Santa Rosa Subregional Long-Term Wastewater Project

RUSSIAN RIVER ALGAE AND MACROPHYTES ASSESSMENT

SANTA ROSA SUBREGIONAL LONG-TERM WASTEWATER PROJECT

Prepared for

City of Santa Rosa
and
U.S. Army Corps of Engineers

April 1996

Prepared by

MERRITT SMITH CONSULTING
Environmental Science and Communication
3675 Mt. Diablo Blvd., #120 Lafayette, CA 94549

For

HARLAND BARTHOLOMEW & ASSOCIATES, INC.

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SUMMARY

The purpose of this report is to characterize the aquatic plant biomass in the Russian River (River). The data in this report are summarized for locations above and below the Laguna de Santa Rosa (Laguna) to facilitate evaluation of discharge of reclaimed water from the City of Santa Rosa. Three components of plant biomass were evaluated: attached algae, submergent macrophytes, and emergent macrophytes. Biomass in the River (as reported in the 1994 and 1995 data) for attached algae did not vary significantly for the three predominant substrata (sand, gravel, and cobble). Submergent macrophytes were rarely observed upstream of Monte Rio during the 1994 and 1995 surveys. Emergent macrophytes were not observed in either year downstream of Casini Ranch.

INTRODUCTION

PURPOSE

The purpose of this report is to characterize the aquatic plant biomass in the Russian River. Biomass data collected in the River will serve as a basis for describing existing conditions and provide input to a water quality model developed to evaluate alternatives for the Santa Rosa Long-Term Wastewater Project (the Project). This report summarizes summer conditions of biomass in the River over two years to provide baseline data for the model. Aquatic plant biomass in the Russian River is primarily influenced by the level of nutrients and other conditions (e.g., light, flow, etc.) in the water and substrate of the River. Plant biomass data, as it relates to the level of nutrients in the River, will allow for the modeling of impacts of nutrient additions to the River from the project alternatives.

The data in this report are summarized for locations above and below the Laguna de Santa Rosa (Laguna) to facilitate evaluation of discharge of reclaimed water from the City of Santa Rosa. However, comparisons of data above versus below the Laguna have not been made because of the many physical differences (not addressed in this report) between those sections of the River that impact plant growth.

STUDY AREA

The Russian River (110 river miles) drains an area of nearly 1,500 square miles from its headwaters upstream of Ukiah, to its mouth at the Pacific Ocean. Large creek systems that flow from steep, mountainous land comprise the watershed of the River. These creeks drain to the flat, alluvial valleys of the upper and middle River, and to the lower canyon beginning at Wohler Bridge. The River reaches tidewater near Duncans Mills (river mile 7) and enters the ocean at Jenner (river mile 0)(Marcus 1992).

The study area for the Project begins in the River downstream of Healdsburg and upstream of the Sonoma County water collectors and Wohler Bridge (see Figure 1). Dry Creek, a large tributary that drains Lake Sonoma, flows into the River just below Healdsburg. Lake Sonoma serves as a water-supply and flood-control reservoir. Flow from the lake is regulated by Warm Springs Dam. Water releases in the summer and restrictions in the winter modify the hydrology of the River. Downstream movement of sediment in the River is greatly reduced by the reservoir (Florsheim 1993).

Other impacts to the River include treated wastewater discharges from the cities of Healdsburg, Santa Rosa, and others (the winter discharge from Santa Rosa flows from the Laguna de Santa Rosa into the River at Mirabel), gravel mining, summer check dams, water diversions, septic systems discharges, flooding, and urban and agricultural runoff. Vineyards and gravel operations line the banks of the River just downstream of Healdsburg and more vineyards bound the River near Oddfellows Park. Gravel skimming operations occur at numerous gravel bars in the River bed (Teytaud 1994). Cattle are

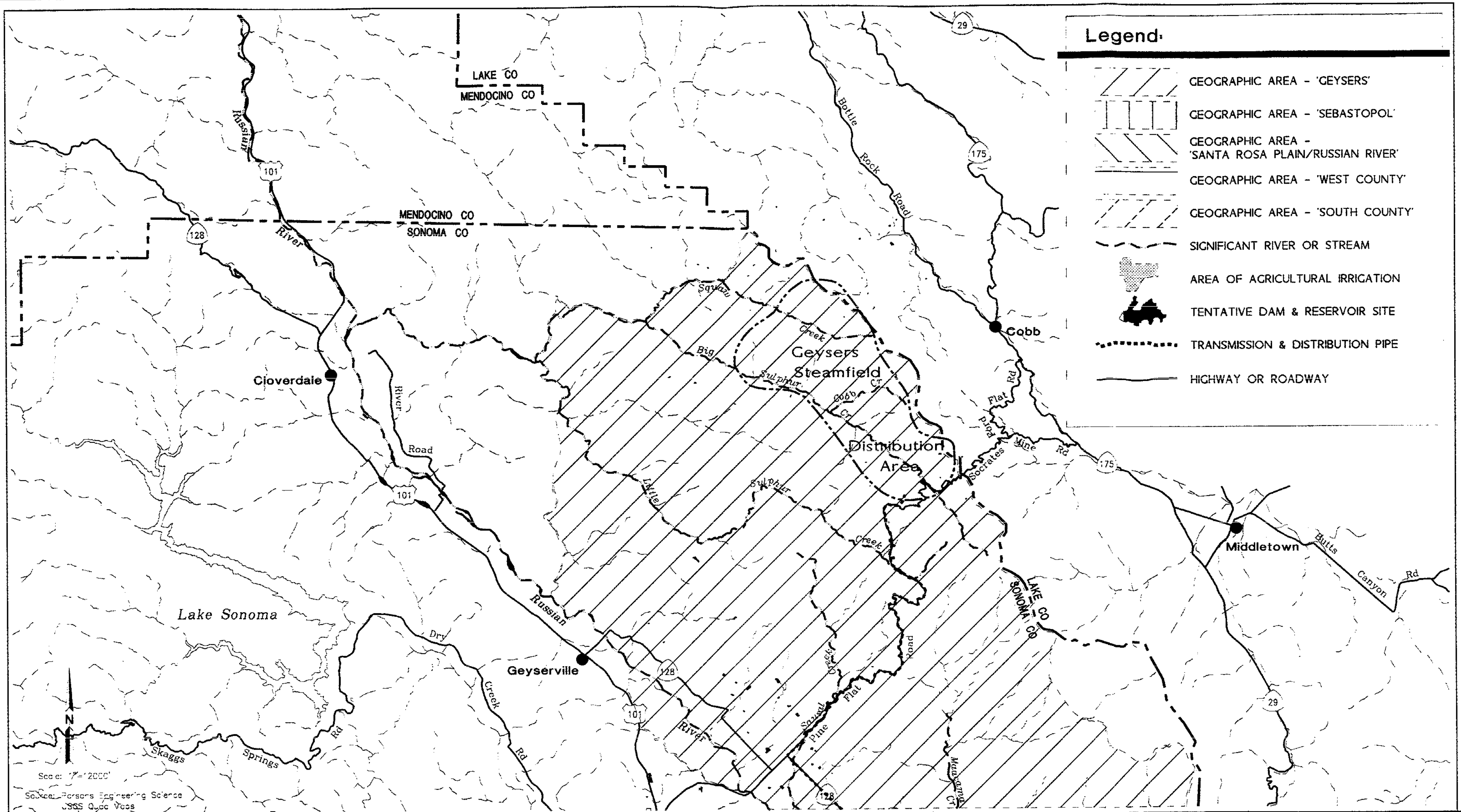

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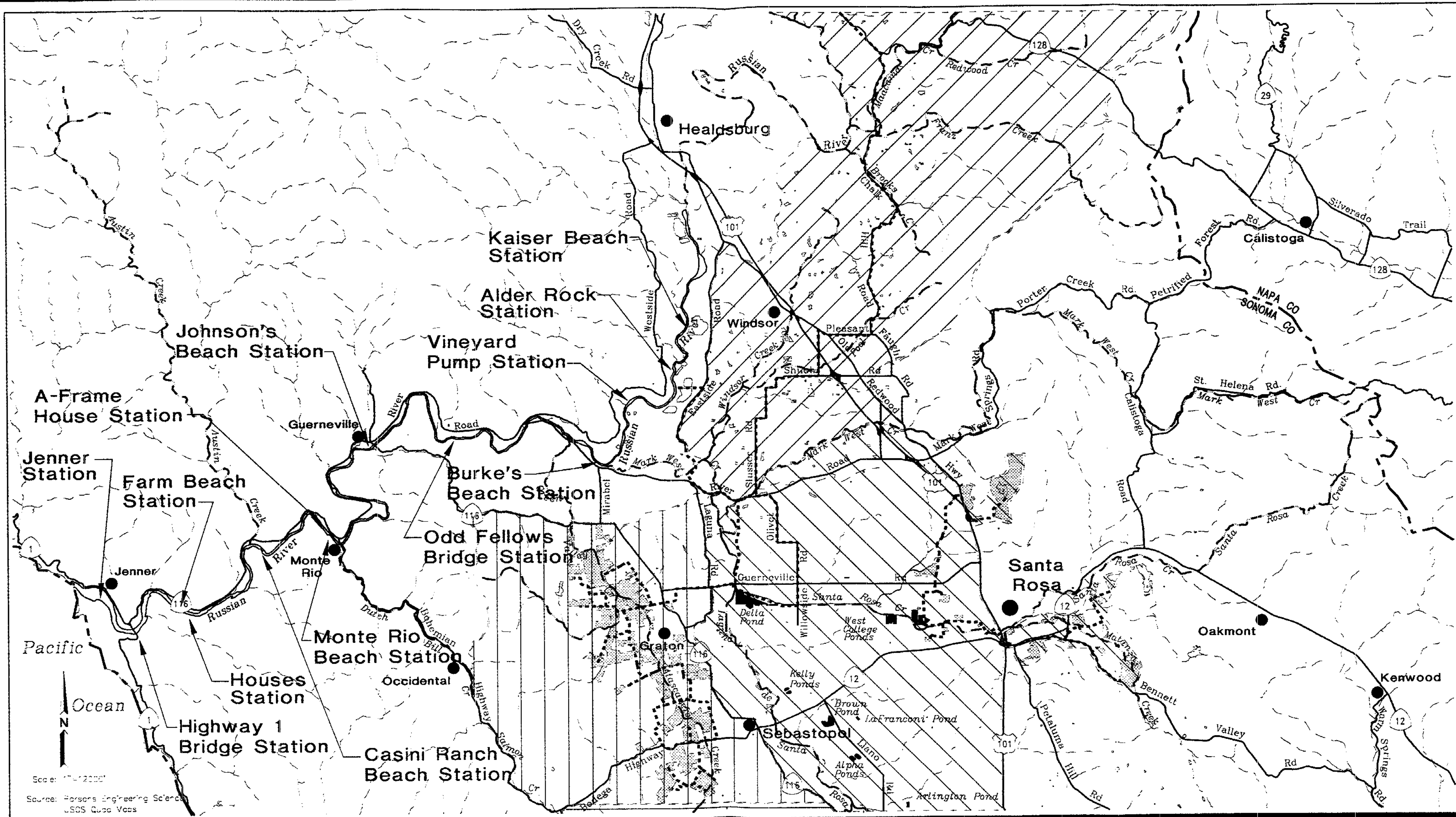
Figure 1a
RUSSIAN RIVER
ALGAE AND MACROPHYTES
MONITORING STATIONS



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RUSSIAN RIVER ALGAE AND MACROPHYTES MONITORING STATIONS

Figure 1b

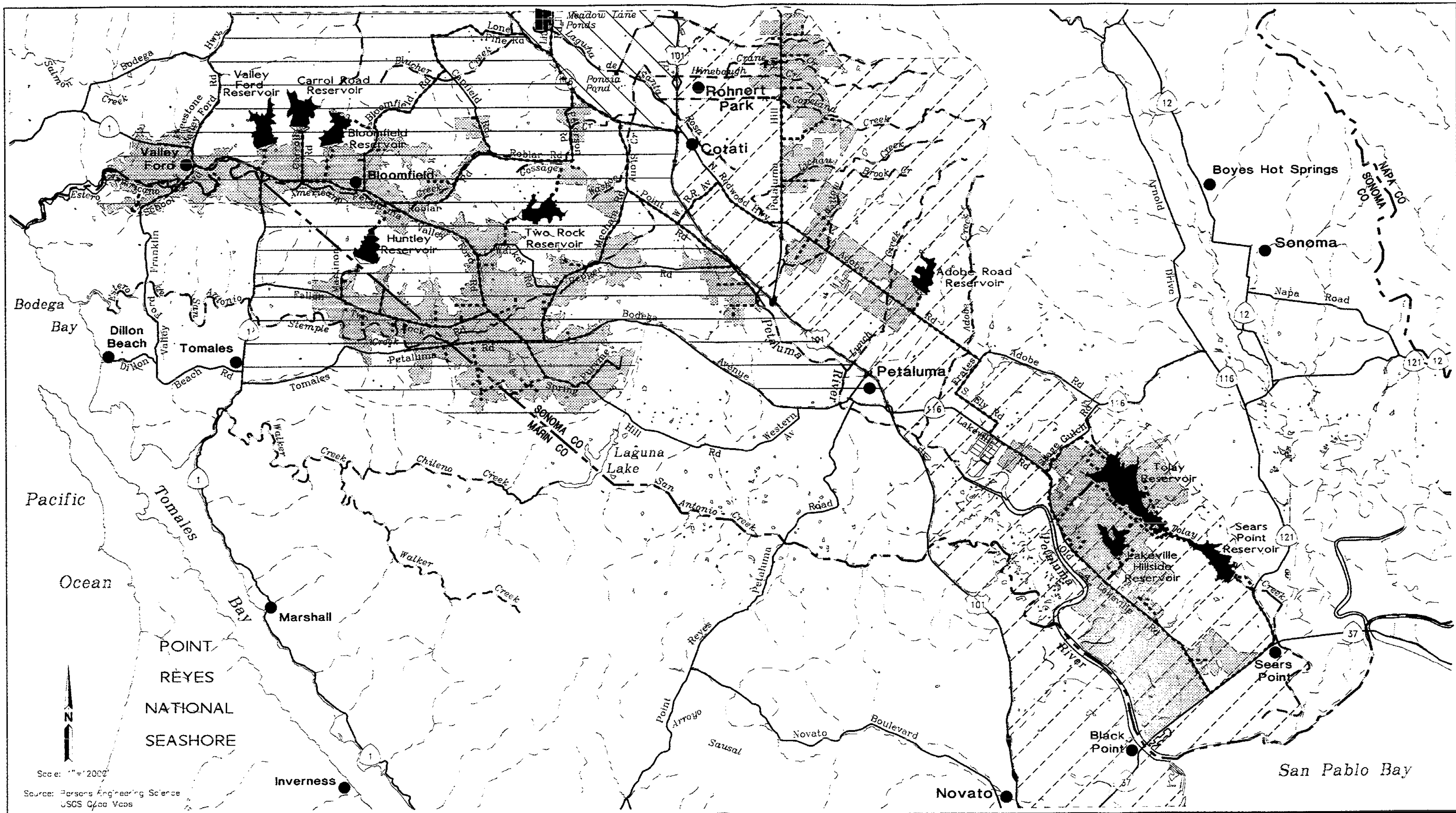

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Figure 1c

RUSSIAN RIVER ALGAE AND MACROPHYTES MONITORING STATIONS grazed along the River downstream of Duncans Mills. During periods of low River inflow, the estuary at the mouth of the River is subject to closure.

The Russian River below Healdsburg provides wildlife habitat, drinking water and recreation among other uses. Several species of warm-water fish live in the River and cold-water fish (such as steelhead trout and coho salmon) migrate upriver to natal habitat. Many mammals (such as river otters and raccoons) and birds (such as herons, ospreys and kingfishers) live and/or feed along the riparian corridor. In addition to the water collectors operated by Sonoma County, other water users such as the City of Windsor divert drinking water from the River. Residents and vacationers swim, canoe and fish along the River and many vacation homes lie downstream of Wohler Bridge.

MONITORING PLAN

Data on plant biomass in the Russian River has been collected for four components: planktonic algae, attached algae, submergent macrophytes and emergent macrophytes. A description of the four plant components and the methods used for data collection follows. Tables 1 and 2 present sampling stations for two of the three biomass components studied: attached algae and submergent algae. Tables 3, 4 and 5 present the 1994 and 1995 plant biomass data collected for the three components (planktonic algae data appear in the Russian River Water Quality Monitoring Technical Report). Data were collected in May, June, July, and September in 1994, and in May, July and August in 1995. Vegetative growth in the River begins to attenuate in the Fall and vegetation dies back significantly for some species and completely for others. Some sampling stations on the River could be reached by car, but most of the sample collection was done using a boat.

Data on the biomass of emergent macrophytes and attached algae are reported in the tables below for stations above and below the confluence with the Laguna de Santa Rosa (Laguna) at approximately 124,000 River feet (the mouth of the River is at 0 feet). Stations above the Laguna are not influenced by winter discharges of reclaimed water from the Santa Rosa Subregional System. Those stations below the Laguna are potentially influenced by Subregional System reclaimed water discharges. Data on the biomass of submergent macrophytes was limited to locations below the Laguna only as reported in Table 4.

Attached Algae

Attached forms of algae include small diatoms and larger filamentous algae such as *Cladophora*. These forms of algae adhere to the substrate (e.g., sand, gravel, cobble) and in the case of *Cladophora*, may create “streamers” by growing to a length of several feet. Data were collected using a one square foot quadrat and a Ponar sampler. Samples were collected from several locations in the River selected at random but representative of stations above and below the Laguna. The stations reflected locations of typical habitat and substrate (sandy pools and rocky shallows) and are described as follows in Table 1:

Table 1.

Stations for Attached Algae in the Russian River

Station	River Feet	Relation to the Laguna
Kaiser Beach	149,000	above
Alder Rock	142,000	above
Vineyard Pump	133,000	above
Burke's Beach in Mirabel	123,000	below
Oddfellows Bridge	97,500	below
Johnson's Beach in Guerneville	80,500	below
Monte Rio Beach	54,500	below
A-frame House	48,000	below
Casini Ranch Beach	39,000	below
Farm Beach	22,500	below
Highway 1 Bridge	14,000	below
Jenner	9,500	below

The quadrat was used to demarcate a 12-inch square (1 ft^2) of substrate from which to sample rocks for attached algae. Rocks within the quadrat were collected by hand from the surface of the River bed and scrubbed with toothbrushes in a pan to dislodge the attached algae. The rocks, brushes, and pans were rinsed with a known quantity of tap water into amber sample bottles for transport to the contract laboratory for chlorophyll *a* analysis. Chlorophyll *a* was measured to provide an index of biomass. Samples were collected from shallow water where cobble-sized rocks (>1 inch diameter) predominated.

The Ponar is a sediment sampler which was used to collect samples from deeper water where the substrate consisted of finer sediments such as gravel, sand and silt. The Ponar was typically deployed with a line from a boat. Sediment collected by the Ponar was transferred to a pan and elutriated by hand with tap water to dislodge the attached algae from the substrate. The rinse water with algae was measured with a graduated cylinder, then drained to amber sample bottles for transport to the contract laboratory for analysis.

Submergent Macrophytes

Submergent macrophytes are rooted higher plants that are typically completely below the water surface. Three genera predominated in the River during the 1994 surveys: *Elodea*, *Myriophyllum,* and *Ruppia* (below Duncans Mills). The stations for submergent macrophyte sampling are listed in Table 2 as follows:

Table 2.

Stations for Submergent Macrophytes in the Russian River

Station	River Feet	Relation to the Laguna
Kaiser Beach	149,000	above
Vineyard Pump	133,000	above
Oddfellows Bridge	97,500	below
Monte Rio	52,000	below
A-frame House	48,000	below
Casini Ranch	39,000	below
Houses	25,000	below
Farm Beach	22,500	below
Highway 1 Bridge	14,000	below

Transects were established at random locations above and below the Laguna representing different habitat (e.g., depth, bank to bank width, etc.) in the River. Samples were collected whenever submerged macrophytes were found along the transects. The transect was first inspected by a diver using snorkel gear to estimate percent cover (percent of the River bed covered by vegetation). A representative section (with a predominating amount of coverage) of the transect was then chosen by a diver using snorkel gear, and a quadrat was used to isolate the vegetation in a consistent manner for each sampling station. All vegetation was then pulled from the substrate, brought to the surface in a mesh bag, drained and weighed.

Emergent Macrophytes

Emergent macrophytes are rooted higher plants that primarily exist above the surface of the water. Water primrose was the only emergent along the River. Primrose grows along the banks and extends out over the surface of the water with runners. The roots of the runners take up water and nutrients from the water column. Estimates of biomass for emergents were made by boating the entire length of the study area. The area of vegetation in the water was estimated in the field.

MONITORING RESULTS

ATTACHED ALGAE

Table 3 presents the chlorophyll *a* data measured from attached algae samples. The attached algae was quantified for three size classes of substrate (sand, gravel and cobble) to represent the typical types of sediment found in the River. Raw data for the attached algae sampling appears in the Appendix. The July, 1994 and July, 1995 samples of attached algae exhibited the greatest biomass of the three months when data were collected in those years. A consistent pattern is not apparent when comparing the biomass data between the three substrata.

Table 3.

Biomass of Attached Algae in Russian River

Sampling Date	Substrate[a]	Stations Above Laguna[b] (mg/m^2 Chlorophyll *a*)	Stations Below Laguna[b] (mg/m^2 Chlorophyll *a*)
May/June, 1994	sand	16 (n=2)	8 (n=1)
	gravel	2 (n=1)	11 (n=2)
	cobble	2 (n=1)	25 (n=6)
July, 1994	sand	17 (n=1)	101 (n=1)
	gravel	79 (n=2)	15 (n=4)
	cobble	2 (n=1)	30 (n=7)
September, 1994	sand	10 (n=1)	8 (n=1)
	gravel	39 (n=2)	7 (n=3)
	cobble	5 (n=1)	15 (n=7)
May, 1995	sand	- (n=0)	0.7 (n=1)
	gravel	0.2 (n=1)	2 (n=1)
	cobble	0.2 (n=1)	2 (n=2)
July, 1995	sand	21 (n=1)	18 (n=1)
	gravel	97 (n=3)	9 (n=3)
	cobble	3 (n=2)	11 (n=5)
August, 1995	sand	12 (n=2)	19 (n=3)
	gravel	8 (n=2)	12 (n=5)
	cobble	5 (n=1)	24 (n=5)

[a] Substrate was defined for sampling locations as “sand” if only sand, as “gravel” if gravel-sized rocks (<1-inch diameter) occurred with sand, and “cobble” if cobble-sized rocks (>1-inch diameter) occurred with sand or gravel.
[b] Replicates were collected at various locations to represent cross-sections of the River. These replicates appear as averages in the table for like substrates.

Significant amounts of attached algae were routinely observed on the cobble substrate sampled. However, the data (Table 3) often reflect much higher chlorophyll *a* values from the sand and gravel samples. The sand and gravel samples were typically taken at greater depths than the cobble samples predicting less algal production due to light attenuation. Data reports from the analytical laboratory were evaluated to verify quality control. Sample duplicates were run by the laboratory for the chlorophyll *a* analysis and these results indicated low %RSD (percent relative standard deviation) for each of several samples investigated.

SUBMERGENT MACROPHYTES

Submergent macrophytes were rarely found upstream of Monte Rio in 1994. No rooted submergent plants were observed during any of the three 1995 surveys. High floodwaters in January and March, 1995 presumably scoured the existing vegetation in the River and disturbed the substrate sufficiently to decrease summer, 1995 submergent biomass.

Table 4 shows the estimated biomass of submergent macrophytes as wet weight and percent cover. Field surveys for submergent plants were conducted in June and September, 1994 and May, July, and August, 1995. No submergent macrophytes were observed during the May, July, or August, 1995 surveys. Raw data for the submergent sampling appears in the Appendix. Submergent macrophytes were not observed upstream of Monte Rio in either the 1994 or 1995 sampling surveys.

Table 4.

Biomass of Submergent Macrophytes in Russian River

Sampling Date	Average Percent Cover of Russian River Bed	Average Wet Weight (g/m^2)
June, 1994	10 (n=6)	3700 (n=6)
September, 1994	23 (n=10)	2400 (n=7)
May, 1995	0	0
July, 1995	0	0
August, 1995	0	0

EMERGENT MACROPHYTES

Table 5 presents estimated emergent biomass both above and below the Laguna. Primrose that extended up the banks was not included in the areal estimates. Field surveys for emergent macrophytes were conducted in June and September, 1994 and May, July, and August, 1995. No emergents were observed during the May and July, 1995 surveys. No emergents were observed downstream of Casini Ranch in the 1994 or 1995 surveys. Raw data for the emergent sampling appears in the Appendix. Emergent macrophytes were rarely observed downstream of Monte Rio and never observed downstream of Casini Ranch during the 1994 and 1995 surveys.

Table 5.

Biomass of Emergent Macrophytes in Russian River

Sampling Date	Stations Above Laguna (ft^2 per River mile)	Stations Below Laguna (ft^2 per River mile)
June, 1994	1623	484
September, 1994	3283	1298
May, 1995	0	0
July, 1995	0	0
August, 1995	1946	861

REFERENCES

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