GUALALA RIVER WATERSHED CONDITIONS REPORT

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SONOMA RESOURCE CONSERVATION DISTRICT

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ABBREVIATIONS USED IN THIS REPORT

CAL FIRE	California Department of Forestry & Fire Protection
CWA	Clean Water Act of 1972
CWHR	California Wildlife Habitat Relationship System
EPA	Environmental Protection Agency
FoGR	Friends of the Gualala River
GRWC	Gualala River Watershed Council
LiDAR	Light detection and ranging
LWD	Large Woody Debris
NCRWQCB	North Coast Regional Water Quality Control Board
NCRP	North Coast Resource Partnership
NCWAP	North Coast Watershed Assessment Program
RCPA	Sonoma County Regional Climate Protection Authority
RWQCB	Regional Water Quality Control Board
Sonoma RCD	Sonoma Resource Conservation District
THP	Timber Harvest Plan
TIGER	Topologically Integrated Geographic Encoding and Referencing system
TMDL	Total Maximum Daily Load
TPZ	Timberland Production Zone
USGS	United States Geological Survey

EXECUTIVE SUMMARY

The primary purpose of this report is to support the Gualala TMDL Action Plan Implementation program which will include a Technical Advisory Committee's development of a framework for evaluating roads, prioritizing roads or subwatersheds for evaluation, and the development of a road assessment methodology. This program will lead to on-the-ground road erosion evaluations that will result in the inventory and assessment of active and abandoned roads in the watershed assessment area. The ultimate objective is to conduct an on-the-ground road erosion inventory required to produce a detailed, prioritized road erosion prevention and erosion control plan to protect and improve habitat for coho and other salmonids and support other beneficial uses.

This report provides a high-level, desktop assessment to determine present-day land use, road networks and densities, and forest landscapes, as well as provide a summary of relevant background information about the Gualala River watershed.

In the 2001 Gualala River Total Maximum Daily Load for sediment, the EPA identified the primary concern of the TMDL as the protection of cold-water fish such as coho and steelhead from human-caused erosion of sediment. The TMDL set 125 percent of natural sediment delivery as the level that would protect cold-water fish for the Gualala River and its tributaries. The current load is estimated to be 1220 tons/mi^2/year and the TMDL is allocated to be 475 tons/mi^2/year. Approximately two-thirds of the current load is estimated to be from anthropogenic sources.

The legacy of past land use changes and practices, as well as emerging impacts from current practices and climate change, affect the health of the watershed and the sustainability of surrounding communities. This report represents the first step in developing an assessment of watershed roads, as part of the North Coast Regional Water Quality Control Board's Basin Plan Amendment, which will include a permit system aimed at cataloging and treating sediment-contributing roads within the watershed.

Timber has historically been the dominant industry in the watershed and the driving force behind current watershed conditions. Nearly the entire watershed is forested, and over half of that forestland is capable of growing merchantable timber. Before the passage of the Z'Berg-Nejedly Forest Practice Act in 1973, timber harvest practices were highly variable and are largely responsible for sediment-related environmental and water quality issues currently still affecting the watershed. Nearly half of the watershed is currently zoned for timber production, and nearly all the watershed currently permits timber harvesting as a compatible land use practice.

The largest landowner in the watershed manages 17 percent of the watershed area as a sustainable timber operation. Approximately an additional 25 percent of the watershed is owned by industrial timber companies, and numerous small non-industrial private landowners beyond that periodically engage in timber harvest.

The top ten largest landowners own approximately 56 percent of the watershed area, approximately 63 percent of the road miles, and approximately 66 percent of the stream crossings in the watershed. There are 26 landowners with 1,000 or more acres, and all together they own approximately 73 percent of the watershed, 74 percent of the road miles, and 77 percent of the stream crossings.

Subsequent actions resulting from this initial analysis will be to develop a framework for evaluating roads, prioritize roads for evaluation, develop a road assessment methodology, conduct on-the-ground road assessments, and report on the results of those analyses. Results will inform the NCRWQCB's implementation of its regulatory program, which will be aimed at requiring landowners and land managers to reduce loading of roads-related sediment to waterways to contribute to the attainment of the Gualala River Watershed Sediment Total Maximum Daily Load.

INTRODUCTION

The Gualala River Watershed is a historically underserved watershed that drains 298 square miles along the coast of southern Mendocino and northern Sonoma counties. The legacy of past land use changes and practices since European colonization, as well as emerging impacts from current practices and climate change, affect the health of the watershed and the sustainability of surrounding communities.

In 2001, the United States Environmental Protection Agency (US EPA) with support from the North Coast Regional Water Quality Control Board (NCRWQCB) in the form of the Technical Support Document for the Gualala River Watershed Water Quality Attainment Action Plan for Sediment (2001), published the Gualala River Total Maximum Daily Load (TMDL) for sediment. This TMDL identified the primary concern of the TMDL as the protection of cold-water fish such as coho salmon (*Oncorhynchus kisutch*), which are nearly extinct, and steelhead trout (*Oncorhynchus mykiss*) from human-caused erosion of sediment. The TMDL that was established for the Gualala River and its tributaries is 475 tons/mi^2/year. It was adopted in December 2001. The current load is estimated to be 1220 tons/mi^2/year. Approximately two-thirds of that current load is estimated to be from anthropogenic sources (US EPA, 2001).

In 2021, the Friends of Gualala River (FoGR) filed a lawsuit against the NCRWQCB because it had not incorporated the 2001 TMDL into the Water Quality Control Plan for the North Coast Region (Basin Plan), as required by the Clean Water Act of 1972.

As part of the agreement reached as a result of this lawsuit, in June 2025 the NCRWQCB amended the Basin Plan to include an Action Plan for the Gualala River Sediment TMDL. This Action Plan requires the establishment of a permit system issued through NCRWQCB's Waste Discharge Requirement Program aimed at cataloging and treating sediment-contributing roads within the watershed.

The primary purpose of this report is to support the Gualala TMDL Action Plan Implementation Program which will include a Technical Advisory Committee's development of a framework for evaluating roads, prioritizing roads or subwatersheds for evaluation, and the development of a road assessment methodology. This program will lead to on-the-ground road erosion evaluations that will result in the inventory and assessment of active and abandoned roads in the watershed assessment area. The ultimate objective is to conduct an on-the-ground road erosion inventory required to produce a detailed, prioritized road erosion prevention and erosion control plan to protect and improve habitat for coho and other salmonids and support other beneficial uses.

This report was contracted to Sonoma Resource Conservation District as part of the development of the Gualala Total Maximum Daily Load Action Plan Implementation Program. This report represents the first step in developing an assessment of watershed roads.

Results will inform the NCRWQCB's implementation of a regulatory system which will contribute to the attainment of the Gualala River Watershed Sediment TMDL by requiring landowners and land managers to reduce loading of sediment from road-related sources.

WATERSHED OVERVIEW

The Gualala River Watershed drains approximately 298 square miles along the coast of southern Mendocino and northern Sonoma Counties. The primary towns in this area are Gualala, Sea Ranch, Stewards Point, and Annapolis. The river is approximately 32 miles long and widens at the mouth into a coastal lagoon/estuary and then enters the Pacific Ocean near the town of Gualala. The Gualala River watershed has five principal subbasins: North Fork, Rockpile Creek, Buckeye Creek, Wheatfield Fork, and the South Fork. The - Mainstem Gualala River runs from approximately three miles from the confluence of the North Fork and the South Fork to the Pacific Ocean.

The Gualala river mouth varies seasonally, between an estuary with open connection to the ocean in winter and spring, and a semi-closed estuary behind a sandbar, typically during summer. During summers it is a shallow, fresh-water dominated system that can also be described as a coastal lagoon.

KASHIA BAND OF POMO INDIANS

The Kashia Band of Pomo Indians were the first inhabitants of the coastal Sonoma County area around Fort Ross. The Kashia lived in lands that extended from the Gualala River in the North to Duncan's Point south of the Russian River. From the West, Kashia territory extended from the pacific coast over coastal mountain ranges down the Warm Springs Creek to the confluence of Dry Creek, 30 miles inland. An estimated 1,500 people inhabited this area pre-contact, and migrated seasonally throughout this territory to take full advantage of the resources for their subsistence. By 1870, only three villages remained and by 1914, the United States federal government began the process of taking land into Trust, establishing the Stewarts Point Rancheria. The Kashia Band of Pomo Indians has approximately 860 members, with the majority of Tribal members residing in Sonoma, Mendocino, Lake, and Napa counties which is the service area for the Kashia Band of Pomo Indians of Stewarts Point Rancheria. The Kashia Band of Pomo Indians has a Tribal Government Office located in Santa Rosa, California (Kashia Band of Pomo Indians, n.d.).

GEOLOGY

The dominant natural force shaping the basin is the evolution of the San Andreas Fault System, including the San Andreas and the Tombs Creek faults. The faults formed as a result of changes in plate motion associated with the subduction of the Pacific and North American plates. The South Fork and Little North Fork, a tributary of the North Fork Gualala River, are located within northwest-southeast trending basins along the alignment of the San Andreas Fault (Fuller, et al., 2002). Varying rates of coastal uplift coupled with alternating rise and fall in sea level modified the landscape (Koehler and Baldwin, 2005). Elevations in the basin range from sea level to 2,650 feet and as such, the terrain is varied and becomes mountainous directly inland of the coastal bluffs (North Coast Regional Water Quality Control Board, 2005). The Gualala River and its tributaries incised into bedrock, especially along fault zones, during periods of low sea level. During prolonged periods of relatively high sea levels, waves carved terraces into the coastline and the lower valleys were likely flooded with seawater and terrestrial sediments. Remnants of that sediment are preserved as the linear terraces and flood plains (Fuller, et al. 2002). The result of the tectonic deformation includes increased sediment yield associated with the coastal uplift and stream downcutting. Factors that likely enhance the watersheds susceptibility to natural disturbance and sediment delivery include intense rainfall, oversteepening of streamside slopes from stream downcutting, fractured and weakened bedrock, and ground movement associated with earthquakes.

The Gualala River Watershed is representative of the California Coast Ranges northward of San Francisco, as it contains the “most rapidly eroding, large-order, non-glaciated drainage basins of comparable size in the United States” (Judson and Ritter, 1964). Bedrock mapped within the watershed east of the San Andreas fault is largely Tertiary to Cretaceous-age marine sandstone and siltstone of the Coastal and Central Belt Franciscan Complex (Fuller and others, 2002). Much of the Central Belt is described as a mélange, which consists of a shattered and sheared shale and sandstone matrix that supports intact blocks of chert, sandstone, and metamorphics. The Pliocene-age marine sandstone and conglomerate of the Ohlson Ranch Formation is mapped along ridgetops within the central and southern portions of the watershed. Bedrock mapped west of the San Andreas fault includes Cretaceous-age sandstone, mudstone, and conglomerate of the Anchor Bay and Stewarts Point members of the Gualala Formation, and sandstone, mudstone, and conglomerate of the Paleocene to Eocene-age German Rancho Formation (Fuller, et al., 2002), and Huffman and Armstrong, 1980). Holocene to Pleistocene-age marine terrace deposits mantle the sedimentary bedrock along northwest-southeast trending ridgelines and uplifted terraces. Large sediment yields are the result of a combination of the underlying sheared and often folded Franciscan rocks, recent uplift, and a unique climate (North Coast Regional Water Quality Control Board, 2001).

SOILS

The soils in the Gualala River Watershed are diverse and closely tied to the region's rugged topography, geology, and climate. Predominantly derived from sedimentary rock formations such as sandstone and shale, these soils tend to be shallow, well-drained, and prone to erosion, especially on steep slopes. In the upland areas, soils are often gravelly loams with moderate fertility, supporting mixed coniferous forests, including redwoods and Douglas-fir. In contrast, the lower floodplains and terraces near the river feature deeper alluvial soils with higher moisture retention, making them more suitable for agriculture and riparian vegetation. Due to historical logging and road construction, many areas within the watershed have experienced increased sedimentation and soil instability, raising concerns about water quality and habitat degradation for species like coho salmon and steelhead trout. Over the last 30 years timber harvest rules have resulted in significant upgrades to roads used in active harvest areas.

CLIMATE

Climate ranges from cool fog-influenced weather near the coast with seasonal temperatures ranging from approximately 40 to 60 degrees Fahrenheit, to interior basin weather with seasonal temperatures ranging from below 0 to 90 degrees Fahrenheit (North Coast Regional Water Quality Control Board, 2003).

Climate Change Threats to Water Quality

Most climate models for the North Coast region predict that future conditions will include warming temperatures, changing precipitation patterns, rising sea levels, and increasing frequency and intensity of natural disasters (Grantham, 2018). The 2024 Intergovernmental Panel on Climate Change (IPCC)'s 2023 Climate Change Synthesis Report describes similar conditions worldwide, leading to the "widespread adverse impacts and related losses and damages to nature and people." There is a sense of urgency to address the ongoing impacts of climate change, while simultaneously reducing greenhouse gas emissions and increasing carbon sequestration and storage.

Increasing temperatures pose one of the most significant threats to the watershed. Since 1900, the average monthly maximum temperature has risen by 2.7 degrees Fahrenheit in the region (Cornwall, 2014). The average annual maximum temperature is likely to increase 5 to 9 degrees Fahrenheit by the end of the century, and the magnitude of temperature increases continues to peak in the summer months (Grantham, 2018). The 2022 Sonoma

County Climate Resilient Lands Strategy report states that temperatures in the region are predicted to increase by nearly 5 degrees Fahrenheit by the 2060s (County of Sonoma, 2022). By the middle of this century, Mendocino County is likely to see an average of 7 to 19 extreme heat days each year, as opposed to the typical 4 days per year. Scientists predict that this will increase to 15 to 35 days each year by the end of the century (Mendocino County, 2021). These factors have increased the frequency of extreme heat events which threaten human health, impact terrestrial and freshwater ecosystems, and strain water and electrical utilities (Grantham, 2018).

Warming temperatures and prolonged drought will desiccate vegetation, reduce dry season streamflow, increase the risk of wildfire, and result in a heavier reliance on groundwater resources for human use (California Energy Commission, 2019). Drought and warming temperatures also threaten surface water reserves, diminishing the water quantity stored due to evaporation.

Precipitation events are predicted to become more extreme (California Energy Commission, 2019). Though annual precipitation is not expected to change significantly, according to the 2021 Sonoma Climate Mobilization Strategy Report, it will be delivered in more intense storms and within a shorter wet season such that an "average" rainfall year will become less common. The rise in extreme precipitation events will increase the extent and frequency of flooding in low lying areas (Sonoma County Regional Climate Protection Authority, 2021). Consequently, landslides, erosion, and poor aquifer recharge may become more prevalent. Peak flows in the wet season are likely to increase (California Energy Commission, 2019). Reduced soil moisture conditions coupled with the rise of intense precipitation events is increasing the frequency and extent of flooding in low-lying areas in the region; these issues will be exacerbated in the coming decades (Grantham, 2018).

According to the North Coast Region Report from California's Fourth Climate Change Assessment (Grantham 2018), the Gualala River watershed is less vulnerable to climate change than other regions locally. Regarding water resources, there is higher annual precipitation and lower anthropogenic water demands than in other areas. The rugged and generally undeveloped coastline offers a greater opportunity to accommodate sea level rise than coastal regions to the south. Finally, the overall cooler temperatures mitigate drought and reduce heat-related injuries (Grantham, 2018). The Gualala River Watershed is adjacent to rising seas and increasingly intense coastal storms. Sea levels along the Mendocino coastline specifically are predicted to rise 23 inches by 2050 and 83 inches by 2100 (North Coast Climate Action, n.d.). As seas rise, communities along the Pacific coast will face effects from El Niño-driven storm events combined with high tides and large waves (California Energy Commission, 2019). Freshwater quantity and quality may be altered due to the migration of saline water farther upstream, groundwater rise, and salinity intrusion (County of Sonoma, 2022).

However, sea-level rise is not expected to impact the watershed's development and infrastructure as severely as in others because of the steep cliffs that separate the coast from Highway 1 and most of the infrastructure (Grantham, 2018).

However, the reach of climate change is global and impacts to precipitation patterns and the increased intensity of storms are certain to compound existing environmental issues, such as temperature and sediment affecting water quality and aquatic habitat. Abnormal drought conditions and late season wind events may exacerbate fire weather conditions in what historically has been a relatively cool and wet ecotype. This could potentially lead to severe wildfire climatic conditions, deviating from the historic baseline. As an underserved area, there may be a lack of investment in climate change adaptation and resilience in the Gualala River watershed.

Climate Change Threats to Human Health and Economy

Socio-economically, climate change poses major challenges to human health, safety, and economic productivity. An increase in extreme heat events can injure or kill vulnerable populations. The greater risk of frequent and intense wildfires associated with climate change results in a higher risk of smoke exposure and inhalation. Pests and disease-vectors that carry diseases are most active during warmer months, so prolonged warm months give pests and pathogens a larger window to reproduce and infect humans (Mendocino County, 2021). Extreme precipitation events may trigger flooding and landslides. Emergency response and evacuation can be especially complicated in remote rural communities such as those in the Gualala River watershed (Grantham, 2018). The increased frequency and severity of emergencies are straining volunteer responders across the region.

Community services and utilities are also vulnerable to climate change. Communication services are highly vulnerable to landslides, severe weather, and wildfires and damage to facilities or infrastructure prevent communities from receiving or relaying emergency information. Energy delivery is also at risk since overhead powerlines and underground natural gas pipelines are susceptible to high winds, landslides, wildfire, and fallen trees. Extreme heat can cause power outages due to mechanical failure, heat damage to above-ground infrastructure, and high demand for electricity (for air conditioning). Additionally, water and wastewater utilities are vulnerable to drought, storms, erosion, and wildfire (Mendocino County, 2021). Response and repair of these critical infrastructures can be severely delayed due to the large size and rough terrain of the watershed, further compounding the damage.

Recreation and tourism, an essential component of the watershed's economy, are directly affected by shoreline flooding, wildfire, severe weather, landslides, forest pests and diseases, drought, dune and bluff erosion, and extreme heat. Water recreation can be directly impacted when there is not enough water to attract people to fishing, swimming, or boating. Outdoor recreation facilities are often shut down due to severe weather or wildfire. Landslides and erosion can prohibit visitors from traveling to sites. Smoke from wildfire curtails outdoor recreation activities (Mendocino County, 2021).

HYDROLOGIC CONDITIONS

Rainfall varies throughout the watershed from 38 inches along the coast to 70 inches inland annually (North Coast Regional Water Quality Control Board, 2001). More than 90 percent of the annual precipitation falls between October and April (North Coast Regional Water Quality Control Board, 2005).

There is ongoing streamflow monitoring by the United States Geological Survey and the California Department of Water Resources, as well as intermittent monitoring by several other organizations, companies, and government agencies.

Rivers and streams are vulnerable to climate change due to the combination of increasing temperatures and changing precipitation patterns. Low flows are one consequence of prolonged, severe dry seasons that are particularly detrimental to cold-water-dependent fish species like steelhead (Grantham, 2018). Contrastingly, heavy rainfalls scour stream channels, initiate landslides, and deposit large volumes of sediment into watercourses.

Groundwater is similarly monitored by the California Department of Water Resources through the Sustainable Groundwater Management Act of 2014, but there is limited data for the Gualala River Watershed. Specifically, the department has not included information about groundwater level, groundwater storage, water quality, land subsidence, the water budget, or interconnected surface water. However, the watershed is broadly described as Class 4 groundwater availability, which are areas with low or highly variable water yield (SGMA Data Viewer, n.d.). The only true aquifer in the watershed is in Annapolis and is not monitored. Data is not methodically gathered across the watershed, and thus conclusions specific to subwatersheds are not available.

The State Water Resources Control Board reported in 2024, "There are 16 drinking water systems in the watershed. For 11 out of the 16 drinking water systems, the water source is listed as groundwater, five have surface water listed as the source, and the remaining one system does not have a known source type" (SWRCB, 2024). "The Gualala River is the main source of drinking water for the Sea Ranch community, and the North Fork Gualala serves the town of Gualala. The town of Annapolis depends on springs and wells" (North Coast Regional Water Quality Control Board, 2005). Stewarts Point Rancheria's source of water is Summerfield Fork (Macias, 2023).

According to Permit Sonoma's Zoning and Land Use GIS map, the groundwater availability in the watershed is classified as Class 4, which are areas with low, or highly variable, water yield (Permit Sonoma, n.d.). Approximately 6 percent of the Gualala watershed overlaps with groundwater basins: the Annapolis Ohlson Ranch Formation Highlands and Fort Ross Terrace Deposits. Both basins are considered Very Low priority as determined by the Sustainable Groundwater Management Act. The remaining 94 percent is in the Franciscan Complex, which is described as "non-water bearing, although it can yield enough water to wells for domestic uses" (SWRCB, 2024). There are no established Groundwater Sustainability Agencies in the watershed.

The amount of water that flows through the Gualala River Watershed is in flux, due to a combination of pressures. Drought, climate change, and land use agriculture are responsible for degraded water quality and fluxes in water supply (California Energy Commission, 2019). The watershed experiences dramatic wet and dry seasons, and the proximity to the ocean could result in a decrease in aquifer recharge (County of Sonoma, 2022).

Management Actions for Water Quantity

Water conservation and flow enhancement projects are another important category. Proposals call for the expansion of off-stream water storage systems to reduce summer pumping pressure on streams. Storage tanks and passive diversion devices are being designed for landowners in the Wheatfield Fork and South Fork subbasins. A cooperative "flow bank" program is being developed in concept, in which landowners coordinate the timing of withdrawals and storage releases to augment instream summer flows. These projects are in the planning stage and aim to ensure water supply reliability for people while maintaining habitat conditions for salmonids.

ESTUARINE CONDITIONS

The estuary provides important resources for juvenile coho and steelhead as they out-migrate and transition from freshwater to saltwater, and the history of the gravel bar at the estuary mouth has been the source of study. A 2005 photographic analysis of aerial photos was unable to qualitatively identify changes in sediment deposition patterns in mouth of the river and concluded that there were "no notable changes in the physical setting and character of the estuary beyond those that likely fall within the natural seasonal variability" and that estuary habitat was not a limiting factor for salmonid populations. Changes in the amount of rainfall in the early months of the rainy season (September and October), and subsequent bar breaching, were attributed to any changes seen (ECORP Consulting, Inc. and Kamman Hydrology & Engineering, Inc., 2005). However, a 2025 analysis of the gravel bar and aerial photos concluded that "the past land use actions and infrastructure have created the conditions seen in the Gualala estuary today, affecting the river's hydrologic and geomorphic processes. Removal of the old growth forests followed by several rounds of clearcutting, coupled with the removal of large wood in all the stream channels, changed how water and sediment move through the stream network. Coarse gravels and cobbles have created large, featureless gravel bars in both the upper and lower estuary. The deposition of gravel in the lower estuary and subsequent gravel bar formation has caused the channel to migrate towards Highway 1 at the downstream end of Mill Bend" and this has led to a decrease in important salmonid habitat and resources (PCI Ecological, 2025).

Predicted sea-level rise could cause the loss of coastal marsh habitats and conversion to mudflats, though this has not yet been observed in the Gualala River Watershed (Grantham, 2018).

VEGETATION COVER

Coastal redwood and Douglas-fir dominate the northwestern and southwestern areas while oak woodlands and grassland cover most of the slopes in the interior basin. Wetlands in the watershed are primarily tidal, associated with the estuary.

This area supports a diverse array of ecological communities and habitat types, owed to the coastal Franciscan mélange of geologic parent materials and coastal influence on climatic conditions which dissipates to nearly ineffectual on the easternmost portions of the watershed. Existing watershed plans, including the 2003 NCWAP, focused on in-stream or near stream values and generally have excluded upland ecosystems beyond a discussion of historic timber harvesting, road building, and development and their influence on water quality.

The following discussion examines the existing vegetation and ecological systems present within the Gualala River Watershed, recognizing the importance of these systems not only on water quality and quantity, but also on watershed values such as quality wildlife habitat, carbon sequestration and storage, and system resilience to disturbance such as fire and disease.

Vegetation assessments in this plan were created utilizing information identified by California Department of Fish and Wildlife's Vegetation Classification and Mapping

Program and U.S. Forest Service Region 5 Remote Sensing Lab, which compiled the best available single data set for land cover across the state of California. The land cover data was classified into the CWHR types based on a decision rule that controlled which layers were given priority in areas of overlap. During the development of this plan, some of the CWHR classifications were grouped together or otherwise modified for ease of interpretation.

The largest habitat types in the watershed include Montane Hardwood/Coastal Oak Woodland, Redwood, Montane Hardwood-Conifer, and to a lesser extent Annual Grasslands and Douglas-fir-dominated landscapes. Other habitat types were mapped at less than significant portions of the watershed, however these habitat elements can be found within those larger mapped ecological types.

Appendix A, Upland Habitat Descriptions includes details on these habitat types. The following table includes the ecological communities found within the watershed, and the relative percentages at which they occupy the area (CDFW 2019).

Table 1. Habitat type by subwatershed

Ecological Type	Percent of Watershed
Annual Grassland	9.8%
Barren	0.1%
Mixed Chaparral	0.4%
Closed-Cone Pine-Cypress	1.3%
Montane Hardwood/ Coastal Oak Woodland	30.5%
Coastal Scrub	0.2%
Agriculture	0.6%
Douglas-Fir	8.2%
Montane Hardwood-Conifer	23.4%
Lacustrine, Marsh, Riverine, Montane Riparian	0.2%
Redwood	25.2%
Total	**100.0%**

Table 2. Habitat type in each subwatershed

Habitat Type	North Fork	Rockpile Creek	Buckeye Creek	Wheatfield Fork	South Fork-Mainstem
Annual Grassland	6.2 %	4 %	7.5 %	11.9 %	13.3 %
Barren	0.26 %	0 %	0.05 %	0.08 %	0.20 %
Mixed Chaparral	<0.01 %	0.25 %	0.11 %	0.65 %	0.55 %
Closed-Cone Pine-Cypress	0.54 %	0 %	<0.01 %	2.22 %	2.0 %
Montane Hardwood/ Coastal Oak Woodland	17.4 %	28.6 %	29.3 %	42.5 %	20.9 %
Coastal Scrub	0.45 %	0.05 %	0.09 %	0.05 %	0.40 %
Agriculture	0.08 %	0 %	0.29 %	0.85 %	1.04 %
Douglas-Fir	5.99 %	12.12 %	12.4 %	8.61 %	4.47 %
Montane Hardwood-Conifer	35.23 %	26.76 %	29.31 %	18.14 %	17.96 %
Lacustrine, Marsh, Riverine, Montane Riparian	<0.01 %	<0.01 %	0.05 %	0.13 %	0.83 %
Redwood	33.71 %	28.16 %	20.86 %	14.87 %	38.08 %

The effective longevity of Douglas-fir is limited in many areas of the coast ranges by the butt rot pathogen *Phaeolus schweinitzii,* and it is vulnerable on exposed sites during drought periods to the flatheaded fir borer, but it seems to persist well in more mesic sites. Sugar pine is in notable decline, as with coastal pines. This is possibly because of a non-native pathogen, in this case the white pine blister rust fungus *Cronartium ribicola*.

Redwoods are resilient to most pathogens and insect pests, but it should be remembered that observations of sites with soils infested by *Phytophthora cinnamomi* and related species indicates that these pathogens also cause a decline of redwoods as well as Douglas-fir (Lee, 2023). Sudden Oak Death (SOD) increases the fuel load of a forest stand and as such, can cause stand-replacing fires even in redwood and Douglas-fir forests. Since management of SOD involves limiting soil disturbance/transport and saturation of root zone soils where possible, this may be difficult at landscape scales.

Upland Wildlife

Appendix B, Upland Wildlife, includes a report of the upland wildlife with threatened or endangered status in the Gualala River Watershed. These species include Northern spotted owl (*Strix occidentalis caurina),* marbled murrelet *(Brachyramphus marmoratus),* Sonoma tree vole (*Arborimus pomo*), Townsend big-eared bat (*Corynorhinus townsendii*), pallid bat (*Antrozous pallidus*), bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus*), American badger (*Taxidea taxus*), North American porcupine (*Erethizon dorsatum*), double-crested cormorant (*Phalacrocorax auritus*), and grasshopper sparrow (*Ammodramus savannarum*). A limiting factor in this report is the lack of long-term monitoring and abundance of data specific to the watershed.

Non-Native Plants, Pests, and Diseases

Threats from non-native tree pests in the Gualala River Watershed are prominent on a variety of tree species and vegetation types, including coastal pines, coastal true firs, hardwoods throughout the watershed, planted vegetation, and a limited number of upland conifer species. They are ranked here in approximate order of perceived virulence:

1. **Non-native *Phytophthora* species.** This group of species is ranked first for several reasons: these pathogens are effectively invisible on the landscape, they spread and damage trees deceptively slowly, and they are highly generalist. *Phytophthora cinnamomi* affects thousands of species of host trees around the world and appears to be widely distributed in Sonoma and Mendocino counties. This species spreads in moist soil and root fragments. In the coastal forests of northern California, *P. cinnamomi* can affect hardwoods (notably, tanoak, huckleberry, rhododendron, pepperwood, madrone, and wax myrtle) and conifers (including redwood and Douglas-fir).

   Other soilborne, non-native *Phytophthora* species that have been recovered in association with vegetation dieback along the North Coast include *P. cambivora, P. pseudocryptogea, P. pseudosyringae, P. cryptogea,* and *P. multivora*. Some of these may have been present in California since European settlement, while others probably arrived more recently. Even the most apparently resilient tree species, such as coast redwood, appear to be vulnerable to the effects of some of these pathogens, particularly *P. cinnamomi*.

Non-native *Phytophthora* species also include *P. ramorum,* cause of sudden oak death, which is primarily airborne rather than soilborne. This pathogen spreads rapidly and widely during years with abundant rainfall, especially when the rainfall comes during the warmer months. It readily kills tanoak and targets certain true oaks in the coastal counties, including (primarily) coast live oak and Shreve oak and (secondarily) California black oak and canyon live oak. Large-scale outbreaks are sporadic because of the need for excessive moisture, but local spread happens to some degree in infested areas every year. The only slow-the-spread measures known to be even marginally successful involve cutting infected hosts, a buffer zone of neighboring asymptomatic hosts, and the main transmitting host (not harmed itself), pepperwood/California bay laurel.

2. **Pitch canker fungus (*Fusarium circinatum*)**. This fungus may have arrived in central California from the southeastern U.S. in the mid-1980s, but it is likely native to some third place, potentially central America or the Caribbean islands. It causes rapid and extensive branch dieback and eventual mortality of bishop, Monterey, and shore pine and is both airborne and vectored by insects. It has been slowly spreading northward from central California for the past forty years and has now reached the Point Arena area. This fungus causes rapid and widespread mortality when it first arrives in an area, but it appears to stimulate resistance in its hosts that eventually leads to damage levels that are chronic but not as drastic.
3. **White pine blister rust caused by *Cronartium ribicola*.** This non-native fungus, which kills all 5-needle pines, has been present and spreading since the early twentieth century. It has likely led to effective extirpation of sugar pine throughout large portions of the Coast Range.
4. **Balsam woolly adelgid (*Adelges tsugae*)**. This sucking pest causes growth reduction, growth distortion, and in some cases death of grand fir. Recent extended observation of this pest suggests that it is only one element of a complex of pests that debilitate and kill mature grand firs, most of which are native to the region, but its ultimate role in the decline complex is still unclear.
5. **Non-native vascular plants.** Several noxious weeds cause overall habitat degradation in the Gualala River Watershed. In the North Coast region, some of these weeds such as English ivy (*Hedera helix*), Scotch broom (*Cytisus scoparius*), gorse (*Ulex europaeus)* and Himalaya blackberry (*Rubus armeniacus*) appear

capable of damaging forests by claiming growing space, crowding out young trees, and/or smothering mature trees. Other primary invasive plant species in the watershed include French broom (*Genista monspessulana*), Yellow starthistle (*Centaurea solstitialis*), and Medusahead (*Taeniatherum caput-medusae*). These species can rapidly displace native plant species and suppress their populations. All of these species require frequent, persistent treatments to control or eradicate populations. Details on life history and treatment options for these species can be found in Appendix C, Non-Native Plant Species.

Climate Change Threats to Vegetation

Vegetation types and their spatial distributions continue to change due to the increased frequency and severity of wildfires, shifting precipitation patterns, prolonged drought, and warming temperatures. For example, coast redwood forests are now more water-stressed due to hot temperatures and declining summer fog moisture, resulting in higher small-stem mortality (Pepperwood, 2015). Fire suppression, in addition to creating the current devastating wildfire regime, has also permitted Douglas-fir encroachment on oak woodlands. Douglas-fir woodlands, however, are experiencing higher mortality due to hotter temperatures, wildfires, pests, and pathogens. A decrease in Douglas-fir encroachment could subsequently allow more drought and heat-tolerant oaks to proliferate (Grantham, 2018). Coastal prairies are being inundated with water as sea level rises and storm surges become more frequent, which is effectively shifting the species composition as salt-intolerant plants decline and plants with higher salt tolerances increase. Rangelands are losing cool-season forages and other drought and heat sensitive vegetation, ushering in invasive species that outcompete natives. It is predicted that chaparral and coast live oak woodlands will thrive and expand as climate change progresses (Pepperwood, 2015). Overall, climate change-related damage has resulted in more landscapes transitioning to early seral conditions. These changes in vegetation types will alter the spatial and temporal distribution of habitat and food resources (Grantham, 2018).

WILDFIRE

The Gualala River watershed has experienced periodic fires throughout its past, either occurring naturally or purposefully set by Kashia people. Existing fire data (which is likely incomplete) records over 20,000 acres burned between 1950 and 1959, perhaps related to the peak rate of timber harvest at that time (NCRWQCB, 2001). There is now a risk of damaging wildfire due to over a century of fire suppression and poor forest management practices, as well as climate change. Climate change creates more fire risk because of higher seasonal temperatures, stronger winds and drought. High intensity wildfires experienced in Sonoma and Mendocino counties within the last decade have been attributed to these factors.

Large damage causing catastrophic wildfires that the region has experienced over the past 20 years was mostly caused by high wind events preceded by a years long drought under high temperatures and low humidities. These fires were mostly caused by electrical distribution equipment in remote and or high wildfire risk areas.

Sustained higher temperatures and lower humidity increases the probability of wildfire ignition and the likely intensity of a wildfire. Wildfires have become more frequent and severe regionally due to a combination of factors, including increasingly warm temperatures, drought, and a lack of forest management (California Energy Commission, 2019). Large destructive wildfires, in addition to damaging the forests that help drive the hydrological cycle, change the amount of water and sediment flowing into streams. Research indicates that there can be a short-term increase in stream water discharge after a wildfire, followed by fewer episodes of very low water levels (U.S. Environmental Protection Agency, 2019). Wildfires also increase the susceptibility of watersheds to flooding and erosion, which result in diminished reservoir capacity. Though the Gualala River Watershed has not experienced severe wildfire in the last two decades, it is still zoned as having a moderate to high severity rating by CAL FIRE's Fire and Resource Assessment Program (California Department of Forestry and Fire Protection, n.d.).

The Climate Explorer is an online tool that allows user to explore how climate is projected to change in any county in the United States. Figure 1 displays the historical and projected average daily maximum temperature of Sonoma County and Figure 2 displays the same for Mendocino County. It is important to note that these projections are county-wide and do not solely account for the Gualala River Watershed.

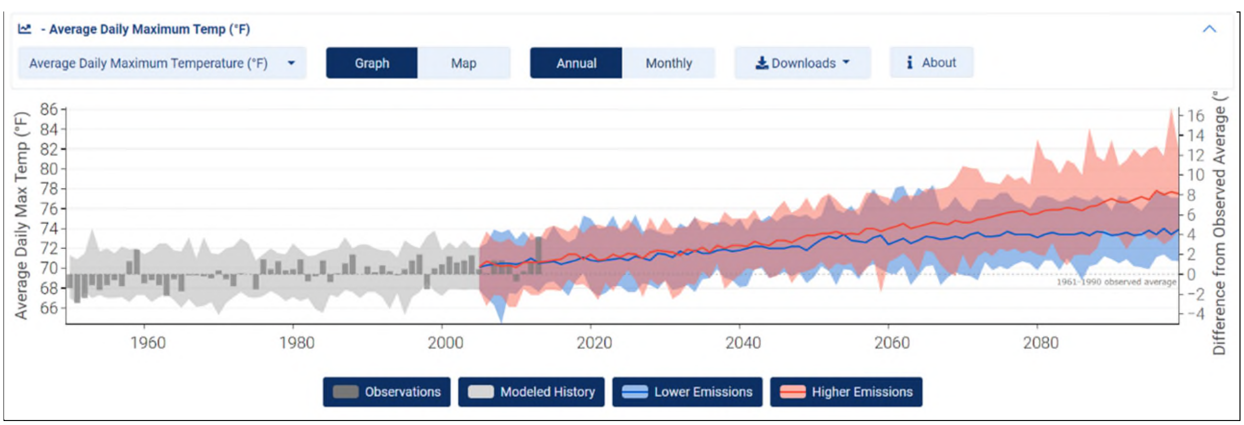

Figure 1. Historic and projected average daily maximum temperature of Sonoma County

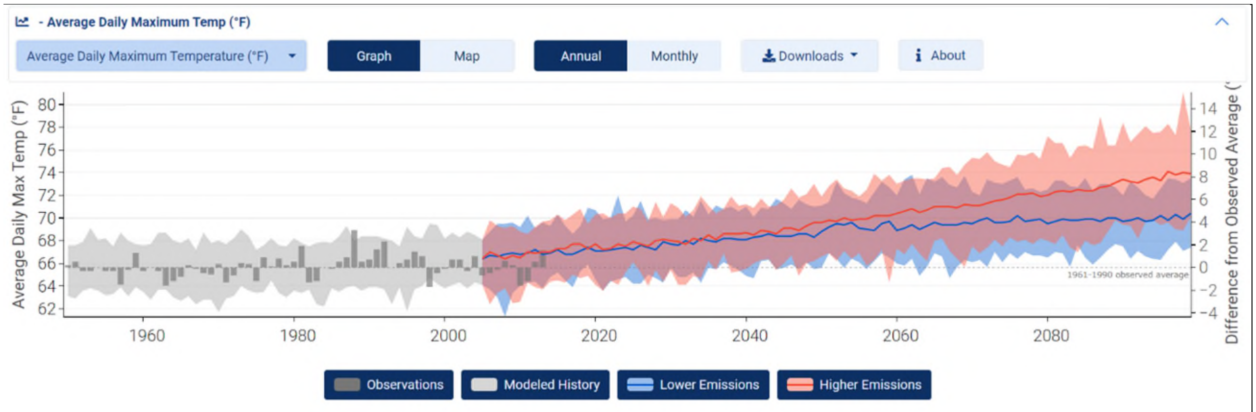

Figure 2. Historical and projected average daily maximum temperature of Mendocino County

Management Actions for Wildfire

Wildfire and vegetation management are emerging as equally critical priorities. Projects are being planned to establish shaded fuel breaks along ridgelines near Timber Cove and Sea Ranch, reducing wildfire risk for vulnerable communities. Selective thinning and prescribed fire are also proposed for mixed conifer–hardwood forests, both to improve fire resilience and to accelerate the development of old-growth characteristics such as large cavities and branching platforms. In oak woodlands, conifer encroachment treatments are being designed to restore historic fire regimes and improve habitat for species that depend on open-canopy conditions. CAL FIRE and local fire districts are expected to play key roles in implementing these vegetation management projects once they move beyond the planning stage.

ACCESS

Only a few public roads cross the watershed. Highway 1 crosses the mainstem of the river at its estuary south of the town of Gualala. Stewarts Point/Skaggs Springs Road connects Stewarts Point on the coast to Lake Sonoma and runs along Wolf Creek and the Wheatfield Fork. Other public roads include King Ridge Road in the South Fork subwatershed, Fish Rock Road, and Annapolis Road (North Coast Regional Water Quality Control Board, 2003).

SALMONIDS AND AQUATIC ORGANISMS

The North Coast Watershed Assessment Program (2003) reported that fish species in the Gualala River include coho (silver) salmon, steelhead trout, pacific lamprey, roach, coastrange sculpin, prickly sculpin, riffle sculpin, and three-spine stickleback. Resident populations of rainbow trout exist above impassable barriers. In the coastal estuary, species include starry flounder, staghorn sculpin, surf smelt, and Pacific herring. Eulachon may have been present in the estuary, Sacramento sucker may have been present in Buckeye Creek and/or Wheatfield Fork. Interestingly, this report also cites personal communication that chinook salmon were caught prior to 1945, though there is no data on their presence in the watershed now (Klampt et al., 2002) and no historical scientific data to support their presence (US EPA, 2001).

Table 3. Current fish species in the Gualala River Watershed

Common Name	Scientific Name
Anadromous	
Coho salmon	*Oncorhynchus kisutch*
Steelhead trout	*Oncorhynchus mykiss*
Pacific lamprey	*Lampetra tridentata*
Freshwater	
Gualala Roach	*Lavinia symmetricus parvipinnis*
Coast range sculpin	*Cottus aleuticus*
Prickly sculpin	*Cottus asper*
Riffle sculpin	*Cottus gulosus*
Threespine stickleback	*Gasterosteus aculeatus*
Marine or Estuarine	
Surf smelt	*Hypomesus pretiosus*
Pacific herring	*Clupea pallasii*
Staghorn sculpin	*Leptocottus armatus*
Starry flounder	*Platicthys stellatus*

From Klampt et al, 2002

The Gualala River and its tributaries are vital to the conservation of coho salmon, steelhead trout, and other aquatic species. Coho salmon are listed as endangered under both the federal and state Endangered Species acts and fall within the Central California Coast (CCC) Evolutionarily Significant Unit. Steelhead trout are listed as federally threatened and are a part of the Northern California (NC) Distinct Population Segment (DPS). Both species were present in large numbers historically and have declined due to human activities that have degraded stream habitat.

Data on salmonids in this watershed are very limited, likely due at least in part to the fact that the majority of the watershed is privately owned and access for surveys has historically been limited. However, the combination of limited fish surveys and anecdotal evidence strongly suggest that coho salmon and steelhead populations were robust prior to the 1960s. A 2005 study found "strong evidence" of coho salmon in 18 streams within the Gualala watershed. The results of this analysis are presented in Appendix G, Map 9, Historical Occurrence of Coho Salmon in Streams of The Central California Coast Coho Salmon Evolutionarily Significant Unit: Gualala River Basin. The NCWAP report (Klampt et al., 2003) concluded that steelhead trout distribution throughout the watershed is likely similar to 1966 distribution.

COHO SALMON LIFE HISTORY

"Coho salmon (*Oncorhynchus kisutch*) are an anadromous fish, with a complex life history that includes spawning and juvenile rearing in rivers for at least one summer followed by migrating to saltwater to feed, grow, and mature before returning to freshwater to spawn" (NOAA, 2012). "Most west coast coho salmon enter rivers in October in response to increased freshwater outflows to the ocean and spawn from November to December and occasionally into January. However, coho salmon on the Mendocino Coast, including the Gualala River watershed, generally enter freshwater much later, in late December or January, and spawn immediately afterwards, probably in response to later peak river flows of limited duration." (North Coast Regional Water Quality Control Board, 2001).

Historical Population Information

Coho salmon in the Gualala River Watershed and adjacent areas are part of the CCC Evolutionarily Significant Unit (ESU). While historical data on CCC coho salmon abundance is limited, the number of wild CCC coho salmon was estimated at 6,000 in the 1990s (California Department of Fish and Game, 2011) and 2,000 to 3,000 by 2011 (Gallagher and Wright, 2012).

The Gualala River Watershed contains one of the few Functionally Independent Populations of the CCC Coho (Spence et al., 2008) and has the highest Intrinsic Potential, excluding the Russian River, of all the coastal watersheds for possible recovery of the CCC Coho ESU (NOAA, 2012; Gualala River Watershed Council, 2016).

In the Gualala River Watershed, coho salmon are known to have historically been present in the North Fork, Buckeye, Wheatfield Fork, and South Fork subbasins (Brown and Moyle, 1991). There were nine adult coho observed entering the mouth of the Gualala River in 1999-2000, and in 2002, young of the year coho were observed in Dry Creek, the Little North Fork, and Doty Creek during electrofishing surveys (North Coast Regional Water Quality Control Board, 2001, and Gualala River Watershed Assessment Report, 2003). The 2003 Gualala River Watershed Assessment Report provides more information on historic coho distribution, and studies referenced in that report suggest that coho were restricted to only the North Fork subbasin in 2001-2002.

Recent Data

A 2011 status review of CCC coho salmon found that populations in the Gualala River Watershed (along with the Russian River, Walker Creek, Pescadero Creek, and San Lorenzo River watersheds) were at high risk of extinction or are extinct (Spence and Williams, 2011). A limiting factor was a lack of population data.

Coho salmon in the watershed are part of the Navarro Point-Gualala Point diversity stratum 2023 5-Year Review for CCC coho salmon, produced by the National Marine Fisheries Service, states that: “Recent data from the Lost Coast-Navarro Point and Navarro Point-Gualala Point diversity strata suggest a slight improvement in the viability of independent populations since the last status review (Williams, 2016), with most populations having rebounded somewhat since low levels reached during California’s multi-year drought between 2012 and 2015. The Gualala River Watershed Council Stream Monitoring Report documents the last live sightings of coho salmon in 2004, where 23 were reported in Dry Creek within the North Fork Gualala Hydrologic Unit. Due to a lack of statistical surveys monitoring coho salmon in Gualala, their current populations are unknown.

In 2013, in partnership with the Sonoma County Water Agency, the North Coast Regional Water Quality Control Board and NOAA, the GRWC conducted snorkel surveys during the low flow periods of June and July on 31km (19 miles) of streams within the Gualala River North Fork Basin “to assess if remnant populations of coho salmon existed. No juvenile Coho were found within the study area during the four years (2013-2016) the surveys were conducted, potentially confirming extirpation within the basin. However, steelhead were found and documented in all reaches surveyed.” (Gualala River Watershed Council, 2016).

Threats

“Unfortunately, the habitat requirements for coho salmon in most streams in the CCC ESU are not at properly functioning conditions and their abundance has decreased, in large part, because the natural rates of critical watershed processes (e.g., sediment delivery, hydrology, wood recruitment, loss of beaver habitat, temperature regulation, etc.) have been substantially altered by human activities (NOAA, 2012).”

Elimination of old growth forests and road building due to timber harvesting have caused extensive erosion, landslides, and siltation of many of the watercourses that feed the Gualala River. The sediment discharged into the creeks and rivers by commercial forestry projects in this watershed has challenged the stability of salmonid populations and habitat. The EPA lists the Gualala River on its federal Clean Water Act §303(d) list of impaired water bodies due to declines in anadromous salmonids from excessive sedimentation and water temperature.

The following text, from the 2016 5-Year Review of CCC coho salmon, lists primary habitat concerns in the ESU:

- High water temperatures and low water flows due to a lack of riparian vegetation and rural residential and agricultural water withdrawals in the Gualala and Navarro rivers.
- Lack of instream habitat complexity (e.g., large woody canopy cover, riffle/run/pool diversity, and access to the floodplain or off-channel habitat) due largely from impacts associated with legacy timber operations and ranching grazing practices in all populations in this diversity stratum.
- Lack of high flow refuge habitat (e.g., off-channel, backwater channel, and floodplain areas), especially with increasing winter storm severity.
- Lack of estuarine habitat complexity (including floodplain and off-channel habitat) due to grazing practices, California State Highway 1, and timber operations throughout the diversity stratum, leading to an increased risk of predation, reduced stress reduced stream carrying capacity, and reduced opportunity for full life history expression (NMFS, 2016).

Recovery Strategies

The 2023 5-Year Review of CCC coho salmon recommends the following recovery actions for the next 5 years:

- Retain, recruit, and actively input large wood into the stream to increase shelter value, pool volume, and floodplain connectivity. Implement restoration projects that create or restore off-channel, estuarine, and floodplain habitat.
- Design and implement restoration projects to create or restore alcoves, floodplain, backwater channel, ephemeral tributary, or seasonal habitats for high-flow refuge.
- Minimize new road construction within floodplains and riparian areas and upon unstable soils or other sensitive areas. Design new roads that are hydrologically disconnected from the stream network.
- Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors.
- Eliminate depletion of summer flows and promote off-stream storage and passive diversion devices designed to allow diversions of water only when minimum streamflow is met.

- Prioritize tributary habitat projects that improve habitat resiliency to climate change. Actions to restore riparian vegetation, streamflow, and floodplain connectivity and regrade incised stream channels can ameliorate temperature increases, base flow decreases, and peak flow increases, thereby improving population resilience to some effects of climate change (NMFS, 2023).

Additionally, in the 2023 5-Year Review of CCC Salmon, National Marine Fisheries Service recommends in partnership with CDFW to develop a re-introduction strategy for the Gualala River population utilizing broodstock from adjacent populations in the Navarro Point-Gualala Point Diversity Strata.

For coho recovery, restoration efforts should focus on the North Fork sub-basin watershed. “The North Fork [sub basin watershed is considered the highest priority watershed as an ‘Initial Focus Core Area’ for restoration (NMFS, 2012). Two factors contribute to this ranking and the importance the subbasin provides to the Gualala River Watershed as a whole.

1. Provides the highest quality salmonid refugia available in the watershed and is the only sub-basin to have possible remnant populations of Coho salmon. The last observations of coho salmon in the watershed were in the Little North Fork and its tributary Doty Creek, and Dry Creek a tributary to the North Fork mainstem.
2. Important source of base flows and cold-water infusion to the lower Gualala during the late season periods when the estuary is prone to warmer temperatures and high salinity conditions (Gualala River Watershed Council, 2016).

Consistent favorable thermal habitat for Coho rearing is evident in the tributaries and the lower reaches of the North Fork mainstem indicating that the watershed can provide suitable thermal habitat (Gualala River Watershed Council, 2016).

Beavers are also believed to play an important role in the formation of salmon habitat. The felling of trees by beavers increases woody debris, leading to increased invertebrate diversity and biomass, and the debris cover, provided by the lodge and food cache, has been shown to attract some fish species including salmonids (Collen and Gibson, 2001).” The implementation of beaver dam analogs could be a potential recovery strategy where appropriate to restore coho bearing streams. More research is needed however case studies of this recovery strategy have been implemented in the Sierra Nevada range.

Planned Management Actions for Coho Salmon Habitat Improvement

Habitat restoration projects are being planned for multiple tributaries, with a focus on restoring conditions for coho salmon and steelhead. Primary guiding documents for this effort include the “Final Recovery Plan for Central California Coast Coho Salmon” (*Oncorhynchus kisutch*) Evolutionarily Significant Unit (National Marine Fisheries Service,

2012) and the "Recovery Strategy for California Coho Salmon" (California Department of Fish and Game, 2004). The North Fork has been identified as the highest priority for coho recovery, and planned projects include large woody debris placements to restore habitat complexity, pool formation, and floodplain connection. Similar projects are being developed for Buckeye Creek and the Wheatfield Fork, where legacy logging removed much of the instream structure. Riparian revegetation is also a major focus, with proposals to plant native species such as alder, willow, and conifer along unshaded reaches in the South Fork and Rockpile Creek. These efforts are intended to stabilize banks, cool stream temperatures, and improve nutrient cycling.

Fish passage improvement is also receiving attention. Undersized and failing culverts continue to fragment habitat in several tributaries. Planned projects in the Annapolis area would replace perched culverts with open-bottom arches, restoring access to upstream rearing and spawning habitat. These projects are expected to be implemented in tandem with road upgrades, providing combined benefits for sediment reduction and connectivity.

STEELHEAD TROUT LIFE HISTORY

Steelhead are the anadromous form of rainbow trout, a salmonid species native to western North America and the Pacific Coast of Asia. They enter the Gualala River to spawn starting in late December through April. After the young emerge, they spend their first 1 to 3 years of life in the watershed before smolting and migrating to the ocean. After spending between one to four seasons maturing in the ocean, Steelhead returns to their native freshwater stream to spawn. Unlike Pacific salmon, steelhead do not necessarily die after spawning and are able to spawn more than once. Steelhead in the Gualala River Watershed are specifically part of the Central Coastal Diversity Stratum.

Historical Population Information

Though the abundance of salmonid populations in the Gualala River Watershed has drastically declined since the 1960s, there is evidence that steelhead populations are currently growing since then. The GRWC's surveys recorded an increase in steelhead redd and adult population from 2016 to 2018. However, these populations are far below the National Oceanic and Atmospheric Administration's (NOAA) recovery target.

Fish passage barriers created by log jams and debris in the 1950s and 1960s logging era reduced the distribution of steelhead trout in the watershed. According to surveys conducted by CDFW in the 1960s and 1970s, there were steelhead observed in four of the five subbasins: North Fork, Buckeye, Wheatfield Fork, and South Fork. The Rockpile subbasin was not surveyed. In comparing these surveys with data collected in 2001, it was determined that steelhead distribution in the watershed had not changed (North Coast

Regional Water Quality Control Board, 2003). While there is limited data on the abundance of steelhead in the watershed, it is known that steelhead were fished in the Gualala River since the 1940s.

In all ten tributaries surveyed in 2001, steelhead young of the year were observed (North Coast Regional Water Quality Control Board, 2003). In the Wheatfield Fork, surveys conducted between 2002-2010 found a high of 1,402 adult steelhead in 2008 and a low of 126 adults in 2009 (DeHaven, 2010). See Tables 3-10 and 3-13 in the 2003 Gualala River Watershed Assessment Report (NCWAP, 2003) for a summary of historic steelhead trout abundance and distribution in the watershed.

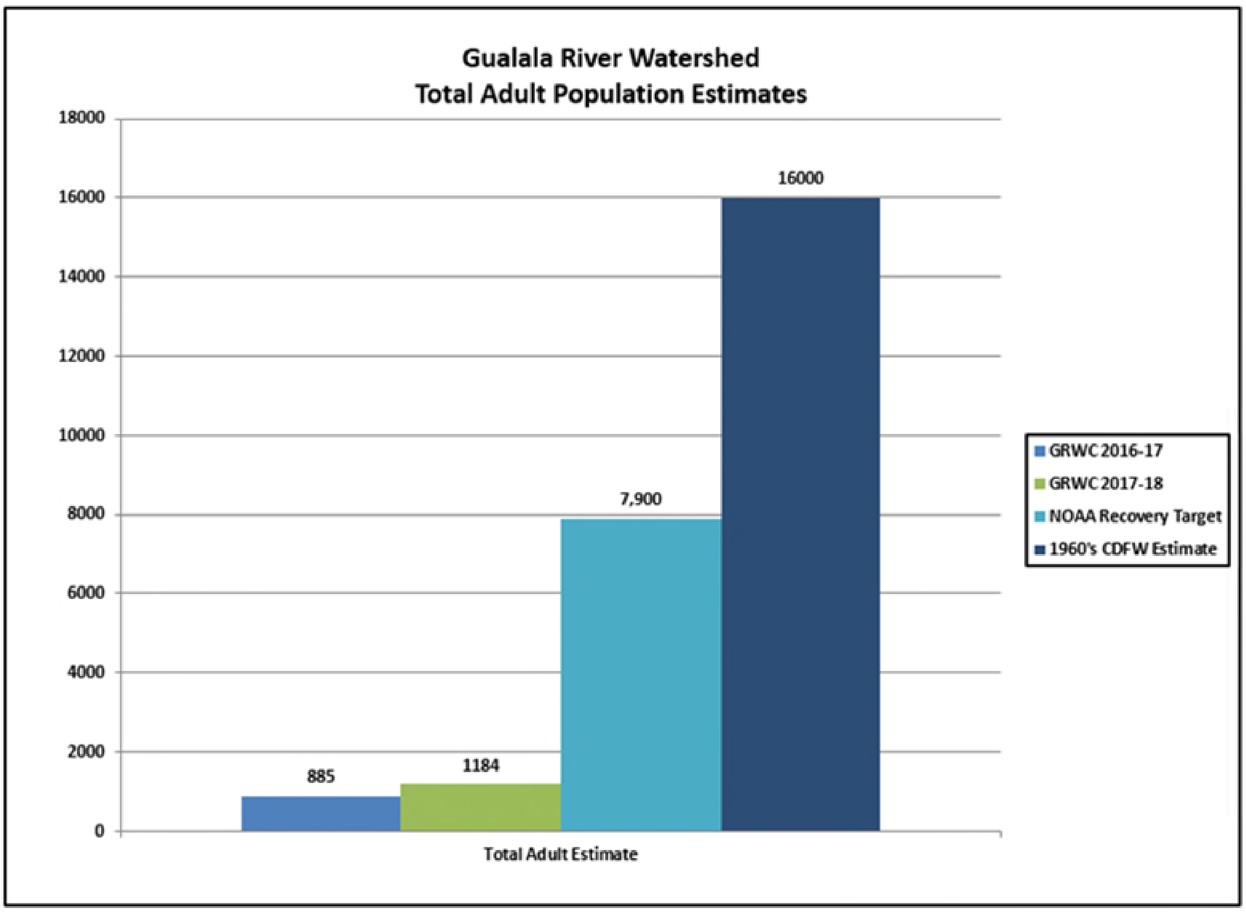

Figure 3. Total adult population estimates of steelhead trout, including CDFW 1960s estimates, NOAA recovery target, and GRWC 2016-2018 estimates

From 1995 to 2008, Mendocino Redwood Company found steelhead trout, but no coho salmon, its fish surveys. This data is available in Appendix G.

Recent Data

In the 2016 5-Year Status Review for North Coast steelhead the available information for winter-run and summer-run populations of North Coast steelhead did not suggest an appreciable increase or decrease in extinction risk since publication of the last status reviews (Williams et al., 2011). Most populations for which there are population estimates available remain well below viability targets; however, the short-term increases observed for many populations, despite the occurrence of a prolonged drought in northern California, suggests this DPS [Distinct Population Segment] is not at immediate risk of extinction" (NMFS, 2016).

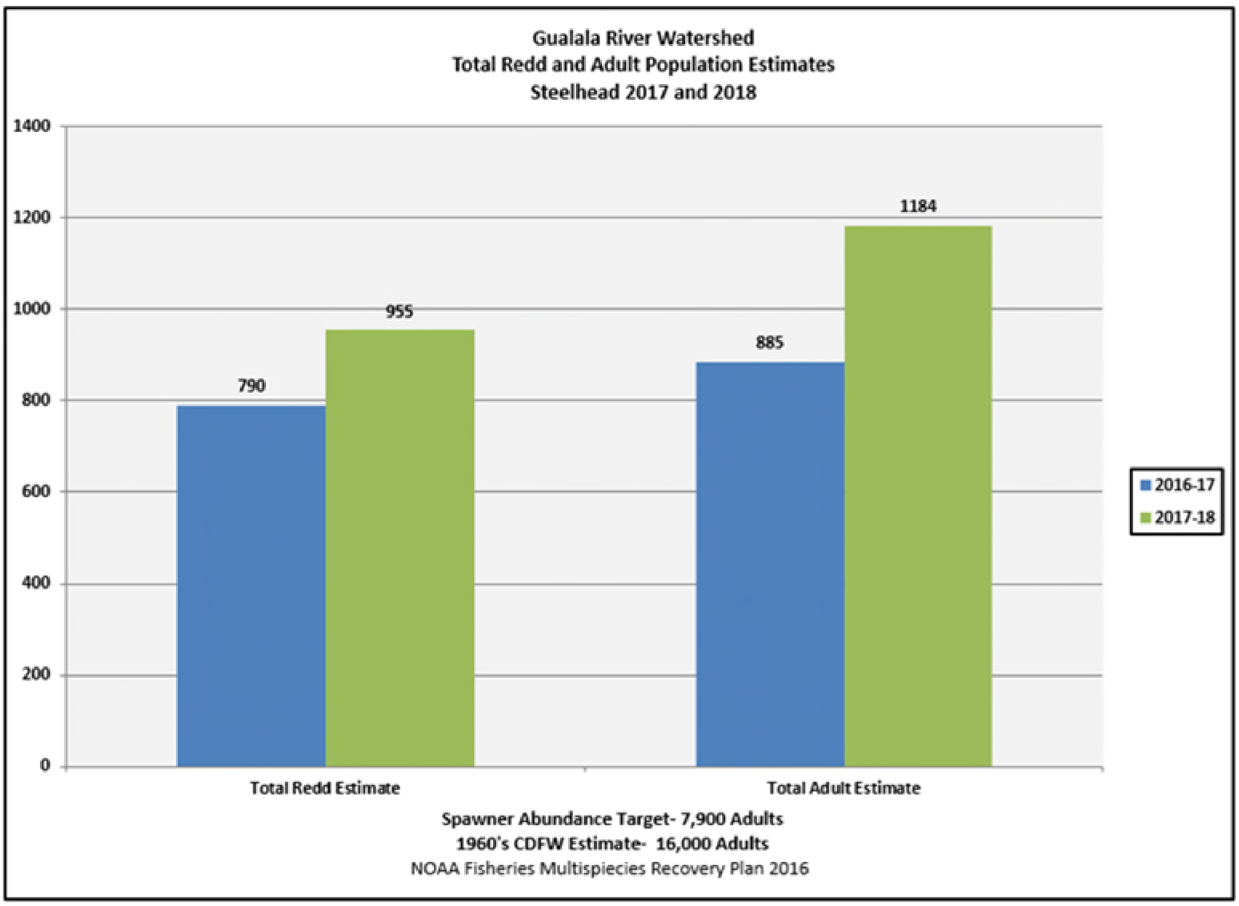

Figure 4. Total redd and adult population estimates of Steelhead Trout in 2017 and 2018

Threats

The summer juvenile steelhead life stage is the most limited in the Gualala River watershed. Impaired canopy cover, reduced habitat complexity, and increased water temperatures coupled with reduced surface flow, are the stresses most limiting summer juvenile survival and ultimately recovery of steelhead within the Gualala River Watershed.

In the 2016 Coastal Multispecies Recovery Plan, watershed conditions and threats to salmonid populations including North Coast steelhead were analyzed using a Conservation Action Planning process. Through this process, the following conditions were rated as Poor for steelhead in the Gualala River Watershed:

- Pool shelter, primary pools, pool/riffle/run ratio.
- Impaired hydrology (passage flow for smolts).
- Stream side road density.
- Water temperature.
- Summer juvenile steelhead reduced density and abundance (NMFS, 2016).

Notably, large wood frequency in the channel was rated as Good. Threats identified as High or Very High included logging and wood harvesting, water diversions and impoundments, agriculture, roads and railroads, and fishing and collecting (NMFS, 2016).

Snorkel surveys provide a relatively low-cost but effective way to track year-to-year changes in abundance. Data from snorkel surveys conducted by the GRWC between 2013 and 2016 produced density charts that showed clear patterns of juvenile steelhead distribution in the North Fork.

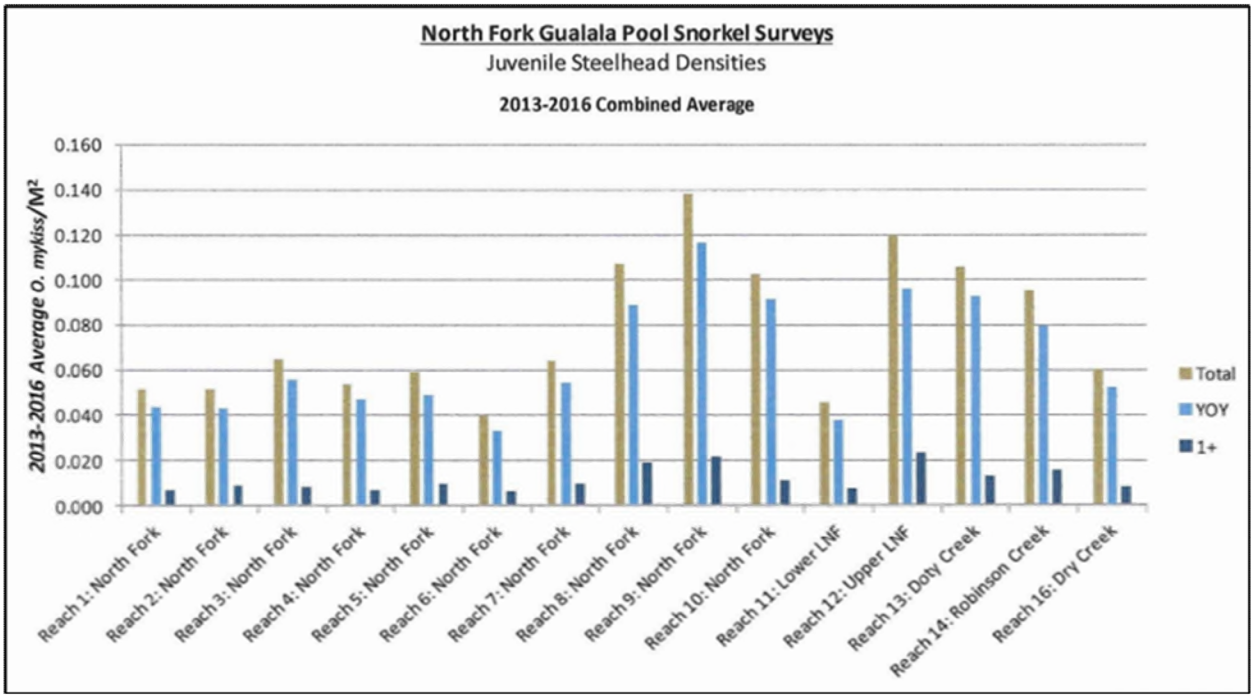

Figure 5. North Fork Gualala Pool snorkel surveys

Because these surveys can be repeated annually, they are well suited to detecting both long-term trends and the effectiveness of habitat restoration projects. Their limitations, however, include dependence on water clarity, surveyor training, and the seasonal timing of fish movements.

Recovery Strategies

"A TMDL aimed at addressing sediment impairments, water temperatures, and water quality was developed by the USEPA in 2001 and adopted by the North Coast Regional Water Quality Control Board in 2004." (NMFS, 2016).

The general recovery strategy for steelhead in the watershed consists of:

- Improving canopy cover and reducing stream water temperature.
- Increasing habitat complexity, including percent primary pools and pool/riffle/flatwater ratios and large wood and shelter.
- Protecting seasonal and summer hydrologic conditions.
- Addressing passage barriers.
- Enhancing estuarine function.

- Improving instream gravel quality and reducing erosion and sedimentation, including upgrading and decommissioning roads.

The Coastal Multispecies Recovery Plan specifically discusses riparian rehabilitation in low gradient areas to enhance summer rearing conditions and placing channel forming features in the reaches of the North Fork, Rockpile, Buckeye, Wheatfield Fork, and South Fork subwatersheds, creating and maintaining riparian buffers. It also indicates that establishing large vineyards in the watershed may reduce groundwater levels and surface flows, limiting steelhead rearing conditions (NMFS, 2016).

The GRWC has implemented extensive restoration in the past two decades within the Doty Creek Planning Watershed, which contains the Little North Fork and Doty Creek, focused on the hydrological disconnection of over 30 miles of timber and ranch roads, therefore remediating all high and medium sediment sources in the watershed. Large wood placement has been the focal point of instream restoration with the placement of 393 logs and root wads totaling 45,179 ft^2 increasing pool formations in the upper Little North Fork reach (#12) by a factor of 2. Restoration efforts have documented success as this may have contributed to the higher density results found in the upper reaches of the tributaries in the GRWC Snorkel Surveys from 2013-2016. (Gualala River Watershed Council, 2013).

There are multiple factors that affect salmonid life history. During the freshwater phase, survival depends in part on stream connectivity, stream condition, and riparian function. See sections on Water Quality and Water Quantity within this report for more information.

GUALALA ROACH

The Gualala roach has been designated as a California Fish Species of Special Concern because they are a distinct subspecies, apparently endemic to the Gualala River system, and their life history and population status are poorly understood. Moyle, 1976, as cited by Higgins, states that the Gualala Roach prefers water temperatures less than 23°C to 24°C for long-term survival but can survive temperatures up to 35°C. (North Coast Regional Water Quality Control Board, 2001). As such they are considered a warm-water fish. “Although no population estimates have been conducted for this species, the bulk of CDFG stream surveys show that roach have increased in abundance while coho have disappeared and steelhead decreased in most tributaries of the Gualala River” and this has been attributed to higher water temperatures associated with loss of riparian vegetation and stream aggradation (Higgins, 1997).

MONITORING STRATEGIES

As drought and climate change multiply the effects of an already degraded habitat, it becomes even more critical to establish reliable models for status and trends of salmonid populations. With the development of accurate abundance and distribution estimates, planning for future restoration efforts can be targeted and efficient, leading to more successful and cost-effective restoration efforts (Gualala River Watershed Council, 2016).

Thalweg Surveys

Another key monitoring tool has been the thalweg survey, which involves measuring the deepest point of the stream channel along a longitudinal profile. These surveys document pool depth, spacing, and overall channel complexity—factors that are critical for salmonid habitat. A 2006 summary of thalweg data concluded that "channel elevations have tended to decline or fluctuate randomly. In no case was there a significant increase in bed elevation relative to [1998] baseline" (O'Connor Environmental, Inc., 2006). Data from prior to 1998 was not used in this analysis. Thalweg data has been used to evaluate whether streams are maintaining the pool frequency and depth necessary to support rearing fish, and to assess the impact of sedimentation on habitat quality. In a sediment-impaired watershed such as the Gualala, thalweg surveys can provide one of the most direct indicators of how land use and erosion influence aquatic systems over time.

Macroinvertebrate Sampling

This sampling adds a biological layer to the monitoring framework. Aquatic insects and other invertebrates are collected from riffles and substrates, then identified and quantified to produce indices of water quality. Because macroinvertebrates respond to cumulative impacts of flow, temperature, sediment, and pollution, they provide a sensitive measure of ecological health that complements physical and chemical monitoring. This method has been employed by GRWC and partner organizations to identify reaches where water quality is impaired, even when standard chemistry measurements such as temperature or turbidity might appear within acceptable ranges.

Large Woody Debris Tracking

The installation and tracking of large woody debris (LWD) represents a more targeted form of monitoring tied to restoration. LWD structures are placed in streams to improve habitat complexity, create pools, and stabilize sediments. Monitoring these installations involves measuring changes in channel morphology, pool formation, and fish use. In the Gualala River Watershed, such projects have been evaluated to determine whether they are increasing habitat availability for salmonids. This type of monitoring links directly to management actions, providing feedback on restoration effectiveness that can be used to design future projects.

Other Aquatic Species

Appendix D, Amphibian Species of Special Concern, includes a report of amphibians with threatened or endangered status in the Gualala River Watershed. These include on the California Red-legged frog (*Rana draytonii*), California giant salamander (*Dicampttodon ensatus*), and Foothill yellow-legged frog (*Rana boylii*).

LAND USE

Approximately 95 percent of the watershed is privately owned, primarily by ranches, private residences, timberlands, and vineyards (North Coast Regional Water Quality Control Board, 2003). The town of Gualala is the largest municipality in the watershed, but population varies depending on the time of year. Current land use consists of grazing, rural subdivisions, vineyards, one private campground, timber harvesting, and two Sonoma County Regional Parks campgrounds.

To provide a discussion on land use in the watershed, an analysis was conducted utilizing publicly available spatial data sets. Data includes, but is not limited to, parcel boundary, ownership information, and zoning designation from the Sonoma and Mendocino County Assessor's offices, LiDAR-derived vegetation data from the Sonoma County Agricultural Preservation and Open Space District, Habitat Classification from the California Department of Fish & Wildlife's California Wildlife Habitat Relationships (CWHR) program, Timber Harvest records from the California Department of Forestry and Fire Protection (CAL FIRE), various aerial photography, and Google Earth imagery.

The Redwood Coast Land Conservancy and The Conservation Fund are exploring new conservation easements in the Wheatfield Fork, with an emphasis on preventing conversion of timberlands to vineyards or other intensive uses. Building on past acquisitions such as the Preservation Ranch property purchase by The Conservation Fund, these planned easements would secure riparian corridors, reduce development pressure, and protect headwater forests.

FORESTED LANDS

Nearly 90 percent of the Gualala River Watershed is forested, and over half of that forestland is capable of growing merchantable timber. Vegetation types defined by and derived from the California Wildlife Habitat Relationship (CWHR) System indicate that the following forest habitat types are present within the watershed: Closed-Cone-Pine-Cypress, Coastal Oak Woodland, Douglas-Fir, Montane Hardwood, Montane Hardwood-

Conifer, Montane Riparian, and Redwood. These forests provide crucial habitat for a variety of flora and fauna while concurrently providing valuable natural resources for the local economy.

Timber has historically been the dominant industry in the watershed, beginning with the introduction of Russian settlers at Fort Ross in 1812 and peaking during the post-war housing boom of the 1950s. The first comprehensive timber harvest legislation was not passed until the Z'Berg-Nejedly Forest Practice Act in 1973, which now regulates the timber harvest process through an extensive environmental review and oversight; before 1973, timber harvest practices were highly variable and are largely responsible for sediment-related environmental and water quality issues currently afflicting the watershed.

Nearly half of the watershed (over 100,000 acres) is currently zoned for timber production, and nearly all land that is not designated as a public facility is designated Resources and Rural Development, which permits timber harvesting as a compatible land use practice. About 17 percent of the watershed area is owned by The Conservation Fund and is managed as a sustainable timber operation. An additional approximate 25 percent of the watershed is owned by industrial timber companies, and numerous small non-industrial private landowners periodically engage in sustainable timber harvest.

While timber harvest can promote healthy forests and a thriving economy, it also presents a risk to water quality; generally, from sedimentation caused by roads and soil disturbance during harvest. Harvest-related erosion and sedimentation can be mitigated through road design and maintenance, soil stabilization and protection, unstable areas protection measures, and watercourse protection measures, as well as erosion control infrastructure like culverts, watercourse crossings, hay or slash mulching, riser pipes, and catch basins.

An updated summary of recent road upgrades and maintenance work should be included in future prioritization work.

The timber industry is facing common issues due to climate change and the associated rising temperatures and changed precipitation conditions. These can exacerbate tree mortality caused by pests, pathogens, wildfire, water deficits, and heat. Flooding and landslides slow or prohibit the harvest and delivery of timber to mills. The timber industry is one of the driving economic forces in the Gualala River Watershed, so a loss of productivity would cause significant financial damage to the region.

AGRICULTURE

Agriculture in the watershed is primarily orchards and vineyards, and to a lesser extent row crops and hay. "Agricultural practices affect aquatic and riparian areas through non-point source pollution, since these areas eventually receive sediments, fertilizers, pesticides, and wastes from associated agricultural lands" (California Department of Fish and Game, 2004).

Conversion of natural systems to row crops and other intensive agriculture is a common phenomenon in Sonoma and Mendocino counties. Historically, row crops and orchards were grown in alluvial flats and grasslands such as in the Alexander Valley, but regional trends have seen vineyard footprints expanding into what historically were considered poor sites for agriculture and better suited for timberland (Merenlender, 2000; Chea, 2006).

Prior to acquisition and development of a conservation easement by the Conservation Fund and partners, over 1,800 acres of forestland in the Gualala River Watershed were slated for vineyard conversion at the Preservation Ranch (Sonoma County, 2009).

Vineyards have the possibility to impair salmonid habitat quality. "The heaviest vineyard water usage is during the spring and summer months when young steelhead are emerging from the gravel, smolts are emigrating to the ocean, and steelhead parr are rearing within available summer habitat. Reduced surface and groundwater from these subbasins could not only impair summer baseflows in these tributaries, but also could impair inflow and water quality conditions within the Gualala estuary. Forestland-to-vineyard conversions are also noted as being potentially more severe to the landscape than past logging practices. The forestland-to-vineyard conversion process includes clear cutting of forestlands, deep ripping of the soil, and increase ground and surface water use, all which result in the permanent conversion of complex forest ecosystems (Friends of the Gualala River, 2011)" (NMFS, 2016). "Hillside vineyard development is becoming an increasing threat to water quality as more and more steep land is converted to vineyards" (North Coast Regional Water Quality Control Board, 2005).

Since the Sonoma County landcover layer was created in 2013 there have been additional permitted vineyard conversions which were identified via a Sonoma County Permit and Resource Management Department records search in 2023-2024. Approximately 129 acres of new vineyards were permitted in the watershed since 2013, and 49 acres were re-planted with vines. Sonoma County does not currently provide geospatial information regarding permits or permitted conversion. CAL FIRE does maintain geospatial information pertaining to timber harvest documentation, including Less-Than-3-Acre-Conversion permits. This information is limited to non-digital records prior to 2015 and was inaccessible for the purpose of this report. Since 2015, five Less-Than-3-Acre conversion permits were issued by CAL FIRE covering 11.3 acres. Conversions to vineyard in the Gualala River Watershed is relatively minor compared to the Russian River Watershed in the rest of Sonoma County. Additionally, a recent downturn in the wine industry may further slow land conversions.

A common threat to water quality from vineyards is sediment from roads and row runoff. In February 2000, Sonoma County adopted a vineyard ordinance to control sedimentation caused by vineyard erosion (County of Sonoma Agriculture/Weights & Measures, 2000). Mendocino County does not have a similar permit program in place. In the North Coast Region, the Regional Water Quality Control Board adopted a permit program for vineyards within the region aimed at reducing sediment. Not all subwatersheds within this region (including the Gualala) are required to enroll, monitor, or submit reports, though the permit states that they are required to comply with the permit orders (California Regional Water Quality Control Board North Coast Region 2024).

Cannabis production is also responsible for the recent conversion of natural systems. Illegal grow operations have been operating in the watershed decades before the legalization of cannabis as a regulated crop. Due to the historic (and likely current) amount of land used for cannabis production due to the prevalence of illegal grow operations, it is not possible to fully quantify the impact of cannabis production overall on the watershed's health. Broadly, the State Water Resources Control Board outlines threats posed to steelhead in the Gualala River Watershed by cannabis production, namely water diversions, impoundments, channel modification, and roads (California State Water Resources Control Board, 2017). There is a large body of evidence to suggest that illegal cannabis production can cause habitat fragmentation, increased sediment yields to streams, poisoning of terrestrial wildlife, degraded water quality including effects on sensitive aquatic species, and degraded or eliminated seasonal streams (Portugal et al., 2018). Legalization and the environmental regulation placed on legal operations are helping to reduce these impacts.

"Some livestock grazing occurs but is not considered a significant contributor to sediment impairment of the watershed" (North Coast Regional Water Quality Control Board, 2005).

Rangelands and agricultural lands are expected to experience additional water stress due to climate change. There will be less reliable water supplies to irrigate, chiefly due to drought, changing precipitation patterns, and soil aridity. The quality of agricultural lands is also projected to decrease because of the loss of cool-season forage growth, woody encroachment, increased pests and diseases, and water deficits (Grantham, 2018). Warming temperatures permit wider activity windows for pests and diseases, increasing the threat of infection or infestation (Mendocino County, 2021). Warmer temperatures also threaten the health of livestock. The agriculture sector, which accounts for several billions of dollars in annual revenue in the region, could be severely damaged (County of Sonoma, 2022).

2025 ROADS ANALYSIS

Overview of Analysis

This section reports a geospatial analysis of land use/ownership, road networks, road densities, and stream crossings within the Gualala River Watershed.

For the purposes of this GIS road density analysis, roads identified and mapped generally include rural low-volume forest, ranch, agricultural, and residential use roads constructed for the purposes of timber access and hauling, agricultural land management, equipment and fire access, and residential ingress and egress. They are throughgoing and contiguous or have a terminal landing that allows for equipment or truck turnarounds. They include permanently maintained roads, seasonal use roads and abandoned historic/legacy roads which may have not seen use for decades but still exist on the landscape and have sediment delivery potential. Skid trails, which are temporary and discontinuous benches developed to yard or “skid” logs to mainline roads or landings are not considered roads for the purposes of this analysis.

Future phases of this project will create a prioritization framework for the road inventory. Once the framework is defined, it is expected the road analysis will be refined to include parameters such as road surface material and terrain which the road runs through.

This GIS analysis is an updated assessment of the road and stream crossing densities within the Gualala River Watershed Boundary Dataset hydrologic unit code 10 (HUC 10). It was completed in November 2025 by Sonoma RCD. This analysis focuses on:

- Roads: Four separate roads layers were used to create a single layer for analysis.
- Streams and Stream Crossings: Streams data from the National Hydrography Dataset (NHD) were used to identify stream crossings that intersect the roads layer.
- Land use/Ownership: The County of Sonoma and County of Mendocino GIS parcel layers were used to create a layer called ‘Aggregated Parcel’, which merges parcels owned by the same individual or entity. This ‘Aggregated Parcel’ layer was used to calculate the density of roads and the density of stream crossings by landholders in the watershed.

Methods

The following datasets were utilized for the desktop geospatial (GIS) analysis:

Table 4. Geospatial data sources referenced

Information contained	Source	Public/Private
Roads	County of Sonoma	Public
Roads	Census Bureau, Topographically Integrated Geographic Encoding and Referencing (TIGER) System	Public
Roads	CAL FIRE	Public
Roads	Gualala Redwood Timber (GRT) LLCCompany	Private
Parcels	County of Sonoma	Parcel boundaries are publicly accessible, but the layer with ownership names is privately accessible
Parcels	County of Mendocino	Public
Streams	National Hydrography Dataset (NHD) High Resolution streamlines	Public
Terrain	North Coast Resource Partnership (NCRP) 2022 LiDAR	Public

Software used: ArcGIS Pro version 3.5

Ownership Identification

County of Sonoma and County of Mendocino GIS parcel layers were merged to create one County Parcels layer. Parcels were then merged by the field designating “Owner Name”. Landowners with approximately 500 acres or more were assessed manually to identify multiple parcels under one ownership. Parcels under one ownership were merged together. For example, “Mendocino Redwood Company” and “Mendocino Redwood Co” were considered to be identical owners. There were 17 landowner names that were manually combined in this manner. This created the layer referred to as ‘Aggregated Parcel’ and total acreage by owner was calculated from this layer.

Roads Layer Creation

There were four existing road GIS layers which were combined to create a single road network used in this analysis. Three layers are publicly available, and one road layer was obtained by the NCRWQB from the Gualala Redwood Timber (GRT) Company. The three public GIS layers are the County of Sonoma Roads layer, the TIGER Census road layer, and the CAL FIRE road layer. These three public layers and the GRT layer were combined in ArcGIS to create a single road network.

All the road layers available (listed in Table 1 above) were visually compared with the 2022 NCRP LiDAR layer to determine their relative accuracies to terrain features on LiDAR. Of the four, the Sonoma County Roads layer appeared to be the most accurate layer across the watershed, meaning that its roads appeared to follow the terrain shown in LiDAR. This County Roads layer primarily includes county-owned roads in the watershed.

The “Conflation” toolset in ArcGIS Pro was used to align road lines from different layers if the lines were within 200-feet of each other; the assumption being that lines further than 200-feet apart were accurately representing two different roads. The “Align” tool was then used to identify inconsistent portions of the input features compared to the target features within that 200-foot search distance and align them with the target features.

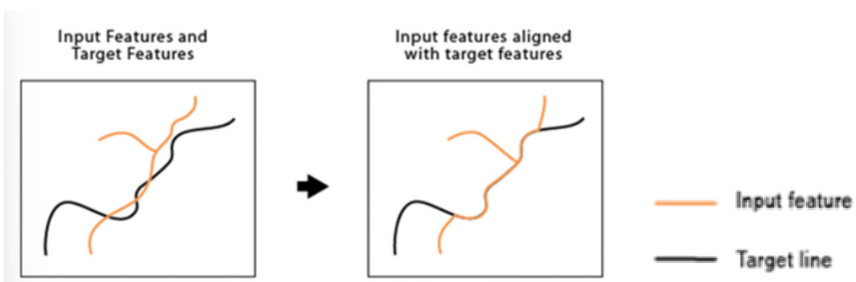

Figure 6. Input and target features

Features

The Sonoma County Roads layer was the base layer to which other layers were iteratively aligned to. The Sonoma County Roads layer was set as the target feature, 200-feet was set as the search distance, and input features were set in the following order: CAL FIRE roads, GRT roads, and TIGER roads. This method helped capture the entirety of the road network within the watershed while being as accurate as possible and without double-counting lines meant to represent the same feature. The “Dissolve” tool was subsequently used to remove any overlapping lines in the layer. This final shapefile is referred to here as the 'Roads Merged' layer. The "Summarize Within" tool was used to sum road length by ownership.

This analysis process differs from the dataset that was used in the desktop assessment conducted by NCRWQCB in 2024, which solely used the GRT roads layer.

Stream Crossing Identification

The "Intersect" tool was used with the Roads Merged layer and the National Hydrography Data Streamlines layer. A point was created wherever a road line and a streamline intersect to represent a stream crossing. The "Summarize Within" tool was used to count crossings by ownership.

Ownership Type

Road density and stream crossing densities by ownership type were not examined for this analysis. If an additional analysis is conducted, it is recommended that the following ownership types be used:

- Public (state)
- Public (federal)
- Non-profit
- Tribal
- Private timber company
- Private non-timber (general, Trust, or other agriculture)

Previous analysis combined public and Tribal lands together. However, future analyses should separate those into two categories, as Tribal lands are legally distinct from public lands. Previous analysis separated private non-timber lands into three categories: non-timber, trust, and general. Many private lands are held in trusts legally but may be managed identically and by the same people as non-trust lands that share the same name. It is recommended that non-timber, trust, and general ownership categories be combined into one. Agriculture, especially vineyards, may be separated into a separate category or combined into private non-timber.

The only non-profit identified in the watershed is The Conservation Fund. The Conservation Fund states that its intention is to manage land in a way that is both ecologically sound and economically viable. The land owned by The Conservation Fund in the Gualala River Watershed is under easement to The Nature Conservancy. Since the use of this property is not primarily timber production nor conservation, it might be considered "non-profit," separate from other categories.

Results

The Gualala River Watershed totals 298 square miles in drainage area, has nearly 1,900 miles of road and over 2,000 crossings. See Appendix G for maps of results.

Table 5. Summary of road miles, stream miles, and stream crossings within the Gualala River Watershed boundary

	Total in watershed	Average (per square mile)
Road Miles*	1,892.5 miles	6.4 miles
Stream Crossings	2,044 crossings	6.9 crossings

**Includes both paved and unpaved roads*

Table 6. Landowners of over 1,000 acres

Landowners of over 1000 acres												
	Landowner ID	Landowner	Area owned (acres)	Area owned (square miles)	Area owned (% of watershed)	Road length (miles)	Road density (miles/sq mi)	Road miles (% of total length in watershed)	Stream crossings (count)	Average crossing density (count/sq mi)	Stream crossings (% of total count in watershed)
Top 10 Landowners	1	The Conservation Fund	33,028	51.6	17%	417.0	8.1	22%	565	10.9	28%
	2	Gualala Redwood Timber LLC	27,698	43.3	15%	415.5	9.6	22%	425	9.8	21%
	3	Soper Company	11,611	18.1	6%	52.4	2.9	3%	71	3.9	3%
	4	Mendocino Redwood Co LLC	8,029	12.5	4%	103.7	8.3	5%	96	7.7	5%
	5	Richardson Ranch LLC	6,694	10.5	4%	58.2	5.6	3%	29	2.8	1%
	6	Flatridge Ranch Mh LLC	4,695	7.3	2%	30.1	4.1	2%	37	5.0	2%
	7	Dale & Ronda Silva Family LLC	4,196	6.6	2%	30.5	4.7	2%	27	4.1	1%
	8	Foppiano Louis M & Helaine	4,095	6.4	2%	22.7	3.6	1%	38	5.9	2%
	9	Rafanelli V Mark TR Et Al	3,641	5.7	2%	17.9	3.1	1%	25	4.4	1%
	10	Vimark Inc	3,598	5.6	2%	38.5	6.8	2%	40	7.1	2%
Other ≥1000 acre Landowners	11	Double K Land & Stock LLC	3,430	5.4	2%	26.6	5.0	1%	39	7.3	2%
	12	South Dakota Trust Company LLC TR Et Al	3,233	5.1	2%	16.8	3.3	1%	18	3.6	1%
	13	Mann Robert C TR	3,099	4.8	2%	11.1	2.3	1%	13	2.7	1%
	14	Ratto James & Deana	2,673	4.2	1%	23.0	5.5	1%	21	5.0	1%
	15	Gleason Tyler Matthew TR Et Al	2,460	3.8	1%	15.4	4.0	1%	21	5.5	1%
	16	Nobles Anita L TR & Nobles Marvin H TR	2,350	3.7	1%	12.2	3.3	1%	12	3.3	1%
	17	Ohlson Ernest TR	1,964	3.1	1%	20.6	6.7	1%	17	5.5	1%
	18	Epperson Charity L TR & Samuel A III TR	1,798	2.8	1%	11.7	4.2	1%	17	6.1	1%
	19	Rips Redwoods LLC	1,614	2.5	1%	18.4	7.3	1%	9	3.6	0%
	20	Dugaboy Properties LLC	1,528	2.4	1%	3.7	1.5	0%	2	0.8	0%
	21	Trione Victor S Succttee 1	1,476	2.3	1%	8.8	3.8	0%	10	4.3	0%
	22	Wheeler Ttee Clare R	1,469	2.3	1%	6.9	3.0	0%	5	2.2	0%
	23	Howlett Family Partnership	1,320	2.1	1%	20.2	9.8	1%	21	10.2	1%
	24	Gloeckner Grandchildren LLC	1,225	1.9	1%	2.3	1.2	0%	1	0.5	0%
	25	Head Lama Of Tibetan Nyingmapa Meditation Center	1,168	1.8	1%	9.4	5.2	0%	8	4.4	0%
	26	Hirsch David M TR	1,013	1.6	1%	7.6	4.8	0%	10	6.3	0%

Land Ownership

According to the Aggregate Parcel layer, there are 977 individual owners in the watershed. Parcels were manually aggregated based on ownership name as defined in the tax information provided by Sonoma and Mendocino counties. Data for all landowners, including those of under 500-acre parcels, are included in all of these analyses, thought the 26 owners with over 1,000 acres are highlighted below.

Nearly three-quarters of the watershed area is owned by 26 landowners, each of whom own over 1,000 acres. Nearly one-quarter of the watershed is made up of ownerships under 1 square mile (640 acres), and a small percentage of ownership is in the 640- to 1,000-acre ownership range.

Road Networks and Road Density

Road density is the total length of roads within an area, divided by the total area. It was calculated in units of miles per square mile. Road densities were calculated by ownership by using the “Summarize Within” Tool on the Road Analysis GIS layer with the Aggregated Parcels layer.

The total length of the road network is 1,892 miles across the 977 aggregated parcel ownerships. There are 346 aggregated parcel ownerships with zero road miles. The maximum road length for one owner, The Conservation Fund owns 417.0 road miles. Gualala Redwood Timber LLC owns 415.6 road miles, which is the second greatest length of roads under single ownership. These top two ownerships manage approximately 44 percent of the total road miles within the watershed, though as noted before this does not separate paved from unpaved roads.

In the Gualala River watershed, the US EPA (2001) concluded that “In general, the higher the road density the higher the overall sediment delivery from roads…For example, Buckeye and North Fork have a road density of approximately 6 miles per square mile and a road related sediment delivery of about 900 tons/square mile/year. In contrast, the other three subwatersheds have less than 5 miles per square mile of road, resulting in less than 700 tons/square mile/year.”

Stream Crossings

Stream crossings are the intersections between the roads and streams, and these densities are represented in crossings per square mile. We calculated the stream crossing densities by ownership by using the “Summarize Within” Tool on the Streams layer with the Aggregated Parcels layer.

There are 1,064 miles of streams in the watershed and 2,044 stream crossings were identified. Of the 977 aggregated parcel ownerships, the majority (794) of ownerships have zero stream crossings. Only 19 percent of ownerships were identified as having stream crossings on roads. Almost half (49 percent) of the total stream crossings are owned by the top two largest landowners: the Conservation Fund (565 crossings) and the Gualala Redwood Timber (425 crossings).

Summary

The top ten landowners own over half of the area, nearly one-third of the road miles, and one-third of the stream crossings in the watershed. There are 26 landowners with 1,000 or more acres, and they own approximately 75 percent of the watershed, road miles, and stream crossings. Since ownership was not aggregated on name for owners under 500 acres, the number of owners in the <640 acres reflects unique parcels rather than unique owners. However, the reported statistics in this table do not depend upon the number of landowners in an area category.

Table 7. Summary of roads, streams, and stream crossings by area owned

Category of Total Area Owned (Acres)	Number of Owners in This Category	Total Percent of Watershed Owned	Total Percent Road Miles	Average Road Density (Miles per Sq Mi)	Total Percent of Stream Crossings
> 1,000	26	72.9 %	74.0 %	6.4	77.2 %
640* - 1,000	13	5.4 %	4.3 %	5.0	2.9 %
<640	938	21.7 %	21.7 %	6.3	20.0 %

**640 acres = 1 square mile. Divisions between 500-1000 acres versus 640-1000 acres do not yield significant differences.*

Of the five subwatersheds in the Gualala River watershed, the North Fork subwatershed has the highest density of roads and of stream crossings and Wheatfield Fork subwatershed has the lowest.

Table 8. Summary of roads, streams, and stream crossings by subwatershed

Subwatershed	Area (Sq Mi)	Road Miles	Road Density (Miles	Number of Stream Crossings	Stream Crossing Density	Percent Area	Percent of Total	Percent of Total

			per Sq Mi)		(Crossings per Sq Mi)		Road Miles	Stream Crossings
North Fork	47.94	391.47	8.17	500	10	10.76	13.81	17.22
Rockpile Creek	35.04	219.80	6.27	301	9	7.86	7.75	10.37
Buckeye Creek	40.22	306.51	7.62	330	8	9.02	10.81	11.36
Wheatfield Fork	83.15	485.56	5.84	478	6	18.65	17.12	16.46
South Fork / Mainstem	63.87	426.67	6.68	354	6	14.33	15.05	12.19

Limitations and Future Phases of the Road Density and Land Use Analysis

Any desktop analysis will be limited by the quality of the data input. The pre-existing GIS roads layers that were used in this analysis represent the highest quality and most complete data available for the watershed. A future phase of the analysis may include manually adjusting roads to match terrain in the 2022 LiDAR. Input from the Technical Advisory Committee prior to doing this work will be key to ensuring a sound methodology to avoid bias. The guidance for the initial desktop roads analysis was to focus on existing maintained and historic/legacy roads used for vehicular and equipment access, hauling timber and land management activities. These roads may be mistaken for historic skid trails without a methodology to determine classification.

Newer vineyard roads may not have been included in these roads layers. Vineyard roads are often unsurfaced and may represent additional sediment sources in the watershed. Intensive agricultural activities impact road and hillside erosion at varying levels of intensity and can contribute sediment and other pollutants to watercourses if best management practices aren't utilized. At present, there is no known dataset in the watershed that can quantify animal agriculture intensity or practices. However, a 2005 report concluded that grazing "is not considered a significant contributor to sediment impairment of the watershed" (North Coast Regional Water Quality Control Board, 2005). Future stages of the road analysis will refine an approach for land use classification which can be applied to road segments for prioritization for road assessment efforts.

Evidence of mass wasting (e.g., sediment movement via landslides) was not examined in this initial desktop analysis.

Given the limitations identified, there is a clear need for further analysis and examination of remote sensing datasets pertaining to land use and road condition in the watershed. These efforts will continue in the Prioritization Framework and Assessment Phases. Ultimately this will lead to on-the-ground site evaluations.

WATER QUALITY DATA

Water quality monitoring at fixed stations has provided the most consistent long-term dataset for the Gualala River watershed. The Gualala River Watershed Council (GRWC) monitoring program once operated a network of 100 water quality sites, with four identified as long-term reference stations. At these stations, repeated measurements of water temperature, turbidity, sedimentation, and riparian canopy cover have been maintained over decades; the data collected between 1992-2023 by GRWC can be found in Appendix H. These reference stations are now being used by the NCRWQCB to support the Gualala River Sediment TMDL Action Plan. Despite reductions in funding that limited the full monitoring network, the continued operation of these reference sites has proven invaluable in linking local monitoring to regional regulatory frameworks (Gualala River Watershed Council. (n.d.).

Hydrologic monitoring is supported by the U.S. Geological Survey (USGS), which operates streamflow gages in the watershed. These gages provide continuous records of discharge, which are essential for understanding seasonal flow patterns, drought impacts, and flood risks. Flow data is also critical for modeling salmonid habitat availability, assessing the impacts of diversions, and managing water allocation in dry years. In a watershed where water use for agriculture and domestic supply is growing, flow data provides a foundation for balancing human needs with ecological requirements.

Timber companies contribute another layer of monitoring, primarily tied to regulatory compliance. Gualala Redwoods Timber LLC, the Conservation Fund, Mendocino Redwood Company, and other landowners who harvest timber under a Timber Harvest Plan (THP) or Nonindustrial Timber Management Plan (NTMP) are required to monitor water quality as part of their Timber Harvest Plans. Their monitoring typically includes assessments of sediment delivery from roads, water temperature impacts from canopy removal, and habitat effects of logging operations. While the primary purpose of this monitoring is compliance with the California Forest Practice Rules, the data also contributes to broader understanding of how forestry practices affect watershed conditions. In some cases, these landowners have worked with the GRWC to implement road upgrades and decommission legacy logging roads, with monitoring used to verify reductions in sediment delivery; other landowners have not engaged with the GRWC but have implemented similar improvements to comply with the Forest Practice Rules (Brandow & Cafferata, 2014).

The water quality of the Gualala River Watershed has been degraded over the past half-century due to a combination of factors including timber harvests, road erosion, road construction, deforestation, stream clearance, development, climate change, major floods and fires, and agriculture. These activities and conditions have degraded water quality, notably: alterations to sediment (more fine sediment and smaller gravel size on average), decreased levels of dissolved oxygen, increased turbidity, increased temperature, and increased pH (NCWQAP, 2003).

In response, the EPA established the Gualala River Sediment TMDL standards in 2001. Excessive sediment and high temperatures were identified as the major impairments to watershed health. The TMDL determined how much sediment the streams could accept while maintaining healthy ecosystem function. It also estimated how much sediment was being delivered to the streams and where those sources of sediment are in the watershed. The TMDL required that NCRWQCB take regulatory action to improve water quality.

Despite the 2001 TMDL, water quality is still impaired. The watershed does not currently support Coho salmon (*Oncorhynchus kisutch)* populations, which could be attributable to poor water quality, high water temperatures, and other factors like migration barriers, altered flow regimes, or loss of habitat complexity. The watershed's capacity to support populations of other aquatic fauna, including steelhead trout (*Oncorhynchus mykiss)*, is greatly diminished (U.S. Environmental Protection Agency, 2001).

The section below details the problems contributing to excessive sedimentation and increased water temperatures, as well as the current conditions of the watershed.

SEDIMENT

Sedimentation can destabilize water channels through channel aggradation, bank erosion, stream incisions, and decreased flood capacity (USGS, 2023). Excessive sediment is also associated with increased turbidity, altered timing of sediment delivery, altered quantity and quality of suspended sediment, and decreased water quality (Bala, 2007). Anadromous fish are particularly vulnerable to sedimentation, as changes in sediment quantity and size impact their spawning and rearing habitat. Sediment-related turbidity also disrupts their food web (National Oceanic and Atmospheric Administration, 2014).

Excess sediment influences water temperature by altering channel morphology, substrate composition, bank scour, downcutting, pool infilling, instream roughness, and stream flows. When sediment load increases, water tends to spread out over larger areas and create shallow, wide channels. More surface area is exposed to solar energy in these shallow channels, potentially increasing water temperature (National Oceanic and Atmospheric Administration, 2014).

However, recent work in northern California coastal watersheds demonstrates that many streams are now receiving sediment at rates far exceeding their long-term natural background. Cosmogenic ^10Be analyses from the Little River and Elk River basins indicate that natural, long-term denudation rates reflect relatively low, geologically driven sediment production over thousands of years, whereas modern sediment yields are substantially higher and dominated by anthropogenic disturbances such as timber harvest, roads, and landslides triggered by land use (Ferrier et al., 2020). These elevated modern sediment inputs have fundamentally altered sediment transport dynamics, producing steeper and more variable sediment rating curves than would be expected under natural conditions (Fisher et al., 2021).

The Technical Support Document for the Gualala River Watershed Water Quality Attainment Action Plan for Sediment (NCRWQCB 2001) summarized data describing sediment conditions from four different sources that collected data across various streams in the watershed. All of the four sources concluded that their study reaches have an overabundance of fine sediment which indicates moderately to highly disturbed watersheds. A few reaches appear to be recovering from prior aggradation, but they seem to be exceptions. A lack of suitable coho rearing pools throughout the watershed was generally reported, due to infill from sediment.

The disparity between long-term erosion rates and present-day sediment delivery indicates that contemporary land uses are driving excess sediment well beyond the channel's capacity to transport and store it in a stable form. This imbalance accelerates channel widening, pool infilling, and bed aggradation, all of which increase thermal exposure and reduce cold-water refugia for salmonids, thereby compounding temperature impairments in sediment-impacted watersheds.

Any sediment delivered to a small stream will eventually be transported to downstream channels (Pacific Watershed Associates, 2001). Excess sedimentation can have detrimental effects on salmon (North Coast Regional Water Quality Control Board, 2006; Flosi et al., 1998; Jensen et al., 2009; Kondolf, 2000) and many other aquatic species.

Nonpoint soil erosion concentration rates tend to increase during high flows corresponding with precipitation-wash off events (Tetra Tech, 2020). Sedimentation can also affect water temperature, in a relationship that tends to increase temperature as sedimentation is increased.

The sediment source analysis conducted by NCRWQCB found that roads are the most significant (by volume) source of sediment in the watershed. The report found that natural sediment yield accounts for one-third of sediment (excluding naturally-occuring landslides), while human-caused sediment accounts for two-thirds of total sediment. Roads are identified as as one of the primary sources of sediment in the watershed (McFadin et al, 2001; Morse, 2002) and include ranch and rural dirt road, as well as unmaintained or poorly maintained county, state, and federally controlled roads (Luce & Black, 2001). The Technical Support Document for the Gualala River Watershed Water Quality Attainment Action Plan for Sediment (NCRWQCB, 2001) sediment source analysis focused on estimating rates of sediment delivered in the recent past on the assumption that during this period, road building, maintenance and timber harvest practices were the same as those currently practiced.

A road can contribute sediment to a stream if it is hydrologically connected, meaning that there are direct routes of drainage or overland flow of road runoff to a stream or lake. Roads that are hydrologically connected to streams can alter the natural flow of water and create concentrated runoff events which can lead to sedimentation.

Roads that are hydrologically connected can contribute sediment via some of the following processes:

- Erosion of road cut slopes
- Erosion of sediment deposited on roads by soil creep from adjacent hillsides
- Interception of hillslope runoff leading to increased stream flows
- Erosion of gravel or unpaved road surfaces

Chronic road surface erosion is that which occurs during every surface runoff event. Uncontrolled water flow from sections of roads and ditches discharging directly to the stream system can also contribute to sedimentation in a stream.

Gully erosion may be caused by poorly drained roads, plugged culverts, or insufficient armoring at fill crossing sites or at ditch-relief culvert outlets. Gully erosion is a more common cause of sedimentation during high water flow. Roads can also cause mass wasting events by weakening the stability of hillsides (Sonoma Resource Conservation District, 2015).

The sediment source loading allocations and load for the Gualala River Watershed, outlined in the Action Plan, is displayed in the table below:

Table 9. Sediment source allocations and load

Sediment Source	Current Load (tons/mi^2/year)	Load Allocation (tons/mi^2/year)	Percent Load Reduction Needed
Natural Landslides	180	180	0
Natural Streambank Erosion	200	200	0
Road-Related Landslides	370	56	85%
Road-Stream Crossing Failures	50	5	90%
Road-Related Gullies	150	8	95%
Road-Related Surface Erosion	140	7	95%
Skid Trail Surface Erosion	30	5	83%
Other Harvest Related Delivery	100	14	86%
TOTAL	**1220**	**475**	**61%**

Data from the GRWC shows that in-stream particle size variability has generally increased over time, indicating that the average particle and pebble size is increasing. Early samples overwhelmingly found fine sediment and more recent samples have included fine sediment mixed with an increasing number of pebbles.

There are many local resources regarding sedimentation and roads. This section draws upon the following: (Low & Napolitano, 2008; Pacific Watershed Associates, 2001; Sonoma Resource Conservation District 2015a; Tetra Tech 2020a; Weaver, Weppner, & Hagans, 2016).

Effects of Timber Industry on Sediment

The Gualala River Watershed contains valuable timber resources and has a long history of timber management (Morse, 2002). The first logging was likely conducted by Russian settlers during the construction of Fort Ross. Large-scale logging activities in the watershed began in the 1850s when harvesting the old-growth redwood and Douglas-fir began in the lower portion of the watershed. Oxen logging was predominant, and felled trees were floated down the river. To support river transport, natural pool structures were removed, streambeds were lined with log planking, and stream channel morphology was altered by the construction of splash dams. Railroads were soon constructed to accommodate the industry (Klamath Resource Information System, n.d.) and further altered watercourses, namely through excavation, wood and earth-filled watercourse crossings (which frequently dammed watercourses), and fill failures (Morse, 2002). Erosion and sedimentation during this era (between 1850 to 1899) degraded the water quality of the watershed, but no monitoring data was collected and was presumably minuscule compared to the recent historic logging operations that spanned from 1900 to 1973.

The introduction of the steam donkey in 1900 and later the deployment of the D-8 and D-10 sized heavy tractors in the 1950s left an indelible mark on the watershed. By 1965, Rockpile, Buckeye, and Wheatfield sub-basins were prime targets for tractor logging. The use of crawler tractors, common in the 1950s and 1960s, was characterized by large-scale sideslope excavations and skid trail networks that followed straight parcel lines regardless of watercourse condition or terrain. Streamside road building pushed large amounts of sidecast over the streambank, often burying the stream channel and forced streams to reform towards the outer streambank as a trench (Morse, 2002). Other significant adverse impacts were caused by in-stream landing construction and the deliberate cutting of streambanks to help facilitate log transport (Morse, 2002). Approximately 95-miles of instream/streamside roads simplified the stream channel complexity and structure throughout the watershed between 1952 and 1968 (Morse, 2002). Many of these roads did not incorporate any erosion control infrastructure, leaving them particularly vulnerable to storm events in which fill and crossing failures were common and accounted for the majority of point source sediment discharges (Morse, 2002).

The passage of the Z'berg-Nejedly Forest Practices Act of 1973 curtailed many of the most damaging logging practices and established stricter regulatory standards and oversight for timber operations. However, despite ongoing advances in environmental policy, regulation, and forest management technology, the legacy of historical timber harvesting persists and, in some cases, continues to contribute sediment through abandoned landings, skid trails, and legacy road networks (Morse, 2002).

Timber harvesting remains a large driver of erosion and sedimentation in the Gualala River Watershed. Logging operations disturb soils at multiple stage, from felling and processing to extraction and transport, but the primary erosion risks arise from road construction, skid trail use, heavy equipment operation, vegetation removal, and failures at watercourse crossings. These disturbances are further exacerbated by the watershed's steep slopes and highly erodible soil types, which increase susceptibility to mass wasting and chronic sediment delivery (NCRWQCB, 2001).

Among these, road construction can still be, and has historically been, is one of the the most disruptive (McFadin et al., 2001). Building or reconstructing haul roads often requires the relocation of large volumes of soil, prolonged heavy machinery use, and exposure of bare slopes. These activities increase the potential for surface erosion and slope instability by increasing the area of bare soil exposed to rainfall and runoff, obstructing stream channels and by altering subsurface flow pathways. Road ditches concentrate storm runoff and increase its erosive power to form gullies and rills, which are pathways of sediment delivery to streams (McFadin et al., 2001). While some level of erosion is inevitable, impacts can be reduced through the use of tracked equipment where feasible, seasonal restrictions on ground disturbance, and operational timing that avoids wet or saturated soil conditions. When roads lack appropriate design features or erosion control infrastructure, the consequences can be severe—culvert failures, slope instability, and full road prism collapse can mobilize thousands of cubic yards of sediment into or adjacent to watercourses (Weaver et al., 2016). However, the Forest Practice Rules currently outline strict road design criteria to minimize the risk of sediment delivery into watercourses; standards which are enforced and monitored by CAL FIRE (Cafferata, 2017).

Even after construction, continued road use degrades soil structure and increases erosion potential. Repeated traffic from heavy equipment compresses road surfaces and underlying subgrades, reducing soil porosity and infiltration capacity. This compaction accelerates surface runoff and limits water absorption during storm events. Similarly, skid trails have historically been major conduits for sediment delivery, though modern legislation and erosion control methods have led to the significant reduction of erosion-related issues associated with skid trails. Log skidding not only compacts soils further, but also disturbs and ruts the ground surface, which can rapidly generate overland flow. Overland flow can and has been mitigated over the last several decades through required water bar installation and soil stabilization measures like slash packing near watercourse crossings. Operating equipment on wet soils amplifies these effects—saturated conditions increase soil bulk density, reduce infiltration even more sharply, and lead to higher rates of sediment transport and deposition.

Additional chronic sources of logging-related erosion and sedimentation include poorly designed or undersized legacy watercourse crossings and crossing failures. Stream culverts and fords that lack hydraulic capacity, proper armoring, or grade control are prone to washout during peak flows. Crossing failures can deliver large sediment pulses in a single event, making them a persistent and high-consequence risk throughout the watershed. Identifying which crossings are at risk of failure, and characterizing the potential consequences of failure, may help to prioritize future work.

Failures are often caused by:

- Undersized and/or inadequate number of culverts
- No culverts, in which cases water may flow either through or beneath the road fill, or across the road surface, or down the inboard ditch
- Plugged culverts
- Improperly placed culverts, including ditch relief culverts, causing gully erosion below outlet or sediment accumulation above the inlet

The 2003 North Coast Watershed Assessment Program (NCWAP) explored in detail the history and trends of timber harvest activities leading up to the new millennium and discussed to great length the impact of harvest and road construction on the watershed. The report is available in full at https://gualalariver.org/river/gualala-river-watershed-assessment-2003/.

> *After 1973, logging operations slowed. Smaller selection method harvests were predominant. By this time, tractor-yarding methods changed to maintain equipment exclusion zones and minimum vegetation retention standards adjacent to watercourses per 1973 Forest Practice Rules. New road locations were moved upslope, but the practice of using existing roads located near streams continued.*
>
> *The new forest practice rules limited the cutblock size, creating smaller logged areas. In the 1990s, harvest activity increased. Smaller but numerous clearcut blocks appear in the redwood lowland areas of the Gualala Redwoods, Inc. ownership. Throughout the watershed, cable method yarding appears with new road construction now moved to upslope and ridgeline locations. Many sections of the older seasonal roads following the stream channel either are abandoned or removed.*
>
> *Numerous seasonal roads still exist near streams and are used as needed during timber harvest activities. During the mid-1990s, Coastal Forestlands (formerly R&J Timber Co. and purchased by Pioneer Resources in 1998) submitted numerous seed tree overstory removal/dispersed timber harvest plans (THPs), covering large areas but removing scattered single trees and remnant stands left from 1960s era entries. Agency review of these THPs clarified road upgrade work requirements to repair the erosion conditions of pre-1973 operations. There has been little harvesting in these areas since 1998. Residential development near the coast, and vineyard development inland, became more active by the 1990s. Ninety-five percent of the Gualala watershed is privately owned. (North Coast Regional Water Quality Control Board, 2003).*

Timber harvest volumes across California have declined considerably since the 1990s and have generally remained low in the years following the recession in 2008 (Marcille, 2016). This period includes times when Emergency Notice harvests were permitted due to large wildfires. The following data from County Department of Agriculture Crop Reports are county-wide, but do show a general reduction in harvest intensity (Mendocino County

Agricultural Crop Report, 1997 and 2023; Sonoma County Agricultural Crop Report, 1997 and 2023).

Table 10. Timber harvest volumes

County	1997 Crop Report	2023 Crop Report
Sonoma	~32 million board feet (mmbf)	~18 mmbf
Mendocino	~243 mmbf	~108 mmbf

In the years since the NCWAP was published in 2003, approximately 13,172.2 acres have been harvested in the watershed, and an additional 16,153.2 acres have been approved for harvest but have not submitted a notice of completion and/or were noted as non-operational by CAL FIRE. This represents a significant slowdown in comparison to the period of the 1990s, in which the NCWAP reported roughly 45,000 acres to be under operation.

Since 2003, proposed silvicultural methods of harvest in the watershed have primarily been single tree or group selection, otherwise known as uneven-aged management, in terms of the acreage covered by harvest plans.

Uneven-aged management accounted for 7,105.6 acres proposed for harvest in the last twenty years. Even-aged silvicultural methods are still regularly proposed in the watershed, and there does not appear within the limited timeline of the last twenty years to be a trend showing major changes in harvest-type proposal, although uneven-aged management is generally considered to be a relatively new strategy in commercial forestry. Between 1997 and 2025, 6,909 acres were proposed for clearcutting in the watershed. Additionally, there were 7,463.8 acres combined proposing either preparatory or removal steps for Seed-Tree/Shelterwood harvest systems, which are methods of even-aged management. Largely due to timber harvest (especially clearcut operations that were common before the Forest Practice Act was passed in 1972) and roads, sedimentation has been a persistent water quality issue in the Gualala River Watershed for decades (North Coast Regional Water Quality Control Board, 2005).

Though the watershed has a long history of timber harvesting, sedimentation issues increased significantly with the large-scale, mechanized logging operations that began as early as the 1940s (McFadin et al., 2001). Timber harvests have the potential to add sediment to watercourses in two primary ways: from the logging operations themselves (including road construction and use), and from destabilized slopes eroding and sliding as a result of the removal of deep-rooted vegetation (Morse, 2002). The removal of vegetation and soil can "increase susceptibility to mass wasting" (NCRWQCB, 2001)

The Recovery Strategy for California Coho Salmon (CDFW, 2004) summarizes the difficulty in understanding what, exactly, effects timber harvesting has on coho salmon. "Identifying the relationships between forestry practices and habitat impacts is complicated for several reasons. First, there is a long history of timber harvesting, and some effects, such as sedimentation and slope instability, continue long after harvesting has occurred. These alterations are referred to as 'legacy' effects, and recovery may take many decades (Murphy, 1995). Legacy effects are a factor along the north coast of California (Monschke, 1996). Second, there have been many technological and management changes in timber harvest, and it is difficult to differentiate legacy effects from recent or current effects. Third, the salmonid habitat elements affected by timber harvest are themselves intimately inter-related. The amount and size frequency distribution of LWD, water temperature, near-stream vegetation, sediment transport and deposition, landsliding, stream flow and supply, and turbidity are all linked to one another."

The Recovery Strategy includes multiple sources to support that "Historical forestry practices and some current forestry practices have been shown to impact several freshwater habitat components important to anadromous salmonids in general, and coho salmon specifically. These impacts include increased maximum and average summer water temperatures, decreased winter water temperature, and increased daily temperature fluctuations; increased sedimentation; loss of LWD; decreased DO concentrations; increased instream organic matter; and decreased stream-bank stability." The Recovery Strategy specifically cites harvesting and silviculture as sources of sediment pollution to coho watersheds.

While early timber harvest was widely damaging to the ecosystem, harvests that follow the required regulatory practices are designed to have substantially reduced impact to the environment. In 1988, a review of implementation of the Forest Practice Act rules found that nearly half of timber harvests threatened aquatic resources (Higgins 1997). CDFW (2004) concludes that "Although the new rules reduce some site-specific impacts, there has not been sufficient time to determine if there have been benefits to coho salmon." However, Aa more recent review, in 2014, concluded that "the rate of compliance with FPRs designed to protect water quality and aquatic habitat is generally high, and that they are effective in preventing erosion, sedimentation, and sediment transport to channels when properly implemented" (Brandow & Cafferata, 2014).

This is exacerbated by the geology of the Gualala watershed. The Technical Support Document for the Gualala River Watershed Water Quality Attainment Action Plan for Sediment (NCRWQCB, 2001) states that “The unstable geology and high precipitation rates along the North Coast of California, including the Gualala watershed, make streams in the region susceptible to elevated sediment loading from anthropogenic and natural sources. Sources of sediment delivery to aquatic habitat include natural erosion processes as well as those influenced by anthropogenic activities, such as road construction and timber harvest”; that “Roads are a major source of erosion and sedimentation on most managed forest and ranch lands” but that “The quality of management planning and implementation strongly influences sediment production from forest-harvesting activity.”

The Gualala River Watershed Assessment (NCRWQCB, 2003) concluded that “By 1956, adverse logging conditions and past improper practices had done considerable damage to the headwaters…extensive timber harvest between 1952 and 1960 (42 percent of the subbasin) created many streamside roads and landings that contributed sediment to the streams…Certain land use activities have accelerated erosion into the river. Between 1950 and 1970, many timbered areas of the watershed were clearcut. Tractors were operated on steep, erosion prone slopes. Erosion and landsliding during the winters of those years appeared excessive compared to that of similar winters as seen in earlier photos…More recent reports show that some of the roads in the watershed are still eroding periodically…Heavy rainfall and high river flows during mid-20th-century storm events activated many road debris slides and washed out large sections of streamside roads. Road failures were more pronounced in steep terrain and along streams and historically active landslides. Sediment generated by the mid-20th-century tractor era disturbances would be routed through the river network over a period of decades to centuries…The mid20th-century tractor era caused the heaviest impacts…most of the contemporary road failures are in close proximity to streams and steep slopes…stream channel characteristics associated with disturbance from sediment have improved from 1984 to 1999/2000. This period includes recent timber harvesting in the northern portion of the watershed that included new road building.”

This report also noted that “Timber Harvest Plan records generally indicate that road failures triggered by storm events represent a portion of contemporary management related sediment pulses in the watershed.”

Logging requires the construction of roads and landings, as well as many passes by heavy equipment that all contribute to compaction. This compaction, paired with vegetation removal, increases the susceptibility of erosion and sedimentation locally at the harvest site and downstream (Brady and Well, 2008). From 1978 until 2000, 69 percent of sediment delivered to the watershed was from timber harvest-related sources, skid trail surface erosion, road-related landslides (from improperly designed roads, uncompacted fill, or insufficient erosion control infrastructure), road-related surface erosion, road-stream crossing failures, and road-related gullies (U.S. Environmental Protection Agency, 2001). Since 2003, more than 13,000 acres of forestland have been harvested out of nearly 16,000 acres proposed for harvest. However, nearly 6,000 of those acres were harvested with selection cuts, which is a silvicultural treatment that retains overhead canopy cover, lessening erosion impacts from harvest operations. Large timber companies own and manage a significant portion of the watershed. They are not the only entities harvesting timber or contributing to the sedimentation issues of the watershed, but small landowners are generally utilizing Nonindustrial Timber Management Plans to harvest logs which do not allow the use of even-aged management.

Significant regulatory steps were outlined in the 2003 the California Forest Practice Rules to further enhance protection measures for road building, maintenance, and harvest operations. The three largest landowners in the watershed regularly harvest timber commercially as part of their operations, and are subject to those rules, including the requirements to improve appurtenant road systems as a condition to approving harvest permits.

2004 General Waste Discharge Requirements - Timber Activities on Non-Federal Lands in the North Coast Region

The NCRWQCB adopted this General WDR in 2004. It is intended to regulate projects that conduct “timber harvest activities” defined as “both commercial and non-commercial activities relating to forest management and timberland conversions”. This includes “any Timber Harvest Plan, Nonindustrial Timber Management Plan, [and] other discretionary permits” issued. It requires users to file an Erosion Control Plan that contains information on controllable sediment discharge sources within project areas, and plans for prevention and mitigation of sediment delivery to watercourses (California Regional Water Quality Control Board North Coast Region, 2004).

Local advocacy groups have long been concerned, not only about clearcutting practices, but also about large tracts of forest being converted to private development, vineyards, and ranches (Baye et al., 2006). There are often concerns about increased water use and potential for erosion with converted timberlands. Based on a GIS analysis by Sonoma RCD in 2025, between 1997 and 2025 approximately 443 acres filed for conversion harvest permit but only 220 acres have been completed. This does not diminish the concern related to the effects of timberland conversion but would indicate that it does not yet appear to be a systemic problem from a water quality perspective, as completed conversions since 1997 only account for .1% of total forestland (about 170,000 acres) in the watershed.

Monitoring data from the GRWC indicates that sediment substrate size is variable across the watershed, but that there might be a net decrease in size over time. In a stream, this could indicate an increase in bank erosion and sedimentation or a higher velocity of water flow; either could potentially increase turbidity and water temperature. These assumptions may be supported by the apparent movement of sediment from uplands to low, shallow areas in the watershed.

Contributions of sediment from past land use, including timber harvesting, have been attributed to the buildup of the gravel bar at the estuary mouth and has led to a decrease in important salmonid habitat (PCI Ecological, 2025) but it has also been suggested that the size and shape of the gravel bar has been consistent since at least the 1929 U.S. Coast and Geodetic Survey mapping and that the estuary is not a limiting factor for salmonid populations (ECORP & Kamman, 2005).

The total length of road miles in the Gualala River Watershed is estimated to be 1,892 miles across 977 or fewer aggregated parcel ownerships. Since 2003, about 268 miles of road were improved to support logging and other natural resource management operations. About 25.1 miles of roads have been decommissioned since 2003, another 52.4 miles of roads have been improved for rural residential and other non-timber related use, and about 16.8 percent of roads are hydrologically disconnected (Gualala River Watershed Council, 2024). Improvements to roads, no matter how small, are crucial to reducing sedimentation and demonstrate the local commitment to repairing the watershed. The GRWC's road improvement projects were designed to improve habitat, not necessarily to support logging operations. A summary of this road work is in Appendix E: Road Upgrades from Gualala River Watershed Council, 2024. The Conservation Fund has conducted sediment reduction projects on their property, including road and stream crossing upgrades (Kelly 2023, pers. comm.) and commercial timber operations will have been required to upgrade roads where needed as part of their THPs. Further identification and summary of areas where roads have been improved or decommissioned will be required for prioritizing future work.

Outlook

Logging continues to be a major industry in the watershed, but as identified in the 2003 NCWAP report, harvest volumes have declined from their peak in the 1950s and 1960s. However, the Recovery Strategy for California Coho Salmon (CDFW,) concludes that both historical and some current forestry practices negatively impact anadromous salmonids, including coho. This relationship is complicated and difficult to differentiate legacy effects from current effects. CDFW concluded that historical forestry practices continue to impact coho watersheds, and that current activities can still affect important coho habitat elements, depending on management. The industry has been shifting over the last fifty years from stand-replacing harvest of old growth to the management of young stands. Increased regulation pertaining to forest management has had an impact not only on the volume of timber removed in the watershed, but the effect individual harvests have on water quality. However, there are still significant effects occurring in the watershed from inadequately maintained public roads, historic timber harvests and associated legacy roads, landings, and skid trails. Continued effort should be made to ensure that problematic streamside roads are decommissioned abandoned where feasible, and additional work to upgrade and stormproof roads in the watershed is done as needed.

A significant portion of the watershed harvested under historic logging methods (i.e., with inadequate road design) has since moved into the ownership of small landowners who lack the financial and technical capacity to make measurable improvements to previously constructed roads. Due to the fractured nature of ownership over the watershed's existing road system, outreach to smaller landowners coupled with financial and technical assistance by qualified professionals will be a critical step. Due to the relatively high fixed costs associated with heavy equipment mobilization, efforts to address road improvements should be done in a comprehensive localized manner spanning multiple ownerships, which will require extensive coordination between landowners, technical experts, roadwork contractors, and funding agencies.

Given that excessive sediment is currently impairing the system, moving or sorting that sediment should be a priority for salmonid recovery. Although the scope of this report is related to the sediment TMDL, which addresses current sediment inputs, addressing past sediment inputs will help to repair historic roads-related damage and enhance habitat for cold-water fish.

In addition to creating habitat features, large woody debris (LWD) in the stream channel can sort sediment and collect spawning gravels (NCWAP 2005, PCI Ecological 2025, The Conservation Fund 2025). Strategically placed, LWD structures can create localized pools and increase pool depth.

There is a lack of LWD throughout the Gualala watershed stream system. The Technical Support Document for the Gualala River Watershed Water Quality Attainment Action Plan for Sediment (NCRWQCB 2001) summarized from a 1997 study that large woody debris are deficient in study reaches. This conclusion is echoed throughout local documents (NCWAP 2005) and reflected in the fact that the two coho recovery strategies call for the placement of large woody debris in streams (CDFG, 2004; National Marine Fisheries Service, 2012). Most large woody debris was removed during streamside road construction and stream clearance projects in the 1970s and 1980s (NCWAP 2005) or may be the result of early logging practices (NCRWQCB 2001). Addition of LWD will help sort gravels in streams which have elevated levels of fine sediment, improving the quality of spawning and rearing habitat. It is critical to pair both reduction of sediment sources and delivery of additional sediment as well as use of stream complexity features to improve conditions in streams where sediment has already entered the stream channels.

Management Actions for Sediment Reduction

Sediment control projects remain a top priority given the watershed's designation as impaired for sediment. Road decommissioning, upgrades, and stream crossing replacements are planned across industrial timberlands as well as smaller private properties. Legacy roads built on steep slopes and along streams continue to threaten water quality, and several projects are being designed to remove failing culverts, re-contour abandoned roadbeds, and hydrologically disconnect problem segments. While timber companies will carry out much of this work as part of regulatory compliance, conservation districts and nonprofits are also preparing to support smaller landowners with technical and financial assistance. Planned projects include upgrades in the Wheatfield Fork and Annapolis areas, where dense road networks intersect with sensitive fish habitat. NCRWQCB is developing a regulatory program aimed at reducing sediment delivery from roads.

Forest Practice Rules Updates

Since 2003, significant regulatory steps have been taken within the forest practice rules that enhance mitigation measures for road building, maintenance, and harvest operations. In 2005, the California Fish and Game Commission listed coho salmon as a threatened species from the Oregon border south to Punta Gorda, and as an endangered species from Punta Gorda south to San Francisco (CDFW, n.d.). Following this listing the State Board of Forestry and Fire Protection adopted a series of rule packages intended to protect listed salmonid species, settling in 2010 on a set of rules that increased watercourse and lake protections and expanded buffer zones in watersheds with anadromous salmonids. These protections included the creation of an additional watercourse classification, a Class-II Large, which is defined as a watercourse contributing to a fish-bearing watercourse with at least 100 acres of drainage area. Identified Class-II Large watercourses require 80 percent canopy cover retention within 100 feet of reaches that run within 1,000 feet of a fish-bearing stream.

In 2015, the Board approved new regulations increasing road maintenance standards which include limiting or disconnecting hydrologic flow from road drainage points to watercourses and at crossing points and included new standards for winter operations and upgraded road surfaces. Since 2003, the GRWC has worked with large landowners in the watershed to implement road upgrading and road decommissioning.

The three largest ownerships of road miles in the Gualala River Watershed are the Conservation Fund (417 road miles), Gualala Redwood Timber (416 road miles), and Mendocino Redwood Company (104 road miles). All these organizations regularly harvest timber commercially as part of their operations, and are subject to the California Forest Practice Rules, including the requirements to improve appurtenant road systems as a condition to approving harvest permits.

TEMPERATURE

According to the TMDL, increased water temperature is a significant water quality issue throughout the watershed. Temperature is not uniform in streams, but cold-water pools and cooler tributaries allow thermal refugia in water for aquatic wildlife (U.S. Environmental Protection Agency, 2001). Cooler water temperatures are crucial for aquatic ecosystems because they increase the water's capacity to hold dissolved oxygen, carbon dioxide, and other gases important to aquatic life. Cold water also has the potential to decrease the presence of dissolved toxic substances that may restrict the suitability of water for human use (Natural Resource Conservation Service, 2012). Cooler waters are necessary for the survival and reproduction of some of the watershed's unique wildlife, especially salmonids. For example, steelhead trout require water temperatures between 46-52 degrees Fahrenheit to spawn (Adams et al., 2011).

Data collected by the GRWC, the U.S. Geological Survey, Gualala Redwood Timber LLC, the North Coast Regional Water Quality Control Board, Mendocino Redwood Company, and the Gualala River Stream Team Stewardship Project over the last two decades indicates that water temperature has remained relatively static throughout the watershed since the development of the 2001 TMDL, but that there are variations across subwatersheds. Specifically, the maximum weekly average water temperature (MWAT) decreased in the Buckeye Creek, Coastal, and Rockpile Creek subwatersheds. There were slight increases in MWAT in the South Fork Gualala, North Fork Gualala, and Wheatfield subwatersheds (Gualala River Watershed Council, 2024), though it is important to note that a large portion of the Wheatfield sub-watershed has a low density of roads, is without significant riparian canopy cover, and historically has not been known to support cold-watered fish species.. Temperature increases in some subwatersheds can be attributed to several factors and can vary greatly across each individual subwatershed, but sedimentation and the loss of canopy cover are likely the driving factors in the Gualala River Watershed (U.S. Environmental Protection Agency, 2001).

Canopy Cover and Water Temperature

Forests, especially riparian forests, intercept sediment and help maintain instream water quality by filtering nutrient runoff. Major bank erosion is much more prevalent on non-vegetated stream banks, resulting in increased sediment loads and channel widening (National Oceanic and Atmospheric Administration, 2014). Canopy cover influences watercourse temperature by regulating microclimates and providing shade.

The relationship of land use impacts to riparian canopy cover in the Gualala watershed has been summarized well by Morse in 2002: “Since 1868, overstory stream canopy cover has been depending on… episodic events [which] have been separated by equally long periods of inactivity and overstory riparian canopy recovery. The extent of riparian canopy cover has shifted rapidly throughout time… in response to three logging era boom and bust cycles…Overstory riparian canopy has now mostly recovered in the higher stream reaches. Lower stream reaches will take longer to recover being wider.”

“The mid-20th-century harvests basically defined canopy conditions today. Current riparian canopy generally consists of mid-sized 40-year-old second growth coniferous/mixed conifer hardwood stands in the middle to upper reaches. In the oak savanna that overlies the mélange of the Franciscan Complex, riparian vegetation has not re-established since logging, probably due to continued grazing, slope instability, and higher air temperatures than in the coastal areas” (NCRWQCB, 2003).

The Technical Support Document for the Gualala River Watershed Water Quality Attainment Action Plan for Sediment (NCRWQCB 2001) summarized canopy conditions: data from 1999 reports canopy cover ranges from 65% to 100%, with lower water temperatures generally appearing to correlate with higher canopy cover. These conditions were not necessarily associated with other beneficial habitat conditions such as pool or substrate quality. Data on canopy cover recovery conclude that canopy in the majority of the study reaches had likely recovered by an estimated 67 percent on average. The North Fork Gualala reach showed unusual recovery, estimated at over 100 percent.

In response to records of canopy loss, some organizations like FoGR have launched restoration initiatives like the Salmonid and Watershed Restoration Project in 2021. Contrastingly, the GRWC has repeatedly measured an increase in riparian canopy cover which is likely due to conservation efforts and regulations put forth by the California Forest Practice Rules. If riparian canopy cover has decreased, it could be the result of climate change, drought, wildfire, landslides, pests, and/or disease. A decrease in riparian canopy cover, if it is occurring, can be detrimental to the health of aquatic organisms and fish; these species rely on forest canopies to provide shade, which in turn regulates the water temperature. The loss of these forests can also decrease the amount of in-stream large woody debris, further altering water temperatures as well as the velocity of flow, spawning habitat, and stream morphology (Thompson et al., 2017).

There is no consensus on the percentage of canopy cover required to support these habitats, though some sources claim 50 to 65 percent canopy cover is most appropriate (Flosi et al., 2002) and others, like the CA Forest Practice Rules, can require up to 80% canopy cover post-harvest in the Coastal Region. The GRWC reports a canopy cover over 65 percent at most monitoring reaches. Canopy closure, long buffer lengths, and the protection of small tributaries and headwaters are necessary to reduce water temperatures and rehabilitate invertebrate communities (Ridgeway & Surfleet, 2021). Some studies indicate that stream restoration is most successful when a continuous buffer width is used from the headwaters down through the watershed (Ridgeway & Surfleet, 2021).

CONTINUED INTEGRATED MONITORING

The Gualala River Watershed has been studied and monitored using a variety of methods, each designed to answer different ecological questions and regulatory needs. Together, these approaches create a layered portrait of watershed health, though gaps remain where monitoring is inconsistent or absent.

When viewed together, these monitoring methods form a mosaic of data sources that document the condition of the Gualala River Watershed. Snorkel surveys capture fish populations, thalweg and LWD monitoring track habitat complexity, macroinvertebrate studies assess water quality, and USGS gauges provide hydrologic context. Timber company monitoring ensures compliance and supplements community data, while LiDAR and county records add a landscape-scale perspective. The GRWC's long-term reference stations serve as the keystone dataset, linking local monitoring to state regulatory processes.

The challenge going forward is not only to maintain these monitoring efforts but also to integrate them more fully. Coordination across agencies, nonprofits, and private landowners will be essential to fill gaps in agricultural and cannabis monitoring, address legacy road impacts, and ensure that data collection keeps pace with the accelerating challenges of climate change. Without reliable and consistent monitoring, the ability to manage the Gualala River Watershed for ecological resilience and community sustainability will remain constrained. With it, however, the watershed can continue to serve as a model of how local, regional, and industry actors can work together to generate the data needed for adaptive management.

PRIOR PLAN RECOMMENDATIONS AND ANALYSIS OF PROGRESS

Federal and state agencies have assessed water quality issues in the Gualala River Watershed and set forth a series of rehabilitation objectives and goals.

1994 Basin Plan

Before the watershed's 2001 TMDL listing, the North Coast Regional Water Quality Control Board outlined two major objectives in their 1994 Basin Plan, following the 1993 303(d) listing of the watershed (North Coast Regional Water Quality Control Board, 1994):

- The discharge of soil, silt, bark, sawdust, or other organic and earthen material from any logging, construction, or associated activity of whatever nature into any stream or watercourse in the basin in quantities deleterious to fish, wildlife, or other beneficial uses is prohibited; and
- The placing or disposal of soil, silt, bark, slash, sawdust, or other organic and earthen material from any logging, construction, or associated activity of whatever nature at locations where such material could pass into any stream or watercourse in the basin in quantities which could be deleterious to fish, wildlife, or other beneficial uses is prohibited.

2001 Gualala River TMDL for Sediment

In the 2001 Gualala River Total Maximum Daily Load for sediment, the EPA identified the primary concern of the TMDL as the protection of cold-water fish such as coho and steelhead from human-caused erosion of sediment. The TMDL that was established for the Gualala River and its tributaries is 125 percent of naturally occurring sedimentation, or 475 tons/mi^2/year. It was established by the US EPA in December 2001. In February 2026 the NCRWQCB will vote to amend the existing Basin Plan to include an Action Plan for the Gualala River Sediment TMDL. This Action Plan will require an establishment of a permit system issued through NCRWQCB's Waste Discharge Requirement Program aimed at cataloging and treating sediment-contributing roads within the watershed. The Basin Plan (NCRWQCB, 2025) outlines the following water quality objectives:

1. Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.
2. Waters shall not contain substances in concentrations that result in deposition of material that causes nuisance or adversely affect beneficial uses.

3. The suspended sediment load and suspended sediment discharge rate of surface water shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.
4. Turbidity shall not be increased more than 20 percent above naturally occurring background levels. Allowable zones of dilution with which higher percentages can be tolerated may be defined for specific discharges upon the issuance of discharge permits or waiver thereof (North Coast Regional Water Quality Control Board, 2001).

2003 North Coast Watershed Assessment Program Report

The NCWAP is an interagency effort between the California Resources Agency and the California Environmental Protection Agency, established to provide a consistent body of information on North Coast watersheds for use by landowners, stakeholders, and collaborative watershed groups. The 2003 NCWAP report listed several key recommendations for the Gualala River Watershed, which include:

- Land managers in this Subbasin should be encouraged to add more large organic debris and shelter structures to meter sediment inputs, improve channel structure, channel function, habitat complexity, and habitat diversity for salmonids. The natural large woody debris recruitment process should be enhanced by developing large riparian conifers with tree protection, planting, thinning from below, and other vegetation management techniques. Instream enhancement is the top tributary recommendation.
- Continue efforts such as road erosion proofing, improvements, and decommissioning throughout the Subbasin to reduce sediment delivery to the river and its tributaries. Road sediment inventory and control is second of the top three tributary recommendations.
- At stream bank erosion sites, encourage cooperative efforts to reduce sediment yield to streams.
- Evaluate the fish rescue activities and fish holding facilities to determine if it is causing a migration barrier and/or habitat degradation due to water diversion.
- Maintain and enhance existing riparian cover. Where current canopy density and diversity are inadequate and site conditions are appropriate, initiate tree planting, thinning, and other vegetation management to hasten the development of a denser, more extensive and diverse riparian canopy; Dry Creek, Robinson Creek, the central and higher reaches of the mainstem, and the lower reaches of Bear and Stewart Creeks are high priority areas for riparian improvements.

- Encourage the use of cable or helicopter yarding on steep and unstable slopes to reduce soil compaction, surface disturbance, surface flow interference, and the resultant sediment yield.
- Evaluate the possibility of spreading timber harvesting operations over time and space to avoid concentrated road use by heavy equipment and resultant mobilization of road surface fines into watercourses.
- Consider careful planning of land uses that could exacerbate mass wasting, since the relative potential of land sliding is high to very high in 56 percent of the Subbasin.
- Encourage continuation and expansion of the in-channel monitoring using the protocols developed by GRWC.
- Encourage more habitat inventory surveys and biological surveys of tributaries, as only 81 percent of the Subbasin has been completed (North Coast Regional Water Quality Control Board, 2003).

2005 North Coast Regional Water Quality Control Board Watershed Planning Chapter

The water quality goals for the Gualala River Watershed set forth by the watershed planning document are primarily centered around protection of the beneficial uses associated with aquatic life and drinking water supplies. The development of the TMDL waste reduction strategy for sediment is the highest priority action in the watershed. The NCRWQCB suggests General Waste Discharge Requirements and property wide Waste Discharge Requirements to address timber operations and timberland conversions.

According to the document, the primary water quality goals center around protection of the beneficial uses associated with aquatic life and drinking water supplies. The development of the TMDL waste reduction strategy for sediment is the highest priority for action in the watershed. In addition to development of the TMDL implementation plan, other available tools will be used as appropriate, such as General Waste Discharge Requirements and property-wide Waste Discharge Requirements to address timber operations and timberland conversions.

Status of additional goals:

- Protect surface and ground water; the NCRWQCB will continue to regulate the permittees in the basin but will need to shift resources to complete additional inspections and evaluations.
- Protect and enhance beneficial uses associated with anadromous fishes. The 2001 TMDL for Sediment is intended to help protect, enhance and restore the cold-water

fishery. Protect and enhance beneficial uses associated with anadromous fishes. A TMDL is being developed that should protect, enhance and restore the cold-water fishery.

- Identify erosion and sediment sources and potential sources, including sources related to new development of hillside vineyards.
- Conduct outreach on best management practices for hillside vineyards.
- Water temperature extremes need to be further assessed.
- Additional monitoring of the effectiveness of best management practices related to vineyards and timberland activities (North Coast Regional Water Quality Control Board, 2005).

2008 Regional Water Quality Control Board Work Plan to Control Excess Sediment in Sediment-Impaired Watersheds

This report describes the actions and tasks that staff of the NCRWQCB took from 2008 until 2018 to control human-caused excess sediment in the sediment-impaired water bodies of the North Coast Region. This work plan was developed as part of the TMDL Implementation Policy Statement for Sediment Impaired Receiving Waters in the North Coast Region (Resolution R1- 2004-0087) (North Coast Regional Water Quality Control Board, 2008), also known as the Sediment TMDL Implementation Policy. It does not address monitoring or non-sediment impairments.

Tasks for the Gualala River, as it relates to water quality and quantity, include:

- Funding excess sediment control, road restoration, and large woody debris placement projects.
- Encouraging the GRWC and/or the Sonoma RCD to develop a third-party nonpoint source control program; identifying the most egregious excess sediment sources; using progressive enforcement or develop waste discharge requirements (WDRs) or conditional waivers; regulating instream gravel mining operations; working with Coastal Ridges to ensure compliance with Measures to Control Excess Sediment Prohibition; developing ownership-wide WDRs for Gualala Redwoods Inc., Mendocino Redwood Company, and Preservation Ranch [purchased by The Conservation Fund in 2011]; and developing WDRs for county roads in Mendocino and Sonoma Counties (North Coast Regional Water Quality Control Board, 2008).

2014 Gualala River Watershed Council Case Study

This case study was developed from 2011 to 2014 by the GRWC using funds from the Department of Conservation Watershed Coordinator Grant. The findings of this research are based on interviews with stakeholders involved and a review of documents associated with the grant. This study concluded that watershed coordinators are integral to the success of the GRWC due to their ability to raise funds, create partnerships, and provide technical support. A lack of consistent funding has prohibited the GRWC from supporting a coordinator position beyond the terms of specific grants.

GRWC's Gualala River Watershed Monitoring Program includes over 30 years of accumulated monitoring data; the monitoring program was "designed to examine and understand watershed conditions and restoration effectiveness through collaboration with private landowners, community groups, and public agencies (Gualala River Watershed Council, n.d.). By 2014, there were 35 monitoring reaches installed along with 100 water quality sites within the watershed. The monitoring framework has allowed the GRWC to make strong inferences about long term natural changes (Borchers, 2014).

2021 TMDL Lawsuit

In December 2001, the EPA established the Gualala River Sediment TMDL as part of a CWA program "to assure that [California's] water quality standards are achieved, and beneficial uses protected". The TMDL study identified excessive sediment and high temperatures as the major impairments to watershed health. Sources of sediment identified in the TMDL include land development, erosion, silviculture, specialty crop production, removal of riparian vegetation, logging road construction and maintenance, and highway/road/bridge construction (U.S. Environmental Protection Agency, 2001).

The TMDL determined the total load of sediment that can be delivered to the Gualala River and its tributaries without causing exceedance of water quality standards. It also allocated the total load among the sources of sediment in the watershed. Control of sediment is integral to the protection of cold-water fish (such as coho salmon and steelhead) from anthropogenic-caused erosion (U.S. Environmental Protection Agency, 2001).

In 2021, FoGR filed a lawsuit against the NCRWQCB because it had not incorporated the 2001 TMDL into their Basin Plan, as required by the CWA (Friends of Gualala River, 2023).

An agreement was reached that requires the NCRWQCB to adopt the Gualala River TMDL into the Basin Plan and create a plan to improve water quality conditions in the watershed. The NCRWQCB is in the process of preparing an amendment to the Basin Plan and an environmental staff report. These documents were available for public review and comment in summer 2025. In February 2026, the NCRWQCB will consider the adoption of the Basin Plan amendment (North Coast Regional Water Quality Control Board, 2023).

ANALYSIS OF PROGRESS

The Gualala River Watershed is historically underserved, likely due to the small population and lack of commercial industry, which makes it challenging for organizations to secure grants and expand scientific research. As such, it is difficult to quantify the progress made since the 2003 NCWAP report was published, due to a general lack of data. Monitoring is conducted by several organizations, companies, and government agencies, though data is not collected methodically across the watershed at consistent time intervals. Specifically, there are gaps in streamflow, temperature, large woody debris, canopy cover, and fish population data in certain parts of the watershed.

The most comprehensive monitoring program is conducted by the GRWC, which has 35 monitoring reaches installed with 100 water quality sites. This data, collected over 30 years, suggests that water temperatures are fairly static, with slight increases in some subwatersheds and decreases in others. This data, collected in a report spanning 1992 to 2023, is available in Appendix F, Stream Monitoring Data from GRWC. There is not enough recent data to make definitive conclusions about pool formation or aquatic macroinvertebrate populations. Stream substrate size across the watershed is variable, though there appears to be a net decrease in size.

The GRWC has implemented several improvement projects, like installing large woody debris in watercourses. This project, which began in 1998 and is ongoing, likely increased pool formation. Gualala Redwoods, Inc. and Mendocino Redwood Company also monitor water quality in specific harvest areas to be compliant with Timber Harvest Plans.

The GRWC Monitoring Program was established with the purpose of understanding watershed conditions. Various water quality and aquatic habitat parameters were collected throughout the lifespan of the Program (1997 to present). Due to unforeseen funding restrictions, the anticipated frequency of monitoring at many locations by GRWC was not met. However, four reference monitoring stations have continued to be monitored throughout the lifespan of the Program. The North Coast Regional Water Quality Control Board is currently assessing data related to instream habitat at these reference stations. This assessment will investigate statistical trends in streambed substrate composition, stream channel complexity, changes in streambed elevation, large woody debris pieces and volume, and salmonid surveys. This information will be available to the public in the form of an appendix to the Gualala River Sediment Total Maximum Daily Load (TMDL) Action Plan.

CONCLUSION

FOREST LANDSCAPES

Most of the Gualala River Watershed is forested. Redwood and Douglas-fir forests dominate the western half of the watershed, while the interior and eastern half of the watershed, contrastingly, is mostly comprised of montane hardwood-conifer forests and oak woodlands which support a smaller volume of commercial conifer timber products. Nearly all of the forested land in the watershed has previously been harvested and legacy road and trail elements from those harvests remain. Poorly designed roads located near or through watercourses, with unstable fills, poorly drained surfaces, and insufficient watercourse crossing design have been constructed throughout the watershed; the effects of which continue to contribute sediment and impair watershed health today.

Although modern forest practice rules and contemporary management techniques are far more effective at minimizing harvest-related erosion and protecting riparian corridors, excessive sediment delivery remains a significant concern when considered with the cumulative effects of elevated background sediment that has not drained from the watershed.

PRESENT-DAY LAND USE

The TMDL Action plan has included Waste Discharge Requirements (WDR) for certain activities in the watershed, including timber harvest on non-federal land, and more recently, commercial vineyard operations. County Roads are subject to maintenance requirements under the 5C waiver program, affecting future revisions or replacement roads, and Caltrans operates under a general permit for storm water discharges on roads they are responsible for.

The majority of the watershed area is owned by a few landowners, many of which are involved in commercial timber production. Commercial timber harvest has been regulated under both the WDR and Forest Practice Rules, which require upgrades to appurtenant road systems utilized during harvest operations. The majority of roads and suspected crossings in the watershed are within the ownership boundaries of the largest ten landowners. Given the risks to water quality associated with roads, these ownerships may hold significant opportunities to reduce the amount of sediment entering the watershed, however more information should be obtained regarding modern improvements that have been made to the road systems on these ownerships prior to development of a road-improvement prioritization scheme.

Roughly 22% of the land base and road miles in the watershed are on ownerships under 640 acres in size. Many of these ownerships share the history of intensive commercial logging that created the road networks still in use today. Properties that have not engaged in commercial timber harvest are unlikely to have been subjected to regulatory mandates to improve their road system, and their roads may be in poor condition. Many small landowners lack financial and technical knowledge to improve their road system and would benefit from government support.

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APPENDICES

Appendix A. Upland Habitat Type Descriptions

Appendix B. Upland Wildlife

Appendix C. Non-Native Plant Species

Appendix D. Amphibian Species of Special Concern

Appendix E. Road Upgrades From Gualala River Watershed Council 2024

Appendix F. Gualala River Watershed Council Monitoring Data Summary 1992 - 2023

Appendix G. Mendocino Redwood Company Gualala Fish Distribution 1995 - 2008

Appendix H. Maps

Appendix A: Upland Habitat Type Descriptions

Closed-Cone Pine-Cypress

Closed-Cone Pine-Cypress habitat includes several different series of evergreen, needle leaved trees. This habitat type is not prevalent in the Gualala River Watershed and only makes up 2.78% of the watershed. It is considered a vulnerable vegetation community that has diminished in size statewide, largely due to logging, development, mining, and stand-replacing wildfires (Comer et al., 2014).

This habitat is typically dominated by a single species of one of the closed-cone pines or cypresses; few stands contain both pines and cypress. In the Gualala Watershed, MacNab and Sargent cypress are frequently associated with foothill pine, leather oak, scrub oak, sticky white leaf manzanita and/or wedgeleaf ceanothus with a herbaceous layer that may support a number of grasses and forbs. The pines which dominate the Closed-Cone habitats are knobcone pine, Monterey pine, Bishop pine, Torrey pine, and beach pine. Knobcone pine frequently grows in small dense patches with chamise, ceanothus, leather oak and manzanita occurring between patches or in openings in the pine stands (Colwell, 1980). Monterey pine stands include coast live oak and occasionally knobcone pine and madrone in the overstory. The shrubby understory includes California buckthorn, poison oak, California huckleberry and woolyleaf manzanita (Roy, 1966). Shrubs associated with Bishop pine stands are typically those of the surrounding vegetation: California huckleberry, salal, rhododendron and labrador tea in the north, (Westman and Whittaker, 1975) and chamise, manzanita, toyon and poison oak in the southern stands (Colwell. 1980).

Pygmy, Sargent, and Monterey cypresses appear to be very vulnerable to root pathogens, especially in wet areas. These include pathogens in the genus *Ilyonectria* and *Seiridium. Ilyonectria* is involved in rapid die-off of entire cypress stands near Fort Bragg and Manchester. The status of the latter as a root pathogen is still under investigation; it is better known for causing cypress canker disease. Additionally, heart- and sapwood decay caused by *Ilyonectria* may be involved in this root decline complex and often causes unexpected premature failure of mature green cypress trees (CAL FIRE, 2024).

Numerous game species, including tree squirrels, and nongame species make up this type for feeding and cover. Few species make substantial use of this type as a breeding habitat, although the great horned owl and red-tailed hawk will nest in Closed-Cone Pine forests (Jensen, n.d.).

Management Implications for Closed-Cone Pine-Cypress:

- Periodic prescribed fire
- Thinning
- Planting

Coastal Prairie

Coastal prairie is commonly defined by its predominant grass species or by its topographic features including sea bluffs, uplifted grassy bald hills, hillside slopes, lowland grasslands, and coastal marine terraces. The northern coastal prairie is dominated by long lived perennial bunchgrasses such as Purple needlegrass, California fescue, and California oatgrass (National Park Service, 2023).

California's Coastal Prairies are the most species-rich grassland type in North America. They are known as biodiversity hotspots and provide a number of services including carbon storage, water filtration, agriculture, and livestock farming. This habitat type is endangered by development, grazing, and shrub encroachment in absence of periodic fire (National Park Service, 2023). There are few pests and pathogens that affect coastal prairies, but invasive species are reshaping the composition of vegetation. For example, about a third of coastal prairie plant species at the UC Davis Bodega Marine Reserve are non-native. Many non-native species prevalent in this habitat type are highly invasive, like velvet grass. Coastal prairies are considered to be a habitat of special concern by the California Department of Fish and Wildlife (UC Davis Coastal and Marine Sciences Institute, n.d.).

The Timber Cove Forest and Fuel Management Plan details rare and listed flora of the coastal prairies in the Timber Cove area: "Swamp harebell (*Campanula californica*), coast lily (*Lilium maritimum*), and Blasdale's bend grass (*Agrostis blasdalei*) have been sighted at Salt Point just north of Timber Cove: they are designated federal Species of Concern under the federal Endangered Species Act.   Sonoma spineflower (*Charizanthe valvida*) , listed endangered under the Federal and State Endangered Species Acts, was last seen at Fort Ross in 1987 and is considered possibly extirpated (Appleton, 2001).

Mixed Chaparral

Mixed Chaparral (MCH) is a structurally homogeneous brushland type dominated by shrubs with thick, stiff, heavily cutinized evergreen leaves. Shrub height and crown cover vary considerably with age since last burn, precipitation regime (cismontane vs. transmontane), aspect, and soil type (Hanes, 1977). At maturity, cismontane Mixed Chaparral typically is a dense, nearly impenetrable thicket with greater than 80 percent absolute shrub cover (CDFW, 1977). Less than 1% of the watershed is comprised of chaparral.

Chaparral is a floristically rich type that supports approximately 240 species of woody plants. Dominant species in cismontane chaparral include scrub oak, chaparral oak, and several species of ceanothus and manzanita. Individual sites may support pure stands of these shrubs or diverse mixtures of several species. Commonly associated shrubs include chamise, birchleaf mountain mahogany, silk-tassel, toyon, yerba-santa, California buckeye, poison-oak, sumac, California buckthorn, hollyleaf cherry, Montana chaparral-pea, and California fremontia. Some of these species may be locally dominant. Leather oak and interior silktassel are widely distributed on cismontane serpentine soils, and chamise and toyon may be abundant on these soils (CDFW, 1977). Shrubs such as Jepson, coyote, dwarf ceanothus and serpentine manzanita are local serpentine endemics (Cheatham and Haller 1975, Thorne 1976, Hanes 1977). Incense-cedar, knobcone pine, Coulter pine, and foothill pine frequently are found in Mixed Chaparral on serpentine soils (Thorne, 1976). In northern California, chaparral merges with Annual Grassland and Blue Oak-Foothill Pine at lower elevations. Chaparral shrubs form the understory of many Blue Oak-Foothill Pine stands. At upper elevations, Mixed Chaparral grades into Coastal Oak Woodland (COW) or mixed conifer types and frequently forms the understory of these habitats (Cheatham and Haller, 1975).

No wildlife species are restricted to chaparral. Wildlife management considerations usually focus on selecting alternative fire management treatments, like prescribed burns that can promote the growth of young palatable shrubs (England, n.d.).

Relatively few native insect pests or pathogens are significant in chaparral systems. Manzanitas are susceptible to branch dieback and occasional whole-plant mortality caused by the fungus *Neofusicoccum australe*, especially during drought periods. Additionally, non-native Phytophthora species such as *P. cinnamomi* and *P. crassamura* are a huge concern for all chaparral vegetation; many of these species have been heavily implicated in dieback of Mediterranean-type shrubland ecosystems throughout the world (Fajardo et al., 2025).

Montane Hardwood/Coastal Oak Woodland

Coastal oak woodlands and montane hardwood are extremely variable. This ecological type includes areas with true oaks in the *Quercus* genus, tanoak, madrone, and California bay laurel, which occupy at least 10 percent overstory canopy cover (Holland, 2005). True oaks found in the planning area include deciduous oaks in the white oak subgroup, including Oregon white oak, valley oak, and blue oak; deciduous oaks in the red oak subgroup, including California black oak, and potentially oracle oak; and evergreen oaks in the red oak subgroup, including coast live oak, canyon live oak, and interior live oak. Coast live oak dominates much of the overstory tree canopy in oak woodlands along the coast. Where Oregon white oak, California black oak, canyon live oak, madrone and interior live oak dominate, the habitat is generally considered Montane Hardwood (Holland, 2005).

Oak woodlands are in general threatened by development and agricultural conversion, introduction of invasive plants and pathogens which kill individual trees and reduce the success of oak progeny and shifts in land use and stewardship practices which have allowed native encroachment of conifers that out compete oaks for sunlight (Cocking et al., 2015).

Most issues with true oaks in Sonoma County predominantly affect deciduous oaks. Evergreen oaks are more adapted to growing in greater density, and with lower available light, when compared to their deciduous cousins. Conifer encroachment is especially problematic because evergreen conifers can continue growing throughout the year, while deciduous oaks are without leaves in the winter (Cocking et al., 2015).

Deciduous oaks throughout the state are currently recognized as a sensitive ecological community due to issues that have been observed regarding their ability to produce pole-sized saplings from seedlings. There are several potential factors that have exacerbated this issue. Ideas as to why oaks have been unable to successfully reproduce include water deficit caused by invasive annual grasses, a lack of fire to provide a clear seed bed, and increased herbivory pressure, possibly due to habitat constraints caused by development (Allen-Diaz et al., 2007). It is likely that the cause of this decline is a combination of many factors, but what is clear is that deciduous oaks likely need human intervention to successfully regenerate in some areas. One thing that may help would be acorn collection and planting during the rainy season. Native oak species are known to have cyclical acorn crop years, with some extraordinarily large crop years being called “mast years.” This ecological adaptation is theorized to throw off the population of acorn predators by providing abundance in one year, allowing squirrels and other rodents to increase their populations, only to provide less the next year and stimulate a population crash (Koenig and Knops, 2000). Encouraging the propagation of acorns during mast years by preparing the seed bed with fire may be an important tool to help regeneration. Fire can be used to essentially fumigate acorn weevils, a major destroyer of acorn crops. Another consideration, which could be taken on at a local level, is that deciduous oak seedlings often seem to propagate only to die before reaching 4 to 5 feet in height. This could again be a combination of effects, but it may be that browsing protection of select individuals could be a fairly low-cost option to increase survivability (McCreary, 2011).

Other major issues affecting oaks include non-native pathogens. *Phytophthora ramorum*, commonly known as sudden oak death (*Phytophthora ramorum*), affects trees in the red oak (*Quercus spp.)* subgroup and is especially detrimental to tanoak (*Notholithocarpus densiflorus*). This water mold effectively girdles trees over time, and trees that seem healthy in one year will appear to die within a few weeks from the first major signs of decline. SOD travels through water droplets and can be dispersed by storm-driven rain splash fog drip, overland flow of water, or the deposition of infested soil or infected foliage from boots or equipment. There is no known cure for sudden oak death, but dense canopy conditions surely exacerbate the problem by reducing evaporation of surface water in contact with affected leaf material and spatial proximity of potential host species allowing for easy transfer of the pathogen from one tree to another. Tanoak and California bay laurel (*Umbellularia californica*) are culturally significant tree species to the Kashia Pomo Indians. While most native tree species on the coast of California are a potential host for SOD, California bay laurel is generally seen as problematic due to the effectiveness in which SOD spores replicate in its plant tissue (Davidson, 2011). While wholesale elimination of California bay laurel is neither feasible, ecologically prudent, or in line with the values identified by The Coalition; foresters and land managers should consider the spatial continuity of California bay laurel, and its proximity to oak species and tanoak, when managing local stands of hardwood in an effort to help limit the spread of sudden oak death to susceptible species.

In addition to sudden oak death, there have been nearby confirmed reports of Mediterranean Oak Borer (MOB), which is a beetle that infects mature trees in the white oak group, such as valley oak, and blue oak, and Oregon white oak. MOB is a fairly new problem in Sonoma and Napa counties, and control measures are still being devised. Because MOB has been detected in this area, it is especially important that firewood from this area not be transported to other areas which may not be affected by MOB. The transportation of firewood is the main method by which invasive beetles migrate in the

United States (UCANR, 2025).

Montane Hardwood-Conifer/Douglas-Fir Forest

Montane Hardwood-Conifer/ Douglas-fir habitat includes both conifers and hardwoods, often as a closed forest. Per the CWHR, to be considered Montane Hardwood-Conifer, at least one-third of the trees must be conifer and at least one-third must be broad-leaved. Conifer-dominated ecosystems in the area are either classified as redwood or Douglas-fir, depending on the dominant species. The Montane Hardwood-Conifer habitat often occurs in a mosaic-like pattern with small pure stands of conifers interspersed with small stands of broad-leaved trees. Typically, conifers form the upper canopy and broad-leaved trees comprise the lower canopy. Most of the broad-leaved trees are sclerophyllous evergreen, but winter-deciduous species also occur. Relatively little understory occurs under the dense, bilayered canopy of Montane Hardwood-Conifer. However, considerable ground and shrub cover can occur in ecotones or following disturbance such as fire or logging. Steeper slopes are normally devoid of litter; however, gentle slopes often contain considerable accumulations of leaf and branch litter (CDFW, 2012).

In the planning area, California black oak (*Quercus kelloggii*), Oregon white oak (*Quercus garryana*), tanoak, Pacific madrone, red/white alder (*Alnus rubra/rhombifolia),* and California bay laurel associate with Douglas-fir, and to a lesser extent, redwood, in Montane Hardwood-Conifer systems. These systems are generally further inland from the coast and on mountainous uplands and are typically an intermediate ecosystem type between the redwood ecosystems of the coast and montane hardwood systems in the interior of the coast ranges (CDFW, 2012).

Montane Hardwood-Conifer/ Douglas-fir provides habitat for a variety of wildlife species. Mature forests are valuable to cavity nesting birds. Moreover, mast crops are an important food source for many birds as well as mammals. Canopy cover and understory vegetation are variable which makes the habitat suitable for numerous species (CDFW, 2012).

There are numerous pests and pathogens pertinent to the Montane Hardwood-Conifer/ Douglas-fir habitat type. Douglas-fir is the dominant conifer in the ecosystem, is vulnerable to mortality caused by flatheaded fir borer (*Phaenops drummondi*), particularly at the drier and more exposed edges of its distribution. In the Coast Range its effective lifespan is limited by the velvet-top fungus (*Phaeolus schweinitzii*), which often thoroughly colonizes Douglas-fir root systems and butt logs by the time the tree has reached 60-80 years, putting it at high risk of tree failure and windthrow. Occasionally the Douglas-fir beetle (*Dendroctonus pseudotsugae*) spreads from windthrown windthrown trees into standing Douglas-fir timber and kills it. Otherwise, Douglas-fir suffers from opportunistic pests that colonize specific tree parts, including *Armillaria* spp., Douglas-fir engraver beetle (*Scolytus unispinosus*), and Douglas-fir twig weevil (*Cylindrocopturus furnissi*). A white pocket rot caused by *Porodaedalea pini* is very common in Douglas-firs of all ages and plays a significant role in reducing tree suitability for wood products use (CAL FIRE, 2024).

This habitat type is fire-adapted and requires stand-replacing fire to ensure persistence of these tree species. Broadcast burning can mimic this natural disturbance and promote montane hardwood-conifer/ Douglas-fir forests. However, some communities may not be receptive to this type of forest treatment. The vegetation of montane riparian forest zones is quite variable and often structurally diverse (Marcot, 1979). Usually, the montane riparian forest zone occurs as a narrow, often dense grove of broad-leaved, winter deciduous trees up to 30 m (98 ft) tall with a sparse understory. Black cottonwood, white alder, big-leaf maple, and thinleaf alder dominate but Oregon ash, willow, and a high diversity of forbs are common associates (CDFW, n.d.). Only 0.03 percent of the Gualala watershed is comprised of montane riparian forests.

All riparian habitats have an exceptionally high value for many wildlife species (Thomas, 1979; Marcot, 1979; Sands, 1977). Such areas provide water, thermal cover, migration corridors and diverse nesting and feeding opportunities. The shape of many riparian zones, particularly the linear nature of streams, maximizes the development of edge which is so highly productive for wildlife (Thomas, 1979).

The range of wildlife that uses the montane riparian forest habitat for food, cover and reproduction includes amphibians, reptiles, birds and mammals. Species include grasshopper sparrows, meadowlarks, badgers, white-tail kites, red-tailed hawks, and western fence lizards (Immel et al., 2020).

A variety of insect pests and tree pathogens inhabit montane riparian systems. For the most part, riparian trees are well-adapted to tolerative native pests such as *Phytophthora siskiyouensis* on alder spp., heart rots on hardwood trees, alder flea beetles (*Macrohaltica ambiens*), and *Calonectria californiensis* on bay laurel, tanoak, and a variety of understory shrubs. The damage potential of alder bark beetle (*Alniphagus aspericollis*), which vectors a newly identified fungus, *Neonectria bordena*, is not yet known. Non-native tree pests that may pose problems in the future include the emerald ash borer (*Agrilus planipennis*), which is not yet known in California, on Oregon ash; the white satin moth (*Leucoma salicis*) on cottonwood; and non-native root rots and bot canker fungi on a variety of hardwoods (CAL FIRE, 2024).

Redwood Forest

The Redwood Habitat is a composite name for a variety or mix of conifer species that grow within the coastal influence zone <50 kilometers (31 miles) from the coast. Here, redwood (*Sequoia sempervirens*) is dominant along the coast, with Douglas-fir (*Pseudotsuga* menziesii*)* as its common associate; tanoak (*Notholithocarpus densiflorus*) and madrone (*Arbutus menziesii*) are also major constituents of the habitat. Other contributing tree species are Bishop pine (*Pinus muricata*), Monterey pine (*Pinus radiata*), California bay laurel (*Umbellularia californica*), Oregon ash (*Fraxinus latifolia*), and bigleaf maple (*Acer macrophyllum*). Interestingly, sugar pine (*Pinus lambertiana*) can also be found in and around Annapolis and Gualala. This vegetation community is dependent on specific soil and microclimate conditions (Mayer, 1988).

Redwood is one of the most valuable commercial timber species in North America. Redwood occupies a niche market as a durable and rot resistant timber product. Fences and decking represent the largest share of the redwood market. The limited geographic range of redwood has helped to keep prices high, which maintains redwood as a viable product despite exceedingly high barriers to market from regulatory costs and long-distance trucking costs to ever fewer sawmills (Stewart, 2007). Coast Douglas-fir occupies a much larger market in dimensional lumber, but its native range extends through far more dominant timber markets from Oregon to British Columbia, and as a result the supply moderates prices. Redwood logging peaked in the post war period from 1945 to 1989, fueled largely from the logging of old growth redwood. In the time since the redwood market has shifted to harvesting second or even third rotation stands, and the remaining viable sawmills are re-tooling for high-efficiency processing of smaller diameter logs (USDA, 2016).

Much of the redwood ecosystem in the planning area has been logged, but there are a few pockets of original old growth habitat still surviving; more occasionally, there are individual remnant trees that weren't logged for various reasons. The climax stage of the redwood habitat is distinguished by a bilayer canopy, usually with redwood or Douglas-fir as the dominant species. After disturbance (usually logging, fire, or flooding) succession proceeds rapidly, becoming dominated by shrubs and redwood sprouts within 10 years. Over time, conifers become more dominant, with resilient shrub types comprising the understory. In the planning area, mid-seral stages are composed of hardwoods which are usually dominant or codominant to the conifers. This mix of conifer and hardwood persists for many years, but eventually gives way to conifer dominance. Fire and flooding in the redwood ecosystem play a major role in terms of reproduction and plant succession. The typical fire-return interval is between 2-27 years. When fire is introduced, various plant species are affected, ultimately altering the habitat stage (Mayer, 1988). After disturbance, succession proceeds rapidly.

Redwood generally appears to lack major pest issues and there are few pathogens that outright kill redwood, although changing climate and increased international trade could change this in the future (NPS, 2020). Other tree species in the redwood ecosystem are affected by a handful of pests and diseases. Currently, sudden oak death is the most concerning pathogen found in the Gualala River area. Sudden oak death readily girdles and kills tanoak, a tree whose acorns provide a significant food source to wildlife and are a traditional food source for the Kashia Pomo Indians. Sudden oak death can infect nearly every tree and shrub species found in the redwood region, including redwood, evergreen huckleberry (*Vaccinium ovatum*), Douglas-fir, bigleaf maple, species of true oaks, and even maidenhair fern (*Adiantum raddianum*) (U.S. Department of Agriculture, n.d.). Tanoak mortality induced by *P. ramorum* represents a significant fuel hazard and can hamper rapid property access and egress within the Gualala River area. Large efforts have been started by California State Parks to reduce tanoak-related hazardous fuels near Fort Ross, which has been a local epicenter for sudden oak death (USFS, 2024). Redwood habitats provide food, cover, or special habitat elements for a variety of sensitive species. Species such as the red-legged frog, osprey, fisher, and marbled murrelet show a relatively high preference for various redwood habitat phases and stages. Redwood also provides habitat to sensitive species such as the peregrine falcon, pileated woodpecker, and northern spotted owl (NPS, 2024).

APPENDIX B: UPLAND WILDLIFE

Northern Spotted Owl (Strix occidentalis caurina)

Life History: The Northern spotted owl is an uncommon permanent resident that utilizes coniferous Forest and Broadleaf Evergreen Forest habitats. The species frequents old growth or mixed stands of old-growth and mature tree (occasionally in younger forests with patches of big trees) with high, multistoried canopy dominated by big trees, with some trees having cavities or broken tops, with woody debris and space under the canopy, and perennial sources of water nearby.

Breeding takes place in natural tree cavities, on broken treetops, and on vacant stick nests of other birds. The species hunts nocturnally from perches in trees, primarily taking small to medium sized mammals, but also taking birds and opportunistic prey. In California, the primary food source for northern spotted owl is the dusky-footed wood rat, which makes its nests from downed woody debris and slash.

Abundance and Distribution: No range-wide estimate for abundance exists because survey methods and effort conducted to date do not provide for reliable estimation of population size across the range (CDFW, n.d.).

The Conservation Fund found that "historically, Northern spotted owl surveys on the Gualala River Forest have been somewhat inconsistent. Surveys in 2012 and 2013 identified one NSO territory located on the ownership and one territory located immediately off property. This is a rather low density of NSO territories compared to other portions of the redwood region. and it is speculated this could be due to a hotter drier climate than other portions of the redwood region where the NSO density is higher (The Conservation Fund, 2014).

Within the range of the Northern spotted owl in California, a total of 175 Timber Harvest Plans (THPs) were submitted to CAL FIRE in 2013 from 10 counties. Of these, 115 THPs were associated with owl activity centers, 5.5 percent of which were in Sonoma County, and 35.38 percent from Mendocino (CAL FIRE; California Department of Fish and Wildlife, 2016).

CDFW stated that at the proposed levels of harvest noted in the THPs, it is apparent that some activity centers have experienced extensive habitat removal or modification over time. It is reasonable to assume that high levels of harvest can negatively impact Northern spotted owls.

Threats: The main threats to northern spotted owl are habitat fragmentation, displacement from barred owl (*Strix varia*), effects from previous habitat loss, and continued habitat loss.

For a full review on threats and impacts to Northern spotted owl see the 2016 *Status Review of the Northern Spotted Owl* by California Department of Fish and Wildlife.

Recovery Strategies: Conservation efforts for the species should focus on improving habitat by increasing the size and complexity of forest structure in young forests and maintaining legacy habitat elements within older forests. The critical breeding period for this species is between March 1st and August 31st, forest operations being undertaken using avoidance measures should plan for operations to occur outside this critical period (Meyer, 2007).

Marbled murrelet (Brachyramphus marmoratus)

Life History: "The Marbled Murrelet is a small seabird in the alcid family found along the Pacific Coast from Alaska to northern California. At sea, it feeds by diving for small fish in nearshore waters, typically within 5 km [kilometers] of the coastline. Unlike most alcids, the Marbled Murrelet nests up to 50 km (most within 30 km) inland in late-successional and old growth coniferous forests. In California, it nests almost exclusively in redwoods (*Sequoia sempervirens*) 200 years old and older (Nelson, 1997). Like most alcids, the Marbled Murrelet is a long-lived slow reproducing species, laying only one egg per year" (California Department of Fish and Wildlife, 2011).

"Although murrelet nesting habitat characteristics may differ throughout the range of the species, some general habitat attributes are characteristic throughout its listed range, including the presence of nesting platforms, adequate canopy cover over the nest, larger patch size of mature forest, and being within commuting distance to the marine environment (Binford et al., 1975; Hamer and Nelson, 1995; Nelson, 1997; McShane et al., 2004; Ralph et al., 1995b). Because murrelets do not construct nests, they depend on the availability of platforms, typically tree limbs with a moss or other thick substrate, such as piles of needles collected on limbs near a tree bole, sufficiently large for laying their single egg and raising a nestling (Nelson, 1997; Ralph et al., 1995).

Abundance and Distribution: Sonoma County and the Gualala River Watershed fall within the Zone 5 region for marbled murrelet. The Northwest Forest Plan estimated the population for all of Zone 5 at 48 birds, most of which presumably occur from the Gualala River north (U.S. Department of Agriculture, 1994) (CDFG, 2011). In 2013, population estimates ranged from 71 birds in Conservation Zone 5 (Falxa and Raphael, 2016)

Recovery Strategies: California Department of Fish and Wildlife identifies that traditionally two types of projects have been employed to benefit the marbled murrelet population:

- The protection of nesting habitat via acquisition of conservation easements or fee title to old-growth forests in danger of being logged,
- Management of corvid populations to reduce their numbers around campgrounds in prime murrelet breeding areas to reduce predation on murrelet nests (eggs and chicks).

Nest predation by corvids, especially ravens and jays, is thought to be one of the primary causes for low productivity among marbled murrelets in California. Hebert and Golightly (2007) documented murrelet nest depredation by Steller's jays and common ravens and recommended that steps be taken "to minimize anthropogenic activities that may increase local corvid densities or disturb murrelets during the early incubation period." Corvids are the predators having the greatest impact to marbled murrelets (U.S. Fish and Wildlife Service, 2009; CDFG, 2011).

The CDFW, formerly California Department of Fish and Game, identified current corvid management efforts being utilized by State and National Parks in marbled murrelet habitat zones which include:

- Education of campers and visitors regarding the effects of human food waste
- “Soft” enforcement of food storage regulations to reduce human food waste
- Improvements to garbage receptacles
- Improvements to food storage lockers
- Removal of ravens and/or their nests

Additional efforts to be expanded to build upon current corvid management strategies are identified in the Marbled Murrelet Restoration Project by California Department of Fish and Game (2011).

Sonoma tree vole (*Arborimus pomo*)

Life History: The Sonoma tree vole (formally the red tree vole) is located throughout Sonoma and Mendocino counties. It inhabits young Douglas-fir stands. Nests can be located in Douglas-fir trees in the mid-canopy region of the trees. This species is critical to the success of the Northern spotted owl as it is one of the owl’s primary food sources. The vole’s primary food source is the needles of young Douglas-fir trees. Tree vole nests look very similar to small woodrats or large bird nests (Brylski and Harris, n.d.).

Abundance and Distribution: The Sonoma tree vole is distributed along the North Coast from Sonoma County north to the Oregon border and is restricted to the fog belt. It is reported to be rare to uncommon throughout its range, though abundance is hard to assess because of difficulty locating nests and capturing individuals (Brylski and Harris, n.d.). A California Natural Diversity Database search indicates that the Sonoma tree vole has been sighted in the vicinity of Fort Ross Creek. Studies suggest that Sonoma tree voles are more abundant in older growth forests (Chinnici et al., 2011). It is classified as a species of special concern in California.

Threats: The Sonoma tree vole is threatened by a loss of habitat from harvest, wildfire, and conversion.

Recovery Strategies: The retention of larger Douglas-fir trees combined with other conservation strategies such as riparian protection, other species protection measures (i.e., Northern spotted owl nest zones), or as a part of a structural element retention strategy wherein large trees with complex structure are retained may help maintain the Sonoma tree vole populations (Chinnici, S. J., Bigger, D., & Johnson, E., 2011).

Bald Eagle (Haliaeetus leucocephalus)

Life History: Bald eagles are raptors that require large bodies of water or free flowing rivers with abundant fish adjacent to snags or other perches. They perch in high, stoutly limbed trees, on snags or broken-topped trees, or on rocks near water. They roost communally in winter in dense, sheltered, remote conifer stands. Bald eagles breed from February through July and lay a clutch of 1-3 eggs. (Polite and Pratt, 1999).

Abundance and Distribution: Bald eagles are more common in the Gualala River Watershed in the winter months, though some are present year-round. Most breeding territories are in northern California. (CDFW, n.d.) It is listed as an endangered species in California.

Threats: The Bald Eagle is threatened by pesticides, logging, development, conversion, poaching, and lead poisoning.

Recovery Strategies: The nationwide effort to restore Bald Eagle populations began in the 1970's with the Endangered Species Act. To help rebound the eagle's population, specific pesticides were banned (DDT), new protections were placed on eagle habitat, and monitoring programs closely watched populations. It is now federally classified as a species of least concern but is still classified as endangered by CDFW. It is also protected by the Migratory Bird Treaty Act (1918) and the Bald and Golden Eagle Protection Act (1962) (CDFW, n.d.).

Townsend's Big Eared Bat *(Corynorhinus townsendii*)

Life History: Townsend's big eared bat requires caves, mines, tunnels, buildings, or other human-made structures for roosting. They primarily feed on small moths but also consume soft-bodied insects. These bats are nocturnal, hibernate, and live in colonies (CDFW, 2020).

Abundance and Distribution: Townsend's big-eared bat is found throughout California, but specifics of its distribution are not well known. They are found in all, but subalpine and alpine habitats and they prefer mesic habitats. It may be found at any season throughout its range. The bat is now considered uncommon in the state. It is a species of special concern in California (CDFW, 2000).

Threats: Human disturbance of roosts and closure or reuse of abandoned mines are major threats to the Townsend's big eared bat. Other threats include non-target pesticide spraying, which reduces the bat's food supply of moths and other insects. Degradation and loss of foraging and roosting habitat from timber harvest practices, land conversion, and livestock grazing are additional threats (Washington Department of Fish and Wildlife, 2012).

Recovery Strategies: There are no recovery strategies in place for this species.

Pallid Bat (Antrozous pallidus)

Life History: The pallid bat eats a wide variety of insects and arachnids and forages over open ground. Their day roosts are in caves, crevices, mines, and occasionally in hollow trees and buildings. Night roosts may be in more open sites, such as porches and open buildings. They prefer rocky outcrops, cliffs, and crevices with access to open habitats. Pallid bats live in colonies.

Abundance and Distribution: The pallid bat is a locally common species of low elevations in California and occurs throughout much of the state. It occupies a wide variety of habitats including grasslands, shrublands, woodlands, and forests from sea level up through mixed conifer forests. The species is most common in open, dry habitats with rocky areas for rooting (CDFW, n.d.). It doesn't migrate long distances but might move short distances to hibernate. Its full range is from western Canada and central United States and down into Baja California, Central Mexico, and Cuba. It is a species of special concern in California.

Threats: The pallid bat is sensitive to habitat encroachment and roost disturbance. It is threatened by the expansion of agriculture into habitat areas, pesticides, fire, and invasive species (Doyle, n.d.).

Recovery Strategies: There are no recovery strategies in place for this species in California. Recovery efforts in other states and countries include increased monitoring and habitat protection (Pallid Bat Recovery Team, 2008).

American Badger (*Taxidea taxus*)

Life History: The American badger is a carnivorous mustelid that consumes rodents and sometimes insects, reptiles, eggs, birds, and carrion. They help control small mammal populations. They burrow in friable soil for cover. Suitable habitat for badgers is characterized by herbaceous, shrub, and open stages of most habitats with dry, friable soils. They are nocturnal, diurnal, non-migratory, and solitary animals (Ahlhorn, n.d.).

Abundance and Distribution: The American badger's home range estimates vary geographically and seasonally. They are found primarily in the Great Plains region of North America, but also occur through the central western Canadian provinces, in appropriate habitat throughout the western U.S., and south throughout the mountainous areas of Mexico (California NatureMapping Program, n.d). It is a species of special concern in California.

Threats: This species is threatened by pesticides, habitat loss, road mortality, predation by domestic dogs or coyotes, trapping, and climate change (Hiatt, n.d.).

Recovery Strategies: There are no recovery strategies for the American Badger in California. However, recovery strategies in other states and countries include additional monitoring, habitat protection, and habitat restoration (Environment and Climate Change Canada, 2021).

Double-Crested Cormorant (*Nannopterum auritum*)

Life History: The double-crested cormorant is a waterfowl that feeds mainly on fish, crustaceans, and amphibians. It prefers water less than 30 feet deep with rocky or gravel bottoms when diving for food. It rests in the daytime and roosts overnight beside water on offshore rocks, islands, steep cliffs, dead branches of trees, wharfs, jetties, or transmission lines. Perching sites must be barren of vegetation. The cormorant species requires considerable length of water or elevated perch for take-off. It breeds mostly from April to July or August and clutch size is usually 3 to 4. This species is monogamous and nests in colonies of a few to hundreds of pairs (Granholm, n.d.).

Abundance and Distribution: The double-crested cormorant is a yearlong resident along the entire coast of California and on inland lakes, in fresh, salt and estuarine waters. Summer residents of mountains and northeastern plateau are absent from about November to March and presumably migrate west and south to lowlands.

Threats: Threats include pesticides, habitat destruction and degradation, entanglement in fishing gear, and predation on eggs and young by gulls and crows (Granholm, n.d.).

Recovery Strategies: There are no recovery strategies for the double-crested cormorant.

American Porcupine (*Erethizon dorsatum*)

Life History: In California, the North American Porcupine has been designated as a Species of Greatest Conservation Need (CDFW, 2015). The species is a wide-ranging herbivore occurring throughout much of North America, often considered diet generalists, consuming a wide range of plant species and materials including leaves, bark, needles, forbs, grasses, and mast. (Woods, 1973; Roze, 2009) The wide distribution of porcupines is often attributed to their impressive physiological tolerance for heat and cold as well as their broad diet (Roze, 2009).

Distribution and Abundance: The North American Porcupine is one of the most widely distributed mammals in North America, but recent reports have suggested declines in parts of its range in the West. In California, little is known about the historical or current status of the porcupine, and maps of its distribution conflict considerably.

Threats: North American porcupines have faced extensive persecution due to their ability to injure pets and damage trees and property. Considered nothing but a pest for many decades, they have been actively killed by hunting, trapping, and poisoning, activities which were often sponsored by bounty programs in the past (Appel et al., 2021). Road mortality is a substantial danger to porcupines throughout their range. Being slow-moving and attracted to salt makes them prone to being hit by vehicles (Appel et al., 2017).

Recovery Strategies: Retention of hardwoods, conifers, and a diverse understory providing suitable habitat for dens and foraging are crucial to porcupine survival in California. More education with forest landowners, research, and monitoring is needed.

Grasshopper Sparrow (*Ammodramus savannarum*)

Life History: The grasshopper sparrow occurs in California primarily as a summer resident from March to September (Garrett and Dunn, 1981; McCaskie, et al., 1979); the breeding season extends from mid-March to August (Collier, 1994).

Distribution and Abundance: Grinnell and Miller (1944) described the grasshopper sparrow as a summer resident from Mendocino, Trinity, and Tehama counties south, west of the Cascade–Sierra Nevada axis and southeastern deserts, to San Diego County, from sea level to 4,900 feet (1494 meters), as in the San Jacinto Mountains. Along California's humid north coast, the grasshopper sparrow is found in prairies and pastures scattered in a largely forested landscape (Harris 2005, Hunter et al. 2005).

Threats: Urbanization, agricultural land coverage to vineyard, transition from native to non-native grasses, fire suppression, and grazing all threaten the grasshopper sparrow's crucial habitat (Shuford and Gardali, 2008)

Recovery Strategies: Retention of intact native grasslands and native shrubs such as California buckwheat and California sagebrush. More research is needed to assess the grasshopper sparrow in the Gualala River Watershed and California in general.

Osprey (Pandion haliaetus)

Life History: The osprey arrives in nesting habitat mid-March to early April, breeds from March to September, and migrates south in October along the western Sierra Nevada and the coast to Central and South America.

Distribution and Abundance: The osprey is found from northern California Cascade Ranges south to Lake Tahoe, and along the coast to Marin County. Ospreys are associated with large bodies of water holding fish, primarily in conifer habitats.

Threats: In the past, pesticides caused reproductive failure, though reproduction has improved since the banning of DDT in the 1970s.

Recovery strategies: There are no recovery strategies for the osprey.

APPENDIX C: NON-NATIVE PLANT SPECIES

Himalayan blackberry (*Rubus armeniacus* or *Rubus discolor*)

Himalayan blackberry (synonym: Armenian blackberry) is a vigorous, sprawling, vine-like evergreen shrub native to western Europe. It produces sweet, edible berry-like fruit and is both a valued cultivated plant as well as a rapidly spreading invasive weed. It is common in the Pacific Northwest and is expanding its range throughout the western United States. It easily spreads vegetatively and by seed. Himalayan blackberry can be easily distinguished from its California native cousin California blackberry (*Rubus ursinus*) by examining the canes (or stems) of the plant. Himalayan blackberry will have a deeply ribbed cane, with thick curved prickles. California blackberry will have a smooth cane, with much smaller straight prickles.

Himalayan blackberry rapidly displaces native plant species and produces thickets so dense that the lack of light severely limits understory plant growth. Native vegetation growing beneath Himalayan blackberry becomes highly suppressed from shading and crowding. The dense, prickly thickets also hinder control efforts and impede access for humans, wildlife, and livestock. When growing near waterways, the species may worsen streambank erosion since its relatively shallow roots do not stabilize soils as do other, more desirable native riparian vegetation.

Treatment of Himalayan blackberry requires frequent and persistent treatment. Chemical controls via foliar spray are the usual prescription for Himalayan blackberry. Himalayan blackberry readily re-sprouts following fire, and typically re-established vigorously post-treatment – fire is thus not a recommended practice, although it can be used to dispose of vegetative clippings. Prescribed herbivory with goats and sheep can be an effective way to keep new growth of blackberry at bay; however, they often will not eat the older canes readily (DiTomaso and Healy, 2007).

Scotch broom (Cytisus scoparius) and French broom (Genista monspessulana)

Scotch and French brooms are upright, woody shrubs that commonly grow to ten feet tall. They have sharply angled branches with simple (single) leaves on young branches and compound (multiple) leaves of three leaflets on older branches. They have yellow to white flowers that bloom between March and June. Management for both broom species is similar, and prevention is the best method of control. Should these species be located on the property, they should be eradicated immediately; they can establish a hardy seed bed that can remain in the soil for decades and capitalizes on disturbance events like fire or logging (DiTomaso and Healy, 2007).

Eradication methods at early stages are:

- Mechanical – Pulling
- Herbivory – limited to goats due to toxins in the plant
- Chemical – foliar spray with herbicide

Yellow starthistle (Centaurea solstitialis)

Yellow starthistle is a gray-green to blue-green plant with a deep, vigorous taproot. It produces bright, thistlelike yellow flowers with sharp spines surrounding the base. Yellow starthistle grows to heights varying from 6 inches to 5 feet. The stems of mature plants are rigid, spreading, and typically branching from the base in open areas. Stems and leaves are covered with a loose, cottony wool that gives them a whitish appearance. Stems appear winged due to leaf bases that extend beyond the nodes. Basal leaves are 2 to 3 inches long and deeply lobed. The upper leaves are short (0.5 to 1 inch long) and narrow with few lobes (UCANR, 2007).

Yellow starthistle seeds germinate from fall through spring, which corresponds to the normal rainy season in California. After germinating, the plant initially allocates most of its resources to root growth. By late spring, roots can extend over 3 feet into the soil profile, although the portion above ground is a relatively small basal rosette. This allows yellow starthistle to out-compete shallow-rooted annual species during the drier summer months when moisture availability is limited near the soil surface. It also helps explain why yellow starthistle survives well into the summer, long after other annual species have dried up, and why it can regrow after top removal from mowing or grazing.

Control of yellow starthistle cannot be accomplished with a single treatment or in a single year. Effective management requires control of the current population and suppression of seed production, combined with establishment of competitive, desirable vegetation. Control methods include well timed use of grazing, mechanical removal, prescribed fire, or chemical control (UCANR, 2007).

Medusahead (Taeniatherum caput-medusae)

Medusahead is a winter annual grass native to Europe. It reduces the amount of desirable forage on rangeland. Plants contain high amounts of silica making it unpalatable for livestock. In addition, the sharp, barbed awns can injure the face and mouth parts of grazing animals. Dead plants create a thick thatch taking two or more years to decompose, disturbing natural cycles of nutrients and other plants while fueling wildfires. (UCIPM, n.d.)

Medusahead is an erect winter annual grass up to 2ft tall, producing spikes of long-awned spikelets. Madusahead matures at least 2 to 4 weeks later in the season than most other annual grasses, generally turning brown much later. The mature plant has slender stems, and the leaf surfaces are glabrous or covered with soft, short hairs, and often appear glassy under magnification. Medusahead produces fibrous roots that grow throughout the cool season, depleting upper soil moisture early in the growing season and accessing deep soil moisture later on. Medusahead flowers early in the summer, its spokes are 0.5 to 2 inches long excluding awns, and the main spike axis does not break apart at maturity. The fertile seeds have long, often twisted, awns 1 to 3 inches long; the seeds and awns are covered with minute, upward-pointing barbs and are rough to the touch. Seed production is prolific. Some florets can remain attached to spikes long after plants turn brown, allowing seeds to disperse by clinging to fur or clothing. Most seeds germinate in fall after the first rain, but some seeds remain dormant or germinate in winter or spring. Seeds can germinate in dense litter under low moisture conditions. Seedlings remain attached to the long-awned floret. Seedlings can survive desiccation of the primary root and develop adventitious roots when moisture becomes available. Most seed appear to germinate or lose viability within 2 years in the field (DiTomaso and Healy, 2007).

Control methods include well-timed use of mowing (during flowering and before seed) and prescribed fire. Prescribed fire in low elevations has proved to be a very effective control method when timed at the point where the seed starts to head out but before seed drop, due to Medusahead's late seeding tendency other desirable grasses will have already dropped their seed (DiTomaso, 2013).

Gorse (Ulex europaeus)

Gorse is native to western Europe and a common invasive along the Pacific coast and elsewhere in North America. It prefers disturbed sites and can survive in many soil and sun conditions, although it is not resistant to very cold winters. Gorse is an important invasive species of concern due its high flammability. Gorse creates environmental conditions favorable to itself by fixing nitrogen and acidifying the upper soil layers, which it prefers. It can form very dense thickets and the plants have strong spines (California Invasive Pest Council, n.d.).
Shrubs are evergreen and grow to approximately 5 feet tall, with yellow pea like flowers typical of other plants in the Fabaceae group. Stems are highly branched and hold spines 1.5-2.5 inches long. Juvenile plants have soft green stems and trifolate leaves. Mature plants appear leafless, though spines produced are actually modified leaves. The root system is extensive and lateral. Reproduction occurs by seed which is produced after a plant reaches 1.5-3 years. Seeds are formed in pods which harden and dry and are then dispersed several feet when popped open. Individual plants may live for up to 30 years, and seeds may live a similar length in the soil(California Invasive Pest Council, n.d.).
Burning a stand can stimulate a flush of seedling germination and can be used prior to treatment with grazing or herbicide. Grazing is best conducted when plants are young and repeated grazing treatments have been shown to reduce seedling establishment and regrowth. One long-term study found that the best control of gorse included burning followed by repeat grazing. Effective herbicide treatments may include common growth regulators and aromatic amino acid inhibitors. In general hand pulling is only effective before a stand becomes established. There are two biological control agents established in California; neither achieve complete control especially in well established stands (California Invasive Pest Council, n.d.).

English Ivy (*Hedera helix*)

English ivy and its other close relatives (*H. canariensis, H. hibernica*) are native to Europe and common in North America as an ornamental plant. Ivy is a perennial, evergreen vine that can develop as a dense ground cover as well as vine up and over trees and shrubs. Trees with ivy infestations are susceptible to wind damage from extra weight, and ivy can easily shade out native species.

Ivy stems develop both adventitious roots and aerial root-like structures that allow plants to climb vegetation and buildings. Plants reproduce vegetatively from stems as well as from fruits after maturity at around ten years old. Stem fragments in contact with moist soil can develop into a new plant. Flowering occurs in fall and fruits mature in spring. Individual plants can live over 100 years.

Non-chemical control of ivy can be effective if all runners can be removed from the site or allowed to completely dry out on site, out of contact with the ground. Cutting promotes resprouting and should be conducted regularly or combined with herbicide use. For treating ivy in trees, “air gapping” the ivy (cutting away a small section of the vines between the ground and the canopy) can be an effective strategy, removing the connection with the soil and leaving upper vines to wither. Burning and grazing are not effective. Herbicide treatments may include common growth regulators, aromatic amino acid inhibitors, and branched-chain amino acid inhibitors (USDA, n.d.)

APPENDIX D: AMPHIBIAN SPECIES OF SPECIAL CONCERN

California Red-legged frog (Rana draytonii)

Life History: The California red-legged frog is the largest native frog in the western United States, and inhabits quiet pools of streams, marshes, and occasionally ponds (U.S. Fish and Wildlife Service, n.d.). It occurs along the Coast Ranges from Mendocino County south and in portions of the Sierra Nevada and Cascades ranges, usually below 1200 meters (3936 feet). They are a highly aquatic species with typically little movement away from streamside habitats but can become mobile during rainy periods. Adults feed on aquatic and terrestrial insects, crustaceans, snails, worms, fish, tadpoles, smaller frogs, and small mammals. Their aquatic larvae are mostly herbivorous. Their breeding period lasts from January to July, peaking in February in the south and March to July in the north. Females lay 750 to 4000 eggs in clusters up to 10 inches across, attached to vegetation 2 to 6 inches below the water surface. They require permanent or nearly permanent pools for larval development, which takes 11 to 20 weeks, and intermittent streams must retain surface water in pools year-round for frog survival (Zeiner, 1990).

Abundance and Distribution: The abundance and distribution of the California red-legged frog is relatively unknown due to insufficient data. In 2003, the North Coast Watershed Assessment Program included no reference to the species in their Gualala River Watershed Assessment Report.

Threats: Habitat loss and alteration, as well as non-native species, are the primary factors that have negatively impacted the California red-legged frog throughout its range. This species is listed as Federally Threatened and as a California Species of Special Concern.

Recovery Strategies: The following was prepared by U.S. Fish and Wildlife (2002) in the Recovery Plan for the California Red-legged Frog (Rana aurora draytonii). Listed below are recovery actions to provide guidance for watershed management plans.

- Protect suitable habitats and buffers in perpetuity.
- Develop and implement guidelines for maintaining adequate water flow regimes, particularly in California red-legged frog habitats downstream of impoundments, water diversions, and residential or industrial developments.
- Develop and implement best management practices to prevent or minimize adverse impacts to the California red-legged frog from in-stream and stream bank activities associated with mining operations.
- Control/eliminate non-native species/predators (plants, vertebrates, invertebrates) using methods that are determined to be the most effective.

- Reduce the detrimental effects of livestock grazing and increase incidental benefits associated with livestock grazing on public and private lands.
- Reduce the effects of timber harvest activities on the California red-legged frog and its habitat.
- Develop site-specific guidelines for recreational activities to reduce or eliminate impacts to the California red-legged frog where these activities pose an on-going threat to habitat quality.
- Decrease the exposure of the California red-legged frog and their habitat to contaminants.
- Develop guidelines for fire management practices (i.e., prescribed burns, emergency fire suppression, emergency water use) to decrease incidental impacts to the California red legged frog.
- Develop and implement best management practices to prevent or minimize adverse impacts to the California red-legged frog from in-stream and stream bank activities associated with flood control actions.
- Implement watershed management and protection plans using cooperative agreements and existing incentive programs (U.S. Fish and Wildlife Service, 2002).

California Giant Salamander (Dicamptodon ensatus)

Life History: California giant salamanders are year-round residents of north-central California, from southern Santa Cruz County to extreme southern Mendocino and Lake counties. They occur in elevations up to 2,160 meters (6,500 feet) primarily in humid coastal forests, especially in Douglas-fir, redwood, red fir, and montane and valley foothill riparian habitats. They live in or near streams in damp forests. Aquatic adults and larvae are found in cool, rocky streams and occasionally in lakes and ponds. Terrestrial adults search for prey such as snails, slugs, other invertebrates, small mice, shrews, possibly reptiles, and other amphibians under surface objects and in tunnels underground. (Stebbins, 1972).

Eggs are laid during spring in concealed locations several feet below the surface in cold, slowly flowing water in springs, channels, under streambanks, and beneath rocks and coarse woody debris in stream bottoms. They are usually found in cool, moist, forest habitats and are associated with rocky streams and springs. They are primarily nocturnal, but may be found in the day, and they are more active on rainy nights.

Abundance and Distribution: “Freshwater species are declining rapidly but more complete data are needed for determining the extent and cause(s) of population declines and extirpations. Integrating newer survey techniques, freely available data, and traditional field work may allow for more effective assessment of population decline" (Pitt et al., 2017).

The North Coast Watershed Assessment Program documented occurrence of the species in both the North Fork and Buckeye Creek subbasins in 2003.

Threats: This species is listed as a California Species of Special Concern and considered Near Threatened on the International Union for Conservation of Nature (IUCN) Red List (International Union for Conservation of Nature, 2020).

Recovery Strategies: There are no specific recovery strategies for the California Giant Salamander. However, strategies outlined for similar species (like the Pacific Giant Salamander) can be applied.

- Habitat protection and restoration
- Population monitoring

Foothill Yellow-legged frog (Rana boylii)

Life History: The foothill yellow-legged frog frequents rocky streams and rivers with rocky substrate and open, sunny banks, in forests, chaparral, and woodlands. Adults are sometimes found in isolated pools, vegetated backwaters, and deep, shaded, spring-fed pools. They reproduce aquatically, in large, open, sunny riverbanks from April to early July after streams have slowed from winter runoff. Eggs appear in grapelike clusters and are laid on the downstream side of rocks in shallow, slow-moving water. While they are attached to submerged rocks, pebbles, and occasionally vegetation, eggs hatch within 5 to 37 days, depending on water temperature. Foothill yellow-legged frog's diet consists of a wide variety of invertebrates, including aquatic, terrestrial, and flying insects, spiders, snails, and grasshoppers. Adults have been known to travel 1000 meters from breeding ground habitat, usually following intermittent or persistent cold-water streams.

Abundance and Distribution: In 2023, the U.S. Fish and Wildlife Service announced that it would provide Endangered Species Act protections to four of the six geographically and genetically distinct population segments (DPS) of the foothill yellow-legged frog. The Service previously determined the North Coast DPS of which the Gualala River Watershed is a part of, are not warranted for listing after data showed high levels of occupancy in streams located throughout their ranges, giving them greater ability to withstand environmental changes and catastrophic events.

Threats: The U.S. Fish and Wildlife Service has identified several threats to the Foothill Yellow Legged Frog which include altered waterflows that are related to water infrastructure, competition with and predation by non-native species, disease, precipitation and temperature changes related to climate change, as well as high-severity wildfires. Water-related recreation and habitat conversion and degradation also threaten this species (U.S. Fish and Wildlife Service, n.d.).

“This is the only clade with an increasing trend in genetic diversity (Peek, 2018). The proliferation of cannabis cultivation, particularly illicit grows in and around what is known as the Emerald Triangle (Humboldt, Mendocino and Trinity counties), the apparent increase in severe wildland fires in the area, and potential climate change effects are cause for concern (California Department of Fish and Wildlife (CDFW), 2019). As a result, this clade does not currently warrant listing as either endangered or threatened (CDFW, 2019).”

Recovery Strategies: No recovery plans or strategies were identified from California and federal sources. The IUCN suggests “continued and strengthened management of protected area(s) where this species occurs, and expanded protection of suitable habitat elsewhere in its range is needed in addition to additional research of this species' distribution, population status, ecology, and threats. Specifically, studies are needed to obtain information on its susceptibility to chytrid fungus” (International Union for Conservation of Nature, 2020).

Limiting stream flow manipulations will benefit the species as it “stands as a sentinel species for healthy stream ecosystems in California—stream flow manipulations have been identified as the primary cause of decline (Thomson et al., 2016), and a comparison of regulated and unregulated montane streams found that unregulated stream flows were associated with greater genetic diversity (Peek 2011)” (McCartney-Melstad et al., 2018)

APPENDIX E: ROAD UPGRADES FROM GUALALA RIVER WATERSHED COUNCIL 2024

Gualala River Watershed - Road Upgrading

Owner	Acres	Abandoned		Deacti-vated	Not Connected	Storm Proofed	Upgraded	Improved Total	Miles Total	Percent Disconnected	Road Miles/Square Mile	
		Fixed	Left								Total*	Connected*
WAA Name	*NF Gualala*											
Planning Watershed	*Billings Creek*											
Other	8,217							0.0	60.6	0.0%	4.7	4.7
Wheeler	882							0.0	3.8	0.0%	2.8	2.8
Gualala River Forest	1,551							0.0	14.7	0.0%	6.1	6.1
Billings Creek	10,650							0.0	79.1	0.0%	4.8	4.8
Planning Watershed	*Doty Creek*											
Gualala Redwood Timb	3,568			2.0	0.6	33.2	0.5	36.3	44.4	81.6%	8.0	1.5
Other	689					0.5		0.5	9.9	5.0%	9.2	8.8
Mendocino Redwood Co	370	0.2				1.0		1.3	5.6	22.7%	9.7	7.5
Doty Creek	4,628	0.2		2.0	0.6	34.7	0.5	38.0	60.0	63.4%	8.3	3.0
Planning Watershed	*Robinson Creek*											
Mendocino Redwood Co	509			0.8				0.8	6.7	12.6%	8.4	7.4
Gualala River Forest	1,982			0.0				0.0	21.4	0.1%	6.9	6.9
Gualala Redwood Timb	5,898	0.2	1.9	5.7	5.5	23.4	13.7	50.4	61.0	82.6%	6.6	1.2
Other	402			0.1		0.0		0.1	3.7	2.5%	5.8	5.7
Robinson Creek	8,792	0.2	1.9	6.6	5.5	23.4	13.7	51.3	92.8	55.3%	6.8	3.0
Planning Watershed	*Stewart Creek*											
Other	249							0.0	2.4	0.0%	6.1	6.1
Gualala River Forest	4,392							0.0	52.6	0.0%	7.7	7.7
Gualala Redwood Timb	1,944			1.3	0.1	0.8	1.9	4.1	22.8	17.9%	7.5	6.2
Stewart Creek	6,585			1.3	0.1	0.8	1.9	4.1	77.8	5.2%	7.6	7.2
NF Gualala	30,654	0.4	1.9	9.9	6.2	58.9	16.1	93.4	309.7	30.2%	6.5	4.5
WAA Name	*Rockpile*											
Planning Watershed	*Lower Rockpile Creek*											
Buckeye Forest	561				0.0			0.0	6.8	0.4%	7.8	7.8
Other	12			0.0				0.0	0.1	1.3%	5.0	4.9
Gualala River Forest	2					0.0	0.0	0.0	0.2	10.1%	54.4	48.9
Gualala Redwood Timb	2,371		0.5	1.3	2.3	2.9	1.7	8.7	22.8	38.2%	6.1	3.8
Lower Rockpile Creek	2,946		0.5	1.3	2.4	2.9	1.7	8.7	29.9	29.2%	6.5	4.6
Planning Watershed	*Middle Rockpile Creek*											
Other	3,428							0.0	26.7	0.0%	5.0	5.0
Buckeye Forest	248							0.0	2.8	0.0%	7.2	7.2
Gualala River Forest	3,793							0.0	34.9	0.0%	5.9	5.9
Howlett	697					0.0		0.0	6.0	0.2%	5.5	5.5
Middle Rockpile Creek	8,165					0.0		0.0	70.4	0.0%	5.5	5.5

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** Occasional very high road miles per square mile are the result of a very small acreage owned in a watershed with a road across it.*

Owner	Acres	Abandoned Fixed	Abandoned Left	Deacti-vated	Not Connected	Storm Proofed	Upgraded	Improved Total	Miles Total	Percent Disconnected	Road Miles/Square Mile Total*	Road Miles/Square Mile Connected*
Planning Watershed *Red Rock*												
Gualala Redwood Timb	9				0.0	0.1		0.1	0.2	48.1%	17.4	9.1
Gualala River Forest	1,561				0.0			0.0	14.7	0.0%	6.0	6.0
Other	4							0.0	0.0	0.0%	2.9	2.9
Buckeye Forest	645							0.0	6.1	0.0%	6.0	6.0
Red Rock	2,219				0.0	0.1		0.1	21.0	0.6%	6.1	6.0
Planning Watershed *Upper Rockpile Creek*												
Other	2,091							0.0	13.7	0.0%	4.2	4.2
Gualala River Forest	2,457							0.0	13.0	0.0%	3.4	3.4
Wheeler	438							0.0	2.3	0.0%	3.4	3.4
Foppiano	4,088							0.0	18.3	0.0%	2.9	2.9
Upper Rockpile Creek	9,073							0.0	47.4	0.0%	3.3	3.3
Rockpile	22,403		0.5	1.3	2.4	3.0	1.7	8.9	168.7	5.3%	4.8	4.6
WAA Name *Buckeye*												
Planning Watershed *Flat Ridge Creek*												
Other	2,465							0.0	12.7	0.0%	3.3	3.3
Buckeye Forest	4,063							0.0	40.4	0.0%	6.4	6.4
Flat Ridge Creek	6,529							0.0	53.1	0.0%	5.2	5.2
Planning Watershed *Grasshopper Creek*												
Other	1,955					1.2	0.2	1.3	22.3	5.9%	7.3	6.9
Buckeye Forest	3,811						1.0	1.0	40.5	2.5%	6.8	6.6
Grasshopper Creek	5,766					1.2	1.2	2.4	62.8	3.7%	7.0	6.7
Planning Watershed *Harpo Reach*												
Other	1,323					0.0		0.0	6.9	0.6%	3.3	3.3
Buckeye Forest	786					0.2		0.2	7.4	2.2%	6.0	5.9
Howlett	613					2.0		2.0	7.9	25.9%	8.2	6.1
Harpo Reach	2,722					2.2		2.2	22.2	10.1%	5.2	4.7
Planning Watershed *Little Creek*												
Buckeye Forest	1,256					0.0	0.0	0.0	19.3	0.0%	9.8	9.8
Gualala Redwood Timb	2,410	0.2		0.6	1.2	4.5	7.4	13.9	33.4	41.6%	8.9	5.2
Other	2,202					0.8		0.8	28.2	3.0%	8.2	7.9
Little Creek	5,868	0.2		0.6	1.2	5.3	7.4	14.7	80.8	18.2%	8.8	7.2
Planning Watershed *North Fork Osser Creek*												
Gualala River Forest	226							0.0	0.7	0.0%	2.0	2.0
Other	4,673							0.0	31.0	0.0%	4.2	4.2
North Fork Osser Cree	4,899							0.0	31.7	0.0%	4.1	4.1
Buckeye	25,784	0.2		0.6	1.2	8.7	8.6	19.3	250.6	7.7%	6.2	5.7

Thursday, February 8, 2024 *Page 2 of 5*

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Owner	Acres	Abandoned Fixed	Abandoned Left	Deacti-vated	Not Connected	Storm Proofed	Upgraded	Improved Total	Miles Total	Percent Disconnected	Road Miles/Square Mile Total*	Road Miles/Square Mile Connected*
WAA Name	*Wheatfield*											
Planning Watershed *Annapolis*												
Other	2,279			0.0		0.5		0.5	24.1	2.3%	6.8	6.6
Mendocino Redwood Co	3,121			0.1		2.2		2.3	34.1	6.6%	7.0	6.5
Gualala Redwood Timb	2,179	0.7	0.5	5.5		1.8	0.1	8.7	27.5	31.6%	8.1	5.5
Annapolis	7,579	0.7	0.5	5.6		4.5	0.1	11.5	85.7	13.4%	7.2	6.3
Planning Watershed *Britain Creek*												
Other	4,220							0.0	22.3	0.0%	3.4	3.4
Soper Wheeler	2,488							0.0	13.7	0.0%	3.5	3.5
Britain Creek	6,708							0.0	36.0	0.0%	3.4	3.4
Planning Watershed *Buck Mountain*												
Buckeye Forest	4							0.0	0.1	0.0%	17.8	17.8
Other	8,185							0.0	41.0	0.0%	3.2	3.2
Buck Mountain	8,189							0.0	41.1	0.0%	3.2	3.2
Planning Watershed *Fuller Creek*												
Mendocino Redwood Co	885					1.1		1.1	7.2	14.6%	5.2	4.4
Other	2,784		0.1			13.2		13.2	27.9	47.3%	6.4	3.4
Buckeye Forest	3,370	1.2	1.1	3.7		2.1		8.1	38.9	20.9%	7.4	5.8
Fuller Creek	7,039	1.2	1.2	3.7		16.3		22.4	74.0	30.3%	6.7	4.7
Planning Watershed *Haupt Cr*												
Mendocino Redwood Co	614		0.6			0.2		0.7	5.1	14.6%	5.3	4.5
Soper Wheeler	32							0.0	0.3	0.0%	6.1	6.1
Other	3,955							0.0	18.0	0.0%	2.9	2.9
Ohlson	1,443							0.0	9.0	0.0%	4.0	4.0
Haupt Cr	6,043		0.6			0.2		0.7	32.3	2.3%	3.4	3.3
Planning Watershed *House Creek*												
Soper Wheeler	3,139							0.0	10.1	0.0%	2.1	2.1
Other	2,155							0.0	14.7	0.0%	4.4	4.4
House Creek	5,293							0.0	24.8	0.0%	3.0	3.0
Planning Watershed *Pepperwood Creek*												
Soper Wheeler	4,371							0.0	18.5	0.0%	2.7	2.7
Other	1,870					0.0		0.0	9.2	0.0%	3.1	3.1
Pepperwood Creek	6,241					0.0		0.0	27.7	0.0%	2.8	2.8
Planning Watershed *Tobacco Creek*												
Other	2,705					1.5		1.5	18.8	8.0%	4.4	4.1
Soper Wheeler	279							0.0	1.0	0.0%	2.3	2.3
Buckeye Forest	2,174							0.0	19.4	0.0%	5.7	5.7
Ohlson	569					0.3		0.3	4.0	8.4%	4.5	4.1
Mendocino Redwood Co	2,334	1.6				6.8		8.4	18.2	46.2%	5.0	2.7
Tobacco Creek	8,061	1.6				8.6		10.2	61.4	16.7%	4.9	4.1

Thursday, February 8, 2024 *Page 3 of 5*

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Owner	Acres	Abandoned Fixed	Abandoned Left	Deactivated	Not Connected	Storm Proofed	Upgraded	Improved Total	Miles Total	Percent Disconnected	Road Miles/Square Mile Total*	Road Miles/Square Mile Connected*
Planning Watershed *Tombs Creek*												
Silva Ranch	1,373					7.5		7.5	13.1	57.0%	6.1	2.6
Other	4,865					0.0		0.0	21.6	0.1%	2.8	2.8
Tombs Creek	6,237					7.5		7.5	34.8	21.6%	3.6	2.8
Planning Watershed *Wolf Creek*												
Soper Wheeler	1,577							0.0	6.7	0.0%	2.7	2.7
Buckeye Forest	2,733							0.0	22.0	0.0%	5.1	5.1
Silva Ranch	2,782					2.3		2.3	11.6	19.6%	2.7	2.1
Other	3,009							0.0	17.6	0.0%	3.7	3.7
Wolf Creek	10,101					2.3		2.3	57.8	3.9%	3.7	3.5
Wheatfield	71,492	3.5	2.3	9.3		39.4	0.1	54.7	475.7	11.5%	4.3	3.8
WAA Name *SF Gualala*												
Planning Watershed *Big Pepperwood Creek*												
Other	678	0.0				0.1		0.1	9.9	1.2%	9.3	9.2
Gualala Redwood Timb	5,853	1.5	1.2	3.9	2.5	24.4	12.7	46.2	74.1	62.4%	8.1	3.0
Big Pepperwood Cree	6,531	1.5	1.2	3.9	2.5	24.5	12.7	46.3	84.0	55.2%	8.2	3.7
Planning Watershed *Lower Marshall Creek*												
Other	6,016							0.0	35.2	0.0%	3.7	3.7
Lower Marshall Creek	6,016							0.0	35.2	0.0%	3.7	3.7
Planning Watershed *Middle South Fork Gualala Ri*												
Mendocino Redwood Co	3							0.0	0.2	0.0%	38.9	38.9
Other	7,907							0.0	44.2	0.0%	3.6	3.6
Middle South Fork Gu	7,910							0.0	44.4	0.0%	3.6	3.6
Planning Watershed *Mouth of the Gualala River*												
Gualala Redwood Timb	3,516			0.0	0.3	6.1	12.7	19.2	45.5	42.1%	8.3	4.8
Other	1,788							0.0	21.3	0.0%	7.6	7.6
Mouth of the Gualala	5,305			0.0	0.3	6.1	12.7	19.2	66.8	28.7%	8.1	5.7
Planning Watershed *Upper Marshall Creek*												
Other	6,619					14.3		14.3	40.4	35.4%	3.9	2.5
Upper Marshall Creek	6,619					14.3		14.3	40.4	35.4%	3.9	2.5
Planning Watershed *Upper South Fork Gualala Ri*												
Soper Wheeler	4							0.0	0.0	0.0%	0.1	0.1
Other	8,399					8.1		8.1	57.1	14.2%	4.4	3.7
Upper South Fork Gua	8,403					8.1		8.1	57.1	14.2%	4.4	3.7
SF Gualala	40,783	1.5	1.2	4.0	2.7	53.1	25.5	88.0	327.8	26.8%	5.1	3.8

Thursday, February 8, 2024 *Page 4 of 5*

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Owner	Acres	Abandoned Fixed	Abandoned Left	Deacti-vated	Not Connected	Storm Proofed	Upgraded	Improved Total	Miles Total	Percent Disconnected	Road Miles/Square Mile Total*	Road Miles/Square Mile Connected*
WAA Name	*Coastal Gualala*											
Planning Watershed	*Black Point*											
Other	3,493					0.0		0.0	47.9	0.0%	8.8	8.8
Gualala Redwood Timb	1,128					3.5	0.4	3.9	14.0	28.1%	7.9	5.7
Black Point	4,621					3.5	0.4	3.9	61.9	6.4%	8.6	8.0
Coastal Gualala	4,621					3.5	0.4	3.9	61.9	6.4%	8.6	8.0
Grand Total	195,737	5.7	5.9	25.1	12.5	166.6	52.4	268.2	1,594.3	16.8%	5.2	4.3

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APPENDIX F: GUALALA RIVER WATERSHED COUNCIL MONITORING DATA SUMMARY 1992 – 2023

Stream Monitoring Report

Ownerships: All
Visit Purpose: All
Planning Watersheds: All

Station Number	Name	Miles Up Stream	Year	Temperature		LWD Bank Full >6 In & >4 Ft or >10 CuFt		Substrate		Streambed (Thalweg)			Riparian Zone				Fish or Redds per Mile			Aquatic Macroinvertebrates				
				Seasonal Maximum	MWAT	CuFt/ 1000'	Pieces/ 1000'	>0.85 mm	D50	Slope	VI	A/D	Canopy %	WLPZ Cr.	Basal Area	Tallest Tree	Coho	SH (1+)	Redds	Richness	Simpson	Hilsenhoff	Russian R Index	% Dominant
Hydrologic Unit	NF Gualala																							
Stream	Abieta Springs																							
752	AbtT	0.09	2009	17.9	16.6																			
Abieta Springs			Avg	17.9	16.6																			
Stream	Bear Creek																							
693	Bear	0.80	2009	17.1	15.1																			
693	Bear	0.80	2013	21.2	18.7																			
693	Bear	0.80	2014	19.5	17.2																			
693	Bear	0.80	2015	19.9	17.5																			
Bear Creek			Avg	19.4	17.2																			
Stream	Billings Cr																							
698	Bil	0.00	2004	25.2	21.6																			
698	Bil	0.00	2009	26.0	20.8																			
698	Bil	0.00	2013	26.0	22.1																			
698	Bil	0.00	2014	21.7	18.6																			
Billings Cr			Avg	24.7	20.8																			
Stream	Doty Creek																							
813	013	0.00	2013														0	122	0					
813	013	0.00	2014														0	154						
813	013	0.00	2015														0	260						
813	013	0.00	2016														0	126						
256	Dot2	0.02	1993					16%																
256	Dot2	0.02	1994					11%																
256	Dot2	0.02	1995					17%																
256	Dot2	0.02	1997					17%																
281	Dot1	0.02	1994	14.1	12.9																			
281	Dot1	0.02	1998	14.8	13.7																			
281	Dot1	0.02	2008	14.5	13.4																			
281	Dot1	0.02	2012	13.8	12.7																			
281	Dot1	0.02	2014	14.5	13.5																			
280	Dot3	0.83	2013	12.9	12.9																			

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Station Number	Name	Miles Up Stream	Year	Temperature		LWD Bank Full >6 In & >4 Ft or >10 CuFt		Substrate		Streambed (Thalweg)			Riparian Zone				Fish or Redds per Mile			Aquatic Macroinvertebrates				
				Seasonal Maximum	MWAT	CuFt/ 1000'	Pieces/ 1000'	>0.85 mm	D50	Slope	VI	A/D	Canopy WLPZ	% Cr.	Basal Area	Tallest Tree	Coho	SH (1+)	Redds	Richness	Simpson	Hilsenhoff	% Dominant	Russian R Index
280	Dot3	0.83	2014	13.7	13.5																			
Doty Creek			Avg	14.0	13.3			16%									0	165	0					
Stream			Dry Creek																					
816	016	0.00	2013														0	249	2					
816	016	0.00	2014														0	200	0					
816	016	0.00	2015														0	193						
816	016	0.00	2016														0	91						
211	Dry3	0.19	1995	17.7	15.7			17%																
211	Dry3	0.19	1996	17.7	15.9																			
211	Dry3	0.19	1997	16.9	15.2			13%																
211	Dry3	0.19	1998			3,148	57		48	0.8%	22						16	0						
211	Dry3	0.19	1999			2,815	53		58	0.7%	20	-0.10	86%	87%	207	118	0	148						
211	Dry3	0.19	2000	16.5	14.8	2,834	49		60	0.7%	21	-0.07	84%	77%			0	48		32	0.79	4.4	16	40
211	Dry3	0.19	2001	16.4	14.1	5,442	85		56	0.7%	19	-0.10					0	127						
211	Dry3	0.19	2002	15.6	14.0	6,558	96		62	0.7%	17	-0.39					11	143						
211	Dry3	0.19	2003	16.1	14.9	7,470	95		43	0.7%	22	-0.33					0	174						
211	Dry3	0.19	2004	14.8	13.7	7,376	101		38	0.8%	29	-0.27					23	175						
211	Dry3	0.19	2005	16.4	15.0	7,312	99		36	0.8%	29	-0.22												
211	Dry3	0.19	2006			7,302	95		29	0.8%	21	0.52												
211	Dry3	0.19	2007			7,229	101		26	0.8%	20	0.54												
211	Dry3	0.19	2008	14.9	13.8	7,519	116		21	0.8%	21	0.42	93%	82%			0	0						
211	Dry3	0.19	2009	15.2	13.7	7,542	119		31	0.9%	23	0.42	88%	79%			0	407						
211	Dry3	0.19	2010	15.4	14.1	7,623	119		30	0.9%	21	0.56												
211	Dry3	0.19	2011	15.0	13.8	7,629	120		30	0.9%	21	0.39	82%	80%			0	63						
211	Dry3	0.19	2012			7,434	118		33	0.9%	25	0.19												
211	Dry3	0.19	2013	14.5	13.0	7,413	115		27	0.9%	22	0.10												
211	Dry3	0.19	2014	15.0	13.8	7,703	117		32	0.9%	24	0.14					0	90						
211	Dry3	0.19	2015			7,133	123		36	1.0%	20	0.14	85%	78%										
211	Dry3	0.19	2016	15.8	14.3	8,154	135		37	1.0%	18	-0.16	87%	82%			0	21						
211	Dry3	0.19	2017	15.7	14.7	8,100	128		32	0.6%	25	-0.07	90%	85%			0	37						
211	Dry3	0.19	2018	15.1	13.6	8,136	131		28	0.7%	21	0.00					0	26						
211	Dry3	0.19	2019	16.0	14.9	7,382	116		27	0.7%	16	0.61	88%	82%										
211	Dry3	0.19	2020			7,664	155		33	0.7%	15	0.67	95%	87%										
211	Dry3	0.19	2021			7,877	159		30	0.7%	16	0.67	88%	74%										
211	Dry3	0.19	2023	15.7	14.2	7,994	164		30	0.7%	21	0.38	89%	71%										

Station Number	Name	Miles Up Stream	Year	Temperature: Seasonal Maximum	Temperature: MWAT	LWD Bank Full (>6 In & >4 Ft or >10 CuFt): CuFt/ 1000'	LWD Bank Full: Pieces/ 1000'	Substrate: >0.85 mm	Substrate: D50	Streambed (Thalweg): Slope	Streambed (Thalweg): VI	Streambed (Thalweg): A/D	Riparian Zone: Canopy % WLPZ	Riparian Zone: Canopy % Cr.	Riparian Zone: Basal Area	Riparian Zone: Tallest Tree	Fish or Redds per Mile: Coho	Fish or Redds per Mile: SH (1+)	Fish or Redds per Mile: Redds	Aquatic Macroinvertebrates: Richness	Aquatic Macroinvertebrates: Simpson	Aquatic Macroinvertebrates: Hilsenhoff	Aquatic Macroinvertebrates: % Dominant	Aquatic Macroinvertebrates: Russian R Index
212	Dry2	1.29	1995	20.9	17.9																			
212	Dry2	1.29	1996	20.7	17.8																			
212	Dry2	1.29	1997	20.5	17.9																			
212	Dry2	1.29	1998	20.6	17.6																			
212	Dry2	1.29	2000			2,477	37			1.8%	13		76%	56%	81	90				41	0.92	4.5	22	19
212	Dry2	1.29	2004														0	500						
212	Dry2	1.29	2005	17.9	16.1																			
212	Dry2	1.29	2008	16.8	15.9	2,185	28		36	1.9%	14	-0.40	87%	85%										
212	Dry2	1.29	2009	16.8	15.7																			
212	Dry2	1.29	2011	16.7	15.3																			
212	Dry2	1.29	2012	16.5	15.1																			
212	Dry2	1.29	2017	18.1	16.9																			
753	Dry1	1.61	2009	16.5	15.7																			
Dry Creek			Avg	16.7	15.1	6,572	105	14%	37	0.9%	21	0.15	87%	79%	144	104	3	142	1	37	0.86	4.5	19	30
Stream			Little North Fork Gualala																					
811	011	0.00	2013														0	167	7					
811	011	0.00	2014														0	127	1					
811	011	0.00	2015														0	159	0					
811	011	0.00	2016														0	144						
201	LNF5	0.02	1992					11%																
201	LNF5	0.02	1993					21%																
201	LNF5	0.02	1994	15.8	14.7			20%																
201	LNF5	0.02	1995	16.7	15.1			21%																
201	LNF5	0.02	1996	15.9	14.6																			
201	LNF5	0.02	1997	16.7	15.4			16%																
201	LNF5	0.02	1998	16.3	15.0																			
201	LNF5	0.02	2001	16.5	14.8																			
201	LNF5	0.02	2003	16.1	15.0																			
201	LNF5	0.02	2004	16.9	15.7																			
201	LNF5	0.02	2005	15.6	14.5																			
201	LNF5	0.02	2008	16.4	15.2																			
201	LNF5	0.02	2009	15.8	14.8																			
201	LNF5	0.02	2010	15.0	13.7																			
201	LNF5	0.02	2011	15.1	14.0																			
201	LNF5	0.02	2012	14.8	13.9																			

Station Number	Name	Miles Up Stream	Year	Temperature: Seasonal Maximum	Temperature: MWAT	LWD Bank Full (>6 In & >4 Ft or >10 CuFt): CuFt/ 1000'	LWD Bank Full: Pieces/ 1000'	Substrate: >0.85 mm	Substrate: D50	Streambed (Thalweg): Slope	Streambed (Thalweg): VI	Streambed (Thalweg): A/D	Riparian Zone: Canopy % WLPZ	Riparian Zone: Cr.	Riparian Zone: Basal Area	Riparian Zone: Tallest Tree	Fish or Redds per Mile: Coho	Fish or Redds per Mile: SH (1+)	Fish or Redds per Mile: Redds	Aquatic Macroinvertebrates: Richness	Aquatic Macroinvertebrates: Simpson	Aquatic Macroinvertebrates: Hilsenhoff	Aquatic Macroinvertebrates: Russian R Index	Aquatic Macroinvertebrates: % Dominant
201	LNF5	0.02	2013	16.6	15.7																			
201	LNF5	0.02	2014	16.0	15.1																			
201	LNF5	0.02	2015	16.5	15.6																			
201	LNF5	0.02	2016	15.0	14.3																			
201	LNF5	0.02	2017	16.8	16.2																			
201	LNF5	0.02	2018	15.3	14.6																			
201	LNF5	0.02	2019	16.4	15.5																			
201	LNF5	0.02	2020	16.8	15.6																			
201	LNF5	0.02	2021	15.4	14.5																			
201	LNF5	0.02	2022	16.4	15.5																			
201	LNF5	0.02	2023	16.1	15.4																			
404	LNF3	0.45	1998														16	0						
404	LNF3	0.45	2001			5,250	83		34	0.6%	33		97%	96%	163	121								
404	LNF3	0.45	2003														0	589						
404	LNF3	0.45	2004			5,102	69		33	0.8%	57	-0.61					0	70						
404	LNF3	0.45	2013	16.4	15.1																			
404	LNF3	0.45	2014	15.6	14.7																			
404	LNF3	0.45	2019	16.4	15.5	9,493	166		19	0.9%	32	0.88	94%	93%	431	169								
404	LNF3	0.45	2021	15.6	14.3																			
404	LNF3	0.45	2022	16.0	14.9																			
404	LNF3	0.45	2023	15.9	15.3																			
812	012	1.29	2013															297	0					
812	012	1.29	2014														0	297	3					
812	012	1.29	2015														0	565						
812	012	1.29	2016														0	418						
202	LNF2	1.47	1993					11%																
202	LNF2	1.47	1994	16.4	14.6			15%																
202	LNF2	1.47	1995	16.4	14.6			19%																
202	LNF2	1.47	1996	16.1	14.1																			
202	LNF2	1.47	1997					20%																
202	LNF2	1.47	1998														32	0						
202	LNF2	1.47	2003														0	322						
202	LNF2	1.47	2004														0	391						
202	LNF2	1.47	2013	17.1	15.2																			
202	LNF2	1.47	2016	15.6	14.4																			

Station Number	Name	Miles Up Stream	Year	Temperature		LWD Bank Full >6 In & >4 Ft or >10 CuFt		Substrate		Streambed (Thalweg)			Riparian Zone				Fish or Redds per Mile			Aquatic Macroinvertebrates				
				Seasonal Maximum	MWAT	CuFt/ 1000'	Pieces/ 1000'	>0.85 mm	D50	Slope	VI	A/D	Canopy % WLPZ	Cr.	Basal Area	Tallest Tree	Coho	SH (1+)	Redds	Richness	Simpson	Hilsenhoff	% Dominant	Russian R Index
203	LNF1	2.27	1993					17%																
203	LNF1	2.27	1994	15.1	13.6			20%																
203	LNF1	2.27	1995	15.8	14.2			12%																
203	LNF1	2.27	1996	15.3	13.7																			
203	LNF1	2.27	1997	15.8	14.5			19%																
203	LNF1	2.27	1998	15.2	13.9	3,010	65		25	1.5%	23						0	0						
203	LNF1	2.27	1999	15.1	13.8	3,632	73		43	1.5%	21	-0.19	87%	89%	255	143	0	285						
203	LNF1	2.27	2000	15.3	13.9	3,771	71		46	1.5%	21	-0.08					0	143		31	0.85	4.5	19	30
203	LNF1	2.27	2001	15.2	13.5	4,802	119		42	1.5%	20	-0.10					0	148						
203	LNF1	2.27	2002	14.5	13.0	4,969	138		65	1.4%	28	-0.26					0	169						
203	LNF1	2.27	2003	15.2	14.0	4,951	140		60	1.4%	30	-0.40					0	235						
203	LNF1	2.27	2004	15.6	14.2	4,915	140		42	1.5%	32	-0.73					0	666						
203	LNF1	2.27	2005	14.9	13.6	5,083	139		40	1.4%	31	-0.93								30		4.6		41
203	LNF1	2.27	2006			5,393	136		36	1.5%	28	-1.08												
203	LNF1	2.27	2007			5,418	137		31	1.5%	31	-0.38												
203	LNF1	2.27	2008	15.3	13.9	6,027	154		23	1.4%	34	-0.72	86%	88%	475	185	0	58						
203	LNF1	2.27	2009	15.1	13.7	6,133	155		48	1.5%	34	-0.66	89%	91%			0	803						
203	LNF1	2.27	2010	14.5	13.1	6,153	153		42	1.5%	33	-0.62												
203	LNF1	2.27	2011	14.6	13.4	6,107	158		43	1.4%	40	-0.53	77%	89%			0	433						
203	LNF1	2.27	2012	14.1	13.0	8,158	181		37	1.5%	33	-0.56					0	343						
203	LNF1	2.27	2013	15.5	14.2	8,209	184		33	1.5%	34	-0.53					0	238						
203	LNF1	2.27	2014	15.1	14.1	8,169	184		26	1.5%	35	-0.36					0	480						
203	LNF1	2.27	2015	15.5	14.4	8,044	182		34	1.5%	34	-0.40	86%	89%			0	243						
203	LNF1	2.27	2016	14.7	13.6	8,181	184		35	1.5%	31	-0.43	89%	88%			0	259						
203	LNF1	2.27	2017	16.0	14.9	8,283	191		34	1.5%	28	-0.52	93%	93%			0	121						
203	LNF1	2.27	2018	14.7	13.6	8,237	194		36	1.5%	31	-0.34	94%	95%			0	74						
203	LNF1	2.27	2019	15.9	14.8	9,275	193		27	1.5%	24	0.45	94%	94%										
203	LNF1	2.27	2020	15.6	14.4	9,201	194		26	1.6%	24	0.53	96%	95%										
203	LNF1	2.27	2021	14.9	13.7	8,833	193		28	1.6%	22	0.43	91%	93%										
203	LNF1	2.27	2022	15.6	14.4	9,187	196		28	1.6%	26	0.60	92%	90%										
203	LNF1	2.27	2023	15.3	14.4	9,415	193		36	1.5%	28	0.21	94%	94%										
408	LNF7	2.37	2005	14.9	13.7																			
255	LNF6	2.86	1993					19%																
255	LNF6	2.86	1994	15.9	14.3			17%																
255	LNF6	2.86	1995					12%																

Station Number	Name	Miles Up Stream	Year	Temperature: Seasonal Maximum	Temperature: MWAT	LWD Bank Full >6 In & >4 Ft or >10 CuFt: CuFt/ 1000'	LWD Bank Full: Pieces/ 1000'	Substrate: >0.85 mm	Substrate: D50	Streambed (Thalweg): Slope	Streambed (Thalweg): VI	Streambed (Thalweg): A/D	Riparian Zone: Canopy WLPZ	Riparian Zone: % Cr.	Riparian Zone: Basal Area	Riparian Zone: Tallest Tree	Fish or Redds per Mile: Coho	Fish or Redds per Mile: SH (1+)	Fish or Redds per Mile: Redds	Aquatic Macroinvertebrates: Richness	Aquatic Macroinvertebrates: Simpson	Aquatic Macroinvertebrates: Hilsenhoff	Aquatic Macroinvertebrates: Russian R Index	Aquatic Macroinvertebrates: % Dominant
255	LNF6	2.86	1997					26%																
255	LNF6	2.86	2013	15.2	14.7																			
255	LNF6	2.86	2014	15.5	14.8																			
Little North Fork Gualala			Avg	15.7	14.5	6,669	151	18%	36	1.4%	30	-0.3	90%	92%	331	155	2	266	2	30	0.85	4.5	19	35
Stream	Lost Creek																							
215	LCr	0.04	1995	16.4	15.3																			
215	LCr	0.04	1996	15.8	15.1																			
215	LCr	0.04	1998	17.0	15.9																			
Lost Creek			Avg	16.4	15.4																			
Stream	McGann Gulch																							
815	015	0.00	2013														0	0	0					
815	015	0.00	2014														0	0						
815	015	0.00	2015														0	42						
815	015	0.00	2016														0	20						
209	MGG2	0.08	1995	16.7	15.9			19%																
209	MGG2	0.08	1996	16.4	15.6																			
209	MGG2	0.08	1997	15.5	14.4			23%																
209	MGG2	0.08	2003														0	104						
210	MGG1	0.42	1995	20.4	16.4																			
210	MGG1	0.42	2002	14.2	13.9																			
210	MGG1	0.42	2003	14.8	14.6																			
210	MGG1	0.42	2004	14.9	14.5																			
210	MGG1	0.42	2008	14.1	13.5																			
210	MGG1	0.42	2011	13.9	13.8																			
McGann Gulch			Avg	15.6	14.7			22%									0	33	0					
Stream	North Fork Gualala																							
801	001	0.00	2013															141						
801	001	0.00	2014														0	712	0					
801	001	0.00	2015														0	344						
801	001	0.00	2016														0	31						
251	NFG	0.06	1996	19.0	16.6																			
251	NFG	0.06	1997	19.3	17.5																			
251	NFG	0.06	2000	19.0	16.4																			
473	NFG4	0.44	2001	19.3	16.6	2,518	64		26	0.3%	28		93%	84%	135	138								
473	NFG4	0.44	2003														0	291						

Station Number	Name	Miles Up Stream	Year	Temperature Seasonal Maximum	Temperature MWAT	LWD Bank Full >6 In & >4 Ft or >10 CuFt CuFt/1000'	LWD Bank Full Pieces/1000'	Substrate >0.85 mm	Substrate D50	Streambed (Thalweg) Slope	Streambed VI	Streambed A/D	Riparian Zone Canopy % WLPZ	Riparian Zone Cr.	Riparian Zone Basal Area	Riparian Zone Tallest Tree	Fish or Redds per Mile Coho	SH (1+)	Redds	Aquatic Macroinvertebrates Richness	Simpson	Hilsenhoff	Russian R Index	% Dominant
473	NFG4	0.44	2009	17.9	15.7																			
473	NFG4	0.44	2013	18.3	16.1																			
473	NFG4	0.44	2015	17.9	15.9																			
473	NFG4	0.44	2016	17.4	15.6																			
473	NFG4	0.44	2017	18.1	16.7																			
473	NFG4	0.44	2018	17.4	15.7																			
473	NFG4	0.44	2019	18.3	16.5																			
473	NFG4	0.44	2020	17.5	15.8																			
473	NFG4	0.44	2022	17.1	15.6																			
473	NFG4	0.44	2023	17.9	16.1																			
802	002	1.19	2013															268	3					
802	002	1.19	2014														0	644	1					
802	002	1.19	2015														0	373						
802	002	1.19	2016														0	48						
802	002	1.19	2018														0	44						
204	NFG3	1.25	1995	20.6	17.5																			
204	NFG3	1.25	1996	20.1	18.7																			
204	NFG3	1.25	1997	19.4	18.2																			
204	NFG3	1.25	1998	20.2	17.7												0	0						
204	NFG3	1.25	1999			2,326	46		19	0.4%	23		64%	46%	140	133	0	109						
204	NFG3	1.25	2000	19.9	17.0												0	698						
204	NFG3	1.25	2001	18.6	16.7	2,924	97		24	0.4%	26	-0.41					0	84						
204	NFG3	1.25	2002														0	317						
204	NFG3	1.25	2003														0	255						
204	NFG3	1.25	2007	19.2	17.3	3,172	57		15															
204	NFG3	1.25	2008	16.8	15.5	2,981	60		28	0.3%	31	-1.00	80%	69%			0	79						
204	NFG3	1.25	2009	17.7	15.9												0	1,484						
204	NFG3	1.25	2010	17.4	15.9																			
204	NFG3	1.25	2011	17.1	15.6																			
204	NFG3	1.25	2012	17.2	15.5																			
204	NFG3	1.25	2013	17.7	16.3																			
204	NFG3	1.25	2014	16.4	15.4												0	642						
204	NFG3	1.25	2015	16.3	15.3												0	209						
204	NFG3	1.25	2016	16.6	15.5												0	42						
204	NFG3	1.25	2017	18.4	16.8												0	50						

Station Number	Name	Miles Up Stream	Year	Temperature Seasonal Maximum	Temperature MWAT	LWD Bank Full >6 In & >4 Ft or >10 CuFt CuFt/ 1000'	LWD Bank Full Pieces/ 1000'	Substrate >0.85 mm	Substrate D50	Streambed (Thalweg) Slope	Streambed (Thalweg) VI	Streambed (Thalweg) A/D	Riparian Zone Canopy % WLPZ Cr.	Riparian Zone Basal Area	Riparian Zone Tallest Tree	Fish or Redds per Mile Coho	Fish or Redds per Mile SH (1+)	Fish or Redds per Mile Redds	Aquatic Macroinvertebrates Richness	Aquatic Macroinvertebrates Hilsenhoff	Aquatic Macroinvertebrates % Dominant	Aquatic Macroinvertebrates Simpson	Aquatic Macroinvertebrates Russian R Index
204	NFG3	1.25	2018	17.0	15.6											0	21						
204	NFG3	1.25	2019	18.1	16.9																		
204	NFG3	1.25	2020	16.8	15.2																		
204	NFG3	1.25	2022	16.4	15.3																		
204	NFG3	1.25	2023	17.3	16.0																		
803	003	2.71	2013														503	10					
803	003	2.71	2014													0	328	1					
803	003	2.71	2015													0	339	3					
803	003	2.71	2016													0	127	0					
803	003	2.71	2017													0	13						
258	NFG	3.83	1994	24.5	19.3																		
258	NFG	3.83	2011	18.7	16.3																		
258	NFG	3.83	2012	18.3	16.5																		
258	NFG	3.83	2016	18.1	16.8																		
258	NFG	3.83	2017	19.4	17.6																		
258	NFG	3.83	2018	18.4	16.8																		
258	NFG	3.83	2019	18.9	17.5																		
258	NFG	3.83	2021	17.5	16.3																		
258	NFG	3.83	2022	17.9	16.9																		
258	NFG	3.83	2023	18.6	17.0																		
804	004	3.83	2012															3					
804	004	3.83	2013														202	6					
804	004	3.83	2014													0	324	4					
804	004	3.83	2015													0	315						
804	004	3.83	2016													0	174						
205	NFG	4.94	1995	21.4	17.7																		
205	NFG	4.94	1996	20.4	17.8																		
205	NFG	4.94	1997	21.1	18.1																		
205	NFG	4.94	2001	19.3	17.0																		
205	NFG	4.94	2012	17.5	15.5																		
205	NFG	4.94	2013	18.6	16.0																		
205	NFG	4.94	2021	17.5	15.4																		
205	NFG	4.94	2022	17.1	15.4																		
205	NFG	4.94	2023	18.3	16.3																		
805	005	5.25	2012															3					

Station Number	Name	Miles Up Stream	Year	Temperature: Seasonal Maximum	Temperature: MWAT	LWD Bank Full >6 In & >4 Ft or >10 CuFt: CuFt/ 1000'	LWD Bank Full: Pieces/ 1000'	Substrate: >0.85 mm	Substrate: D50	Streambed (Thalweg): Slope	Streambed (Thalweg): VI	Streambed (Thalweg): A/D	Riparian Zone: Canopy % WLPZ	Riparian Zone: Cr.	Riparian Zone: Basal Area	Riparian Zone: Tallest Tree	Fish or Redds per Mile: Coho	Fish or Redds per Mile: SH (1+)	Fish or Redds per Mile: Redds	Aquatic Macroinvertebrates: Richness	Aquatic Macroinvertebrates: Simpson	Aquatic Macroinvertebrates: Hilsenhoff	Aquatic Macroinvertebrates: Russian R Index	Aquatic Macroinvertebrates: % Dominant
805	005	5.25	2013															494	10					
805	005	5.25	2014														0	566	3					
805	005	5.25	2015														0	267						
805	005	5.25	2016														0	196						
406	NFG2	5.38	1998	21.4	18.6																			
406	NFG2	5.38	2004														0	303						
406	NFG2	5.38	2012	18.3	16.0																			
406	NFG2	5.38	2013	19.4	16.8																			
406	NFG2	5.38	2015	19.4	16.6																			
406	NFG2	5.38	2017	19.7	17.3																			
474	NFG	6.08	2001	22.4	18.4																			
474	NFG	6.08	2002	20.9	18.7																			
474	NFG	6.08	2003	22.1	19.3																			
474	NFG	6.08	2004	20.5	18.8																			
474	NFG	6.08	2008	21.7	18.4																			
474	NFG	6.08	2010	20.3	17.6																			
474	NFG	6.08	2011	20.8	17.9																			
474	NFG	6.08	2012	18.7	15.9																			
474	NFG	6.08	2013	20.2	17.6																			
474	NFG	6.08	2014	19.7	16.5																			
474	NFG	6.08	2016	20.4	17.7																			
474	NFG	6.08	2017	21.2	18.9																			
474	NFG	6.08	2019	20.6	18.7																			
474	NFG	6.08	2020	19.0	17.5																			
474	NFG	6.08	2023	20.9	17.9																			
806	006	6.21	2013															65						
806	006	6.21	2014														0	388						
806	006	6.21	2015														0	169	0					
806	006	6.21	2016														0	142						
807	007	7.71	2013															171						
807	007	7.71	2014														0	616						
807	007	7.71	2015														0	248	5					
807	007	7.71	2016														0	240						
214	NFG	7.99	1995	23.9	21.0																			
214	NFG	7.99	1996	23.7	21.1																			

Station Number	Name	Miles Up Stream	Year	Temperature		LWD Bank Full >6 In & >4 Ft or >10 CuFt		Substrate		Streambed (Thalweg)			Riparian Zone				Fish or Redds per Mile			Aquatic Macroinvertebrates				
				Seasonal Maximum	MWAT	CuFt/ 1000'	Pieces/ 1000'	>0.85 mm	D50	Slope	VI	A/D	Canopy % WLPZ	Canopy % Cr.	Basal Area	Tallest Tree	Coho	SH (1+)	Redds	Richness	Simpson	Hilsenhoff	Russian R Index	% Dominant
214	NFG	7.99	1997	24.0	21.2																			
214	NFG	7.99	1998	24.3	21.4																			
214	NFG	7.99	2004														0	1,081						
214	NFG	7.99	2014	21.1	19.3																			
272	NFG	9.09	1994	24.5	21.4																			
272	NFG	9.09	2001	24.1	21.0																			
272	NFG	9.09	2009	22.9	19.2																			
272	NFG	9.09	2012	21.8	18.5																			
808	008	9.13	2013														0	714						
808	008	9.13	2014														0	796						
808	008	9.13	2015														0	572						
808	008	9.13	2016														0	394						
216	NFG1	9.85	1995	25.9	21.5																			
216	NFG1	9.85	1996	26.4	21.8																			
216	NFG1	9.85	1997	26.9	22.0																			
216	NFG1	9.85	2003														0	236						
216	NFG1	9.85	2012	20.8	18.2																			
809	009	11.02	2013														0	2,098						
809	009	11.02	2014														0	329						
809	009	11.02	2015														0	480						
809	009	11.02	2016														0	263						
810	010	12.16	2013															175	15					
810	010	12.16	2014														0	838	1					
810	010	12.16	2015														0	241						
810	010	12.16	2016														0	218						
810	010	12.16	2017														0	317						
691	NFG5	12.22	2004	24.4	21.0																			
691	NFG5	12.22	2009	23.2	19.5	227	4		20	0.3%	43		50%	43%	99	95								
691	NFG5	12.22	2013	23.4	20.7																			
691	NFG5	12.22	2014	20.7	18.5																			
691	NFG5	12.22	2015	19.8	18.8																			
691	NFG5	12.22	2017	23.7	19.8																			
North Fork Gualala			Avg	19.8	17.5	2,358	54		22	0.3%	30	-0.7	72%	61%	125	122	0	364	4					
Stream		Peaches Creek																						
269	Pea3	0.30	1994	16.2	15.7																			

Station Number	Name	Miles Up Stream	Year	Temperature: Seasonal Maximum	Temperature: MWAT	LWD Bank Full (>6 In & >4 Ft or >10 CuFt): CuFt/ 1000'	LWD Bank Full: Pieces/ 1000'	Substrate: >0.85 mm	Substrate: D50	Streambed (Thalweg): Slope	Streambed (Thalweg): VI	Streambed (Thalweg): A/D	Riparian Zone: Canopy % WLPZ	Riparian Zone: Canopy % Cr.	Riparian Zone: Basal Area	Riparian Zone: Tallest Tree	Fish or Redds per Mile: Coho	Fish or Redds per Mile: SH (1+)	Fish or Redds per Mile: Redds	Aquatic Macroinvertebrates: Richness	Aquatic Macroinvertebrates: Simpson	Aquatic Macroinvertebrates: Hilsenhoff	Aquatic Macroinvertebrates: Russian R Index	Aquatic Macroinvertebrates: % Dominant
269	Pea3	0.30	1998	17.5	16.0																			
269	Pea3	0.30	2008	16.8	15.5																			
269	Pea3	0.30	2009	16.2	15.2																			
269	Pea3	0.30	2012	16.0	14.7																			
213	Pea2	1.52	1995	17.0	16.0																			
213	Pea2	1.52	1996	17.3	16.1																			
213	Pea2	1.52	1997	17.8	16.4																			
Peaches Creek			Avg	16.9	15.7																			
Stream		Robinson Cr East																						
827	027	0.00	2013																8					
692	Rbn2	0.15	2004	20.6	17.9																			
692	Rbn2	0.15	2009	21.0	18.2	153	8		44	1.6%	65		73%	77%	163	92								
692	Rbn2	0.15	2013	21.7	19.5																			
692	Rbn2	0.15	2014	18.6	17.1																			
692	Rbn2	0.15	2015	19.3	17.4																			
697	Rbn1	0.47	2004			622	7		26	0.6%	23													
697	Rbn1	0.47	2009	23.0	18.7	690	11		33	0.6%	35	-0.39												
697	Rbn1	0.47	2013	20.0	19.0																			
Robinson Cr East			Avg	20.6	18.3	488	9		34	0.9%	41	-0.4	73%	77%	163	92			8					
Stream		Robinson Cr West																						
814	014	0.00	2012																0					
814	014	0.00	2013														0	185	0					
814	014	0.00	2014														0	394	0					
814	014	0.00	2015														0	76						
814	014	0.00	2016														0	130						
260	Rob	0.01	1994	14.6	13.8																			
207	Rob2	0.11	1995	19.6	15.8			15%																
207	Rob2	0.11	1996	19.6	15.7																			
207	Rob2	0.11	1997	20.2	16.2			18%																
207	Rob2	0.11	1998	18.5	15.4			18%									12	0						
207	Rob2	0.11	1999			1,643	49		36	1.4%	13		66%	74%	201	139	0	113						
207	Rob2	0.11	2000	17.2	14.7												0	422						
207	Rob2	0.11	2001														0	13						
207	Rob2	0.11	2003														0	100						
207	Rob2	0.11	2004														0	361						

Station Number	Name	Miles Up Stream	Year	Temperature		LWD Bank Full >6 In & >4 Ft or >10 CuFt		Substrate		Streambed (Thalweg)			Riparian Zone				Fish or Redds per Mile			Aquatic Macroinvertebrates				
				Seasonal Maximum	MWAT	CuFt/ 1000'	Pieces/ 1000'	>0.85 mm	D50	Slope	VI	A/D	Canopy % WLPZ	Canopy % Cr.	Basal Area	Tallest Tree	Coho	SH (1+)	Redds	Richness	Simpson	Hilsenhoff	Russian R Index	% Dominant
207	Rob2	0.11	2005	14.8	14.1																			
207	Rob2	0.11	2008	15.8	14.6												0	21						
207	Rob2	0.11	2009	15.6	14.5																			
207	Rob2	0.11	2010	14.7	13.6																			
207	Rob2	0.11	2011	15.1	14.0	1,713	48		22	1.3%	25	-0.32	88%	72%										
207	Rob2	0.11	2012	14.8	13.9																			
207	Rob2	0.11	2015	16.2	15.1																			
409	Rob	0.57	2005	16.0	14.6																			
263	Rob	0.78	1994	17.7	15.5																			
263	Rob	0.78	2003														0	101						
263	Rob	0.78	2004														0	317						
263	Rob	0.78	2011	14.9	14.0																			
263	Rob	0.78	2012	14.9	13.8																			
208	Rob1	1.29	1995	16.6	14.9																			
208	Rob1	1.29	1996	16.4	15.0																			
208	Rob1	1.29	1997	16.7	14.9																			
208	Rob1	1.29	1998	16.2	14.9																			
208	Rob1	1.29	2003														0	76						
Robinson Cr West			Avg	16.5	14.7	1,678	49	17%	29	1.4%	19	-0.3	77%	73%	201	139	1	165	0					
Stream			Sosueme Cr																					
206	Sosu	0.04	1995	20.4	14.2																			
206	Sosu	0.04	1996	16.9	14.2																			
206	Sosu	0.04	1997	16.4	13.8																			
206	Sosu	0.04	1998	16.5	14.4																			
206	Sosu	0.04	2000	18.0	14.0																			
Sosueme Cr			Avg	17.6	14.1																			
Hydrologic Uni	NF Gualala		Avg	17.7	15.9	5,818	114	18%	35	1.1%	27	-0.1	86%	82%	214	129	1	270	3	33	0.85	4.5	19	33
Hydrologic Unit			Rockpile																					
Stream			Dynamite Cr.																					
478	Dyn1	0.00	2002	14.8	13.4																			
478	Dyn1	0.00	2009	13.7	13.2																			
Dynamite Cr.			Avg	14.3	13.3																			
Stream			Emily Creek																					
276	Emy	0.07	1997	15.2	14.1																			

Station Number	Name	Miles Up Stream	Year	Temperature: Seasonal Maximum	Temperature: MWAT	LWD Bank Full >6 In & >4 Ft or >10 CuFt: CuFt/ 1000'	LWD Bank Full: Pieces/ 1000'	Substrate: >0.85 mm	Substrate: D50	Streambed (Thalweg): Slope	Streambed (Thalweg): VI	Streambed (Thalweg): A/D	Riparian Zone: Canopy % WLPZ	Riparian Zone: Cr.	Riparian Zone: Basal Area	Riparian Zone: Tallest Tree	Fish or Redds per Mile: Coho	Fish or Redds per Mile: SH (1+)	Fish or Redds per Mile: Redds	Aquatic Macroinvertebrates: Richness	Aquatic Macroinvertebrates: Hilsenhoff	Aquatic Macroinvertebrates: % Dominant	Aquatic Macroinvertebrates: Simpson	Aquatic Macroinvertebrates: Russian R Index
276	Emy	0.07	1998	15.0	13.9																			
276	Emy	0.07	2002	14.3	13.3																			
Emily Creek			Avg	14.8	13.8																			
Stream			Horsethief Canyon																					
681	Hor1	0.00	2004	17.5	17.0																			
681	Hor1	0.00	2009	16.4	15.9																			
Horsethief Canyon			Avg	16.9	16.4																			
Stream			Red Rock Creek																					
678	RRc	0.23	2009	15.6	15.1																			
678	RRc	0.23	2013	15.7	15.0																			
Red Rock Creek			Avg	15.6	15.0																			
Stream			Rockpile Creek																					
221	Roc3	0.45	1995	23.1	19.6																			
221	Roc3	0.45	1996	22.4	19.3																			
221	Roc3	0.45	1997	22.4	19.7																			
221	Roc3	0.45	1998	23.2	19.8	1,291	18		25	0.3%	17						0	677						
221	Roc3	0.45	1999			2,514	31		31	0.3%	10	-0.21	90%	37%	266	175	0	11						
221	Roc3	0.45	2000	22.1	18.4												0	169						
221	Roc3	0.45	2001	21.5	18.4												0	53						
221	Roc3	0.45	2002	22.7	17.5												0	48						
221	Roc3	0.45	2003	21.7	19.0	2,382	27		19	0.3%	13	-0.40					0	67						
221	Roc3	0.45	2004	21.7	18.6												0	20						
221	Roc3	0.45	2008	20.1	18.1												0	11						
221	Roc3	0.45	2009	20.6	17.3												0	1,552						
221	Roc3	0.45	2010	19.5	17.2																			
221	Roc3	0.45	2011	19.8	17.5																			
221	Roc3	0.45	2012	19.4	17.1																			
221	Roc3	0.45	2013	19.8	18.5																			
221	Roc3	0.45	2014	20.6	17.7	2,566	38		23	0.4%	21	-0.49	82%	45%	409	195								
221	Roc3	0.45	2016	19.3	17.2																			
221	Roc3	0.45	2017	20.2	18.3																			
221	Roc3	0.45	2018	19.1	17.5																			
221	Roc3	0.45	2019	19.8	18.3																			
221	Roc3	0.45	2022			2,878	41		30	0.3%	19	-0.63	93%	58%										
221	Roc3	0.45	2023	18.9	17.3																			

Station Number	Name	Miles Up Stream	Year	Temperature: Seasonal Maximum	Temperature: MWAT	LWD Bank Full (>6 In & >4 Ft or >10 CuFt): CuFt/ 1000'	LWD Bank Full: Pieces/ 1000'	Substrate: >0.85 mm	Substrate: D50	Streambed (Thalweg): Slope	Streambed (Thalweg): VI	Streambed (Thalweg): A/D	Riparian Zone: Canopy % WLPZ	Riparian Zone: Cr.	Riparian Zone: Basal Area	Riparian Zone: Tallest Tree	Fish or Redds per Mile: Coho	Fish or Redds per Mile: SH (1+)	Fish or Redds per Mile: Redds	Aquatic Macroinvertebrates: Richness	Aquatic Macroinvertebrates: Simpson	Aquatic Macroinvertebrates: Hilsenhoff	Aquatic Macroinvertebrates: Russian R Index	Aquatic Macroinvertebrates: % Dominant
275	Roc2	1.93	1997	20.1	19.5																			
275	Roc2	1.93	1998	23.9	20.2												0	508						
275	Roc2	1.93	2004	20.2	18.7																			
275	Roc2	1.93	2005	19.0	17.7																			
275	Roc2	1.93	2012	19.9	17.4																			
275	Roc2	1.93	2013	19.3	17.7																			
275	Roc2	1.93	2014	19.4	17.9																			
275	Roc2	1.93	2015	19.2	18.3																			
275	Roc2	1.93	2021	17.5	16.6																			
275	Roc2	1.93	2022	19.4	18.1																			
222	Roc	2.65	1994	21.9	19.4																			
222	Roc	2.65	1995	23.5	19.7																			
222	Roc	2.65	1996	22.1	19.4																			
222	Roc	2.65	1997	22.4	19.8																			
222	Roc	2.65	2012	19.9	17.3																			
222	Roc	2.65	2013	21.1	18.8																			
222	Roc	2.65	2014	19.8	17.8																			
401	Roc1	3.56	1998	23.7	20.8																			
401	Roc1	3.56	2005																	26		2.9		29
401	Roc1	3.56	2006			5,416	56		24	0.2%	29		99%	58%	406	160								
401	Roc1	3.56	2008	20.6	19.1																			
401	Roc1	3.56	2009	19.8	17.8																			
401	Roc1	3.56	2013	20.9	18.8																			
401	Roc1	3.56	2014	20.2	18.2																			
401	Roc1	3.56	2018	20.1	18.1																			
401	Roc1	3.56	2019	20.9	18.9																			
701	Roc4	6.10	2005																	26		3.0		39
701	Roc4	6.10	2006			2,961	36		34	0.2%	52		83%	60%	207	100								
701	Roc4	6.10	2008	21.3	19.5																			
701	Roc4	6.10	2009	21.3	18.6																			
701	Roc4	6.10	2013	22.5	19.9																			
701	Roc4	6.10	2019	20.6	19.0																			
680	Roc	7.77	2004	24.8	21.2																			
680	Roc	7.77	2009	23.6	19.5																			
683	Roc5	9.77	2004	24.0	20.6																			

Station Number	Name	Miles Up Stream	Year	Temperature Seasonal Maximum	Temperature MWAT	LWD Bank Full (>6 In & >4 Ft or >10 CuFt) CuFt/ 1000'	LWD Pieces/ 1000'	Substrate >0.85 mm	Substrate D50	Streambed (Thalweg) Slope	VI	A/D	Riparian Zone Canopy WLPZ	% Cr.	Basal Area	Tallest Tree	Fish or Redds per Mile Coho	SH (1+)	Redds	Aquatic Macroinvertebrates Richness	Simpson	Hilsenhoff	Russian R Index	% Dominant
683	Roc5	9.77	2009	23.2	19.1																			
Rockpile Creek			Avg	21.0	18.6	2,858	35		27	0.3%	23	-0.4	89%	52%	322	158	0	312		26		3.0		34
Hydrologic Uni Rockpile			Avg	20.2	18.0	2,858	35		27	0.3%	23	-0.4	89%	52%	322	158	0	312		26		3.0		34
Hydrologic Unit		**Buckeye**																						
Stream		Buckeye Creek																						
709	Buc	0.00	2008	23.6	20.3																			
709	Buc	0.00	2013	24.4	20.8																			
709	Buc	0.00	2015	21.1	18.5																			
709	Buc	0.00	2017	23.6	19.9																			
871	071	0.00	2014														0	233						
223	Buc3	0.34	1994	21.1	18.3																			
223	Buc3	0.34	1995	23.0	19.0																			
223	Buc3	0.34	1996	21.4	18.8																			
223	Buc3	0.34	1997	22.4	19.5																			
223	Buc3	0.34	1998	22.7	19.7												0	459						
223	Buc3	0.34	1999	21.1	18.0												0	0						
223	Buc3	0.34	2000			3,001	55		33	0.3%	46		81%	56%	136	185	0	194		32	0.88	4.0	19	26
223	Buc3	0.34	2001	21.1	18.0												0	67						
223	Buc3	0.34	2002														0	137						
223	Buc3	0.34	2003														0	315						
223	Buc3	0.34	2004	21.3	17.9												0	46						
223	Buc3	0.34	2008	20.6	17.0	2,190	67		22	0.2%	58	-0.73	80%	54%			0	310						
223	Buc3	0.34	2009	19.4	16.5																			
223	Buc3	0.34	2010	18.0	16.2																			
223	Buc3	0.34	2011	18.8	16.6																			
223	Buc3	0.34	2012	18.4	16.0																			
223	Buc3	0.34	2013	19.4	17.1																			
223	Buc3	0.34	2014	18.1	16.4	2,824	83		22	0.2%	41	-0.86	86%	59%			0	250						
223	Buc3	0.34	2015	17.2	16.0																			
223	Buc3	0.34	2016	18.3	16.3																			
223	Buc3	0.34	2017														0	32						
223	Buc3	0.34	2018	17.5	16.0												0	63						
223	Buc3	0.34	2019	18.7	16.9																			

Station Number	Name	Miles Up Stream	Year	Temperature: Seasonal Maximum	Temperature: MWAT	LWD Bank Full (>6 In & >4 Ft or >10 CuFt): CuFt/ 1000'	LWD Bank Full: Pieces/ 1000'	Substrate: >0.85 mm	Substrate: D50	Streambed (Thalweg): Slope	Streambed (Thalweg): VI	Streambed (Thalweg): A/D	Riparian Zone: Canopy % WLPZ	Riparian Zone: Canopy % Cr.	Riparian Zone: Basal Area	Riparian Zone: Tallest Tree	Fish or Redds per Mile: Coho	Fish or Redds per Mile: SH (1+)	Fish or Redds per Mile: Redds	Aquatic Macroinvertebrates: Richness	Aquatic Macroinvertebrates: Simpson	Aquatic Macroinvertebrates: Hilsenhoff	Aquatic Macroinvertebrates: Russian R Index	Aquatic Macroinvertebrates: % Dominant
223	Buc3	0.34	2020	17.9	15.9	2,816	96		25	0.4%	46	-0.72	93%	78%										
223	Buc3	0.34	2021	14.1	13.8																			
223	Buc3	0.34	2022	17.9	16.0																			
223	Buc3	0.34	2023	18.9	16.7	3,786	91		23	0.5%	46	0.15	91%	70%										
876	076	1.75	2017	22.8	18.8																			
876	076	1.75	2018	19.7	17.9																			
224	Buc2	3.01	1995	23.9	19.9																			
224	Buc2	3.01	1996	22.1	19.3																			
224	Buc2	3.01	1997	22.7	19.8																			
224	Buc2	3.01	2000	20.9	18.1																			
224	Buc2	3.01	2003														0	287						
224	Buc2	3.01	2012	18.3	16.4																			
224	Buc2	3.01	2013	19.0	17.7																			
224	Buc2	3.01	2014	17.1	15.5																			
231	Buc1	6.25	1994	21.7	19.7																			
231	Buc1	6.25	1995	24.4	20.9																			
231	Buc1	6.25	1996	23.7	20.8																			
231	Buc1	6.25	1997	23.7	21.1																			
231	Buc1	6.25	1998	24.0	21.0	273	11		25	0.4%	27													
231	Buc1	6.25	2001	24.3	20.5																			
231	Buc1	6.25	2002	21.2	17.8																			
231	Buc1	6.25	2011	20.6	18.8															59	0.14		0	31
231	Buc1	6.25	2012	20.6	18.5																			
877	077	9.36	2014														0	153						
878	078	10.30	2014														0	136						
670	Buc4	11.17	2005																	27	0.14	4.6		38
670	Buc4	11.17	2006	26.3	22.2	944	8		15	0.6%	26		100%	89%	268	100								
670	Buc4	11.17	2008	20.2	18.6																			
670	Buc4	11.17	2009	21.3	17.9																			
670	Buc4	11.17	2011	22.7	19.4																			
601	Buc7	12.31	2000	26.0	21.0																			
601	Buc7	12.31	2001	25.6	20.9																			
601	Buc7	12.31	2004	25.6	20.9																			
601	Buc7	12.31	2005	24.0	20.5																			
601	Buc7	12.31	2011	22.1	19.0																			

Station Number	Name	Miles Up Stream	Year	Temperature Seasonal Maximum	MWAT	LWD Bank Full >6 In & >4 Ft or >10 CuFt CuFt/ 1000'	Pieces/ 1000'	Substrate >0.85 mm	D50	Streambed (Thalweg) Slope	VI	A/D	Riparian Zone Canopy % WLPZ	% Cr.	Basal Area	Tallest Tree	Fish or Redds per Mile Coho	SH (1+)	Redds	Aquatic Macroinvertebrates Richness	Simpson	Hilsenhoff	Russian R Index	% Dominant
601	Buc7	12.31	2012	23.2	18.4																			
601	Buc7	12.31	2013	25.6	20.6																			
601	Buc7	12.31	2015	21.7	18.8																			
672	Buc8	15.53	2005	18.0	16.5	232	6		71	1.5%	69		33%	36%	83	65				35		4.1		22
672	Buc8	15.53	2006	24.4	19.4																			
672	Buc8	15.53	2013	22.5	19.7																			
672	Buc8	15.53	2015	17.6	16.7																			
672	Buc8	15.53	2017	21.3	18.9																			
673	Buc9	16.48	2005			325	20		60	1.6%	58		28%	29%	106	146				38		3.6		18
673	Buc9	16.48	2006	26.7	22.8																			
673	Buc9	16.48	2013	19.8	18.0																			
673	Buc9	16.48	2015	21.9	18.0																			
673	Buc9	16.48	2017	21.7	18.4																			
Buckeye Creek			Avg	21.4	18.5	1,821	49		33	0.6%	46	-0.5	74%	59%	148	124	0	179		38	0.39	4.1	10	27
Stream		Flat Ridge Creek																						
602	FLR2	0.04	2000	25.6	20.9																			
602	FLR2	0.04	2001	25.2	20.5																			
602	FLR2	0.04	2005	19.5	16.7	1,173	16		47	1.1%	89		12%	11%	143	122				38		3.2		25
602	FLR2	0.04	2006	25.8	22.6																			
602	FLR2	0.04	2009	26.3	20.7																			
602	FLR2	0.04	2013	26.0	21.5																			
602	FLR2	0.04	2015	23.0	19.4																			
602	FLR2	0.04	2017	24.0	20.0																			
Flat Ridge Creek			Avg	24.4	20.3	1,173	16		47	1.1%	89		12%	11%	143	122				38		3.2		25
Stream		Franchini Creek																						
667	FRN1	0.19	2005	16.5	14.9															29		4.2		31
667	FRN1	0.19	2006	18.7	16.4	4,627	150		32	3.5%	31		75%	97%	191	70								
667	FRN1	0.19	2008	14.9	14.5																			
667	FRN1	0.19	2009	14.2	14.0																			
667	FRN1	0.19	2010	14.2	13.9																			
Franchini Creek			Avg	15.7	14.7	4,627	150		32	3.5%	31		75%	97%	191	70				29		4.2		31
Stream		Grasshopper Creek																						
696	GRS1	2.65	2005																	30		3.8		31
696	GRS1	2.65	2006			8,000	190		28	2.2%	24		82%	88%	169	90								
696	GRS1	2.65	2009	15.1	14.5																			

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Station Number	Name	Miles Up Stream	Year	Temperature Seasonal Maximum	Temperature MWAT	LWD Bank Full >6 In & >4 Ft or >10 CuFt CuFt/ 1000'	LWD Bank Full Pieces/ 1000'	Substrate >0.85 mm	Substrate D50	Streambed (Thalweg) Slope	Streambed (Thalweg) VI	Streambed (Thalweg) A/D	Riparian Zone Canopy % WLPZ	Riparian Zone Canopy % Cr.	Riparian Zone Basal Area	Riparian Zone Tallest Tree	Fish or Redds per Mile Coho	Fish or Redds per Mile SH (1+)	Fish or Redds per Mile Redds	Aquatic Macroinvertebrates Richness	Aquatic Macroinvertebrates Simpson	Aquatic Macroinvertebrates Hilsenhoff	Aquatic Macroinvertebrates Russian R Index	Aquatic Macroinvertebrates % Dominant
Grasshopper Creek			Avg	15.1	14.5	8,000	190		28	2.2%	24		82%	88%	169	90				30		3.8		31
Stream	Little Creek																							
666	LiCr	0.09	2012	14.3	13.9																			
754	LitUp	2.27	2009	13.7	12.9																			
754	LitUp	2.27	2010	13.7	13.0																			
754	LitUp	2.27	2011	14.2	13.4																			
754	LitUp	2.27	2012	14.5	13.2																			
754	LitUp	2.27	2015	14.1	13.7																			
Little Creek			Avg	14.1	13.3																			
Stream	Meg Creek																							
286	Meg	0.01	1998	15.1	14.3																			
286	Meg	0.01	2002	15.0	13.3																			
Meg Creek			Avg	15.0	13.8																			
Stream	North Fork Buckeye Creek																							
702	NFB2	0.02	2005			771	12		40	0.6%	62		96%	82%	154	85				31		3.9		27
702	NFB2	0.02	2008	21.0	18.6																			
702	NFB2	0.02	2009	19.5	17.3																			
702	NFB2	0.02	2017	22.5	19.7																			
989	089	1.33	2017	24.6	20.4												0	154						
989	089	1.33	2018	22.8	19.6																			
North Fork Buckeye Creek			Avg	22.1	19.1	771	12		40	0.6%	62		96%	82%	154	85	0	154		31		3.9		27
Stream	Soda Springs Creek																							
671	SSP1	0.08	2005			2,395	102		66	2.2%	68		100%	94%	153	100				34		3.6		21
671	SSP1	0.08	2006	19.7	17.9																			
671	SSP1	0.08	2010	16.5	15.1																			
671	SSP1	0.08	2011	17.4	15.6																			
Soda Springs Creek			Avg	17.9	16.2	2,395	102		66	2.2%	68		100%	94%	153	100				34		3.6		21
Hydrologic Uni	Buckeye		Avg	20.6	18.0	2,383	65		36	1.1%	49	-0.5	73%	65%	156	107	0	177		35	0.39	3.9	10	27
Hydrologic Unit	**Wheatfield**																							
Stream	Danfield Creek																							
640	Dan	0.76	2012	21.0	18.7																			
640	Dan	0.76	2013	27.1	22.7																			
640	Dan	0.76	2014	25.6	20.6																			
640	Dan	0.76	2015	25.7	21.6																			

Station Number	Name	Miles Up Stream	Year	Temperature		LWD Bank Full >6 In & >4 Ft or >10 CuFt		Substrate		Streambed (Thalweg)			Riparian Zone				Fish or Redds per Mile			Aquatic Macroinvertebrates				
				Seasonal Maximum	MWAT	CuFt/ 1000'	Pieces/ 1000'	>0.85 mm	D50	Slope	VI	A/D	Canopy % WLPZ	Cr.	Basal Area	Tallest Tree	Coho	SH (1+)	Redds	Richness	Simpson	Hilsenhoff	Russian R Index	% Dominant
640	Dan	0.76	2019	24.8	20.5																			
Danfield Creek			Avg	24.8	20.8																			
Stream			Elk Creek																					
706	Elk	0.00	2005	18.4	16.3																			
706	Elk	0.00	2006	21.0	18.4																			
706	Elk	0.00	2009	21.0	17.2																			
706	Elk	0.00	2017	21.0	18.3																			
Elk Creek			Avg	20.3	17.6																			
Stream			Fuller Creek																					
889	119	0.00	2012																0					
889	119	0.00	2013																7					
902	Ful	0.06	1999	24.0	18.9																			
902	Ful	0.06	2013	21.7	19.1																			
608	Ful1	0.38	2001	21.0	17.8																			
608	Ful1	0.38	2002	20.6	17.5																			
608	Ful1	0.38	2009	20.6	16.5																			
608	Ful1	0.38	2010	18.6	16.2																			
608	Ful1	0.38	2011	19.6	16.7																			
608	Ful1	0.38	2012	19.9	16.6																			
608	Ful1	0.38	2014	19.4	16.8																			
608	Ful1	0.38	2015	19.8	17.2																			
608	Ful1	0.38	2020	21.7	18.8																			
890	120	1.21	2012																1					
890	120	1.21	2013																7					
609	Ful3	2.31	2008	19.4	17.5																			
606	Ful	3.03	2001	23.2	18.5																			
606	Ful	3.03	2002	22.9	18.4																			
606	Ful	3.03	2004	21.7	18.2																			
606	Ful	3.03	2005	20.6	18.0																			
606	Ful	3.03	2006	23.6	19.8																			
606	Ful	3.03	2009	20.6	16.8																			
606	Ful	3.03	2011	19.6	17.0																			
606	Ful	3.03	2014	19.4	16.6																			
606	Ful	3.03	2018	19.0	16.3																			
Fuller Creek			Avg	20.8	17.6														4					

Station Number	Name	Miles Up Stream	Year	Temperature Seasonal Maximum	Temperature MWAT	LWD Bank Full >6 In & >4 Ft or >10 CuFt CuFt/ 1000'	Pieces/ 1000'	Substrate >0.85 mm	D50	Streambed (Thalweg) Slope	VI	A/D	Riparian Zone Canopy % WLPZ	Cr.	Basal Area	Tallest Tree	Fish or Redds per Mile Coho	SH (1+)	Redds	Aquatic Macroinvertebrates Richness	Simpson	Hilsenhoff	Russian R Index	% Dominant
Stream			Haupt Cr																					
637	Hapt	0.38	2011	19.2	17.4																			
637	Hapt	0.38	2012	18.3	16.7																			
637	Hapt	0.38	2013	20.5	18.9																			
637	Hapt	0.38	2014	18.6	17.2																			
637	Hapt	0.38	2018	18.2	16.0																			
637	Hapt	0.38	2019	19.8	17.7																			
637	Hapt	0.38	2020	28.3	22.7																			
Haupt Cr			Avg	20.4	18.1																			
Stream			House Creek																					
755	Hse7	1.33	2012	27.3	22.6																			
755	Hse7	1.33	2013	28.3	24.8																			
755	Hse7	1.33	2014	28.0	22.3																			
755	Hse7	1.33	2015	26.9	22.6																			
755	Hse7	1.33	2019	27.0	23.1																			
759	Hse5	4.89	2017	27.1	23.0																			
759	Hse5	4.89	2018	29.5	23.4																			
759	Hse5	4.89	2019	26.4	22.0																			
760	Hse4	5.00	2017	27.5	23.0																			
760	Hse4	5.00	2018	25.8	21.1																			
760	Hse4	5.00	2019	26.2	22.0																			
761	Hse3	5.76	2020	27.9	21.8																			
House Creek			Avg	27.3	22.6																			
Stream			Jennifer Creek																					
228	Jen	0.19	1995	14.5	13.9																			
228	Jen	0.19	1996	14.0	13.4																			
228	Jen	0.19	1997	14.8	14.2																			
228	Jen	0.19	1998	14.1	13.6																			
228	Jen	0.19	2002	16.3	13.1																			
Jennifer Creek			Avg	14.7	13.6																			
Stream			North Fork Fuller Creek																					
619	NFU	0.02	2000	22.7	18.8																			
619	NFU	0.02	2001	22.7	18.3																			
619	NFU	0.02	2002	22.1	17.9																			
619	NFU	0.02	2004	20.3	17.4																			

Station Number	Name	Miles Up Stream	Year	Temperature		LWD Bank Full >6 In & >4 Ft or >10 CuFt		Substrate		Streambed (Thalweg)			Riparian Zone				Fish or Redds per Mile			Aquatic Macroinvertebrates				
				Seasonal Maximum	MWAT	CuFt/ 1000'	Pieces/ 1000'	>0.85 mm	D50	Slope	VI	A/D	Canopy % WLPZ	Cr.	Basal Area	Tallest Tree	Coho	SH (1+)	Redds	Richness	Simpson	Hilsenhoff	Russian R Index	% Dominant
619	NFU	0.02	2005	20.1	16.9																			
619	NFU	0.02	2006	23.2	19.6																			
619	NFU	0.02	2009	21.0	16.6																			
619	NFU	0.02	2014	19.0	16.8																			
619	NFU	0.02	2018	19.2	17.0																			
665	NFu2	1.14	2004	18.1	16.3																			
665	NFu2	1.14	2014	16.0	15.0																			
665	NFu2	1.14	2015	16.0	15.1																			
North Fork Fuller Creek			Avg	20.0	17.1																			
Stream		Palchett Creek																						
901	97-3	0.08	1999	15.7	14.5																			
Palchett Creek			Avg	15.7	14.5																			
Stream		Pepperwood South																						
756	PpS1	0.06	2012	28.0	22.0																			
756	PpS1	0.06	2013	29.6	24.8																			
756	PpS1	0.06	2014	27.0	22.5																			
756	PpS1	0.06	2015	27.3	22.9																			
756	PpS1	0.06	2017	25.7	22.4																			
756	PpS1	0.06	2018	26.0	22.2																			
756	PpS1	0.06	2019	25.5	21.3																			
756	PpS1	0.06	2020	25.6	21.8																			
767	PPS4	1.67	2014			119	3		25	0.6%	51		16%	17%	223	63								
767	PPS4	1.67	2020			84	5		25	0.5%	42	-0.65	32%	10%	72	75								
757	PpS5	1.89	2013	20.2	18.7																			
757	PpS5	1.89	2014	23.5	18.7	159	7		25	0.7%	42		15%	47%	46	0								
757	PpS5	1.89	2020			64	9		26	0.7%	29	-0.20	16%	59%	41	0								
642	Pps6	2.27	2012	29.1	22.6																			
642	Pps6	2.27	2013	28.7	23.4																			
642	Pps6	2.27	2014	29.5	21.9																			
642	Pps6	2.27	2015	29.9	23.6																			
642	Pps6	2.27	2017	27.9	20.9																			
642	Pps6	2.27	2018	28.7	21.6																			
642	Pps6	2.27	2019	27.1	21.8																			
642	Pps6	2.27	2020	28.3	22.7																			
Pepperwood South			Avg	27.1	22.0	107	6		25	0.6%	41	-0.4	20%	33%	95	35								

Station Number	Name	Miles Up Stream	Year	Temperature Seasonal Maximum	Temperature MWAT	LWD Bank Full (>6 In & >4 Ft or >10 CuFt) CuFt/ 1000'	LWD Bank Full Pieces/ 1000'	Substrate >0.85 mm	Substrate D50	Streambed (Thalweg) Slope	Streambed VI	Streambed A/D	Riparian Zone Canopy % WLPZ	Riparian Zone Cr.	Riparian Zone Basal Area	Riparian Zone Tallest Tree	Fish or Redds per Mile Coho	Fish or Redds SH (1+)	Fish or Redds Redds	Aquatic Macroinvertebrates Richness	Simpson	Hilsenhoff	Russian R Index	% Dominant
Stream		Redwood Creek																						
704	Rdw1	0.38	2005																	30		4.2		25
704	Rdw1	0.38	2006	20.6	19.7	5,445	146		26	6.9%	20		79%	97%	105	70								
Redwood Creek			Avg	20.6	19.7	5,445	146		26	6.9%	20		79%	97%	105	70				30		4.2		25
Stream		South Fork Fuller Creek																						
618	SFU	0.02	2000	22.5	19.1																			
618	SFU	0.02	2001	22.5	18.7																			
618	SFU	0.02	2002	22.1	18.2																			
618	SFU	0.02	2004	19.1	17.4																			
618	SFU	0.02	2005	21.0	18.3																			
618	SFU	0.02	2006	23.2	20.1																			
618	SFU	0.02	2009	19.4	16.7																			
618	SFU	0.02	2014	18.3	16.3																			
618	SFU	0.02	2018	19.1	17.1																			
662	SFu2	1.52	2004	21.8	18.4																			
662	SFu2	1.52	2014	18.3	15.9																			
662	SFu2	1.52	2015	18.1	15.8																			
663	SFu1	2.65	2005			4,327	59		61	2.1%	24				115	75				32		3.2		26
663	SFu1	2.65	2009	15.2	14.2																			
South Fork Fuller Creek			Avg	20.0	17.4	4,327	59		61	2.1%	24				115	75				32		3.2		26
Stream		Sugarloaf Creek																						
660	Sug	0.00	2014	19.0	17.7																			
660	Sug	0.00	2019	20.3	17.8																			
Sugarloaf Creek			Avg	19.7	17.8																			
Stream		Tombs Creek																						
657	tomb	0.00	2014	23.7	19.8																			
657	tomb	0.00	2019	21.7	18.9																			
659	tomb	0.00	2014	19.0	16.2																			
659	tomb	0.00	2019	18.4	17.2																			
910	Tmb4	0.00	2014	18.3	16.7																			
910	Tmb4	0.00	2019	19.3	17.5																			
656	tomb	0.09	2009	26.0	20.4																			
656	tomb	0.09	2017	23.9	19.9																			
Tombs Creek			Avg	21.3	18.3																			
Stream		Wheatfield Fork Gualala River																						

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Station Number	Name	Miles Up Stream	Year	Temperature Seasonal Maximum	Temperature MWAT	LWD Bank Full >6 In & >4 Ft or >10 CuFt CuFt/ 1000'	LWD Bank Full Pieces/ 1000'	Substrate >0.85 mm	Substrate D50	Streambed (Thalweg) Slope	Streambed (Thalweg) VI	Streambed (Thalweg) A/D	Riparian Zone Canopy WLPZ	Riparian Zone % Cr.	Riparian Zone Basal Area	Riparian Zone Tallest Tree	Fish or Redds per Mile Coho	Fish or Redds per Mile SH (1+)	Fish or Redds per Mile Redds	Aquatic Macroinvertebrates Richness	Aquatic Macroinvertebrates Simpson	Aquatic Macroinvertebrates Hilsenhoff	Aquatic Macroinvertebrates % Dominant	Aquatic Macroinvertebrates Russian R Index
707	WFG	0.00	2006	24.4	22.0																			
707	WFG	0.00	2008	26.7	22.8																			
707	WFG	0.00	2009	28.7	23.4																			
707	WFG	0.00	2017	27.9	23.7																			
708	WFG	0.00	2006	26.3	24.3																			
708	WFG	0.00	2008	22.9	19.4																			
708	WFG	0.00	2009	29.5	23.4																			
708	WFG	0.00	2011	22.5	19.5																			
708	WFG	0.00	2012	29.1	23.2																			
708	WFG	0.00	2013	23.6	20.5																			
708	WFG	0.00	2017	27.9	23.6																			
711	WFG	0.00	2013	27.1	24.4																			
226	Wfg3	0.42	1995	25.5	20.9																			
226	Wfg3	0.42	1996	23.8	20.3																			
226	Wfg3	0.42	1997	23.1	21.9																			
226	Wfg3	0.42	1998	24.7	21.7												0	981						
226	Wfg3	0.42	2000			1,828	22		27				86%	40%	153	160				32	0.85	4.3	15	32
226	Wfg3	0.42	2001	23.2	20.0																			
226	Wfg3	0.42	2002														0	60						
226	Wfg3	0.42	2003			1,310	18		21	0.1%	21						0	182						
226	Wfg3	0.42	2008	21.0	18.9	1,637	29		16	0.1%	29	0.05	81%	15%			0	137						
226	Wfg3	0.42	2009	22.5	19.0																			
226	Wfg3	0.42	2010	20.8	19.1																			
226	Wfg3	0.42	2011	22.5	19.5																			
226	Wfg3	0.42	2012	21.0	18.6																			
226	Wfg3	0.42	2015	20.2	18.7																			
226	Wfg3	0.42	2016	20.6	18.6																			
226	Wfg3	0.42	2018	21.0	18.3																			
226	Wfg3	0.42	2020	20.6	18.6																			
226	Wfg3	0.42	2021	18.3	16.9																			
226	Wfg3	0.42	2022	20.6	18.6																			
226	Wfg3	0.42	2023	21.2	19.4																			
29	62	0.69	2009							0.2%	22													
29	62	0.69	2012								24	-0.25												
32	WFGr	0.69	2009							0.2%	21													

Station Number	Name	Miles Up Stream	Year	Temperature		LWD Bank Full >6 In & >4 Ft or >10 CuFt		Substrate		Streambed (Thalweg)			Riparian Zone				Fish or Redds per Mile			Aquatic Macroinvertebrates				
				Seasonal Maximum	MWAT	CuFt/ 1000'	Pieces/ 1000'	>0.85 mm	D50	Slope	VI	A/D	Canopy % WLPZ	Cr.	Basal Area	Tallest Tree	Coho	SH (1+)	Redds	Richness	Simpson	Hilsenhoff	Russian R Index	% Dominant
32	WFGr	0.69	2012							0.1%	25	-0.31												
30	70	0.99	2009							0.1%	19													
30	70	0.99	2012								26	-0.48												
908	108	1.76	2018	27.9	22.1																			
908	108	1.76	2019	27.2	22.9																			
909	109	1.96	2018	28.8	23.0																			
909	109	1.96	2019	27.8	23.4																			
227	Wfg2	2.69	1995	26.4	22.0																			
227	Wfg2	2.69	1996	24.0	21.2																			
227	Wfg2	2.69	1997	25.3	22.2																			
227	Wfg2	2.69	1998	24.3	21.5																			
227	Wfg2	2.69	2000	25.3	21.2																			
227	Wfg2	2.69	2003														0	286						
403	WFG1	5.28	1998	26.4	22.9																			
603	WFG	7.29	2002	24.0	21.6																			
603	WFG	7.29	2013	24.8	22.4																			
891	101	7.46	2013																18					
994	101	7.48	2018	25.6	21.6																			
994	101	7.48	2019	25.2	22.7																			
994	101	7.48	2020	24.4	21.4																			
612	WFG	7.58	2001	25.6	22.4																			
612	WFG	7.58	2002	25.6	22.4																			
612	WFG	7.58	2013	25.4	22.9																			
995	102	8.64	2017														0	133						
620	WFG4	8.90	2000	27.8	23.1																			
620	WFG4	8.90	2001	26.0	23.1																			
620	WFG4	8.90	2002	26.3	23.0																			
620	WFG4	8.90	2004	25.7	21.9																			
620	WFG4	8.90	2008	26.3	21.8																			
620	WFG4	8.90	2017	26.7	22.9																			
620	WFG4	8.90	2019	26.3	23.4																			
620	WFG4	8.90	2020	25.6	21.6																			
651	WFG6	22.73	2005																	24		4.0		20
651	WFG6	22.73	2006	27.0	23.5	10	1		49	0.6%	38		66%	18%	82	70								
651	WFG6	22.73	2009	21.8	19.9																			

Station Number	Name	Miles Up Stream	Year	Temperature		LWD Bank Full >6 In & >4 Ft or >10 CuFt		Substrate		Streambed (Thalweg)			Riparian Zone				Fish or Redds per Mile			Aquatic Macroinvertebrates				
				Seasonal Maximum	MWAT	CuFt/ 1000'	Pieces/ 1000'	>0.85 mm	D50	Slope	VI	A/D	Canopy % WLPZ	Cr.	Basal Area	Tallest Tree	Coho	SH (1+)	Redds	Richness	Simpson	Hilsenhoff	Russian R Index	% Dominant
651	WFG6	22.73	2017	24.9	20.5																			
652	WFG7	23.11	2005																	29		3.7		24
652	WFG7	23.11	2006	27.9	25.8	107	1		22	0.6%	26		87%	63%	161	70								
652	WFG7	23.11	2009	25.2	20.9																			
652	WFG7	23.11	2017	24.8	20.7																			
Wheatfield Fork Gualala Riv			Avg	24.8	21.5	979	14		27	0.2%	25	-0.2	80%	34%	132	100	0	297	18	28	0.85	4.0	15	25
Stream		Wolf Creek																						
649	Wolf	0.00	2018	25.8	19.7																			
649	Wolf	0.00	2019	24.5	19.9																			
Wolf Creek			Avg	25.1	19.8																			
Hydrologic Uni	Wheatfield		Avg	23.2	19.8	1,372	27		29	1.0%	29	-0.3	53%	41%	111	65	0	297	7	29	0.85	3.9	15	25
Hydrologic Unit				**SF Gualala**																				
Stream		Big Pepperwood																						
218	Ppw3	0.15	1994	15.9	14.4																			
218	Ppw3	0.15	1995	16.5	15.0																			
218	Ppw3	0.15	1996	16.2	14.3																			
218	Ppw3	0.15	1997	17.3	15.6																			
218	Ppw3	0.15	1998	17.2	15.2	2,490	88		41	1.4%	14						0	153						
218	Ppw3	0.15	1999	15.9	14.4	2,324	84		30	1.5%	13	-0.31	90%	88%	323	105	0	132						
218	Ppw3	0.15	2000	16.2	14.5												0	21		32	0.79	4.7	15	39
218	Ppw3	0.15	2001														0	48						
218	Ppw3	0.15	2002	15.6	14.1	6,539	150		45	1.4%	13	-0.68	96%	87%	563	87	0	37						
218	Ppw3	0.15	2003	15.5	14.1	7,310	153		35	1.4%	16	-1.16												
218	Ppw3	0.15	2004	16.0	14.7	8,161	153		28	1.4%	15	-1.02					0	28						
218	Ppw3	0.15	2005	15.6	14.2	8,119	151		37	1.4%	17	-1.11												
218	Ppw3	0.15	2006			10,327	180		22	1.6%	16	-1.20												
218	Ppw3	0.15	2007			10,378	185		35	1.5%	15	-1.13												
218	Ppw3	0.15	2008	15.9	14.8	10,354	198		31	1.5%	17	-1.27	90%	87%			0	5						
218	Ppw3	0.15	2009	15.4	14.3	10,733	204		38	1.5%	16	-1.12					0	84						
218	Ppw3	0.15	2010	14.6	13.2	10,887	209		33	1.5%	15	-1.13												
218	Ppw3	0.15	2011	14.8	13.5	11,228	217		38	1.5%	16	-1.39	88%	87%			0	153						
218	Ppw3	0.15	2012	14.7	13.5	11,203	208		21	1.5%	17	-1.42					0	201						
218	Ppw3	0.15	2013	16.1	14.9	11,268	215		25	1.5%	15	-1.58					0	58						

Station Number	Name	Miles Up Stream	Year	Temperature: Seasonal Maximum	Temperature: MWAT	LWD Bank Full (>6 In & >4 Ft or >10 CuFt): CuFt/1000'	LWD Bank Full: Pieces/1000'	Substrate: >0.85 mm	Substrate: D50	Streambed (Thalweg): Slope	Streambed: VI	Streambed: A/D	Riparian Zone: Canopy % WLPZ	Riparian Zone: % Cr.	Riparian Zone: Basal Area	Riparian Zone: Tallest Tree	Fish or Redds per Mile: Coho	Fish or Redds per Mile: SH (1+)	Fish or Redds per Mile: Redds	Aquatic Macroinvertebrates: Richness	Simpson	Hilsenhoff	% Dominant	Russian R Index
218	Ppw3	0.15	2014	15.7	14.8	11,372	219		24	1.3%	15	-1.46					0	32						
218	Ppw3	0.15	2015	16.2	15.2	11,249	216		27	1.6%	13	-1.36	91%	91%	918	184	0	42						
218	Ppw3	0.15	2016	14.9	13.8	11,123	225		30	1.5%	13	-1.83	91%	91%										
218	Ppw3	0.15	2017	16.0	15.5	11,478	253		26	1.4%	13	-1.77	91%	91%			0	0						
218	Ppw3	0.15	2018	14.5	13.9	11,300	251		28	1.4%	14	-1.83					0	16						
218	Ppw3	0.15	2019	16.5	15.3	13,184	334		25	1.7%	12	-0.34	93%	93%										
218	Ppw3	0.15	2020	16.4	15.4	13,301	341		28	1.7%	10	-0.18	96%	95%										
218	Ppw3	0.15	2021	14.1	13.7	13,049	341		31	1.7%	9	-0.27	91%	91%										
218	Ppw3	0.15	2022	14.9	14.4	13,471	337		26	1.7%	14	-0.34	92%	90%										
218	Ppw3	0.15	2023	15.8	15.2	13,547	314		33	1.6%	19	-0.49	90%	93%										
219	Ppw2	1.29	1994	17.2	14.6																			
219	Ppw2	1.29	1995	17.0	14.9																			
219	Ppw2	1.29	1996	16.7	14.7																			
219	Ppw2	1.29	1997	17.8	15.0																			
219	Ppw2	1.29	1998	17.3	14.9																			
219	Ppw2	1.29	2009	14.3	13.5																			
219	Ppw2	1.29	2011	14.1	13.1																			
219	Ppw2	1.29	2012	13.9	12.9																			
219	Ppw2	1.29	2017	16.0	15.1																			
Big Pepperwood			Avg	15.8	14.5	10,183	218		31	1.5%	14	-1.1	91%	90%	601	125	0	67		32	0.79	4.7	15	39
Stream		Camper Creek																						
699	Cmp	0.00	2004	17.9	16.5																			
699	Cmp	0.00	2005	17.9	16.3																			
699	Cmp	0.00	2014	17.9	16.4																			
Camper Creek			Avg	17.9	16.4																			
Stream		Carson Cr																						
605	Car	0.00	2004	16.8	15.6																			
605	Car	0.00	2005	18.1	16.8																			
605	Car	0.00	2014	17.1	16.6																			
631	Car1	0.01	2004			2,724	39		39	1.5%	42		88%	98%	143	140								
Carson Cr			Avg	17.3	16.4	2,724	39		39	1.5%	42		88%	98%	143	140								
Stream		Groshong Gulch																						
250	Gros	0.05	1996	14.1	13.1																			
250	Gros	0.05	2002	16.2	13.3																			
250	Gros	0.05	2012	13.3	12.3																			

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Station Number	Name	Miles Up Stream	Year	Temperature: Seasonal Maximum	Temperature: MWAT	LWD Bank Full (>6 In & >4 Ft or >10 CuFt): CuFt/ 1000'	LWD Bank Full: Pieces/ 1000'	Substrate: >0.85 mm	Substrate: D50	Streambed (Thalweg): Slope	Streambed (Thalweg): VI	Streambed (Thalweg): A/D	Riparian Zone: Canopy %	Riparian Zone: WLPZ Cr.	Riparian Zone: Basal Area	Riparian Zone: Tallest Tree	Fish or Redds per Mile: Coho	Fish or Redds per Mile: SH (1+)	Fish or Redds per Mile: Redds	Aquatic Macroinvertebrates: Richness	Aquatic Macroinvertebrates: Simpson	Aquatic Macroinvertebrates: Hilsenhoff	Aquatic Macroinvertebrates: Russian R Index	Aquatic Macroinvertebrates: % Dominant
277	GrG	0.27	1998	13.9	13.4																			
277	GrG	0.27	2000	17.8	14.5																			
277	GrG	0.27	2011	13.4	12.9																			
Groshong Gulch			Avg	14.8	13.3																			
Stream	Gualala River																							
614	Gua8	0.00	2000	22.9	18.4																			
614	Gua8	0.00	2009	21.7	18.1																			
614	Gua8	0.00	2017	22.1	18.5																			
614	Gua8	0.00	2018	20.2	17.9																			
750	Gul	1.19	2009	22.5	19.2																			
750	Gul	1.19	2011	23.2	19.7																			
Gualala River			Avg	22.1	18.6																			
Stream	Little Pepperwood																							
220	Lpw	0.11	1994	15.8	14.3																			
220	Lpw	0.11	1995	19.4	16.0																			
220	Lpw	0.11	1996	17.8	15.0																			
220	Lpw	0.11	1997	16.7	16.0																			
220	Lpw	0.11	1998	17.8	15.6																			
220	Lpw	0.11	2002	15.1	13.8																			
220	Lpw	0.11	2003	15.9	14.8												0	121						
220	Lpw	0.11	2004	14.8	14.3												0	8						
220	Lpw	0.11	2005	16.0	14.6																			
220	Lpw	0.11	2008	14.7	14.3																			
220	Lpw	0.11	2009	14.4	13.7																			
220	Lpw	0.11	2012	14.2	13.1																			
220	Lpw	0.11	2016	14.5	13.7																			
220	Lpw	0.11	2018	15.0	13.9																			
Little Pepperwood			Avg	15.9	14.5												0	65						
Stream	Marshall Creek																							
607	Mar	0.00	2004	22.5	19.7																			
607	Mar	0.00	2015	21.0	18.6																			
Marshall Creek			Avg	21.7	19.2																			
Stream	McKenzie Creek																							
617	McK1	0.00	2000	20.7	18.3																			
617	McK1	0.00	2001	20.2	17.5																			

Station Number	Name	Miles Up Stream	Year	Temperature Seasonal Maximum	Temperature MWAT	LWD Bank Full >6 In & >4 Ft or >10 CuFt CuFt/1000'	LWD Bank Full Pieces/1000'	Substrate >0.85 mm	Substrate D50	Streambed (Thalweg) Slope	Streambed VI	Streambed A/D	Riparian Zone Canopy % WLPZ	Riparian Zone Cr.	Riparian Zone Basal Area	Riparian Zone Tallest Tree	Fish or Redds per Mile Coho	Fish or Redds SH (1+)	Fish or Redds Redds	Aquatic Macroinvertebrates Richness	Simpson	Hilsenhoff	% Dominant	Russian R Index
617	McK1	0.00	2003	20.6	18.7																			
617	McK1	0.00	2004	18.7	17.2																			
617	McK1	0.00	2005	20.6	18.1																			
615	McK1	0.03	2000	16.0	15.1																			
615	McK1	0.03	2001	20.6	17.5																			
615	McK1	0.03	2004	19.8	17.5	1,250	8		38	1.2%	27		95%	95%	248	153								
615	McK1	0.03	2005	20.2	17.8																			
615	McK1	0.03	2013	22.9	19.7																			
615	McK1	0.03	2014	20.1	17.9																			
615	McK1	0.03	2015	21.4	18.2																			
McKenzie Creek			Avg	20.1	17.8	1,250	8		38	1.2%	27		95%	95%	248	153								
Stream			Palmer Creek																					
621	Plm	0.00	2000	23.6	19.3																			
621	Plm	0.00	2003	20.5	18.2																			
621	Plm	0.00	2004	20.6	17.5																			
621	Plm	0.00	2005	20.6	17.9																			
621	Plm	0.00	2013	18.1	17.0																			
Palmer Creek			Avg	20.7	18.0																			
Stream			South Fork Gualala River																					
217	Gua1	0.98	1994	22.7	19.2																			
217	Gua1	0.98	1995	25.3	20.6																			
217	Gua1	0.98	1996	24.4	20.1																			
217	Gua1	0.98	1997	24.6	22.4																			
217	Gua1	0.98	1998			934	17		24	0.1%	23		93%	16%										
217	Gua1	0.98	1999														0	32						
217	Gua1	0.98	2000	23.2	19.2	804	15		25	0.0%	22	-0.10	96%	17%	226	199	0	21		28	0.87	4.4	16	28
217	Gua1	0.98	2001	23.3	19.1	1,649	34		20	0.1%	20	0.19					0	11						
217	Gua1	0.98	2002			1,488	28		22	0.1%	27	0.01					0	0						
217	Gua1	0.98	2003			1,094	25		12	0.1%	22	0.10					0	149						
217	Gua1	0.98	2004	23.2	20.0	1,264	28		19	0.1%	26	0.18					0	97						
217	Gua1	0.98	2006			1,025	21		20															
217	Gua1	0.98	2007			1,087	22		15	0.1%	21	-0.23												
217	Gua1	0.98	2008	24.5	19.8	1,110	29		19	0.1%	23	-0.24					0	26						
217	Gua1	0.98	2009	23.2	18.9	1,109	30		16	0.1%	22	-0.14					0	166						
217	Gua1	0.98	2010	22.4	18.3																			

Station Number	Name	Miles Up Stream	Year	Temperature: Seasonal Maximum	Temperature: MWAT	LWD Bank Full (>6 In & >4 Ft or >10 CuFt): CuFt/ 1000'	LWD Bank Full: Pieces/ 1000'	Substrate: >0.85 mm	Substrate: D50	Streambed (Thalweg): Slope	Streambed (Thalweg): VI	Streambed (Thalweg): A/D	Riparian Zone: Canopy % WLPZ	Riparian Zone: Cr.	Riparian Zone: Basal Area	Riparian Zone: Tallest Tree	Fish or Redds per Mile: Coho	Fish or Redds per Mile: SH (1+)	Fish or Redds per Mile: Redds	Aquatic Macroinvertebrates: Richness	Aquatic Macroinvertebrates: Hilsenhoff	Aquatic Macroinvertebrates: % Dominant	Aquatic Macroinvertebrates: Simpson	Aquatic Macroinvertebrates: Russian R Index
217	Gua1	0.98	2011	22.5	18.8												0	465						
217	Gua1	0.98	2012	22.1	18.5												0	1,067						
217	Gua1	0.98	2013	23.2	19.8	1,064	27		18	0.1%	34	-0.70					0	127						
217	Gua1	0.98	2014	22.9	19.4												0	346						
217	Gua1	0.98	2015	21.7	19.7	1,128	29		24	0.1%	30	-0.53					0	153						
217	Gua1	0.98	2016	22.5	19.2																			
217	Gua1	0.98	2017	22.9	19.3												0	269						
217	Gua1	0.98	2018	22.3	19.5	1,849	32		19	0.0%	38	-0.71					0	148						
217	Gua1	0.98	2019	22.5	19.6																			
217	Gua1	0.98	2020	22.5	19.6																			
217	Gua1	0.98	2021	21.7	19.3																			
217	Gua1	0.98	2022	21.7	19.5	1,758	37		22	0.1%	31	-1.12	93%	27%										
217	Gua1	0.98	2023	22.6	19.3																			
833	033	3.56	2017														0	138						
225	SFG	4.36	1995	24.8	20.8																			
225	SFG	4.36	1997	22.1	20.6																			
225	SFG	4.36	2013	22.9	20.1																			
225	SFG	4.36	2017	22.9	19.7																			
225	SFG	4.36	2018	22.5	18.7																			
16	280	5.13	2009							0.1%	22													
16	280	5.13	2012								27	0.02												
19	SFGr	5.13	2009							0.1%	28													
19	SFGr	5.13	2012							0.2%	28	0.06												
17	295	5.25	2009							0.2%	25													
17	295	5.25	2012								23	0.05												
18	310	5.67	2009							0.2%	32													
18	310	5.67	2012								29	0.09												
20	370	6.77	2009							0.3%	20													
20	370	6.77	2013								20	-0.27												
229	SFG	7.39	1995	23.4	19.9																			
229	SFG	7.39	1996	22.1	19.0																			
229	SFG	7.39	1997	25.6	20.5																			
402	SFG	7.77	1998	22.1	19.7												0	961						
402	SFG	7.77	1999			1,473	33		18	0.3%	29		76%	26%	204	203	0	400						
402	SFG	7.77	2000	22.4	18.9												0	268						

Station Number	Name	Miles Up Stream	Year	Temperature: Seasonal Maximum	Temperature: MWAT	LWD Bank Full >6 In & >4 Ft or >10 CuFt: CuFt/ 1000'	LWD Bank Full: Pieces/ 1000'	Substrate: >0.85 mm	Substrate: D50	Streambed (Thalweg): Slope	Streambed (Thalweg): VI	Streambed (Thalweg): A/D	Riparian Zone: Canopy % WLPZ	Riparian Zone: Cr.	Riparian Zone: Basal Area	Riparian Zone: Tallest Tree	Fish or Redds per Mile: Coho	Fish or Redds per Mile: SH (1+)	Fish or Redds per Mile: Redds	Aquatic Macroinvertebrates: Richness	Aquatic Macroinvertebrates: Simpson	Aquatic Macroinvertebrates: Hilsenhoff	Aquatic Macroinvertebrates: % Dominant	Aquatic Macroinvertebrates: Russian R Index
402	SFG	7.77	2001														0	153						
402	SFG	7.77	2002														0	121						
402	SFG	7.77	2008			1,391	31		19	0.4%	31	-0.11					0	1,327						
402	SFG	7.77	2016	20.2	17.6																			
402	SFG	7.77	2018	19.4	17.7																			
402	SFG	7.77	2019	20.2	18.8																			
402	SFG	7.77	2020	19.0	18.2																			
402	SFG	7.77	2021	17.5	16.9																			
402	SFG	7.77	2022	19.8	18.0																			
402	SFG	7.77	2023	18.4	17.8																			
230	SFG	9.32	1995	22.9	18.9																			
230	SFG	9.32	1996	21.8	18.4																			
230	SFG	9.32	1997	24.4	22.3																			
230	SFG	9.32	1998	22.6	19.5																			
230	SFG	9.32	2009	20.6	17.6																			
230	SFG	9.32	2011	20.2	17.6																			
230	SFG	9.32	2012	19.4	17.0																			
230	SFG	9.32	2014	18.7	17.2																			
230	SFG	9.32	2017	21.0	18.2																			
230	SFG	9.32	2018	19.4	17.2																			
230	SFG	9.32	2019	20.2	18.3																			
838	038	12.80	2017														0	251						
233	SFG	17.92	2017	22.4	19.4																			
233	SFG	17.92	2019	22.5	19.8																			
232	SFG	23.67	2014	16.4	15.4																			
232	SFG	23.67	2017	19.3	17.7																			
616	SFG4	33.52	2000	19.4	16.7																			
616	SFG4	33.52	2001	19.8	16.4																			
616	SFG4	33.52	2003	19.5	17.4																			
616	SFG4	33.52	2004	18.7	16.7																			
616	SFG4	33.52	2005	19.0	17.2																			
616	SFG4	33.52	2013	22.5	17.9																			
716	SFG3	33.52	2015	16.7	16.0																			
South Fork Gualala River			Avg	21.6	18.8	1,264	27		20	0.1%	26	-0.2	89%	22%	215	201	0	291		28	0.87	4.4	16	28
Stream	Wild Hog Creek																							

Station Number	Name	Miles Up Stream	Year	Temperature Seasonal Maximum	Temperature MWAT	LWD Bank Full >6 In & >4 Ft or >10 CuFt CuFt/ 1000'	LWD Bank Full Pieces/ 1000'	Substrate >0.85 mm	Substrate D50	Streambed (Thalweg) Slope	Streambed (Thalweg) VI	Streambed (Thalweg) A/D	Riparian Zone Canopy % WLPZ	Riparian Zone Canopy % Cr.	Riparian Zone Basal Area	Riparian Zone Tallest Tree	Fish or Redds per Mile Coho	Fish or Redds per Mile SH (1+)	Fish or Redds per Mile Redds	Aquatic Macroinvertebrates Richness	Aquatic Macroinvertebrates Simpson	Aquatic Macroinvertebrates Hilsenhoff	Aquatic Macroinvertebrates % Dominant	Aquatic Macroinvertebrates Russian R Index
604	Whg	0.00	2004	14.9	14.6																			
604	Whg	0.00	2005	17.9	17.2																			
Wild Hog Creek			Avg	16.4	15.9																			
Hydrologic Uni	SF Gualala		Avg	19.1	16.9	6,395	136		27	0.9%	21	-0.7	91%	76%	375	153	0	196		30	0.83	4.6	16	33
Hydrologic Unit			**Coastal Gualala**																					
Stream			East Branch Russian Gulch																					
469	ERuG	0.09	2010								59													
East Branch Russian Gulch			Avg								59													
Stream			Russian Gulch																					
471	RuG1	0.61	2000	17.5	14.9	8,615	169			0.9%	34		77%	40%	184	65				27	0.81	4.9	11	38
471	RuG1	0.61	2002	21.6	15.8																			
471	RuG1	0.61	2010								27													
Russian Gulch			Avg	19.5	15.3	8,615	169			0.9%	30		77%	40%	184	65				27	0.81	4.9	11	38
Stream			Salal Creek																					
470	Sal1	0.76	2000	15.3	13.5	2,048	127		9	4.7%	11		87%	89%	158	120				33	0.86	2.9	20	29
470	Sal1	0.76	2001	13.7	13.4																			
Salal Creek			Avg	14.5	13.4	2,048	127		9	4.7%	11		87%	89%	158	120				33	0.86	2.9	20	29
Stream			School House Creek																					
472	ScH	0.27	2000			829	66		0	5.9%	54		97%	97%	466	123								
School House Creek			Avg			829	66		0	5.9%	54		97%	97%	466	123								
Stream			Stockoff Creek																					
940	Sto	0.45	2015	15.2	14.6												0	130						
Stockoff Creek			Avg	15.2	14.6												0	130						
Hydrologic Uni	Coastal Gual		Avg	16.7	14.4	3,830	121		5	3.8%	37		87%	75%	269	103	0	130		30	0.83	3.9	16	33
Hydrologic Unit			**Russian Estuary**																					
Stream			Jenner Gulch																					
407	Jen1	0.61	1998	15.6	14.4	2,124	71		20	3.3%	19		87%	88%										
407	Jen1	0.61	2000	18.0	14.4															40	0.90	4.2	22	26
407	Jen1	0.61	2001	15.1	13.5																			
407	Jen1	0.61	2010								19													
Jenner Gulch			Avg	16.2	14.1	2,124	71		20	3.3%	19		87%	88%						40	0.90	4.2	22	26
Hydrologic Uni	Russian Estu		Avg	16.2	14.1	2,124	71		20	3.3%	19		87%	88%						40	0.90	4.2	22	26

Station Number Name	Miles Up Stream	Year	Temperature		LWD Bank Full >6 In & >4 Ft or >10 CuFt		Substrate		Streambed (Thalweg)			Riparian Zone				Fish or Redds per Mile			Aquatic Macroinvertebrates				
			Seasonal Maximum	MWAT	CuFt/ 1000'	Pieces/ 1000'	>0.85 mm	D50	Slope	VI	A/D	Canopy % WLPZ	Cr.	Basal Area	Tallest Tree	Coho	SH (1+)	Redds	Richness	Simpson	Hilsenhoff	Russian R Index	% Dominant
		Avg	19.8	17.4	5,107	105	18%	31	1.0%	27	-0.4	82%	72%	220	116	1	250	3	32	0.73	4.0	16	29
		Min	12.9	12.3	10	1	5%	0	0.0%	9	-1.8	12%	10%	41	0	0	0	0	24	0.14	2.9	0	18
		Max	29.9	25.8	13,547	341	48%	71	6.9%	89	0.88	100%	98%	918	203	32	2,098	18	59	0.92	4.9	22	41
Old Growth Watersheds (HRSP)			**18.5**	**16.6**			**21.6%**	**62**											**26.2**	**0.89**			
Poor-Normal-Good										**>20**									**26-35**	**.8-.89**	**4.6-3.1**	**12-17**	**39-15**
NCWQCB Target			**18.3**	**16.8**			**<14%**																

Temperature

- Seasonal Maximum – The highest water temperature recorded during the summer.
- Maximum weekly average temperature (MWAT) - The highest average temperature for any seven day rolling average

Large Woody Debris (LWD)

- LWD must be at least 6 inches on the small end and longer than 4 feet.
- Cubic Feet per 1,000 feet – The cubic volume of LWD located between the bankfull lines.
- Pieces per 1,000' – The number of LWD pieces per 1000'

Stream Substrate

- <0.85mm – The percent fines less than 0.85 millimeters in a McNeal sample.
- D50- The pebble size of the median pebble of a 100 pebble sample. Three sample sites on each reach are averaged.

Fish Surveys

- Presence/absence snorkel surveys also estimate fish numbers per mile.
  - Coho – Coho salmon any age.
  - SH (1+) – Steelhead one year old or older.
- Redds - Number of salmon spawning nests found per mile during the season.

Streambed (Thalweg) Survey

- Slope – the slope of the channel
- VI – The variation index is the [(SD of residual depth/bank full depth) *100]. This is a way of quantifying roughness and hence suitability for fish. Greater than 20 is a good indication of recovery.
- A/D – The change in elevation of the channel (aggradation or degradation) relative to the first year of measurement.

Riparian Condition

- Canopy Cover percent as measured with a spherical densiometer. Every 200', canopy percent is measured in the center of the channel. And at bank full and 50' into the riparian zone from bankfull on both sides of the channel. Four measurements are averaged at each point.
- WLPZ (Watercourse and Lake Protection Zone) – The average of all the measurements taken on either side of the channel 50' into the riparial zone.
- Cr. – The average of all the measurements taken in the center of the channel.
- Riparian inventory plots were locate both sides of the channel every 200'
- Basal Area – Is the average basal area in square feet of all the riparian plots
- Tallest Tree – Is the tallest tree measured on the riparian plots.

Macroinvertebrates

- Richness – Total number of Genuses represented.
- Simpson Diversity Index – Measures the evenness of species diversity
- Hilsenhoff – This is a locally modified Hilsenhoff index. It indicates levels of organic pollution
- Russian River Index – A localized index that combines several standard metrics
- Percent Dominant Taxon – this is a species distribution index

APPENDIX G: MENDOCINO REDWOOD COMPANY GUALALA FISH DISTRIBUTION 1995 -2008

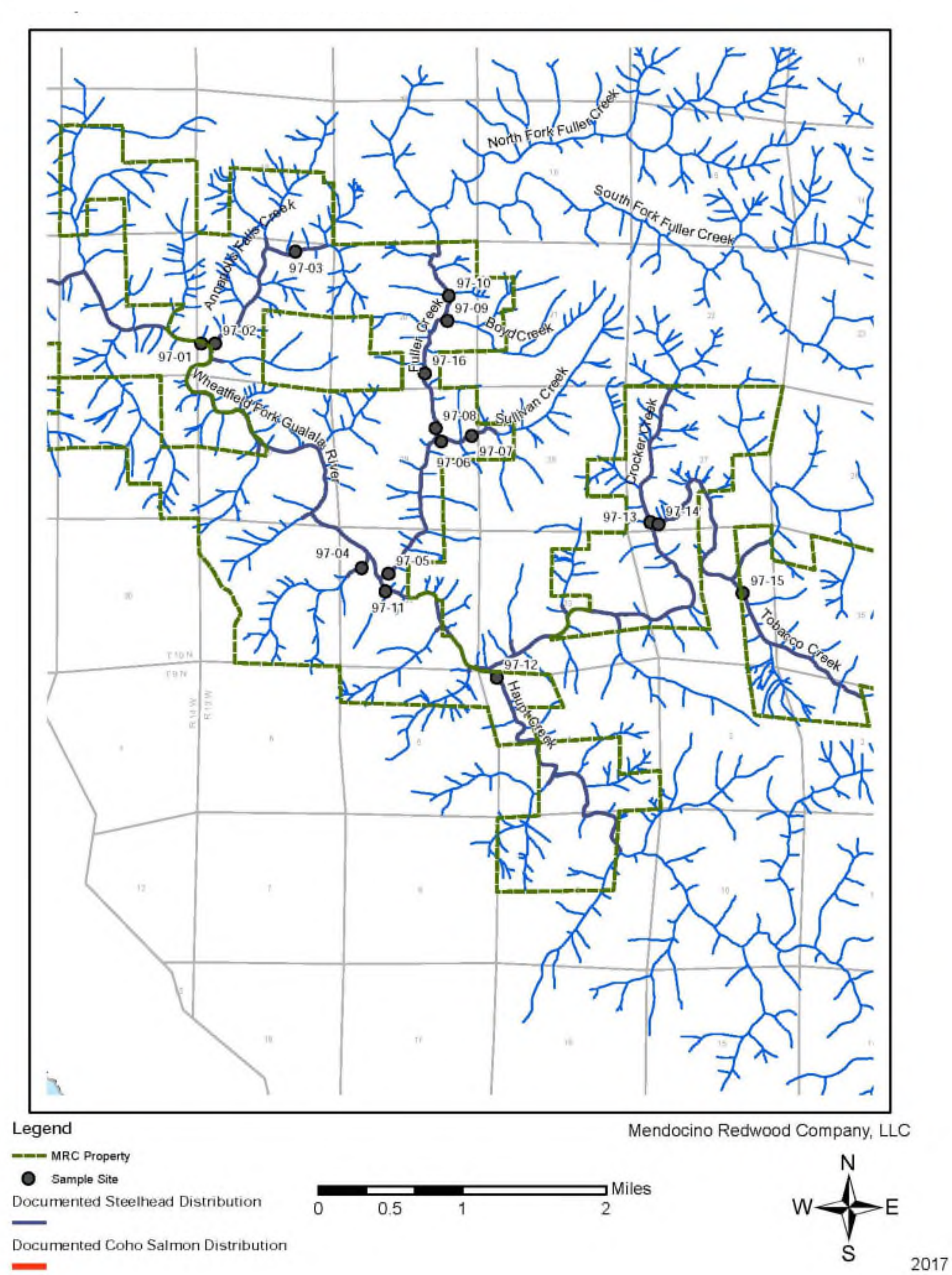

Table A183. Summary of results for fish distribution surveys within the Gualala River watershed, Mendocino Co., California. Refer to Map 35.

STREAM NAME	SITE ID	DATE	STH <70 MM	STH 70-130 MM	STH >130 MM	COH <70 MM	COH 70-130 MM	OTHER SPECIES
WHEATFIELD FORK	97-01	8/15/1995	PRESENT	PRESENT	PRESENT			RCH SCP STB
WHEATFIELD FORK	97-01	7/16/1996	PRESENT	PRESENT	PRESENT			RCH SCP
WHEATFIELD FORK	97-01	8/9/2000		2	1			RCH SCP
WHEATFIELD FORK	97-01	8/6/2001	50					CRY RCH
WHEATFIELD FORK	97-01	10/11/2002						CRY RCH STB
ANNAPOLIS FALLS CREEK	97-02	8/15/1995	PRESENT	PRESENT				CRY CGS
ANNAPOLIS FALLS CREEK	97-02	7/16/1996	PRESENT					
ANNAPOLIS FALLS CREEK	97-02	8/9/2000	8	1				CR YLF
ANNAPOLIS FALLS CREEK	97-02	8/6/2001	9					
TRIB TO ANNAPOLIS FALLS CREEK #1	97-03	8/15/1995	PRESENT	PRESENT	PRESENT			
TRIB TO ANNAPOLIS FALLS CREEK #1	97-03	7/16/1996	PRESENT					CGS
TRIB TO ANNAPOLIS FALLS CREEK #1	97-03	8/9/2000	5	2				
TRIB TO ANNAPOLIS FALLS CREEK #1	97-03	8/6/2001	2		1			
TRIB TO WHEATFIELD FORK #1	97-04	8/14/1995	PRESENT					CGS RCH YLF
TRIB TO WHEATFIELD FORK #1	97-04	7/16/1996	PRESENT					CGS

* Species Abbreviations; ALL=Alligator Lizard; AMM=Pacific Lamprey Larvae; BLF=Bullfrog; BLG=Bluegill; BKS=Black Salamander; CAT=Catfish; CGS=Coastal/California Giant Salamander; CHK=Chinook Salmon; CNT=California Newt; COH=Coho Salmon; CR=Coast Range Sculpin; CRY=Crayfish; GTR=Garter Snake; LAM=Pacific Lamprey; NEW=Newt (Unidentified Spp); NWP=Northwestern Pond Turtle; PR=Prickly Sculpin; PTF=Pacific Tree Frog; RBN=Red Bellied Newt; RCH=California Roach; RLF=Red-legged Frog; RSN=Rough Skinned Newt; SCP=Sculpin (Unidentified Spp); SKR=Sacramento Sucker; STB=Stickleback; STH=Steelhead Trout; TLF=Coastal Tailed Frog; WBL=Western Brook Lamprey; WDS=Wandering Salamander; WTD=Western Toad; YLF=Yellow-legged Frog.

* Blank spaces indicate that no organisms were observed.

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Table A184. Summary of results for fish distribution surveys within the Gualala River watershed, Mendocino Co., California. Refer to Map 35.

STREAM NAME	SITE ID	DATE	STH <70 MM	STH 70-130 MM	STH >130 MM	COH <70 MM	COH 70-130 MM	OTHER SPECIES
TRIB TO WHEATFIELD FORK #1	97-04	8/9/2000	2					CGS
TRIB TO WHEATFIELD FORK #1	97-04	8/8/2001		1				RCH
TRIB TO WHEATFIELD FORK #1	97-04	10/10/2002	1					RCH
FULLER CREEK	97-05	8/14/1995	PRESENT	PRESENT	PRESENT			RCH SCP STB YLF
FULLER CREEK	97-05	7/16/1996	PRESENT	PRESENT	PRESENT			RCH SCP
FULLER CREEK	97-05	8/9/2000	5	1				RCH SCP
FULLER CREEK	97-05	8/8/2001	4					CRY NWP RCH SCP
FULLER CREEK	97-05	10/10/2002	8	2				RCH SCP
FULLER CREEK	97-05	7/25/2007	75	10				CR CRY CGS PR RCH STB YLF
FULLER CREEK	97-05	10/14/2008	3					RCH YLF
FULLER CREEK	97-05	9/22/2010	25	30	1			RCH SCP STB
FULLER CREEK	97-05	8/21/2014	100	5	2			CRY RCH SCP STB YLF WTD
SULLIVAN CREEK	97-06	8/14/1995	PRESENT	PRESENT				YLF
SULLIVAN CREEK	97-06	7/17/1996	PRESENT	PRESENT	PRESENT			
SULLIVAN CREEK	97-06	8/8/2000	5	4				RCH SCP YLF

* Species Abbreviations; ALL=Alligator Lizard; AMM=Pacific Lamprey Larvae; BLF=Bullfrog; BLG=Bluegill; BKS=Black Salamander; CAT=Catfish; CGS=Coastal/California Giant Salamander; CHK=Chinook Salmon; CNT=California Newt; COH=Coho Salmon; CR=Coast Range Sculpin; CRY=Crayfish; GTR=Garter Snake; LAM=Pacific Lamprey; NEW=Newt (Unidentified Spp); NWP=Northwestern Pond Turtle; PR=Prickly Sculpin; PTF=Pacific Tree Frog; RBN=Red Bellied Newt; RCH=California Roach; RLF=Red-legged Frog; RSN=Rough Skinned Newt; SCP=Sculpin (Unidentified Spp); SKR=Sacramento Sucker; STB=Stickleback; STH=Steelhead Trout; TLF=Coastal Tailed Frog; WBL=Western Brook Lamprey; WDS=Wandering Salamander; WTD=Western Toad; YLF=Yellow-legged Frog.

* Blank spaces indicate that no organisms were observed.

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Table A185. Summary of results for fish distribution surveys within the Gualala River watershed, Mendocino Co., California. Refer to Map 35.

STREAM NAME	SITE ID	DATE	STH <70 MM	STH 70-130 MM	STH >130 MM	COH <70 MM	COH 70-130 MM	OTHER SPECIES
SULLIVAN CREEK	97-06	8/8/2001	7	2				RCH YLF
SULLIVAN CREEK	97-07	7/17/1996	PRESENT	PRESENT	PRESENT			YLF
SULLIVAN CREEK	97-07	8/8/2000						CGS YLF
SULLIVAN CREEK	97-07	8/8/2001						CGS YLF
SULLIVAN CREEK	97-07	10/10/2002	7	2				
FULLER CREEK	97-08	8/14/1995	PRESENT	PRESENT				RCH STB
FULLER CREEK	97-08	7/17/1996	PRESENT	PRESENT	PRESENT			RCH SCP STB YLF
FULLER CREEK	97-08	8/8/2000	6	2				RCH STB
FULLER CREEK	97-08	8/8/2001	10	4				CR PR RCH
FULLER CREEK	97-08	10/10/2002	11	1				RCH
TRIB TO FULLER CREEK #1	97-09	8/14/1995	PRESENT	PRESENT				CGS
TRIB TO FULLER CREEK #1	97-09	7/17/1996	PRESENT	PRESENT	PRESENT			
TRIB TO FULLER CREEK #1	97-09	8/8/2000	6	1				CGS
TRIB TO FULLER CREEK #1	97-09	8/6/2001	6					CGS
FULLER CREEK	97-10	8/14/1995	PRESENT	PRESENT	PRESENT			RCH STB

* Species Abbreviations; ALL=Alligator Lizard; AMM=Pacific Lamprey Larvae; BLF=Bullfrog; BLG=Bluegill; BKS=Black Salamander; CAT=Catfish; CGS=Coastal/California Giant Salamander; CHK=Chinook Salmon; CNT=California Newt; COH=Coho Salmon; CR=Coast Range Sculpin; CRY=Crayfish; GTR=Garter Snake; LAM=Pacific Lamprey; NEW=Newt (Unidentified Spp); NWP=Northwestern Pond Turtle; PR=Prickly Sculpin; PTF=Pacific Tree Frog; RBN=Red Bellied Newt; RCH=California Roach; RLF=Red-legged Frog; RSN=Rough Skinned Newt; SCP=Sculpin (Unidentified Spp); SKR=Sacramento Sucker; STB=Stickleback; STH=Steelhead Trout; TLF=Coastal Tailed Frog; WBL=Western Brook Lamprey; WDS=Wandering Salamander; WTD=Western Toad; YLF=Yellow-legged Frog.

* Blank spaces indicate that no organisms were observed.

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Table A186. Summary of results for fish distribution surveys within the Gualala River watershed, Mendocino Co., California. Refer to Map 35.

STREAM NAME	SITE ID	DATE	STH <70 MM	STH 70-130 MM	STH >130 MM	COH <70 MM	COH 70-130 MM	OTHER SPECIES
FULLER CREEK	97-10	7/17/1996	PRESENT	PRESENT				RCH SCP STB
FULLER CREEK	97-10	8/8/2000	16	2				RCH SCP STB YLF
FULLER CREEK	97-10	8/6/2001	11					PR
FULLER CREEK	97-10	10/11/2002	5	5				
FULLER CREEK	97-16	9/27/2005	14	8				RCH STB YLF
FULLER CREEK	97-16	10/19/2006	43	13	1			PR RCH STB
FULLER CREEK	97-16	10/20/2011	11	11				CGS PR RCH STB
FULLER CREEK	97-16	10/17/2012	29	5	1			STB YLF
FULLER CREEK	97-16	6/12/2013	21	2				CR RCH
FULLER CREEK	97-16	8/5/2015	40	25	5			CR PR RCH SCP YLF
WHEATFIELD FORK	97-11	8/14/1995	PRESENT	PRESENT	PRESENT			RCH STB
WHEATFIELD FORK	97-11	7/16/1996	PRESENT	PRESENT				RCH SCP
WHEATFIELD FORK	97-11	8/8/2000	1	2				RCH STB
WHEATFIELD FORK	97-11	8/8/2001						RCH
WHEATFIELD FORK	97-11	10/10/2002	19	6				RCH STB YLF

* Species Abbreviations; ALL=Alligator Lizard; AMM=Pacific Lamprey Larvae; BLF=Bullfrog; BLG=Bluegill; BKS=Black Salamander; CAT=Catfish; CGS=Coastal/California Giant Salamander; CHK=Chinook Salmon; CNT=California Newt; COH=Coho Salmon; CR=Coast Range Sculpin; CRY=Crayfish; GTR=Garter Snake; LAM=Pacific Lamprey; NEW=Newt (Unidentified Spp); NWP=Northwestern Pond Turtle; PR=Prickly Sculpin; PTF=Pacific Tree Frog; RBN=Red Bellied Newt; RCH=California Roach; RLF=Red-legged Frog; RSN=Rough Skinned Newt; SCP=Sculpin (Unidentified Spp); SKR=Sacramento Sucker; STB=Stickleback; STH=Steelhead Trout; TLF=Coastal Tailed Frog; WBL=Western Brook Lamprey; WDS=Wandering Salamander; WTD=Western Toad; YLF=Yellow-legged Frog.

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Table A187. Summary of results for fish distribution surveys within the Gualala River watershed, Mendocino Co., California. Refer to Map 35.

STREAM NAME	SITE ID	DATE	STH <70 MM	STH 70-130 MM	STH >130 MM	COH <70 MM	COH 70-130 MM	OTHER SPECIES
HAUPT CREEK	97-12	8/15/1995	PRESENT	PRESENT				CGS RCH STB
HAUPT CREEK	97-12	7/17/1996	PRESENT	PRESENT	PRESENT			RCH SCP STB
HAUPT CREEK	97-12	7/6/2000	12	3				
HAUPT CREEK	97-12	8/6/2001	3	2				PR RCH STB YLF
CROCKER CREEK	97-13	8/15/1995						CGS YLF
CROCKER CREEK	97-13	7/17/1996	PRESENT	PRESENT				
CROCKER CREEK	97-13	7/7/2000	11	2				CGS YLF
CROCKER CREEK	97-13	8/6/2001						CGS YLF
CROCKER CREEK	97-13	10/11/2002		1				CGS YLF
WHEATFIELD FORK	97-14	8/15/1995		PRESENT				RCH STB
WHEATFIELD FORK	97-14	7/17/1996	PRESENT		PRESENT			RCH STB
WHEATFIELD FORK	97-14	7/7/2000	2					RCH STB
WHEATFIELD FORK	97-14	8/6/2001	1					AMM RCH STB
WHEATFIELD FORK	97-14	10/11/2002		2				RCH STB YLF WTD
TOBACCO CREEK	97-15	8/15/1995	PRESENT	PRESENT				CGS

* Species Abbreviations; ALL=Alligator Lizard; AMM=Pacific Lamprey Larvae; BLF=Bullfrog; BLG=Bluegill; BKS=Black Salamander; CAT=Catfish; CGS=Coastal/California Giant Salamander; CHK=Chinook Salmon; CNT=California Newt; COH=Coho Salmon; CR=Coast Range Sculpin; CRY=Crayfish; GTR=Garter Snake; LAM=Pacific Lamprey; NEW=Newt (Unidentified Spp); NWP=Northwestern Pond Turtle; PR=Prickly Sculpin; PTF=Pacific Tree Frog; RBN=Red Bellied Newt; RCH=California Roach; RLF=Red-legged Frog; RSN=Rough Skinned Newt; SCP=Sculpin (Unidentified Spp); SKR=Sacramento Sucker; STB=Stickleback; STH=Steelhead Trout; TLF=Coastal Tailed Frog; WBL=Western Brook Lamprey; WDS=Wandering Salamander; WTD=Western Toad; YLF=Yellow-legged Frog.

* Blank spaces indicate that no organisms were observed.

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Table A188. Summary of results for fish distribution surveys within the Gualala River watershed, Mendocino Co., California. Refer to Map 35.

STREAM NAME	SITE ID	DATE	STH <70 MM	STH 70-130 MM	STH >130 MM	COH <70 MM	COH 70-130 MM	OTHER SPECIES
TOBACCO CREEK	97-15	7/17/1996	PRESENT					CGS RSN
TOBACCO CREEK	97-15	8/8/2000	7	3				CGS
TOBACCO CREEK	97-15	8/6/2001		7				YLF
TOBACCO CREEK	97-15	10/11/2002						YLF

* Species Abbreviations; ALL=Alligator Lizard; AMM=Pacific Lamprey Larvae; BLF=Bullfrog; BLG=Bluegill; BKS=Black Salamander; CAT=Catfish; CGS=Coastal/California Giant Salamander; CHK=Chinook Salmon; CNT=California Newt; COH=Coho Salmon; CR=Coast Range Sculpin; CRY=Crayfish; GTR=Garter Snake; LAM=Pacific Lamprey; NEW=Newt (Unidentified Spp); NWP=Northwestern Pond Turtle; PR=Prickly Sculpin; PTF=Pacific Tree Frog; RBN=Red Bellied Newt; RCH=California Roach; RLF=Red-legged Frog; RSN=Rough Skinned Newt; SCP=Sculpin (Unidentified Spp); SKR=Sacramento Sucker; STB=Stickleback; STH=Steelhead Trout; TLF=Coastal Tailed Frog; WBL=Western Brook Lamprey; WDS=Wandering Salamander; WTD=Western Toad; YLF=Yellow-legged Frog.

* Blank spaces indicate that no organisms were observed.

Click here for physical data
Click a Site ID for map

Table B183. Summary of site parameters within the Gualala River watershed, Mendocino Co., California. Refer to Map 35.

Stream Name	SITE ID	DATE	METHOD e=electrofish d=dive v=visual	EFFORT (minutes)	DISTANCE SAMPLED (feet)	POOL:RIFFLE: FLATWATER SAMPLED (%)	VISIBILITY*	FLOW*	DO (mg/l)	TEMP (°C)	pH
WHEATFIELD FORK	97-01	8/15/1995	D				3	2		21	
WHEATFIELD FORK	97-01	7/16/1996	D				3	3		21	
WHEATFIELD FORK	97-01	8/9/2000	E	2	213	44:56:0	3	2	9	20	7.9
WHEATFIELD FORK	97-01	8/6/2001	D		150	100:0:0	3	0		21.8	7.4
WHEATFIELD FORK	97-01	10/11/2002	D		500	100:0:0	3	0	6.8	16.4	6.9
ANNAPOLIS FALLS CREEK	97-02	8/15/1995	E	6			3	1		15.5	
ANNAPOLIS FALLS CREEK	97-02	7/16/1996	D				3	1		15.5	
ANNAPOLIS FALLS CREEK	97-02	8/9/2000	E	2	101	67:33:0	3	1	8.7	16	8
ANNAPOLIS FALLS CREEK	97-02	8/6/2001	E	2	48	100:0:0	3	0		15	6.7
TRIB TO ANNAPOLIS FALLS CREEK #1	97-03	8/15/1995	E	3			2	1		14.5	
TRIB TO ANNAPOLIS FALLS CREEK #1	97-03	7/16/1996	D				2	1		13.5	
TRIB TO ANNAPOLIS FALLS CREEK #1	97-03	8/9/2000	E	1	109	58:42:0	3	1	3.4	15	6.9
TRIB TO ANNAPOLIS FALLS CREEK #1	97-03	8/6/2001	E	2	113	46:54:0	1	0		13.7	6.6
TRIB TO WHEATFIELD FORK #1	97-04	8/14/1995	E	3			3	0		15	
TRIB TO WHEATFIELD FORK #1	97-04	7/16/1996	V	3			3	1		15.5	

*Visibility: 1=<1 ft. 2=1-5 ft. 3=>5 ft.

*Flow: 0=Intermittent 1=<1 CFS 2=1-5 CFS 3=>5 CFS

*Blank spaces indicate that no data was collected.

Click Site ID for biological data

Table B184. Summary of site parameters within the Gualala River watershed, Mendocino Co., California. Refer to Map 35.

Stream Name	SITE ID	DATE	METHOD e=electrofish d=dive v=visual	EFFORT (minutes)	DISTANCE SAMPLED (feet)	POOL:RIFFLE: FLATWATER SAMPLED (%)	VISIBILITY*	FLOW*	DO (mg/l)	TEMP (°C)	pH
TRIB TO WHEATFIELD FORK #1	97-04	8/9/2000	E	2	92	38:62:0	3	1	8.8	14	8.1
TRIB TO WHEATFIELD FORK #1	97-04	8/8/2001	E	2	97	84:16:0	3	0	4.9	14.8	6.8
TRIB TO WHEATFIELD FORK #1	97-04	10/10/2002	D		100	100:0:0	3	0	7.18	12.2	6.5
FULLER CREEK	97-05	8/14/1995	D				3	1		16.5	
FULLER CREEK	97-05	7/16/1996	D				3	2		22	
FULLER CREEK	97-05	8/9/2000	E	2	161	52:48:0	3	1	7.3	17	7.5
FULLER CREEK	97-05	8/8/2001	D		96	90:10:0	3	1	6.6	17.2	7.4
FULLER CREEK	97-05	10/10/2002	D		100	100:0:0	3	1	9.34	13.7	7.3
FULLER CREEK	97-05	7/25/2007	E	18	365	82:18:0	2	1	8.41	17.8	7.9
FULLER CREEK	97-05	10/14/2008	V	5	20		3	1	4.66	9.38	9.7
FULLER CREEK	97-05	9/22/2010	E	12	302	93:0:4	2	2	11.28	12.84	8.5
FULLER CREEK	97-05	8/21/2014	D	45	370	95:5:0	2	1		16.8	
SULLIVAN CREEK	97-06	8/14/1995	D				3	1		16.5	
SULLIVAN CREEK	97-06	7/17/1996	D				3	1		17	
SULLIVAN CREEK	97-06	8/8/2000	E	3	101	87:13:0	3	1	8.7	15	7.4

*Visibility: 1=<1 ft. 2=1-5 ft. 3=>5 ft.

*Flow: 0=Intermittent 1=<1 CFS 2=1-5 CFS 3=>5 CFS

*Blank spaces indicate that no data was collected.

Click Site ID for biological data

Table B185. Summary of site parameters within the Gualala River watershed, Mendocino Co., California. Refer to Map 35.

Stream Name	SITE ID	DATE	METHOD e=electrofish d=dive v=visual	EFFORT (minutes)	DISTANCE SAMPLED (feet)	POOL:RIFFLE: FLATWATER SAMPLED (%)	VISIBILITY*	FLOW*	DO (mg/l)	TEMP (°C)	pH
SULLIVAN CREEK	97-06	8/8/2001	E	2	100	60:40:0	3	1	7.2	15.2	7.1
SULLIVAN CREEK	97-07	7/17/1996	D				3	0		17	
SULLIVAN CREEK	97-07	8/8/2000	E	2	87	34:66:0	3	1	6.7	16	7.5
SULLIVAN CREEK	97-07	8/8/2001	E	1	104	67:33:0	3	1	8.32	15.2	7.0
SULLIVAN CREEK	97-07	10/10/2002	D		90	100:0:0	3	1	9.65	12.6	7
FULLER CREEK	97-08	8/14/1995	D				3	1		20.5	
FULLER CREEK	97-08	7/17/1996	D				3	2		19.5	
FULLER CREEK	97-08	8/8/2000	E	3	170	64:18:18	3	1	8.4	18	7.8
FULLER CREEK	97-08	8/8/2001	E	3	99	80:20:0	3	1	8.04	17.3	7.5
FULLER CREEK	97-08	10/10/2002	D		116	100:0:0	3	1	10.17	13.7	7.1
TRIB TO FULLER CREEK #1	97-09	8/14/1995	E	4			3	1		15	
TRIB TO FULLER CREEK #1	97-09	7/17/1996	D				3	1		15	
TRIB TO FULLER CREEK #1	97-09	8/8/2000	E	1	105	63:37:0	3	1	9	15	7.8
TRIB TO FULLER CREEK #1	97-09	8/6/2001	E	2	101	39:61:0	3	1		14.7	7.2
FULLER CREEK	97-10	8/14/1995	D				3	1		22	

*Visibility: 1=<1 ft. 2=1-5 ft. 3=>5 ft.

*Flow: 0=Intermittent 1=<1 CFS 2=1-5 CFS 3=>5 CFS

*Blank spaces indicate that no data was collected.

Click Site ID for biological data

Table B186. Summary of site parameters within the Gualala River watershed, Mendocino Co., California. Refer to Map 35.

Stream Name	SITE ID	DATE	METHOD e=electrofish d=dive v=visual	EFFORT (minutes)	DISTANCE SAMPLED (feet)	POOL:RIFFLE: FLATWATER SAMPLED (%)	VISIBILITY*	FLOW*	DO (mg/l)	TEMP (°C)	pH
FULLER CREEK	97-10	7/17/1996	D				3	2		21	
FULLER CREEK	97-10	8/8/2000	E	10	239	69:31:0	3	1	8.2	17	7.8
FULLER CREEK	97-10	8/6/2001	E	2	157	55:45:0	3	1	7.2	18.4	7.4
FULLER CREEK	97-10	10/11/2002	E	1	42	14:67:19	3	1	8.1	13.6	7.6
FULLER CREEK	97-16	9/27/2005	E	3	490	74:16:11	3	2		13.5	6.4
FULLER CREEK	97-16	10/19/2006	E	12	396	100:0:0	2	2		9.4	7.5
FULLER CREEK	97-16	10/20/2011	E	7	260	69:8:23	2	2	10.65	12.87	8.4
FULLER CREEK	97-16	10/17/2012	D	15	200	100:0:0	3	1		12	
FULLER CREEK	97-16	6/12/2013	E	6	198	91:0:9	2	2		14	
FULLER CREEK	97-16	8/5/2015	E	10	302	99:1:0	3	1		16.5	
WHEATFIELD FORK	97-11	8/14/1995	D				3	2		22.5	
WHEATFIELD FORK	97-11	7/16/1996	D				3	2		24.5	
WHEATFIELD FORK	97-11	8/8/2000	E	4	208	66:34:0	3	2	6.3	20	7.3
WHEATFIELD FORK	97-11	8/8/2001	D		166	67:33:0	3	0	7.48	22	8
WHEATFIELD FORK	97-11	10/10/2002	D		200	100:0:0	3	0	11.11	16.3	7.5

*Visibility: 1=<1 ft. 2=1-5 ft. 3=>5 ft.

*Flow: 0=Intermittent 1=<1 CFS 2=1-5 CFS 3=>5 CFS

*Blank spaces indicate that no data was collected.

Click Site ID for biological data

Table B187. Summary of site parameters within the Gualala River watershed, Mendocino Co., California. Refer to Map 35.

Stream Name	SITE ID	DATE	METHOD e=electrofish d=dive v=visual	EFFORT (minutes)	DISTANCE SAMPLED (feet)	POOL:RIFFLE: FLATWATER SAMPLED (%)	VISIBILITY*	FLOW*	DO (mg/l)	TEMP (°C)	pH
HAUPT CREEK	97-12	8/15/1995	E	4			3	0			
HAUPT CREEK	97-12	7/17/1996	D				3	1		20	
HAUPT CREEK	97-12	7/6/2000	E	3	108	75:25:0	3	1	6.25	16.1	6.9
HAUPT CREEK	97-12	8/6/2001	E	1	134	76:24:0	3	1		21.4	7.0
CROCKER CREEK	97-13	8/15/1995	E	3			3	1		15.5	
CROCKER CREEK	97-13	7/17/1996	D				3	1		15	
CROCKER CREEK	97-13	7/7/2000	E	3	100	65:35:0	3	1	8.85	13.8	7.1
CROCKER CREEK	97-13	8/6/2001	E	4	90	77:23:0	3	1		15.4	6.4
CROCKER CREEK	97-13	10/11/2002	E	1	72	64:36:0	3	1	6.8	12.2	7.2
WHEATFIELD FORK	97-14	8/15/1995	D				3	2		25	
WHEATFIELD FORK	97-14	7/17/1996	D				3	3		19	
WHEATFIELD FORK	97-14	7/7/2000	D		285	56:0:44	2	2	10.34	20	8.5
WHEATFIELD FORK	97-14	8/6/2001	D		130	73:27:0	3	2	7.8	25.9	8.1
WHEATFIELD FORK	97-14	10/11/2002	E	1	173	46:54:0	3	1	6.3	15.6	7.5
TOBACCO CREEK	97-15	8/15/1995	E	5			3	1		17	

*Visibility: 1=<1 ft. 2=1-5 ft. 3=>5 ft.

*Flow: 0=Intermittent 1=<1 CFS 2=1-5 CFS 3=>5 CFS

*Blank spaces indicate that no data was collected.

Click Site ID for biological data

Table B188. Summary of site parameters within the Gualala River watershed, Mendocino Co., California. Refer to Map 35.

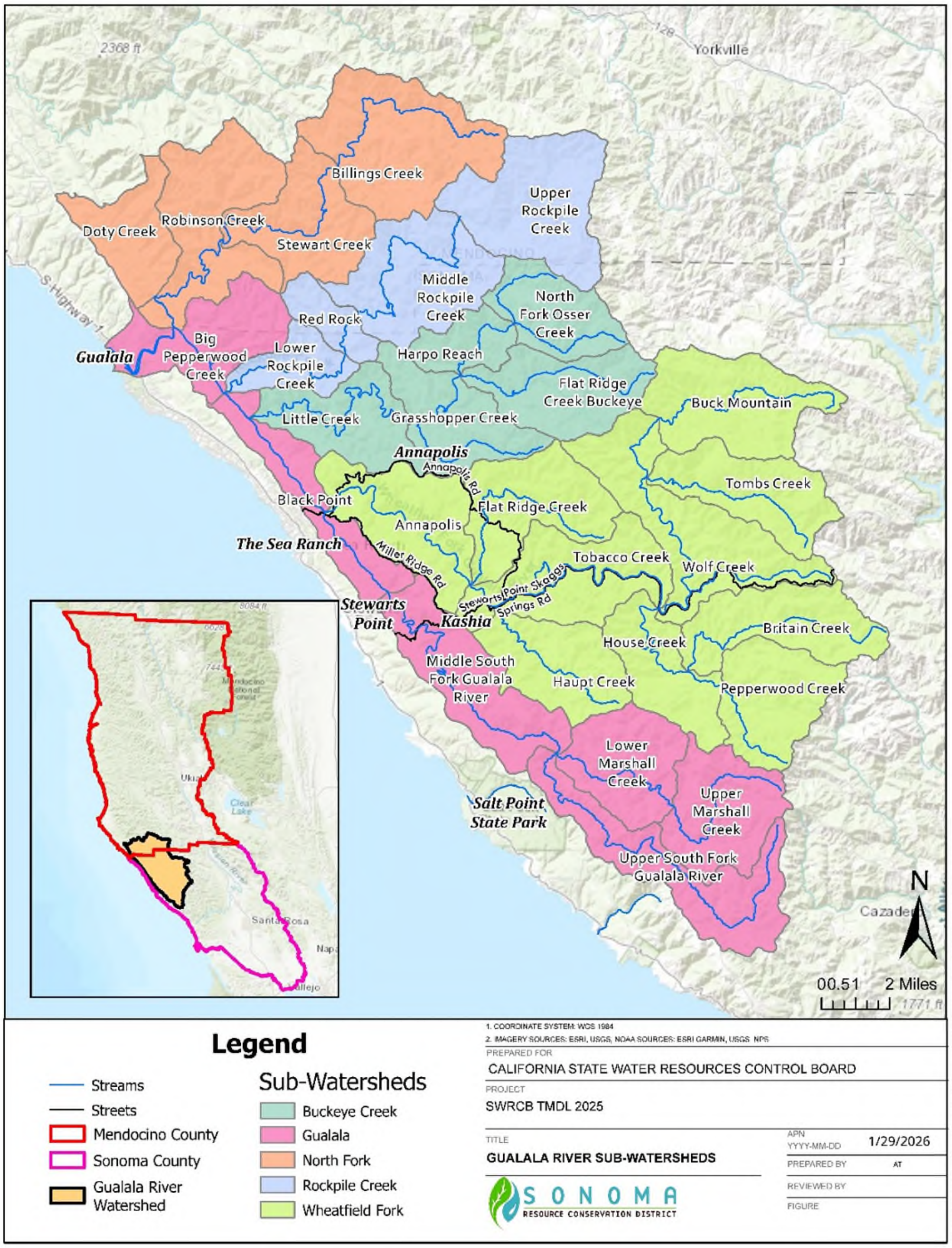
Stream Name	SITE ID	DATE	METHOD e=electrofish d=dive v=visual	EFFORT (minutes)	DISTANCE SAMPLED (feet)	POOL:RIFFLE: FLATWATER SAMPLED (%)	VISIBILITY*	FLOW*	DO (mg/l)	TEMP (°C)	pH
TOBACCO CREEK	97-15	7/17/1996	D				3	1		15	
TOBACCO CREEK	97-15	8/8/2000	E	3	105	52:48:0	3	1	8.5	15	7.9
TOBACCO CREEK	97-15	8/6/2001	E	2	110	35:65:0	3	1	7	17	7.5
TOBACCO CREEK	97-15	10/11/2002	E	1	88	35:65:0	3	1	8.4	11.7	7.1

*Visibility: 1=<1 ft. 2=1-5 ft. 3=>5 ft.
*Flow: 0=Intermittent 1=<1 CFS 2=1-5 CFS 3=>5 CFS
*Blank spaces indicate that no data was collected.

Click Site ID for biological data

APPENDIX H: MAPS

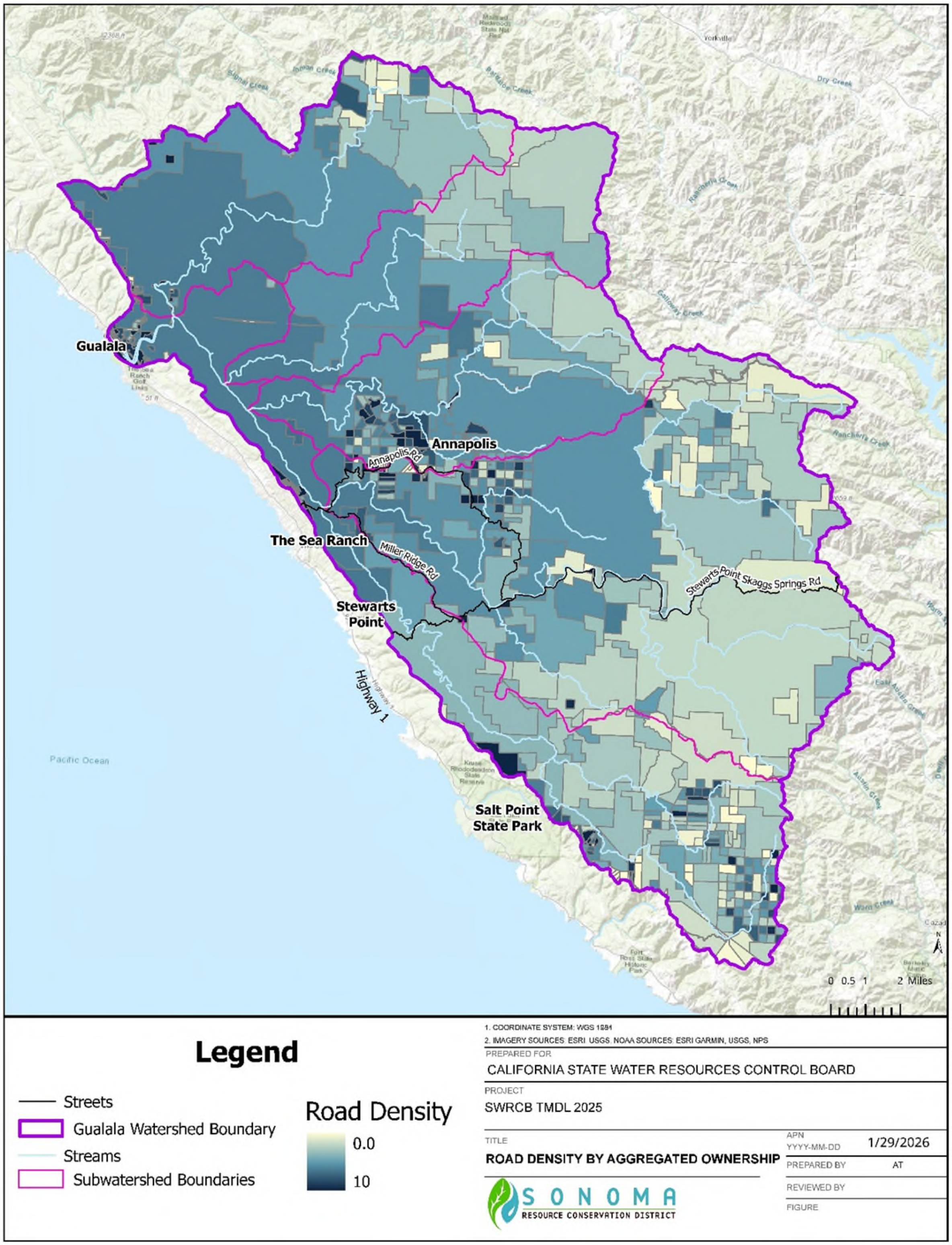
Map 1. Watershed and subwatersheds



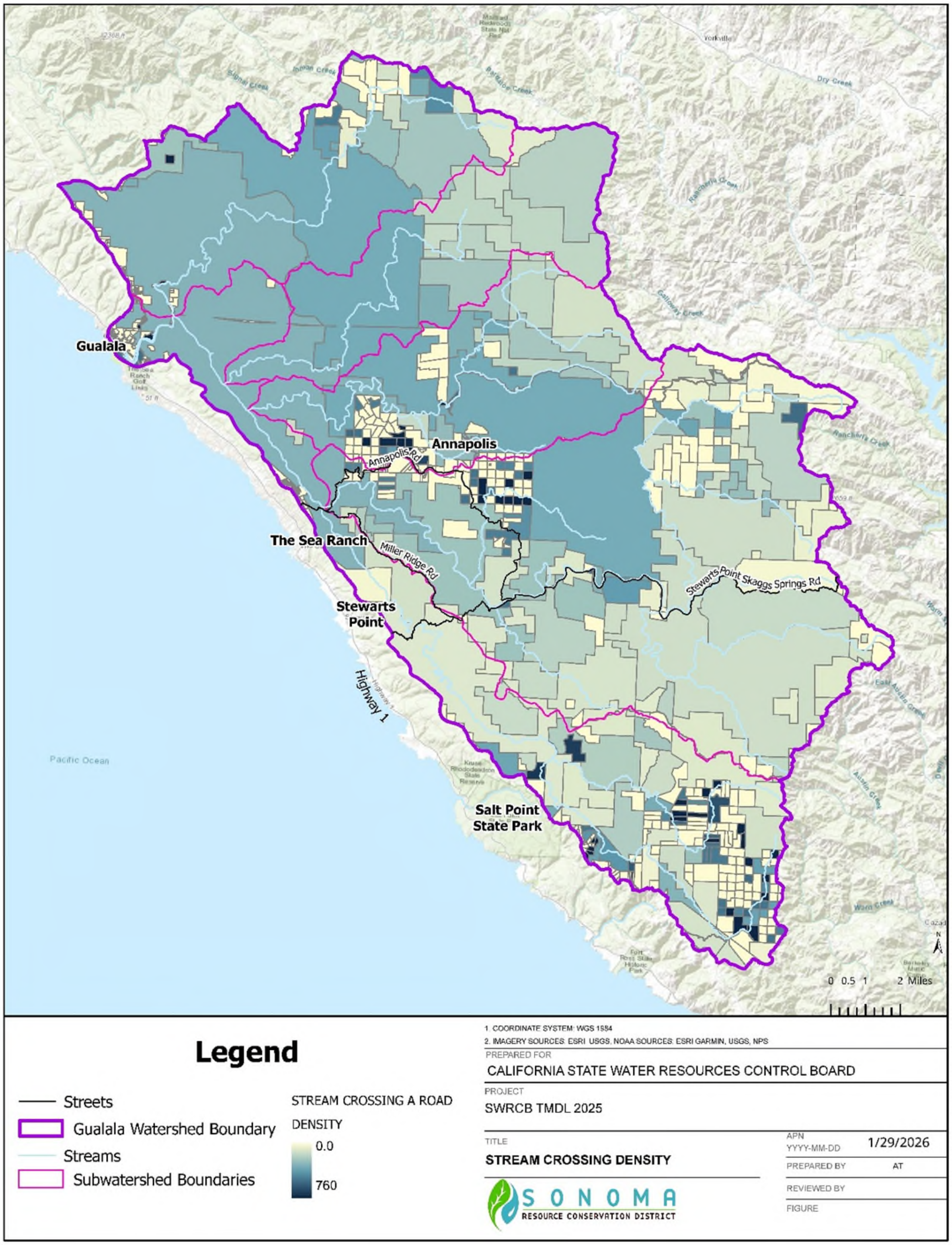
Map 2. Roads


North Fork
Rockpile
Gualala
Buckeye
Annapolis
The Sea Ranch
Wheatfield
Stewarts Point
South Fork
Highway 1
Pacific Ocean
Salt Point State Park
Legend
Gualala Streams
Roads
Gualala Watershed Boundary
Gualala Watersheds
Buckeye
North Fork
Rockpile
South Fork
Wheatfield
1. COORDINATE SYSTEM: WGS 1984
2. IMAGERY SOURCES: ESRI USGS NOAA SOURCES: ESRI GARMIN, USGS, NPS
PREPARED FOR
CALIFORNIA STATE WATER RESOURCES CONTROL BOARD
PROJECT
SWRCB TMDL 2025
TITLE
ROADS
APN
YYYY-MM-DD
1/29/2026
PREPARED BY
AT
REVIEWED BY
FIGURE
SONOMA
RESOURCE CONSERVATION DISTRICT

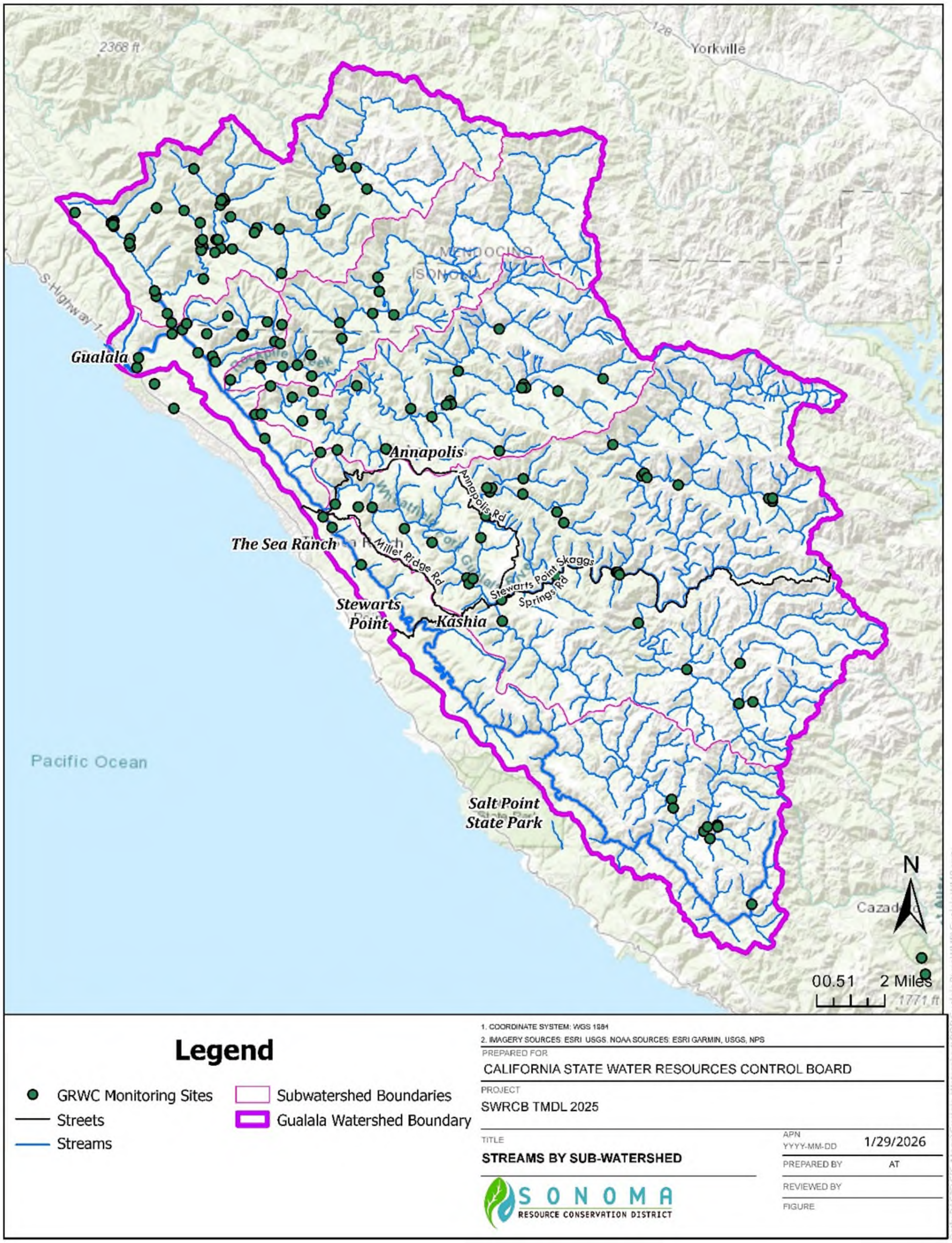
Map 3. Road density by aggregated ownership



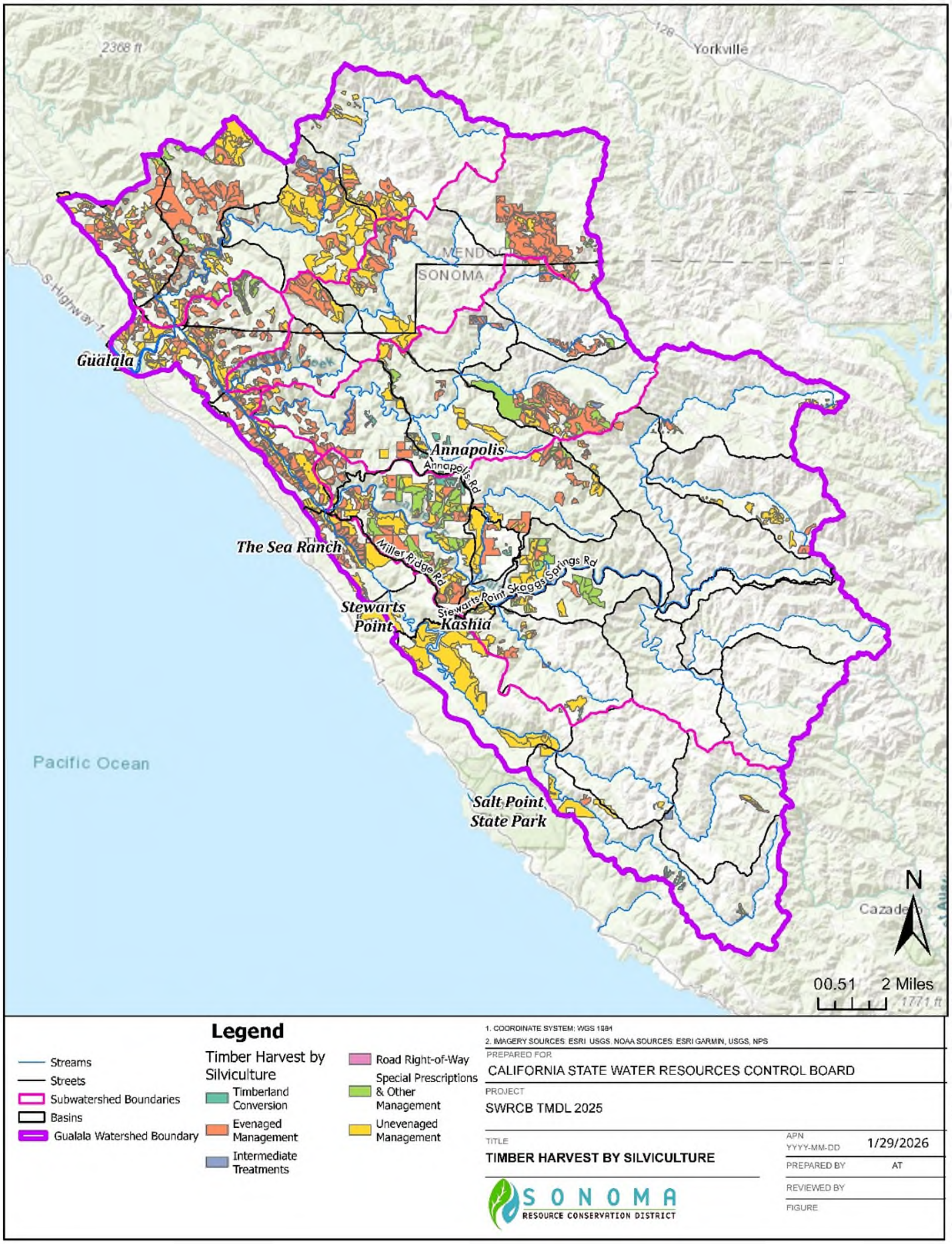
Map 4. Stream crossing density by owner



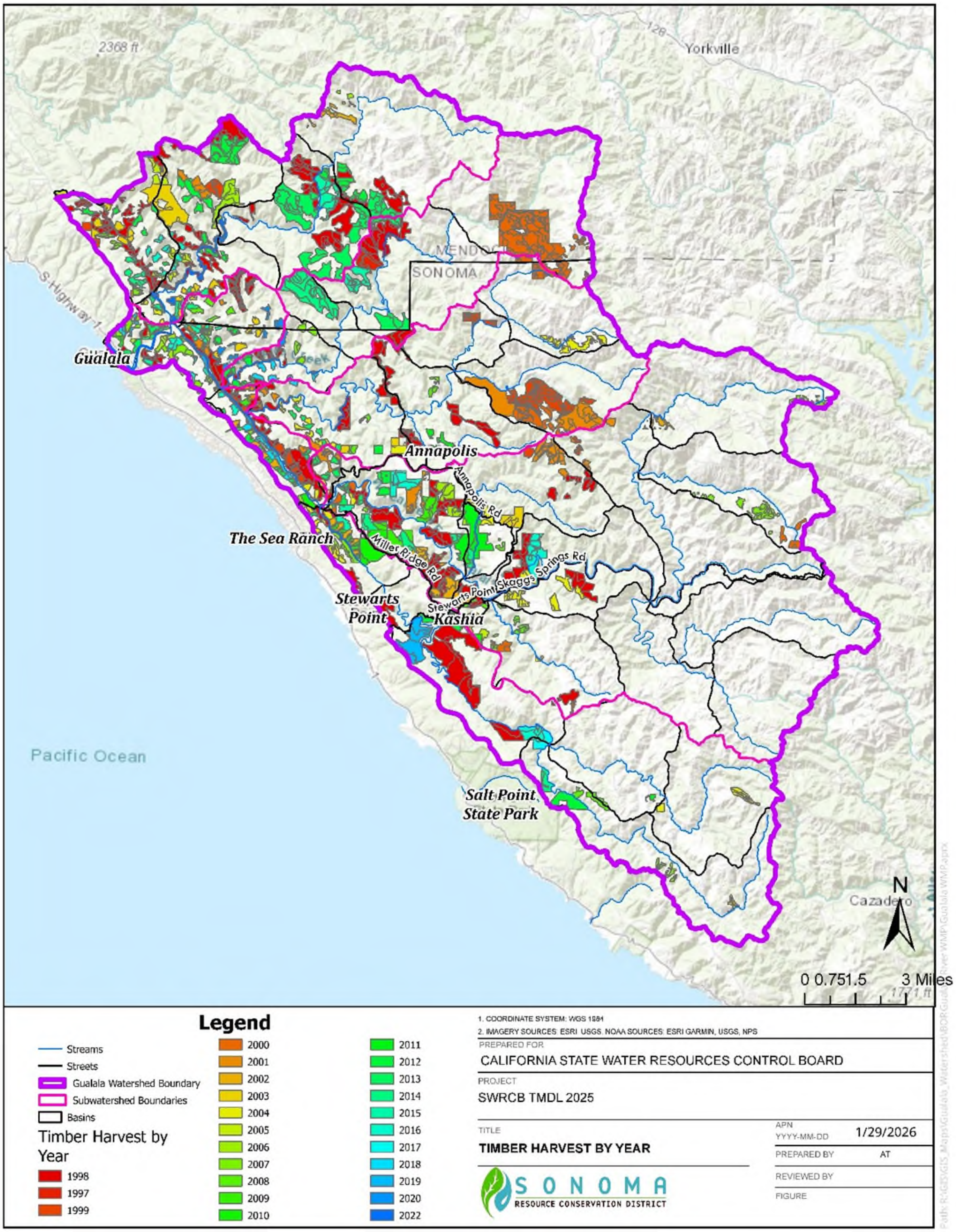
Map 5. Gualala River Watershed Council Monitoring Sites



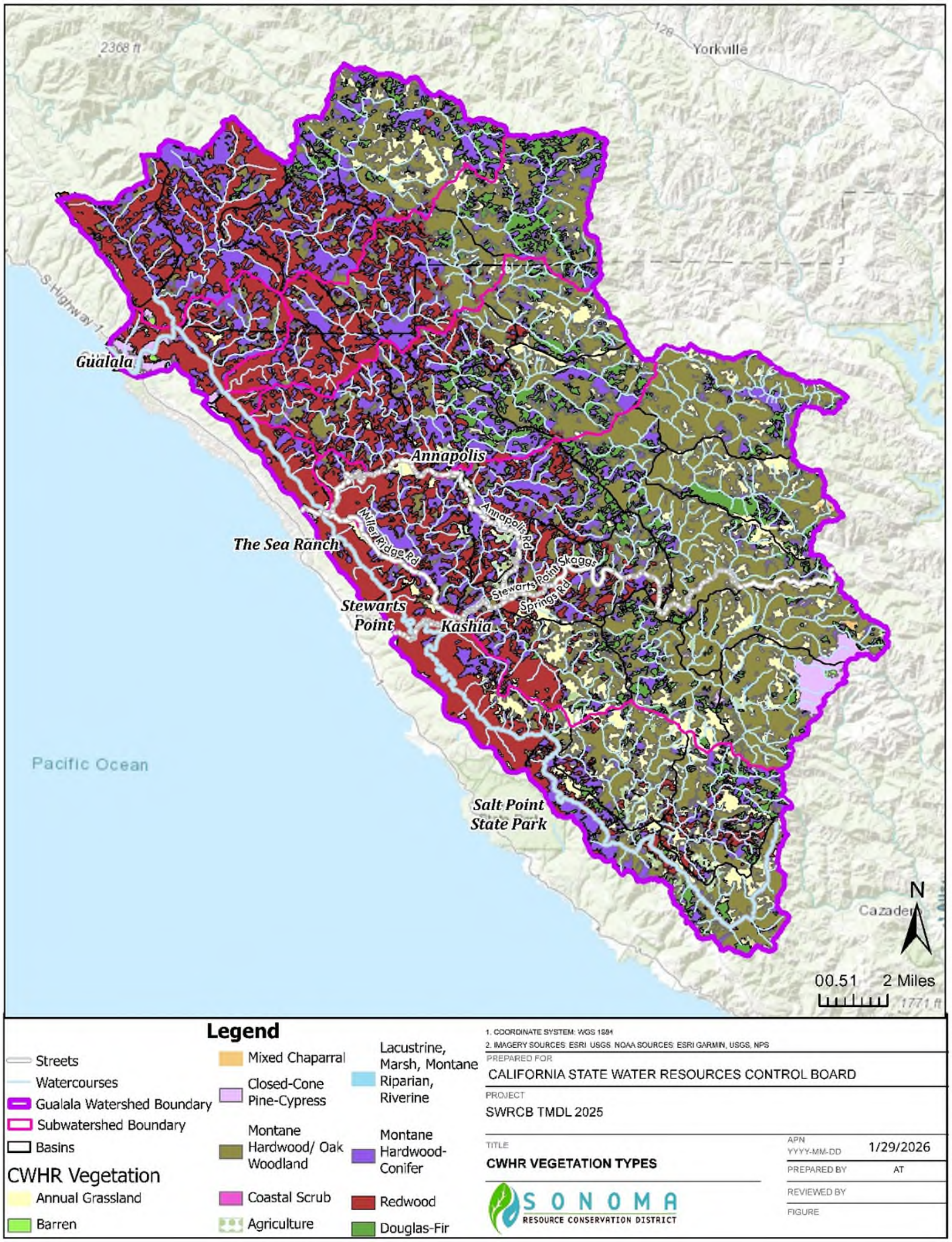
Map 6. Timber harvest by silviculture



Map 7. Timber harvest by year



Map 8. California Wildlife Habitat Relationships System Vegetation Types



Map 9. Historical Occurrence of Coho Salmon

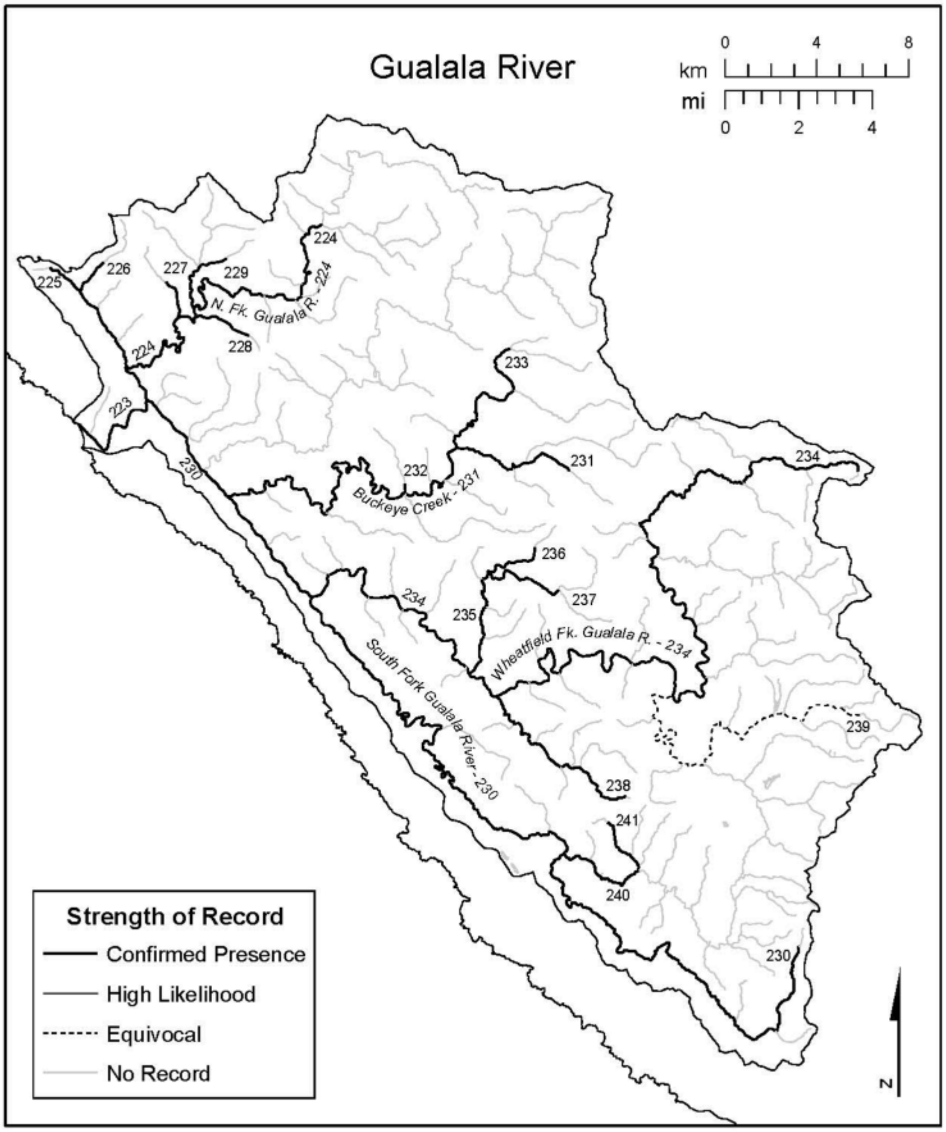


FIGURE 12. Historical distribution of coho salmon in the Gualala River basin. Numbers correspond to stream numbers in Appendix A. Upper distributional limit for each stream based on IP model predictions. Unlabeled streams include the mainstem Gualala River [223], Little North Fk. Gualala River [225], Doty Cr. [226], Robinson Cr. [227], McGann Gulch [228], Dry Cr. [229], Franchini Cr. [232], North Fk. Buckeye Cr. [233], Fuller Cr. [235], North Fk. Fuller Cr. [236], South Fk. Fuller Cr. [237], Haupt Cr. [238], House Cr. [239], Marshall Cr. [240], and Sproule Cr. [241].

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