FINAL REPORT

ON

TOXIC SUBSTANCE DETECTION AND EARLY WARNING

FOR THE RUSSIAN RIVER

[Prepared in fulfillment of the Water Quality Management Planning Program (Section 205(j), workplan dated May 14, 1985.]

by

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INTRODUCTION

Background

The December, 1981, amendments to the Federal Clean Water Act included a new Section, 205(j), for the specific purpose of funding water quality management programs. In March of 1985 the State Water Resources Control Board (State Board) approved a priority list of fundable projects, including this project. The North Coast Regional Water Quality Control Board (Regional Board) approved the workplan at its May, 1985 meeting (NCRWQCB, 1985). Project funds were made available in early 1986, and the project commenced in March of 1986.

This project was a cooperative effort among the Regional Board, the Sonoma County Water Agency (SCWA), and N.E.T. Pacific, Inc. (formerly Anatec Laboratories, Inc.). Seventy-five percent of the project funds came from a Section 205(j) grant*, while the remaining twenty-five percent was provided in materials and services by the contributors.

Several separate tasks were identified and described in the workplan (NCRWQCB, 1985), and the reader is referred to that document for a detailed description of the individual tasks. This final report serves to complete the project and describes the degree to which each of the three following objectives were met:

1 - implement special resin column monitoring techinques for toxic substances in the Russian River basin,
2 - evaluate an innovative motion analysis system for an early warning system for water users in the Russian River basin, and
3 - form an inter-agency task force to make recommendations concerning an early warning network for water users in the Russian River basin.

The Regional Board administrated the project, and the SCWA provided

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* Primary funding for this study has been provided by the California State Water Resources Control Board using Section 205(j) grant funds made available by the U.S. Environmental Protection Agency. This does not signify that the contents necessarily reflect the views and policies of the U.S. Environmental Protection Agency or the California State Water Resource Control Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

special laboratory space, a building for field evaluations, and staff assistance. N.E.T. provided the motion analysis system, assistance in testing and operating the equipment, and assistance in data analysis and this final report.

Project Description

The project was conducted in the Russian River basin, the most populated section of the North Coast region. This basin supports the largest industrial development within the North Coast Region, and the quality of the Russian River and its tributaries is directly influenced by man's cultural activities.

The Russian River originates in the coastal range of Mendocino and Lake Counties and flows southwesterly through Sonoma County to the Pacific Ocean. The major surface streams include the Russian River and its East and West forks, Big Sulfur Creek, Dry Creek, Mark West Creek, Santa Rosa Creek, Laguna de Santa Rosa, and Austin Creek (Figure 1).

Precipitation in the Russian River basin occurs primarily as rainfall, with snow being deposited at the upper elevations. Valley areas receive an annual average of about 30 to 40 inches of precipitation. Average annual precipitation at higher elevations in the basin is up to 80 inches.

The high amounts of precipitation result in periodic winter flooding, with the Russian River flowing at over 40,000 cubic feet per second (cfs) during flood conditions. Many communities and associated industries are located within the floodplain of the river and its tributaries. Two major impoundments, Lake Mendocino and Lake Sonoma, reduce winter season flood severity and provide for summer flow releases at a minimum of 125 cfs at Guerneville to serve surface and near-river diversions.

The valley floor areas of the Russian River basin are alluvial deposits, with shallow groundwaters yielding high quality water for domestic uses. The shallow groundwaters are closely connected with the surface flow regime. Over much of its mainstem reach, the Russian River is alternately recharging to or receiving discharge from the shallow groundwaters of the basin.

The Russian River basin supports several important beneficial uses, the highest being its use as a drinking water supply for nearly 500,000 people in Mendocino, Sonoma, and northern Marin counties. The municipal water systems provide limited, if any, off-stream storage and only minimal water treatment by chlorination. Many of these municipal diversions are Ranney collectors placed in or adjacent to the river,

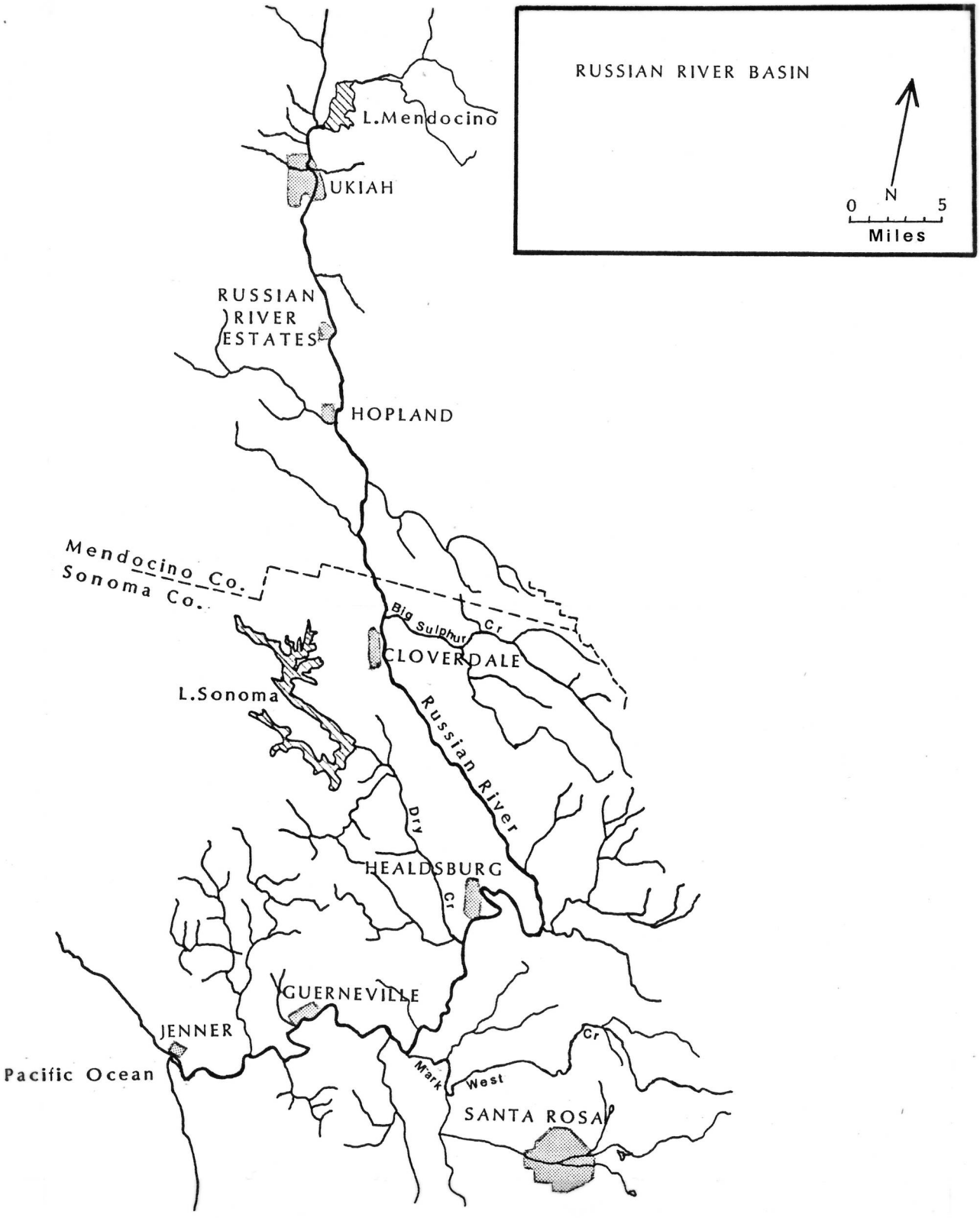

Figure 1. The Russian River basin, Mendocino and Sonoma counties, California.

drawing upon the river underflow through collection systems in the alluvial gravels. There is direct hydraulic continuity with river surface flows and these subsurface collectors.

The river supports an anadromous fishery, and is a popular sport fishing area. Recreational uses such as swimming and boating make tourism along the river an important local industry. The river is used to irrigate and provide frost protection to thousands of acres of sensitive crops such as wine grapes, and is used as a water supply for wineries, breweries, and other industries.

The threat of uncontrolled or unknown toxic substance discharges and/ or spills into the Russian River is of immense concern to the Regional Board, water purveyors, and residents of Mendocino, Sonoma, and northern Marin counties. This concern prompted the development of a workplan under the first phase of 205(j) grant funding for a program to identify potential discharge sources within the basin (NCRWQCB, 1983). That program was completed in 1985, and findings indicate that management practices on the storage, use, transport, and disposal of hazardous substances vary widely within the basin (Warner, et.al., 1985). Inspections conducted under the program showed many businesses utilize excellent practices and positive controls designed to prevent discharge to groundwaters or surface waters, while others have virtually no preventive measures. Some businesses inspected during the program were found to have illegal, direct discharges to surface waters or groundwater, and required regulatory action.

The results of experimental monitoring in the Russian River as a part of that previous project indicated that discharges and/or spills to the river had occurred, and further emphasized the need for early warning to Russian River water users in the event of river water contamination. Water supplies along the Russian River have been forced to close in the last few years due to known chemical spills, raising a greater concern among water users regarding an unknown and undetected spill. The concern is that domestic supplies may need to be closed, but the need will not be discovered until much later, when after-the-fact monitoring and reporting indicate that a contaminant was present.

Monitoring systems which rely on cumbersome chemical analyses are limited by the time it takes to conduct analyses, the high cost of the continuous or repeated analyses, and the need to specify individual or classes of compounds for analysis, and as such are not suitable for "early warning". An early warning system that uses a quick indicator, such as that tested in this 205(j) project, is the only viable solution for immediate indication or warning of toxic substances in the Russian River.

This project contains two concepts which meet the high priority needs of both state and local agencies concerned with the protection of domestic water uses of the river: 1) monitoring techniques that assess the quality of the river waters over extended periods of time (resin column monitoring of the surface water), and 2) an early warning system to alert regulatory agencies, water purveyors and users of a potential "toxics" problem in the river (computer-linked motion analysis of aquatic organisms). Consequently, this project has received considerable support from local agencies.

TASK DESCRIPTIONS

A brief description of each task outlined in the original workplan (NCRWQCB, 1985) is provided below with a discussion of the product(s) resulting from the task.

TASK 1. IDENTIFY EARLY WARNING STATIONS

Objective:

Determine key river sites that could serve as early warning stations for major drinking water diversions along the entire Russian River.

Work Description:

The concept of early warning is one of providing advance notice of a harmful substance in a domestic water supply. Obviously, an early warning station must be located far enough upstream of the supply of concern to provide adequate warning. Additionally, the ideal early warning station location must be downstream of all potential inputs of toxic substances into the water supply. This task involved combining our knowledge of the locations of major supplies and potential toxic chemical inputs with estimates of river travel times to propose likely sites for early warning stations.

Task Product:

The final report for Task 1, "Estimation of Russian River Travel Times with Proposed Siting for Toxic Substance Early Warning in the Russian River Basin" (April 14, 1988), details the methods used to determine potential sites for early warning stations. The locations of the major domestic supply diversions were obtained from the Mendocino and Sonoma County Departments of Public Health and the State Department of Health Services.

The locations of potential input of toxic and hazardous chemicals were obtained from three main sources: the Mendocino and Sonoma County Agricultural Commissioners' Offices, aerial overflights of the basin to verify agricultural use areas, and a database of toxic and hazardous chemical users in the Russian River basin. The computerized database was derived from a previous Section 205(j) project (NCRWQCB, 1983) in which potential toxic and hazardous chemical users in the basin were surveyed. A program to obtain information from the database was developed and used to locate major areas of potential input (Appendix A). That program also allows the database to be queried regarding types and amounts of chemicals upstream, downstream, or within a given location in the Russian River drainage.

Travel times for the Russian River at various flow rates were estimated using river flow rate data from the U.S. Geological Survey, Water Resources Division. Data from the 1982 formalin spill into the Russian River at Ukiah provided a verification of the travel time estimates at one river flow rate. The U.S. Army Corps of Engineers' flood crest travel time estimates (SCWA, 1987) also provided some verification of our method.

The final analysis of the data resulted in ten proposed locations for early warning sites in the Russian River. Those sites would provide an estimated eight-hours' advance notice time to each major domestic supply zone in the Russian River.

TASK 2. SELECT PROTOTYPE STUDY SITE

Objective:

Select and develop the most readily useable site for the purposes of conducting the resin column sampling and testing the prototype early warning system.

Work Description:

The prototype site required power and telephone and a location close to the river near Santa Rosa. A secure site was preferred, one that was not subject to winter flooding and vandalism. Some building to house the equipment was necessary, as was a supply of water from the river.

Task Product:

The SCWA offered a space on their diversion caisson about 20 miles from the Regional Board office that was secure (locked gate and patrolled) and above a 100-year projected flood event. The site had power and a telephone line. We installed a small submersible pump and plumbing in the river to supply water to the resin column sampler and early warning test equipment. The SCWA constructed a small air-conditioned building to house the test equipment. The site became functional in April of 1986.

TASK 3. RESIN COLUMN PROCEDURES AND SAMPLING

Objective:

Transfer the resin column prototypes from University of California development to Regional Board implementation.

Work Description:

A laboratory clean room was required as an ultra-clean area to prepare and extract the resins. Additionally, equipment and supplies were needed to construct the resin columns and samplers, and prepare the resins. Laboratory work involved initial methods familiarity and development, then actual resin preparation and extraction. Field work involved actual sampling of the Russian River and selected tributaries.

Task Products:

Three documents were produced from this effort - 1) quality assurance/quality control plan, 2) guide to resin procedures, and 3) final report on the resins methods development and sampling implementation. The SCWA constructed a clean room in their Santa Rosa laboratory for our use in resin experimentation. We constructed resin columns from Teflon and assembled a resin column sampler. Two other samplers were transferred to the project from the University of California at Santa Cruz.

We successfully developed and used methods for sampling heavy metals in water with three different resins. Metals were monitored at mid-range parts per trillion levels (nanograms per Liter) in three ionic forms: cationic (positively-charged), anionic (negatively-charged), and organically complexed (ligands). Our work with the resins for sampling pesticides and herbicides was revealing, but did not result in methods for use. The major problem was in accounting for all of an organic compound to which a resin was exposed. Although known amounts of specific organic chemicals were added to the resins, we were unable to consistently account for the fate of most of the chemicals.

Actual environmental sampling for heavy metals was initiated in September of 1986 and continued through April of 1988. Heavy metals concentrations in the Russian River and selected tributaries were well below State and federal criteria and/or standards. The metals were found in expected ionic states and in low concentrations. A possible relationship of chromium concentration to storm runoff events was observed. Sampling during the winter of 1988-89 is planned by the Regional Board to investigate the relationship and suggest a cause and possible remedy.

The final report, "Implementation of Special Monitoring with Macroreticular Resins in the Russian River Basin, Sonoma County, California" (October 7, 1988) details the methods development and results of the experiments and environmental sampling.

TASK 4. ASSESS EARLY WARNING SYSTEM

Objective:

Test the prototype early warning system (EW) under laboratory and field conditions and evaluate its performance with regard to the water quality of the river as determined by resin column and traditional sampling methods.

Work Description:

Ideally, an early warning system should be capable of detecting toxic and/or hazardous substances in the river (and threatening public water supplies) and producing a warning to water purveyors. It was discovered early on that comparing the evaluation of the motion analysis system with conventional sampling methods would be difficult except in the theoretical sense.

This task involved testing a prototype computerized motion analysis system for detection of behavioral changes in aquatic organisms with exposure to various chemicals, in the laboratory as well as in the field situation at the prototype site (SCWA diversion caisson). The motion analysis system utilizes changes in motion patterns of aquatic animals in response to toxicants in the water supplied to the organisms. A video camera provides images to a computer analyzing motion pattern changes. This part of the project involved three phases: 1) laboratory testing, 2) field testing, and 3) field operation.

Task Product:

The laboratory testing provided baseline information on the motion patterns of water fleas (*Daphnia magna*) and the fathead minnow (*Pimephales promelas*) in the absence of any toxicants and also under controlled exposure to chlorine, copper, phenol, and xylene. The computer and aquarium systems were modified as a result of the field testing and put into actual operation at the SCWA Wohler site on the Russian River. The field work began in December of 1986, and continued through March of 1988. Although some problems were encountered with the operation of the system, a design for a system that would remotely sense was developed. Investigations with additional chemicals and more field testing are needed prior to actual implementation by any agency.

The final report, "Investigation of a Video-based Motion Analysis System for Early Warning of Toxic Substances in Drinking Water Supplies", (November 14, 1988), details the methods used for laboratory and field testing and the results of the testing. It also presents the conceptualization of alarm criteria, Task 5.

TASK 5. DEVELOP ALARM CRITERIA

Objective:

Determine the criteria for issuing an alarm based on detection by the early warning system.

Work Description:

An alarm necessarily incorporates knowledge of the type and nature of a substance in the water and the management implications of whether or not to shut down a domestic water supply. The amount of information on the type and nature of a substance hinges on the sensitivity of the EW system, i.e., will it detect specific classes of chemicals, and at what levels? The management concerns regarding an alarm issuance are, obviously, liability from failing to issue an alarm when the public is at risk and issuing too many "false-alarms" thus incurring inconvenience and excessive cost. This task was dealt with in conjunction with Task 4 and investigated both technical and management viewpoints.

Task Product:

The final report for Task 5 contains a section detailing the concepts of toxic substance detection and computer software decisions from a technical standpoint. A discussion of management implications is also included in that report.

TASK 6. FORM EW IMPLEMENTATION TASK FORCE

Objective:

Form a task force to develop and recommend an early warning system for toxic substances at key locations in the Russian River basin.

Work Description:

A multi-agency task force was formed in November of 1986 to review the findings of this study and make recommendations regarding the implementation of an actual early warning network for the Russian River. In addition to the project cooperators, the following agencies have participated in the Task Force:

City of Ukiah, Department of Public Works
Mendocino County Water Conservation and Flood Control District
Sonoma County Public Health Department
State Department of Fish and Game
State Department of Health Services
California Department of Food and Agriculture (county commissioners offices in Mendocino and Sonoma counties)
Mendocino County Office of Emergency Services

It was decided early on that the task force could provide guidance to the project. However, it was not to be the body to actually develop and implement an early warning system. The task force would provide recommendations regarding the efficacy of such a system, and water purveyors would take the lead in implementing such a system if plausible.

Task Products:

The consensus of the Task Force regarding the implementation of an early warning system for Russian River water users was:

1 - The system investigated during this project is promising, offers protection not currently available, and should receive further support to bring it to an implementable state.

2 - The Sonoma County Water Agency is very interested in further testing and installation of a pilot unit once costs are defined.

3 - Sources of funding should be investigated and might include an inter-agency alliance from the Russian River basin and/or grants (American Water Works Association, for example).

4 - The Russian River water users/purveyors should be responsible for pursuing additional funding and eventual implementation of an early warning network.

5 - The Regional Board should continue to encourage and promote the implementation of an early warning network to further protect domestic supplies from unknown discharges of toxic and hazardous materials.

TASK 7. FINAL REPORT

Objective:

Identify specific implementing agencies, necessary administrative actions and coordination, implementation costs, and likely funding sources for EW implementation.

Work Description:

This final report was prepared during the months of September and October of 1988, and involved compilation of all the project data, task force meetings, and coordination with other agencies and interested individuals.

Task Product:

The specifics for implementation are contained in the next section of this final project report, "Implementation and Financial Plan."

TASK 8. PUBLIC PARTICIPATION

Objective:

Obtain timely input and suggestions from public agencies, affected entities, and interested persons.

Work Description:

Seven progress reports were presented at regularly-scheduled and noticed Regional Board meetings in the Russian River basin. Comments were solicited from affected and interested agencies and persons prior to and during the meetings.

Task Product:

Most input was received during task force meetings, and from the Regional Board during the public meetings. Little substantive input was received from the general public or local action groups. Changes in the project based on public input included monitoring at additional sites and for additional metals. All other public participation was in the form of general comments or questions regarding technical material.

IMPLEMENTATION AND FINANCIAL PLAN

The primary intent of this project was the implementation of resin column monitoring techniques in the Russian River basin and the investigation of an innovative early warning system concept for domestic water supplies.

The Regional Board has developed reliable methods for heavy metals monitoring in water using special resin column techniques. Two Regional Board monitoring programs have been identified that will use those techniques: 1) continued monitoring for runoff effects at the Wohler site on the Russian River, and 2) another Section 205(j) project investigating non-point source pollution of the Laguna de Santa Rosa (tributary to Mark West Creek, tributary to the Russian River). Funding for those two programs will come from Regional Board routine monitoring budget and federal Section 205(j) funds, respectively. Other monitoring programs utilizing those techniques will be implemented as the need arises. Funding could be from a variety of State and federal funds available to the Regional Board. As regards use of the methodology by other agencies or interested persons, the methods that were developed by the Regional Board are considered public information.

The Board of Directors of the SCWA indicated in their Resolution DR84-1674 that it is the directors' intent "...to assume responsibility for the continuing operation and maintenance of an early-warning system beyond the two-year life of the program, provided the program results in the development of a viable system which would allow for a timely warning of a toxic substance in the Russian River".

SUMMARY

This two-year Federally funded project was a cooperative effort among the North Coast Regional Water Quality Control Board (Regional Board), the Sonoma County Water Agency (SCWA), and N.E.T. With the help of the SCWA, the Regional Board refined special resin column monitoring techniques for heavy metals in water. Those techniques were successfully implemented during a monitoring program in the Russian River basin. The metals monitored were found at levels well below State and Federal criteria and standards. The Regional Board also investigated the use of special resins for monitoring organic chemicals (pesticides and herbicides) in water, but was unable to achieve consistent, reliable results. The investigations and results are presented in a report titled "Implementation of Special Monitoring with Macroreticular Resins in the Russian River Basin, Sonoma County, California, October 7, 1988."

N.E.T., with the help of the Regional Board and the SCWA investigated the efficacy of a video-based, computerized motion analysis system for early warning of toxic chemicals in drinking water. The system employed motion pattern analysis of water fleas (Daphnia magna) and fathead minnows (Pimephales promelas) in response to toxins injected into the water under laboratory conditions. The system was tested with water fleas at a field site on the Russian River. The findings of those investigations are detailed in a report titled "Investigation of a Video-based Motion Analysis System for Early Warning of Toxic Substances in Drinking Water Supplies, November 14, 1988."

The Regional Board also estimated river travel times for the Russian River and proposed potential sites for early warning stations based on potential for toxic substances input, travel times, and locations of domestic supply areas. The information from that task is detailed in a report titled, "Estimation of Russian River Travel Times with Proposed Siting for Toxic Substance Early Warning in the Russian River Basin."

An interagency Task Force composed of representatives from the water purveyors, county and State health departments, county agricultural offices, State Fish and Game, and county offices of emergency services reviewed the project findings. The group made recommendations regarding the monitoring and early warning system investigations, presented under Task 6, page 10.

REFERENCES CITED

NCRWQCB, 1983. Development of a Toxic and Hazardous Substance Control Program for the Russian River. Workplan, June 30, 1983: 34pp.

NCRWQCB 1985. Toxic Substance Detection and Early Warning for the Russian River. Section 205(j) Water Quality Management Planning Program. North Coast Regional Board, Workplan, May 14, 1985: 21 pp + Appendices.

Sonoma County Water Agency 1987. Emergency Operation Plan. Revision 2, January, 1987.

Warner, S.A., Brown, K., and C. Goodwin 1985. Storage, Transport, and Spills of Hazardous Materials in the Russian River Basin. N. Coast Regional Water Quality Control Board, December 18, 1985: 120 pp + Appendices.

APPENDIX A

TOXTRAC

Toxic Substance Tracking System

for the

Russian River Basin

by

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December 16, 1987

PROGRAM DESCRIPTION

This program utilizes a database derived from the 1983 - 1985 205(j) project to investigate use, storage, and handling of toxic and hazardous materials in the Russian River drainage. The data consist of business names, addresses, and volumes for chemicals stored within 26 broad chemical classes. The program allows the user to query the database in three ways:

1 - enter the chemical class and desired drainage location to obtain a listing of businesses and the volumes of the selected chemical class stored by each business.
2 - enter the desired drainage location to obtain a listing of businesses and volumes for all chemical classes.
3 - select the desired drainage location to obtain a listing of total volumes for each chemical class contained in the selected location.

INTRODUCTION

A database is a collection of records, each record is filed by way of it's business name, much like the records in a filing cabinet. Each record contains all the pertinent information about that business (e.g. address, toxic chemical volumes).

These records also contain five position numbers, used to reference the business location relative to the Russian River Drainage (See Appendix 1). Position numbers 1 - 5 represent the number of miles upstream from the mouth (position number 1) or confluence of the preceeding stream (position numbers 2 - 5).

EXAMPLES:

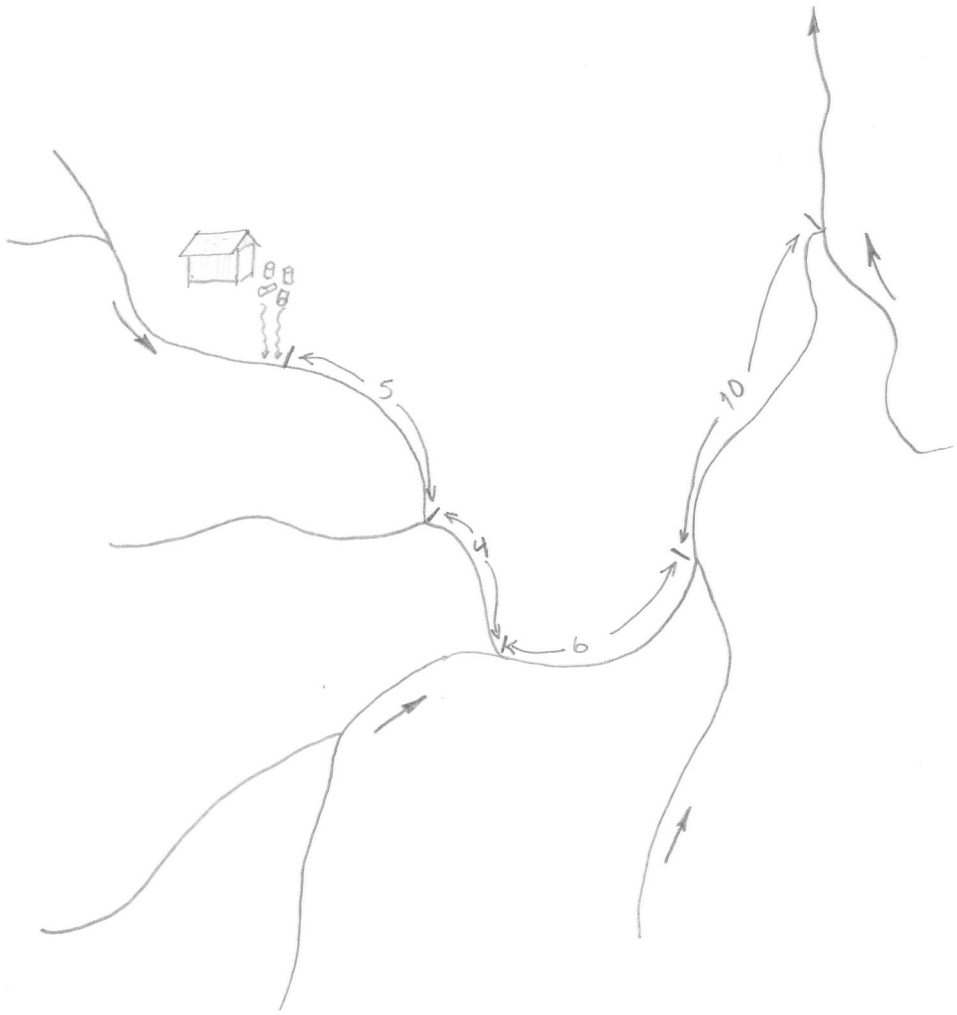
1) If position 1 for a facility equals 10, this means that the runoff from the facility could enter the 1st stream 10 miles upstream from the river mouth.

2) If position 2 equals 6, this means that the runoff could enter the 2nd stream 6 miles upstream from the confluence of the 1st and 2nd streams.

3) If position number 1 equals 10, and position number 2 equals 6, then the runoff could enter the 2nd stream 6 miles upstream from the confluence of the 1st and 2nd streams, and that the 2nd stream enters the 1st stream 10 miles upstream from the mouth of the 1st stream.

If any position number equals 0, then that order of stream is not involved.

Refer to next page for a graphic example of the above explanation.



Don's toxic waste location = position(1) = 10
position(2) = 6
position(3) = 4
position(4) = 5
position(5) = 0

RUNNING THE PROGRAM

Before you can run the program:

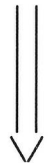
1) A users name and password will be needed; User name = russian, Password = river.
2) Consult Appendix 2 to ensure proper hardware and software configuration.

TO START

Enter, 'kman toxtrac', press enter

You will first be prompted to enter your user name, and password. Then the main menu (Figure 1) will appear; select the desired option and press return. Appendix 3 contains a description of these options.

Figure 1



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TOXTRAC - toxic substance tracking system
Developed by Donald Winkle
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 1 : Data retrieval

 2 : Data entry

 3 : Data modification

 4 : Post data entry/modification file reindexing

 5 : Exit to DOS


 Enter desired option _____________________
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RETRIEVING DATA

Figure 2 is the second menu encountered, by selecting the DATA RETRIEVAL option from the main menu.

Figure 2

STATE OF CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
NORTH COAST REGION
TOXIC SUBSTANCE TRACKING SYSTEM FOR THE RUSSIAN RIVER

1:Diesel	2:Gas	3:Other fuels
4:Chlorinated Solvents	5:Auto Solutions	6:Other Solvents
7:Acids	8:Bases	9:Resins
10:Oil	11:Formaldehyde	12:Metals
13:Carbamates	14:Organophosphates	15:Organochlorines
16:Phenoxy Herbicides	17:Other Pesticides	18:Reducers
19:Oxidizers	20:Photo Proc. Fluids	21:Cement Products
22:Fertilizers	23:Surfactants(soaps)	24:Chlorinated Phenolics
25:Non-chlor Phenolics	26:Abandoned Underground Tank	
27:ALL CLASSES	28:STATISTICS MENU	29:EXIT TO MAIN MENU

Enter Chemical Class Number > _____

Do you wish to print this (y/n) ? _____

Options 1 - 26 list the toxic hazard classifications available. An example of such a printout for chlorinated solvents is Figure 3 on the following page.

Appendix 4 is a detailed list of the toxins in each category.

Option 27, "All Classes", will list facilities and volumes for all toxins in the designated drainage area.

Option 28, "Statistics Menu", gives totaled volumes for all toxins in the designated area. This option is discussed in more detail on pages 7 & 8.

Option 29, "Exit to Main Menu", will return you to the first menu.

Figure 3

Page 1 of RUSSIAN RIVER TOXIC SUBSTANCE TRACKING SYSTEM REPORT

BUSNAME	STADD	STCITY	CLSOLV	POS1	POS2	POS3	POS4	POS5
PEOPLE'S CAR REPAIR	542 BUENA VISTA DR.	SANTA ROSA	20	26.8	5.2	1.2	3.4	1.8
U SAVE CLEANERS	600 LEWIS RD.	SANTA ROSA	150	26.8	5.2	1.2	3.4	1.8
POSTAL INSTANT PRESS	997 PINER RD.	SANTA ROSA	55	26.8	5.2	1.2	3.4	0.0
STICKS & THRONES	3161 COFFEY LANE	SANTA ROSA	50	26.8	5.2	1.2	3.4	3.5
SANTA ROSA JUNIOR COLLEGE	1501 MENDOCINO AVE.	SANTA ROSA	55	26.8	5.2	1.2	3.4	4.7
PETER PAN CLEANERS	2231 MENDOCINO AVE.	SANTA ROSA	100	26.8	5.2	1.2	3.4	0.0
HEWLETT-PACKARD CO	1412 FOUNTAIN GROVE PKWY.	SANTA ROSA	3625	26.8	5.2	1.2	3.4	4.6
HEWLETT-PACKARD CO	3273 AIRWAY DRIVE	SANTA ROSA	4625	26.8	5.2	1.2	3.4	3.5
MAJOR CLEANERS	2533 GUERNEVILLE RD.	SANTA ROSA	65	26.8	5.2	1.2	3.4	0.1
HENRY'S ONE HOUR MARTINIZ	1214 WEST STEELE LANE	SANTA ROSA	30	26.8	5.2	1.2	3.4	0.0
CROWN CLEANERS	1975 MENDOCINO AVE.	SANTA ROSA	55	26.8	5.2	1.2	3.4	0.0
PEPSI COLA BOTTLING CO.	3029 COFFEY LANE	SANTA ROSA	10	26.8	5.2	1.2	3.4	1.8

This printout lists the business name (BUSNAME), street address (STADD), city (STCITY), volume of chemical class (in this case, chlorinated solvents: CLSOLV), and river positions (POS1, POS2, POS3, POS4, POS5).

Note that the river position designations are the same for the first four positions: this selection is for the Piner Creek drainage. Position 1 is the mileage from the ocean up the Russian River to the mouth of Mark West Creek. Positions 2,3, and 3 are the mileages up Mark West Creek to the Laguna de Santa Rosa, up the Laguna to Santa Rosa Creek, and up Santa Rosa Creek to Piner Creek, respectively. Position 4 is the mileage up Piner Creek to the nearest point at which runoff from the listed facility might reach the stream.

TO USE

Enter the number corresponding to the desired option on the main menu and press return. Next, indicate whether or not you would like a printed version of the output by entering a 'Y' or 'N' and pressing enter.

If options 1 - 26 or option 27 is selected, The River Position Reference Selection menu will appear (Figure 4).

Figure 4

RIVER POSITION REFERENCE SELECTION
1)UPSTREAM 2)DOWNSTREAM 3)UPSTREAM INCL 4)DOWNSTREAM INCL 5)EXCLUSIVE

Enter 1st order stream position > ___._ Enter position ref._____
Enter 2nd order stream position > ___._ Enter position ref._____
Enter 3rd order stream position > ___._ Enter position ref._____
Enter 4th order stream position > ___._ Enter position ref._____
Enter 5th order stream position > ___._ Enter position ref._____

If everything is ok press enter _____

The purpose of the Reference Selection menu is to isolate a portion of the river drainage system. When using this menu it may be helpful to refer to Appendix 5.

To isolate a portion of the drainage, enter a river mileage position, press enter, then enter the River Position Reference selection (explained below), and press enter.

1) UPSTREAM - Upstream from entered river mileage, not including the mileage entered.
2) DOWNSTREAM - Downstream from entered river mileage, not including the mileage entered.
3) UPSTREAM INCL (inclusive) - Same as 1 except, river mileage is included.

4) DOWNSTREAM INCL (inclusive) - Same as 2 except, river mileage is included
5) EXCLUSIVE - Search is based on that stream mileage position, not up- or down-stream. This option will mostly be used when a tributary location is at the specific river mileage position to isolate the search to that tributary.

If a particular stream order is not applicable to your situation enter "0" for river position and "3" for reference selection to restrict the search to all upstream locations.

STATISTICS MENU (option 28)

Figure 5 shows the statistics menu. It lists the fifteen major drainage areas of the Russian River. These may either be drainage basins such as "Sulphur Creek Drainage" or urban areas such as "Cloverdale Area". See Appendix 4 for drainage area mileage designations.

The output will consist of the chemical classes in the area of interest and their associated total volumes (Figure 6, next page).

Figure 5

TOXIC SUBSTANCE VOLUMES BY AREA/DRAINAGE

1:Jenner area	2:Austin Creek Drainage
3:Guerneville area	4:Santa Rosa Drainage
5:Windsor Drainage	6:Healdsburg area
7:Dry Creek Drainage	8:Geyserville area
9:Cloverdale area	10:Sulphur Creek Drainage
11:Pieta Creek Drainage	12:Hopland area
13:Ukiah area	14:West Fork Drainage
15:East Fork Drainage	16:None of the above

Choose One _____

TO USE

Enter the number corresponding to the area of interest.

Option 16 will allow you to designate your own area by entering a range of river mileages.

An example printout of the Dry Creek drainage follows on page 8.

Figure 6

Dry Creek drainage

Number of records processed	54.0
Abandoned undergorund tank/s	8.0
Diesel	31580.0
Gas	6850.0
Chlorinated Solvents	746.0
Other Solvents	2270.0
Other Fuels	145.0
Acids	1880.0
Bases	700.0
Auto Solutions	175.0
Organophosphates	1.0
Phenoxy Herbicides	1.0
Oil	2160.0
Other Pesticides	71.0
Metals	935.0

PRESS ANY KEY

APPENDIX 1

The figures contained and explained herein demonstrate the stream position referencing method used to select a drainage area. An explanation is also given regarding the designation of the position numbers for a facility.

Figure 1 - This is an illustration of the five position reference codes available on the tracking system.

Figure 2 - This is an illustration of how to isolate the Spring Creek drainage with the river position references and codes available on the tracking system.

2(A) The Mark West Creek drainage in the Russian River basin

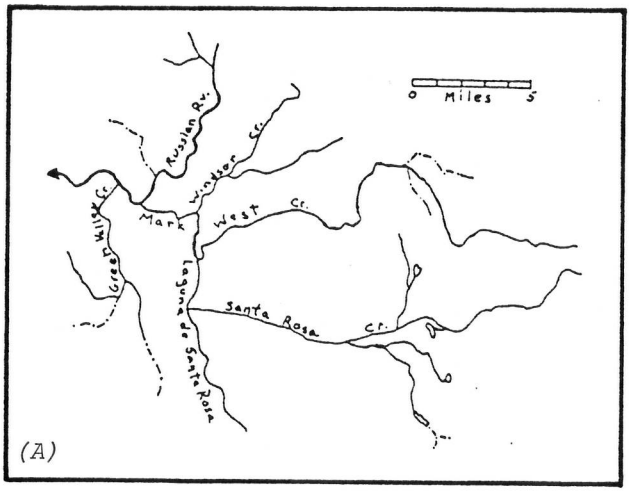
2(B) Mark West Creek and tributaries isolated by using position 1 to designate the mileage from the mouth of the Russian River to the confluence and selecting reference 5, exclusive.

2(C) The Laguna de Santa Rosa and tributaries isolated by adding position 2 to designate the mileage up Mark West Creek to the confluence with the Laguna and selecting reference 5, exclusive.

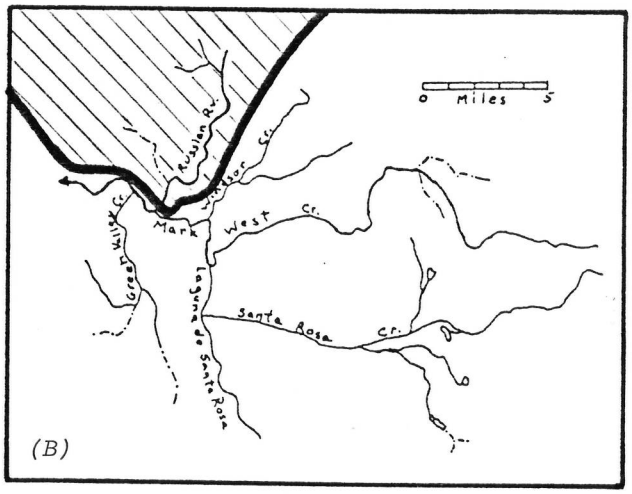
2(D) Santa Rosa Creek and tributaries isolated by adding position 3 to designate the mileage up the Laguna de Santa Rosa to the confluence with Santa Rosa Creek and selecting reference 5, exclusive.

2(E) Matanzas Creek and tributaries isolated by adding position 4 to designate the mileage up Santa Rosa Creek to the confluence with Matanzas Creek and selecting reference 5, exclusive.

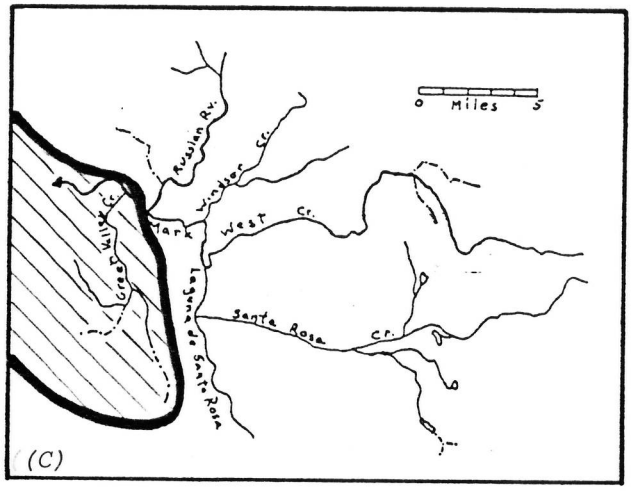
2(F) Spring Creek isolated by adding position 5 to designate the mileage up Matanzas Creek to the confluence with Spring Creek and selecting reference 3, upstream inclusive.



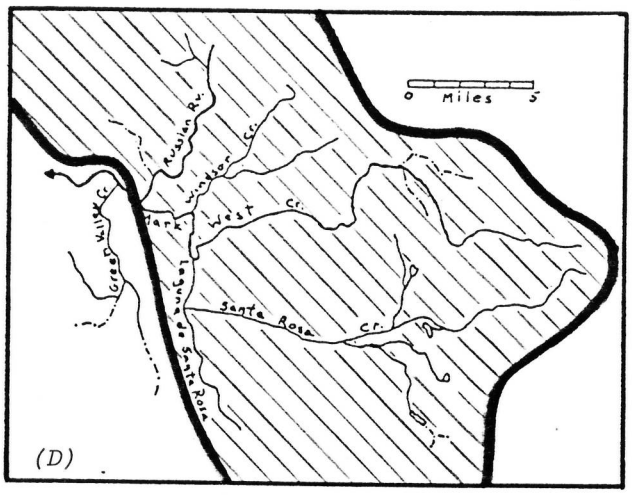
The Mark West Creek Drainage, Russian River Basin



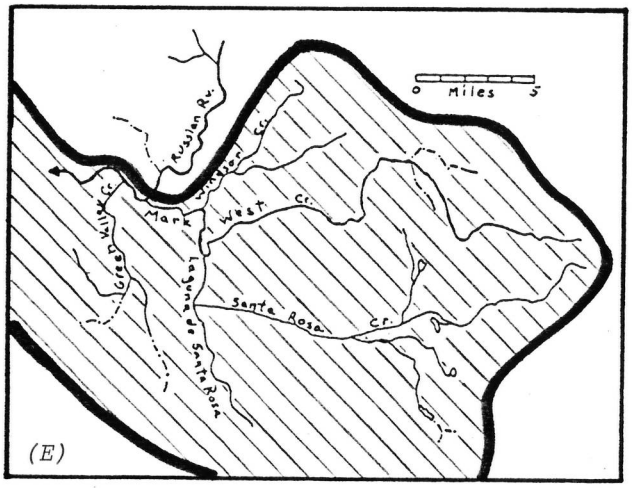
Code 1 - Upstream



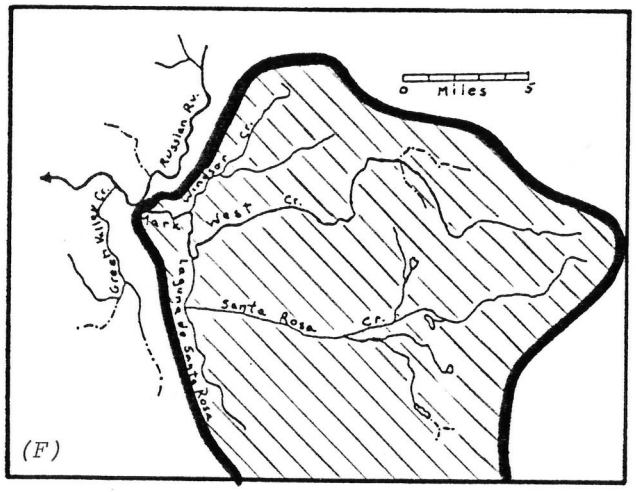
Code 2 - Downstream



Code 3 - Upstream Inclusive

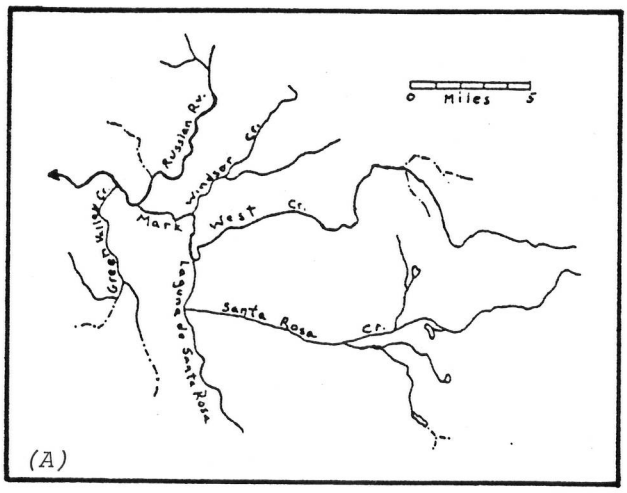


Code 4 - Downstream Inclusive

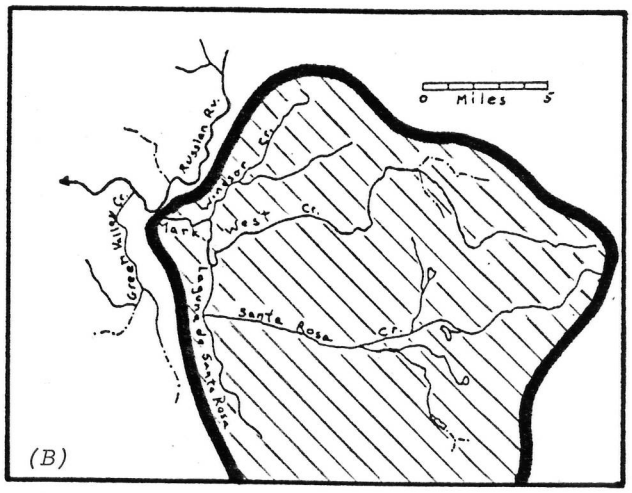


Code 5 - Exclusive

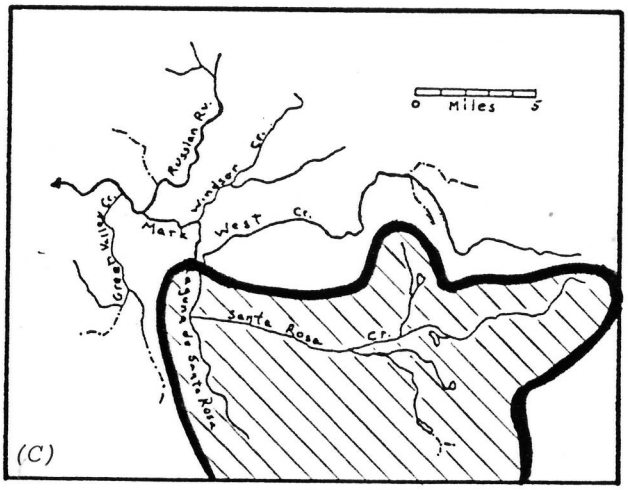
Figure 1. Illustration of the five river position reference codes using the Mark West Creek drainage, tributary to the Russian River.



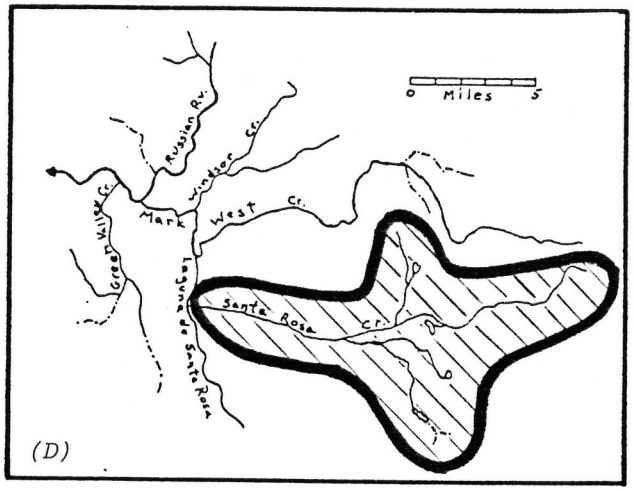
The Mark West Creek drainage
Russian River Basin



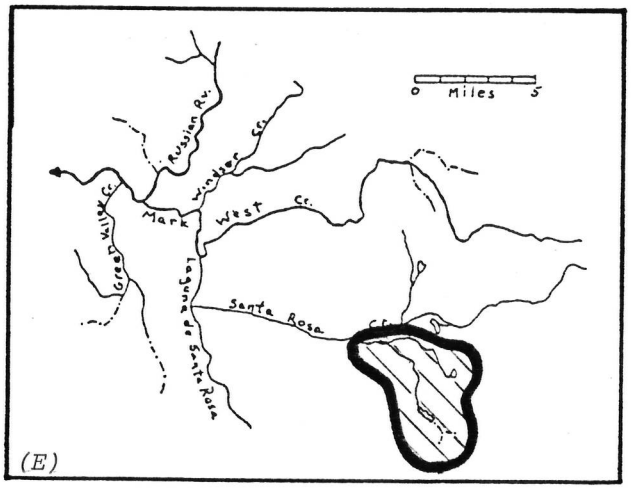
Mark West Creek and tributaries
26.8(5), 0(3), 0(3), 0(3), 0(3)



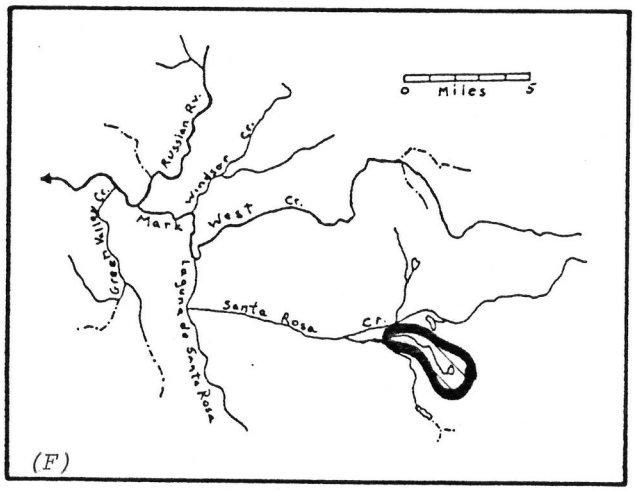
Laguna de Santa Rosa and tributaries
26.8(5),5.2(5), 0(3), 0(3), 0(3),



Santa Rosa Creek and tributaries
26.8(5), 5.2(5), 1.2(5), 0(3), 0(3)



Matanzas Creek and tributaries
26.8(5), 5.2(5), 1.2(5), 8.2(5), 0(3)



Spring Creek drainage area
26.8(5), 5.2(5), 1.2(5), 8.2(5), 0.8(3)

Figure 2. Illustration using river miles and river position reference codes to isolate the Spring Creek drainage within the Mark West Creek drainage, Russian River Basin. The river miles are followed by the reference code in parentheses, e.g. 26.8 river miles, reference code 5.

How business stream locations were designated

The street addresses for the facilities were listed from the database, and they were located as best as possible on USGS 15" topographic quadrangle maps covering the area. Drainage was considered to be downslope, or down the road to the nearest drainage ditch or creek. The first position location was where the runoff was expected to enter a creek (or flood control channel). The creek might be an unnamed, intermittant stream, but would not be a ditch lacking an intermittant stream symbol on the topographic map. That is, no mileages were calculated up a drainage ditch or a road. Thus, the first position located on the map would be the last position used to identify the facility location.

The drainage was then followed downstream until it entered the Russian River. Mileages were then measured along the various streams back to the point where the runoff entered the creek, or to the fifth order stream position, if the location was beyond a fifth order stream.

Where unnamed creeks intersected, the longest one was considered as the continuation of the lower order stream (main stream), and the shorter as the entrance of a higher order tributary. An arrow was drawn on the map to indicate the main stream channel, so that future measurements would be consistent. The mileage measurments were also noted on the map, and were used for subsequent entries along that drainage network.

In flat urban areas away from streams, drainage was considered to be downslope paralleling the major roads (storm sewars) until a creek or flood control channel was encountered. An attempt was made to logically locate drainages in this situation, i.e., not crossing Highway 101 unless a drainage was specified on the map.

APPENDIX 2

SYSTEM REQUIREMENTS

IBM/PC, XT, AT or Compatibles
at least 256K RAM
Harddisc with at least 3MB of available storage

These files must be present on the same drive and/or directory:

Knowledgemanager program files -
kman.exe

fdm001.ovl	fdm002.ovl	fdm003.ovl	fdm004.ovl	fdm005.ovl	fdm006.ovl
fdm007.ovl	fdm008.ovl	fdm009.ovl	fdm010.ovl	fdm011.ovl	fdm012.ovl
fdm013.ovl	fdm014.ovl	fdm015.ovl	fdm016.ovl		

Database index files -

dls.ind	fert.ind	sufact.ind	gass.ind	reducers.ind
undrtnk.ind	clsolv.ind	othpest.ind	othsolv.ind	ohtfuel.ind
oxid.ind	acid.ind	clphen.ind	met.ind	nclphen.ind
bases.ind	resin.ind	carb.ind	op.ind	autosoln.ind
phenoxy.ind	oil.ind	formald.ind	photo.ind	cempr.ind
oc.ind				

Toxtrac program files -
toxtrac.ipf getvol.ipf getstat.ipf getinfo2.ipf next.ipf

Toxtrac database file -
newtox.itb

APPENDIX 3

This is the first menu encounterd when using the program.

TOXTRAC - toxic substance tracking system
Developed by Donald Winkle
COPYRIGHT 1987 California Water Quality Control Board

1 : Data retrieval

2 : Data entry

3 : Data modification

4 : Post data entry/modification file reindexing

5 : Exit to DOS

Enter desired option _____

Option 1. data retrieval, will place you in the data retrieval section of the program, second menu.

Option 2. data entry, will allow the user to enter new data. This section has not been completed yet (the user must go into the data entry mode of Knowledgemanager).

Option 3. data modification, will allow the user to modify existing data. This section has not been completed yet.

Option 4. post data entry/modification file reindexing, is a requirement after any entry of new data or modification of existing data and will reindex the database. This need not be done under any other circumstances.

Option 5. exit to DOS, will end the program and return the user to the operating system (DOS).

APPENDIX 4

Listing of common chemicals included in the chemical classes encountered in the second menu (Figure 2, page 4).

Diesel
- diesel fuels

Gas
- gasoline

Other fuels
- aviation fuel
- kerosene

Chlorinated solvents
- trichloroethylene (TCE)
- trichloroethane (TCA)
- tetrachloroethylene (PERK or PCE)
- freon
- methylene chloride
- Safety Kleen^{tm}
- all other chlorinated ethers, benzenes, toluenes, etc.

Auto solutions
- all radiator, brake, transmission, hydraulic fluids, <u>except</u> oil

Other solvents
- xylene
- toluene
- alcohols
- all other non-chlorinated solvents

Acids
- hydrochloric acid
- sulfuric acid
- all other acids, except chromic and arsenic

Bases
- sodium hydroxide (caustic)
- all other caustics, alkalies, bases

Resins
- resins
- acrylics
- adhesives and glues
- paints

Oil
- petroleum-based oil
- all petroleum-based, oil-containing wastes

Formaldehyde
- formalin in any concentration

Metals
- arsenic acid
- chromic acid
- copper sulfate
- potassium dichromate
- iron compounds
- printing inks

Carbamates
- carbamate pesticides

Organophosphates
- organophosphate pesticides

Organochlorines
- organochlorine pesticides

Phenoxy herbicides
- 2,4 - dichlorophenoxyacetic acid (2,4-D)
- 2,4,5 - trichlorophenoxyacetic acid (2,4,5-T, 2,4,5-TP, Silvex)

Other pesticides
- all other pesticides not falling into any of the above four categories

Reducers

Oxidizers
- potassium permanganate

Photo proc. fluids
- film developers, fixers
- all photo-processing fluids

Cement products
- lime, extenders, wetting agents
- all other agents used in cement products

Fertilizers
- nitrogen compounds
- phosphorous compounds
- all fertilizer products

Surfactants
- detergents, soaps, wetting agents

Chlorinated phenolics
- tetra- and pentachlorinated phenol all chlorinated phenolic compounds

Non-chlor phenolics
- phenol
- phenolic resins
- all non-chlorinated phenolic compounds

Abandoned underground tank
- any abandoned underground storage tanks

APPENDIX 5

Stream entry into the Russian River	Miles upstream from mouth
Austin Creek into Russian River at	7.2
East Austin into Austin at	4.2
St.Elmo into Austin at	6.2
Ward into Austin at	7.6
Bearpaw into Austin at	11.5
Dutch Bill Creek into Russian River at	10.2
Duvoul into Dutch Bill at	3.4
Grub into Dutch Bill at	3.8
Alder into Dutch Bill at	4.8
Lancel into Dutch Bill at	5.7
Hulbert Creek into Russian River at	14.6
Fife Creek into Russian River at	15.0
Pocket Canyon into Russian River at	15.5
Green Valley Creek into Russian River at	25.4
Atascadero into Green Valley at	4.8
Purrington into Green Valley at	6.0
Mark West Creek into Russian River at	26.8
Windsor into Mark West at	3.2
Pool into Windsor at	2.3
Laguna de Santa Rosa into Mark West at	5.2
Santa Rosa Creek into Laguna at	1.2
Piner into Santa Rosa Crk. at	3.4
Paulin into Piner at	1.8
Matanzas into Santa Rosa Crk. at	8.2
Spring Cr. into S.R. Crk. at	0.8
Rincon into Santa Rosa Crk. at	10.8
Ducker into Rincon at	0.9
Colgan into Laguna at	8.8
Blucher into Laguna at	9.0
Bellevue-Wilfred FCC* into Laguna at	12.2
Todd into B-W FCC at	2.0
Washoe into Laguna at	12.6
Gossage into Washoe at	1.0
Hinebaugh into Laguna at	12.7
Copeland into Laguna at	14.4
Porter into Mark West at	18.5
Porter Creek into Russian River at	28.5

* FCC = flood control channel

Dry Creek into Russian River at	35.4
Mill Creek into Dry Creek at	1.0
Felta into Mill at	1.2
Wallace into Mill at	3.4
Crane into Dry Creek at	6.5
Grape into Dry Creek at	7.7
Pena into Dry Creek at	11.4
Chapman into Pena at	4.8
Dutcher into Dry Creek at	12.4
Fall into Dry Creek at	12.8
Schoolhouse into Dry Creek at	13.8
Brooks Creek into Russian River at	45.9
Barnes into Brooks at	2.1
Martain into Barnes at	0.4
Maacama into Russian River at	46.8
Franz into Maacama at	0.7
Redwood into Maacama at	4.7
Foote into Redwood at	2.5
Kellogg into Redwood at	4.5
Briggs into Maacama at	7.3
Hoot Owl Creek into Russian River at	49.4
Sausal Creek into Russian River at	50.1
Lytton Creek into Russian River at	51.6
Gird Creek into Russian River at	53.2
Miller Creek into Russian River at	56.5
Gill Creek into Russian River at	59.3
Crocker Creek into Russian River at	63.5
Barrelli Creek into Russian River at	64.0
Cloverdale Creek into Russian River at	67.4
Big Sulphur Creek into Russian River at	68.0
Little Sulphur into Big Sulphur at	5.8
North Branch into Little Sulphur at	2.4
Frassier into Big Sulphur at	7.6
Squaw into Big Sulphur at	9.7
Geysers Canyon into Big Sulphur at	14.2

Edwards Creek into Russian River at	72.2
Cummiskey Creek into Russian River at	73.2
Pieta Creek into Russian River at	76.5
Feliz Creek into Russian River at	79.9
Dooley Creek into Russian River at	81.5
McNab Creek into Russian River at	86.7
Parsons Creek into Russian River at	87.4
Morrison Creek into Russian River at	91.0
Robinson Creek into Russian River at	93.4
Mill Creek into Russian River at	96.2
McClure into Mill at	0.5
Doolin into Russian River at	96.3
Gibson into Doolin at	0.2
Orrs Creek into Russian River at	98.1
Sulphur Creek into Russian River at	98.2
Ackerman Creek into Russian River at	99.9
Howard Creek into Russian River at	100.0
Hensley Creek into Russian River at	100.3
East Fork into West Fork Russian River at	100.7
East Canal into East Fork at	9.3
West Canal into East Fork at	10.1
Busch Creek into East Fork at	14.3
York Creek into West Fork Russian River at	101.9
Forsythe Creek into West Fork Russian River at	105.4