JAY DAVIS



# SEGMENTATION OF THE SAN FRANCISCO BAY-DELTA

Andrew Gunther

San Francisco Bay Delta
Aquatic Habitat Institute
Building 180, Richmond Field Station
1301 S. 46th Street
Richmond, CA 94804

November 12, 1987

# SEGMENTATION OF THE SAN FRANCISCO BAY-DELTA

# SEGMENTATION OF THE SAN FRANCISCO BAY-DELTA

## Introduction

The Aquatic Habitat Institute has been requested by the Environmental Protection Agency to develop a segmentation scheme for San Francisco Bay, including the Sacramento-San Joaquin River Delta. The purpose of this effort is to provide a guide by which contaminant data from different studies can be combined in a consistent manner for statistical analysis. Although any segmentation scheme will necessarily contain subjective elements, such a division of the estuary will provide policy-makers with a framework for developing aggregate statistics on which to base regional or temporal comparisons. Segmenting the Bay-Delta system can also provide a nomenclature and reporting format for use by Bay scientists.

The ultimate goal of segmentation is to provide a rational basis for regulatory decisions regarding such issues as treatment levels, mass emission rates, and discharge locations. Such a complex goal, which can only be achieved with additional data on the fate and effects of contaminants in the estuary, is not an objective of this study. This report, however, should be carefully evaluated with a view to its possible incorporation into a complex management tool of that importance.

While useful for reducing complex and multiple data sets to manageable size, segmentation can result in the loss of information and may produce misleading data due to the lack of uniformity within a segment. A scheme with too little detail may obscure differences that are ecologically important, while too much subdivision in a segmentation scheme will limit its value as a tool for integrating data. Estuarine segmentation should thus be viewed as a screening tool: combining data into segment averages cannot substitute for careful site-specific analysis of factors that might influence the parameters of interest.

An estuary can be segmented using one or more biological, chemical, physical, geographical, or political parameters such as emergent vegetation, average salinity, depth, straits or county borders. Clearly, the needs of the end user will determine the utility of a given segmentation scheme. Thus, a benthic ecologist might desire a relatively detailed scheme that reflects the varying nature of sediments in the estuary,

while a fisheries specialist might only require a simple scheme that highlights the major portions of the Bay-Delta. Furthermore, certain parts of the estuary might be greatly influenced by spatial characteristics such as depth, while in other reaches temporal characteristics such as tides or salinity might be more important.

Consequently, developing a segmentation scheme requires compromising among different determining factors and end-use disciplines. This need for compromise, when combined with the dynamic nature of the San Francisco Bay-Delta, limits the utility of any general segmentation scheme. The scheme reported here is based upon depth, location of major outfalls, and the geography and hydrology of the estuary, taking into account other segmentation schemes that have been developed. It is specifically concerned with contaminant distribution, and is meant to complement rather than supplant existing segmentation schemes by providing a more detailed division of the estuary. It can, however, be employed at various levels of aggregation, as needed by the user.

It is essential that the proposed scheme be verified by collecting and reviewing data for consistency within segments. Such a "ground-truthing" exercise is necessary to determine whether the scheme can be utilized successfully in its current configuration. It is expected that as data are collected and compiled useful changes to the proposed scheme will become clear.

The next section briefly describes the existing segmentation schemes for the Bay and Delta. This is followed by a description of the proposed segmentation scheme, including the boundaries of each segment and the locations of major outfalls. The appendix provides the latitude and longitude of the major discharge outfalls, and the coordinates of the nodes of the scheme are available from EPA or AHI.

## Existing Segmentation Schemes

Four systems have been identified for dividing the Bay-Delta ecosystem into sections or segments, including one older scheme that appears to be no longer in use. Two hydrologic mapping systems have been developed by the United States Geological Survey (USGS) and the State Water Resources Control Board (SWRCB), in addition to the water quality segments developed by the Regional Water Quality Control Boards

(RWCQBs). The hydrologic mapping systems are for the entire state, and their focus upon drainage basins results in only large-scale divisions of the estuary itself. The RWQCB schemes, while specifically for the estuary, still provide relatively large-scale segmentation.

In accord with the Federal Water Pollution Control Act Amendments of 1972 the San Francisco Bay RWQCB has divided the Bay into receiving water segments and classified these segments based upon existing water quality (Figure 1). After application of best practicable treatment for effluents, segments are classified as "effluent limited" if water quality objectives are being met or "water quality limited" if objectives are not being met (Table 1). The Board has established minimum treatment levels for discharge into each segment based upon these classifications. Attempts have also been made to estimate the assimilative capacity of the water quality limited segments. The Central Valley RWQCB has undertaken a similar effort for the Central Valley, including the Delta.

| Segment | Classification |
|---|---|
| Pacific Ocean | Effluent Limited |
| Central Bay | Water Quality Limited[c] |
| San Pablo Bay | Water Quality Limited[c] |
| Carquinez Strait | Water Quality Limited[c] |
| Suisun Bay | Water Quality Limited[c] |
| Delta | Water Quality Limited[c] |
| Lower Bay[a] | Water Quality Limited[c] |
| South Bay[b] | Water Quality Limited |
| Suisun Marsh | Water Quality Limited[c] |
| Napa River | Water Quality Limited[c] |
| Petaluma River | Water Quality Limited |
| Sonoma Creek | Water Quality Limited[c] |
| Alameda Creek | Water Quality Limited |
| Richardson Bay | Water Quality Limited[c] |
| Tomales Bay | Water Quality Limited |

a. The region from Hunters Point-Oakland Airport south to San Mateo bridge.
b. The region south of the San Mateo bridge.
c. Suspected, but more data is needed for determination.

Table 1: San Francisco Bay Receiving Water Segments. Source: RWQCB (1986)

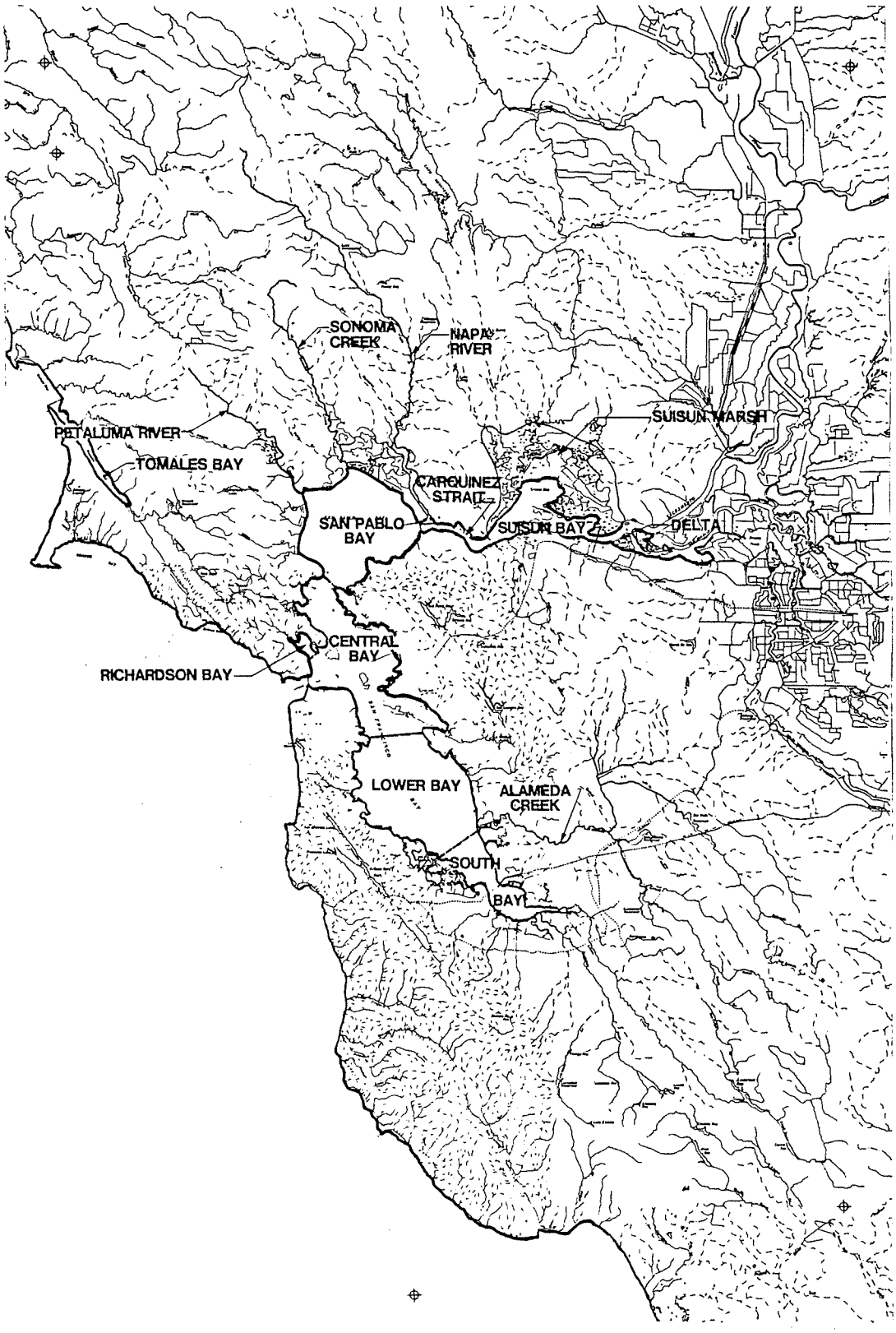



Figure 1. Receiving Water Segments Prepared by the San Francisco Bay RWQCB. Source:RWQCB (1986)

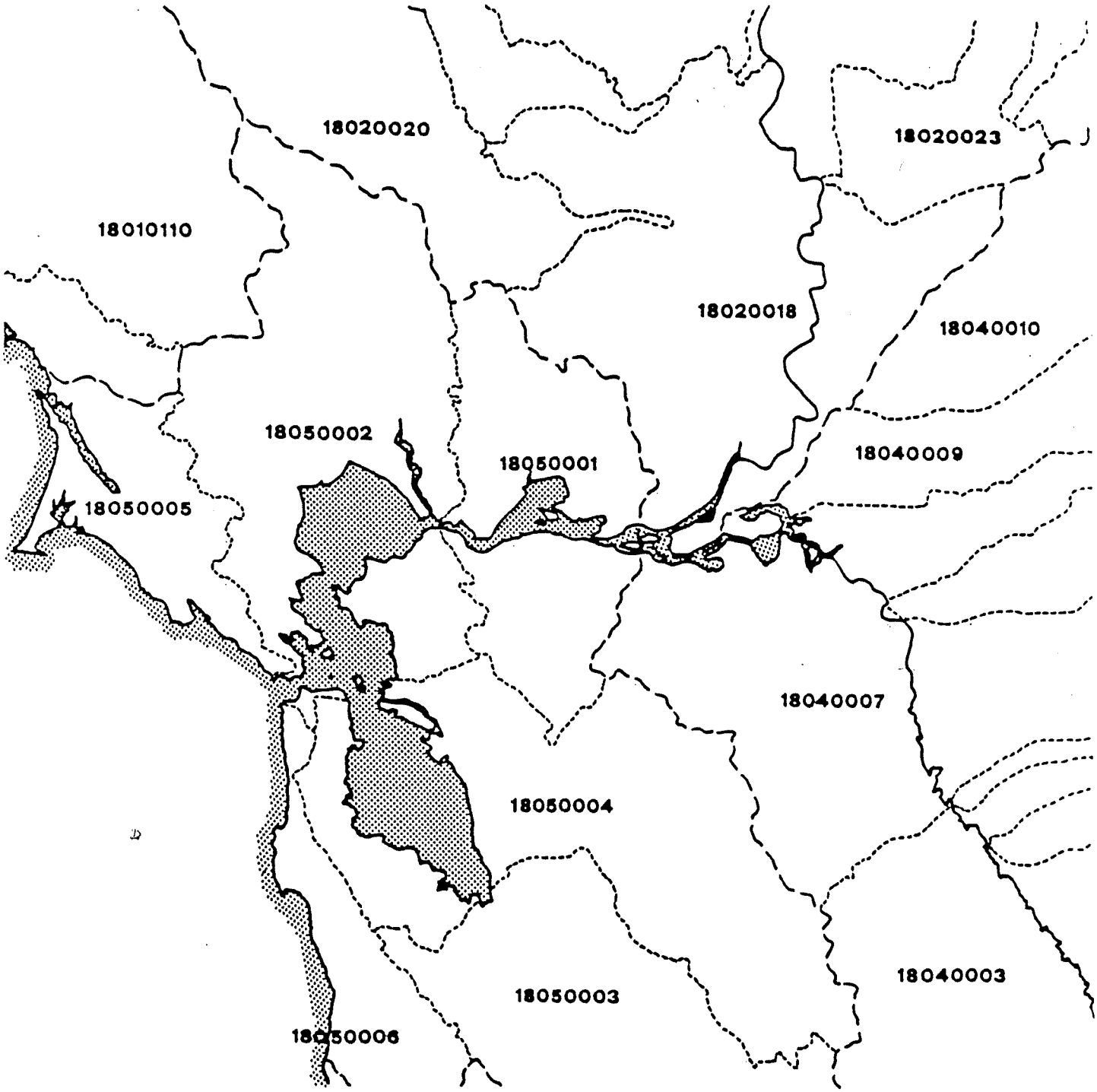
The United States Geological Survey has established a national system of hydrologic regions based upon river drainages. The 21 regions around the country are divided into over 200 subregions, and each subregion is split into accounting units and finally to cataloging units. This effort was undertaken in part as a result of the Water-Resources Planning Act of 1965, the implementation of which required a geographic and hydrologic standard by which to make planning decisions.

The hydrologic cataloging units, the smallest divisions within the USGS system, are usually larger than 1,800 $km^2$. The borders of these units form a segmentation scheme for the Bay and Delta (Figure 2). As this system is designed for managing data on the drainage basins themselves rather than the receiving waters, no firm guidelines were developed for dividing estuaries or lakes (Seaber et al. 1984). This scheme is thus of little use when attempting to develop a system for synthesizing environmental data from the waters of the Bay and Delta.

The SWRCB and the California Department of Water Resources (DWR) have developed a hydrologic mapping system of California that is similar to the USGS scheme (Figure 3). The objective of the State scheme is to provide the agencies with a coordinated system for planning and data storage. The SWRCB, for example, is using this hydrologic mapping system in the development of its nonpoint-source pollution project.

The SWRCB and DWR divide the state into identical hydrologic basins, units, areas, and subareas. The two agencies have different coding systems to describe the various segments, however. The hydrologic areas in the State scheme coincide with the USGS hydrologic cataloguing units. The subareas in the State scheme thus represent an additional level of detail beyond that provided by the USGS mapping system.

These subareas still provide only large-scale segmentation of the estuary itself, as the State plan is focused upon the entire estuarine drainage area. For example, the South Bay (between the Bay and Dumbarton Bridges) is one hydrologic area with no subareas described (the Bay Channel Hydrologic Area). Similarly, the region between the Bay, Golden Gate, and Richmond-San Rafael Bridges is one subarea (the Central Bay Hydrologic subarea; see Figure 3).




..... Hydrologic Cataloging Unit Boundary

- - - - - - - - Hydrologic Subregional Boundary

Figure 2. USGS Hydrologic Cataloging Units for the San Francisco Bay-Delta.
Source: USGS Hydrologic Unit Map of California, 1974.

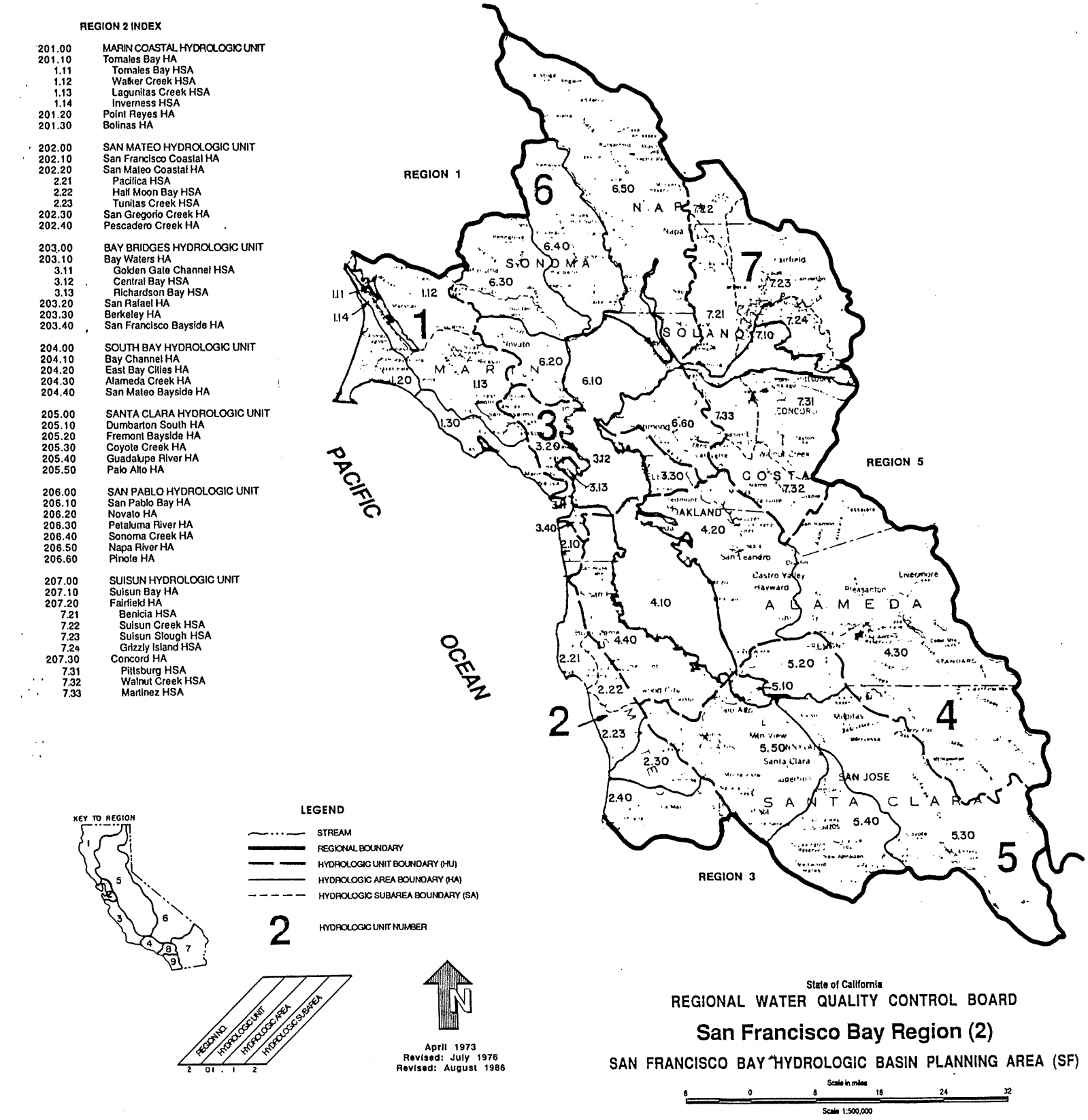



Figure 3: The Hydrologic Mapping System developed by the The State Water Resources Control Board and the Department of Water Resources.

Finally, a segmentation scheme was developed by the Sanitary Engineering Research Laboratory of the University of California as part of the Comprehensive Study of San Francisco Bay conducted for the State Water Quality Control Board in the late 1960s (Pearson et al. 1969). This plan appears to be a division of the Bay into convenient study zones, as there was no documentation of the reasoning behind the scheme provided by the authors. This segmentation plan was later identified by the USGS in 1973 as delineating receiving water regions for the Bay (Figure 4; Hines 1973).

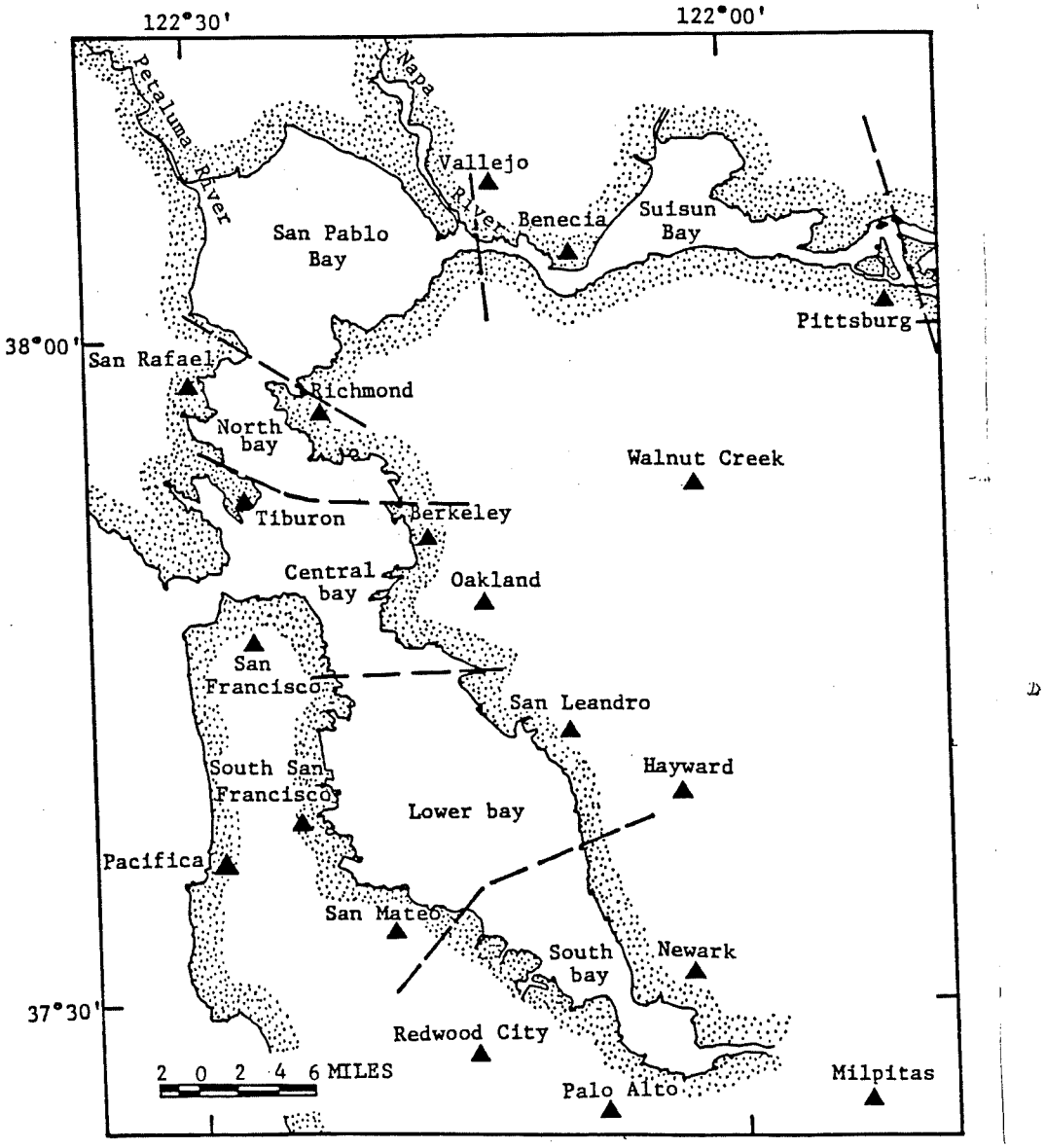



Figure 4. Receiving Water Regions for San Francisco Bay. Developed by Pearson et al. (1969). Source: Hines (1973).

These existing schemes, while useful, result in segments which are too large for rigorous study of all contaminants in the San Fransisco Bay-Delta system. To understand and evaluate the transport and fate of some contaminants (e.g. particulates), and to identify important spatial variability in contaminant distributions, it is necessary to divide the estuary into smaller segments. This is particularly important when examining the distribution of contaminants in sediments. The next section describes a more detailed segmentation scheme for the estuary.

## Proposed Bay-Delta Segments

The proposed segmentation scheme is pictured in Figures 5 and 6. The nomenclature used to label the segments is based upon the common names of the major water bodies or Bay sections: South Bay (SB), Central Bay (CB), San Pablo Bay (SP), and Suisun Bay (SU). The scheme subdivides the Bay within these five areas, and also includes the Delta. In general, the proposed segments represent finer divisions of the large segments contained in the existing schemes described above. Depths are indicated in feet rather than meters to correspond to NOAA nautical charts. For ease of mapping segment borders are presented as straight lines. In the future it may be desirable to substitute bathymetric contours as segment borders in many instances.

### South Bay (Figure 5)

The segments in the South Bay include eastern and western sections and follow depth contours. Transverse divisions at the Dumbarton Bridge, the San Mateo Bridge, and the northern part of the San Bruno Shoal are based in part on continuous fluorescence and salinity measurements, which show a trend that would support this segmentation plan (Powell et al. 1986).

SB 1. This segment includes Coyote Creek, the major tributary to the South Bay. Cloern and Oremland (1983) noted that the impacts of the 1979 sewage spill in the South Bay did not penetrate far beyond the mouth of Coyote Creek, indicating that it could be

considered a hydrologically distinct segment. The San Jose/Santa Clara Sewage Treatment Plant and New United Motors discharge into this segment.

SB 2. This is the southernmost section below the Dumbarton Bridge, exclusive of the section of the central channel below the bridge. This segment includes the outfalls of the Palo Alto and Sunnyvale Sewage Treatment Plants.

SB 3. This segment includes the mud flats on the southwestern side of the South Bay.

SB 4. This is the deep channel in the South Bay, from just south of the Dumbarton Bridge to the San Mateo Bridge. This segment includes the outfall of the South Bayside System Authority.

SB 5. This segment includes the mudflats on the eastern side of the South Bay between the Dumbarton and San Mateo Bridges.

SB 6. The shallow western portion of the South Bay from the San Mateo Bridge to the Hunters Point/San Bruno Shoal region is included in this segment. This segment contains the outfall of the North Bayside System Authority.

SB 7. This is the deep channel between the San Mateo Bridge and the northern portion of San Bruno Shoal. The outfall of the City of San Mateo Sewage Treatment Plant in contained in the extreme southern section of this segment.

SB 8. This segment includes the large shallow section on the eastern side of the South Bay from the San Mateo Bridge to Alameda. The western border of this segment is at a depth of approximately 12-14 feet. Eelgrass beds (Zostera marina) are located in the northern portion of this segment (California Department of Fish and Game [CDFG] and U.S. Fish and Wildlife Service [USFWS] 1978).

SB 9. This is the San Francisco shoreline south of the Bay Bridge, including Islais Creek, the outfall of the San Francisco Southeast Sewage Treatment Plant, and the cooling water discharges for PG&E's Potrero and Hunters Point units.

SB 10. This segment contains the deep channel between Hunters Point and the Bay Bridge, south to San Bruno Shoal.

SB 11. The deeper region of the eastern side of the South Bay, from 12-14 feet out to 38-40 feet, is included in this segment. This segment also contains the outfall of the East Bay Dischargers Association (EBDA) and the east side of San Bruno Shoal.

SB 12. This segment contains the Oakland Inner Harbor.

Central Bay (Figure 5)

The Central Bay is basically a marine environment, characterized by marine species, a relatively high degree of flushing, and deeper waters. There is significant variation in sediments throughout this region, while the water column is relatively homogeneous.

CB 1. This is the area bounded by Oakland Harbor, the Bay Bridge, and Yerba Buena Island, extending to a depth of 20-25 feet on the west . This segment contains the outfall of the East Bay Municipal Utility District (EBMUD).

CB 2. This segment contains the southern section of the Central Bay channel, from the Bay Bridge to the Tiburon Peninsula. The eastern border of this segment is at a depth of 35-40 feet.

CB 3. This is the deep portion of the Central Bay east of the Golden Gate and Racoon Strait, bordered on the east by a line between Angel Island and North Beach. This segment includes the Alcatraz disposal site, the Sausalito-Marin City outfall, and the outfall shared by Tiburon-Belvedere and the Sewage Agency of Southern Marin.

CB 4. This segment is the shallower shelf (to 50 feet) southwest of Angel Island.

CB 5. This segment is Richardson Bay, including Belvedere, out to a depth of about 25 feet where the shelf drops away.

CB 6. This segment contains the eastern portion of the Central Bay from a depth of about 7 feet on the east to 35 feet on the West. It is bordered on the north by Point Richmond, on the South by the Bay Bridge, and also includes the deeper region east of Treasure Island.

CB 7. The Richmond-Albany Shoreline, Richmond Inner Harbor, Point Isabel, and the Berkeley Yacht Harbor are included in this segment, as is the outfall of the Stauffer Chemical plant in Richmond. The Lauritzen Canal, a heavily contaminated site, is located in the Richmond Inner Harbor.

CB 8. This segment contains the Berkeley-Emeryville shoreline, including the Emeryville Marina and mudflats.

CB 9. This segment runs from Point Chauncey to Point San Pedro, including San Rafael Bay, with an eastern border at a depth of 35 feet. This segment includes the outfall of the Central Marin Sanitation Agency and the Paradise Cove Sewage Treatment Plant.

CB 10. The northern portion of the central channel, including all areas deeper than about 35 feet, are contained in this segment. It is bordered on the north by San Pablo Strait, and includes the Southampton Shoal Channel.

CB 11. The northwestern part of the Central Bay, out to a depth of about 35 feet, is included in this segment. The Chevron Long Wharf and the outfall of the West County Agency are contained in this segment. Large beds of eelgrass (Zostera marina) can be found in this segment between Point San Pedro and Castro Point (CDFG and USFWS 1978).

San Pablo Bay (Figure 5)

The segments in San Pablo Bay include the central channel and the regions surrounding it. The large region north and west of the channel is very shallow with silty sediments and mudflats, and is characterized by a low flushing rate. The region south and east of the channel is deeper, has a higher flushing rate, sandy sediments including some shell banks, and has more algae and sea grasses.

SP 1. This segment includes the marshlands and mudflats surrounding the western portion of San Pablo Bay from Point San Pablo the southern tip of Tubbs Island. It includes the Novato-Ignacio and Las Gallinas Sewage Treatment Plant outfalls. Gallinas and Novato Creeks run into this segment, as does the Petaluma River.

SP 2. The marshlands and mudflats from Tubbs Island to the southern end of Mare Island are included in this segment. Sonoma Creek, and the outfall of the Sonoma Valley Sewage Treatment Plant, are included in this segment.

SP 3. The large, shallow region of San Pablo Bay to the north and west of the channel is contained in this segment.

SP 4. This segment includes the main channel of San Pablo Bay, from San Pablo Strait to Carquinez Strait.

SP 5. The portion of San Pablo Bay south and east of the channel and west of Point Pinole is included in this segment. The outfalls of the Chevron refinery and Chevron Chemical are located in this segment. This region also represents the northernmost range of eelgrass (Zostera marina) in the Bay-Delta (CDFG and USFWS 1978).

SP 6. The portion of San Pablo Bay south of the main channel and east of Point Pinole makes up this segment. The outfalls of Union Oil, Pacific Refining, and the Hercules-Rodeo Sewage Treatment Plant are also contained in this segment. PG&E's Oleum unit also discharges into this segment.

SP 7. This segment includes Carquinez Strait, from Mare Island to the Martinez-Benicia Bridge. The eastern border at the Bridge is about 35 feet deep, and the Crockett-Valona (includes C & H Sugar), Vallejo, Port Costa, and Benicia Sewage Treatment Plant outfalls are contained in this segment. The outfall of the Shell Oil Company is located in the extreme eastern portion of the segment.

SP 8. This small segment includes Southampton Bay and the shallow shelf around Commodore Jones Point.

SP 9. The Napa River comprises this segment. The Napa, Calistoga, St. Helena, and Yountville Sewage Treatment Plants discharge into the Napa River, as does the Mare Island Naval Shipyard.

SP 10. The Petaluma River comprises this segment.

Suisun Bay (Figure 5)

As with the other water bodies, Suisun Bay is segmented primarily by depth. The channel in the southernmost portion is separated from the shallow reaches, such as Grizzly Bay and the Suisun Marsh.

SU 1. This segment includes the ship channel and the deeper, southern portion of the Bay from the Martinez-Benicia Bridge to Chipps Island. It also includes the deeper region where the reserve fleet is anchored. The outfalls of Central Contra Costa Sanitation District, General Chemical, Stauffer Chemical (Martinez), the Exxon refinery, and Tosco Oil Company are included in this segment.

SU 2. All portions of Central Suisun Bay and Grizzly Bay less than 20 feet deep are included in this segment, as is Roe Island and the channel between Roe and Ryer Islands.

SU 3. This segment includes Honker Bay, the remaining shallow reaches of Suisun Bay, and Snag, Freeman, and Simmons Islands. The deeper channels between Simmons Island and Ryer, Freeman, and Snag Islands are also included in this segment.

SU 4. Suisun marsh comprises this segment, which includes the outfall of the Fairfield Suisun Sewage Treatment Plant.

Delta (Figure 6)

The extreme variability in physical, biological, and chemical parameters in the Delta make any segmentation scheme based upon these characteristics extremely subjective. Even finer divisions of the Delta than those presented below will still exhibit remarkable heterogeneity. Consequently, the following general segmentation attempts to characterize the informal scheme that is in use among scientists working on the Delta. This scheme is based upon the general location of phytoplankton populations, although these change from year to year.

West Delta. The West Delta includes the region from Chipps Island to Jersey Point and Rio Vista. The outfalls of Dow Chemical, United States Steel, Crown Zellerbach, Du Pont de Nemours, Fibreboard, and PG&E's Pittsburg and Contra Costa units are located in this segment, as is the outfall of the Delta-Diablo Sewage Treatment Plant.

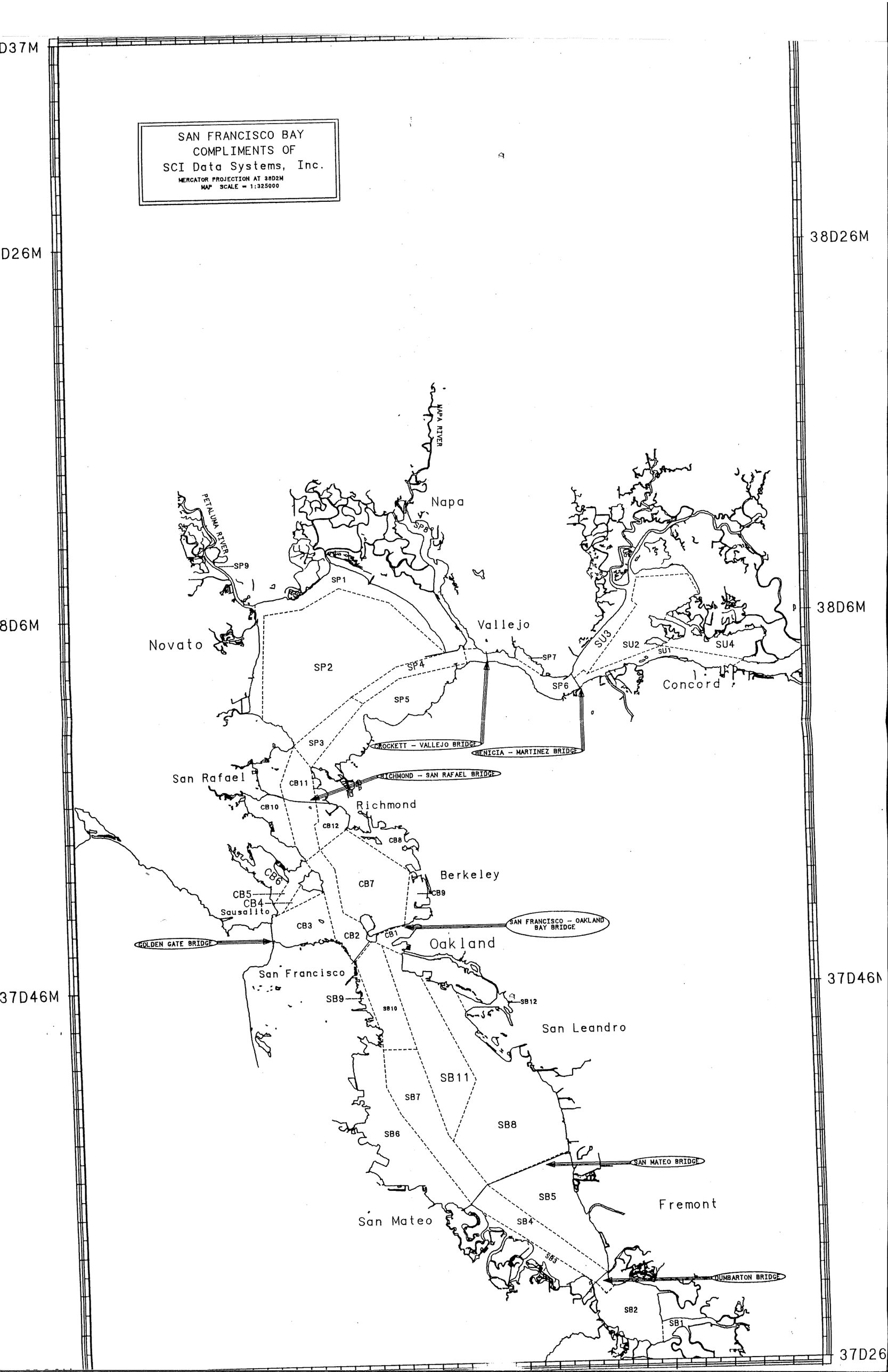
North Delta. The North Delta includes the region from Rio Vista and 3-Mile-Slough north to Sacramento. Sacramento, West Sacramento, Walnut Grove, Davis, Vacaville, and Lodi Sewage Treatment Plants discharge into this segment.

Central Delta. The region from Rio Vista and 3 Mile Slough south to the Fabian Bell Canal and the intersection of San Joaquin and Old Rivers is the Central Delta. The POTWs discharging into this segment are Rio Vista, Stockton, and Central Contra Costa Sanitary District #19. McCormick and Baxter also discharges into this segment.

South Delta. The South Delta is the region south of the line formed by the intersection of the San Joaquin and Old Rivers and the Fabian Bell Canal. The South Delta extends to Vernalis, and includes the outfalls of the Tracy Sewage Treatment Plant and Libbey-Owens-Ford.

East Delta. The East Delta includes all points east of a line that bisects the San Joaquin river at Wakefield Landing. This segment contains the City and Port of Stockton, Rough and Ready Island, and San Joaquin river south of Stockton.

Fig. 5. Proposed Segmentation Scheme for San Francisco Bay.


SAN FRANCISCO BAY
COMPLIMENTS OF
SCI Data Systems, Inc.
MERCATOR PROJECTION AT 38D2M
MAP SCALE = 1:325000
38D26M
38D6M
37D46M
37D26
NAPA RIVER
PETALUMA RIVER
Napa
Vallejo
Novato
San Rafael
Richmond
Berkeley
Oakland
San Francisco
San Leandro
San Mateo
Fremont
Concord
Sausalito
SP1
SP2
SP3
SP4
SP5
SP6
SP7
SP8
SP9
SU1
SU2
SU3
SU4
CB1
CB2
CB3
CB4
CB5
CB6
CB7
CB8
CB9
CB10
CB11
CB12
SB1
SB2
SB3
SB4
SB5
SB6
SB7
SB8
SB9
SB10
SB11
SB12
CROCKETT – VALLEJO BRIDGE
BENICIA – MARTINEZ BRIDGE
RICHMOND – SAN RAFAEL BRIDGE
SAN FRANCISCO – OAKLAND BAY BRIDGE
GOLDEN GATE BRIDGE
SAN MATEO BRIDGE
DUMBARTON BRIDGE

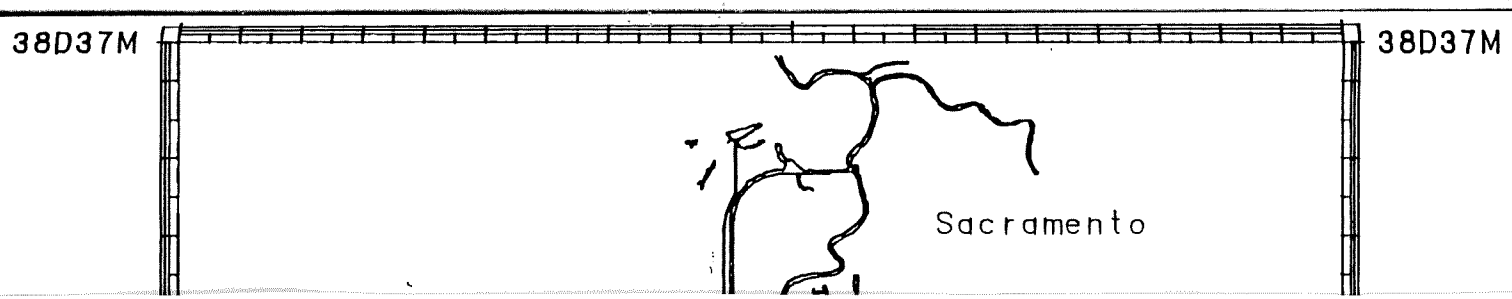
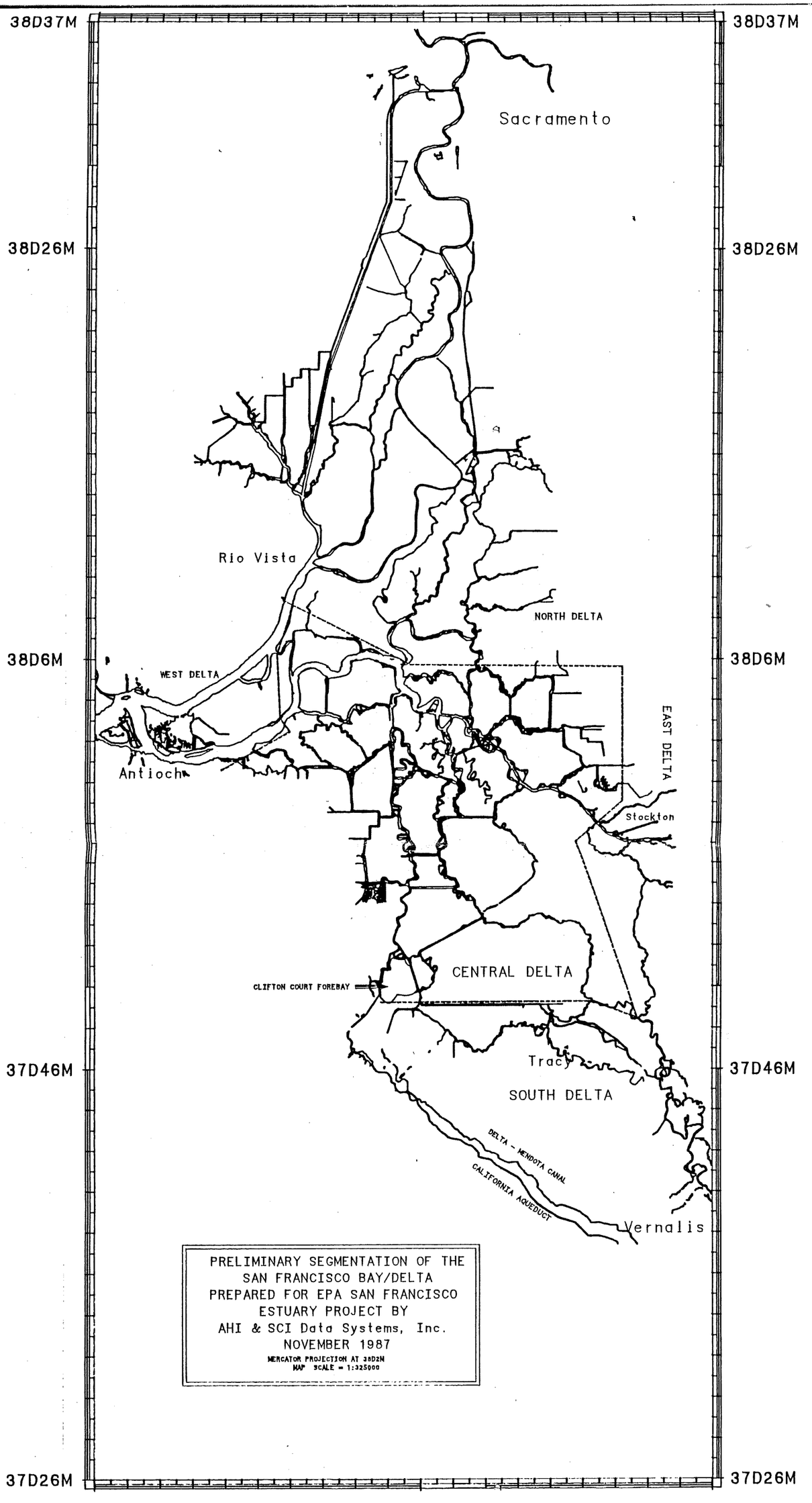



Fig. 6


38D37M
38D26M
38D6M
37D46M
37D26M
121D53M
121D33M
121D15M
Sacramento
Rio Vista
NORTH DELTA
WEST DELTA
EAST DELTA
Antioch
Stockton
CENTRAL DELTA
CLIFTON COURT FOREBAY
Tracy
SOUTH DELTA
DELTA - MENDOTA CANAL
CALIFORNIA AQUEDUCT
Vernalis
PRELIMINARY SEGMENTATION OF THE
SAN FRANCISCO BAY/DELTA
PREPARED FOR EPA SAN FRANCISCO
ESTUARY PROJECT BY
AHI & SCI Data Systems, Inc.
NOVEMBER 1987
MERCATOR PROJECTION AT 38D2N
MAP SCALE = 1:325000

## Literature Cited

California Department of Fish and Game, United States Fish and Wildlife Service, 1978. Preliminary Aerial Survey of San Francisco Bay.

Cloern, J.E., and R.S. Oremland, 1983. Chemistry and microbiology of a sewage spill in South San Francisco Bay. Estuaries 6:399-406.

Hines, W.G., 1973. A Review of Wastewater Problems and Wastewater Management Planning in the San Francisco Bay Region. Water Resources Division, Open File Report, Menlo Park, California.

Pearson, E.A., Storrs, P.N., and R.E. Selleck, 1969. Final Report: A Comprehensive Study of San Francisco Bay, Volume III. Waste Discharges and Loadings. Sanitary Engineering Research Laboratory, College of Engineering, and School of Public Health, University of California. SERL Report #67-3.

Powell, T.M., Cloern, J.E., and R.A. Walters, 1986. Phytoplankton spatial distribution in South San Francisco Bay: mesoscale and small-scale variability. pp. 369-383 in: Estuarine Variability, Wolfe, D.A., ed, Academic Press, Inc, New York.

RWQCB, 1986. Water Quality Control Plan: San Francisco Bay Basin (2). California Regional Water Quality Control Board, San Francisco Bay Region.

Seaber, P.R., Kapinos, F.P., and G.L. Knapp, 1984. State Hydrologic Unit Maps. U.S. Geological Survey, Open-File Report 84-708.

### Acknowledgments

The author is indebted to the following people for their comments on the draft of this manuscript: Mr. Edward Long, Dr. Michael Josselyn, Dr. Harlan Proctor, Dr. Donald Baumgartner, Dr. David J.H. Phillips, Mr. Richard Whitsel, Mr. William Davoren, Dr. Perry Herrgesel, and Mr. Jay Davis. The graphics for this report (Figures 5 and 6) were prepared by Ms. Jo Lane Satzer of SCI Data Systems, Inc., Annapolis, MD.

# APPENDIX

## Location of Major Outfalls

This appendix presents available data regarding the location of major POTW and industrial outfalls in the San Francisco Bay-Delta. The information on the latitude and longitude of POTW outfalls in the Bay has been obtained, when available, from NPDES permits filed with the San Francisco Bay Regional Water Quality Control Board.

| | North Latitude | | | West Longitude | | | |
|---|---|---|---|---|---|---|---|
| Discharger | Degrees | Minutes | Seconds | Degrees | Minutes | Seconds | Segment |
| **POTWs** | | | | | | | |
| Benicia | 38 | 02 | 30 | 122 | 09 | 03 | SP 7 |
| Calistoga | 38 | 33 | 34 | 122 | 33 | 28 | SP 9 |
| Central CC Sanitary | 38 | 02 | 44 | 122 | 05 | 55 | SU 1 |
| Central CC Sanitary #19 | | | | | | | CD |
| Central Marin | 37 | 56 | 54 | 122 | 27 | 23 | CB 9 |
| Davis | | | | | | | ND |
| Delta-Diablo | | | | | | | WD |
| EBDA | 37 | 42 | | 122 | 48 | | SB 11 |
| EBMUD | 37 | 49 | 02 | 122 | 20 | 50 | CB 1 |
| Fairfield-Suisun | 38 | 12 | 33 | 122 | 03 | 24 | SU 4 |
| Hercules-Rodeo | 38 | 03 | 06 | 122 | 15 | 55 | SP 6 |
| Las Gallinas | 38 | 01 | 32 | 122 | 30 | 58 | SP 1 |
| Lodi | | | | | | | ND |
| Mountain View | | | | | | | SU 1 |
| Napa | 38 | 13 | 45 | 122 | 17 | 00 | SP 9 |
| North Bayside | 37 | 39 | 55 | 122 | 21 | 41 | SB 6 |
| Novato-Ignacio | 38 | 04 | 00 | 122 | 29 | 00 | SP 1 |

| | North Latitude | | | West Longitude | | | |
|---|---|---|---|---|---|---|---|
| Discharger | Degrees | Minutes | Seconds | Degrees | Minutes | Seconds | Segment |
| Palo Alto | 37 | 27 | 11 | 122 | 06 | 36 | SB 2 |
| Paradise Cove | | | | | | | CB 9 |
| Port Costa | | | | | | | SP 7 |
| Rio Vista | | | | | | | CD |
| Sacramento | | | | | | | ND |
| SF Southeast | 37 | 44 | 58 | 122 | 22 | 22 | SB 9 |
| SF Northpoint | | | | | | | |
| S Jose-S Clara | 37 | 26 | 06 | 121 | 57 | 08 | SB 1 |
| San Mateo | 37 | 34 | 50 | 122 | 14 | 45 | SB 7 |
| Sausalito-Marin | 37 | 50 | 37 | 122 | 28 | 03 | CB 3 |
| Sewage Agen. of S. Marin | 37 | 53 | 40 | 122 | 28 | 10 | CB 3 |
| South Bayside | 37 | 33 | 48 | 122 | 12 | 55 | SB 4 |
| Sonoma Valley | 38 | 14 | 14 | 122 | 25 | 51 | SP 2 |
| Sunnyvale | 37 | 26 | | 122 | 02 | | SB 2 |
| St. Helena | 30 | 20 | 10 | 122 | 26 | 15 | SP 9 |
| Stockton | | | | | | | CD |
| Tracy | | | | | | | SD |
| Vacaville | | | | | | | ND |
| Vallejo | 38 | 07 | 37 | 122 | 16 | 00 | SP 7 |
| Walnut Grove | | | | | | | ND |
| W. Sacramento | | | | | | | ND |
| West County Agency | 37 | 54 | 41 | 122 | 25 | 06 | CB 11 |
| Yountville | 38 | 24 | 24 | 122 | 20 | 27 | SP 9 |

| | North Latitude | | | West Longitude | | | |
|---|---|---|---|---|---|---|---|
| Discharger | Degrees | Minutes | Seconds | Degrees | Minutes | Seconds | Segment |
| **INDUSTRY** | | | | | | | |
| C & H Sugar | | | | | | | SP 7 |
| Chevron Oil | | | | | | | SP 5 |
| Chevron Chem. | | | | | | | SP 5 |
| Crown Zellerbach | | | | | | | WD |
| Dow Chemical | | | | | | | WD |
| Du Pont | | | | | | | WD |
| Exxon | | | | | | | SU 1 |
| Fibreboard | | | | | | | WD |
| General Chem. | | | | | | | SU 1 |
| Libbey-Owens Ford | | | | | | | SD |
| Mare Island Naval Shipyard | | | | | | | SP 9 |
| McCormick and Baxter | | | | | | | CD |
| New United Motors | | | | | | | SB 1 |
| Pacific Refining | | | | | | | SP 6 |
| PG & E | | | | | | | |
| Contra Costa | | | | | | | WD |
| Hunter's Pt | | | | | | | SB 9 |
| Oleum | | | | | | | SP 6 |
| Pittsburg | | | | | | | WD |
| Potrero | | | | | | | SB 9 |
| Shell Oil | | | | | | | SP 7 |

| | North Latitude | | | West Longitude | | | |
|---|---|---|---|---|---|---|---|
| Discharger | Degrees | Minutes | Seconds | Degrees | Minutes | Seconds | Segment |
| Stauffer Chem Martinez | | | | | | | SU 1 |
| Richmond | | | | | | | CB 7 |
| Tosco | | | | | | | SU 1 |
| Union Oil | | | | | | | SP 6 |
| U.S. Steel | | | | | | | WD |

Latitudes and Longitudes

| | | | | | | |
|---|---|---|---|---|---|---|
| | 037 | 29 | 40 | 122 | 05 | 16 |
| | 037 | 29 | 21 | 122 | 05 | 41 |
| | 037 | 30 | 15 | 122 | 07 | 17 |
| | 037 | 34 | 44 | 122 | 15 | 18 |
| | 037 | 35 | 21 | 122 | 16 | 11 |
| | 037 | 40 | 19 | 122 | 22 | 06 |
| | 037 | 43 | 42 | 122 | 21 | 23 |
| | 037 | 29 | 52 | 122 | 06 | 18 |
| | 037 | 35 | 23 | 122 | 14 | 35 |
| | 037 | 37 | 11 | 122 | 16 | 56 |
| | 037 | 41 | 30 | 122 | 18 | 11 |
| | 037 | 48 | 22 | 122 | 21 | 12 |
| | 037 | 40 | 35 | 122 | 15 | 30 |
| | 037 | 46 | 35 | 122 | 18 | 39 |
| | 037 | 47 | 24 | 122 | 23 | 03 |
| | 037 | 48 | 30 | 122 | 21 | 53 |
| | 037 | 48 | 14 | 122 | 20 | 26 |
| | 037 | 48 | 26 | 122 | 21 | 40 |
| | 037 | 49 | 17 | 122 | 19 | 37 |
| | 037 | 49 | 08 | 122 | 20 | 26 |
| | 037 | 48 | 49 | 122 | 21 | 30 |
| | 037 | 48 | 35 | 122 | 28 | 32 |
| | 037 | 49 | 32 | 122 | 28 | 38 |
| | 037 | 48 | 39 | 122 | 25 | 02 |
| | 037 | 51 | 12 | 122 | 25 | 03 |
| | 037 | 50 | 40 | 122 | 26 | 10 |
| | 037 | 50 | 26 | 122 | 27 | 31 |
| | 037 | 51 | 13 | 122 | 27 | 19 |
| | 037 | 50 | 33 | 122 | 28 | 33 |
| | 037 | 52 | 21 | 122 | 27 | 02 |
| | 037 | 49 | 35 | 122 | 22 | 40 |
| | 037 | 50 | 09 | 122 | 23 | 46 |
| | 037 | 52 | 09 | 122 | 24 | 43 |
| | 037 | 53 | 46 | 122 | 25 | 04 |
| | 037 | 55 | 26 | 122 | 24 | 54 |
| | 037 | 56 | 19 | 122 | 25 | 30 |
| | 037 | 57 | 53 | 122 | 25 | 40 |
| | 037 | 59 | 08 | 122 | 26 | 47 |
| | 037 | 56 | 44 | 122 | 27 | 22 |
| | 037 | 53 | 38 | 122 | 26 | 52 |
| | 037 | 51 | 58 | 122 | 19 | 00 |
| | 037 | 54 | 32 | 122 | 23 | 24 |
| | 037 | 52 | 55 | 122 | 26 | 14 |
| | 037 | 52 | 20 | 122 | 25 | 45 |
| | 038 | 02 | 49 | 122 | 21 | 47 |
| | 038 | 03 | 55 | 122 | 17 | 08 |
| | 038 | 07 | 20 | 122 | 22 | 59 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 97 | 038 | 03 | 39 | 121 | 59 | 29 |
| 98 | 038 | 03 | 41 | 121 | 57 | 22 |
| 99 | 038 | 07 | 54 | 122 | 02 | 30 |
| 100 | 038 | 07 | 27 | 122 | 00 | 07 |
| 101 | 037 | 30 | 01 | 122 | 07 | 39 |
| 102 | 037 | 30 | 27 | 122 | 06 | 57 |
| 103 | 037 | 30 | 45 | 122 | 06 | 32 |
| 104 | 038 | 08 | 53 | 121 | 41 | 31 |
| 105 | 038 | 05 | 45 | 121 | 33 | 38 |
| 106 | 038 | 05 | 39 | 121 | 20 | 35 |
| 107 | 037 | 59 | 05 | 121 | 20 | 34 |
| 108 | 037 | 57 | 06 | 121 | 23 | 25 |
| 109 | 037 | 48 | 31 | 121 | 19 | 38 |
| 110 | 037 | 49 | 20 | 121 | 22 | 22 |
| 111 | 037 | 49 | 17 | 121 | 35 | 27 |
| 112 | 038 | 00 | 36 | 121 | 45 | 14 |
| 113 | 038 | 02 | 29 | 121 | 41 | 02 |
| 114 | 038 | 03 | 07 | 121 | 41 | 39 |
| 115 | 038 | 06 | 15 | 121 | 41 | 52 |
| 116 | 038 | 08 | 38 | 121 | 40 | 52 |