or squawfish (introduced).

According to the 1999 U.S. EPA study, the salmon industry which thrived in the nineteenth century declined through the twentieth century, and a "spawning reconnaissance study of chinook salmon carried out by the U.S. Fish and Wildlife Service in 1959 in the VDR indicated that the basin had the capability to support 7,000 chinook and reported 1,500 occupied redds (spawning grounds) at the time. In 1965, DFG estimated that the annual adult salmon runs in the Van Duzen numbered 2,500 chinook and 500 coho."[13]

LOWER EEL RIVER PLANNING WATERSHED

The Lower Eel planning watershed is comprised of the region draining into the Eel River from the confluence of the Middle Main Eel and South Fork Eel to the Pacific Ocean; all land draining to the Van Duzen River is considered part of the Van Duzen planning watershed. Covering 191,052 acres, the Lower Eel planning watershed is the only watershed in the Eel River Basin completely located within Humboldt County. At the western end of the watershed lies the 33,000 acre Eel River Delta. Over 200 different species of birds have been observed utilizing the Eel River Delta, and it is considered a vital link of the coastal flyway. Additionally, riparian corridors attract many types of land birds, including song birds, upland game birds, and raptors.

Rivers and Streams

Using the Strahler stream order classification system, there are 639 miles of streams in the Lower Eel planning watershed. Approximately 85 percent of the streams fall in orders 1 or 2 (the smallest tributaries). Only 5 percent of the streams are classified in orders 4, 5, and 6.

Land Cover Type

Land cover is similar to the Klamath River watershed: mostly forested with a variety of conifers and hardwoods, though the presence of red alder and willow are also notable.

Water Quality

The EPA has classified the Lower Eel with a rating of "more serious problems." Presumably this is due to the aggregate strain of the sedimentation loads of the tributaries as well as the regulation of flows by human means.

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[13] Ibid.

Current Sediment Runoff

The amount of sediment washed through the Eel River is legendary, a process known as sediment production or yield. In 1971, Brown & Ritter found that the Eel River was one of the highest sediment producing rivers in the world, carrying fifteen times as much sediment as the notoriously muddy Mississippi. While the Brown & Ritter study calculated that the South Fork Eel had proportionally less sediment than other Eel tributaries, the levels calculated are substantial. The study measured sediment yield during a time of widespread soil disturbance from road building and highly erosive timber harvest practices.

Watershed Management Problems

The towns of Scotia, Ferndale, and Rio Dell will be granted Phase II NPDES storm water permits. At the town of Redcrest, there is an underground tank that is leaking MTBE to the river and a failing onsite disposal system that needs investigation. In the Ferndale and Fortuna areas, there are about 85 dairies, many with manure management problems and some where cows have direct access to streambanks.

Pacific Lumber Company (PALCO) is harvesting heavily, above quantities in the Sustained Yield Plan, in the lower Eel River and Van Duzen River watersheds including Bear, Stitz, and Jordan Creeks. PALCO is currently conducting a watershed analysis in this area and there is extensive Regional Water Quality Control Board oversight. Also, cattle grazing on PALCO land and many poorly maintained roads contribute sediment to local creeks, which are aggrading and causing flooding and domestic water supply problems. The Regional Water Quality Control Board is conducting both a watershed analysis in the lower Eel River area and an effectiveness monitoring study downstream of where PALCO has installed Best Management Practices (BMPs) to reduce erosion and sedimentation effects.

Fish

The Eel River supports the largest remaining native coho salmon population in California, as well as fall-run chinook salmon, steelhead trout, coastal cutthroat trout, green sturgeon, and Pacific lamprey.

According to the National Marine Fisheries Service, the Eel was once the largest producer of chinook and coho salmon in the state, and second largest of steelhead trout. commercial fishing along the Eel was once a million dollar industry. The canneries of the Lower Eel reported 100,000 salmon per year with a maximum annual harvest estimated at 500,000 fish in the early 1900s. In 1988, the Department of Fish and Game estimated there were 31,000 fish in the entire Eel River System. They are now listed as threatened under the Endangered Species Act.

The Lower Eel portion of the watershed is of little significance as spawning ground for anadromous fishes, but is important as a migration route to upstream spawning grounds and as a return route to the ocean for surviving adult steelhead, juvenile trout, and salmon. In addition, salmon utilize the downstream pools as holding areas until there is sufficient flow from the fall rains to permit upstream passage. It is also likely that some downstream juvenile

migrants use the estuary as a nursery area throughout much of the year, since juvenile king salmon and steelhead have been found there during fall, winter, and spring months.

MIDDLE MAIN EEL RIVER PLANNING WATERSHED

The Middle Main Eel River (upstream of its confluence with the South Fork Eel) encompasses a planning watershed of approximately 482,136 acres (753.3 square miles) within Humboldt and Mendocino counties. Average precipitation per year is 56.86 inches. Public landholdings include part of Six Rivers National Forest.

Rivers and Streams

Using the Strahler stream order classification system, there are 504 miles of streams in the Middle Main Eel planning watershed. Approximately 81 percent of the streams fall in orders 1 or 2 (the smallest tributaries). Twelve percent of the streams are classified in orders 4 and higher.

Land Cover Type

Within Humboldt County, the Middle Main Eel River planning watershed is approximately 76 percent moderate to heavily forested, with some patches of annual grassland, pine forest and chaparral. Much of the watershed has been used for timber production and harvested at various times in the recent past. The predominant vegetative cover types include: fir forest (33.28 percent), oak woodlands (31.5 percent), annual grasslands (21.3 percent), and redwood forest (9.41 percent). Agricultural crop land account for only 0.08 percent or 117 acres.

Water Quality

The EPA has classified the Middle Fork Eel as having "less serious problems." As with the Lower Eel River watershed, the Middle Eel River has high seasonal rainfall combined with a rapid runoff rate on unstable soils that delivers large amounts of sediments to the river. With or without changes in the channel from increases in coarse sediment, salmon are negatively affected by the additions of fine sediment. Fine sediment smothers spawning sites, reducing the ability of salmon to reproduce successfully.

Fish

The Eel River supports the largest remaining native coho salmon population in California, as well as fall-run chinook salmon, steelhead trout, coastal cutthroat trout, green sturgeon, and Pacific lamprey.

The abundance of salmon and steelhead in the Eel River system has been declining over the past 60 years. Factors contributing to the declines are habitat loss caused by timber harvesting practices, associated road building following World War II, as well as certain types of grazing practices, water diversion, and over-fishing.

For a more detailed discussion of the Eel River fisheries, their life stages, and status, the reader is referred to the sections for the Lower Eel River watershed and the South Fork Eel River watershed.

SOUTH FORK EEL RIVER PLANNING WATERSHED

The South Fork Eel River planning watershed covers approximately 690 square miles in northern Mendocino and southern Humboldt counties. The watershed surrounds the South Fork of the Eel River, winding from approximately 58 miles from the Laytonville area of Mendocino County, up U.S. Highway 101 through Humboldt Redwoods State Park and the famed Avenue of the Giants in Humboldt County. The river itself winds for nearly 100 miles, flowing northward joining the Eel River near Weott.

Rivers and Streams

Using the Strahler stream order classification system, there are 1,527 miles of streams in the South Fork Eel River planning watershed with 838 miles in Mendocino County and 689 miles in Humboldt County. In Humboldt County, approximately 79 percent of the streams fall in orders 1 or 2 (the smallest tributaries). Only 14 percent of the streams are classified in orders 4-6.

Land Cover Type

Vegetative cover consists primarily of timberlands and oak woodlands (64 percent in fir and redwood, and 19 percent in oak woodland). The remaining vegetative cover is in annual grass (14 percent) and other vegetative cover types (3 percent).

Water Quality

The EPA has classified the South Fork Eel as having "less serious problems." The major concerns for the South Fork Eel are sedimentation and temperature.

Current Sediment Runoff

While the South Fork Eel has proportionately less sediment than other Eel tributaries, sediment levels are substantial. According to the 1999 U.S. EPA study, the main channel of the South Fork Eel has been subject to stream aggradation (sedimentation) since 1964. U.S. Army Corps of Engineers measurements of aggradation show increases in elevation for four sections of the river from 1.6 feet in 1968 to approximately 11 feet in 1998 with the elevation at one cross-section decreasing by 1.3 feet. (USACE, 1999). Channel widening also appears to be continuing, although the trend is less evident. These types of channel changes result from both local and upstream sediment inputs.

Sedimentation of tributary streams in the South Fork Eel has also reached notable levels. Sediment from Cuneo Creek, a tributary of Bull Creek, has buried two bridges with more than 10 meters of sediment and the channel widened from tens to hundreds of meters (LaVen, 1987 and Short, 1987). The 1964 flood resulted in widening of Bull Creek by up to 400 feet (Jager and LaVen, 1981.) Because precise historical measurements of stream changes

are rarely undertaken, there is uncertainty about the spatial extent of similar channel changes within tributaries of the South Fork Eel. Department of Fish and Game observers (DFG, 1996 and DFG, 1996-1998) find that some channel changes (e.g. filling of pools with sediment) that reduce the habitat complexity needed by salmon, are frequent.

Watershed Management Problems

For the South Fork Eel, the major sources of sediment were found to be road-related, including roads associated with timber harvest. More specific issues identified as concerns for sediment loading are road surface erosion, road crossing failures and gullies, and skid trails, as well as landslides from roads and harvest.

Temperature Problems

Stream temperatures have been measured at many locations in the South Fork Eel and it is well documented that many locations have summer temperatures that exceed the tolerances of cold water fish. In the South Fork Eel, the most sensitive period for salmon is the summer-rearing period, when young coho and steelhead stay in freshwater streams while they mature.

The 1999 EPA TMDL study focuses on the role of shading in preventing stream water temperature increases, expressing load allocations as percent effective shade for individual stream requirements. Effective shade is a function of vegetation height, stream width, and/or topographical barriers. As a means of controlling temperature pollutant load allocations, effective shade is useful in that it is measurable, meets legal requirements, and has a greater value in guiding management activities than a loading capacity for heat. For the South Fork Eel, narrow streams need to be almost totally shaded while wider streams would not be totally shaded even under natural vegetation conditions.

Fish

As stated above, the Eel River supports the largest remaining native coho salmon population in California, as well as fall-run chinook salmon, steelhead trout, coastal cutthroat trout, green sturgeon, and Pacific lamprey. The South Fork Eel in particular is considered to have significant remnant populations of coho salmon (DFG, 1996). University of California fisheries experts (Brown, 1994) found that the South Fork Eel population is important because it has very little hatchery influence and thus is important for the genetic integrity of the stock.

MATTOLE RIVER BASIN

The Mattole River Basin encompasses the Cape Mendocino planning watershed in the southern portion of Humboldt County.

CAPE MENDOCINO PLANNING WATERSHED

The Cape Mendocino planning watershed (also known as the Mattole Watershed) is located in California's North Coast Range. The watershed is immediately east of the "triple junction" of the American, Pacific, and Gorda tectonic plates, a highly active geologic province (see

Chapter 10 for details on geologic conditions), and encompasses a total area of approximately 319,628 acres. Almost all (98 percent) of it lies in Humboldt County and the remainder is in Mendocino County. The Cape Mendocino planning watershed is largely circumscribed by mostly steep mountains. Headwater elevations range from 1,350 feet to 4,087 feet.

Rivers and Streams

The Mattole River is the main waterway in the watershed; it receives water from over 74 tributary streams. There are approximately 545 perennial stream miles in the watershed. The mainstem Mattole is approximately 62 miles and its watershed encompasses approximately 304 square miles, most of which is within Humboldt County south of the Eel Basin. Kings Range National Conservation Area occupies the southwestern coast of the County.

According to the Mattole Restoration Council, the Mattole River's winter streamflow averages between 1,710 and 4,170 cfs while summer and fall flows are often below 60 cfs, with a minimum measured flow of 20 cfs.

There are 40 sub-watersheds in the Cape Mendocino watershed and 1,062 miles of streams in the Humboldt County portion. (There are also 18 miles of the Planning Area's streams in Mendocino County.) Based on the Strahler stream order classification system approximately 80 percent of the streams fall in orders 1 or 2 (the smallest tributaries), similar to other coastal watershed planning areas in the County.

The Mattole River enters the Pacific Ocean approximately 10 miles south of Cape Mendocino. During most summers, a sand spit encroaches all the way across the river mouth to form a bay mouth barrier, which creates a lagoon behind it. Generally the barrier remains until runoff from fall rains breeches it. However, in some years large swells at times of high tide overtop the barrier and a new outlet channel is carved through the barrier.

Land Cover Type

Unlike other watersheds in Humboldt County and the North Coast region, the Cape Mendocino is marked by prairie grassland instead of redwood forest. This is largely explained by the dry climate of the Cape Mendocino planning watershed, due to the King Range along its western edge blocking summer fog moisture from entering into the region. Forested stands consist primarily of tan-oak and Douglas fir as the major tree species, and madrone, big-leaf maple, chinquapin, bay, canyon live-oak, and alder to a lesser extent. Fir forests and oak woodlands are the predominant vegetation types in the area, with 46 percent presently in fir forests and 20 percent of the area in oak woodlands. Only about five percent of the vegetative cover is redwood forest, unusual for the North Coast.

Natural prairie grassland is concentrated on the northwestern portion of the basin, but prairie soils occur throughout the basin, mostly on ridgetops. Approximately one fifth (21 percent) of the area is covered by grasslands. According to the public review draft Mattole Watershed Synthesis Report (March 22, 2002), half of the forest land in the watershed is comprised of trees that have an average size of 12-24 inches diameter at breast height (DBH). As these trees mature, harvesting will likely increase in the watershed planning area. Twenty percent (20

percent) of the area is covered by stands that average greater than 24 inch DBH trees and another 11 percent is covered by pole-sized trees 6-11 inches DBH.

Water Quality

The California Regional Water Quality Control Board has stated that groundwater near Blue Slide Creek, one of the Mattole River's tributaries, has been impacted with petroleum hydrocarbons leaked from diesel-powered generators.

The watershed sits at the confluence of three tectonic plates, putting great stress on the area's rock. Mattole rock therefore breaks down very easily and is highly susceptible to erosion, which contributes large amounts of sediments to the river. High winter rainfall and rapid runoff on unstable soils delivers large amounts of sediment to the river, and as a result, the Mattole River transports huge sediment loads.

Current Sediment Runoff

Sediment supplied to streams from landslides can vary, dependent on the bedrock and/or landslide types being eroded. For example, debris slides in the King Range are likely to produce coarser grained materials (sands and cobbles), while earthflows in the Coastal terrane (a region geologically distinct from its surroundings) will produce significant amounts of finer grained materials (silts and clays) during high water flows.

Watershed Management Problems

Road construction throughout the watershed contributed to the erosive forces and high volume of sediment in the river and its tributaries, perhaps up to 76 percent of the total sediment load.

Fish

Fishery resources of the Cape Mendocino planning watershed include fall-run chinook salmon, coho salmon, and steelhead trout, although both chinook and coho salmon are thought to be in decline. A wide variety of fish utilize the estuary for spawning and juvenile rearing habitat.

According to the NCWAP, two notable fish species that have apparently gone extinct in the Mattole Basin are spring- run chinook salmon and green sturgeon. Many fish in the Mattole Basin use the estuary for spawning and juvenile rearing habitat. Excessive logging is historically responsible for reducing fish production, primarily from oversiltation.

The NCWAP notes that chinook salmon juveniles are detained in the estuary at the mouth of the Mattole River because of the creation of lagoon conditions early in the summer. This prevents them from going to the ocean until it reopens in Fall. Unfortunately, conditions in the estuary through the summer are not hospitable and studies conducted by Humboldt State University within the past fifteen years have shown high, and perhaps total, mortality in some years.

SUMMARY OF WATERSHEDS

- The Klamath is the second-largest river in California; the mouth of the Klamath-Trinity complex, however, is not part of the Humboldt County coast.
- The flows of both the Klamath and Trinity Rivers have been heavily reduced by Bureau of Reclamation diversions, and are marked by summer temperatures lethally high for salmonids.
- Redwood Creek and the Mad River are highly erosive and filled with sediment, to the point that anadromous species are no longer able to reach spawning grounds, yet have good to fair water quality.
- Neither Trinidad nor Eureka Plain drains to a single waterway; while Eureka Plain has some sediment problems and the majority of the County's population, both have generally good water quality.
- The Eel River complex, the largest river system draining to Humboldt County's coast (and third-largest in California), is plagued by massive sediment loads from unstable soils and heavy rains. Water quality decreases downstream. The Eel River is also host to Humboldt County's largest fisheries.
- The Cape Mendocino watershed is highly erosive due to road construction, is drier and more mountainous than other coastal watersheds, and has poor water quality.
- Nearly all major waterways are host to anadromous fisheries, particularly chinook and coho salmon and cutthroat and steelhead trout.

1.3 GROUNDWATER

REGIONAL SETTING

The western portion of Humboldt County is defined as part of the California Coastal Basin Aquifer. Individual aquifers in Humboldt County are located in the valleys of the Klamath Mountains and the Coast Ranges and are distributed along California's Pacific Coast. This region has been subjected to intense tectonic forces for millions of years leading to folding and faulting and the rise of the Klamath and Salmon Mountains in Northern California. Terrestrial, marine, and volcanic rocks deposited in intermontane valleys compose the aquifers referred to as Coastal Basin aquifers.

Humboldt County is in the North Coast Hydrologic Area. There are four groundwater basins in Humboldt County: Hoopa Valley, Mad River Valley, Eureka Plain, and Eel River Valley (see Table 1-5). The Eureka Valley Basins, comprised of the Mad River Valley, the Eureka Plain, and the Eel River Valley, are a part of the Coastal Basins. These basins consist of unconsolidated deposits of sand, gravel, silt, and clay and are bounded by consolidated and semi-consolidated rocks. The aquifer is recharged by runoff from the hills.

Chloride concentrations in excess of the 250 milligrams per liter drinking-water recommendation are reported in water from wells near the Eel River. This may be the result

of brackish water from the tidal reaches of the river. Shallow wells in the dune sands also are prone to seawater intrusion because they must obtain freshwater from a thin lens that floats on saltwater. Excessive withdrawals or minimal recharge lower the freshwater layer in the dunes and allow salty water to be drawn into wells. Groundwater is monitored by the Department of Water Resources, Northern District.

The North Coast Region's Basin Plan groundwater policy (for domestic and municipal supplies) includes maximum standards for substances affecting taste and odor; coliform; and chemicals and radioactive materials in concentrations above state hazardous materials levels.[14]

Table 1-5: Groundwater Basins in Humboldt County

Groundwater Basin	*Tributaries*	*Size (sq.mi.)*	*Average Well Yield (gpm)*	*Maximum Well Yield (gpm)*	*Storage Capacity (acre-feet)*
Eel River Valley	Eel and Van Duzen Rivers	120	400	1,200	136,000
Eureka Plain	Freshwater, Salmon, and Jacoby Creeks and the Elk River	60	400	1,200	n/a
Mad River Valley	Mad River	60	400	n/a	60,000
Hoopa Valley	Lower Trinity and Lower Klamath Rivers	5	300	n/a	19,000

Source: Department of Water Resources, 1998.

COMMUNITY AQUIFERS

Arcata reports that aquifers in its planning area are generally less than 100 feet deep. While there are approximately 60 small groundwater contamination sites in the city, the municipal water supply is not threatened. Groundwater quality is not expected to change in the near future, as few new homes and businesses are expected to withdraw water from wells. The water service in North Arcata is currently drawing one million of the approximately two million gallons per day which the local aquifer can provide.[15]

Eureka's planning area is included in the Table Bluff – Eureka Plain groundwater region, with the Eureka terrace, Elk River basin, and Freshwater Creek basin primarily supplying groundwater. Humboldt Community Services District is currently able to deliver 1,500 gallons per minute (or 2,400 acre-feet per year). According to the USGS, the quality of groundwater in the Eureka area is generally acceptable for most uses, although concentrations of dissolved iron in water from many wells may exceed the EPA's secondary drinking-water recommendation of 300 micrograms per liter, and ionic and bacterial levels make groundwater unsuitable for domestic or municipal use.

McKinleyville lies within the Eureka Area Basin, which is fed by the lower Little, Mad, and Eel Rivers. Groundwater is primarily used for pastureland irrigation in this area, with industry

[14] City of Eureka, *General Plan Background Report,* Feb 1997.

[15] City of Arcata, *Draft Program EIR: Arcata General Plan: 2020 and Local Coastal Land Use Plan*, Nov 1998.

and public-supply withdrawals benefiting to a lesser degree. Current rates of withdrawal do not appear to exceed recharge rates. Agricultural activities, sewage disposal, and fertilizer use deposit nutrient- and bacterium-rich water in to the local aquifer, but groundwater pollution is not considered significant. No cases of methemoglobinemia ("blue baby syndrome"), the most salient public-health concern related to nitrate-tainted well water, have been reported.[16]

The Avenue of the Giants Community Planning Areas (including Stafford, Redcrest, Weott, Myers Flat, Miranda, and Phillipsville) are associated with the Eel River groundwater basins, with the prime source being at the Eel-Van Duzen delta. Approximately 10,000 of the estimated annual yield of 40,000 to 60,000 acre-feet are currently being pumped for agriculture. Groundwater in rural Humboldt County is generally directed to individual domestic needs and irrigation for farmed areas of the deltas, and the Eel's well water is considered suitable for these uses.

GROUNDWATER CONCERNS

The Eel River, Humboldt Bay, Trinity River, and Klamath River Watershed Management Areas all list groundwater contamination as a primary water quality issue.

Potential ground water contamination, such as nutrient loading via ground water to streams, is of concern. Pesticide and herbicide applications on private and public lands are also of concern. Use of pesticides and herbicides along roadways, in agricultural operations, in urban areas, and in lily bulb farming and forestlands in Watershed Management Areas poses a threat to ground and surface waters. There are also a number of lumber mills (such as the Burnt Ranch Mill) that have a history of using wood preservatives including pentcholorophenol that may be the source of soil and groundwater contamination. See also the section on underground storage tanks and leaking underground fuel tanks in Chapter 12: Fire and Other Hazards.

To protect water resources within a watershed context, a mix of point and nonpoint source discharges, ground and surface water interactions, and water quality/water quantity relationships must be considered. These complex relationships present considerable challenges to water resource protection programs. The State and Regional Boards are responding to these challenges with the Watershed Management Initiative (WMI). The WMI is designed to integrate various surface and ground water regulatory programs while promoting cooperative and collaborative efforts within watersheds. It is also designed to focus limited resources on key issues.

1.4 STORMWATER AND NONPOINT SOURCE POLLUTION

Stormwater is an important factor in the distribution of sediments, chemicals, and other natural and human-produced compounds throughout a watershed. Runoff from heavy rains picks up these potential pollutants and carries them downstream, where they may be

[16] McKinleyville Community Planning Area, *Draft Program EIR for McKinleyville Community Plan Update,* June 1999.

deposited or remain suspended in sensitive ecological areas. With its wet climate and large amount of land dedicated to timber production and agriculture, pollution due to stormwater runoff is particularly important in Humboldt County.

NONPOINT SOURCE POLLUTION

Nonpoint source (NPS) pollution, also known as polluted runoff, is the leading cause of water quality impairments in California and the nation. Nonpoint sources, including natural sources, are the major contributors of pollution to impacted streams, lakes, wetlands, estuaries, marine waters, and ground water basins. Unlike pollution traceable to a single location or "point" (such as a sewage treatment plant), NPS pollution comes from many diffuse sources, and is principally caused by stormwater, snowmelt, or agricultural runoff moving across and diffusing into the ground. The runoff picks up natural and human pollutants and deposits them throughout the natural watershed (in rivers, lakes, coastal areas, and aquifers).[17]

While point source pollution is much better-known, the U.S. EPA states that nonpoint source pollution is the leading cause of water quality problems. In California, NPS pollution is estimated to represent 80 percent of the State's water pollution.[18] Its effects on specific waters vary and may not always be fully assessed, but overall it has harmful effects on drinking water, recreation, fisheries, and wildlife.[19] NPS pollution sources come from a wide range of human activity, including agriculture, forestry, roads and transportation, boating and marine activity, wetlands management, and general urban activity; suspended sediments are the largest mass of pollutants.[20] Some of these pollutants are summarized in Table 1–6.

Table 1-6: Nonpoint Source Pollutants by Source

Source	*Types of Pollutants*
Agriculture	Fertilizers, herbicides, pesticides, sediments (erosion), nutrients, salts
Forestry and Construction	Sediments (erosion), pesticides, fertilizers
Roads and Automobiles	Petroleum hydrocarbons, heavy metals, oil, brake fluid, road salts, sediments (erosion), debris
Marinas and Recreational Boating	Low dissolved oxygen, metals, petroleum hydrocarbons, solvents, antifreeze, surfactants, acids, debris
Urban and Residential	Oil, grease, toxic chemicals, paints, battery acid, household cleaning products, nutrients and pathogenic bacteria (from garden fertilizers, leaves, grass clippings, pet wastes, and faulty septic tanks), viruses, sediment, oxygen-demanding substances, heavy metals

Sources: California EPA, U.S. EPA, Pennsylvania Dept of Environmental Protection, Tennessee Dept of Agriculture.

[17] EPA's Polluted brochure EPA-841-F-94-005, 1994.

[18] State of California, Office of the Governor, Annual Environment Report and Message of the Governor, 1995-1996.

[19] EPA's Polluted brochure EPA-841-F-94-005, 1994.

[20] California Coastal Commission, California Management Measures for Polluted Runoff Vol. 2, Jan 2000, p 59.

NPS POLLUTION AND FISHERIES

A sample Watershed Management Initiative (explained under "Abatement Programs–State," below) for the Middle Eel River includes the following nonpoint source issues relating to concerns about cold water fisheries identified by the Regional Water Quality Control Board (RWQCB) staff:

- **Stream Sedimentation**. Changes in the morphology of channels have occurred from increased sedimentation rates; shallower, wider channel form increases insolation (sunlight penetration), decreases low flow velocity, increases deposition of very fine material. Sedimentation of small streams in the Eel River delta has caused localized flooding and accelerated erosion in some cases from redirected stream channels. Gravel extraction is also a concern. The regulation of gravel extraction is primarily through a US Army Corps and California Department of Fish and Game process.
- **Timber Harvest Practices**. Logging has decreased the canopy cover over tributaries and the mainstem of the river. Lack of canopy cover increases the solar radiation reaching the water and increases water temperature. High water temperatures are detrimental to cold water fisheries' reproduction.
- **Dairies and Grazing**. While the potential impacts from livestock uses have not been fully evaluated, concern has been raised regarding dairy industry and grazing impacts to the watershed from direct discharges of waste and/or whey, animals in the creeks and waterways, trampling of stream banks, and other erosion mechanisms. Dairies should be brought up to Title 27 standards. Grazing issues include erosion and sedimentation, and water chemistry issues.
- **Herbicide Application**.
- **Interbasin Transfers of Water and Regulated Flows from Dams**. These activities affect sediment, flow, and temperature dynamics and may contribute to the impairment of the beneficial uses.

Storm water runoff from all watersheds draining to Humboldt Bay conveys indicators of bacterial contamination that impacts shellfish harvest. Seasonal and rainfall-based shellfish harvesting closures are in effect to mitigate the effects of nonpoint source runoff. A shellfish Technical Advisory Committee was established in November of 1995 to address nonpoint source runoff issues.

ABATEMENT PROGRAMS

Federal

At the Federal level, the United States Environmental Protection Agency (EPA) is the primary force concerned with pollution abatement. While the EPA works in partnerships with state agencies and provides information on NPS issues, it does not conduct any NPS-targeted programs of its own. However, although runoff is generally considered nonpoint source

pollution, upon entering a storm drain system it may be considered point source pollution and be subject to the EPA's National Pollutant Discharge Elimination System (NPDES) Storm Water permit program.

Congress amended the Clean Water Act (CWA) in 1987 to establish the Section 319 Nonpoint Source Management Program. Through this program, states, territories, and Indian Tribes can receive grants as defined in Section 319(h) to be used toward NPS-abatement activities "including technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and monitoring to assess the success of specific nonpoint source implementation projects."[21] In Humboldt County, there are currently five projects open (see Table 1-7).

Table 1-7: Section 319(h) Grants in Humboldt County Watersheds

Project Title	*Contracting Agency*	*Amount Awarded*	*Actions*
Humboldt Bay Watershed	Redwood Community Action Agency	$215,000	Decommissioning of abandoned logging roads, removal of stream crossings and fish passage barriers, construction of livestock exclusion fencing, riparian corridor revegetation, water quality monitoring, and K-12 watershed education
Humboldt Bay Watershed Enhancement	Redwood Community Action Agency	$239,315	BMP implementation, water quality monitoring, and community education
Klamath River Watershed Restoration	U.S. Fish and Wildlife Service	$187,504	Modifying irrigation diversions, installation of livestock exclusion fencing, installation of riparian plantings, and public education
Klamath River Watershed Restoration	U.S. Fish and Wildlife Service	$180,000	Installation of an irrigation tailwater recovery pond, installation of livestock exclusion fencing, and implementation of upslope sediment reduction and road stabilization
Eel River Cooperative Sediment Reduction and Water Quality Improvement	Humboldt County RCD	$248,751	Reducing sedimentation and improving riparian habitat and water temperatures

Source: U.S. EPA, 2002.

State

In California, the State Water Resources Control Board (SWRCB) and the nine Regional Water Quality Control Boards (RWQCBs) have primary responsibility for the protection of water quality. In 1990, Congress improved and expanded the Coastal Zone Act through the Coastal Zone Act Reauthorization Amendments (CZARA), which expanded the

[21] U.S. EPA Office of Water website, www.epa.gov/owow/nps/cwact.html, 29 Mar 2002.

SWRCB/RWQCBs' NPS management partnership to include the California Coastal Commission (CCC).

The Coastal Act (section 30519.5) requires the CCC to conduct periodic reviews of certified Local Coastal Plans (LCPs) to evaluate whether or not the LCPs are being implemented by the local governments in a manner that conforms with the act. Because of this, it is important that the County of Humboldt address the nonpoint source program requirements in the General Plan Update process. The CCC will review all new LCPs, LCP Amendments, and coastal development permits (CDPs) applications brought before it for appropriate nonpoint source pollution prevention and control activities.

The State's NPS Pollution Control Program created a 15-year State NPS Plan in 1998, known as the *Nonpoint Source Program Strategy and Implementation Plan, 1998-2012* or *PROSIP*, with three elements: California's Management Measures for Polluted Runoff (CAMMPR) in the areas of agriculture, forestry, urban areas, marinas, hydromodification, and wetlands; a 15-year program strategy; and the first of three five-year Implementation Plans (which identifies a process and actions for administrative coordination, public participation, technical assistance, critical coastal areas, additional management measures, and monitoring). The Program additionally requires construction and other industrial sites to develop a Storm Water Pollution Prevention Plan (SWPPP) to identify and control pollutants that may be picked up in stormwater runoff.[22]

Under the Plan, the State is committed to implementing mitigation measures addressing NPS by 2013, with a three-tiered approach with priorities identified in the Watershed Management Initiative (WMI) chapters of the Plan. The WMI, approved by the SWRCB in 1995, uses an integrated planning approach to create and implement unique solutions for each watershed. The chapter is revised annually to reflect the changing priorities and conditions in the State's watersheds.

Past State and Regional Board programs tended to be directed at site-specific problems. This approach was reasonably effective for controlling pollution from point sources. However, with diffuse nonpoint sources of pollutants, a new regulatory strategy was needed. The WMI uses a strategy to draw solutions from all interested parties within a watershed, and to more effectively coordinate and implement measures to control both point and nonpoint sources. Greater detail on the WMI is provided in Volume II of this report.

The California Coastal Commission has instituted a Plan for Controlling Polluted Runoff (CPR) in the Coastal Zone for July 1999 through June 2003, with programs including erosion and sediment control; facility wastewater and runoff from confined animal facilities; nutrient, pesticide, grazing, and irrigation water management; and education and outreach. Elements of the Plan include implementation of Management Measures (MMs), administrative coordination, public participation and education, and funding.

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[22] State of California, Office of the Governor, Annual Environment Report and Message of the Governor, 1995-1996, p 70.

1.5 REGULATORY FRAMEWORK

FEDERAL REGULATIONS

Section 404 of the Clean Water Act

Section 404 of the Clean Water Act requires that a permit be obtained from the U.S. Army Corps of Engineers prior to the discharge of dredged or fill materials into any "waters of the United States" including wetlands. Waters of the United States are broadly defined in the Corps' regulations (33 CFR 328) to include navigable waterways, their tributaries, lakes, ponds, and wetlands. Wetlands are defined as: "Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that normally do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."[23] Such permits often require mitigation to offset losses of these habitat types. Wetlands that are not specifically exempt from section 404 regulations (such as drainage channels excavated on dry land) are considered to be "jurisdictional wetlands." The Corps of Engineers is required to consult with the U.S. Fish and Wildlife Service, Environmental Protection Agency, State Regional Water Quality Control Board and DFG (among other agencies) in carrying out its discretionary authority under Section 404.

The Corps of Engineers grants two types of permits, individual and general. Individual permits are required for certain activities that may have a potential for more than a minimal impact and necessitate a detailed application. The most common type of general permit is a nationwide permit. Nationwide permits pre-authorize certain specific activities, and are designed to regulate with little delay or paperwork activities having minimal impacts. Nationwide permits typically take two to three months to obtain, whereas individual permits can take a year or more. To qualify for a nationwide permit, strict conditions must be met. If conditions are met, permittees may proceed with specified activities without notifying the Corps of Engineers. However, some nationwide permits require a 30-day pre-construction notification period before activities can begin. Activities for which nationwide permits are available include minor road crossings, utility corridors, and stormwater outfalls.

Part III of the *Federal Register*[24] contains a Final Notice of Issuance and Modification of Nationwide Permits (NWPs) by the U.S. Army Corps of Engineers (Corps). The maximum acreage limits of most of the new and modified NWPs is 0.5 acre. Most of the new and modified NWPs require notification to the district engineer for activities that result in the loss of greater than 0.1 acre of waters of the United States.

For projects requiring individual 404 permits that are not considered "water dependent" (such as marinas or harbors) that occur in "special aquatic sites" (which include wetlands), the Environmental Protection Agency 404(b) (1) guidelines and Corps regulations require

[23] Code of Federal Regulations, *Wetlands definition,* 1982.

[24] Code of Federal Regulations, *Final Notice of Issuance and Modification of Nationwide Permits,* 65 CFR 12818-12899, Volume 65(47) March 9, 2000.

that an alternatives analysis be conducted. Before an individual permit may be granted, the conclusion of the analysis must demonstrate to the agencies' satisfaction that there are no "practicable alternatives" that are less damaging to aquatic habitats than the proposed project. The first step in the 404(b) (1) process is to analyze alternatives that meet project objectives and would avoid filling special aquatic sites. If project sponsors are able to demonstrate that the proposed filling of wetlands is necessary to meet project objectives and there are no practicable alternatives to this filling, then the project mitigation plan would be reviewed by the U.S. Fish and Wildlife Service (USFWS) in relation to their mitigation policies.

Section 401 of the Clean Water Act

A Section 401 Water Quality Certification or waiver from the California State Water Resources Control Board is required before a Section 404 permit becomes valid. The Regional Board will also review the project for consistency with Waste Discharge Requirements under the State land disposal regulations (Subchapter 15). In reviewing the project, the Regional Board will consider impacts to waters of the State in addition to filling of wetlands in accordance with the State wetland policy. Usually, mitigation is required (if not already a condition of the 404 permit) in the form of replacement of restoration of adversely impacted "waters of the U.S."

STATE AGENCIES AND REGULATIONS

Agencies

The State Water Resources Control Board (SWRCB) holds joint authority for water allocation and water quality protection in California and is composed of five members appointed by the Governor. The State Board oversees nine Regional Water Quality Control Boards (RWQCBs), which develop and enforce water quality objectives and implementation plans that will best protect the beneficial uses of the State's waters. Regional Boards develop basin plans for their hydrologic areas, issue waste discharge requirements, take enforcement action against violators, and monitor water quality. Each RWQCB has nine part-time members appointed by the Governor.

The State Department of Water Resources (DWR) prepares and updates the California Water Plan to guide development and management of the State's water resources; operates the State Water Resources Development System to supply good quality water; regulates dams, provides flood protection, and assists in emergency management; educates the public about the importance of water and its proper use; and serves a variety of local water needs.

The DFG and Department of Forestry and Fire Protection (CDF) often work in concert with the Water Boards and DWR.

California Environmental Quality Act

The California Environmental Quality Act (CEQA), passed in 1970, requires state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible.

CEQA applies to certain activities of state and local public agencies. A public agency must comply with CEQA when it undertakes an activity that is subject to discretionary approval and that may cause either a direct physical change in the environment or a reasonably foreseeable indirect change in the environment. Most proposals for physical development in California are subject to the provisions of CEQA, as are many governmental decisions that do not immediately result in physical development (such as adoption of a general or community plan). Every development project that requires a discretionary governmental approval will require at least some environmental review pursuant to CEQA, unless an exemption applies.

The environmental review required imposes both procedural and substantive requirements. At a minimum, an initial review of the project and its environmental effects must be conducted. Depending on the potential effects, further review may be conducted in the form of an environmental impact report (EIR). A project may not be approved as submitted if feasible alternatives or mitigation measures are able to substantially lessen the significant environmental effects of the project

CEQA is a self-executing statute. The Agency does not enforce CEQA, nor does it review for compliance with CEQA the many state and local agency actions that are subject to CEQA. Public agencies are entrusted with compliance with CEQA and its provisions are enforced, as necessary, by the public through litigation and the threat thereof. It is each public agency's duty to determine what is and is not subject to CEQA. The Resources Agency does not review the facts and exercise of discretion by public agencies in individual situations.[25]

North Coast Watershed Assessment Program

In 1999, the California Resources Agency and the California Environmental Protection Agency began developing an interagency watershed assessment program for California's North Coast. The purpose of the program is to develop consistent, scientifically credible information to guide landowners, agencies, watershed groups, and other stakeholders in their efforts to improve watershed and fisheries conditions.

The agencies brought together the DFG, CDF, Department of Conservation's Division of Mines and Geology (DMG), DWR, and the North Coast RWQCB to identify the appropriate role and objectives of a state assessment program. The resulting North Coast Watershed Assessment Program, or NCWAP, is designed to meet four goals:

- Develop baseline information about watershed conditions.
- Guide watershed restoration programs.
- Guide cooperative interagency, non-profit, and private sector approaches to protect the best through stewardship, easement, and other incentive programs.
- Better implement laws requiring watershed assessments such as Forest Practices, Clean Water and Porter-Cologne Acts, Lake or Streambed Alteration Agreement, and others.

[25] California Environmental Resources Evaluation System, "Frequently Asked Questions about CEQA," 1998.

The program provides a process for collecting and analyzing information to answer a set of critical questions designed to characterize current and past watershed conditions. While NCWAP will not produce prescriptions, design projects, analyze cumulative effects of proposed projects, perform risk management, or recommend policy development or regulations, information will be used to guide watershed management and restoration planning, restoration and recovery planning for anadromous fisheries, and implementation of watershed protection policies and regulations.

LOCAL GOVERNMENT REGULATION

General Plan

As a local government's basic planning document, the General Plan is a key component of a local government's effort to control negative impacts to water resources. Through its policies and standards, the General Plan can be an effective tool in controlling the effects of development and a particularly valuable tool for addressing nonpoint source pollution issues. Four mandatory elements deal with issues relating to water quality and pollution issues:

1. land use – density and intensity of use affect nonpoint pollution sources;
2. conservation – may address watershed protection, land or water reclamation, prevention or control of the pollution of stream and other coastal waters, regulation of land uses along stream channels, etc.;
3. open space – applies to preservation of natural resources, including fish and wildlife habitat, rivers, streams, bays and estuaries, and other open spaces; and
4. circulation – should plan not only for transportation but also for water, sewage, and storm drainage infrastructure.

The County Framework Plan (1984) serves as the General Plan and establishes numerous water resources policies (see Section 1.6 for a complete listing of existing policies). This report is part of phase II of Humboldt County's General Plan update process and the information presented in this report will serve as the basis for making informed decisions on future policies which will impact watersheds and water quality.

Local Coastal Plans

Local Coastal Plans (LCP) are required by the State Coastal Act to be prepared for the County's portion of the coastal zone. The LCP consists of a local government's land use plans (LUPs), zoning ordinances, zoning district maps, and within sensitive coastal resource areas, other implementing actions which meet the requirements of and implements the provisions and policies of the Coastal Act at the local level.

By controlling the type, location, and intensity of land uses in the coastal zone, the LCPs have a direct relation to efforts to control the impact of pollution on water bodies along the coastal zone. As the California Coastal Commission (CCC) develops more comprehensive review procedures

for nonpoint source pollution (see Volume II of this report), it is important that Humboldt County address the nonpoint source program requirements in the General Plan Update process to ensure compliance.

Grading, Erosion Control, Geological Hazards, Streamside Management Areas and related Ordinances.

Completing the regulatory framework provided by local government are the ordinances that implement the General Plan and Local Coastal Plans' policies and standards. Humboldt County's ordinances dealing with grading, erosion control, geological hazards, and streamside management areas were recently strengthened with revisions adopted by the Board of Supervisors in May 2002.

Key revisions include:

- update of Building Regulations to incorporate updated uniform codes.
- creation of a subsection within the Building Regulations addressing Grading, Excavation, Erosion, and Sedimentation.
- modification of other sections relating to geologic hazards and processing of grading and building permits within or affecting Streamside Management or Other Wet Areas.
- addition of Geologic Hazards Regulations, including the incorporation of "area of demonstration of stability" provisions.
- establishment of a Streamside Management Ordinance, which codifies the Interim Implementation Standards for the Open Space Element of the General Plan (applicable to Non-Coastal areas only).
- ordinance revisions addressing vegetation removal or other land disturbing activities, and an ordinance revision needed to assure consistency between County regulations.

These revisions completed efforts to codify and implement comprehensive provisions for dealing with the development and conservation activities with potential impacts to streamsides as well as addressing nonpoint source pollution from runoff water. These ordinance revisions have a number of critical benefits including:

- implementation of various General Plan elements including water quality, biological resources, critical and sensitive habitats, geologic hazards, open space, conservation, and erosion and sedimentation control.
- additional guidance on the application of erosion and sediment control measures to various developments.
- enhancement of existing zoning regulations which conform to all local, state, and federal requirements to protect property rights, sensitive habitats, and coastal and other sensitive resources.
- management of risk in geologically unstable areas and improvement of erosion control regulations.

- implementation, to varying degrees, of numerous mitigation measures included within the Environmental Impact Report prepared and adopted for the County's Framework Plan.

These revisions are detailed in Volume II of this report.

1.6 POLICY ISSUES

This section focuses on water resource issues from a public policy perspective. In evaluating existing and future conditions, the County must consider the various policy options for the issues identified in Phase I of the General Plan Update, which are summarized in the Critical Choices Report. These key questions help frame the issues for policy options for biological resources. As background, the existing policies in the General Plan are presented, followed by a discussion of issues and policy options that respond to them. The policy evaluation worksheets that will be used to guide discussion of these issues are in the Appendix. These worksheets are provided as a tool for members of the public to evaluate policy options and indicate preferences for accepting, modifying or rejecting these options.

EXISTING POLICIES

Existing policies regarding water resources are found in several sections of the County General Plan (Framework Plan). This are listed below, followed by policies that pertain specifically to the Coastal Zone.

GOALS

1. To maintain or enhance the quality of the County's water resources and the fish and wildlife habitat utilizing those resources.

2. To maintain a dependable water supply, sufficient to meet existing and future domestic, agricultural, industrial needs and to assure that new development is consistent with the limitations of the local water supply.

POLICIES

1. Ensure that land use decisions are consistent with the long term value of water resources in Humboldt County.

2. Regulate development that would pollute watershed areas.

3. Ensure that the intensity and timing of new development will be consistent with the capacity of water supplies.

4. Existing water uses shall be considered during the review for new water uses.

5. The availability of groundwater should be used as a prime factor in determining the desirable amount of residential development in a particular area in order to protect groundwater resources from depletion or contamination.

6. Projects must provide evidence of water availability prior to recordation of map.

7. Maximize the use of water conservation techniques appropriate for new and existing development.

8. Continue participation in all state, regional or local water resource planning efforts effecting surface run-off or groundwater supplies.

9. Encourage further investigation on the County's water resources by federal and state water resource agencies.

10. Large water export projects will not be approved or supported unless specific requirements and assurances are satisfied. These shall include the 1978 water policy statement policies regarding "Water Export Projects on Humboldt County Streams". (See Standards 5a-1)

11. Support flow release schedules from existing reservoirs that maintain or enhance the fisheries of those rivers.

12. Support the development of fisheries enhancement projects on small Humboldt County streams.

13. Ensure that projects located within state designated wild, scenic or recreational river basins are consistent with the guidelines in the State Wild and Scenic Rivers Act (as amended).

14. The development of environmentally sound small hydroelectric projects on publicly and privately owned lands in Humboldt County is generally encouraged. The County should only examine small hydroelectric project proposals for impacts not reviewed by other agencies and for overall consistency with the intent of the General Plan.

COASTAL ZONE POLICIES

The Humboldt County Local Coastal Program's Technical Study on Water Quality lists the following sections of the Coastal Act (within the California Public Resources Code) as directly related to water quality and water resources.

30231. The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges and entrainment, controlling runoff, preventing depletion of ground water supplies and substantial interference

with surface waterflow, encouraging waste water reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, and minimizing alteration of natural streams.

30236. Channelizations, dams, or other substantial alterations of rivers and streams shall incorporate the best mitigation measures feasible, and be limited to (1) necessary water supply projects, (2) flood control projects where no other method for protecting existing structures in the flood plain is feasible and where such protection is necessary for public safety or to protect existing development, or (3) developments where the primary function is the improvement of fish and wildlife habitat.

POLICY ISSUES AND OPTIONS

Each key question or issue raised in the Critical Choices Report that relates to water resources is discussed below. Based on County and public input, these policy options will be refined. Some of these options also will shape preparation of "sketch plans" (generalized land use plans for accommodating future development), while others will be implemented through zoning and subdivision regulations or other programs. Appendix B provides a worksheet for the public to evaluate these policy options in the same format as used for the Building Communities Report.

ISSUE

- *How can County land use policies implement Clean Water Act - Total Maximum Daily Load (TMDL) requirements?*

In Humboldt County, the majority of 303(d) listings and TMDL designations are initiated in response to sedimentation and siltation. While these are largely natural processes, they can be aggravated by human interference. In most cases the potential sources of impairment include riparian grazing, rangeland, and streambank modification.[26] Land use policies designed to buffer high-velocity or high-flow regions of streams from grazing animals would allow riparian vegetation to grow freely, which would in turn reduce destabilization of streambanks and lessen overall sedimentation. The second most common impairment, temperature, is believed to have similar sources, with removal of riparian vegetation explicitly listed as well.

Option 1.1 Continue to use the Streamside Management Areas and the Streams and Riparian Corridors Protection Regulations for the Coastal Zone to protect water resources. These provisions establish development restrictions within a prescribed setback zone varying in width from 100 feet to 200 feet on either side of the stream. The County's zoning regulations allow the width of the riparian zone to be expanded to protect special habitat areas with the concurrence of the property owner.

Option 1.2 Establish a secondary watershed protection zone along streams and riparian corridors where TMDL designations have been established. The secondary zone would

[26] North Coast Regional Water Quality Control Board, *1998 California 303(d) List and TMDL Priority Schedule*, approved 12 May 1999.

protect and improve water quality by establishing performance standards, such as no increase in natural runoff, and review procedures to minimize pollution, siltation, and other environmental impacts from upland development that would directly or indirectly affect water quality. This new policy would be consistent with a watershed-based planning approach.

Option 1.3 Continue to require use of Best Management Practices for Stormwater Control to minimize pollution from area sources. Best Management Practices manuals have been developed by the California Stormwater Quality Task Force for construction activity and for residential, commercial and industrial development; similar guides are available for agricultural operations. The County requires Best Management Practices in its grading ordinance. Timber operations, however, are exempt from compliance with best management practices because the State Water resources Control Board has determined that best management practices result in less water quality protection than adherence to water quality control plans that conform to the State Water Code.

Option 1.4 Pursue grant funds to rehabilitate impacted watersheds to meet TMDL targets for sediment control and water temperature reductions. The County should pursue funding assistance to develop and implement programs to facilitate achievement of TMDL targets.

ISSUE

- *What is the County policy on exporting water?*

Seventy percent of the Trinity River's water is exported (under the auspices of the Bureau of Reclamation) to the Central Valley Project; water from the Eel River has been exported for agriculture (via the Federal Energy Regulatory Commission) since 1922.[27] The County's current water export policy was adopted by the Board of Supervisors in 1978 and did not provide for any strong protection or holding of the County's water resources. Efforts to draft a new water policy limiting exports to 10 percent of any stream's natural flow is underway, but will likely not be completed within the next year and may be difficult to reconcile with Federal authority and practice.[28]

Option 1.5 Update the County's Water Export Policy to strongly encourage the reduction of water exports from Humboldt County and to ensure that water quality, fisheries and sensitive habitat will not be adversely affected by a new water export project. Include specific standards for habitat and fisheries protection and water quality in an updated policy. Although much of the water exported from the County is done under the auspices of other government agencies, the County should actively pursue the reduction of water exports. However, if new water export projects are proposed, it is very important that County policy provide standards for the protection of water quality, fisheries, and habitat

[27] California Department of Fish and Game, Final Environmental Document Analyzing the…Take of Coho Salmon North of San Francisco, Dec 2001.

[28] Don Tuttle, Humboldt County Public Works Department, personal communication, 28 March 2002.

protection. This approach is preferable to a numerical limit on the percent of surface water that could be exported because of seasonable variations in rainfall and the fact that the County has surplus water supplies that could generate needed income. The current policy only requires that ecological impacts be considered and that water quality control be included in a project, with no specific standards to ensure non-degradation – no adverse impacts. Also, flow release schedules are only to provide for the maintenance of fishery resources, not enhancement, which means where fisheries and water quality have been degraded, there is no obligation to meet a specified standard.

ISSUE

- *How can streams be protected from increasing flow velocities in urban areas?*

Increased velocities may occur as a result of stream channelization or increased storm water runoff from paved surfaces of urban development. Minimizing runoff and maintaining a natural, permeable streambed are the primary means of protecting streams from increased velocities. Where streambeds have already been channelized, a stream can be slowed by regrading its channel to minimize acceleration.

Option 1.6 Establish standards for maximum allowable runoff from new development where streams and water quality could be adversely impacted. The TMDL designations would be a starting point, but additional factors related to flood control and watershed management also would need to be considered as part of the standard-setting process.

Option 1.7 Establish flood control and stormwater management standards on a watershed basis, taking account of planned urban development, not just existing uses. Currently, flood hazard mapping is based on existing conditions, without analysis of the effects of planned urban development that can increase runoff unless controls, such as catch basins, are installed. This option would impose significant costs on the County because new flood zone mapping would be needed.

ISSUE

- *What are the cumulative impacts of water withdrawal for rural development?*

Water resources are plentiful enough in the County that withdrawal of any kind is not considered an issue of great importance in the foreseeable future. Groundwater remains abundant (the water table is estimated at 9 to 10 feet below ground level in much of the County) as summer fog and the lack of high-consumption agriculture minimize the need for irrigation,[29] and current infrastructure and surface rights are estimated to allow for double the estimated 2025 demand.[30]

[29] Don Tuttle, Humboldt County Public Works Department, personal communication, 28 March 2002.

[30] Dyett and Bhatia, *Building Communities*, Feb 2002, p 5-3.

Option 1.8 Continue to monitor groundwater withdrawals associated with rural subdivisions. The County's new GIS system can facilitate this process.

Option 1.9 Eliminate the special provisions for subdivisions over 60 acres in size, which exempt them from having to provide information on water availability. Asking all subdividers to provide this information will enable the County to track groundwater demands.

Option 1.10 Restrict residential development in resource production areas. Restricting residential development in resource production areas will not only reduce land use conflicts but also minimize water demand and help to reduce erosion impacts from road and housing construction.