California **Water Plan**
Update 2009

North Coast

INTEGRATED WATER MANAGEMENT






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Regional Reports

Northern Region Office

The Division of Integrated Regional Water Management assists public and private agencies and the general public with water issues throughout the state. Four regional offices are located throughout California to maintain close contact with local interests to facilitate communication and to work on water-related matters. The offices are:

- Northern Region in Red Bluff,
- North Central Region in West Sacramento,
- South Central Region in Fresno, and
- Southern Region in Glendale.

Each of the regional offices offers technical guidance and assistance in water resource engineering, project management, hydrology, groundwater, water quality, environmental analysis and restoration, surveying, mapping, water conservation, and other related areas within the boundaries of their offices. Because of the regional offices' close ties with local interests, DWR regional coordinators in each office facilitate overall communication between DWR divisions and local partners to ensure coordinated efforts throughout all DWR programs and projects.

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North Coast Hydrologic Region

Setting

The North Coast Hydrologic Region encompasses redwood forests, inland mountain valleys, and the semi-desert-like Modoc Plateau. The region includes all or large parts of Modoc, Siskiyou, Del Norte, Trinity, Humboldt, Mendocino, Lake, and Sonoma counties (Figure NC-1). It also includes small areas of Glenn and Marin counties. The region includes the Pacific Ocean coastline from Tomales Bay to Oregon, and then extends east along the border to the Goose Lake Basin. This region covers roughly 19,500 square miles, or more than 12 percent of California's land area. Most of the region is mountainous and rugged. The dominant topographic features in the region are the California Coast Range, the Klamath Mountains, and Modoc Plateau. The mountain crests, which form the eastern boundary of the region, are about 6,000 feet elevation with a few peaks higher than 8,000 feet. About 425 miles of ocean shoreline form the western boundary of the region. All streams in the North Coast Hydrologic Region empty into the Pacific Ocean between Bodega Bay and Oregon. Only 13 percent of the land is classified as valley or mesa, and more than half of that is in the higher-elevation northeastern part of the region in the upper Klamath River Basin.

The North Coast Hydrologic Region as defined by the North Coast Integrated Regional Water Management (IRWM) Plan is consistent with the North Coast Region boundary used by the North Coast Regional Water Quality Control Board (Regional Water Board). Most of the population is concentrated along the Pacific Coast and in the inland valleys immediately north of the San Francisco Bay Area.

Watersheds

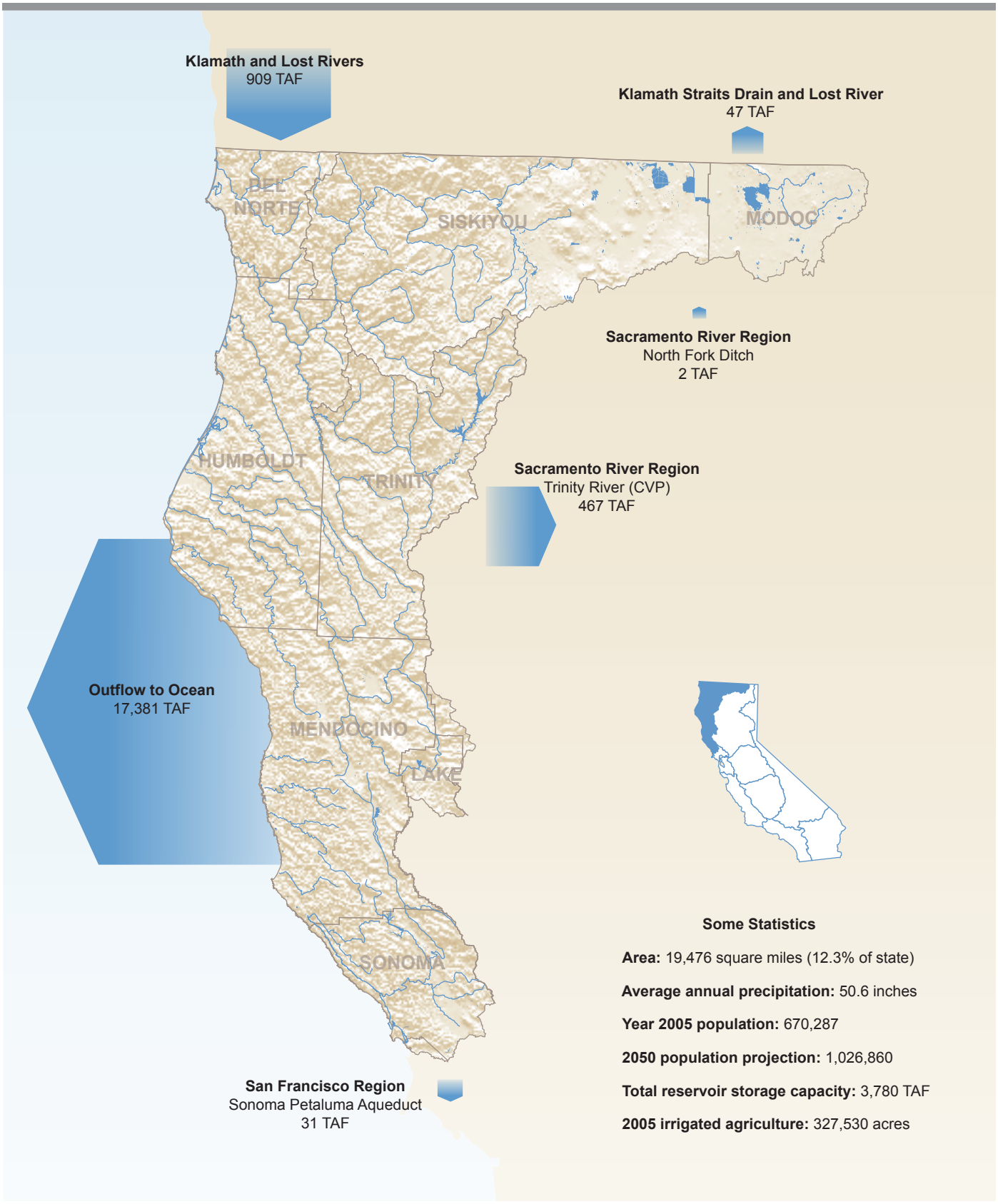
Watershed Boundaries

The area's Water Quality Control Plan divides the North Coast region into two natural drainage basins—the Klamath River Basin and the North Coastal Basin. The North Coastal Basin is divided into four watershed management areas (WMA): the Humboldt, Eel River, Russian/ Bodega, and North Coast. Following is a summary of the descriptions of each area as defined by the Watershed Management Initiative (WMI) of the State Water Resources Control Board (State Water Board) and a description of the principal flood-producing streams.

Klamath River Basin

Klamath Watershed Management Area. The Klamath River begins at Upper Klamath Lake in Oregon, then drains through the Klamath and Siskiyou mountains, ending at the Pacific Ocean about 20 miles south of Crescent City. The Klamath has four major tributaries in California: the Shasta, Scott, Salmon, and Trinity rivers. Derived from Mt.

Figure NC-1 North Coast Hydrologic Region 2005 inflows and outflows



Box NC-1 Acronyms and Abbreviations Used in this Report

AHPS	Advanced Hydrologic Prediction System
API	antecedent precipitation index
BLM	US Bureau of Land Management
Cal EMA	California Emergency Management Agency
CCA(s)	Critical Coastal Area(s)
CDEC	California Data Exchange Center
cfs	cubic feet per second
CRS	Community rating System
CVP	Central Valley Project (federal)
DFG	California Department of Fish and Game
DWR	California Department of Water Resources
FEMA	Federal Emergency Management Agency
FIRM(s)	Flood Insurance Rate Map(s)
ICWMP	Integrated Coastal Watershed Management Plan
IRWM	Integrated Regional Water Management
NC	North Coast
NIMS/SEMS	National Incident Management System/Standardized Emergency Management System
NFIP	National Flood Insurance Program
NPS	nonpoint source
NRCS	US Natural Resources Conservation Service
NWS	National Weather Service
PCE	perchloroethylene
PVP	Potter Valley Project
RAP	regional acceptance process
Regional Water Board	Regional Water Quality Control Board
State Water Board	State Water Resources Control Board
SWAMP	Surface Water Ambient Monitoring Program
taf	thousand acre-feet
TMDL	total maximum daily load
TRD	Trinity River Diversion
USACE	US Army Corps of Engineers
USBR	US Bureau of Reclamation
USFS	US Forestry Service
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey
WMA	Watershed Management Area
WMI	Watershed Management Initiative

Shasta's snowmelt, the Shasta River flows into the Klamath north of Yreka. The Scott River flows through Scott Valley and joins the Klamath just upstream of Hamburg. The Salmon River drains parts of the Klamath Mountains into the Klamath River at Somes Bar. The Trinity River is described later. The Klamath WMA is divided into three subbasins: Lower Klamath, Middle Klamath, and the Upper Klamath.

The Lower Klamath subbasin includes the Klamath River and its tributaries downstream from the Scott River, excluding Trinity River. It covers 2,564 square miles and includes the Salmon River, Blue River, and Klamath River delta/estuary. This subbasin contains mountainous terrain that historically supported a silviculture economy of the small communities along the Lower Klamath River. Salmon fishing has been important in the region because the Karuk and Yurok tribes have their ancestral communities along the river. Today, recreational fishing joins traditional fishing as an important part of the area's economic and social structure.

The Middle Klamath subbasin encompasses the portion of the Klamath River and its tributaries between the confluence of the Klamath and Scott rivers to Iron Gate Dam including the mainstem of the Klamath River and Scott and Shasta River watersheds. The basin covers 2,850 square miles. Both the Shasta and Scott rivers receive water from precipitation and snowmelt. The small towns in the watershed including Etna, Fort Jones, and Callahan have roots in a silviculture and agricultural economic base.

The Upper Klamath subbasin encompasses the area upstream of Iron Gate Dam. However, only a small part of this area is in California. The primary subwatershed in California is the Lost River watershed. The Lost River watershed covers about 1,689 square miles and includes Clear Lake Reservoir and Lower Klamath Lake watershed. The area around Clear Lake Reservoir is characterized by high desert streams and is sparsely populated. Land uses in the California portion are primarily irrigated agriculture, grazing, and lands administered for the National Wildlife Refuge.

Trinity River Watershed Management Area. The Trinity River basin drains an area of about 2,900 square miles of mountainous terrain. The Trinity River is the largest tributary to the Klamath River. It flow into Clair Engle and Lewiston lakes then through the Hoopa Valley and Yurok Indian reservations to the Klamath River at Weitchpec. The South Fork Trinity River is a tributary near Salyer. The inner valley gorges are considered highly unstable, and much of the WMA is prone to seismically induced landslides, especially during winter months when soils are saturated. Annual precipitation averages 57 inches with a low of 37 inches in Weaverville and Hayfork and highs of 75 inches in Trinity Center and 85 inches in the Hoopa Mountains. Occasionally, summer thunderstorms may start wildfires and produce extensive runoff.

The Trinity River WMA is primarily rural with human populations centered near Trinity Center, Weaverville, Lewiston, Hayfork, Hoopa, and Willow Creek. Timber harvest has traditionally been a large factor in the economy on both federal and private land. The US Forest Service (USFS) and Bureau of Land Management (BLM) manage about 80 percent of the land in the WMA; of the remaining 20 percent, about half are industrial timberlands.

In the early 1950s, two major water-development features were installed near the community of Lewiston. The Trinity River Diversion (TRD) consists of Trinity Dam and its reservoir (Trinity Lake) and Lewiston Dam and its reservoir (Lewiston Lake) and related facilities.

North Coastal Basin

Humboldt Bay Watershed Management Area. The Humboldt Bay WMA encompasses water bodies that drain to the Pacific Ocean from Humboldt Bay north to Redwood Creek. The major river systems in the WMA are the Mad River and Redwood Creek. The Mad River flows from above Ruth Reservoir in Trinity County and empties into the ocean just west of McKinleyville. North of the Mad River, Redwood Creek from near Snow Cap Mountain, flows through Redwood National Park until ending at the Pacific Ocean west of Orick. Additional water bodies include Humboldt Bay, Mad River Slough, and coastal lagoons (Big, Stone, and Freshwater lagoons) and streams (Elk, Little River, Freshwater, Jacoby, and Maple creeks). The terrain is predominantly mountainous with a few small valleys, the Mad River and Redwood Creek floodplains, and marine terraces. Precipitation ranges from 32 to 98 inches annually. The streams support production of anadromous salmonoids, including steelhead and cutthroat trout, coho and Chinook salmon.

Eel River Watershed Management Area. The Eel River and its tributaries comprise the third largest river system in California and the largest river system draining to Humboldt County's coast. The river begins in northern Lake County and western Glenn County, flows through Lake Pillsbury (the largest reservoir in the WMA), into Mendocino and Humboldt counties, and across a coastal plain to join the Pacific Ocean south of Humboldt Bay. Its principal tributaries are the Middle, North, and South forks of the Eel River, Black Butte River, and the Van Duzen River. The Middle Fork drains northeastern Mendocino County to the main Eel at Dos Rios. The North Fork originates in southern Trinity County and joins the main stream near the Mendocino-Trinity County Line. The South Fork begins in northwestern Mendocino County and joins the main river north of Weott. Black Butte River flows from Glenn County northward to the Middle Fork of the Eel River east of Covelo. In October 2006, 21 miles of Black Butte River were listed as Wild and Scenic. The Van Duzen River drains part of western Trinity County then flows into the Eel near Rohnerville. The Eel River WMA encompasses roughly 3,684 square miles. The upper watershed is mountainous, and soils are steep and highly erodible.

The primary irrigated crop areas are on the Eel and Van Duzen floodplains. Fodder crops are mainly grown in these areas to supply the local dairy industry. The largest communities in the lower Eel River area are Fortuna and Ferndale. Other communities in the watershed include Rio Dell, Scotia, Garberville, Laytonville, and Willits. In most of the alluvial valleys, surface water and groundwater are closely connected; for this reason, surface water withdrawals have a substantial effect on local groundwater supplies.

Russian/Bodega Watershed Management Area. This WMA includes the Russian River and Bodega hydrologic units including the Bodega Harbor, Salmon Creek, Americano Creek, and Stemple Creek watersheds.

The Russian River hydrologic unit encompasses 1,485 square miles in Mendocino and Sonoma counties. The Russian River flows from north of Ukiah to its confluence with

Mark West Creek and into the Pacific Ocean near Jenner. Dry Creek flows from Lake Sonoma and meets the Russian River just south of Healdsburg, and the Laguna de Santa Rosa enters the Russian River southwest of Windsor. Major water storage components of the Russian River include Lake Sonoma and Lake Mendocino on the East Fork of the Russian River. The summer climate is moist and cool near the coast with temperatures increasing toward the inland areas. Depending on location, average annual precipitation ranges from 30 to 80 inches.

The Bodega hydrologic unit contains streams with headwaters in the Coast Range that enter the Pacific Ocean south of the Russian River. Salmon, Americano, and Stemple creeks and their associated estuaries are the main water bodies in this hydrologic unit. The terrain is relatively steep and erodible and is sensitive to disturbance. Cooler temperatures with annual precipitation between 32 and 42 inches typify the climate of the watershed. Because of the Mediterranean climate, summertime flows are often nonexistent in Americano and Stemple creeks, Salmon Creek flow is low but sustained. Each of these subwatersheds has estuaries. The Estero Americano (Americano Creek) and the Estero de San Antonio (Stemple Creek) are prized for their resemblance to fjords and the enhanced resource values associated with these isolated estuarine environments.

North Coast River Watershed Management Area. The North Coast rivers not included in other WMAs are included in this grouping. The major watersheds are the Smith River, Bear River, Mattole River, Ten Mile River, Noyo River, Big River, Albion River, Navarro River, Garcia River, and Gualala River and Greenwood, Elk and Alder creeks. The most flood-prone of these are the Smith, Navarro, and Mattole rivers. The Smith River meets the Pacific about 4 miles south of the Oregon border after flowing from the Siskiyou Wilderness area and from above the California-Oregon border. The Navarro and Mattole rivers begin in the Coast Range and terminate at the Pacific Ocean near Albion and Punta Gorda, respectively. The 12 Critical Coastal Areas in the North Coast WMA are the Mattole River, King Range National Conservation Area, Pudding Creek, Noyo River, the Pygmy Forest Ecological Staircase, Big River, Albion River, Navarro River, Garcia River, the Kelp beds at Saunders Reef, Del Mar Landing Ecological Reserve, and Gerstle Cove.

Ecosystems

The North Coast region is characterized by sedimentary geology with inclusions of metamorphic, granitic, and volcanic rock. The presence of both north-west and south-east trending faults and geologic structures largely defines the river systems in the Coast Range. In the northern coastal and interior region, larger metamorphic and intrusive blocks form the Siskiyou Mountains. The eastern extent of the Klamath Basin lies within the volcanic Cascade mountain range.

Significant natural freshwater bodies, apart from rivers and estuaries, are scant. Existing large, natural freshwater bodies include the remnants of historical Tule Lake in Modoc

County, Meiss Lake in Siskiyou County, and Laguna de Santa Rosa in Sonoma County (largest tributary to the Russian River).

Estuaries and littoral environments are very significant to the region. They provide important habitat for a variety of organisms and are strongly affected by freshwater outflow. Examples are Lake Earl in Del Norte County, Humboldt Bay and northern lagoons in Humboldt County, and Bodega Bay in Sonoma County. Included in this category are the often extensive estuarine environments of the many waterways including the Smith, Klamath, Tenmile, Noyo, Albion, Big, Navarro, Gualala, and Russian rivers.

The estuarine environment along the coast is extremely important to many species of waterfowl and shore birds, both for feeding and nesting. In addition, anadromous salmonids, which use estuaries as a staging area to physiologically adapt to changes in salinity, benefit from these environments. Marine invertebrates and fish use the rich resources in tideland areas along the North Coast and serve as forage for seabirds and marine mammals. Offshore coastal rocks are used for resting and reproduction by marine mammals and as nesting areas by many species of seabirds.

Many local drainages that flow directly to the ocean are too minor to be described in this overview but are nonetheless important. These smaller watersheds are "interfluves," or areas outside of the larger watershed boundaries used at the regional planning scale. Local drainages include important ecosystems that may provide habitat for sensitive species and other wildlife. The entire region contains many sensitive species including 30 federal Endangered plants, 4 federal Endangered fish (including the Central Coast Evolutionarily Significant Unit coho salmon), 4 federal Endangered birds, and 7 federal Endangered mammals. The North Coast region is renowned for its wealth of natural resources, recreational opportunities, wildlife, and scenic vistas. The region's mountains, valleys, forests, and grasslands are home to deer (*Odocoileus hemionus*), common garter snake (*Thamnophis sirtalis*), elk (*Cervus elaphus*), Vaux's swift (*Chaetura vauxi*), black bear (*Ursus americanus*), southern torrent salamander (*Rhyacotrition vareigatus*), mountain lion (*Puma concolor*), and many other animal species. The abundant streams and rivers of the region provide essential habitat for anadromous fish and other aquatic life. The lakes and reservoirs support both cold and warm water fish. In addition, the remnant lakes and managed reservoirs of the far northeastern portion of the region are important for migratory waterfowl and serve as critical links in the Pacific Flyway.

The principal reaches (and tributaries) of the Klamath, Eel, and Smith rivers have been designated Wild and Scenic under federal and State law.

Climate

Weather conditions and temperatures vary dramatically from the cooler coastal areas to the arid inland valleys in Siskiyou and Modoc counties. In the western coastal portion of this region, average temperatures are moderated by the influence of the Pacific Ocean

and range from highs in the mid-80s in the summer to lows in the mid-30s during the winter. In the inland regions of Siskiyou and Modoc counties where a Mediterranean climate prevails, temperatures are more variable with summer highs usually reaching the 100-degree mark and winter lows often dropping below freezing.

Heavy rainfall make this portion of the Coast Range the most water-abundant area of California. Mean annual runoff is about 29 million acre-feet, which constitutes about 41 percent of the state's total natural runoff, the largest volume compared to all other hydrologic regions of California. More than half of the region's precipitation runs freely to the ocean as natural runoff. Major rivers in decreasing order of average annual runoff are the Klamath with 11 million acre-feet; the Eel, 6 million acre-feet; the Smith, 3 million acre-feet; the Russian, 1.6 million acre-feet; and the Mad and Mattole, 1 million acre-feet each. Annual average precipitation in the North Coast region is about 50 inches, ranging from more than 100 inches per year in eastern Del Norte County to less than 15 inches annually in the Lost River drainage area of Modoc County. A relatively small fraction of precipitation is in the form of snow falling at elevations above 4,000 feet.

Population

The North Coast Hydrologic Region had 670,287 people in 2005. About 2 percent of the state's total population lives in this region, and 49 percent of the region's population lives in incorporated cities. Between 2000 and 2005, the region grew by 26,287 people, a growth of 4 percent over the 5-year period. For historical population data, 1960–2005, see Volume 5, The Technical Guide.

In Water Plan Update 2009, we project population growth based on the assumptions of future scenarios. Discussion of the three scenarios used in this Water Plan and how the region's population may change through 2050 can be found later in this report under Looking to the Future.

Senate Bill 18 (Chapter 905, Statutes of 2004) requires cities and counties to consult with Native American Indian Tribes during the adoption or amendment of local general plans or specific plans. A contact list of appropriate Tribes and representatives within a region is maintained by the Native American Heritage Commission. (See Box NC-2 for information about regional Tribal concerns.)

Land Use Patterns

Forest and rangeland represent about 98 percent of this region's land area. Much of the region is identified as federal BLM land, national forests, State or National Park, and Native American Indian lands such as the Hoopa Valley and Round Valley reservations (Table NC-1). The major land uses in the North Coast region consist of timber production, agriculture, fish and wildlife management, recreational areas, and open space. However, in recent years the timber industry has declined as a result of over-cutting.

Box NC-2 California Native American Tribal Information, North Coast Hydrologic Region

Demographics.

- Tribes with historic or cultural ties to the North Coast region are primarily the Pit River (Achomawi) in the northeast corner; the Hupa, Karuk, Mattole, Shasta, Tolowa, Upper Klamath, Wiyot, and Yurok in the northwest section; and the Achomowai, Cahto, Concow, Nomalaki, Wailaki, Wintun, Yuki, and Pomo in the middle third of the region; and Pomo, Northern Pomo, Southern Pomo, and Coast Miwok in the lower third of the region.
- Currently, Tribal landholdings located in this region include: Big Lagoon, Blue Lake, Cher-Ae (Trinidad), Cloverdale, Coyote Valley, Dry Creek, Elk Valley, Graton, Hoopa, Hopland, Karuk, Laytonville, Lytton, Manchester-Point Arena, Noyo River, Pinoleville, Potter Valley, Quartz Valley, Redwood Valley, Resighini, Rohnerville, Round Valley, Sherwood Valley, Smith River, Steward's Point, Table Bluff, Weaverville (Nor-El-Muk), XL Ranch, Yreka (Shasta) and Yurok reservations, rancherias, or communities. The Klamath land base is in Oregon. Approximately 26 individual allotments are also located within this region

Collaborative Efforts.

- For the past 15 years, the Shasta-Trinity National Forest has been working in conjunction with native people from the Pit River, Winnmem Wintu, Shasta Indian Nation, and other Tribes on watershed restoration. Activities include restoration of springs and meadows, seed collection, plantings in sensitive and burned areas, and an indigenous plants greenhouse celebration. The Shasta-Trinity Forest maintains a traditional gathering policy. The Forest Service uses "participating agreements" that include cost-share elements and Memorandum of Understanding (MOU). For example, the Pit River has an MOU for principles and protocols; a project-specific Memorandum of Agreement (MOA) is used with individual bands.
- The Shasta Valley Resource Conservation District is involved in rehabilitation of the Shasta River, including Tribal water quality monitoring activities.
- Sonoma County has a consultation process for projects and worked with three Tribes on land use decisions that might affect Tribes.
- In Hopland, Tribes and ranchers are working with the California Conservation Corp for restoration work including instream flows and temperature.
- The InterTribal Sinkyone Wilderness Council is a nonprofit consortium of ten federally-recognized California Indian tribes engaged in cultural land conservation, Native stewardship, habitat restoration, and education. The Council partnered with Sinkyone State Park on a watershed rehabilitation project that greatly reduced sediment loads.
- The Hoopa and Yurok undertook Trinity River restoration work, through an AmeriCorp Watershed Stewards project, for gravel introduction and riparian habitat work. The Hoopa Tribe was a lead agency on the Trinity River Restoration Program Environmental Impact Report.

Issues and Priorities.

- Mercury contamination issues regarding fish consumption and use of plant materials is an important matter. Risks need to be identified; within the Cache Creek watershed, the California Department of Toxic Substances Control is working with Tribes to analyze materials. Outreach is needed to explain known risks, especially in problem areas such as Clear Lake. To help explain mercury risks, the California Indian Environmental Alliance provided training at community events and Indian Health Centers during the summer of 2009.
- Water exports through bottled water activities were proposed for the McCloud watershed by Nestle, which is seeking to re-open negotiations on its proposal.
- Burning is a traditional land management practice that is severely constrained by agencies. The Forest Service is strongly encouraged to involve Tribes in controlled burns.
- Sandbars block river mouths during droughts, blocking spawning access for fish
- Illegal diversions and abandoned diesel generators, from illegal activities, affect water quality and create a fuel/fire problem.
- Flood risks and emergency response: Resighini Rancheria is on the floodplain and has no protection. Many Tribes are not considered in County evacuation and emergency response plans.
- Protection of rookeries and estuaries.

Priorities and accomplishments.

- Tribal non-point source projects funded by EPA for water conservation, fisheries, and restoration efforts; the Yurok and Klamath have many sediment reduction projects with tree planting along streams.
- Tribes are working with Tribal health agencies to try and assure water supplies.
- 2003 Klamath Basin Tribal Water Quality Workgroup formed to support Klamath fisheries (with Kier Associates)

NOTE: Above information was gathered from Tribal input at the California Water Plan Update regional workshops and the Tribal water plenary session that are supporting the California Tribal Water Summit.

Table NC-1 Tribal lands with acreage, North Coast Hydrologic Region

Federal Trust Lands	Acres	Tribal owners
Big Lagoon Rancheria	20	Yurok and Tolowa Indians
Blue Lake Reservation	31	Wiyok, Yurok, Hupa and other Indians
Cloverdale Reservation (According to Tribe's home page, the Rancheria was terminated by the US Government in 1958)	Unknown at this time	Pomo Indians
Coyote Valley Reservation	58	Pomo Indians
Dry Creek Rancheria	75	Pomo Indians
Elk Valley Reservation	105	Tolowa Indians
Graton Rancheria (Appears now to be one private lot owned by one individual - was 15 acres for Coast Miwok)	Unknown at this time	Gloria Armstrong
Guidiville Reservation	44	Pomo Indians
Hoopa Valley Reservation - Hoopa Valley Indian Reservation	85,446	Hupa Indians
Hopland Reservation	Unknown at this time	Pomo Indians
Karuk Reservation	Unknown at this time	
Manchester Reservation - Point Arena Rancheria	364	Pomo Indians
Lytton Rancheria	Unknown at this time	
Laytonville Rancheria	264	Cahto and Pomo Indians
Pinoleville Rancheria	99	Pomo Indians
Potter Valley Rancheria (Not shown/listed on BIA Map - Found on SDSU listing and added here)	10	Little River Band of Pomo Indians
Quartz Valley Reservation	174	Klamath, Karuk, and Shasta Indians
Round Valley Reservation	30,537	Achomawi, Concow, Nomelaki, Wailaki, Wintun, Yuki, Pit River, Little Lake, and Pomo Indians
Rohnerville Reservation	60	Wiyot and Mattole Indians
Redwood Valley Rancheria	177	Northern Pomo Indians
Sherwood Valley Rancheria	356	Pomo Indians
Table Bluff Reservation	102	Wiyot Indians
Stewarts Point Rancheria	100	Kashia Pomo Indians
Trinidad Rancheria	47.2	Yurok, Weott (Wiyot), and Tolowa Indians
XL Ranch Reservation Pit River Tribe	9,254	Pit River Indians
Smith River Rancheria	186	Tolowa Indians
Yurok Reservation	56,585	Yurok Indians
Resighini Rancheria	228	Yurok Indians

Note: Indian lands held in Trust includes Tribal and allotted as well as Trust lands in the form of Public Domain Allotments (PDAs). Source: US Bureau of Indian Affairs. Pacific Region Acreage Summary FY 2008

Vacationers, boaters, anglers, and sightseers are attracted to the region's 400-plus miles of scenic ocean shoreline, including nearby forests with more than half of California's coastal redwoods. The inland areas are mountainous and include 10 wilderness areas managed by USFS. More than 40 State parks, numerous USFS campgrounds, the Smith River National Recreation Area, and the Redwood National Park are within

this hydrologic region. It is an area of rugged natural beauty with some of the most renowned fishing in North America.

Climate, soils, water supply, and distance to market are factors that limit the types of agricultural crops that can be grown in the North Coast region. In this region, agriculture predominantly depends on natural precipitation and runoff because few or insufficient reservoirs exist. The majority of rainfall occurs in the winter and early spring months, but crops are generally grown during spring and summer. Often, due to reduced water supply during dry years, farmers turn to groundwater (if economically available), deficit irrigation, or fallowing.

Irrigated agriculture uses most of the North Coast region's developed water supplies. Irrigation today accounts for about 81 percent of the region's water use, while municipal and industrial use is about 19 percent. About 327,500 acres, or about 2 percent of the region, is irrigated. Of that, 175,600 acres lie in the Upper Klamath River Basin (in California) above the confluence of the Scott and Klamath rivers. Although the predominant crops in the North Coast region are pasture and alfalfa, other significant crops exist. The highest value crops in the region include wine grapes and orchards in the Russian River Basin. In 2005 total acreage of these crops was more than 60,000 acres, bringing in more than $437.8 million. In Del Norte County, ornamental flowers had a total acreage (of bulbs) of 435 acres and brought in more than $5.8 million of gross sales (2005).

For more discussion about the timber industry, see Resolution #21 Improve the Timber Harvest Plan Development and Review Process in the California Performance Review–Government for the People for a Change, Volume 4 Issues and Recommendations, Chapter 5 Resource Conservation and Environmental Protection. Available online: cpr.ca.gov/CPR_Report/Issues_and_Recommendations/Chapter_5_Resource_Conservation_and_Protection/RES21.html.

County of Del Norte Agricultural Commission Office: http://www.dnco.org/cf/topic/topic4.cfm?Topic=AgriculturalDepartment&SiteLink=200007b.html

Sonoma County Agricultural Crop Report 2005 http://www.sonoma-county.org/agcomm/pdf/2005_crop_report.pdf

Regional Water Conditions

Environmental Water

The North Coast region generally has the most abundant water resources of any region of the state. However, the North Coast has experienced significant unpermitted growth (i.e., building without any permits, including lack of water rights) and is seeing an increased number of illegal diversions for illegal crop (marijuana) growth, which seriously impairs instream water availability and water quality. Estimates of the number of building sites constructed without permits in Humboldt County currently range around 1,800.

This affects fully appropriated streams such as the Eel and Mad rivers and the Smith River, which is the largest undammed Wild and Scenic River in California. Maintenance of summer flow is a continual challenge.

Maintaining and restoring the ecological health of the North Coast region depends heavily on local watershed groups and watershed coordination efforts, landowners, the public, and local resource experts. Many of the watersheds in the North Coast region have completed watershed assessments, watershed management plans, and strategies. All of these documents identify the resources within their respective watersheds and needs for restoration, including the potential for improving water resources via restoration or other actions.

Unsurfaced roads are a major contributor of sediment, especially fine sediment to streams. In order to manage their effects, roads near streams are often rocked, which is better than native surface roads but not as good as the more expensive paved, chip sealed, etc. Much of the North Coast rock is of poor quality and breaks into fine particles quickly, further reducing the effectiveness and the duration of efficacy for rocking.

There are negative effects due to legal and illegal water drafting. In order to abate dust (which helps with subsequent erosion from road surfaces), water is drafted from streams as a permitted activity. Meanwhile, illegal drafting to irrigate clandestine marijuana crops has become a serious problem along many of the streams. Late in the summer and early autumn, the flow of many streams is depleted to such an extent that there are significant concerns about direct and cumulative effects on habitat of salmonid and other aquatic organisms. California Department of Fish and Game (DFG) staff through environmental review and permitting continue to address water conservation and water quality needs. Future collaboration with other resource agencies on California Environmental Quality Act project review, Lake or Streambed Alteration Agreement Processes (Fish and Game Code Section 1600 permits), and environmental review of pending water rights applications will help contribute to watershed conservation efforts.

The coho salmon (*Oncorhynchus kisutch*) range for California is coincident with coastal draining watersheds from the Oregon border down to northern Monterey Bay. DFG, with the assistance of recovery teams representing diverse interests and perspectives, created the Recovery Strategy for California Coho Salmon (*Oncorhynchus kisutch*), a guide for the process of recovering coho salmon on the north and central coasts of California. DFG's Recovery Strategy for Coho Salmon (2004) emphasizes cooperation and collaboration at many levels, and recognizes the need for funding, public and private support for restorative actions and maintaining a balance between regulatory and voluntary efforts. Landowner incentives and grant programs are some of the many tools available to recover coho salmon. However, the success of this Recovery Strategy will ultimately be determined by the long-term commitment and efforts of all who live in, or are involved with, coho salmon watersheds. DFG staff in the North Coast Hydrologic Region have established a program with Sanctuary Forest for riparian water users to "forbear" their water right pumping in Mattole River in exchange for grant-funded water storage tanks.

Water Supplies

Many of the smaller communities and rural areas in the North Coast region are supplied by small local surface water and groundwater systems. Larger water supply projects in this region include US Bureau of Reclamation (USBR) Klamath Project, the US Army Corps of Engineers (USACE) Russian River Project (Lake Mendocino and Lake Sonoma), and the Humboldt Bay Municipal Water District's Ruth Reservoir, which serves coastal communities from Eureka to McKinleyville. Because the Upper Klamath River watershed is in both California and Oregon, the federal Klamath Project includes water supply lakes and reservoirs in both states. Lakes and reservoirs in the California portion include Clear Lake Reservoir for water supply, Tule Lake and Lower

Klamath Lake as waterfowl refuges, and Iron Gate Reservoir as a hydroelectric plant of PacifiCorp (formerly Pacific Power and Light Company). The primary water supply sources on the Oregon side are Gerber Reservoir and Upper Klamath Lake. The Klamath Project is the largest agricultural irrigation project in the region, and supplies water to about 240,000 acres, of which 62 percent is in Oregon and 38 percent in California. To maintain adequate instream fishery flows for the lower Klamath River, water releases must be coordinated among the various reservoirs operated by different agencies in both states.

Two of the largest water supply reservoirs in the North Coast region are USBR's Trinity Lake (2.437 million acre-feet) on the Trinity River and the USACE Lake Sonoma (380 thousand acre-foot) in the Russian River watershed. These facilities provide water for instream flows, recreation, hydropower, and water supply purposes.

Water from Trinity Lake is exported from the North Coast region to the Sacramento River region through USBR's Clear Creek Tunnel. The amount of water released from Trinity Lake through the Clear Creek Tunnel is based on the water year type (www.trrp.net/faq/index.htm, USBR classification). The average monthly releases to the Clear Creek Tunnel from Lewiston Lake are about 240 cubic feet per second peak flow in February to a minimum of 80 cubic feet per second in July and August.

Lake Sonoma is operated by the USACE to provide flood control and instream flows in the Lower Russian River. Lake Sonoma was completed in 1983 to capture and regulate water from Dry and Warm Springs creeks (tributaries to the Russian River) in Sonoma County.

Upstream on the Russian River, an intra-basin water transfer system known as the Potter Valley Project (PVP) has been in existence since 1908 and diverts water from the upper reaches of the Eel River at Cape Horn Dam through a tunnel to the East Fork Russian River upstream from Lake Mendocino. The PVP is owned and operated by Pacific Gas and Electric and produces electricity for the city of Ukiah.

The water stored behind Coyote Dam (Lake Mendocino, built 1958) is used to meet instream flow requirements and urban and agricultural uses in the upper and lower Russian River watershed and the Santa Rosa area. Mendocino County authorities would like Coyote Dam raised to increase water storage in Lake Mendocino.

Groundwater development is sporadic throughout the mountainous areas of the region, and wells are generally along the many valleys' rivers and streams. As described in the Department of Water Resources (DWR) California's Groundwater (2003), very few significant aquifers in the coastal mountains are capable of providing reliable water. In the coastal areas, most groundwater is developed from shallow wells that are typically installed in the sand and gravel beds adjacent to rivers. Significant groundwater basins exist in two main areas: the upper Klamath River valley along the California border with Oregon and the southern tip of the North Coast region underlying the Santa Rosa area.

Water Uses

Environmental

The principal developed uses of environmental water occur in the Lower Klamath Lake National Wildlife Refuge, Tule Lake National Wild Refuge, Clear Lake National Wild Refuge, Butte Valley Wildlife Area, and Shasta Valley Wildlife Area. In Butte Valley, most of the water for wildlife comes from groundwater and Meiss Lake (about 3,000 acres). As a result of the passage of both federal and State Wild and Scenic Rivers acts in 1968 and 1972, many of the major rivers in the North Coast region have been preserved to maintain their free-flowing character to provide for environmental uses. Most of the Eel, Klamath, Trinity, and Smith rivers are designated as Wild and Scenic, which preserves these river resources and protects them from new water development. On the Trinity River, efforts to restore the fishery led to a federal Record of Decision to increase the fishery flow releases from Trinity Lake. After several years of legal challenges, this decision was upheld by a July 2004 federal court decision. The water allocated to downstream fishery flows is now being increased from the previous 340,000 acre-feet per year to a new schedule that ranges between 368,600 acre-feet in a critically dry year to 815,000 acre-feet in an extremely wet year.

Agricultural and Urban

The water balance tables and the narrative discussion in this report provide a detailed summary of the actual region-wide water supplies and water uses from years 1998 through 2005 for the entire North Coast region. (See Water Balance Summary below.)

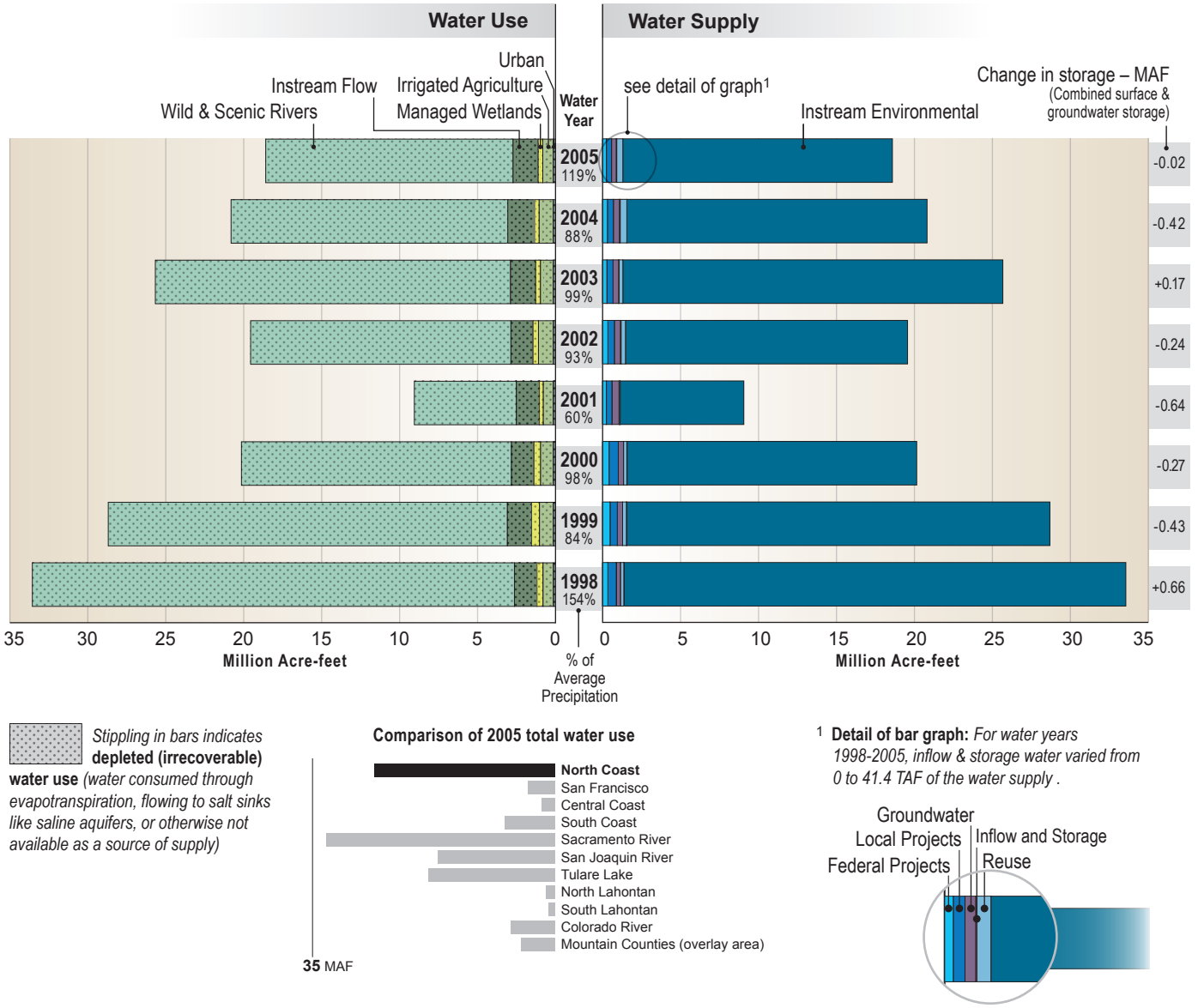
Water Balance Summary

Figure NC-2 summarizes the total developed water supplies and distribution of the dedicated water uses within this hydrologic region for the eight years from 1998 through 2005. As indicated by the variation in the horizontal bars for wet (1998) and dry (2001) years, the distribution of the dedicated supply to various uses can change significantly based on the wetness or dryness of the water year. The more detailed numerical information about the developed water supplies and uses is presented in Volume 5 Technical Appendix, which provides a breakdown of the components of developed supplies used for agricultural, urban, and environmental purposes and Water Portfolio data. See Water Portfolio data and figures in Volume 5 The Technical Guide.

For the North Coast region, dedicated environmental water for instream fishery flows dominate the use of developed water; urban and agricultural water uses in this region are much smaller portion of the total. The water supply portion of Figure NC-2 also indicates that most of the water supply in this region is from surface water flows with minor usage from groundwater sources.

Table NC-2 presents information about the total water supply available to this region for the eight years from 1998 through 2005, and the estimated distribution of these water

Figure NC-2 **North Coast water balance for water years 1998–2005**



supplies to all uses. The annual change in the region's surface water and groundwater storage is also estimated, as part of the balance between supplies and uses. In wetter water years, water will usually be added to storage, but during drier water years, storage volumes may be reduced. Of the total water supply to the region, more than half is either used by native vegetation; evaporates to the atmosphere; provides some of the water for agricultural crops and managed wetlands (effective precipitation); or flows to other states, the Pacific Ocean, and salt sinks like saline groundwater aquifers. The remaining portion, identified as consumptive use of applied water, is distributed among urban and agricultural uses and for diversions to managed wetlands. For some of the data values presented in Table NC-2, the numerical values were developed by estimation techniques, because actual measured data are not available for all categories of water supply and use.

Table NC-2 North Coast Hydrologic Region water balance for 1998-2005 (in TAF)

North Coast (TAF)	Water Year (Percent of Normal Precipitation)							
	1998 (154%)	1999 (84%)	2000 (98%)	2001 (60%)	2002 (93%)	2003 (99%)	2004 (88%)	2005 (119%)
Water Entering the Region								
Precipitation*	79,216	45,590	50,755	31,254	50,520	53,304	47,461	64,296
Inflow from Oregon/Mexico	2,105	2,189	1,498	988	995	1,000	973	909
Inflow from Colorado River	0	0	0	0	0	0	0	0
Imports from Other Regions	2	2	2	2	2	2	2	2
Total	**81,323**	**47,781**	**52,255**	**32,244**	**51,517**	**54,306**	**48,436**	**65,207**
Water Leaving the Region								
Consumptive Use of Applied Water ** (Ag, M&I, Wetlands)	646	827	791	647	876	756	800	617
Outflow to Oregon/Nevada/Mexico	184	410	114	66	100	72	85	67
Exports to Other Regions	883	1,008	1,144	703	671	895	1,023	498
Statutory Required Outflow to Salt Sink	32,348	27,149	18,763	8,021	18,095	24,375	19,261	17,294
Additional Outflow to Salt Sink	115	122	125	122	85	79	75	87
Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, Natural and Incidental Runoff, Ag Effective Precipitation & Other Outflows	46,491	18,697	31,592	23,323	31,929	27,956	27,608	46,660
Total	**80,667**	**48,213**	**52,529**	**32,882**	**51,755**	**54,133**	**48,852**	**65,222**
Storage Changes in the Region [+] Water added to storage [–] Water removed from storage								
Change in Surface Reservoir Storage	703	-198	-246	-491	14	414	-166	170
Change in Groundwater Storage ***	-47	-234	-28	-147	-252	-241	-250	-185
Total	**656**	**-432**	**-274**	**-638**	**-238**	**173**	**-416**	**-15**
Applied Water ** (compare with Consumptive Use)	1,166	1,499	1,353	1,018	1,401	1,220	1,279	1,050

* The percent precipitation is based upon a running 30 year average of precipitation for the region and discrepancies can occur between information calculated for Update 2009 and earlier published data.

** Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.

*** Change in Groundwater Storage is based upon best available information. Basins in the north part of the state (North Coast, San Francisco, Sacramento River and North Lahontan regions and parts of Central Coast and San Joaquin River Regions) were modeled - spring 1997 to spring 1998 for the 1998 water year and spring 1999 to spring 2000 for the 2000 water year. All other regions and years were calculated using the following equation:

GW change in storage = intentional recharge + deep percolation of applied water + conveyance deep percolation and seepage - withdrawals

This equation does not include the unknown factors such as natural recharge and subsurface inflow and outflow.

Water Quality

Regional Water Quality Issues

In the North Coast region, the overarching water quality issues are protection of the coastline, protection and restoration of anadromous fish, protection of drinking water, and pollution prevention. The State Water Board approved the WMI as part of its 1995 Strategic Plan; the WMI remains part of the current Strategic Plan. The WMI establishes a broad framework overlying the numerous federal- and State-mandated priorities. As such, the WMI helps the State Water Boards to achieve water resource protection, enhancement, and restoration while balancing economic and environmental impacts. The local Regional Water Board has the duty to assist in the implementation of the WMI in the North Coast region.

Water quality problems include contamination of surface water due to nonpoint source (NPS) pollution from storm water runoff, erosion and sedimentation (poorly maintained roads, agriculture, and timber harvest), channel modification, gravel mining, dairies, and MTBE, perchloroethylene (PCE), and dioxin contamination. Groundwater contamination from leaking underground tanks and health and safety issues from contaminated areas that are open to the public are also priority issues. See Appendix B for more on water quality issues in the North Coast region.

Water Governance

More complete information on water governance will be developed for California Water Plan Update 2013. This will include identification of local, State, tribal, and federal government agencies and institutions that are responsible for managing the region's water resources, flood protection, and wastewater. A list of regional flood management participants is included in Appendix A Flood Management, and IRWM plans provide information about water planning organizations in this region.

Local Planning and Priorities

Local planning efforts in the North Coast region have historically been segregated into jurisdictional planning and watershed planning. Most jurisdictional planning has been focused on county-based general plans and city-based planning. Although general plans often have a natural resources element, many do not fully integrate the natural resource-based water management issues in a given area.

Watershed planning in the North Coast region has predominantly focused on natural resources including specific species, habitats, and ecosystem processes and has largely been directed by State natural resources agencies. In general, watershed planning does not tend to incorporate municipal considerations to the degree that is necessary for effective integrated water management planning and implementation.

Historically, there is a lack of framework for integration of State priorities with local planning efforts. While cumulative impacts are felt at the regional or even statewide scale, many of these impacts tend to be caused at the local level and are most affected by local planning. It is therefore critical that the transfer of data and priorities between State and local planning efforts take place in an organized fashion. Scale issues may also be problematic. State agencies are addressing broad statewide issues and priorities, while local planning is high resolution and focused at the county, city, or watershed scale.

Integrated Coastal Watershed Management Planning

The North Coast IRWM Plan works with and incorporates the Integrated Coastal Watershed Management Plans (ICWMPs) in the North Coast region. Current ICWMPs are under way in the City of Trinidad, the watersheds of the Noyo and Big rivers, the Mattole River, the Russian River, and Salmon Creek. These watershed planning processes place an emphasis on all of the objectives of the North Coast IRWM Plan, with a special focus on Critical Coastal Areas and Areas of Special Biological Significance.

Statewide Priorities

In addition to the IRWM Proposal Solicitation Packages and Guidelines, the State of California has developed several guidance documents that are applicable to integrated water management planning in the North Coast Hydrologic Region. These include the State Water Board's WMI and the associated Regional Water Board's Basin Plan, California Water Plan Update 2009 (this document), and DFG's Recovery Strategy for Coho Salmon. Significant research, planning, and staff expertise has been invested in these guidance documents. The documents provide technical and jurisdictional direction to the region in terms of integrated planning to achieve water quality objectives and the recovery of endangered salmonids.

Following is a list of statewide priorities that the North Coast IRWM Plan will meet or contribute to.

- Total maximum daily load (TMDL) limits implementation
- Regional Water Board's WMI implementation
- Water Board's NPS Pollution Plan
- State species recovery plans implementation
- Environmental justice concerns
- Integrated projects with multiple benefits
- Support and improvement of local and regional water supply reliability
- Long-term attainment and maintenance of water quality standards, e.g., eliminate or significantly reduce pollution in impaired waters and sensitive habitat areas including areas of special biological significance
- Safe drinking water and water quality projects that serve disadvantaged communities

Federal Priorities

The North Coast IRWM planning process identifies and incorporates appropriate federal priorities. These may include species recovery plans as outlined by National Oceanic and Atmospheric Administration Fisheries, components of the US Environmental Protection Agency's NPS program, and other planning information from agencies such as Natural Resources Conservation Service, US Geological Survey (USGS), and US Fish and Wildlife Service (USFWS).

Flood Management

Flood Hazards

Because of heavy rainfall, poor land use practices, extremely high sediment loads, and steep mountains, the region's rivers exhibit short lag times and cause very destructive floods. Flooding due to snowmelt is rare primarily because of the region's proximity to the Pacific Ocean and relatively low elevation mountains. High spring tides coupled with intense rainfall can cause flooding to shoreline communities, particularly in the Humboldt Bay area. Tsunamis caused by oceanic earthquakes also pose a very real threat, particularly to the community of Crescent City in Del Norte County.

While flooding has been attenuated via flood control works and damages have been reduced by improved land use practices and zoning ordinances, flood-induced damages are still an omnipresent threat to the North Coast region. Flood hazards in the region include these representative situations (for specific instances, see the Challenges section in this report):

- Protection from flooding is not provided for a flood equal to the event with 1 percent probability (1 percent event) for some residences and commercial facilities.
- Highways and roads are vulnerable to the 1 percent event in many locations.
- Some existing culverts and channels do not have sufficient capacity to carry flow resulting from the 1 percent event.
- Population growth and the ensuing development increase the area of impervious surface without sufficient mitigation, increasing peak runoff.
- Development occurs in the floodplain of the 1 percent event without sufficient mitigation, causing increased flood damage risk.
- Mapping of the 1 percent event floodplain is incomplete in some areas. Unmanaged vegetation has reduced floodflow capacity at some locations.
- Channel aggradation has reduced flood flow capacity at some locations.
- County emergency plans do not have procedures for evacuation of tribal lands.
- Tsunamis can threaten coastal areas.

Historic Floods

Communities in the North Coast region have suffered frequent flood damage since at least 1861. Recent notable events have been:

- The St. Valentine's Day storm of 1986

- A massive tropical storm with a rain-on-snow event in January 1997
- Rain-on-snow floods of late December 2005 and early January 2006 closing Interstate 5 near the Oregon border, flooding Shasta Valley and Scott Valley, and damaging outdoor recreational facilities in Klamath National Forest

For more information on these floods see Appendix A Flood Management. Flood records for selected flood-producing streams are listed in Appendix A in Table NCA-1, Record floods for selected streams.

Flood Governance

Flood management is a cooperative effort for which federal, State, and local agencies all play significant parts. The principal participants are listed in Box NC-3 Flood Management Agencies. For more information on the agencies' roles, see Table NCA-2 Flood management participants in Appendix A Flood Management

Flood Risk Management

Flood risk management includes a wide variety of projects and programs, which may be grouped as Structural Approaches (constructed facilities, coordination and reservoir operations, maintenance), Land Use Management (regulation, flood insurance), and Disaster Preparedness, Response and Recovery (information and education, event management).

Structural Approaches

Constructed Facilities. Flood control works in the North Coast Hydrologic Region are relatively sparse compared to other regions in the state. Completed projects include reservoirs, levees, and channel improvements.

Five flood-protection reservoirs built by Sonoma County Water Agency in cooperation with the US Natural Resources Conservation Service (NRCS) have reduced flooding in the Santa Rosa area. Lakes Sonoma and Mendocino and channel modifications in the Russian River and Dry Creek, built by USACE, have reduced flood damages in Ukiah Valley and the Santa Rosa Plain. Several water-supply and hydroelectric reservoirs also provide incidental flood control benefits.

Other projects constructed by USACE include levees and channel improvements on the Eel River in the Delta, Mad River at Blue Lake, Redwood Creek at Orick, East Weaver Creek at Weaverville, and Klamath River and Turwar Creek at Klamath and Klamath Glen.

Local sponsors and descriptions for reservoirs and non-storage flood control facilities in the region are listed in Appendix A in Table NCA-3 Flood control facilities.

Box NC-3 Flood Management Agencies

Federal

- Federal Emergency Management Agency
- Natural Resources Conservation Service
- National Weather Service
- US Geological Survey
- US Army Corps of Engineers
- US Bureau of Reclamation

Tribal

- Tribal governments of the region

State

- California Conservation Corps
- California Emergency Management Agency
- Department of Corrections
- Department of Forestry and Fire Protection
- Department of Water Resources

Local

- Humboldt County Department of Public Works
- Lake County Watershed Protection District
- Mendocino County Russian River Flood Control and Watershed Conservation Improvement District
- Siskiyou County Flood Control and Water Conservation District
- Sonoma County Water Agency
- County and city emergency services units
- County and city planning departments
- County and city building departments
- Local flood maintenance organizations
- Local conservation corps
- Local emergency response agencies
- Local initial responders to emergencies

Coordination and Reservoir Operations. There are no formal operations agreements for operation of flood protection facilities in the region. However, during high water periods county flood control and emergency services agencies are in continuous contact with the State-Federal Flood Operations Center in Sacramento through the DWR and National Weather Service (NWS) North Coast Flood Center in Eureka. Reservoir operators coordinate with DWR and USACE during daily operations conferences at the center. These conferences often lead to voluntary modifications of individual schedules to improve overall system operation.

For most large flood control reservoirs in California, USACE has participated with a federal contribution to the cost of the flood control space. The NRCS has also financed flood control space in smaller reservoirs. The reserved space in multipurpose reservoirs is most often defined by a trapezoidal diagram of volume required versus date, modified by conditions in the latter part of flood season. Generally, the diagrams require a flood space reservation increasing from zero from the beginning of the flood season, invariant with date during mid-season, and decreasing to zero again at season's end. Superimposed on these diagrams are modifications based on either an antecedent precipitation index or a runoff forecast. The index-controlled diagrams are usually decreased from the trapezoid and shortened in time during drier years, beginning in mid-season. The runoff-controlled diagrams increase the trapezoid and extend it in time for the greater runoff forecasts. Single-purpose flood control reservoirs are kept as low as possible. For any reservoir, there are usually downstream controls of various kinds on evacuation rates.

Lakes Sonoma and Mendocino are multipurpose facilities having flood control reservations during flood season. They are normally operated independently due to the long time it takes Lake Mendocino releases to reach the Russian-Dry Creek confluence. For them, the flood control diagram extends from early October to April.

Maintenance. Maintenance of flood control works is a critical activity which preserves the integrity of the facilities, ensuring continued protection for the public. This effort is made more difficult by two factors. Lack of adequate financing for many installations is the result of tax-management efforts of the late twentieth century which have placed controls on former sources of revenue, and heightened public awareness of the environment has resulted in new regulations making the permitting process lengthy and expensive. Compounding the problem, deferred maintenance can cause establishment of new habitat which then must be protected.

Maintenance of flood control facilities is usually the responsibility of the local maintaining agency, which is usually the local sponsor, or if there is none, the constructing agency. Most USACE projects are maintained by the sponsoring local maintaining agency, but reservoirs in particular may be exceptions. In this region, Lake Mendocino and Lake Sonoma are maintained directly by the USACE, with their dams. NRCS projects follow a pattern of close cooperation with a local sponsor, with NRCS providing maintenance standards and the local sponsor performing the maintenance. USBR projects are invariably reservoirs, which may be maintained by USBR or the local maintaining agency. USBR maintains Clair Engle Lake, Lewiston Lake, Clear Lake Reservoir, and Tule Lake Sump in this region. The local constructing agency maintains non-federal projects.

Land Use Management

Regulation. Counties are the main agencies responsible for designating and regulating floodways. Del Norte County regulates development on the Lower Klamath River's floodplain, while Humboldt County does the same on the Eel River in the vicinity of Fortuna. The Scott Valley Area Plan, as part of the Siskiyou County General Plan, regulates the Scott River floodplain for the 1 percent event for appropriate uses, primarily agriculture. All local land use jurisdictions must adopt a floodplain management ordinance identifying 1 percent floodplains and floodways, in order to qualify for the Federal Emergency Management Agency (FEMA) flood insurance.

Adopting designated floodways facilitates enforcement of floodplain building ordinances.

Sonoma County has designated the Russian River, Laguna de Santa Rosa, and Mark West Creek as floodways. Siskiyou County and the towns of Etna and Fort Jones have designated three streams as floodways via zoning ordinances: Scott River, Etna Creek, and Moffett Creek, respectively.

Flood Insurance. The National Flood Insurance Program (NFIP) is administered by FEMA. It enables property owners in participating communities to purchase insurance as protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. About 97 percent of California communities participate in the NFIP. Of those, approximately 12 percent participate in the Community Rating System (CRS) Program, which encourages communities to go beyond minimum NFIP requirements in return for reduced insurance rates. Quality mapping is critical to administering an effective flood insurance program, developing hydrologic and hydraulic information for determining floodplain boundaries and allocating flood protection project funds.

FEMA has provided Flood Insurance Rate Maps (FIRMs) for virtually all areas within the region. As of June 2009, FIRMs of two of the region's eight counties are new since 2005, and five more are scheduled to be updated by 2010. One county had a partial update in 2008.

CRS rates communities from 1 to 10 on the effectiveness of flood protection activities. The lower ratings bring larger discounts on flood insurance. Of the 8 counties and 26 cities in the hydrologic region, only Lake County participates in the NFIP rating system. As of May 2009, the county is in CRS Class 10.

For more information on the Community Rating System program, go to Internet site: http://www.fema.gov/business/nfip/crs.shtm

Disaster Preparedness, Response, and Recovery

Information and Education. The California Data Exchange Center (CDEC) provides real-time and historical hydrometeorological data for hundreds of stations statewide, as well as real-time data on releases, spill rates, and elevations of many reservoirs. For this region, CDEC provides gage data from DWR (48 gages), USBR (30), USFS (35), USGS (55), and several other federal, State, and local agencies, a total of 221 gages, and real-time flow and stage data for the Smith, Klamath, Shasta, Scott, Salmon, Trinity, Mad, Eel, Noyo, Van Duzen, Mattole, Garcia, Gualala, Russian, Big, and Navarro rivers and Redwood Creek. For access to CDEC data, go to cdec.water.ca.gov.

The USGS maintains and publishes statistics for stream gages nationwide. For access to USGS gage data, see waterdata.usgs.gov/nwis.

DWR's Awareness Floodplain Mapping program provides an easy-to-use computer interface for viewing areas vulnerable to flooding by the flood event having a 1 percent probability of occurrence. The program applies to areas not already covered by FEMA maps. For this region, FIRMs have been drawn for all counties but coverage of some areas may have been deferred. By 2015, all areas expected to develop over the next 25 years will have mapped floodplains.

Accurate hydrologic and hydraulic models inform the design of effective flood control structures and emergency actions before, during, and after floods. The NWS Advanced Hydrologic Prediction Service (AHPS) uses historical hydrologic data, current river and

watershed conditions, and near-term meteorological outlooks to forecast river flows. The service is publicly available for certain streams of the North Coast region. Locations are given in Appendix A, Table NCA-5 AHPS stream forecast points.

Event Management. Under the Standardized Emergency Management System (SEMS) and the National Incident Management System (NIMS), initial flood emergency response is made by the responsible party at the site. When its resources are exhausted, the county emergency management organization (Operational Area) provides support. If necessary, additional support is coordinated by a region of the California Emergency Management Agency (Cal EMA). Through the Cal EMA region and Cal EMA headquarters, help can be obtained from any State agency. Cal EMA coordinates with federal agencies and private organizations as well. The North Coast Flood Center in Eureka and the State-federal Flood Operations Center (a joint facility of DWR and the Sacramento Weather Office and California-Nevada River Forecast Center, both units of NWS) are normally called early in the event to provide weather and river forecasts, facilitate information flow, provide field situation analysis, and give flood fight expertise. Severe situations that require Cal EMA involvement may also require emergency response by USACE, which is obtained by request of DWR. Table NCA-4 Flood emergency response organizations in Appendix A is a listing of specific response organizations.

Recovery after a flood event may involve the funding and construction services of USACE if the facilities are parts of federal projects. Availability of resources to repair local and private facilities, remove flood waters, and restore housing, businesses, and infrastructure often depends on the severity of the event and the allocation of event-specific federal or State funds.

Flood preparedness and mitigation efforts are promoted and funded by many organizations, including city and county governments, Cal EMA, DWR, NWS, and USACE. In May of 2009, Del Norte, Humboldt, Mendocino, and Sonoma counties including a few local Tribes performed a coordinated emergency tsunami incident exercise to prepare for a possible event.

Relationship with Other Regions

The Klamath River Basin straddles the border with Oregon, such that water from the upper basin flows into Oregon via the Lost River and eventually returns to California above Iron Gate Reservoir. On the Oregon side of this interstate basin, two surface water diversions export an average of 29,600 acre-feet per year from Klamath River tributaries into the Rogue River system in Oregon. The Klamath River Basin also receives a small amount of imported water (about 2,000 acre-feet per year) from the upper reaches of the Sacramento River Hydrologic Region (for irrigation purposes) through a canal called the North Fork Ditch. The North Fork Ditch begins at a diversion upstream from Lake Siskiyou on the North Fork of the Sacramento River and ends at Dwight Hammond Reservoir about 2.5 miles southwest of Weed.

The North Coast region exports a large volume of water from the upper reaches of the Trinity River into the Sacramento River region through USBR's Central Valley Project (CVP) at Lewiston Dam and the Clear Creek Tunnel. In the southern portion of the region, a smaller quantity of roughly 31,000 acre-feet per year is exported from the lower Russian River into the northern portion of the San Francisco Bay region through the Sonoma-Petaluma Aqueduct to supply communities in northern Marin County and southern Sonoma County.

Regional Water and Flood Planning and Management

The forum and focus of regional planning activities varies significantly from north to south across the North Coast region because of the diversity of water issues and the involved water agencies. In the far north interstate Klamath River watershed, much of the planning is being done by federal agencies such as USBR, NRCS, and USFWS, among others. These federal agencies are working to balance the needs of the federal Klamath Project with water for fish, Tribal interests, and interests of communities affected by the federal project. Planning and issue resolution for the Trinity River also have a significant federal lead role because of the federal CVP at Trinity and Lewiston lakes. In general, many of the Northern California counties lack funding at the level available to federal agencies to conduct regional planning.

In the central portion of the region, the communities and water issues in Humboldt, Trinity, and Mendocino counties tend to be organized at the local or county levels, partly because these areas are geographically separated from other developed regions. The planning activities of Humboldt Bay Municipal Water District and the Humboldt County General Plan update are one of the primary forums for regional planning for the Arcata and Eureka areas. The Mendocino Council of Governments and the Mendocino Community Services District are among the lead water planning agencies for the county, which includes Ukiah and portions of the upper Russian River wine country.

Sonoma County is the southernmost county in the North Coast Hydrologic Region, and water planning is closely associated with those of the adjoining San Francisco Bay Hydrologic Region. Water planning is strongly focused on meeting the urban needs of Santa Rosa and the surrounding communities served by Sonoma County Water Agency. The agency coordinates with and is a member of several San Francisco Bay area regional planning groups such as the Bay Area Water Agencies Coalition that provides significant direction and guidance for regional planning. Much of Sonoma County regional planning also focuses on the competing uses of the Russian River, which is the largest river in this part of the North Coast region. The Russian River Action Plan has been updated by Sonoma County Water Agency (as a coordinated effort among federal, State, and local agencies) to protect and restore salmonid fishery populations and habitat.

The State agency with the most significant influence on regional water planning activities in the North Coast region is the Regional Water Board. Although

headquartered in Santa Rosa, this agency has key responsibilities for surface water quality and regulations for all of the rivers in the region. The board oversees several water quality programs and issues related to timber operations, vineyard runoff, NPS pollution, the development of TMDL limits, and the development of water quality objectives for individual basin plans.

Integrated Regional Water Management

IRWM planning empowers stakeholders to collaboratively develop integrated solutions and diversified water management portfolios to meet regional water management challenges. The IRWM effort serves a vital role (in combination with local and statewide planning) providing for sustainable water use, water quality, and environmental functions.

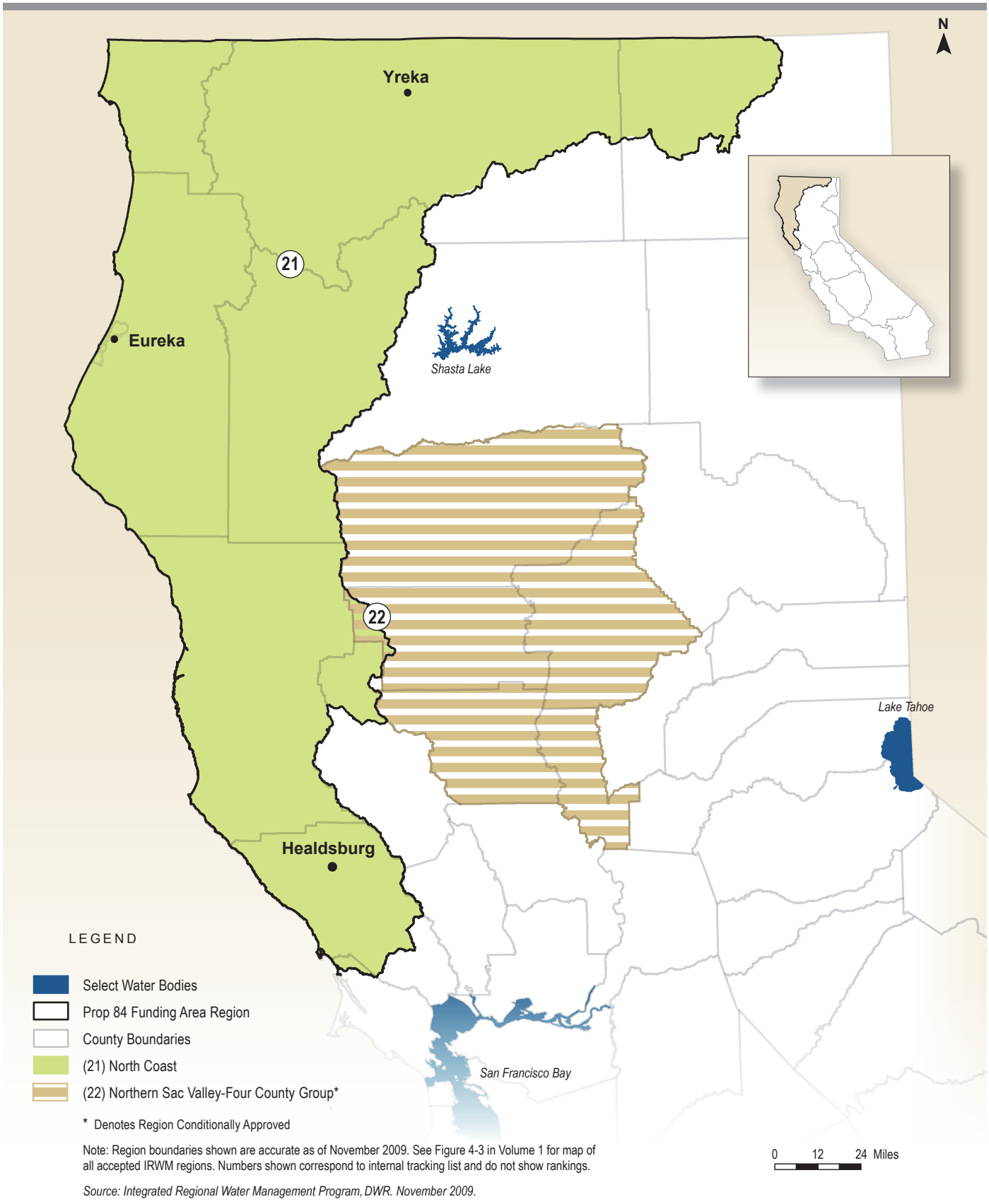
The IRWM Planning Act, signed by the Governor as part of SB1 in 2008 (CWC Sec 10530 et seq), provides a general definition of an IRWM plan as well as guidance to DWR as to what IRWM program guidelines must contain. The Act states that the guidelines shall include standards for identifying a region for the purposes of developing or modifying an IRWM plan. The first Regional Acceptance Process (RAP) spanned 2008-2009. Final decisions were released in fall 2009. The region acceptance process is used to evaluate and accept an IRWM region into the IRWM grant program. The North Coast IRWM region is the sole IRWM planning effort in the North Coast Funding Area, and the region spans the entire funding area (Figure NC-3).

The following list includes the six primary integrated water management objectives for the North Coast region. These objectives were developed with input from the policy review panel, technical peer review committee, resources agencies, Tribes, and stakeholders in the North Coast region. These objectives are all interrelated and are relevant at both the local and regional scale.

- **Objective 1.** Conserve and enhance native salmonid populations by protecting and restoring required habitats, water quality and watershed processes.
- **Objective 2.** Protect and enhance drinking water quality to ensure public health.
- **Objective 3.** Ensure adequate water supply while minimizing environmental impacts.
- **Objective 4.** Support implementation of TMDLs, the Regional Water Board's WMI and the Non-Point Source Program Plan.
- **Objective 5.** Address environmental justice issues as they relate to disadvantaged communities, drinking water quality and public health.
- **Objective 6.** Provide an ongoing, inclusive framework for efficient intraregional cooperation, planning, and project implementation.

The main water issues identified by and strategies used to overcome the many issues are summarized in Table NC-3.

Figure NC-3 Regional acceptance process IRWM regions, North Coast Hydrologic Region



Note: Region boundaries shown are accurate as of November 2009. See Figure 4-3 in Volume 1 for map of all accepted IRWM regions. Numbers shown correspond to internal tracking list and do not show rankings.

Source: Integrated Regional Water Management Program, DWR. November 2009.

Table NC-3 Strategies in North Coast Integrated Regional Water Management Plan (2007)

Strategy	North Coast IRWMP (version 2007)
Ecosystem restoration	✓
Environmental and habitat protection and improvement	✓
Flood management	✓
Land use planning	✓
NPS pollution control	✓
Stormwater capture and management	✓
Surface storage	✓
Water and wastewater treatment projects	✓
Water conservation	✓
Water quality protection and improvement	✓
Water recycling	✓
Water supply reliability	✓
Watershed planning	✓
Wetlands enhancement and creation	✓
Web site: http://www.northcoastirwmp.net/	

Some highlighted regional projects in the North Coast region are highlighted here[1].

- **Araujo Dam Restoration Project.** Irrigation pumps and pipes were installed to replace ditch irrigation and a flashboard dam as part of the project. The seasonable flashboard dam, which had created fish passage barriers and poor water quality, was replaced with a fish-friendly intake structure. The pipes provide more efficient use of water than ditch irrigation.
- **Newell Water System.** A new water system for the community of Newell, Modoc County replaces a failing antiquated system installed in the 1940s.
- **Upper Mattole River Culvert Replacement.** A culvert replacement in Humboldt County will allow for 100-year floodflows to pass without damaging the road. Properly sized culvert can reduce the amount of sediment input into streams by decreasing the chances of road failure during flood conditions.
- **Westport Water Tank.** A site is being prepared for the installation of a new water tank in Westport, Mendocino County. This will improve the water supply and reliability for the coastal hamlet.

Plans under Development

The Lake County IRWM plan deals with downstream issues regarding the Sacramento Hydrologic Region (of which it is a part). The portion of Lake County that falls within the North Coast Hydrologic Region is hydrologically separate from that portion of the county in the Sacramento region. Because of this, readers are referred to the Sacramento

1 Information about these projects was given to the Water Plan by the Roundtable of Regions, which provides links to and works with IRWM planning groups.

River Hydrologic Region report in Volume 3 for further information on the developing IRWM plan for Lake County.

Recent Accomplishments

Hazard Mitigation Plans

The federal Disaster Mitigation Act of 2000 amended existing law with regards to hazard mitigation planning. The Act emphasizes pre-disaster mitigation and mitigation planning. In order to receive federal hazard mitigation funds in the future, all local jurisdictions must now adopt a hazard mitigation plan identifying hazards, risks, mitigation actions and priority and providing technical support for those efforts. Between 2005 and 2008, Humboldt, Lake, Mendocino, and Sonoma counties adopted hazard mitigation plans and subsequently received Cal EMA approval. In 2006, the Karuk Tribe of California also adopted a plan.

Trinity County Waterworks District #1 has developed an evacuation plan in the event that the Ewing Reservoir dam near Hayfork fails. By writing hazard mitigation plans, three entities—Sonoma County, Humboldt County, and the Karuk Tribe—have taken advantage of the pre- and post-disaster funding provided by the Disaster Mitigation Act of 2000. The plans identify natural local hazards (floods included), assess the disaster mitigation capabilities of pertinent jurisdictions, and provide action implementation plans for reducing hazard risks.

Four of the eight counties in this region have adopted hazard mitigation plans. For more information, see "Challenges" in this report.

Flood Control

Flood control facilities have been constructed in the region to protect life and property from the consequences of high water and debris flow. Notable among the constructed works are seven flood control reservoirs. For information on these facilities and others in the region, see Structural Approaches in this report and Appendix A, Table NCA-3, Flood control facilities. In addition to the listed facilities, facilities and procedures were implemented in Crescent City after 1964 to improve warning and public awareness of tsunamis and to mitigate their effects.

Challenges

Water Quality

The region faces many water quality and water supply challenges. The Regional Water Board's water quality priorities highlight the need for control of NPS runoff from logging, rural roads, agriculture, and urban areas. In fact, sediment, temperature, and nutrients are the primary focus of the Regional Water Board's 303(d) list of impaired water bodies. Along the coast, NPS pollution can cause microbial contamination of

shellfish growing areas; especially for oysters. Much of the region is characterized by rugged, steep, forested lands with highly erodable, loosely consolidated soils. Together with wildfires, extensive timber harvesting, and heavy precipitation primarily in the form of rain and natural geology components, the watershed is highly susceptible to erosion and landslides. Such heavy runoff, in turn, causes stream sedimentation that affects habitat for spawning and rearing of anadromous fish. Channel modifications and water diversions have radically changed water-quality conditions in many water bodies in the region, reducing natural flows that dilute contaminant concentrations and lessen their impacts. In the southern portion of the region, the development of new hillside vineyards is an increasing source of erosion and pesticides.

Fisheries can be adversely affected by a number of factors related to both water quality and water quantity. The Eel, Mad, Trinity, Klamath, and Russian rivers, as well as many other streams, suffer from sedimentation, which can smother salmonid spawning areas. The North Coast region's basin plan sets turbidity restrictions to control erosion impacts from logging and related activities, such as road building. Timber harvests can also decrease the canopy shading rivers and streams, thereby increasing water temperatures to levels that are detrimental to cold water fisheries. The basin plan also specifically establishes temperature objectives for the Trinity River, in which reduced flows have disrupted temperature and physical cues for anadromous fish runs. Because of water diversions, summer temperatures in the Trinity as well as the Klamath can be lethal to salmonids. Fisheries can be further affected by the lack of woody debris for pool habitat and sediment metering.

The North Coast Regional Water Board's basin plan requires tertiary treatment of wastewater discharges to the Russian River, a major source of domestic water, and establishes limits on bacteriological contamination of shellfish-growing areas along the coast. The plan also prohibits or strictly limits waste discharges to the Klamath, Trinity, Smith, Mad, and Eel rivers, as well as estuaries and other coastal waters. NPS runoff, especially after heavy precipitation, has resulted in contamination and closure of shellfish harvesting beds in Humboldt Bay. In the lower Russian River watershed storm water runoff also might be contributing to high ammonia and low dissolved oxygen levels in Laguna de Santa Rosa, which is threatening aquatic life. Mercury in fish tissue is a water quality concern in Lakes Pillsbury, Mendocino, and Sonoma; a health advisory for mercury has been issued for Lake Pillsbury.

Groundwater quality problems in the North Coast region include contamination from seawater intrusion and nitrates in shallow coastal groundwater aquifers; high total dissolved solids and alkalinity in groundwater associated with the lake sediments of the Modoc Plateau basins; and iron, boron, and manganese in the inland groundwater basins of Mendocino and Sonoma counties. Septic tank failures in western Sonoma County, at Monte Rio and Camp Meeker, and along the Trinity below Lewiston Dam, are a concern because of potential impacts to groundwater wells and recreational water quality.

Other water quality concerns include the impacts of boating fuel constituents such as MTBE to recreational water use at Trinity, Lewiston, and Ruth lakes. In addition,

historical abandonment of mines, past unregulated forest herbicide application, and historical discharge of wood treatment chemicals at lumber mills, including Sierra Pacific Industries near Arcata and Trinity River Lumber Company in Weaverville, are regional issues of concern. Of note, according to the 305(b) report, only the Russian River Basin has a long-term water quality data set in this region, which is necessary to evaluate quality changes over time.

Reliable Water Supply

Even though the North Coast region produces a substantial share of California's surface water runoff, only about 10 percent of this runoff occurs in the summer and water supplies are limited throughout much of the area. Small surface-water supply projects generally have limited carryover capacity that cannot supply adequate water during extended months of low rainfall. The drinking water for many of the communities on the North Coast, such as Klamath, Smith River, Crescent City, and most of the Humboldt Bay area, is supplied by Ranney collectors (horizontal wells adjacent to or under the bed of a stream). Erosion is undercutting some of these collectors, such as those in the Mad River supplying the Humboldt Bay Municipal Water District (which serves Eureka, Arcata, and McKinleyville). As such, these "wells" may actually be under the direct influence of surface water, which would then require filtration. The city of Willits has had chronic problems with turbidity, taste, and odor with water from Morris Reservoir, and high arsenic, iron, and manganese levels in its well supply. Organic chemical contamination has closed municipal wells in the cities of Sebastopol and Santa Rosa. The town of Mendocino typifies the problems related to groundwater development in the shallow marine terrace aquifers; surveys in the mid-1980s indicate about 10 percent of wells go dry every year and up to 40 percent go dry during droughts.

The Klamath River Basin is an interstate watershed with surface storage facilities in both California and Oregon and competing water needs for agriculture, Tribal rights, waterfowl refuges, and endangered fish. The primary water storage facilities belong to the federal Klamath Project, which is operated by USBR, in conjunction with other dams and diversion structures operated by local irrigation districts, wildlife management agencies, and electric power companies. In 2001, the lack of rainfall generated a severe drought, which aggravated water disputes and caused harsh effects to agriculture, waterfowl refuges, and the downstream fisheries. The endangered fish populations include listed species such as the Lost River and shortnose suckers, coho salmon, and steelhead trout. During 2001, USBR was only able to deliver about 75,000 acre-feet of water to agriculture in California, which is about 25 percent of normal. In the Tule Lake and Lower Klamath Lake subbasins, this translated to a drought disaster for both agriculture and the wildlife refuges. In 2002, about 33,000 adult salmon died due to water quality and quantity problems while trying to swim up the Klamath.

Federal agencies have taken a lead role in conducting studies and developing proposals to resolve the competing water needs in the Klamath Basin, with assistance from State agencies in Oregon and California, and several local governments and interest groups. USBR is developing a new Klamath Project Operations Plan intended to establish

specific allocation procedures to best meet the needs of agriculture, fishery restoration per the Endangered Species Act, waterfowl refuges, and Tribal water rights. USGS has initiated a four-phase Klamath Basin groundwater study to document water levels, water quality, and groundwater flow patterns; and to identify potential opportunities for future groundwater conjunctive use. NRCS has developed an adaptive management program that allocates federal funds for agricultural conservation programs, fish and wildlife habitat, water quality improvements, and water storage improvements, which are intended to increase water use efficiencies and achieve long-term reductions in total water use. Other federal agencies in the Klamath Basin Working Group include USFS, USFWS, BLM, and the National Marine Fisheries Service. Many of these programs and studies will take several years to develop and implement so the overall ability to successfully meet all competing water needs will not be known for several years. In the meantime, below-normal water supply conditions during the past three years continue to aggravate the water management issues, disputes, and negative effects to basin resources.

Fisheries

The TRD project diverts most of the upper-basin's water yield at Lewiston for power generation and to support the CVP. Challenges in management of the fishery as a result of the hydrologic changes produced by the TRD project include altered stream-channel conditions and instream habitat for many miles below Lewiston Dam on Trinity River. Trinity River downstream of the TRD provides habitat for anadromous salmonoids and other native species including non-native brown trout.

The Eel River WMA is a well-known recreation destination with numerous State and private campgrounds along its length. The river also supports a large recreational fishing industry and is the third largest producer of salmon and steelhead in the state. However, due to the erodible soils, steep terrain, and land use history, the viability of the anadromous fishery is of significant concern.

Flooding

Recurrent flooding is a problem in many places in the North Coast region. At many locations, lives, homes, business, farm lands, and infrastructure are frequently at risk. Providing better protection for lives and property remains the definitive flood management challenge. Solutions may range from governmental regulation of occupancy and building in flood-prone areas through local or watershed-based non-structural measures to infrastructure such as levees and reservoirs, constructed with consideration of environmental needs. Development of a discharge-based standard, such as protection from the flood having an 0.5 percent, 1 percent, or 2 percent probability of occurrence (or such a standard in conjunction with land use type or other pertinent factor) would facilitate equitable distribution of State and federal support funding. Some particularly vulnerable locations in the region are on the Russian River (notably at Guerneville but also in Potter Valley, Ukiah, and Sanel Valley), and the Trinity, Garcia, Navarro, and Elk rivers. Santa Rosa, Fortuna, Hydesville, Carlotta, Stafford, Redcrest,

Hayfork, Noyo Harbor, Ferndale, and Blue Lake are subject to frequent flooding. Existing facilities are inadequate on Martin Slough. The 2006 tsunami at Crescent City was the impetus for warning, regulatory and structural improvements to local flood management systems, but lesser although still large events continue to damage docks and vessels.

More impervious area from continued urbanization in the region brings greater runoff, making retention of flood protection levels a challenging issue. Urbanization often causes increases in erosion and sedimentation. Construction of flood infrastructure or changes in land use may cause subsequent undesirable vegetation growth, whether of native or invasive species. Regulation of occupancy and land use is critical for reducing the number and severity of flood damage occurrences in an era of population growth. One problem site is the Salt River, where aggradation and excessive vegetal growth are occurring. Another is Laguna de Santa Rosa, where flood storage capacity has been critically reduced by sediment deposits.

Effective preparedness for flood events depends on accurate evaluation of the risk, adequate measures for mitigation of flood damage, sufficient preparation for response and recovery activities, and coordination among local, State and federal agencies. Completion of floodplain mapping, both the FEMA FIRMs and the State's complementary Awareness Floodplain Mapping, will provide much needed information for evaluating flood risk. Mitigation may take many forms, including restriction of use, floodproofing, or structural protection of vulnerable sites. Some actions that help meet the challenge of response and recovery preparedness are organization for emergency management, formal agreement on responsibilities for emergency actions and funding, and use of warning systems. In the North Coast region, some current needs are development of emergency response systems for Tribal lands and floodproofing of structures in the Russian River floodplain.

Local funding for flood maintenance and construction projects has become less effective in recent years because of several factors: heightened public awareness of the need to protect the environment has increased the cost of upkeep and improvement; concern for endangered species has made scheduling more complex; both environmental and endangered species considerations have made permits more difficult to obtain; measures to reduce taxation, especially on property, have rendered revenue increases difficult to achieve; and inflation has increased costs. Meeting the requirements of these new restraints has become a high-profile local challenge.

Looking to the Future

When compared to the more developed regions of the state, urban and agricultural water use in the North Coast Hydrologic Region is a relatively small part of the total available water. However, localized water supply problems are expected to continue for communities with limited surface water and groundwater, particularly during extended droughts. Although significant water supplies exist throughout most of the North Coast

region, the ability to acquire funding to upgrade and expand water systems is a major problem for rural communities.

Along the coast, the Humboldt Bay Municipal Water District system may expand to serve the Trinidad-Moonstone area, which is experiencing local water deficiencies. The Eureka-Arcata area may undergo construction of a regional water treatment plant and is investigating groundwater development as an alternative source, which would not require the same level of water treatment.

Crescent City has an adequate supply of water from the Smith River but needs to increase system transmission and storage capacity. Additionally, Crescent City may build a new water treatment facility to keep up with future demands. The city of Rio Dell is considering construction of a surface water treatment facility. Ranney wells will be installed in the Eel River as a primary water supply for Rio Dell. Trinity County Waterworks District No. 1, which serves the town of Hayfork from the 800 acre-foot Ewing Reservoir, has plans to enlarge the reservoir and expand its surface water system.

In the Klamath River Basin, USBR is leading efforts to balance water needs between the historical agricultural uses of the Klamath Project, instream needs of endangered fish, and other system water uses. The recent dry hydrologic conditions have intensified these issues, and federal funding was approved in 2002 to provide relief through the development of conservation programs and the increased availability of groundwater. USBR is continuing to update the Klamath Project long-term operations plan, but these difficult issues have delayed its completion. The Klamath River Compact Commission provides a forum for discussions on management of interstate water resources between Oregon, California, and the federal agencies and promotes intergovernmental cooperation on water allocation issues. A few additional groundwater wells are likely to be constructed to augment irrigation supplies in the Butte Valley and Tule Lake areas. Pressure for additional groundwater development in areas like Scott and Shasta valleys will be greater since the 2002 listing of the coho salmon. The new listing, along with stricter applications of DFG instream regulations, will reduce the surface water supplies available for irrigation from existing water developments and natural runoff.

The lower Russian River watershed and the adjoining Santa Rosa area are projected to experience the most significant urban growth in the North Coast Hydrologic Region. This growth will continue to stress the available water supply and accentuate the need to balance urban water uses with environmental water needs. The Sonoma County Water Agency has a central role in maximizing the use of existing water supplies and is actively developing conservation, water recycling, and groundwater conjunctive use. The Sonoma County Water Agency is also restoring and preserving the Russian River fishery and habitat and is the lead agency for developing and implementing a Russian River Action Plan.

Restoration and protection of salmonid habitat will continue to be a prominent fishery issue for all of the major coastal rivers. The federal listing of coho salmon and steelhead

under the Endangered Species Act and the State listing of the coho salmon generate additional regulatory requirements that affect all surface water uses on these rivers. DFG's coho salmon recovery plan guides actions directed at the recovery of this species. Existing and planned water projects will need to be operated in ways that do not affect the fishery, which might alter methods and schedules for water diversions, hydropower operations, and wastewater discharges. Surface water quality issues such as sediment loads, nutrients, and elevated temperatures can also affect the fishery. These challenges fall under the jurisdiction of the North Coast Regional Water Board, which is developing basin plans to address water quality problems and protect the coastal rivers.

FloodSAFE is a strategic initiative of DWR that seeks a sustainable integrated flood management and emergency response system throughout California that improves public safety, protects and enhances environmental and cultural resources, and supports economic growth by reducing the probability of destructive floods, promoting beneficial floodplain processes, and lowering the damages caused by flooding. FloodSAFE is guiding development of regional flood management plans. These plans will encourage regional cooperation in identifying and addressing flood hazards and will include flood-hazard identification, risk analyses, review of existing measures, and identification of potential projects and funding strategies. The plans will emphasize multiple objectives, system resiliency, and compatibility with State goals and IRWM plans.

Climate Change

Climate change will present new challenges to the North Coast Hydrologic Region, especially for flood protection. A higher sea elevation will lower the level of protection that jetties provide to marinas and coastal communities. Rising sea levels are expected to increase the base elevation of rivers, exacerbating channel aggradation. As a result, floodflow capacities will be reduced, necessitating costly and frequent maintenance measures. Although snowmelt contributes little to the region's runoff, the lower ratio of snow to rain could result in more frequent flood stage discharges. Increased interception and evapotranspiration rates from longer plant growing seasons (courtesy of a warmer climate) could help to mitigate the magnitude of the floods. But the mitigations may be negated by greater rainfall.

Future Scenarios

For Update 2009, we evaluated different ways of managing water in California depending on alternative future conditions and different regions of the state. The ultimate goal is to evaluate how different regional response packages, or combinations of resource management strategies from Volume 2, perform under alternative possible future conditions. The alternative future conditions are described as future scenarios. Together the response packages and future scenarios show what management options could provide for sustainability of resources and ways to manage uncertainty and risk at a regional level. See Box NC-4 for scenario descriptions.

Box NC-4 Scenario Descriptions

Update 2009 uses three baseline scenarios to better understand the implications of future conditions on water management decisions. The scenarios are referred to as baseline because they represent changes that are plausible and could occur without additional management intervention beyond those currently planned. Each scenario affects water demands and supplies differently.

- **Scenario 1 – Current Trends.** For this scenario, recent trends are assumed to continue into the future. In 2050, nearly 60 million people live in California. Affordable housing has drawn families to the interior valleys. Commuters take longer trips in distance and time. In some areas where urban development and natural resources restoration has increased, irrigated crop land has decreased. The state continues to face lawsuits: from flood damages to water quality and endangered species protections. Regulations are not comprehensive or coordinated, creating uncertainty for local planners and water managers.
- **Scenario 2 – Slow & Strategic Growth.** Private, public, and governmental institutions form alliances to provide for more efficient planning and development that is less resources intensive than current conditions. Population growth is slower than currently projected—about 45 million people live here. Compact urban development has eased commuter travel. Californians embrace water and energy conservation. Conversion of agricultural land to urban development has slowed and occurs mostly for environmental restoration and flood protection. State government implements comprehensive and coordinated regulatory programs to improve water quality, protect fish and wildlife, and protect communities from flooding.
- **Scenario 3 – Expansive Growth.** Future conditions are more resource intensive than existing conditions. Population growth is faster than currently projected with 70 million people living in California in 2050. Families prefer low-density housing, and many seek rural residential properties, expanding urban areas. Some water and energy conservation programs are offered but at a slower rate than trends in the early century. Irrigated crop land has decreased significantly where urban development and natural restoration have increased. Protection of water quality and endangered species is driven mostly by lawsuits, creating uncertainty.

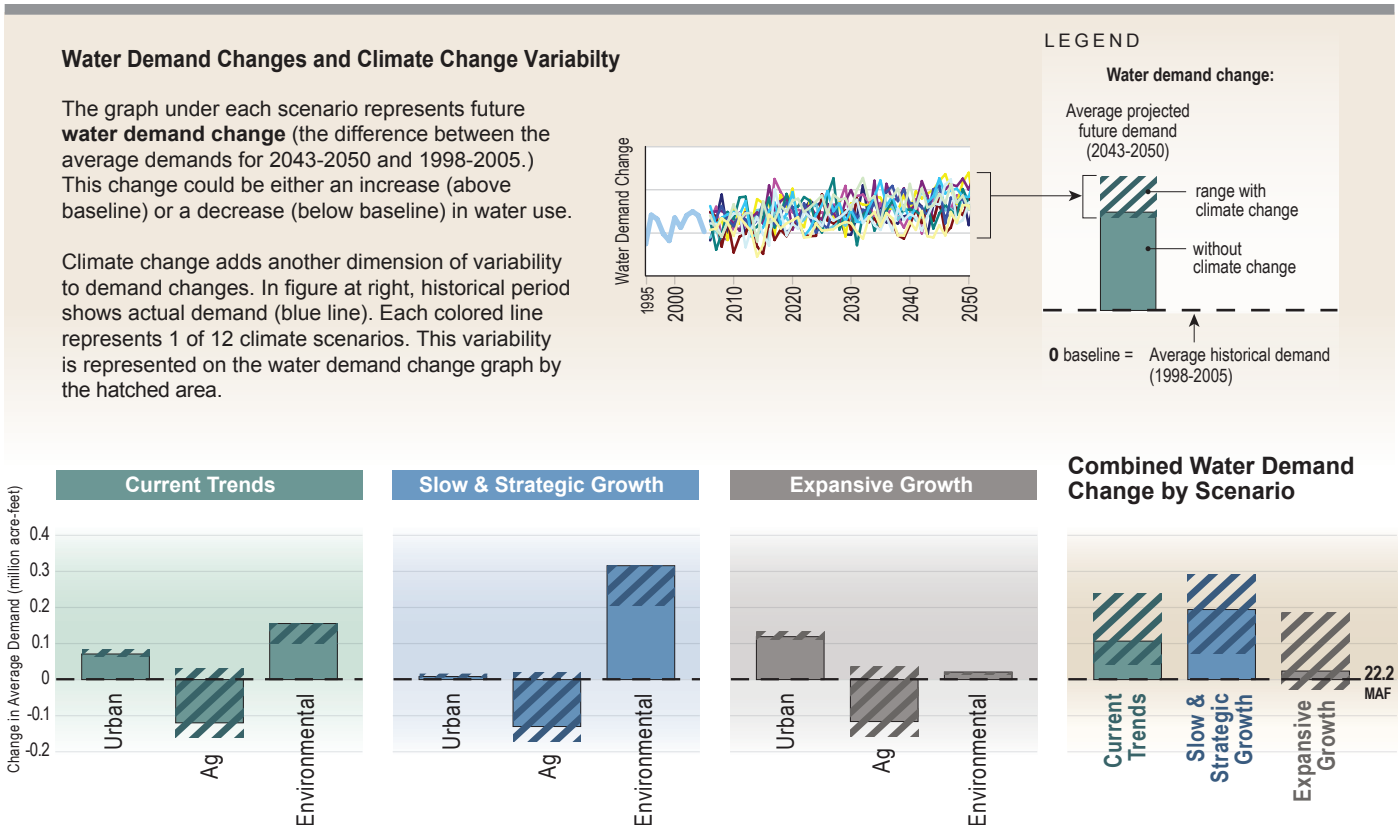
Total Demand Change

Figure NC-4 shows change in total water demand in the North Coast hydrologic region for each scenario. The change in water demand is based on the difference between the historical average (1998–2005) and future average (2043–2050) water demands. Future demand is shown with and without climate change. The change in water demand without climate change is shown with solid bars and with climate change is shown with hatched bars. As shown in the figure, water demand without climate change (solid bar) increases by about 20 thousand acre-feet under the Expansive Growth scenario, and it increases by about 190 thousand acre-feet under Slow & Strategic Growth, primarily due to increases in environmental water. The Current Trends scenario falls in between with an increase of about 110 thousand acre-feet. Considering 12 alternative climate change scenarios (hatched bar), the range of water demands varies. On the high end of warmer and drier climates, water demand for the three scenarios increases when compared with no climate change.

Urban Demand Change

Figure NC-4 shows urban water demand change in North Coast with and without climate change under the Current Trends, Slow & Strategic Growth, and Expansive Growth scenarios. Generally, urban water demand increases due to population growth and other demographic changes. Without climate change and when compared with historical average, Slow & Strategic Growth has the least increase in water demand (about 10 taf), Expansive Growth has the most increase (120 taf) and the Current Trends

Figure NC-4 2050 Water demand changes, North Coast Hydrologic Region



scenario is in between (70 taf). When climate change is considered, the range of water demand is similar in magnitude for all three scenarios (hatched bar).

Agricultural Demand Change

Agricultural water demand change in the North Coast is shown in Figure NC-4. Agricultural water demand generally lessens due to reduction in irrigated acreage and increases in background water conservation. Without climate change (solid bar), the Slow & Strategic Growth scenario has the most reduction in water demand (130 taf). When climate change is considered, Slow & Strategic Growth again shows the most reduction in water demand below historical average under the warmer and drier climates when compared with the other two scenarios (170 taf).

Environmental Demand Change

Figure NC-4 shows environmental water demand change for the North Coast region. Future environmental water demand is based on historical unmet demand and indexed to climate. With no climate change, Slow & Strategic Growth shows the most increase in demand (320 taf) and Expansive growth has the least amount (20 taf). This is primarily due to the assumption that more water will be provided under the Slow & Strategic Growth scenario than under the other two scenarios. When climate change is factored in, Slow & Strategic Growth still shows the largest range of demand change.

Appendix A. Flood Management: North Coast Hydrologic Region

Historic Floods

Flood Parameters

Table NCA-1, Record floods for selected streams, is based on US Geologic Survey records. The selected stations were selected from all USGS gaging stations in the hydrologic region, according to the criteria in Box NCA-1.

The table is supplemented with one particularly important site from the records of the Department of Water Resources (DWR): the Eel River at Fernbridge.

Flood Descriptions

Early Floods. Communities in the North Coast Hydrologic Region have suffered frequent flood damage that has been observed since at least 1861. Devastating floods were recorded in the winter of 1861-62. Torrential flooding occurred throughout the region in 1937. Winter floods between 1935 and 1945 in Sonoma County spurred the Army Corps of Engineers to develop a flood control plan and construct Coyote Valley Dam, which impounded Lake Mendocino upon its completion in 1958. A warm, wet air mass from the Pacific Ocean moved into Northwest California in December 1955, and caused widespread flooding in communities along the Van Duzen, Eel, Mad, and Klamath rivers; damages were estimated to be $36 million.

March 1964 Tsunami. The largest earthquake in North American history, an 8.4 on the Richter scale, hit on March 27, 1964, in Prince William Sound (south coast of Alaska). The earthquake generated a tsunami that towered more than 20 feet once it made land on the North Coast. The huge wave smashed into Crescent City in the early morning of March 28 and devastated the community. Parts of Citizens Dock, a major distribution hub for the city's bustling natural resources industry, were completely wrecked and several fishing vessels were capsized. 289 homes and businesses were damaged by the

Box NCA-1 Selection Criteria, North Coast Hydrologic Region

- The watercourse must be a natural stream with a watershed of at least 100 square miles.
- The station must have a reasonably continuous record of discharge from 1996 to the present.
- The station must be far enough from other stations on the same river to reasonably represent a separate condition.
- Stations in well defined watercourse locations such as deep canyons are omitted, unless particularly important to the overall flood situation.

Table NCA-1 Record floods for selected streams, North Coast Hydrologic Region

Stream	Location	Mean annual runoff (taf)	Peak stage of record (ft)	Peak discharge of record (cfs)
Dry Cr.	near Geyserville	218[2]	15.5	7,600
Russian R.	near Guerneville	1,663	49.7[1]	102,000
Russian R.	near Healdsburg	1,039	30.0[1]	73,000
Russian R.	near Cloverdale	699	31.6	55,200
Russian R.	near Hopland	515	30.0[4]	45,000
Navarro R.	near Navarro	375	40.6	64,500
Mattole R.	near Petrolia	945	36.6	90,400
Eel R.	at Fernbridge[5]	n/a	29.5	800,000
Van Duzen R.	near Bridgeville	624	24.0	48,700
South Fork Eel R.	near Miranda	1,355	46.0	199,000
Eel R.	at Fort Seward	3,388	82.6	561,000
Middle Fork Eel R.	near Dos Rios	1,146	32.9[1]	135,000
Eel R.	at Van Arsdale Dam near Potter Valley	337[2]	34.7[1]	64,100
Mad R.	near Arcata	997[2]	30.7	81,000
Redwood C.	at Orick	734	28.2[1]	50,500
Klamath R.	near Klamath	12,690[2]	63.0[1]	557,000
Trinity R.	at Hoopa	3,568[2]	57.0	231,000
South Fork Trinity R.	below Hyampom	1018	33.5[4]	88,000[4]
Trinity R.	near Burnt Ranch	1,346[2]	29.8	78,100
Trinity R.	at Lewiston	422	10.4	14,400
Klamath R.	at Orleans	5,928	76.5	307,000
Salmon R.	at Somes Bar	1,304	46.6[3]	133,000[3]
Klamath R.	near Seiad Valley	2,807	33.8	165,000
Scott R.	near Fort Jones	463	25.3	54,600
Shasta R.	near Yreka	135	13.9[1]	21,500
Klamath R.	below Iron Gate Dam	1,500	13.6	29,400
Smith R.	near Crescent City	2,720	48.5	228,000

Note: taf=thousand acre-feet; ft = feet; cfs=cubic feet per second

[1] Different date than discharge

[2] Most recent but less than period of record

[3] Due to failure of upstream debris dam

[4] Outside period of record

[5] From records of the Department of Water Resources

big wave; 11 people were killed and three were never found. Damages were estimated at $16 million in 1964 dollars.

December 1964. Floods from high rainfall in December 1964 were estimated to be equal or greater to those of the devastating floods of 1861-1862; for example, the Eel

River's peak discharge near Scotia in 1964 was greater than the Mississippi's north of St. Louis during the floods of 1993. Whole towns were wiped out; Orick, Hoopa, Weitchpec, and Orleans suffered major damage from floodwaters, sediment deposits and timber washed off upstream lumber yards. Floodwaters from the Russian River inundated large swaths of Santa Rosa, rendered 500 people homeless in Guerneville and drowned large acreages of agricultural land near Sebastopol when high flows backed up into Mark West Creek.

January 1969 and January 1970. Preceded by a wet, soil-saturating December, heavy precipitation in January 1969 flooded roads and isolated residences along the Eel and Russian Rivers. A similar storm that dumped rain on saturated soils in January 1970 eroded banks of the Scott River and deposited up to a foot of fine sediment in many buildings at Fort Jones. Flooding in conjunction with landslides damaged infrastructure and buildings along the Eel and Russian Rivers.

January 1974. The movement of a blocking high-pressure center in the middle of January 1974 permitted heavy precipitation to drench the region. Residences were inundated due to failed levees, many roads were washed out by high flows and large sediment loads were deposited on agricultural lands.

February 1986. The St. Valentine's Day storm of 1986 fueled the power of storm waters from the Eel, Trinity, and Klamath rivers, which washed out highways 101 and 96 in innumerable places and isolated residences throughout the region.

January 1997. A massive tropical storm in January 1997 ravaged the region, punishing residences, the Golden Bears Casino, and in-stream restoration projects.

Winter 2005-2006. Flooding in late December 2005 and early January 2006 closed Interstate 5 near the Oregon border, damaged outdoor recreational facilities in Klamath National Forest and cut off power to many towns, including Trinidad and Blue Lake.

Flood Governance

Many federal, State, and local agencies have responsibilities in the overall effort to manage floods. The principal participants in the North Coast Hydrologic Region and their activities are listed in Table NCA-2, Flood management participants.

Most listed activities are self-explanatory. Descriptions of some follow:

- **Flood project development.** Performing feasibility studies, planning, and design of constructed facilities.
- **Encroachment control.** Establishing, financing and operating a system of permitting and enforcing permits to encroach on constructed facilities.
- **Floodplain conservation or restoration.** Any overt activity causing part of a floodplain to remain in effect or to be reinstated as a watercourse overflow area.

Table NCA-2 Flood management participants, North Coast Hydrologic Region

	Structural approaches						Land use management							Preparedness, response and recovery									
	Flood Projects						Floodplains			Flood insurance		Regulation		Data management			Flood education	Event management					
	Financing	Development	Construction	Operation	Encroachment control	Maintenance	Conservation	Restoration	Delineation	Administration	Participation	FIRM mapping	Building Permits	Designated floodways	Data collection	Hydrologic analysis	Data station maintenance		Preparedness	Response management	Response personnel	System administration	Recovery funding	Recovery operations	Mitigation
Federal agencies																									
Federal Emergency Management Agency										●		●											●		●
National Weather Service															●	●	●	●	●	●	●				
Natural Resources Conservation Service	●	●	●																						
US Geological Survey															●	●	●								
US Army Corps of Engineers	●	●	●	●	●	●									●	●	●	●	●	●	●		●	●	●
US Bureau of Reclamation		●	●	●	●	●												●	●	●	●				
State agencies																									
California Conservation Corps																				●	●				
Department of Corrections																					●				
Department of Forestry and Fire Protection																				●					
Department of Water Resources	●	●	●	●	●	●			●	●		●			●	●	●	●	●	●	●		●	●	
California Emergency Management Agency																			●	●	●	●	●		●
Local agencies																									
County emergency services units																			●	●	●				
County planning departments														●											
County building departments													●												
Local flood maintenance organizations				●	●	●																			
Local conservation corps																				●	●				
Local initial responders to emergencies																			●	●	●				
Humboldt County Department of Public Works						●																			
Lake County Watershed Protection District	●	●	●	●	●	●																			
Mendocino County Russian River Flood Control and Watershed Conservation Improvement District				●	●	●																			
Siskiyou County Flood Control and Water Conservation District				●	●	●																			
Sonoma County Water Agency	●	●	●	●	●	●												●							

- **Flood insurance administration or participation.** Contribution to the management of or acting as a sponsor and cooperator in the National Flood Insurance Program including the Community Rating System.
- **Hydrologic analysis.** Hydrologic or statistical analysis of collected hydrometeorological data.
- **Flood education.** Informing the general public about any aspect of flood management; publishing or broadcasting collected hydrometeorological data or other flood-related material.
- **Recovery Operations.** Financing or performing any activity intended to return flood-impacted facilities or persons to normal status.
- **Event Management System Administration.** Oversight of the National Incident Management System/Standardized Emergency Management System (NIMS/SEMS) as applied to California.

Flood Risk Management

Structural Approaches

The principal reservoirs and non-storage facilities contributing to flood control are listed below in Table NCA-3 Flood control facilities.

Disaster Preparation, Response, and Recovery

Management of flood emergencies is the responsibility of many organizations and individuals. Response is required by law to conform to the Standardized Emergency Management System, under which action is taken by levels of organization. It is begun by the person or organization on the site. That entity resists personal injury and property damage to the best of its ability, only calling on the next level when its resources become insufficient, and succeeding levels follow the same procedure. Table NCA-4 Flood emergency responders indicates the responsible entities at successive levels of response.

Table NCA-5 Advanced Hydrologic Prediction Service stream forecast points is a list of forecast points that can be used in the AHPS of NWS.

Integrated Regional Water Management

Both of the two IRWMPs in the region address flood control. The North Coast IRWMP discusses flooding primarily in the context of anadromous fisheries and conjunctive use (e.g., enhanced control of polluted floodwaters will improve surface and groundwater water quality). The IRWMP recommends for implementation two projects with flood control components on the Salt and Big Rivers. The Lake County IRWMP also addresses flood control issues.

Table NCA-3 Flood control facilities, North Coast Hydrologic Region

Project or facility	Stream	Owner (Sponsor)	Description	Protects
Reservoirs and Lakes				
Spring L.	Santa Rosa Cr.	Sonoma Co. WA (NRCS)	3,415 AF flood control, 85 AF sediment pool	Santa Rosa and vicinity
Matanzas Cr. Res.	Matanzas Cr.	Sonoma Co. WA (NRCS)	1,300 AF flood control, 200 AF sediment pool	Santa Rosa and vicinity
Piner Creek Res.	Paulin Cr.	Sonoma Co. WA (NRCS)	215 AF flood control, 15 AF sediment pool	Santa Rosa and vicinity
Brush Cr. Middle Fork Res.	Middle Fork Brush Cr.	Sonoma Co. WA (NRCS)	120 AF flood control, 10 AF sediment pool	Santa Rosa and vicinity
L. Mendocino	Russian R.	USACE	38 taf flood control	Ukiah, Cloverdale, Healdsburg
L. Sonoma	Dry Cr.	USACE	136 taf flood control	Healdsburg, Guerneville
L. Pillsbury	Eel R.	PG & E	Incidental flood control	Dos Rios, Nashmead
Van Arsdale Res.	Eel R.	PG & E	Incidental flood control	Dos Rios, Nashmead
Ruth L.	Mad R.	Humboldt MWD	Incidental flood control	Mad River
L. Shastina	Shasta R.	Montague WCD	Incidental flood control	agricultural lands
Clair Engle L.	Trinity R.	USBR	Incidental flood control	Lewiston, Douglas City
Lewiston L.	Trinity R.	USBR	Incidental flood control	Lewiston, Douglas City
Clear Lake Res.	Lost R.	USBR	Incidental flood control	agricultural lands
Upper Klamath L.	Link R.	USBR	Incidental flood control	agricultural lands
Tule Lake Sump	Lost R.	USBR	Incidental flood control	agricultural lands
Non-storage Flood Control Facilities				
Eel River, Sandy Prairie, and Delta Area	Eel R.	USACE	4.0 mi. levee	Fortuna
Klamath River	Klamath R., Turwar Cr.	USACE	Levees, bank protection, and town site raising	Klamath, Klamath Glen
Redwood Creek	Redwood Cr.	USACE	6.3 mi levee, 3.4 mi. channel realignment	Orick
East Weaver Creek	E. Weaver Cr.	USACE	Channelizing and levees	Weaverville
Mad River at Blue Lake	N. Fork Mad R.	USACE	Levees and channel clearing	Blue Lake

taf = thousand acre-feet

Table NCA-4 Flood emergency responders, North Coast Hydrologic Region

Responder	Level	Comment
Person(s) or organization(s) on the site	0	Any emergency
Emergency services units of the 26 cities in the region	1	Any emergency
Emergency services units of the eight counties in the region	1 or 2	Any emergency, and by request from Level 1 responders
Department of Water Resources	2	Flood Operations Center, flood fight and Corps liaison
California Emergency Management Agency (Cal EMA), Coastal Region	3	Any emergency, Del Norte, Humboldt, Lake, Mendocino and Sonoma Counties, by request of county (operational area)
California Emergency Management Agency, Inland Region	3	Any emergency, Modoc, Siskiyou and Trinity Counties, by request of county (operational area)
US Army Corps of Engineers	3	Specified water-related emergencies, by request of DWR
California Conservation Corps	3	Personnel and equipment for flood fight
Department of Forestry and Fire Protection	3	Personnel and equipment for flood fight
Cal EMA Headquarters	4	All emergencies, entire hydrologic region, by request of Cal EMA Region

Table NCA-5 Advanced Hydrologic Prediction Service stream forecast points, North Coast Hydrologic Region

River Basin	Stream	Location
Russian River	Dry Creek	Lake Sonoma
Russian River	East Fork Russian River	Lake Mendocino
Eel River	Eel River	Fernbridge
Eel River	Eel River	Fort Seward
Eel River	Eel River	Scotia
Mad River	Mad River	Arcata
Eel River	Middle Fork Eel River	Dos Rios
Navarro River	Navarro River	Navarro
Redwood Creek	Redwood Creek	Orick
Klamath River	Salmon River	Somes Bar
Klamath River	Scott River	Fort Jones
Smith River	Smith River	Doctor Fine Bridge
Smith River	Smith River	Jed Smith near Crescent City
Eel River	South Fork Eel River	Miranda
Klamath River	South Fork Trinity River	Hyampom
Klamath River	Trinity River	Trinity Lake
Eel River	Van Duzen River	Bridgeville

Appendix B. Water Quality: North Coast Hydrologic Region

Nonpoint Source Pollution

Nonpoint source (NPS) pollution is the leading cause of water quality impairment in California. The North Coast Regional Water Quality Board's (Regional Water Board) water quality priorities highlight the need for control of NPS runoff from logging, rural roads, agriculture (including grazing and irrigation runoff), and urban areas. Sediment, temperature, and nutrients are the items of primary focus in the Regional Water Board's 303(d) list of impaired water bodies. Along the coast, NPS pollution can cause microbial contamination of shellfish (and in particular, oyster) growing areas. In rivers, lakes, and reservoirs in the Klamath Basin, extreme growths of blue green algae and accompanying microcystin neurotoxins have been found in high concentrations, leading to issuance of a health advisory by the State.

Mercury

Mercury in fish tissue is a water quality concern in Lake Pillsbury (Eel River), Lakes Mendocino and Sonoma (Russian River), and Trinity Lake (Trinity River); health advisories for mercury have been issued for Lake Pillsbury and Trinity Lake.

Erosion and Sedimentation

The Regional Water Board has prepared Work Plan to Control Excess Sediment in Sediment-Impaired Watersheds (04-08-2008). The plan describes actions and tasks that staff is doing or intends to do over the next 10 years (as resources allow) to control human-caused excess sediment transport in the sediment-impaired water bodies of the region. Besides harming aquatic life, excess sediment can limit the use of water for domestic consumption, agriculture, industry, wildlife, fishing, and recreation and it can cause or contribute to flooding.

Timber Harvesting

Timber harvesting can decrease the canopy shading of rivers and streams, thereby increasing water temperatures to levels that are harmful to cold water fisheries such as coho salmon, Chinook salmon, and steelhead trout. Timber harvesting can also lead to increased runoff and sediment transport if not addressed sufficiently during harvesting.

Critical Coastal Area Protection

Protection of Critical Coastal Areas (CCAs) was identified in the State Water Board Watershed Management Initiative, Appendix C. The Critical Coastal Program was established to coordinate actions within identified CCAs through an interagency committee (CCA Committee) led by the California Coastal Commission, the State Water Board, six coastal Regional Water Boards, and the public to identify CCAs and develop additional management measures necessary to protect these areas. The intent of CCA designation is to direct attention to coastal areas of special biological, social, and environmental significance, and to provide an impetus for these areas to receive special support and resources. These areas include Environmentally Sensitive Habitat Areas currently designated in the California's Coastal Zone Management program, areas adjacent to Areas of Special Biological Significance, California's National Estuarine Research Reserves, National Estuary Program, and National Marine Sanctuaries. Goals of the CCA Program include ensuring that the management measures and management practices of the NPS plan are fully implemented; provide a mechanism to develop and apply additional management measures as needed to achieve or maintain high quality water in CCAs; and to develop action plans for each CCA to improve degraded water quality and to protect exceptional water quality.

Water Diversions/Channel Modification

The State Water Board Basin Plan specifically establishes temperature objectives for the Trinity River in which reduced flows have disrupted temperature and physical cues for anadromous fish runs. Because of water diversions resulting in lower in-stream flows, summer temperatures in the Trinity and Klamath rivers can be lethal to salmonids. Fisheries can be further adversely affected by the lack of woody debris for pool habitat and sediment control.

Promoting Water Recycling

On a regional scale, the North Coast Regional Water Board's Basin Plan recommends recycling portions of urban and agricultural water to help meet water demands for quality and supply. Urban water recycling occurs along highways, as supply for agricultural fields (for forage), and on some municipal landscaping. Agricultural and dairy wastes are treated to reduce pathogen and nutrient loading prior to application to farmland for reuse. Water recycling in urban areas normally includes both active and passive water treatment. Active water treatment consists of any method where energy is necessary to process the effluent. Passive water treatment includes the use of settling ponds, wetlands and field rotation in pastures. In practice, when water is destined to be recycled, any effluent is first actively processed through a purification system, than applied directly to landscaping or agricultural fields. Passive treatment of discharged

water requires planning considerations specific to the original water use. In irrigated agriculture, one current trend is to create small areas adjacent to crops designed to have all tail water (which would normally flow off the owner's property) pass through these strips. In urban areas, storm water runoff catchment basins are being used to help filter water potentially containing NPS pollution. These tail water areas help to slow water flow allowing for greater settling of solids that in turn helps to prevent sediment, nutrient and pesticide transport in the watershed.

Vineyards

The expansion of vineyards in the North Coast region to areas which were previously nonirrigated due to soil conditions or other causes has increased demand for local water supplies. Frost protection for growing buds can also require significant water resources during the spring season. The majority of new vineyards are irrigated using microspray or drip systems to conserve as much water as possible. The new installations use the latest technologies ensuring the optimum use of resources. However, NPS pollution from vineyards, including pesticides, is still a concern. Current cultural practices recommended by UC Cooperative Extension include minimum tillage to prevent soil transport and minimum fertilizer and pesticide applications, on an as needed basis. The goal of these recommendations is to minimize the impact agricultural (vineyard) management has on the environment. Agricultural tail water return systems and settling basins for runoff also help to conserve and protect water supplies.

Gravel Mining

Historical gravel mining along many of the North Coast's rivers and streams has presented a particular problem concerning sediment transport. Many (if not all) of the waterways have been affected by silt and clay deposition causing a negative impact on local and regional fish spawning areas. Several major gravel mining operations along the Russian River have been curtailed in recent years. Improvements, such as settling basins, have been implemented to control the amount of sediment outflow from these mining areas to help improve downstream water quality.

Dairies

The North Coast Regional Water Board in its Strategic Plan recommends increased coordination with Resource Conservation districts and the agricultural community to deal with rangeland and confined animal problems including bank erosion and animal waste in streams. Direct discharges of waste and/or whey to streams, though prohibited, and the presence of animals in the creeks and waterways, have impacted water quality for years.

Groundwater Quality

Groundwater quality problems in the North Coast region include contamination from seawater intrusion and nitrates in shallow coastal groundwater aquifers; high total dissolved solids and alkalinity in groundwater associated with the lake sediments of the Modoc Plateau basins; and iron, boron, and manganese in the inland groundwater basins of Mendocino, Sonoma, and Siskiyou counties. Past and potential septic tank failures in western Sonoma County at Monte Rio and Camp Meeker, along the Trinity below Lewiston Dam, and along the shore of Arcata Bay/Humboldt Bay, and other areas throughout the region, are a concern due to potential impacts to groundwater wells and recreational water quality.

Health and Safety Issues in Publicly Accessible Contaminated Areas

Water quality problems in the region include contamination of surface water due to NPS pollution from storm water runoff, erosion and sedimentation (roads, agriculture, and timber harvest), failing septic tanks, channel modification, gravel mining, dairies, and MTBE and dioxin contamination. In areas where people can come into contact with contaminated waters, the State Water Board, North Coast Regional Water Board, and California Coastal Commission have the responsibility to protect the people. One of highest priority of the Regional Water Board's Basin Plan is to develop a freshwater beach program with the Sonoma County Health Department for the Russian River. In recent years concentrations of highly toxic microcystins from blue green algae have led to advisories for Iron Gate reservoir on the Klamath River.

Monitoring

According to the 305(b) report, only the Russian River basin has a long-term water quality data set in this region, which is necessary to evaluate quality changes over time. Current Surface Water Ambient Monitoring Program (SWAMP) sampling will contribute to this data set.

North Coast San Francisco and Central Coast Sustainability Workgroup

This workgroup was formed to identify and describe the connections between water quality and climate change on the coast from central California to the Oregon border as well as actions in the water quality arena that can help reduce greenhouse gases and solve the problems created by climate change. It hopes to build a local framework for adaptive management for sustainability—focusing on carbon neutrality, the resiliency of energy and water infrastructure and ecosystem viability, and fostering pilot projects to test new ideas.

Other Regional Issues

Additional regional concerns are abandoned mines, forest herbicide application, and historical discharge of wood treatment chemicals at lumber mills, including the Green Diamond/Simpson, L/P, and Sierra Pacific Industries sites near Arcata, and Trinity River Lumber Company in Weaverville.

Appendic C. Selected References: North Coast Hydrologic Region

Citations to the World Wide Web (URL) were accurate at the time of writing

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The California Water Plan provides a framework for resource managers, legislators, Tribes, other decision-makers, and the public to consider options and make decisions regarding California's water future. Our goal is that this document meet Water Code requirements, receive broad support among those participating in California's water planning, and be a useful document. With its partners, DWR completed the final Update 2009 volumes and Highlights in December 2009.

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