GUALALA RIVER

APPENDIX 1: HYDROLOGY

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I. GENERAL BASIN DESCRIPTION

The Gualala River drains 298 square miles along the coast of southern Mendocino and northern Sonoma Counties. The river enters the Pacific Ocean near the town of Gualala, 114 miles north of San Francisco, and 17 miles south of Point Arena. The Gualala River Basin is elongated running over 32 miles long north–south, with an average width of 14 miles. A general location map is shown in Figure 1 of the synthesis report. The North and South Fork stream channels follow very near, if not directly on top of, the San Andreas Fault Zone. A relatively straight and continuous ridgeline separates the Gualala River from the ocean. The river crosses the ridge in a saddle and flows northward to the ocean at the town of Gualala. Elevations vary from sea level to 2,602 feet at Gube Mountain. The basin is bordered by the Garcia River Basin to the north and the Russian River Basin to the east.

The main stem of the Gualala River flows from the confluence of the South Fork and North Fork to the Pacific Ocean. This reach is greatly influenced by seasonal closures of the river mouth, which typically occur in early summer and last until the first heavy rains of October or November, although it may also close briefly during the winter months (DFG 1968 and EIP 1994). Aggradation of the streambed in the lower portions of the major tributaries has probably reduced surface water flow to the estuary during periods of low precipitation.

The climate is influenced by fog near the coast with seasonal temperatures ranging between 40 and 60 degrees F, but the interior basin can vary during the year from below freezing to over 90 degrees F. Rainfall is also highly seasonal with approximately 90 percent falling between October and April. Mean annual rainfall amounts are lowest near the lower elevations along the coastline at about 33 inches and increase eastward to the eastern edge of the upper basin to a maximum of about 63 inches.

The Gualala River Basin has a long history of land use, fire, and floods. Since snow accumulation is minimal, a rainfall/runoff hydrology predominates in the basin. With steep slopes and high rainfall amounts, detention time and time of concentration of rainfall are reduced. Alterations of the landscape can likely change the hydrologic curves, flood frequencies and peaks within the subbasins of the Gualala River.

Only one streamflow gage, South Fork Gualala River near Annapolis, USGS station #11467500, operated within the basin for a significant period (October 1950 – September 1971 and June 1991 – June 1994). The gage was located below the confluence with the Wheatfield Fork and measured the runoff from 161 or 54 percent of the total 298 square mile Gualala River Basin.

DWR's Statewide Planning Program delineates the Gualala River Basin within the North Coast Hydrologic Region (HR), the Coastal (#03) Planning Subarea (PSA), and the Gualala (#19) Detailed Analysis Unit (DAU). The USGS delineates the Gaulala River Basin within Hydrologic Unit #18010109.

The Gualala River assessment team has divided the basin into five principal subbasins for assessment purposes (Figure 2). These divisions, considered "sub planning watersheds" under the CalWater 2.2 Planning Watershed designation, are as follows: Wheatfield Fork (37 percent of drainage), Mainstem/South Fork (21), North Fork (16), Buckeye Creek (14), and Rockpile Creek (12). DFG staff performed field surveys to determine channel classifications for each of these subbasins. In their surveys, DFG crews utilize a channel classification system developed by David Rosgen (1994) as described in the California Salmonid Stream Habitat Restoration Manual (Flosi, et al., 1998). Rosgen channel typing describes relatively long stream reaches using eight channel features: channel width, depth, velocity, discharge, channel slope, roughness of channel materials, sediment load and sediment size. There are eight general channel types in the Rosgen classification system.

North Fork

The North Fork Subbasin is made up of one complete Calwater Hydrologic Subarea, the North Fork Hydrologic Subarea. There are 33.7 perennial stream miles in 15 perennial tributaries in this subbasin. Nine of these tributaries have been inventoried by DFG. There were 13 reaches, totaling 22.2 miles in the inventory surveys. The inventory included channel and habitat typing, and biological sampling.

In the North Fork Subbasin, there were six type F channels, totaling 15.7 miles; two type A channels, totaling 0.5 miles; and six type B channels, totaling 5.6 miles. Type F stream reaches are wide, shallow, single thread channels. They are deeply entrenched, low gradient reaches and often have high rates of bank erosion. Type F reaches flow through low-relief valleys and gorges, are typically working to create new floodplains, and have frequent meanders. Type A stream reaches are narrow, moderately deep, single thread channels. They are entrenched, high gradient reaches with step/pool sequences. Type A reaches flow through steep V- shaped valleys, do not have well-developed floodplains, and have few meanders. Type B stream reaches are wide, shallow, single thread channels. They are moderately entrenched, moderate to steep gradient reaches, which are riffle-dominated with step/pool sequences. Type B reaches flow through broader valleys than type A reaches, do not have well-developed floodplains, and have few meanders (Flosi, et al., 1998).

Rockpile Creek

The Rockpile Creek Subbasin is made up of one complete Calwater Hydrologic Subarea, the Rockpile Hydrologic Subarea. There are 22.7 perennial stream miles in three perennial tributaries in this subbasin. The mainstem of Rockpile Creek was inventoried by DFG. There was 1 reach, totaling 5.1 miles in the inventory survey. The inventory included channel and habitat typing, and biological sampling.

In the Rockpile Creek Subbasin, there was one type F channel, totaling 5.1 miles. Type F stream reaches are wide, shallow, single thread channels. They are deeply entrenched, low gradient reaches and often have high rates of bank erosion. Type F reaches flow through low-relief valleys and gorges, are typically working to create new floodplains, and have frequent meanders.

Buckeye Creek

The Buckeye Creek Subbasin is made up of one complete Calwater Hydrologic Subarea, the Buckeye Creek Hydrologic Subarea. There are 29.6 perennial stream miles in nine perennial tributaries in this subbasin. The mainstem of Buckeye Creek was inventoried by DFG. There were two reaches, totaling 9.7 miles in the inventory survey. The inventory included channel and habitat typing, and biological sampling.

In the Buckeye Creek Subbasin, there were two type F channels, totaling 9.7 miles. Type F stream reaches are wide, shallow, single thread channels. They are deeply entrenched, low gradient reaches and often have high rates of bank erosion. Type F reaches flow through low-relief valleys and gorges, are typically working to create new floodplains, and have frequent meanders.

Wheatfield Fork

The Wheatfield Fork Subbasin is made up of one complete Calwater Hydrologic Subarea, the Wheatfield Fork Hydrologic Subarea. There are 75.5 perennial stream miles in 12 perennial tributaries in this subbasin. Six of these tributaries have been inventoried by DFG. There were six reaches, totaling 43.9 miles in the inventory surveys. The inventory included channel and habitat typing, and biological sampling.

In the Wheatfield Fork Subbasin, there were 5 type F channels, totaling 36.8 miles; and one type B channels, totaling 7.1 miles. Type F stream reaches are wide, shallow, single thread channels. They are deeply entrenched, low gradient reaches and often have high rates of bank erosion. Type F reaches flow through low-relief valleys and gorges, are typically working to create new floodplains, and have frequent meanders. Type B stream reaches are wide, shallow, single thread channels. They are moderately entrenched, moderate to steep gradient reaches, which are riffle-dominated with step/pool sequences. Type B reaches flow through broader valleys than type A reaches, do not have well-developed floodplains, and have few meanders.

Mainstem/South Fork

The Mainstem/South Fork Subbasin is made up of one complete Calwater Hydrologic Subarea, the Gualala River Hydrologic Subarea. There are 55 perennial stream miles in 10 perennial tributaries in this subbasin. Three of these tributaries have been inventoried by DFG. There were three reaches, totaling 5.8 miles in the inventory surveys. The inventory included channel and habitat typing, and biological sampling.

In the Mainstem/South Fork Subbasin, there were two type F channels, totaling 5.7 miles; and one type B channel, totaling 395 feet. Type F stream reaches are wide, shallow, single thread channels. They are deeply entrenched, low gradient reaches and often have high rates of bank erosion. Type F reaches flow through low-relief valleys and gorges, are typically working to create new floodplains, and have frequent meanders. Type B stream reaches are wide, shallow, single thread channels. They are moderately entrenched, moderate to steep gradient reaches, which are riffle-dominated with step/pool sequences. Type B reaches flow through broader valleys than type A reaches, do not have well-developed floodplains, and have few meanders.

II. PRECIPITATION

Precipitation in the Gualala River Basin is highly seasonal, with approximately 90 percent falling between October and April. A very small portion of the precipitation may fall as snow in the upper reaches of the basin. However, ridgeline elevations are less than 2,600 feet, and snowfall accumulations are very thin. Therefore, snowmelt events or rain-on-snow events are probably not hydrologically significant. Seven precipitation gages are or were located within the Gualala River Basin with three gages having a period of record exceeding 20 years. Twelve gages are or were located within five miles of the basin boundaries; four gages have a period of record exceeding 40 years. Twelve additional gages are or were located within five to ten miles of the basin boundaries; four gages have a period of record exceeding 40 years. Table II-1 contains the gage identifiers, location, period of record, annual, and maximum daily precipitation for 12 gages with long-term periods of record within or near the Gualala River Basin. Chart II-1 graphically illustrates the period of record for the gages. Figure II-1 provides a location map for the gages located within the basin. Mean annual rainfall amounts are lowest near the coastline at 33 inches and increase eastward to the eastern edge of the basin to a maximum of 63 inches. Highest rainfall amounts occur along the drainage divide in the southeastern region of the basin.

Two long-term precipitation stations still operating are located near the basin at lower elevations. The Fort Ross gage is located in the town of Fort Ross along the coast near the southern portion of the basin, and has the longest period of record (1876 – present). It lies approximately two miles outside of the basin boundary. Chart II-2 shows the annual precipitation at Fort Ross along with the cumulative departure from the mean for Water Years 1876 - 2000. The mean precipitation for the 125-year period of record is 43.27 inches. The wettest year was 1878 and the driest year was 1977 when 94.44 and 16.01 inches of precipitation were recorded, respectively.

The Cloverdale gage is located in the town of Cloverdale northeast of the central eastern portion of the basin, approximately 11 miles outside of the basin boundary at elevation 315 feet. Chart II-3 shows the annual precipitation at Cloverdale along with the cumulative departure from the mean for Water Years 1903 - 2000. The mean precipitation for the 101-year period of record from 1894 - 1896 and 1903 - 2000 is 40.89 inches. The wettest year was 1983 and the driest year was 1924 when 79.26 inches and 13.54 inches of precipitation were recorded, respectively.

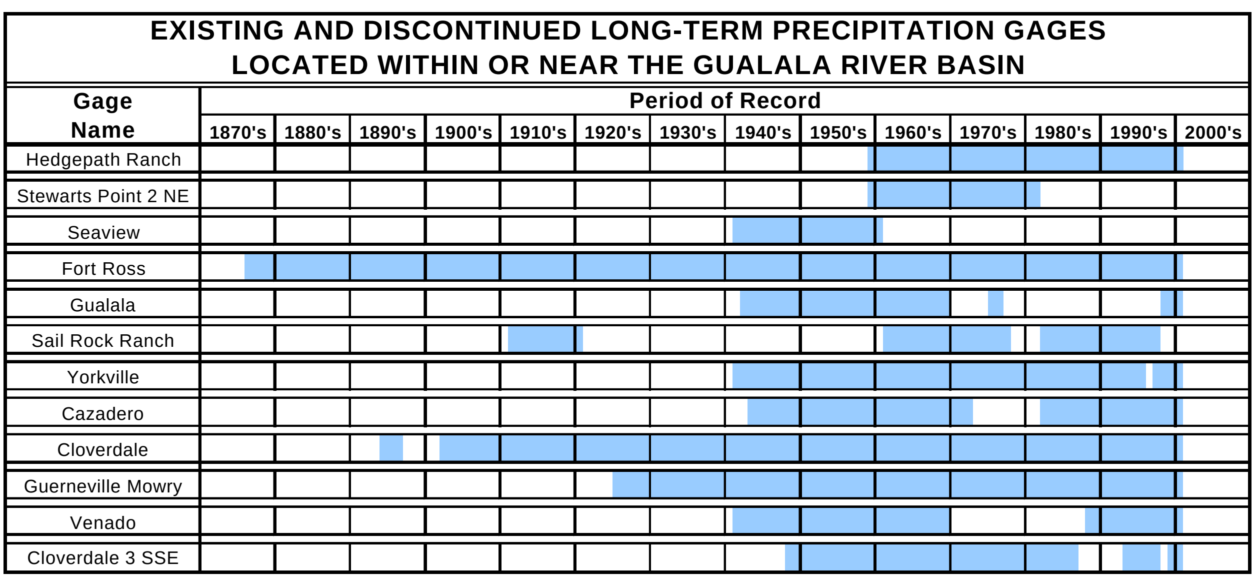
While the Fort Ross gage shows a general decline in precipitation beginning about 1920 to the present, the Cloverdale gage and other long-term precipitation gages within the North Coast region do not indicate such a decline. Long-term precipitation trends are difficult to assess due to the general lack of spatial and temporal data and the questionable accuracy of older data. Maury Roos, the Chief Hydrologist for DWR, was requested to comment on long-term precipitation trends over the last 50 to 100 years for the North Coast. The following are some of his comments. "Precipitation is highly variable from year to year, so it is easy to get apparent trends if one starts or ends in a wet or dry period. James Goodrich (hydrology consultant and retired DWR hydrologist) has run 100 years of long-term records to look for statewide or regional trends. If one takes the numerical results for his latest statewide sample and tries a simple regression line, it will show a small apparent increase of around five percent during the 20th century. I doubt if it is significant; we are probably seeing the bulge of five or six good water years in the latter half of the 1990s. In fact, just adding 2001 seems to have changed the slope, in inches, from 0.015 to 0.012. A similar chart ending in 1995 showed a slight negative slope. A seven-station chart for the North Coast region with departure from average shows no real trend since the mid-1930s. One of the seven stations is Fort Ross and I am suspicious of its 1890 to 1920 record."

Table II-1: Existing and discontinued long-term precipitation gages located within or near the Gualala River Basin.

EXISTING AND DISCONTINUED LONG-TERM PRECIPITATION GAGES LOCATED WITHIN OR NEAR THE GUALALA RIVER BASIN												
Gage Name	**Hedge-path Ranch 1/**	**Stewarts Point 2 NE 1/**	**Seaview 1/**	**Fort Ross**	**Gualala**	**Sail Rock Ranch**	**Yorkville**	**Cazadero**	**Cloverdale**	**Guerne-ville Mowry**	**Venado**	**Cloverdale 3 SSE**
Gage #	**F 80**	**F80**	**F80**	**F80**	**F80**	**F80**	**F80**	**F90**	**F90**	**F90**	**F90**	**F90**
	3889 50	**8540 02**	**8542 60**	**3161 00**	**3679 00**	**7639 50**	**9851 00**	**1602 00**	**1837 00**	**3684 00**	**9273 00**	**1838 00**
GAGE LOCATION												
County	Mendocino	Sonoma	Sonoma	Sonoma	Mendocino	Mendocino	Sonoma	Sonoma	Mendocino	Sonoma	Sonoma	Sonoma
Longitude	122.294	123.367	123.208	123.250	123.533	123.583	123.313	123.292	123.017	123.000	123.017	122.983
Latitude	38.606	38.663	38.525	38.517	38.750	38.883	38.905	38.530	38.817	38.500	38.617	38.750
Elevation	920	860	1500	116	1000	100	1120	1040	315	55	1260	320
PERIOD OF RECORD												
Begin	1959	1959	1941	1876	1942	1911	1941	1943	1894	1925	1941	1948
End	present	1982	1961	present	present 2/	1998 3/	present 4/	present 5/	present 6/	present	present 7/	present 8/
ANNUAL PRECIPITATION												
Average	57.51	47.97	64.53	43.27	52.91	50.32	48.78	72.23	40.89	46.71	59.24	44.83
Maximum	100.78	85.23	106.65	94.44	83.42	93.94	94.70	123.24	79.26	94.54	113.35	79.16
Year	1998	1974	1958	1878	1958	1974	1941	1958	1983	1998	1941	1983
Minimum	20.62	21.13	42.17	16.01	34.87	23.69	20.30	44.02	13.54	17.33	33.06	18.38
Year	1977	1977	1947	1977	1947	1977	1977	1964	1924	1977	1991	1977
ANNUAL 24-HOUR MAXIMUM PRECIPITATION												
Average	5.14	3.94	4.72	3.65	3.85	4.13	3.93	6.09	3.43	4.14	5.17	3.84
Maximum	8.22	6.13	8.58	10.00	7.31	8.07	7.05	10.75	8.37	12.40	10.32	8.37
Year	1960	1969	1946	1875	1946	1974	1965	1956	1963	1978	1995	1963
Minimum	1.65	1.23	2.46	1.15	2.11	1.98	1.60	3.09	1.31	1.25	2.70	1.52
Year	1977	1977	1947	1976	1949	1912	1977	1989	1939	1977	1948	1977

Notes: 1/ Gage located within the Gualala watershed.
2/ Inactive 1970 - 1975 & 1977 - 1997.
3/ Inactive 1921 - 1960 & 1978 - 1982
4/ Inactive 1996.
5/ Inactive 1973 - 1982.
6/ Inactive 1897 - 1902.
7/ Inactive 1970 - 1988.
8/ Inactive 1987 - 1992 & 1997 - 1998.

Chart II-1: Period of record for long-term precipitation gages located within or near the Gualala River Basin.



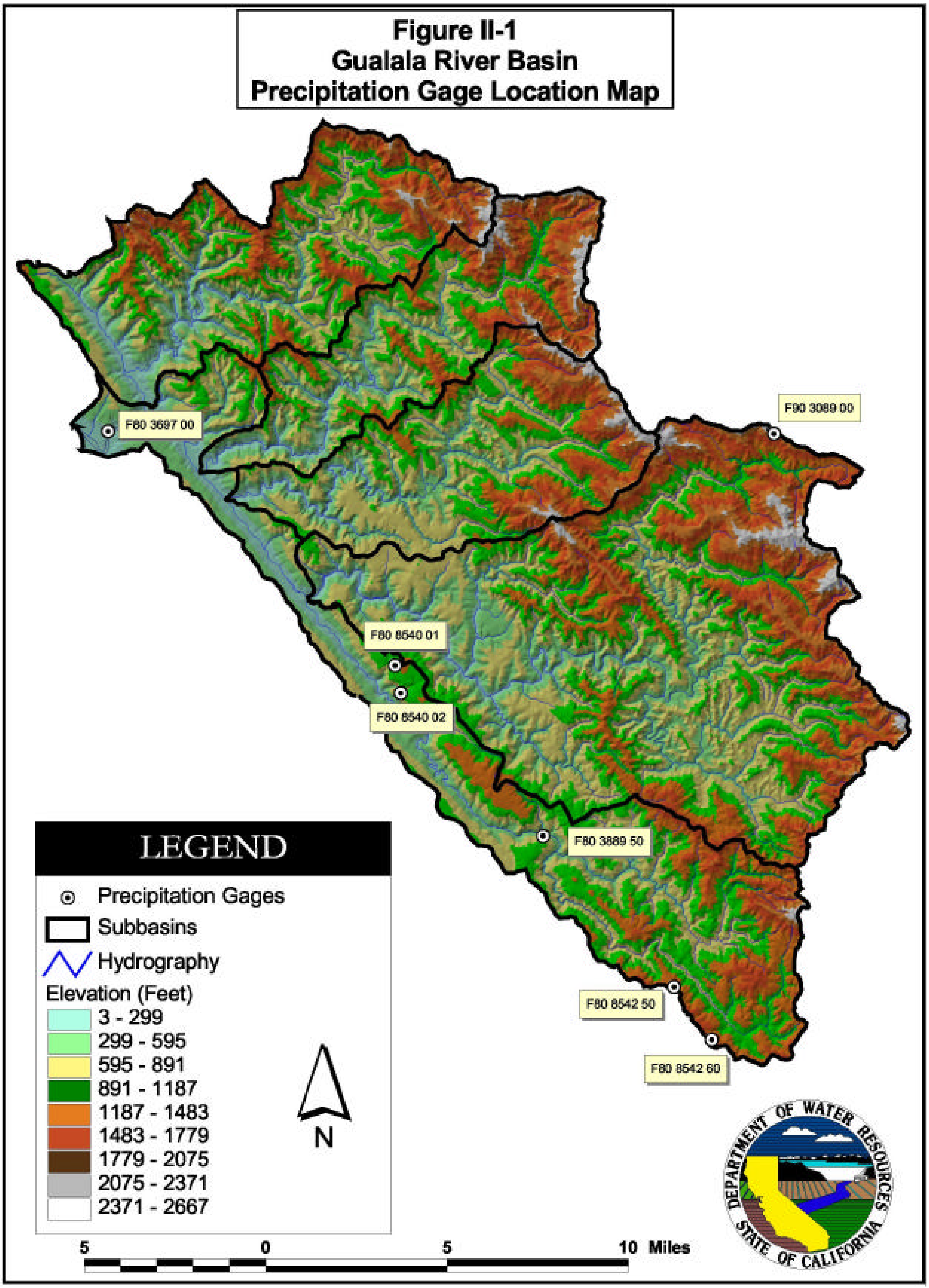


Figure II-1
Gualala River Basin
Precipitation Gage Location Map

Chart II-2: Annual precipitation and cumulative departure from the mean for the Fort Ross gage, DWR F80 3161 00, for Water Years 1876 - 2000.

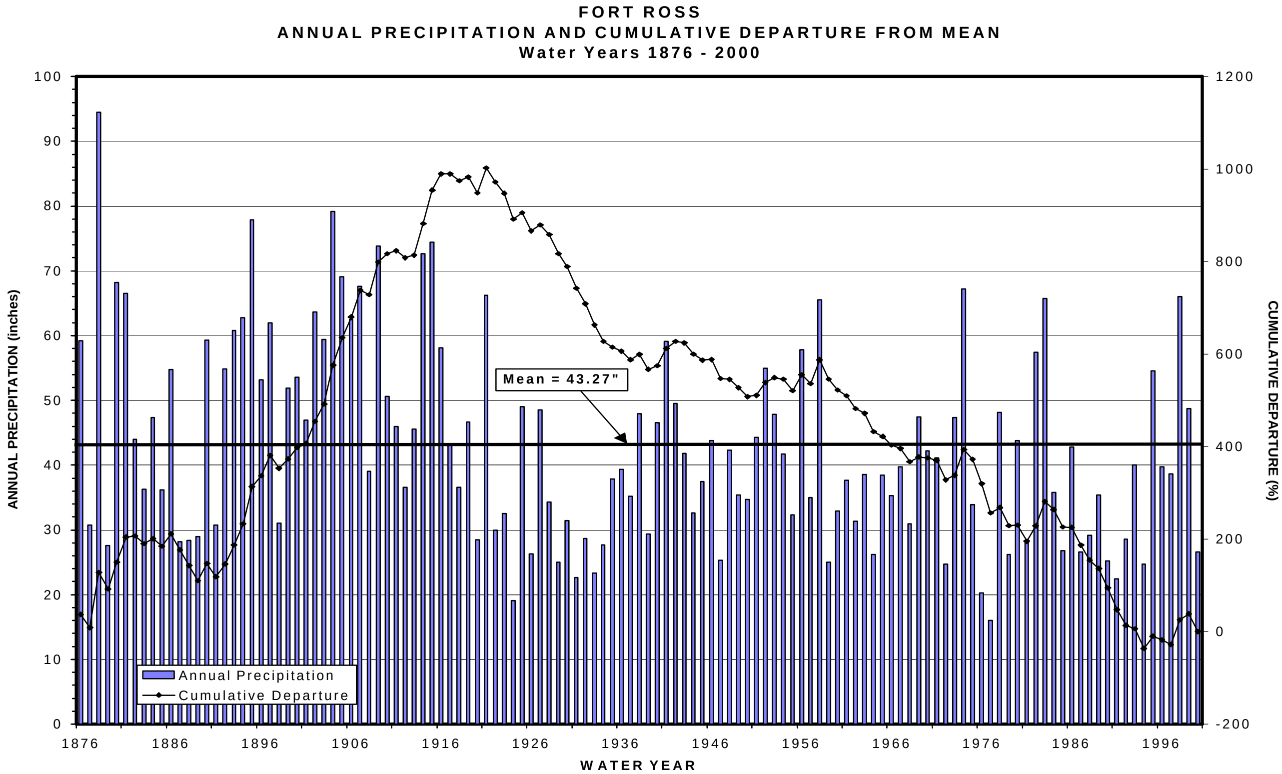
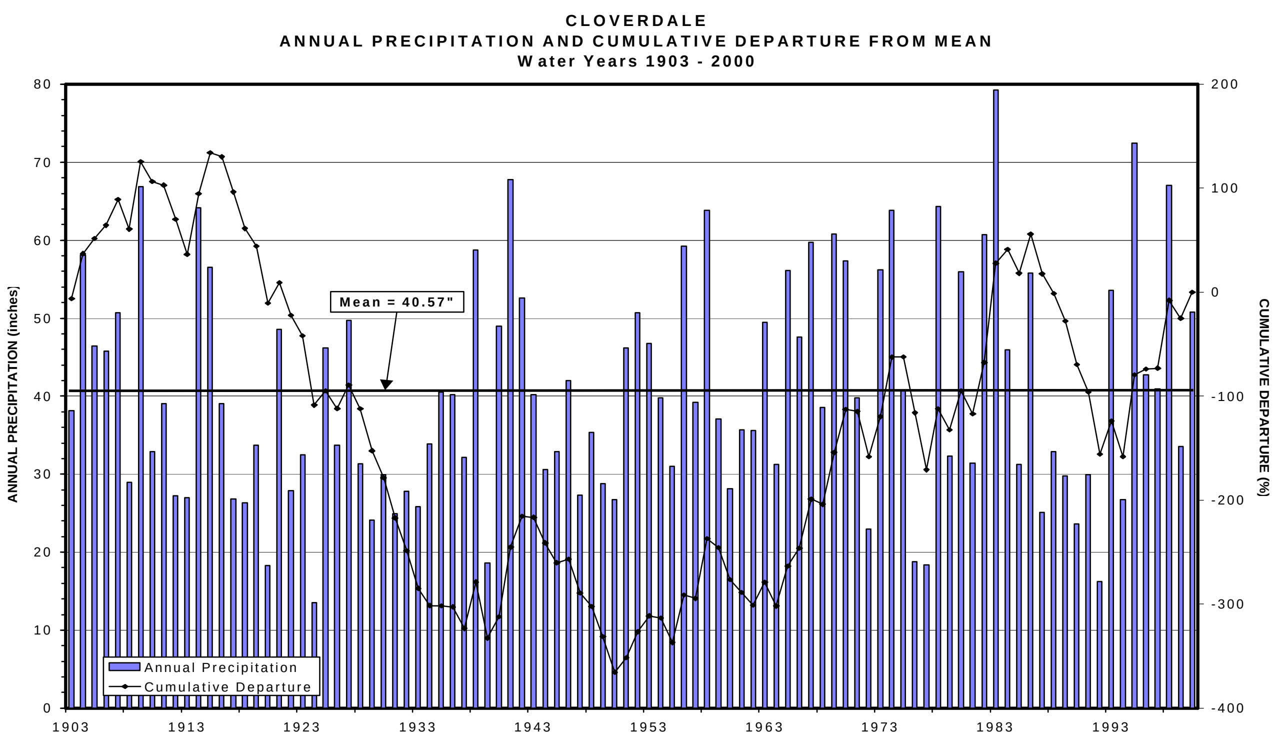


Chart II-3: Annual precipitation and cumulative departure from the mean for the Cloverdale gage, DWR F90 1837 00, for Water Years 1903 - 2000.



III. STREAMFLOW

Streamflow data are an important component in determining the existing conditions and assisting assessment, restoration, and management activities in North Coast river basins. Streamflow can be a limiting factor for anadromous fisheries affecting migration and the quantity and quality of spawning, rearing, and refugia areas. Streamflow also has a direct affect on other factors such as water temperature, dissolved oxygen, and sediment and chemical transport. Streamflow data are required to quantify stream sediment and chemical transport total loads and for calibrating hydrologic or hydraulic computer models. Although floodplain management and design and construction projects such as bridges and road crossings, water diversions, fish ladders and screens, and streambank stabilization are not included in NCWAP, streamflow data is a significant benefit to these as well as other activities including SWRCB water right application and license reviews and judicial water supply allocations.

A common problem for watershed managers is the lack of data and the inability to compare current flow conditions to historic conditions. If long-term data collection programs are not established and supported, resources managers are forced to sometimes make profound policy, management, and operational decisions based on limited scientific data.

Due to the general lack of streamflow data available within the North Coast region, funding was provided through NCWAP to install and operate streamflow gaging stations. NCWAP will also provide for the continued operation of selected existing streamflow gaging stations that are subject to discontinuation due to funding reductions. Additional support for new streamflow gaging station installation and operation within North Coast river basins will be provided by the SWRCB Surface Water Ambient Monitoring Program (SWAMP). All new streamflow gaging stations will be equipped with water temperature sensors and some with other water quality sensors for measuring parameters such as turbidity, dissolved oxygen, pH, and conductance. Existing stations may also be equipped with additional water quality sensors. Selected stations will be equipped with telemetry to provide a portion of the collected data on a real-time basis via the California Data Exchange Center (CDEC) web site. Real-time streamflow and water quality data will help NCWAP agencies and other stakeholders identify event sampling opportunities or hazardous conditions for fish survival. Flood forecasters and emergency response personnel will also benefit from this real-time streamflow data.

Selection of sites, data collection type, and period of station operation will be based on available funding, existing stations, resumption of discontinued stations for historic comparisons, access, favorable site conditions, and special NCWAP or SWAMP identified needs. Stations located at the terminus of the basins or major subbasins where none currently exist will be a priority. Some stations will be operated for the long-term for trend and base correlation analysis, while others may only be operated for short periods. Electronic multiple parameter data loggers will be used at all stations to collect detailed time series data, normally every 15 minutes or hourly, for all sensors.

DWR and the USGS will work cooperatively to install and operate the new streamflow gaging stations. Data quality assurance and control techniques developed by the USGS will be employed. The stations will be constructed to withstand substantial flood events and incidental vandalism. Stations installed for short-term operation will be constructed with the assumption that data collection may be resumed at a later date. About nine to 12 direct stream discharge measurements along with simultaneous water stage (elevation) data over a wide range of water stages will normally be performed annually at each station. High discharge measurements may require the installation of cableway systems if bridges are not located nearby or if measurements by boat are impractical. Multiple direct field measurements of water stage and water quality parameters will also be performed to verify and calibrate the station sensors.

Water stage and water quality time series data will normally be downloaded from the station data loggers and then uploaded into a database and reviewed and edited for accuracy on a monthly basis. Time series streamflow data will be determined by correlating the direct discharge measurements with the simultaneous water stage data. This stage vs. discharge relationship or rating curve is then applied to the stage recordings from the station's stage sensor and data logger to compute streamflow for the same time series interval as water stage, normally every 15 minutes. Once the rating curves are developed, real-time flow data will be provided over the Internet via the CDEC web site for those stations equipped with telemetry. Real-time telemetry also allows the station's operator to remotely monitor the operation of the station allowing a timely response to station malfunctions. Real-time data is not reviewed and edited for inaccuracies such as telemetry transmission error, sensor drift or malfunction, or discharge rating curve shift and is considered preliminary and subject to revision. The reviewed and finalized data for the October through September water year will usually be available about three to six months after the end of the water year.

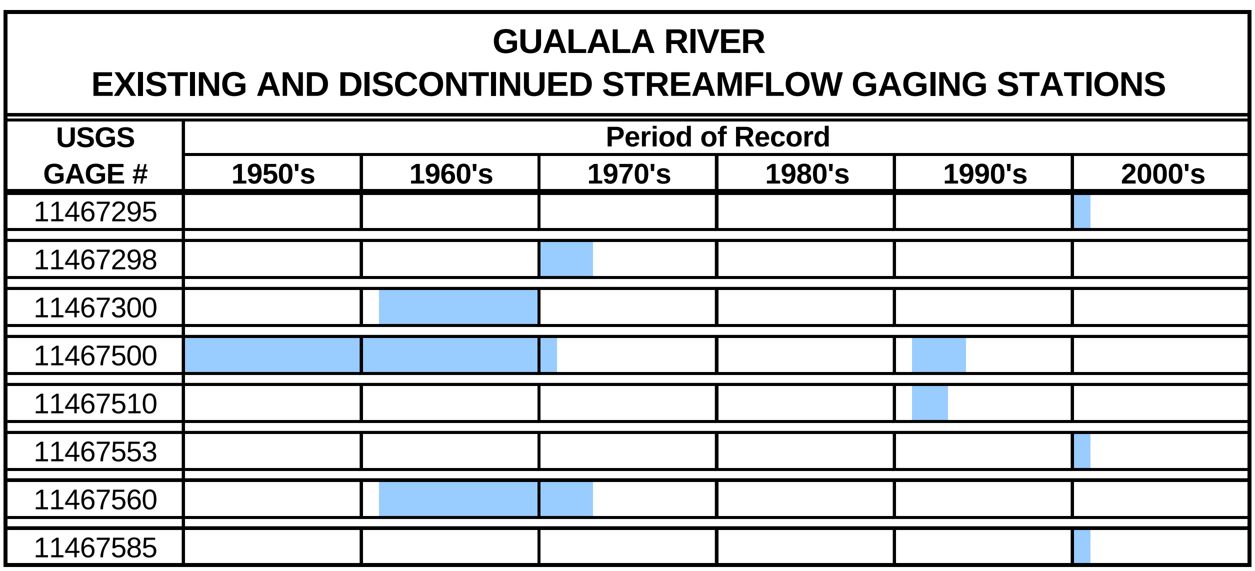
Similar to other basins within the North Coast, only a few streamflow gaging stations have historically operated within the Gualala River Basin. Streamflow data had not been collected by any agency since 1994. To gain additional streamflow data, three stream gaging stations were installed for NCWAP during the fall of 2000. Stations were installed near each of the confluences of the North Fork and Wheatfield Fork with the South Fork and another on the South Fork above the Wheatfield Fork. The three new gages were also equipped with water temperature sensors. Combined, the gages will measure the discharge from about 207 square miles or 69 percent of the entire drainage basin and provide runoff data from subbasins with varying hydrological, geographical, and land use characteristics. The new Wheatfield and South Fork gages combined will be comparable to the long-term historic South Fork Gualala River near Annapolis gage. A list of the new and discontinued streamflow gaging stations along with their location, flow data type, and period of record is shown in Table III-1. Chart III-1 graphically illustrates the period of record for each gage. A location map is provided in Figure III-1.

Table III-1: Existing and discontinued streamflow gaging stations located within the Gualala River Basin.

GUALALA RIVER EXISTING AND DISCONTINUED STREAMFLOW GAGING STATIONS							
Operating Agency	**Gage Number**	**Gage Name**	**1/ Data Type**	**Drainage Area (sq. mi.)**	**Elevation (feet)**	**County**	**Period of Record**
USGS	11467295	S. F. Gualala River above Wheatfield Fork near Annapolis 2/	QC	48.25	75	Sonoma	10/00 - present
USGS	11467298	Unnamed Tributary 1 to Wheatfield Fork Gualala River near Annapolis	QP	0.33	320	Sonoma	10/70 - 9/73
USGS	11467300	Unnamed Tributary 2 to Wheatfield Fork Gualala River near Annapolis	QP	0.19	375	Sonoma	8/61 - 9/70
USGS	11467500	S. F. Gualala River near Annapolis	QC 3/	161	70	Sonoma	10/50 - 9/71, 6/91 - 6/94
USGS	11467510	S. F. Gualala River near the Sea Ranch	QC 4/	161	65	Sonoma	6/91 - 9/92
USGS	11467553	N. F. Gualala River above S. F. Gualala River near Gualala 2/	QC	47.46	30	Mendocino	10/00 - present
USGS	11467560	China Gulch at Gualala	QP	0.54	40	Mendocino	8/61 - 9/73
USGS	11467585	Wheatfield Fork Gualala River above S. F. Gualala River near Annapolis 2/	QC	111.36	75	Sonoma	10/00 - present

Notes: 1/ QP = annual peak flow only. QC = continuous flow record.
2/ New gages installed and operated for NCWAP.
3/ No record for flow greater than 1,000 cfs for the period 6/91 - 6/94.
4/ No record for flow greater than 30 cfs.

Chart III-1: Period of record for streamflow gaging stations located within the Gualala River Basin.



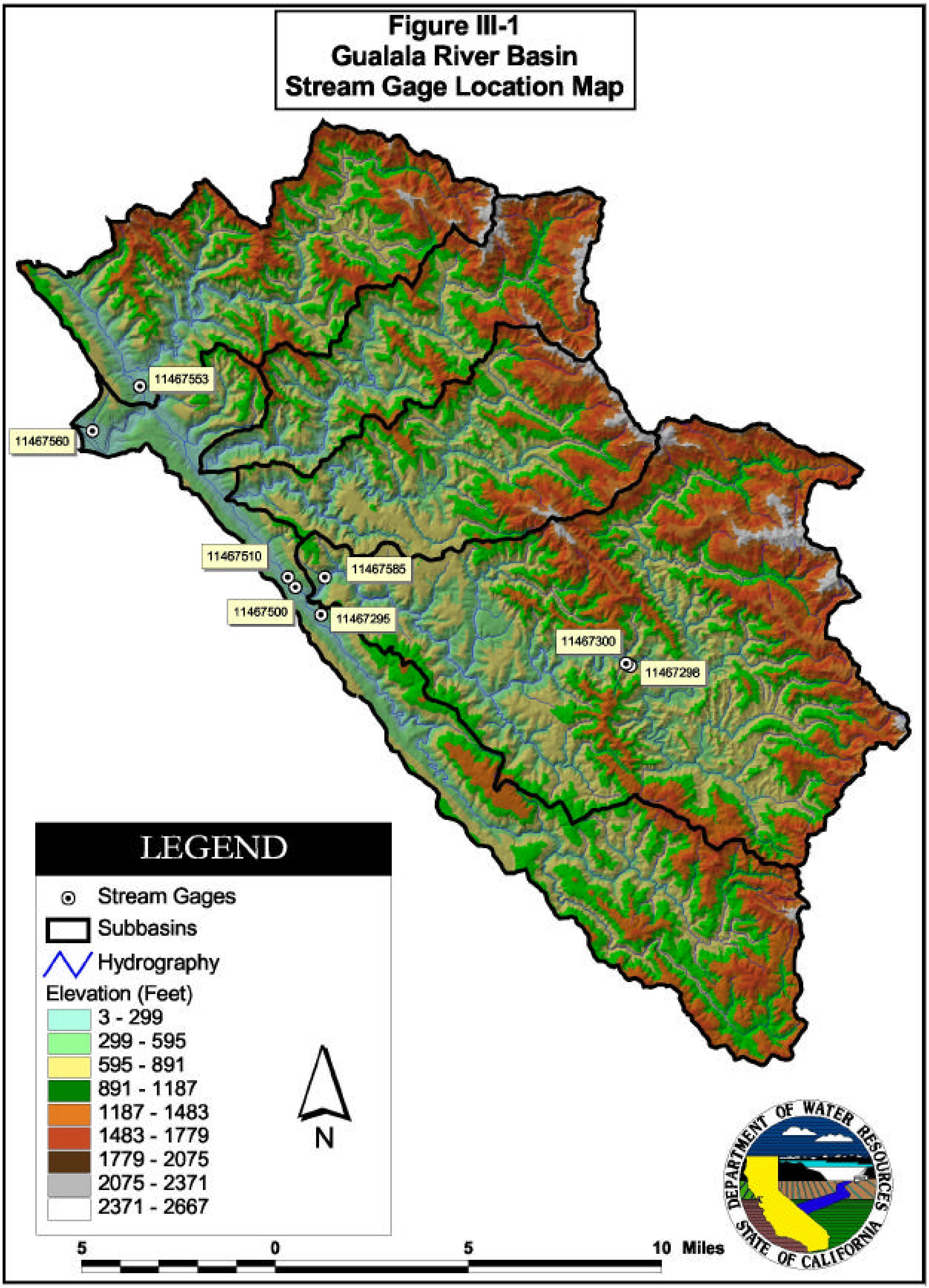


Figure III-1
Gualala River Basin
Stream Gage Location Map

Installation of the new gages by DWR and the USGS began in November 2000. The date of the actual recording of stage and water temperature data for each station and sensor varied. The USGS operated the gages during water year 2001 and have provided final data for stage, discharge, and water temperature. It is usual USGS practice to estimate mean daily data back to the beginning of the water year prior to the actual recording of data by the station's sensors if the recording of data began early in the water year and during periods of sensor malfunction. The final edited and reviewed data by the USGS for the entire water year is usually available three to six months after the end of the water year. Charts III-2 and III-3 graphically show the daily discharge and water temperature data for the three gages for water year 2001. Chart III-4 shows the daily maximum and minimum water temperatures for the North Fork gage. Although no flow occurred at the gaging sites, the temperature sensors are submerged in pools.

There was no flow at the Wheatfield and South Fork gages during the late summer and early fall of 2001. In contrast, during the severe drought of 1976 – 1977, surface flows were low, but continued through the summer (NCWQCB 2001). In October 2000, while investigating potential streamflow gaging station sites along the lower portions of the Wheatfield and South Forks, no surface flow was also observed at certain locations while measurable flow was present upstream or downstream. Underlying bedrock outcrops and aggradation of the streambed probably result in the surfacing and sub-surfacing of water flow in the lower portions of the major tributaries. The data also show that the North Fork maintained a minimum base flow and was the only contributor to surface flow to the estuary during the early fall of 2000 and the late summer of 2001.

Only one streamflow gage, South Fork Gualala River near Annapolis, USGS station #11467500, operated within the basin for a significant period (October 1950 - September 1971 and June 1991 - June 1994). This station was located below the confluence with the Wheatfield Fork and measured the runoff from 161 or 54 percent of the total 298 square mile Gualala River Basin. During the period of 1991 - 1994, the gage was operated to record low flows only. A summary and statistical analysis of the flow data for this station follows.

Table III-2 shows the mean monthly discharge for the period of record for the South Fork Gualala River near Annapolis gage. Chart III-5 graphically illustrates the mean, maximum, and minimum daily discharge for each day of the water year for the period of record. Chart III-6 shows the annual yield or runoff volume in acre-feet and the cumulative departure from the mean for the period of record and Chart III-7 presents daily discharge duration for the period of record.

A frequency analysis for annual peak discharge and low-flow was completed using the methodology from the USGS Bulletin number 17B, "Techniques of Water-Resources Investigation of the USGS" and Ven Te Chow's "Handbook of Hydrology". The annual instantaneous series data was used for the peak discharge frequency. The Gringorten plotting position equation was selected, as it tended to give better results when using the normal distribution. Table III-3 shows the ranked data, plotting position, and frequencies. Chart III-8 shows the peak discharge for the period of record with the five-year moving average superimposed. The moving average indicates the general trend of a series. Peak discharge versus return period is shown in Chart III-9. The return period, also referred to as the recurrence interval, is a statistical representation of the number of years within which a given event will be equaled or exceeded.

The low-flow frequency analysis was similar to the peak discharge analysis except that the discharge values were determined by calculating the minimum seven-day running average of the mean daily discharge for each water year. These values were then used to complete the frequency analysis described above. Table III-4 shows the ranked data, plotting position, and frequencies. Chart III-10 shows the seven-day low-flow for the period of record with the five-year moving average. The low-flow discharge versus return period is shown in Chart III-11.

Excluding the period of June 1991 – June 1994 when the gage was operated for low-flow only, 21 years of record are available for the South Fork Gualala gaging station. The USGS recommends a minimum of 20 years of flow data to perform a detailed frequency analysis. Therefore, the computed return periods and exceedance probabilities for peak and low-flow are considered estimates only. Long-term precipitation gages in the area indicate the 1951 – 1971 period of record for the gage was above average.

The two highest flood events during the 21-year operation of the gage occurred December 22, 1955 at 55,000 cfs and January 19, 1966 at 47,800 cfs with computed return periods using the normal distribution of about 100 and 20 years, respectively. Seven other annual peak events during the operation of the gage exceeded 30,000 cfs. While other North Coast rivers experienced near record flood flows in December 1964, the South Fork Gualala River gage recorded only 21,000 cfs. An examination of other streamflow gages in the area indicates recent flood events at the South Fork Gualala gage site of 30,000 cfs or greater probably occurred in 1974, 1983, 1986, 1993, 1995, and 1997.

Three out of the four lowest annual seven-day running average low-flow occurred during water years 1967 – 1971 although these were above average runoff years. The 5-year moving average trend line shown in Chart III-10 indicates a general decline in low-flow beginning in water year 1966 and continuing until the gage was discontinued in September 1971. As stated earlier in this report, aggradation of the stream channels has probably resulted in the sub-surfacing of surface water flow in the lower reaches of the major tributaries. Aggradation may have resulted from the transport and deposit of bedload and suspended sediment material during the large flood events of 1955 and 1966.

Long-term annual and seasonal trends in streamflow within the basin are difficult to assess due to the general lack of spatial and temporal streamflow data. Similar to precipitation data, the limited existing streamflow data does not show any distinct long-term increase or decrease in annual runoff. Affects on unit discharge hydrographs due to changes in land use or geomorphology within the basin can not be directly assessed with existing data. In general, native vegetation removal as a result of timber harvesting, fire, or agricultural or urban development tends to produce runoff from precipitation quicker in time and greater in peak and volume. Changes in runoff characteristics can currently only be assessed by the use of rainfall/runoff models. However, the accuracy of any model relies on the quantity and quality of spatial and temporal field collected data within at least the surrounding region for calibration purposes.

The continued operation of the streamflow gaging stations installed within the Gualala River Basin for NCWAP in Water Year 2001 and other existing streamflow and precipitation gages within the North Coast region should be considered as part of any watershed management or fish restoration program.

Chart III-2: Daily discharge for the three new streamflow gages within the Gualala River Basin for Water Year 2001.

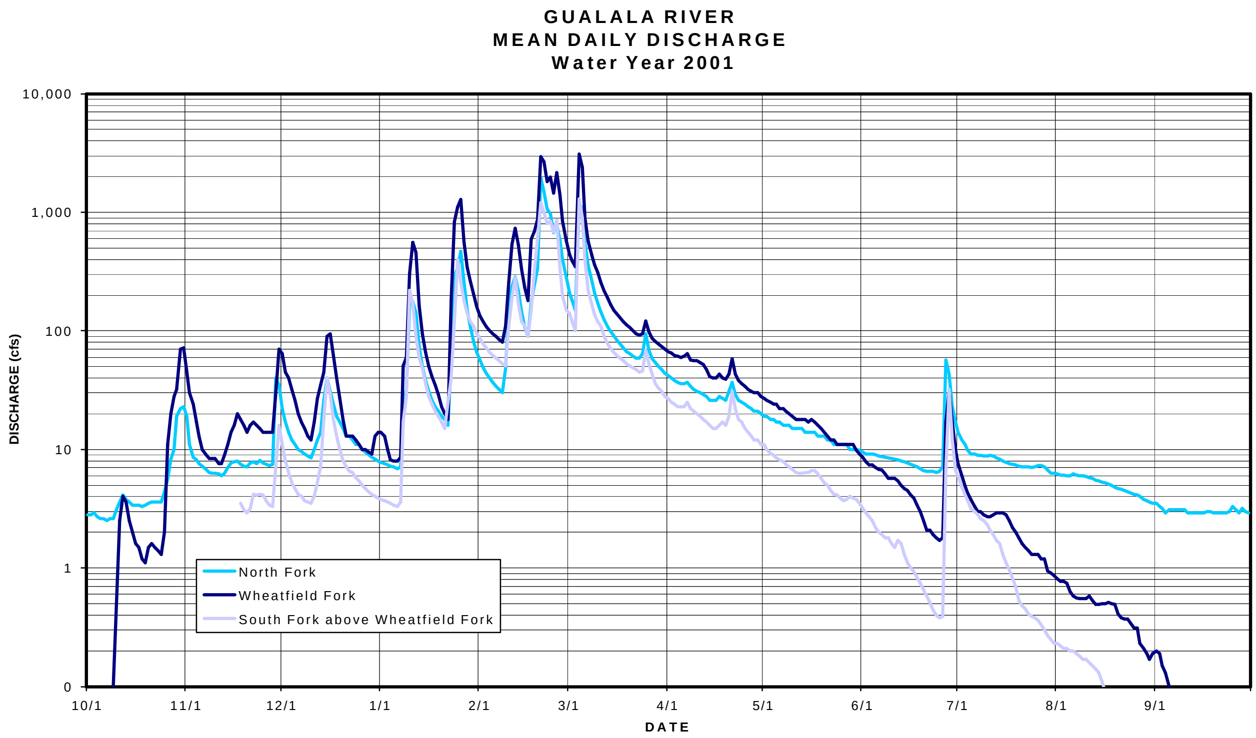


Chart III-3: Daily water temperature for the three new streamflow gages within the Gualala River Basin for Water Year 2001.

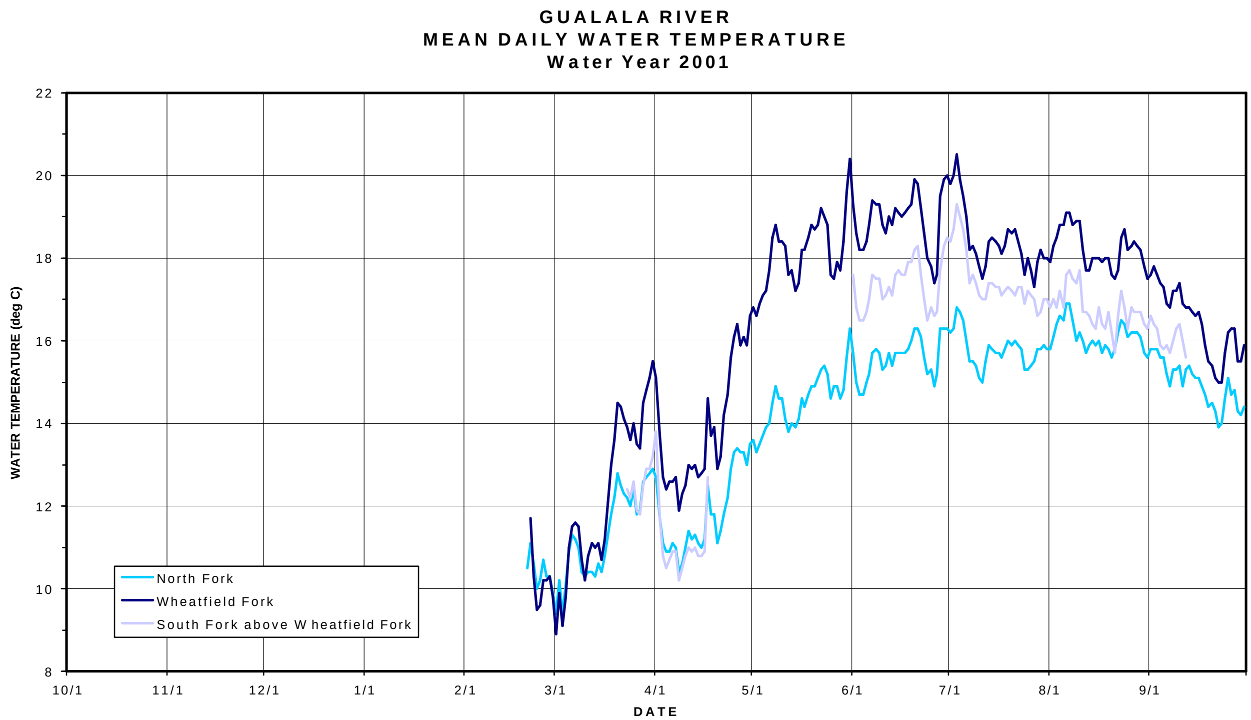


Chart III-4: Daily maximum and minimum water temperature for North Fork Gualala River near Gualala, USGS station #11467553, for Water Year 2001.

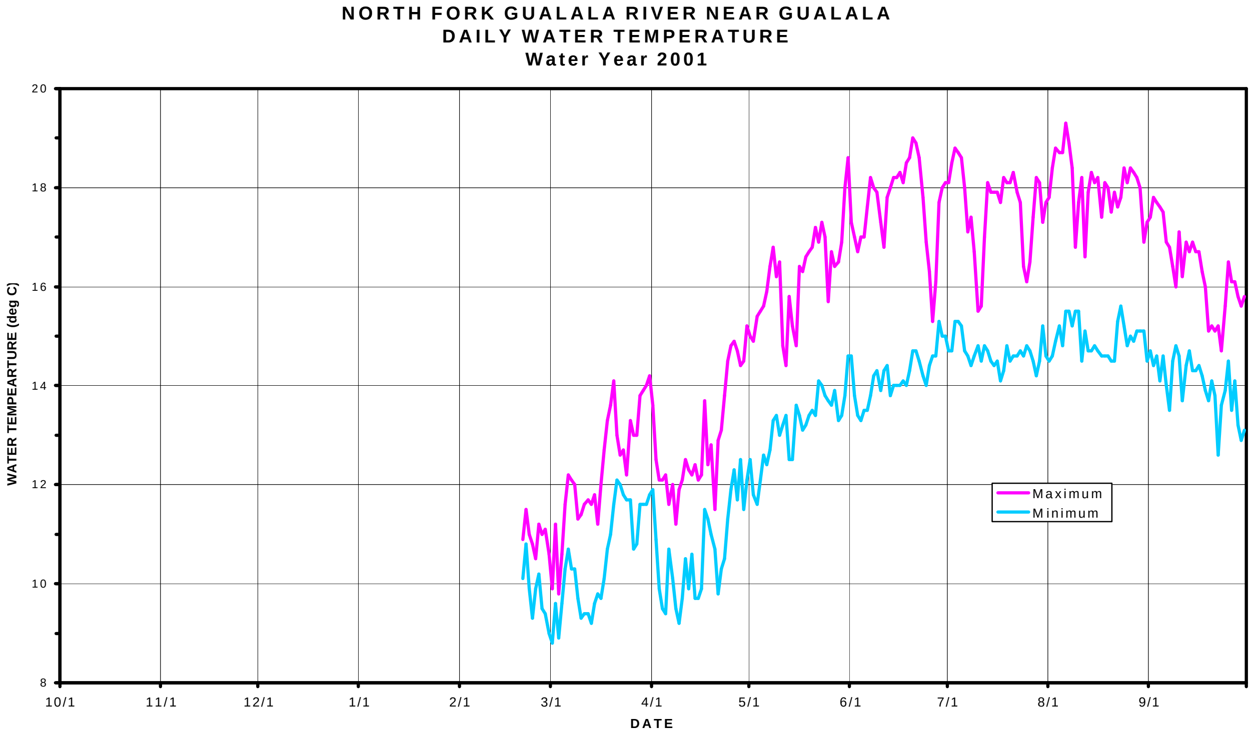


Table III-2: Summary of monthly mean discharge and annual yield for South Fork Gualala River near Annapolis, USGS station #11467500, for the period of record.

SOUTH FORK GUALALA RIVER NEAR ANNAPOLIS
USGS STATION #11467500
MEAN MONTHLY DISCHARGE AND ANNUAL YIELD
WATER YEARS 1951-1971 and 1991-1994
(units in cfs, NR = no record)

Water Year	Month: Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Min	Max	Avg	WY Total	Yield (ac-ft)
1951	NR	NR	1,343	1,420	1,280	747	98	159	28	12	4	2	NR	NR	NR	NR	NR
1952	21	312	2,343	2,111	1,140	905	167	89	34	17	7	4	4	2,343	596	7,150	434,118
1953	4	18	1,847	2,501	135	481	362	163	53	19	9	7	4	2,501	466	5,597	342,446
1954	14	343	270	2,165	863	843	983	109	40	14	25	11	11	2,165	473	5,680	341,394
1955	15	375	782	588	147	83	658	135	33	13	5	4	4	782	237	2,839	171,556
1956	6	88	3,060	2,367	1,650	273	102	78	27	11	5	5	5	3,060	639	7,671	464,709
1957	38	24	15	482	1,039	943	309	660	103	24	9	90	9	1,039	311	3,735	222,413
1958	736	225	577	1,322	4,407	870	1,256	98	61	20	9	6	6	4,407	799	9,587	560,214
1959	7	20	22	1,134	1,533	164	88	33	14	4	3	36	3	1,533	255	3,057	178,536
1960	11	8	13	510	1,713	1,188	188	78	31	13	6	5	5	1,713	314	3,765	224,221
1961	8	87	979	586	1,586	1,034	172	68	30	9	5	4	4	1,586	381	4,569	270,907
1962	6	266	417	260	2,385	1,023	119	52	21	11	5	6	5	2,385	381	4,572	266,079
1963	434	71	560	663	1,144	643	1,401	152	47	21	11	7	7	1,401	430	5,154	307,082
1964	37	879	146	820	150	135	56	32	18	8	4	3	3	879	190	2,285	138,031
1965	22	481	2,276	1,589	273	162	955	118	44	18	10	6	6	2,276	496	5,954	361,541
1966	7	461	544	1,312	906	448	151	51	22	12	6	2	2	1,312	327	3,922	234,512
1967	1	556	1,028	1,909	390	905	866	159	77	21	8	5	1	1,909	494	5,925	359,023
1968	13	36	338	972	1,043	632	124	52	21	9	9	7	7	1,043	271	3,256	195,696
1969	24	61	1,284	2,677	1,798	488	240	66	31	12	5	4	4	2,677	558	6,690	400,006
1970	15	25	1,445	4,152	613	314	73	33	14	3	2	2	2	4,152	558	6,691	407,564
1971	8	395	2,259	1,357	132	858	244	72	29	11	5	4	4	2,259	448	5,375	328,354
1991	NR	NR	NR	NR	NR	NR	NR	NR	12	5	2	1	NR	NR	NR	NR	NR
1992	13	22	NR	183	NR	NR	182	45	20	11	3	2	NR	NR	NR	NR	NR
1993	12	16	NR	NR	NR	NR	337	196	197	42	14	6	NR	NR	NR	NR	NR
1994	5	21	NR	NR	NR	117	61	35	12	NR	NR	NR	NR	NR	NR	NR	NR
Min	1	8	13	183	132	83	56	32	12	3	2	1	1	782	190	2,285	138,031
Max	736	879	3,060	4,152	4,407	1,188	1,401	660	197	42	25	90	11	4,407	799	9,587	560,214
Avg	63	208	1,026	1,413	1,159	603	383	114	41	14	7	9	5	2,071	431	5,174	310,420

Chart III-5: Mean, maximum, and minimum daily discharge for each day of the water year for South Fork Gualala River near Annapolis, USGS station #11467500, for Water Years 1951 - 1971

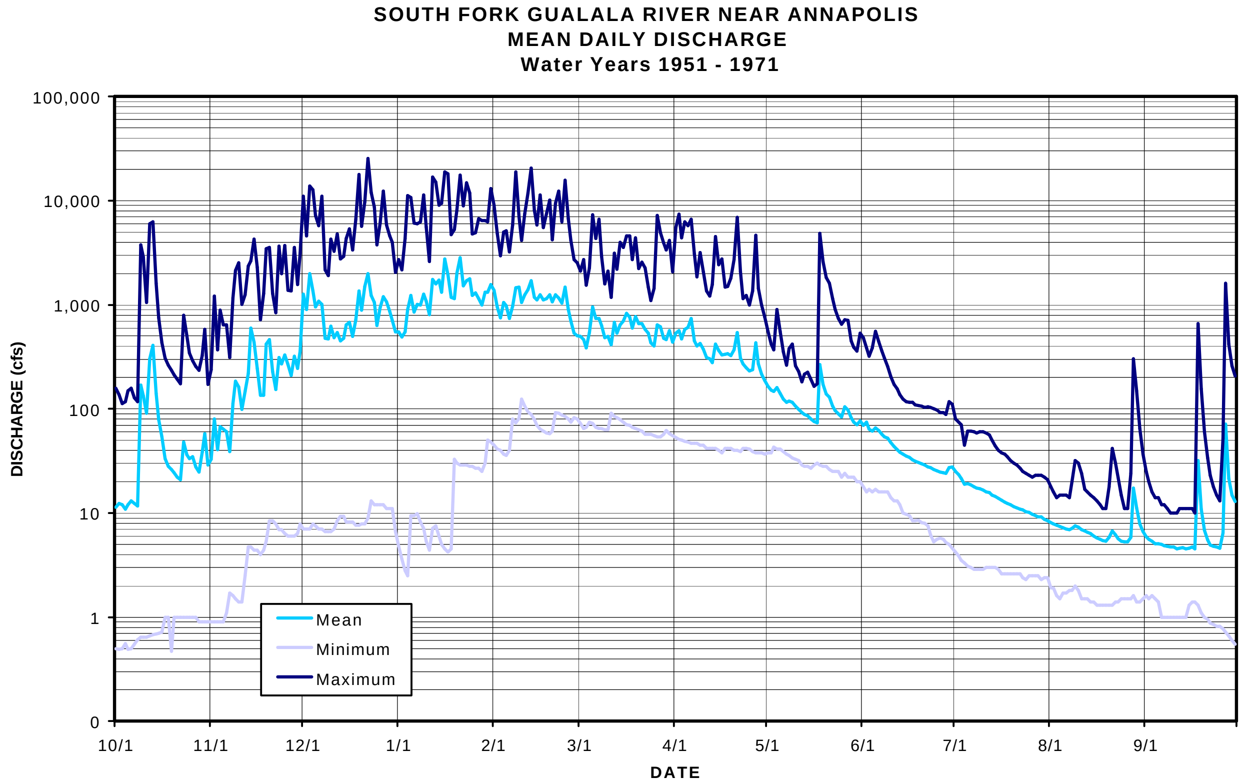


Chart III-6: Annual yield and cumulative departure from the mean for South Fork Gualala River near Annapolis, USGS station #11467500, for Water Years 1952 – 1971.

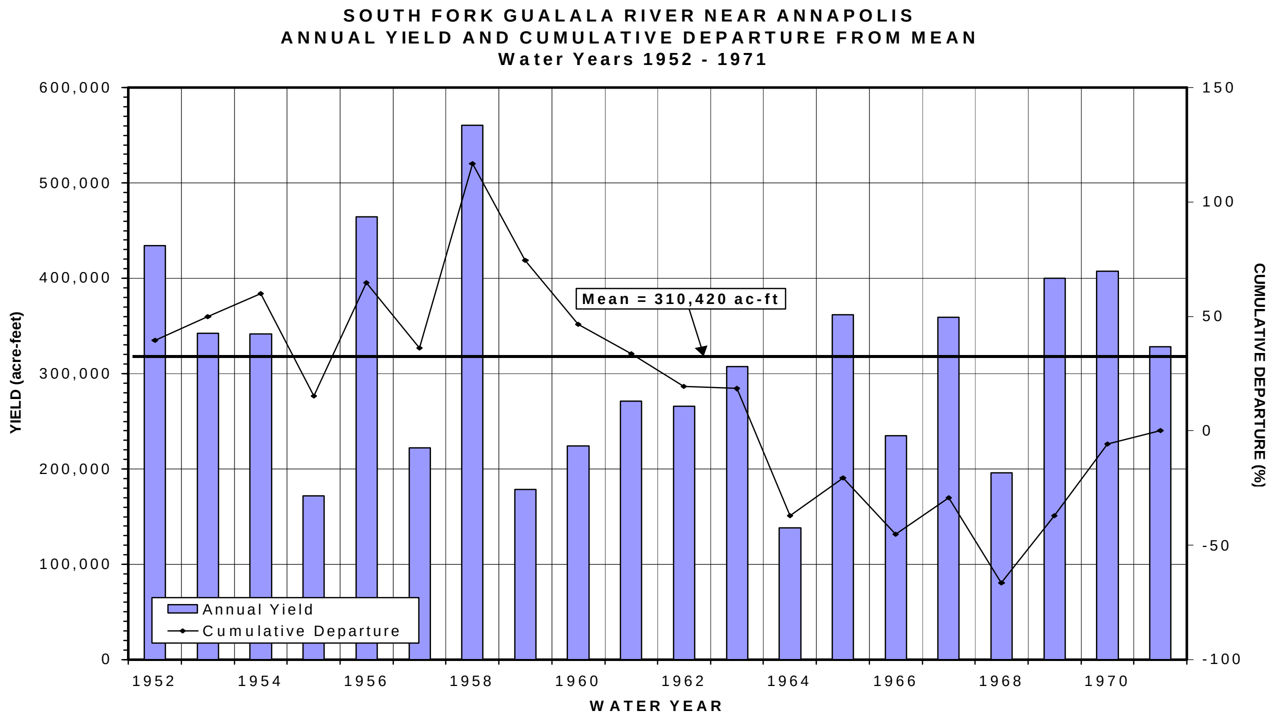


Chart III-7: Daily discharge duration for South Fork Gualala River near Annapolis, USGS station #1146750, for Water Years 1952 – 1971.

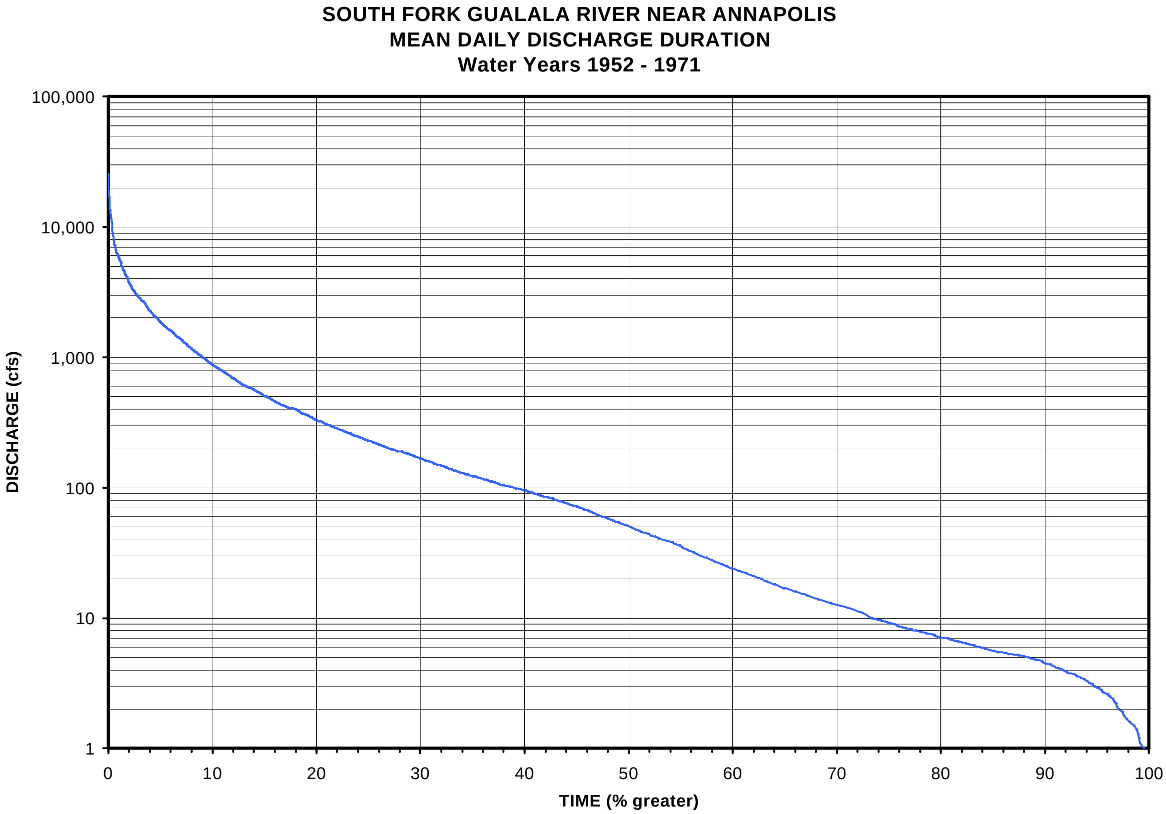


Table III-3: Annual instantaneous peak discharge and frequency analysis for South Fork Gualala River near Annapolis, USGS station #11467500, for Water Years 1951 – 1971.

SOUTH FORK GUALALA RIVER NEAR ANNAPOLIS, USGS #11467500 ANNUAL PEAK DISCHARGE FREQUENCY ANALYSIS Water Years 1951 - 1971						
Ranked Data			**Gringorten Plotting Positions**			**Statistics**
Rank	Water Year	Peak Discharge (cfs)	Return Period (Years)	Frequency	Exceedance Probability	Statistical Moments of Discharge
1	1956	55,000	37.71	0.973	0.027	
2	1966	47,800	13.54	0.926	0.074	
3	1962	37,700	8.25	0.879	0.121	Mean = 28234.76
4	1954	35,900	5.93	0.831	0.169	
5	1970	35,800	4.63	0.784	0.216	SDEV = 11888.37
6	1958	35,400	3.80	0.737	0.263	
7	1951	34,100	3.22	0.689	0.311	Variance = 1.41E+08
8	1953	33,900	2.79	0.642	0.358	
9	1960	33,700	2.47	0.595	0.405	Skew = 0.27
10	1952	29,500	2.21	0.547	0.453	
11	1969	29,100	2.00	0.500	0.500	
12	1967	28,900	1.83	0.453	0.547	
13	1971	27,900	1.68	0.405	0.595	
14	1963	23,000	1.56	0.358	0.642	
15	1965	21,400	1.45	0.311	0.689	
16	1959	19,100	1.36	0.263	0.737	
17	1961	15,900	1.28	0.216	0.784	
18	1968	15,200	1.20	0.169	0.831	
19	1964	15,000	1.14	0.121	0.879	
20	1955	9,870	1.08	0.074	0.926	
21	1957	8,760	1.03	0.027	0.973	

Normal Distribution Computed Return Periods

Years	Discharge (cfs)
100	55,900
50	52,700
25	49,100
10	43,500
5	38,200
2	28,200

Chart III-8: Annual instantaneous peak discharge and 5-year moving average for South Fork Gualala River near Annapolis, USGS station #11467500, for Water Years 1951 – 1971.

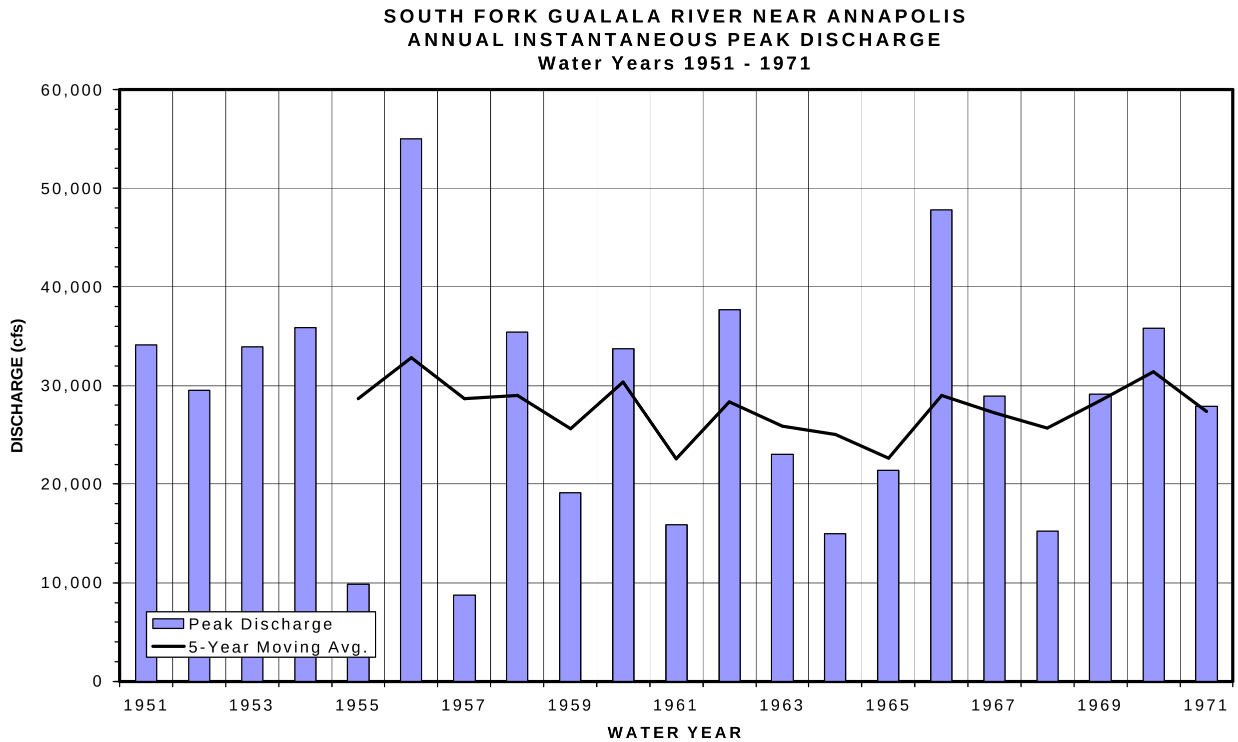


Chart III-9: Annual instantaneous peak discharge return period for South Fork Gualala River near Annapolis, USGS station #11467500, for Water Years 1951 – 1971.

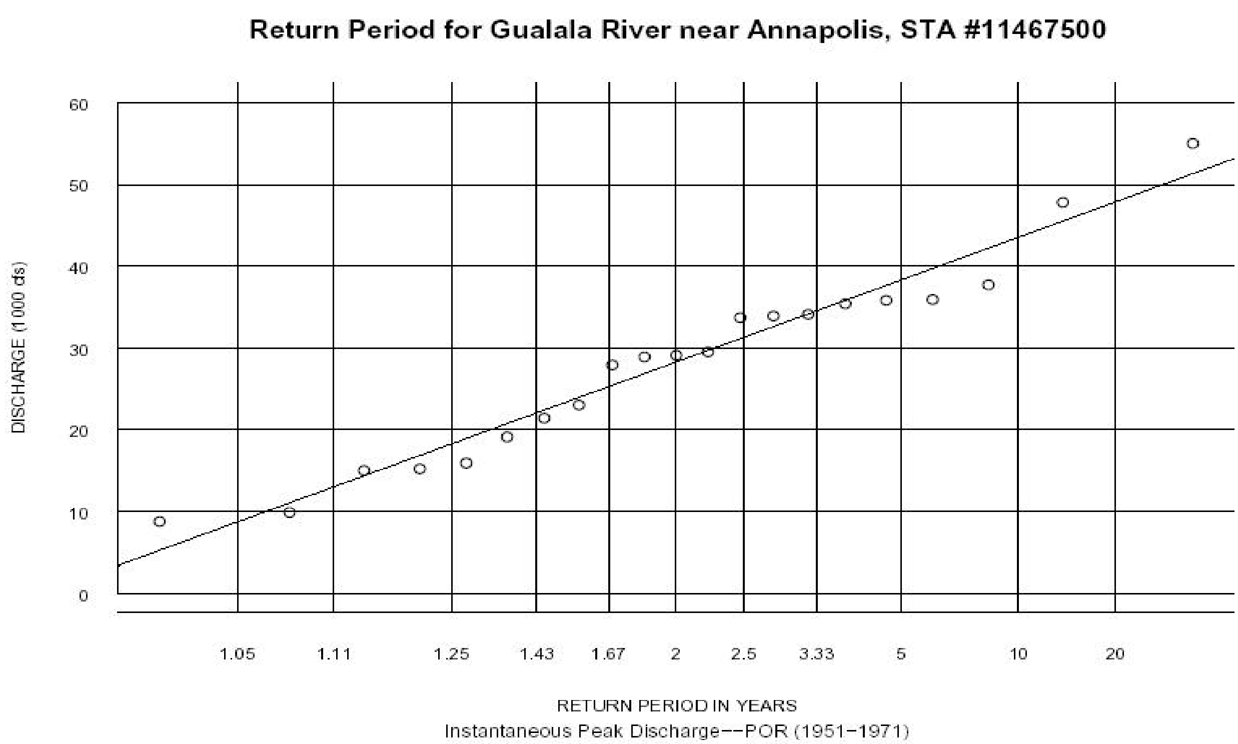


Table III-4: Annual minimum seven-day running average low-flow and frequency analysis for South Fork Gualala River near Annapolis, USGS station #11467500, for Water Years 1951 – 1971.

SOUTH FORK GUALALA RIVER NEAR ANNAPOLIS, USGS #11467500 ANNUAL MINIMUM 7-DAY LOW-FLOW FREQUENCY ANALYSIS Water Years 1951 - 1971						
Ranked Data			Gringorten Plotting Positions			Statistics
Rank	Water Year	Minimum 7-Day Average (cfs)	Return Period (Years)	Frequency	Exceedance Probability	Statistical Moments of Discharge
1	1971	0.5	37.71	0.973	0.027	
2	1970	0.7	13.54	0.926	0.074	
3	1967	0.9	8.25	0.879	0.121	Mean = 4.77
4	1951	1.0	5.93	0.831	0.169	
5	1966	1.3	4.63	0.784	0.216	SDEV = 8.12
6	1959	2.3	3.80	0.737	0.263	
7	1969	2.4	3.22	0.689	0.311	Variance = 65.97
8	1956	2.7	2.79	0.642	0.358	
9	1964	2.8	2.47	0.595	0.405	Skew = 3.71
10	1955	3.1	2.21	0.547	0.453	
11	1953	3.1	2.00	0.500	0.500	
12	1952	3.4	1.83	0.453	0.547	
13	1965	3.4	1.68	0.405	0.595	
14	1962	3.6	1.56	0.358	0.642	
15	1961	3.7	1.45	0.311	0.689	
16	1957	4.1	1.36	0.263	0.737	
17	1960	4.2	1.28	0.216	0.784	
18	1968	4.4	1.20	0.169	0.831	
19	1958	4.8	1.14	0.121	0.879	
20	1954	5.4	1.08	0.074	0.926	
21	1963	6.1	1.03	0.027	0.973	

Chart III-10: Annual minimum seven-day running average low-flow and the 5-year moving average for South Fork Gualala River near Annapolis, USGS station #11467500, for Water Years 1951 – 1971.

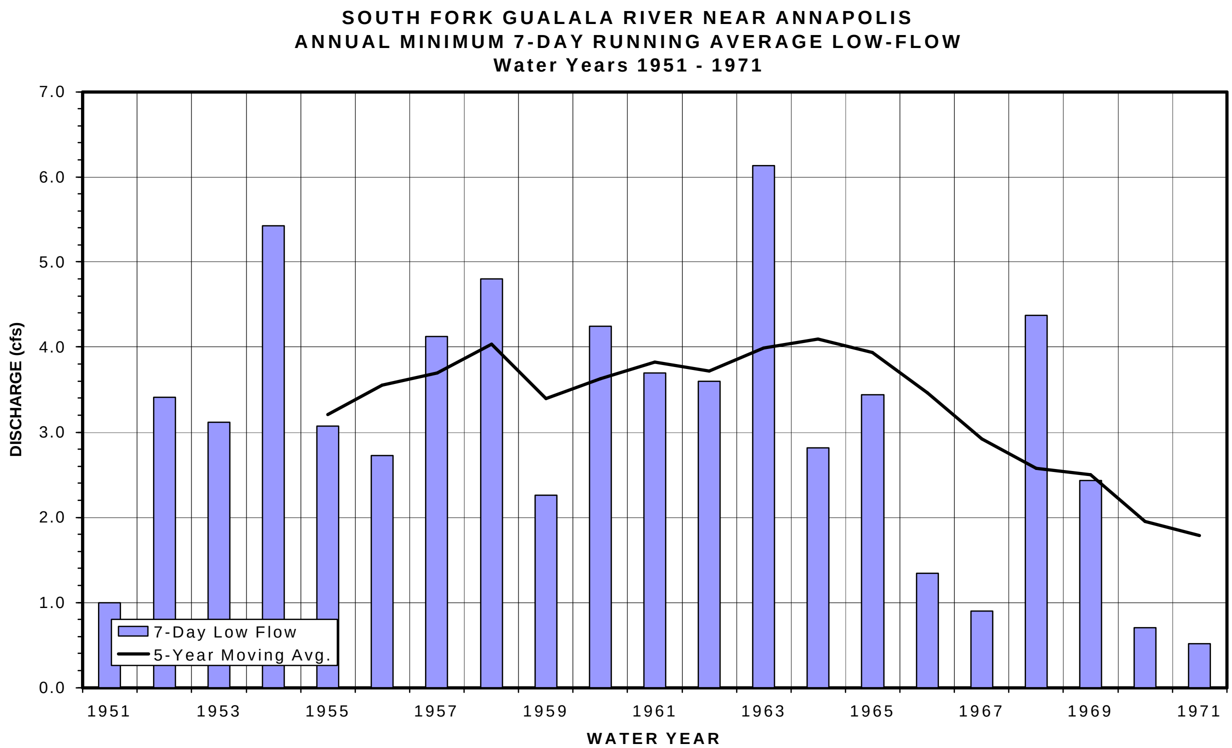
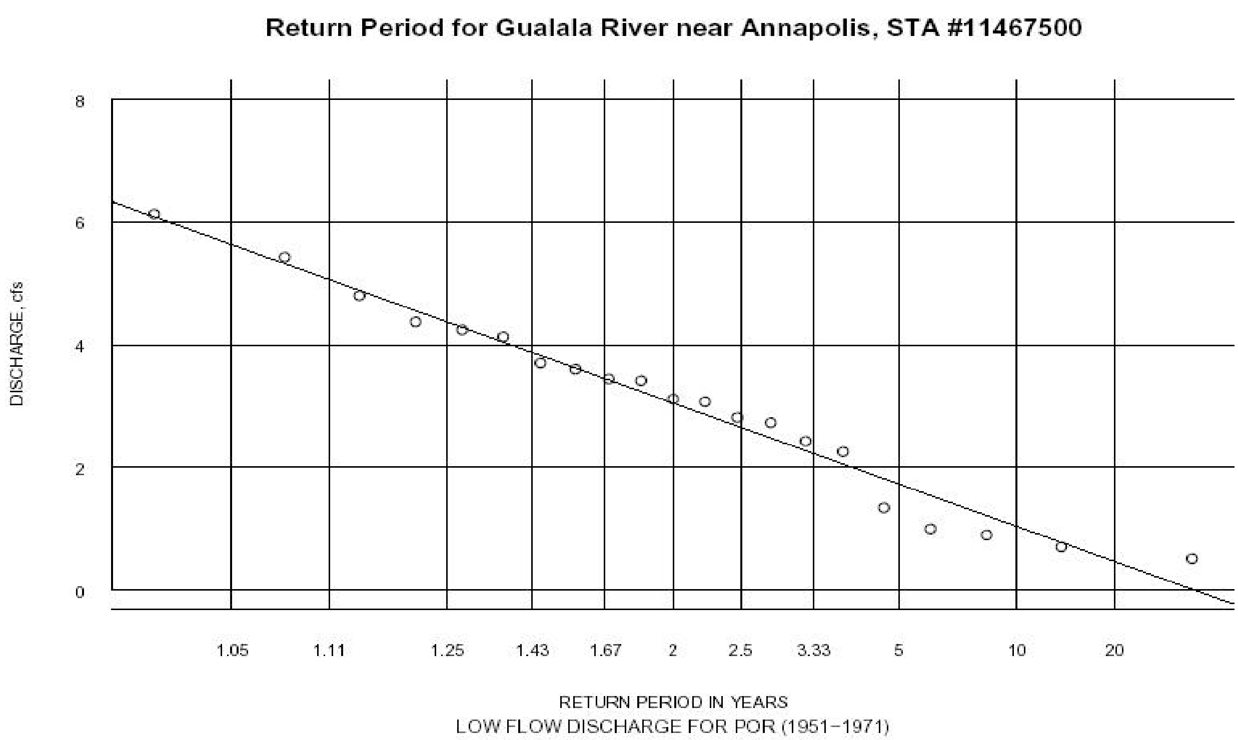


Chart III-11: Annual minimum seven-day running average low-flow return period for South Fork Gualala River near Annapolis, USGS station #11467500, for Water Years 1951 – 1971.



IV. SURFACE WATER RIGHTS AND WATER USE

California law recognizes various types of water rights to surface water flow. Their proof of existence and exercise can often be a complicated and controversial issue. Surface water diversions can have a major impact on streamflow and consequently fisheries habitat. Ground water extractions, with a few exceptions, are not subject to California law and can also affect streamflow. A description of the different types of surface water rights can be found at the SWRCB web site (www.waterrights.ca.gov). A more detailed description is published in an article in the Pacific Law Journal, Volume 19, and Issue 4, entitled “Overview of California Water Law” by William R. Atwater and James Merkle.

The two predominate types of water rights within the Gualala River Basin are riparian and appropriative. Riparian water rights generally apply to the diversion and use of surface water from a natural watercourse on lands that the watercourse passes through or borders. No California statute defines riparian rights and a State permit is not required, but a riparian water rights doctrine has been established in the State by decisions of the courts and confirmed by Section 3, Article XIV of the California Constitution.

Common restrictions and conditions that apply to all riparian water rights include: 1) the diversion of water is limited to natural flowing water as distinguished from return flows derived from the use of ground water, water seasonally stored and later released, or water diverted from another watershed; 2) a parcel of land losses its riparian right if it is severed from the land bordering the watercourse unless the right is reserved by deed for the severed parcel; 3) they are of equal priority with all other riparian rights to the same natural flow of a watercourse regardless of the date of initial use; 4) they are neither created by use nor lost by nonuse; 5) they can not be transferred to another parcel of land but can be dedicated to streamflow purposes; and 6) a “Statement of Water Diversion and Use” is required, with certain exceptions, to be filed periodically with the SWRCB. This statement establishes a record of actual water use.

Appropriative water rights generally apply to the diversion and use of water on lands that do not border the watercourse. Appropriative water rights are divided into two types, those initiated before December 19, 1914 (pre-1914) and those initiated after December 19, 1914 (post-1914).

Prior to enactment of the California Water Commission Act in December 1914, the appropriation of water from surface streams was obtained in accordance with the guidelines in Sections 1410 through 1422 of the California Civil Code of 1872. To appropriate water, it was necessary to post a notice at the proposed point of diversion and record a copy of the notice with the respective County Recorder. The right was considered valid as long as the appropriator maintained continuous beneficial use of the water. The amount that could be rightfully claimed was fixed by actual beneficial use as to both amount and season of diversion.

In 1914, the California Water Commission Act abolished the procedures previously followed for water appropriation, and established an application process. Water appropriation now requires compliance with the provisions of Division 2, Part 2 of the California Water Code. These provisions established the steps that must be followed to initiate and acquire an appropriative water right. The purpose of filing an application for a permit is to secure a right to the use of unappropriated water and to establish a record of the right so that its status relative to other rights may be determined.

A prospective appropriator must file an application with the SWRCB. The application includes all information pertinent to the development, acquisition, and use of the water, including point of diversion, diversion flow rates, time of diversion, quantity of diversion, and place and purpose of use. The application is then reviewed by the SWRCB. The review process includes: 1) posting or publication of the application.

If protests are received, a hearing or investigation is conducted; 2) availability of unappropriated water; 3) possible environmental impacts as required by the California Environmental Quality Act; and 4) possible fisheries impacts by the California Department of Fish and Game.

Although ground water extractions do not generally require a SWRCB application, underground water extractions from "subterranean streams flowing through known and definite channels" are under the SWRCB jurisdiction and are subject to the same review as surface water extractions.

If the application is approved, a permit is issued with terms and conditions to develop the diversion facilities. If the terms and conditions are completed and adhered to during a specific time frame, a license is issued limiting the water user to a quantity of water that was demonstrated as beneficially used during the permitting process. The terms and conditions set by the SWRCB normally apply after the license is issued.

Common conditions and restrictions that apply to all pre-1914 and post-1914 appropriative water rights include: 1) appropriation of water can be from the natural flow of a watercourse, return flows derived from the use of surface or ground water, water seasonally stored and later released, or water diverted from another watershed; 2) they can be transferred to other lands or for streamflow purposes; 3) they typically follow the "first in time, first in right" doctrine of priority among other appropriators but are inferior to riparian water rights - there may be times during the diversion season when no unappropriated water is available; 4) they can be lost after five years of nonuse; and 5) a "Statement of Water Diversion and Use" is required, with certain exceptions, to be filed periodically with the SWRCB. This statement provides a record of actual water use.

Disputes over the exercise of surface water rights occur and can occasionally only be resolved by court litigation. The SWRCB is authorized to pursue civil action if a water user violates the terms of a post-1914 appropriative water right, but does not have the authority to determine the validity of other vested water rights. The County Superior Courts are sometimes compelled to adjudicate water rights as a result of disputes that can not be resolved by other methods. A typical water right adjudication defines numerous aspects of the water rights involved including the quantity of use, priority to other vested water rights, point of diversion, and the purpose, place and season of use. Court adjudicated water rights do not currently exist within the Gualala River Basin.

A search of the SWRCB's Water Right Information Management System (WRIMS) was performed to determine the number and types of water rights within the Gualala River Basin. The WRIMS database is under development and may not contain all post-1914 appropriative water right applications that are on file with the SWRCB at this time. Some pre-1914 and riparian water rights are also contained in the WRIMS database for those water rights whose users have filed a "Statement of Water Diversion and Use". A list of water rights and associated information contained within WRIMS for the Gualala River Basin is presented in Table IV-1. A location map of the point of diversion is shown in Figure IV-1.

According to Table IV-1, SWRCB post-1914 appropriative water right permits and statements of water use exist for a total of about 4,500 acre-feet per year (ac-ft/yr) of water from the Gualala River Basin, at a maximum diversion rate of about 8.0 cubic feet per second (cfs). The purpose of use of these water rights includes domestic, fire protection, irrigation, municipal, recreation, and stockwatering.

DWR periodically conducts land and water use surveys within the basin for its Statewide Planning Program. The data collected during these surveys is used with other information to estimate current water use during an average water supply year and to forecast future water requirements for agricultural, municipal, industrial, recreational, and environmental uses for each detailed analysis unit (DAU) of the State. This information is published in the Bulletin 160 series entitled “The California Water Plan Update”. The latest completed land use survey by DWR was performed in 1986. At that time, no cultivated agricultural lands were identified within the Gualala River Basin, but due to the mapping scale, only plots of land of two acres or greater could to be delineated. DWR has also identified cultivated agricultural lands for plots greater than two acres for Mendocino and Sonoma Counties from 1997 aerial photographs. Based on preliminary data, cultivated agricultural land in 1997 totaled about 350 acres within the Gualala River Basin. A majority of these recently cultivated lands have been planted in vineyards.

As stated in the Gualala River Watershed Literature Search and Assimilation (Higgins 1997): “While agricultural water use in the Gualala River Basin has been very low in the past, vineyards are now being developed in some areas. These vineyards may have a direct impact on tributary flow if surface water is used. If wells are drilled in upland areas, and if the aquifer is joined to headwater springs, flows in some tributaries could be affected”. Estimates of the acreage of vineyards that exist today within the Gualala River Basin range from 700 to 1,000 acres. These vineyards probably do not normally require much direct irrigation, as rainfall is normally ample. Some growers may not apply any direct irrigation water depending on the soil type and purpose of the particular grape crop. Some growers probably use sprinkler systems for frost protection during the early spring, which can also serve as irrigation water. DWR land and water use staff have estimated the annual maximum direct application of water by drip systems for vineyards within the basin is about 9 inches per acre during the dry months of April though October. The estimated peak flow rate for irrigation is 12 gallons per minute per acre (gpm/ac) and up to 50 gpm/ac for frost protection. Assuming 1,000 acres of vineyards, the potential instantaneous peak water demand for irrigation could reach 27 cfs and greater than 100 cfs for frost protection. Since ground water sources are limited in the basin and are unlikely to supply much of the irrigation or frost protection water demand, water for these demands is probably supplied mainly from small ponds or catch basins, filled by local surface runoff or diversions from nearby streams. It would be rare for all vineyard acres to be irrigated or frost protected at the same time, but the use of water for these purposes may be required for a majority of the acres during prolonged dry periods or extreme frost events and could have a significant affect on streamflow.

Current water use in the Gualala River Basin by rural residential development is probably minor. EIP Associates (1994) projected that development of vacation homes or residences could result in the use of up to 2.5 cfs for the entire basin. DWR uses population data from the State Department of Finance to estimate municipal water use. Table IV-2 presents population and municipal water use data for the Gualala River Basin.

Table IV-2: Population and municipal water use.

GUALALA RIVER
POPULATION AND MUNICIPAL WATER USE
DWR Detailed Analysis Unit #19

		Municipal Water Use (ac-ft/yr)		
Year	Permanent Population	Surface Water	Ground Water	Total
1995	1,705	0	150	150
2020	2,160	0	190	190

Two major municipal water users, the North Gualala Water Company (NGWC) and the Sea Ranch, currently extract water from the Gualala River Basin. The SWRCB issued an appropriative water right permit to NGWC to divert water from the North Fork Gualala River. The permit stipulates a maximum diversion of 2.0 cfs, but when the natural flow of the North Fork falls below stipulated by-pass flows for fish, NGWC is prohibited from diverting any water from the North Fork. The by-pass flows vary with the time of year, but a minimum by-pass flow of 4.0 cfs is required at all times. In August 2000, the SWRCB ruled that the by-pass flows applied to both surface water diversions and extractions from underground water from two NGWC offset wells that had been previously found to fall under the SWRCB's jurisdiction as "subterranean streams flowing through known and definite channels". The SWRCB decisions regarding these water extractions are currently under litigation in the Superior Court of Mendocino County. The plaintiff, NGWC, is claiming the water extractions from their offset wells do not fall under the jurisdiction of the SWRCB.

The Sea Ranch once drew surface water directly from the South Fork Gualala River, but they currently draw water from the aquifer below the lower South Fork Gualala riverbed by offset wells and have augmented storage with an off-site reservoir. The SWRCB again ruled that the water extractions from the aquifer are from "subterranean streams" and are therefore under the SWRCB jurisdiction. The Sea Ranch's appropriative water right permit allows for a maximum extraction of 2.8 cfs, although actual historic maximum diversions have been substantially less. These diversions are also dependent on minimum fish by-pass flows stipulated in the SWRCB permit.

Any water extraction from surface or groundwater supplies, depending on the amount, location, and season, can affect streamflow, water quality, and consequently fish habitat. The method of diversion of surface flows, such as dams and pumps without properly designed fish ladders or screens, can also impede and adversely affect all species of fish. Based on existing water rights, land use data, and observations by DFG staff during their stream field surveys conducted from June – November 2001, current water diversions within the Gualala River Basin do not appear to significantly affect streamflows, but most actual diversions or resulting streamflow reductions have not been recorded. DFG staff has also observed some in-channel summer dams that have caused habitat alterations.

Current low-flow constraints in the Gualala River will most likely prohibit future additional appropriative water right allocations by the SWRCB. However, greater use of the rights allocated to the Sea Ranch and NGWC is expected in the future and the unregulated water right or illegal extraction of water for the irrigation and frost protection of existing and future crops, or domestic and municipal purposes may, at times, have an adverse impact on fish habitat and should be monitored.

The NCRWQCB's Basin Plan designates ten existing and one potential beneficial uses of water for the Gualala River Basin. The Water Board has responsibility for protecting all beneficial uses. Accordingly, the water quality parameters assessed in this report are compared to water quality objectives for the protection of all beneficial uses. However, the assessment is focussed primarily on the salmonid fishery beneficial uses: COLD (cold freshwater habitat), SPWN (spawning, reproduction, and/or early development), MIGR (migration of aquatic organisms), EST (estuarine habitat), and REC-1 (water contact recreation-fishing). A complete list of beneficial uses appears in Appendix 4.

Table IV-1: List of SWRCB Water Right Information Management System surface water rights.

Page 1 of 2

GUALALA RIVER BASIN

LIST OF WATER RIGHTS CONTAINED IN THE STATE WATER RESOURCES CONTROL BOARD WATER RIGHT INFORMATION MANAGEMENT SYSTEM (WRIMS) DATABASE

	1/ WRIMS ID	2/ Owner	3/ Type	Application Number	Application Date	Permit Number	Permit Date	License Number	License Date
1	A011416	Soper-Wheeler Company	A	011416	6/5/46	006884	8/26/47	005424	1/28/59
2	A011416	Soper-Wheeler Company	A	011416	6/5/46	006884	8/26/47	005424	1/28/59
3	A019294	Bessie Richardson	A	019294	3/8/60	012666	2/15/61	none	na
4	A021202	Mary Adreatta	A	021202	3/22/63	014214	10/24/63	009284	4/9/70
5	A021883	North Gualala Water Co.	A	021883	8/26/64	014853	9/3/65	none	na
6	A022377	Sea Ranch Water Co.	A	022377	1/31/66	015358	4/7/67	none	na
7	A022446	Russ Zumwalt	A	022446	4/11/66	015241	11/2/66	009844	8/31/71
8	A022538	V. Rafanelli	A	022538	7/29/66	015350	4/7/67	009807	6/7/71
9	A022719	Arthur Rasmason	A	022719	3/7/67	015455	9/7/67	010079	5/11/73
10	A022732	Mary Adreatta	A	022732	3/20/67	015423	7/11/67	010523	8/19/75
11	A022824	Gualala Ranch Assoc.	A	022824	6/16/67	015495	9/29/67	010228	5/3/74
12	A022972	Kashia Band/Pomo Indians	A	022972	1/22/68	015684	9/10/68	012874	4/22/92
13	A023073	Russ Zumwalt	A	023073	1/24/68	015776	1/14/69	009843	8/31/71
14	A024081	Edward Tunheim	A	024081	6/1/72	017405	7/12/78	011775	3/27/85
15	A024082	Edward Tunheim	A	024082	6/1/72	017406	7/12/78	011776	3/27/85
16	A024083	Edward Tunheim	A	024083	6/1/72	017407	7/12/78	011777	3/27/85
17	A025131	Judith Isaac	A	025131	8/19/76	017021	1/9/78	011383	4/15/83
18	A025187	Timber Hill Ranch LLC	A	025187	10/27/76	016973	11/1/77	none	na
19	A026263	URI Annapolis Springs Ranch	A	026263	3/24/80	018216	4/21/81	none	na
20	A027635	Judith Isaac	A	027635	1/20/83	018902	6/15/83	012497	2/27/90
21	A029466	Sea Ranch Water Co.	A	029466	4/13/89	020751	7/29/94	none	na
22	A030438	Sea Ranch Water Co.	A	030438	3/22/95	020801	7/13/95	none	na
23	A031033	Dana Radtkey	A	031033	3/21/00	none	na	none	na
24	A031033	Dana Radtkey	A	031033	3/21/00	none	na	none	na
25	A031194	Alaska Water Exports	A	031194	6/6/01	none	na	none	na
26	A031194	Alaska Water Exports	A	031195	6/7/01	none	na	none	na
27	C000913	Arthur Rasmason	C	000913	9/7/77	na	na	000913	8/30/79
28	C004544	Alice Garrett	C	004544	12/18/97	na	na	none	na
29	C004579	Alice Garrett	C	004579	12/18/97	na	na	none	na
30	C004580	Alice Garrett	C	004580	12/18/97	na	na	none	na
31	C004654	Alice Picus	C	004654	12/31/97	na	na	none	na
32	C004664	Alice Ficus	C	004664	12/31/97	na	na	none	na
33	D030000R	Kenneth Wilson	D	030000R	8/28/91	na	na	000135R	6/22/92
34	D030001R	Kenneth Wilson	D	030001R	8/28/91	na	na	000136R	6/22/92
35	S009985	Phyliss McMillen	S	009985	10/9/79	na	na	na	na
36	S009995	Edward Tunheim	S	009995	12/1/67	na	na	na	na
37	S009996	Edward Tunheim	S	009996	12/1/67	na	na	na	na
38	S010007	Edward Tunheim	S	010007	12/1/67	na	na	na	na
39	S013469	Robert Warner	S	013469	5/17/90	na	na	na	na
40	S014006	Berkeley - Alabany YMCA	S	014006	5/13/93	na	na	na	na
41	S014299	Walter Flowers	S	014299	1/5/95	na	na	na	na

Notes: 1/ State Water Resources Control Board WRIMS water right identification.
2/ Current WRIMS owners name. May not be current owner of property.
3/ A = SWRCB appropriative water right, C = stockwater pond, D = small domestic registration,
S = pre-1914 appropriative water right or riparian water right

Table IV-1: List of SWRCB Water Right Information Management System surface water rights (continued).

GUALALA RIVER BASIN

LIST OF WATER RIGHTS CONTAINED IN THE STATE WATER RESOURCES CONTROL BOARD
WATER RIGHT INFORMATION MANAGEMENT SYSTEM (WRIMS) DATABASE

	1/ WRIMS ID	Source	Tributary To	Maximum Annual Diversion Volume (acre-feet / year)	Maximum Diversion Rate	2/ Purpose of Use	3/ POD Location	County
1	A011416	Old House Creek	Wheatfield Fk.	10	0.42 cfs	D, I, S	SW SW, 5, 9N,12W, M	Sonoma
2	A011416	Old House Creek	Wheatfield Fk.	10	0.42 cfs	D, I, S	SE NW, 5, 9N, 12W, M	Sonoma
3	A019294	unnamed stream	S. F. Gualala R.	105	(no data)	(no data)	NE SW, 25, 10N, 14W, M	Sonoma
4	A021202	unnamed stream	Carson Cr.	9.2	(no data)	R, S	NW SW, 3, 8N, 12W, M	Sonoma
5	A021883	N. F. Gualala R.	Gualala R.	(no data)	2.0 cfs	M	NE NW, 23, 11N, 15W, M	Mendocino
6	A022377	S. F. Gualala R.	Gualala R.	(no data)	2.8 cfs	M	SW SE, 16, 10N, 14W, M	Sonoma
7	A022446	S. F. Gualala R.	Gualala R.	(no data)	0.077 cfs	I	SW SW, 15, 8N, 12W, M	Sonoma
8	A022538	unnamed stream	House Cr.	194	(no data)	E, R, S, W	NE NE, 4, 9N, 12W, M	Sonoma
9	A022719	unnamed stream	Wheatfield Fk.	7.6	(no data)	R, S	NE SW, 36, 10N, 13W, M	Sonoma
10	A022732	unnamed stream	McKenzie Cr.	10	(no data)	R, S	NE SE, 34, 9N, 12W, M	Sonoma
11	A022824	unnamed stream	S. F. Gualala R.	5	(no data)	R	NW NE, 15, 8N, 12W, M	Sonoma
12	A022972	Wheatfield Fk. under flow	Gualala R.	14.7	16,220 gpd	D	SE SE, 32, 10N, 13W, M	Sonoma
13	A023073	S. F. Gualala R.	Gualala R.	1.2	(no data)	R, S	SW SW, 15, 8N, 12W, M	Sonoma
14	A024081	unnamed spring	unnamed stream	8	225 gpd	E, I, R, S	SE NE, 28, 9N, 13W, M	Sonoma
15	A024082	unnamed stream	S. F. Gualala R.	15	675 gpd	E, R, S, W	NW NW, 28, 9N, 13W, M	Sonoma
16	A024083	unnamed stream	S. F. Gualala R.	43	8,100 gpd	D, E, I, R, S	SE NW, 28, 9N, 13W, M	Sonoma
17	A025131	unnamed stream	S. F. Gualala R.	5	(no data)	E, R	SE NE, 02, 8N, 13W, M	Sonoma
18	A025187	unnamed stream	S. F. Gualala R.	6	(no data)	E, I, R, S	NW NW, 27, 9N, 13W, M	Sonoma
19	A026263	unnamed stream	Sullivan Cr.	14	(no data)	E, I	SW SW, 21, 10N, 13W, M	Sonoma
20	A027635	unnamed stream	S. F. Gualala R.	12	(no data)	E, R	SE NE, 02, 8N, 13W, M	Sonoma
21	A029466	S. F. Gualala R. under flow	Gualala R.	225	(no data)	M	SW SE, 16, 10N, 14W, M	Sonoma
22	A030438	S. F. Gualala R. sub. stream	Gualala R.	75	(no data)	M	SW SE, 16, 10N, 14W, M	Sonoma
23	A031033	Allen Cr.	House Cr.	46	0.06 cfs	D, I, W	NE SW, 18, 9N, 12W, M	Sonoma
24	A031033	unnamed spring	unnamed stream	46	0.06 cfs	D, I, W	SW SE, 18, 9N, 12W, M	Sonoma
25	A031194	Gualala River	Pacific Ocean	20,000	170 cfs	M	SE SE, 27, 11N, 15W, M	Mendocino
26	A031194	Gualala River	Pacific Ocean	20,000	170 cfs	M	SE NW, 26, 11N, 15W, M	Mendocino
27	C000913	unnamed stream	S. F. Gualala R.	2.3	(no data)	S	SE SE, 36, 10N, 14W, M	Sonoma
28	C004544	unnamed stream	Gualala R.	9	(no data)	S	NW NW, 26, 10N, 14W, M	Sonoma
29	C004579	unnamed stream	Gualala R.	0.7	(no data)	S	NW NW, 26, 10N, 14W, M	Sonoma
30	C004580	unnamed stream	Gualala R.	0.4	(no data)	S	NW NW, 26, 10N, 14W, M	Sonoma
31	C004654	unnamed stream	Gualala R.	1	(no data)	S	NE NE, 14, 10N, 14W, M	Sonoma
32	C004664	unnames stream	Gualala R.	1	(no data)	S	NE NE, 14, 10N, 14W, M	Sonoma
33	D030000R	unnamed stream	House Cr.	10	(no data)	D	NW SW, 5, 9N, 11W, M	Sonoma
34	D030001R	unnamed stream	House Cr.	8	(no data)	D	NE NE, 6, 9N, 11W, M	Sonoma
35	S009985	Sullivan Gulch	Fuller Cr.	(no data)	(no data)	D	SE SW, 21, 10N, 13W, M	Sonoma
36	S009995	Lake Oliver	Italian Gulch	13.8	(no data)	R, S	NW SE, 28, 9N, 13W, M	Sonoma
37	S009996	Lower Lake	Italian Gulch	10	(no data)	R, S	NW NW, 28, 9N, 13W, M	Sonoma
38	S010007	unnamed spring	Italian Gulch	(no data)	40 gpd	S	NE SE, 28, 9N, 13W, M	S onoma
39	S013469	S. F. Fuller Cr.	Fuller Cr.	(no data)	0.029 cfs	D	NE SW, 16, 10N, 13W, M	Sonoma
40	S014006	Wheatfield Fk.	Gualala R.	(no data)	0.133 cfs	D	SW SW, 26, 10N, 13W, M	Sonoma
41	S014299	S. F. Gualala R.	Gualala R.	(no data)	0.11 cfs	I	NE NW, 7, 8N, 12W, M	Sonoma

Notes: 1/ State Water Resources Control Board WRIMS water right identification.
2/ D = domestic, E = fire protection, I = irrigation, M = municipal, R = recreation, S = stockwatering,
W = fish & wildlife protection or enhancement.
3/ Point of diversion location. Quarter-Quarter Section, Section, Township, Range, Base & Meridian (M = Mount Diablo; H = Humboldt)

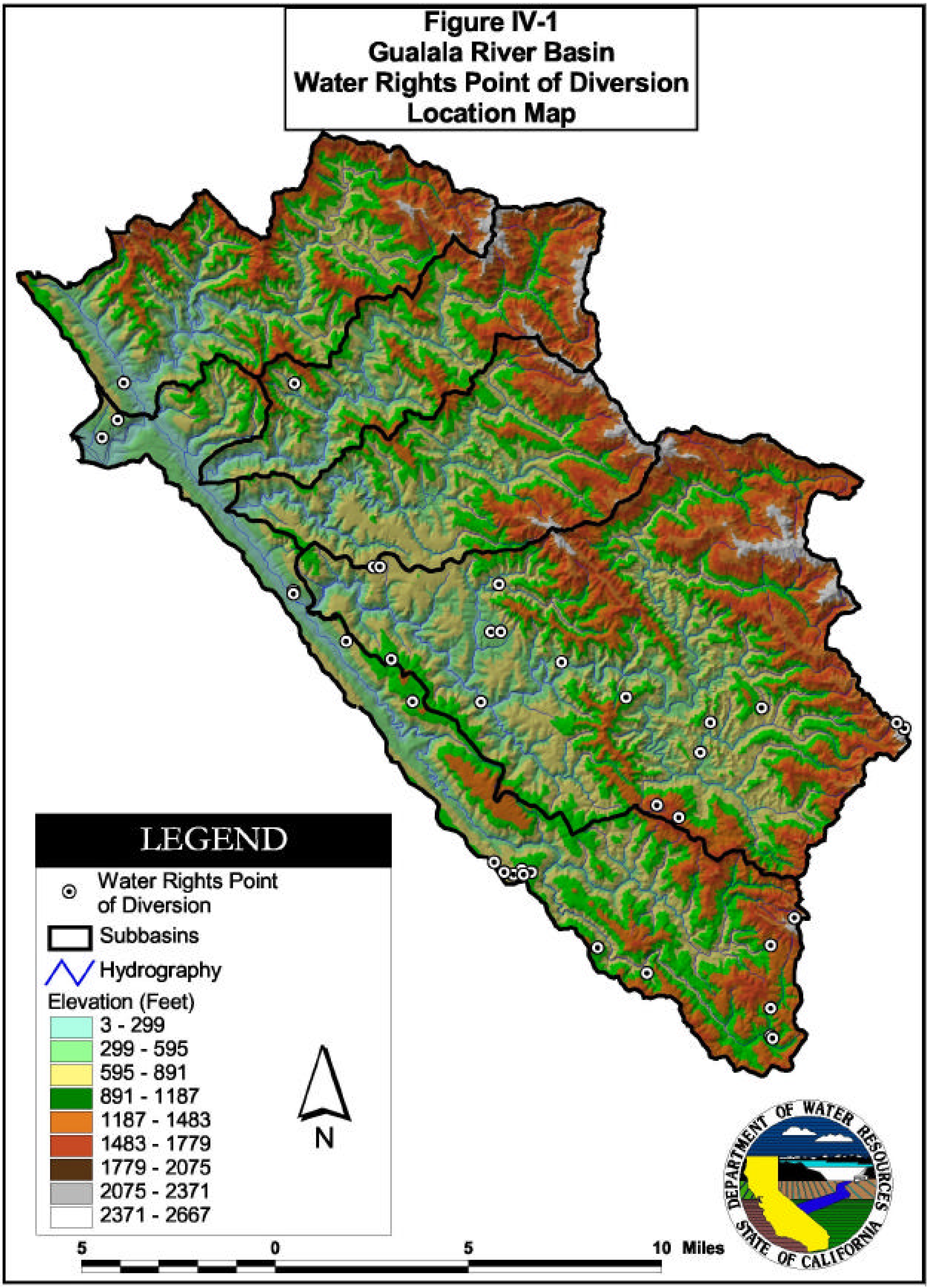


Figure IV-1
Gualala River Basin
Water Rights Point of Diversion
Location Map
LEGEND
Water Rights Point of Diversion
Subbasins
Hydrography
Elevation (Feet)
3 - 299
299 - 595
595 - 891
891 - 1187
1187 - 1483
1483 - 1779
1779 - 2075
2075 - 2371
2371 - 2667
N
5
0
5
10 Miles