Surface Water Ambient Monitoring Program

Site-Specific Monitoring Workplan
Central Coast Regional Water Quality Control Board

1. Introduction

Fiscal Year (FY) 2002-03 will mark the second year of the coordinated implementation of the Surface Water Ambient Monitoring Program (SWAMP). The "site-specific" monitoring efforts described as one component of SWAMP is presented in Section VI of the report to the Legislature titled "Proposal for a comprehensive ambient surface water quality monitoring program." This workplan is intended to address that component of the SWAMP program. A description of the monitoring efforts that will be implemented through the Central Coast Ambient Monitoring Program (CCAMP) is described in this document.

State Board guidance intended that this portion of SWAMP be targeted at specific locations in each region but provides the RWQCBs significant flexibility in this site selection effort. The RWQCBs at their discretion may perform monitoring at clean sites to determine baseline conditions or in areas suspected or known to be polluted. Because CCAMP has already been underway for four years and already includes both ambient and focused monitoring components, study design will follow that of previous years, where long-term "ambient" monitoring sites are selected at major tributary inputs and at the mainstem upstream of each tributary input, and "focused" monitoring sites are placed at other locations of interest in the watershed (such as above and below specific land uses, point sources, best management practices, or other areas in need of characterization). Ambient site selection is not based on suppositions regarding water quality, but rather on hydrogeomorphology. Focused monitoring sites are selected using a number of different criteria, including land use patterns, known problem areas, etc.

2. Identify Sites to Monitor

Locations to be monitored are shown for each of five Watershed Rotation Years and for ongoing Coastal Confluences monitoring. All sites (except offshore mussel watch sites) are monitored for conventional water quality. A subset of these sites is monitored for Rapid Bioassessment, sediment quality, toxicity, and tissue bioaccumulation. A preliminary site list for watershed and coastal confluence monitoring is shown in Table 1.

Table 1. Central Coast Ambient Monitoring Program Site List

Rotation Year	Hydrologic Sub Area	WaterBody	Site Tag	Site Name
2003	30411	Scott Creek	304SCM	304SCM-Scott Creek d/s Mill Creek
2003	30412	Bear Creek	304BEP	304BEP-Bear Creek @ Elks Park
2003	30412	Boulder Creek	304BH9	304BH9-Boulder Creek @ Highway 9
2003	30412	Branciforte Creek	304BRA	304BRA-Branciforte Road @ Ocean Street
2003	30412	Newell Creek	304NGA	304NGA-Newell Creek @ Glen Arbor
2003	30412	San Lorenzo River	304RIV	304RIV-San Lorenzo River @ River Street
2003	30412	San Lorenzo River	304SLA	304SLA-San Lorenzo River @ Alder
2003	30412	San Lorenzo River	304SLE	304SLE-San Lorenzo @ Elks Park
2003	30412	San Lorenzo River	304SLP	304SLP-San Lorenzo River @ Graham Hill Road
2003	30412	Zayante Creek	304ZAY	304ZAY-Zayante Creek @ Graham Hill Road
2003	30413	Aptos Creek	304APS	304APS-Aptos Creek @ Soquel Road
2003	30413	Soquel Creek	304SEO	304SEQ-Soquel East @ Olive Spring
2003	30413	Soquel Creek	304SWO	304SWO-Soquel West @ Olive Spring
2003	30413	Valencia Creek	304VAL	304VAL-Valencia Creek @ Soquel Road
2003	30510	Corralitos Creek	305COR2	305COR2-Upper Corralitos Creek
2003	30510	Harkins Slough	305HAR	305HAR-Harkins Slough @ Harkins Slough Road
2003	30510	Pajaro River	305CHI	305CHI-Pajaro River @ Chittenden Gap
2003	30510	Pajaro River	305MUR	305MUR-Pajaro River @ Murphy's Crossing
2003	30510	Salsipuedes Creek	305COR	305COR-Salsipuedes Creek - Down stream of Corralitos Creek
2003	30510	Watsonville Slough	305WAT	305WAT-Watsonville Slough
2003	30510	Watsonville Slough	305WSA	305WSA-Watsonville Slough @ San Andreas Road
2003	30520	Pajaro River	305PAJ	305PAJ-Pajaro River @ Betabel Road
2003	30530	Llagas Creek	305HOL	305HOL-Llagas Creek @ Holsclaw Road
2003	30530	Llagas Creek	305LLA	305LLA-Llagas Creek @ Bloomfield Avenue
2003	30530	Pajaro River	305FRA	305FRA-Pajaro River @ Frazier Lake Road
2003	30530	Tequisquita Slough	305TES	305TES-Tequisquita Slough
2003	30530	Uvas Creek	305UVA	305UVA-Uvas Creek @ Bloomfield Avenue
2003	30540	Pacheco Creek	305PAC	305PAC-Pacheco Creek
2003	30550	San Benito River	305HRL	305HRL-San Benito River below Hernandez Reservoir
2003	30550	San Benito River	305SAN	305SAN-San Benito @ Y Road
2003	30550	Tres Pinos Creek	305TRE	305TRE-Tres Pinos Creek
2004	30600	Carneros Creek	306CAR	306CAR-Carneros Creek in Los Lomas @ Blohm Road
2004	30910	Old Salinas River	309POT	309POT-Old Salinas River @ Potrero Road
2004	30910	Salinas Reclamation Canal	309ALD	309ALD-Salinas Reclamation Canal @ Boranda Road
2004	30910	Salinas Reclamation Canal	309ALU	309ALU-Salinas Reclamation Canal @ Airport Road
2004	30910	Salinas Reclamation Canal	309AXX	309AXX-Salinas Reclamation Canal Storm Drain @ and Airport Road
2004	30910	Salinas River (Lower)	309SAC	309SAC-Salinas River @ Chualar bridge on River Road
2004	30910	Salinas River (Lower)	309SDR	309SDR-Salinas Storm Drain u/s Davis Road
2004	30910	Tembladero Slough	309TEM	309TEM- Tembladero Slough @ Preston Road
2004	30920	Gabilan Creek	309GAB	309GAB-Gabilan Creek @ Independence Road and East Boranda Road
2004	30920	Quail Creek	309QUA	309QUA-Quail Creek @ Potter Road
2004	30920	Quail Creek	309UQA	309UQA-Quail Creek @ Old Stage Road
2004	30930	Arroyo Seco River	309SET	309SET-Arroyo Seco River @ Thorne Road

Rotation Year	Hydrologic Sub Area	WaterBody	Site Tag	Site Name
2004	30930	Salinas River (Mid)	309GRN	309GRN-Salinas River @ Elm Road in Greenfield
2004	30940	Salinas River (Mid)	309DSA	309DSA-Salinas River d/s San Ardo @ Cattleman Road
2004	30940	Salinas River (Mid)	309KNG	309KNG-Salinas River @ Highway 101 in King City
2004	30940	San Lorenzo Creek	309LOK	309LOK-San Lorenzo Creek @ First Street in King City
2004	30960	Arroyo Seco River	309SEC	309SEC-Arroyo Seco River @ Elm Street
2004	30970	Alisal Creek	309UAL	309UAL-Salinas Reclamation Canal @ Old Stage Road
2004	30970	San Lorenzo Creek	309LOR	309LOR-San Lorenzo Creek @ Bitterwater Road east of King City
2004	30970	Topo Creek	309TOP	309TOP-Topo Creek @ Metz Road
2004	30981	Atascadero Creek(309)	309ATS	309ATS-Atascadero Creek @ Highway 41
2004	30981	Nacimiento River	309NAC	309NAC-Nacimiento River @ Highway 101
2004	30981	Salinas River (Upper)	309PSO	309PSO-Salinas River @ 13th Street in Paso Robles
2004	30981	Salinas River (Upper)	309SAT	309SAT-Salinas River @ Highway 41 bridge
2004	30981	Salinas River (Upper)	309SUN	309SUN-Salinas River u/s Nacimiento @ Bradley Road
2004	30981	Salinas River (Upper)	309USA	309USA-Salinas River u/s San Ardo @ the Bradley bridge
2004	30981	San Antonio River	309SAN	309SAN-San Antonio River @ Highway 101
2004	31700	Cholame Creek	317CHO	317CHO-Cholame Creek @ Bitterwater Road
2004	31700	Estrella River	317EST	317EST-Estrella River @ Airport Road
2004	31700	Estrella River	317ESE	317EST-Estrella River @ Estrella River Road, u/s Highway 46
2005	31100	Soda Lake	311SLE	311SLE-Soda Lake Northeast
2005	31100	Soda Lake	311SLN	311SLN-Soda Lake Culverts at Seven Mile Road
2005	31210	Blosser Channel	312BCD	312BCD-Blosser Channel d/s of ponds
2005	31210	Bradley Channel	312BCU	312BCU-Bradley Channel u/s of ponds
2005	31210	Bradley Cyn Creek	312BCF	312BCF-Bradley Canyon diversion channel @ Foxen Canyon Road
2005	31210	Bradley Cyn Creek	312BCG	312BCG-Bradley Canyon Creek @ Orcut-Garey Road
2005	31210	Little Oso Flaco Creek	312OFN	312OFN-Little Oso Flaco Creek
2005	31210	Main Street Canal	312MSD	312MSD-Main Street Canal u/s Ray Road
2005	31210	Nipomo Creek	312NIP	312NIP-Nipomo Creek @ Highway 166
2005	31210	Nipomo Creek	312NIT	312NIT-Nipomo Creek @ Tefft Street
2005	31210	Orcutt Solomon Creek	312OLA	312OLA-Orcutt Solomon tributary @ Betteravia Lakes
2005	31210	Orcutt Solomon Creek	312ORB	312ORB-Orcutt Solomon Creek @ Black Road
2005	31210	Orcutt Solomon Creek	312ORC	312ORC-Orcutt Solomon Creek u/s Santa Maria River
2005	31210	Orcutt Solomon Creek	312ORI	312ORI-Orcutt Solomon Creek @ Highway 1
2005	31210	Oso Flaco Creek	312OFC	312OFC-Oso Flaco Creek @ Oso Flaco Lake Road
2005	31210	Oso Flaco Creek	312TIX	312TIX-Osos Flaco Creek @ Highway 1
2005	31210	Oso Flaco Lake	312OFL	312OFL-Oso Flaco Lake @ culvert
2005	31210	Santa Maria River	312SBC	312SBC-Santa Maria River @ Bull Canyon Road
2005	31210	Santa Maria River	312SBS	312SBS-Santa Maria River @ Bonita School Road
2005	31210	Santa Maria River	312SMI	312SMI-Santa Maria River @ Highway 1
2005	31220	Cat Cyn Creek	312CAT	312CAT-Cat Canyon Creek @ Foxen Canyon Road
2005	31220	LaBrea Creek	312BRE	312BRE-LaBrea Creek @ vinryard
2005	31220	Sisquoc River	312SIS	312SIS-Sisquoc River @ Santa Maria Way
2005	31220	Sisquoc River	312SIV	312SIV-Sisquoc River
2005	31230	Alamo Creek	312ALA	312ALA-Alamo Creek u/s Twitchell Reservoir
2005	31230	Cuyama River	312CAV	312CAV-Cuyama River u/s Ventucopa @ Highway 33
2005	31230	Cuyama River	312CCC	312CCC-Cuyama River d/s Cottonwood Canyon
2005	31230	Cuyama River	312CKM	312CKM-Cuyama River u/s Kirschenmann Road @ 166

Rotation Year	Hydrologic Sub Area	WaterBody	Site Tag	Site Name
2005	31230	Cuyama River	312CUT	312CUT-Cuyama River below Twitchell @ White Rock Lane
2005	31230	Cuyama River	312CUY	312CUY-Cuyama River d/s Buckhorn Road
2005	31230	Huasna River	312HUA	312HUA-Huasna River @ Huasna Townsite Road
2005	31230	Salisbury Creek	312SAL	312SAL-Salisbury Creek @ Branch Canyon Wash
2006	31510	Canada de la Gaviota	315GAI	315GAI-315GAI-Canada de la Gaviota @ Highway 1
2006	31510	Canada del Refugio	315RSB	315RSB-315RSB-Canada del Refugio u/s Highway 101
2006	31510	Devereux Slough	315DEV	315DEV-Devereux Slough @ the Golf Course culvert
2006	31510	Dos Pueblos Canyon Creek	315DOS	315DOS-Dos Pueblos Canyon Creek @ Highway 101
2006	31510	El Capitan Creek	315CAP	315CAP-El Capitan Creek ds Highway 101
2006	31510	Los Carneros Creek	315LCR	315LCR-315LCR-Los Carneros Creek @ Hollister Road
2006	31531	Maria Ynacio Creek	315MYC	315MYC-315MYC-Maria Ynacio Creek @ Patterson Avenue
2006	31300	San Antonio Creek	313SAB	313SAB-San Antonio Creek @ Rancho de las Flores Bridge/Highway 135
2006	31300	San Antonio Creek	313SAE	313SAE-San Antonio Creek @ San Antonio Road East
2006	31300	San Antonio Creek	313SAI	313SAI-San Antonio Creek @ San Antonio Road West
2006	31410	Salsipuedes Creek(314)	314SAL	314SAL-Salsipuedes Creek @ Santa Rosa Road
2006	31410	San Miguelito Creek	314MIG	314MIG-San Miguelito Creek at W.North Ave.
2006	31410	Santa Ynez River(lower)	314SYF	314SYF-Santa Ynez River d/s Lompoc @ Floordale
2006	31410	Santa Ynez River(lower)	314SYI	314SYI-Santa Ynez River @ Highway 101
2006	31410	Santa Ynez River(lower)	314SYL	314SYL-Santa Ynez River u/s Lompoc @ Highway 246
2006	31410	Santa Ynez River(upper)	314SYC	314SYC-Santa Ynez River d/s Lake Cachuma @ Highway 154
2006	31410	Santa Ynez River(upper)	314SYP	314SYP-Santa Ynez River @ Paradise Road
2006	31510	Bell Creek	315BEL	315BEL-Bell Creek on Bacara Resort Access Road
2006	31510	Jalama Creek	315JAL	315JAL-315JAL-Jalama Creek u/s County Park @ Rail Road Trussels
2006	31510	Tecolote Creek	315TCI	315TCI-315TCI-Tecolote Creek @ Bacara Resort access Road
2006	31531	Atascadero Creek(315)	315ATU	315ATU-Atascadero Creek @ Patterson Avenue
2006	31531	Atascadero Creek(315)	315DCK	315DCK-Tributary to Atascadero Creek at 2 boot ranch
2006	31531	Glenn Annie Creek	315ANN	315ANN-Glenn Annie Creek u/s Holister Road
2006	31531	San Jose Creek	315SJC	315SJC-315SJC-San Jose Creek @ Kellogg Boulevard
2006	31531	San Pedro Creek	315SPC	315SPC-315SPC-San Pedro Creek d/s of Holister Road
2006	31532	Arroyo Burro Creek	315ABH	315ABH-Arroyo Burro Creek @ Hope Street
2006	31532	Mission Creek	315MIU	315MIU-315MIU-Mission Creek @ Cathedral Oaks Road
2006	31532	Montecito Creek	315MTC	315MTC-315MTC-Montecito Creek @ Jamison Lane
2006	31532	San Ysidro Creek	315YSI	315YSI-315YSI-San Ysidro Creek @ Jamison Lane
2006	31533	Romero Creek	315ROM	315ROM-315ROM-Romero Creek @ Jamison Lane
2006	31533	Sycamore Creek	315SCC	315SCC-315SCC-Sycamore Creek @ Punta Gorda Street
2006	31534	Arroyo Paredon	315APC	315APC-Arroyo Paredon Creek @ Via Real
2006	31534	Carpinteria Creek	315CAU	315CAU-Carpenteria Creek @ Highway 192
2006	31534	Santa Monica Creek	315SMC	315SMC-Santa Monica Creek @ Carpenteria Avenue
2006	31534	Toro Canyon Creek	315TOR	315TOR-315TOR-Toro Canyon Creek @ Via Real
2007	30700	Carmel River	307CMD	307CMD-Carmel River @ Schulte Road
2007	30700	Carmel River	307CMN	307CMN-Carmel River @ Nason Road, Community Park
2007	30700	Carmel River	307CMU	307CMU-Carmel River @ Esquiline Road
2007	30700	Tularcitos Creek	307TUL	307TUL-Tularcitos Creek @ Carmel Valley Road
2007	30800	Big Sur River	308BSU	308BSU-Big Sur River @ Pfeiffer, Weyland camp
2007	30800	Garapata Creek	308GAR	308GAR-Garapata Creek @ Garapata Creek Road
2007	30800	Limekiln Creek	308LIM	308LIM-Limekiln Creek @ Limekiln State Park

Rotation Year	Hydrologic Sub Area	WaterBody	Site Tag	Site Name
2007	30800	Little Sur River	308LSR	308LSR-Little Sur River @ Highway 1
2007	30800	Little Sur River	308LSU	308LSU-Little Sur River @ Old Coast Road
2007	30800	Mill Creek	308MIL	308MIL-Mill Creek @ Mill Creek Picnic Area
2007	30800	San Jose Creek	308SJC	308SJC-San Jose Creek @ Private Road Access
2007	31011	San Carpoforo Creek	310SCP	310SCP-San Carpoforo Creek @ Highway 1
2007	31013	Pico Creek	310PCO	310PCO-Pico Creek @ Highway 1
2007	31013	San Simeon Creek	310SSU	310SSU-San Simeon Creek @ San Simeon Road
2007	31014	Santa Rosa Creek	310SRU	310SRU-Santa Rosa Creek @ Main Street
2007	31015	Villa Creek	310VIA	310VIA-Villa Creek us Highway 1
2007	31016	Cayucos Creek	310CAY	310CAY-Cayucos Creek @ Cayucos Creek Road
2007	31017	Old Creek	310OLD	310OLD-Old Creek @ Cottontail Creek Road
2007	31018	Toro Creek	310TOR	310TOR-Toro Creek us Highway 1
2007	31021	Morro Creek	310MOR	310MOR-Morro Creek @ Lila Keiser Park
2007	31022	Chorro Creek	310CAN	310CAN-Chorro Creek @ Canet Road
2007	31022	Chorro Creek	310CAN	310CAN-Chorro Creek @ Canet Road
2007	31024	Prefumo Creek	310PRE	310PRE-Prefumo Creek @ Calle Joaquin
2007	31024	San Luis Obispo Creek	310SLC	310SLC-San Luis Obispo Creek @ Cuesta Park
2007	31024	San Luis Obispo Creek	310SLM	310SLM-San Luis Obispo Creek @ Mission Plaza
2007	31024	San Luis Obispo Creek	310SLV	310SLV-San Luis Obispo Creek @ Los Osos Valley Road
2007	31024	Stenner Creek	310SCN	310SCN-Stenner Creek @ Nipomo street
2007	31025	Coon Creek	310COO	310COO - Coon Creek @ Pecho Valley Road
2007	31031	Arroyo Grande Creek	310AGB	310AGB-Arroyo Grande Creek @ Biddle Park
2007	31031	Arroyo Grande Creek	310AGF	310AGF-Arroyo Grande Creek @ Fair Oaks
2007	31031	Arroyo Grande Creek	310AGS	310AGS-Arroyo Grande Creek @ Strother Park
2007	31031	Los Berros Creek	310BER	310BER-Los Berros Creek @ Valley Road
Ongoing	30411	Scott Creek	304SCO	304SCO-Scott Creek lagoon
Ongoing	30411	Waddell Creek	304WAD	304WAD-Waddell Creek lagoon
Ongoing	30412	San Lorenzo River	304LOR	304LOR-San Lorenzo Estuary
Ongoing	30413	Aptos Creek	304APT	304APT-Aptos Creek lagoon
Ongoing	30413	Soquel Creek	304SOQ	304SOQ-Soquel Creek lagoon
Ongoing	30420	Gazos Creek	304GAZ	304GAZ-Gazos Creek Lagoon
Ongoing	30510	Pajaro River	305THU	305THU-Pajaro River @ Thurwachter Bridge
Ongoing	30700	Carmel River	307CML	307CML-Carmel River @ Highway 1
Ongoing	30800	Big Creek	308BGC	308BGC-Big Creek @ Highway 1
Ongoing	30800	Big Sur River	308BSR	308BSR-Big Sur River @ Andrew Molera
Ongoing	30800	Willow Creek	308WLO	308WLO-Willow Creek @ Highway 1
Ongoing	30910	Old Salinas River	309OLD	309OLD-Old Salinas River @ Monterey Dunes Way
Ongoing	30910	Salinas River (Lower)	309DAV	309DAV-Salinas River @ Davis Road
Ongoing	30910	Tembladero Slough	309TDW	309TDW-Tembladero Slough @ Monterey Dunes Way
Ongoing	31012	Arroyo de la Cruz Creek	310ADC	310ADC-Arroyo de la Cruz @ Highway 1
Ongoing	31013	San Simeon Creek	310SSC	310SSC-San Simeon Creek @ State Park foot bridge
Ongoing	31014	Santa Rosa Creek	310SRO	310SRO-Santa Rosa Creek @ Moonstone Drive
Ongoing	31022	Chorro Creek	310TWB	310TWB-Chorro Creek @ South Bay Boulevard
Ongoing	31024	San Luis Obispo Creek	310SLO	310SLO-San Luis Obispo Creek @ lagoon
Ongoing	31025	San Luis Obispo Creek	310SLB	310SLB-San Luis Obispo Creek @ San Luis Bay Drive
Ongoing	31026	Pismo Creek	310PIS	310PIS-Pismo Creek above Highway 101

Rotation Year	Hydrologic Sub Area	WaterBody	Site Tag	Site Name
Ongoing	31031	Arroyo Grande Creek	310ARG	310ARG-Arroyo Grande Creek @ 22nd Street
Ongoing	31210	Santa Maria River	312SMA	312SMA-Santa Maria River @ Estuary
Ongoing	31300	San Antonio Creek	313SAC	313SAC-San Antonio Creek @ Rail Road Bridge, u/s lagoon
Ongoing	31410	Santa Ynez River(lower)	314SYN	314SYN-Santa Ynez River @ 13th Street
Ongoing	31510	Canada de la Gaviota	315GAV	315GAV-Canada de la Gaviota @ State Park entrance
Ongoing	31531	Atascadero Creek(315)	315ATA	315ATA-Atascadero Creek @ Ward Drive
Ongoing	31532	Arroyo Burro Creek	315ABU	315ABU-Arroyo Burro Creek @ Cliff Drive
Ongoing	31532	Mission Creek	315MIS	315MIS-Mission Creek @ Montecito Street
Ongoing	31534	Carpinteria Creek	315CRP	315CRP-Carpinteria Creek @ 6th Street
Ongoing	31534	Franklin Creek	315FRC	315FRC-Franklin Creek @ Carpenteria Avenue
Ongoing	31534	Rincon Creek	315RIN	315RIN-Rincon Creek @ Bates Road, u/s Highway 101

3. Objectives

Table 2 indicates the relationship between monitoring types and beneficial uses recognized in the Central Coast Basin Plan. Monitoring approaches currently employed by CCAMP are shown in bold. Though the program will become more robust as additional monitoring approaches are added, the current suite of monitoring activities address all beneficial uses to some degree. Virtually all primary rivers and streams and their immediate tributaries in Region 3 are designated for cold water fisheries, commercial and sport fishing, contact and non-contact recreation, groundwater recharge, municipal and domestic supply, spawning, and migration beneficial uses. Many also support threatened and endangered species and biological habitats of special significance. Because these important beneficial uses tend to be universal in the Region and require most stringent water quality objectives, the CCAMP suite of indicators targets these beneficial uses particularly, and is intended to be applied uniformly to all sites.

The CCAMP program design includes monthly monitoring for conventional water quality (CWQ) at all sites. At a subset of sites, generally selected based on hydrogeomorphological considerations or special interest, other monitoring approaches are applied. These include sediment chemistry and toxicity, tissue chemistry, Rapid Bioassessment for benthic invertebrates, habitat assessment, and flow measurement. Other approaches which have not yet been applied but which will be included as funding increases include water column chemistry, sedimentation assessment, habitat assessment, geomorphology and remote sensing.

Table 2. Relationship between Beneficial Uses in Region 3 and Monitoring Activities (currently employed monitoring approaches are shown as X's)

	CWQ	Sed Chemistry	H2O Chemistry	Tissue Chemistry	Rapid Bioassessment	Toxicity	Geomorphology	Habitat	Remote Sensing	Flow	Sedimentation
Municipal & Domestic	X		+	X					+	X	
Estuarine Habitat	X	X	+	X	X	X	+	+	+	X	+
Marine Habitat	X	X	+	X	X	X	+	+	+		+
Wildlife Habitat	X	X	+	X	X	X	+	+	+	X	+
Biological Habitat of Special Significance	X	X	+	X	X	X	+	+	+	X	+
Rare & Endangered Species	X	X	+	X	X	X	+	+	+	X	+
Fish Migration	X	X	+	X	X	X	+	+	+	X	+
Fish Spawning	X	X	+	X	X	X	+	+	+	X	+
Shellfishing	X			X							
ASBS	X	X	+	X	X	X	+	+	+	X	+
Agricultural Supply	X	X	+							X	
Industrial Process Supply	X		+								
Industrial Service Supply	X								+		+
Groundwater Recharge	X		+				+		+	X	
Fresh Water Replenishment	X		+				+		+	X	
Navigation	X	X				X	+		+	X	+
Hydroelectric Power Generation	X						+		+	X	
Water Contact Recreation	X										
NonContact Recreation	X										
Commercial and Sport Fishing	X	X	+	X	X	X	+	+	+	X	
Aquaculture	X	X	+	X		X					
Warm Water Habitat	X	X	+	X	X	X	+	+	+	X	+
Coldwater Habitat	X	X	+	X	X	X	+	+	+	X	+

CCAMP Site-Specific Monitoring Objectives

The following objectives address questions posed in the SWAMP Site-Specific Monitoring Guidance related to beneficial use support. Though the program will become more robust as additional monitoring approaches are added, the current suite of monitoring activities address all objectives to some degree. Monitoring activities which address these objectives are indicated in Table 3.

Is it safe to swim?

Beneficial Use: Water Contact Recreation
Monitoring Approach: CWQ monthly monitoring for coliform organisms; compilation of other data sources

Objective(s): At sites throughout water bodies that are used for swimming, or that drain to areas used for swimming, screen for indications of bacterial contamination by determining percent of samples exceeding adopted water quality objectives, based on monthly samples collected over a year period in 5-year intervals.

Compile pathogen indicator data collected by local agencies and organizations into a single database to describe shoreline and creek mouth conditions, and screen for geographic indications of bacterial contamination by determining percent of samples exceeding adopted water quality objectives.

Is it safe to drink the water?

Beneficial Use: Municipal and Domestic Water Supply
Monitoring Approach: CWQ monthly sampling for coliform, nutrients, and minerals

Objective(s): At sites throughout water bodies that are sources of drinking water, screen for percent of samples of microbial or chemical contaminants that exceed drinking water standards or adopted water quality objectives used to protect drinking water quality, based on monthly samples collected over a year period in 5-year intervals.

At sites throughout water bodies that are sources of drinking water, estimate the concentration of microbial or chemical contaminants above and below screening values, drinking water standards, or adopted water quality objectives used to protect drinking water quality, based on monthly samples collected over a year period in 5-year intervals.

Is it safe to eat fish and other aquatic resources?

Beneficial Uses: Commercial and Sport Fishing, Shellfish Harvesting
Monitoring Approach: Annual fish and mussel tissue collection and chemical analysis through the State Mussel Watch Program, Toxic Substances Monitoring Program and Coastal Fish Contamination Program.

Objective(s): At sites located near the lower ends of streams and rivers, and in lakes, enclosed bays and estuaries, screen for contamination problems by estimating the concentration of chemical contaminants in fish and shellfish, and determining whether samples exceed several critical threshold values of potential human impact (advisory or action levels).

At long-term monitoring sites located near the lower ends of streams and rivers, in nearshore areas and in enclosed bays and estuaries, estimate the year-to-year concentration of chemical contaminants in fish and shellfish and determine whether samples exceed several critical threshold values of potential human impact (advisory or action levels).

At popular fishing locations at river mouths, lakes, nearshore waters, enclosed bays, and estuaries, screen for contamination problems by estimating the concentration of chemical contaminants in sport fish species and determining whether samples exceed several critical threshold values of potential human impact (advisory or action levels).

Are aquatic populations, communities, and habitats protected?

Beneficial Uses: Cold Freshwater Habitat; Preservation of Biological Habitats; Warm Freshwater Habitat; Wildlife Habitat

Monitoring Approach: Synoptic sampling for sediment and water column toxicity, sediment chemistry, and benthic invertebrate assemblages. Toxicity Identification Evaluation and/or chemistry follow-through for toxic sites.

Objective(s): At sites along the mainstem and at the lower ends of major tributaries of streams and rivers, screen for indications of water quality and sediment degradation using several critical threshold values of toxicity, benthic community analysis, habitat condition, and chemical concentration.

Beneficial Use: Rare, Threatened or Endangered Species; Spawning
Monitoring Approach: CWQ monthly sampling for dissolved oxygen, nutrients, turbidity, temperature. Pre-dawn sampling for dissolved oxygen sags. Toxicity sampling. Benthic invertebrate assemblage assessment.

Objective(s): At sites along the mainstem and at the lower ends of major tributaries of streams and rivers, screen for indications of water quality degradation for anadromous fish species, using fish toxicity testing, benthic community analysis, habitat condition, and physical and chemical water condition.

Is water safe for agricultural use?

Beneficial Use: Agricultural supply
Monitoring Approach: CWQ monthly sampling for nutrients, salts and TDS

Objective(s): At sites throughout waterbodies that are used for agricultural purposes, estimate concentrations of chemical pollutants above or below screening values or adopted water quality objectives used to protect agricultural uses, based on monthly samples collected over a year period in 5-year intervals.

Are aesthetic conditions of the water protected?

Beneficial Use: Non-Contact Water Recreation
Monitoring Approach: CWQ monthly qualitative assessment of % algal cover, presence of scum, odor, etc.

Objective(s): At sites throughout water bodies, estimate aesthetic condition above or below screening values used to protect non-contact water recreation, based on monthly samples collected over a year period in 5-year intervals.

Table 3. Program Objectives and monitoring activities which can address them

SWAMP Question	CWQ	SedChem	H2OChem	Tissue Chem	Rapid Bioassessment	Toxicity	Geomorphology	Habitat	Remote Sensing	Flow	Sedimentation
Safe to Swim	X										
Safe to Drink	X		+								
Safe to Eat Fish	X			X							
Aq. Pops Protected	X	X	+	X	X	X	+	X	+	X	+
Spawning	X	X	+		X	X	+	+		+	+
Flow	X				X		+	+		X	+
Ag Use	X										
Industrial Supply	X		+								
Non Contact Rec	X							+			

3.1 General study design

3.1.1. Overview of general approach

The Central Coast Ambient Monitoring Program (CCAMP) monitoring strategy for watershed characterization calls for dividing the Region into five watershed rotation areas and conducting synoptic, tributary based sampling each year in one of the areas. Over a five-year period all of the Hydrologic Units in the Region are monitored and evaluated. In addition to watershed rotation monitoring CCAMP also conducts monitoring at 32 coastal confluences throughout the region. CCAMP uses a tributary-based site selection approach for watershed rotation sites, additional monitoring sites are established in each rotation area to provide focused attention on watersheds and waterbodies known to have water quality impairments. The CCAMP strategy of establishing and maintaining permanent long term monitoring sites provides a framework for trend analysis and detection of emergent water quality problems. CCAMP uses a variety of monitoring approaches to characterize status and trends of coastal watersheds, including:

Rapid Bioassessment using benthic invertebrates
Conventional water quality analysis
Analysis of tissue, water, and sediment for organic chemicals and metals
Toxicity evaluations
Habitat assessments
Sedimentation evaluations

In order to develop a broad picture of the overall health of waters in Region 3, a similar baseline monitoring study design is applied in each watershed. This provides compatibility across the Region and allows for prioritization of problems across a relatively large spatial scale. However, it is important that each watershed analysis incorporate additional, watershed specific knowledge into the study design, so that questions which are narrower in focus can also be addressed. For example, in watersheds where Total Maximum Daily Load assessments are being undertaken, other program funds can be applied to support additional monitoring for TMDL development. Special studies are undertaken as funding and staffing permits to further focus monitoring on questions of interest specific in individual watersheds.

Watershed characterization involves three major components: acquisition and evaluation of existing data, monitoring of surface water and habitat quality, and developing a watershed assessment based on findings.

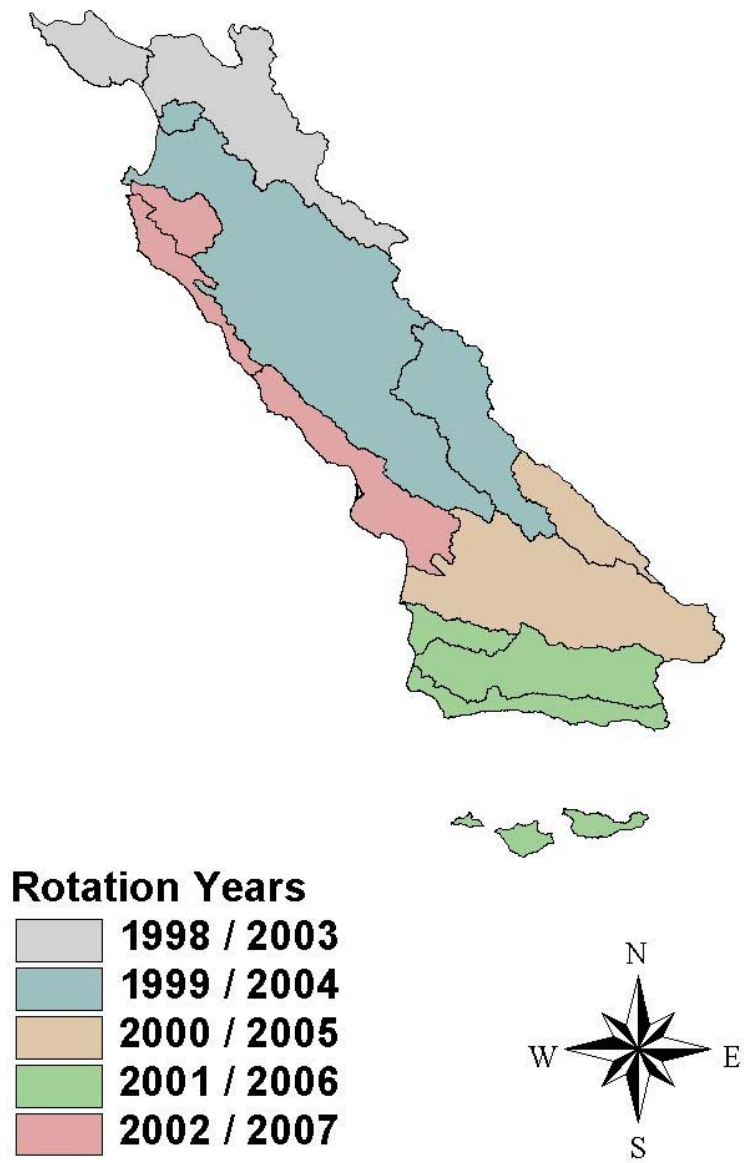
Initial Data Acquisition and Evaluation

Existing sources of data are evaluated for pollutants of concern, historic trends, data gaps, etc. These include Department of Health Services, USGS, Department of Fish and Game, Department of Pesticide Regulation, Toxic Substances Monitoring Program, STORET, NPDES discharge data, and other sources. Data from County, City, and other selected programs are acquired. Existing data is evaluated for standard exceedences, pollutant levels which warrant attention, beneficial use impairment, and other pertinent information.

Watershed Monitoring

In order to provide water body assessments on the USEPA mandated reporting cycle, the Region has been divided into five watershed groups based on scientific, logistic, and financial considerations. Figure 1 shows these watershed divisions. This component of the CCAMP study design involves collection of surface water quality and habitat data which will provide information at a level of detail suitable for assessment reporting requirements, including Clean Water Act 305(b) and 303(d), and for supporting various statewide programs and initiatives (e.g. Nonpoint Source Program, Watershed Management Initiative).

Figure 1. Watershed Rotation in Region 3



Sampling sites are located at the primary discharge point of the watershed, and at the discharge of each major tributary into the watercourse which drains the watershed. For the purposes of site selection a "major tributary" is defined as a watercourse which drains a minimum percentage of the rotation area or which is the major watercourse that drains a Hydrological Area, Hydrological Subarea, or watershed of special concern. Some sites are also located above and below areas of significant human activity, including urban development, agriculture, and point source discharges. Site selection is constrained by site accessibility. In order to provide safe, all-weather access, conventional water quality sites are located preferably at bridges where sampling devices can be suspended during periods of high flow. Benthic invertebrate sites are located upstream of conventional water quality sites, but out of the immediate influence of bridges. Other sampling activities are conducted at a subset of conventional water quality sites.

Basic characterization includes collection of water chemistry, sediment chemistry, toxicity, tissue bioaccumulation, habitat assessment, and bioassessment data, as well as acquisition of basic GIS data layers, where available, describing land use, geology, soils, discharge locations, known problem sites, etc.

Conventional Water Quality - Basic water quality parameters, including nutrients, fecal and total coliform, dissolved oxygen, turbidity, pH, chlorophyll *a*, major ions and conductivity, are collected once a month. Monthly sampling provides an opportunity to evaluate seasonal variability as well as a variety of flow conditions. This program is not designed to be a storm event monitoring program. Sampling is maintained on an even monthly interval without regard for timing of weather events. Even interval sampling permits use of certain time-series analysis techniques, such as the Mann-Kendall or seasonal Kendall tests described by the U.S. EPA National Monitoring Program (Monitoring Guidance for Determining the Effectiveness of Nonpoint Source Pollution Controls, EPA 1997).

A multianalyte probe is used to collect several of the parameters, including dissolved oxygen, pH, water temperature, turbidity, conductivity and chlorophyll *a*. Observations of air temperature, algal growth, scum, odor, and other indications of water and habitat conditions are also recorded. Flow is estimated using a number of means. Whereever possible, sites are located near existing county and USGS gages. Flow is estimated elsewhere using cross-sectional flow measurements (pygmy gurley) or stream stage and calibrated discharge curves. In some locations flow measurements are not possible, and watershed modeling techniques are used to estimate flow. Water samples are bottled as appropriate and held at $4^{o}C$, before being transferred to a commercial laboratory for analysis. Chain-of-Custody documentation is maintained for all samples. Quality assurance procedures at the laboratory are consistent with SWAMP approved quality assurance requirements and follow U.S. EPA approved methods (BC Laboratories, 1998). Water quality parameters collected on a monthly basis are shown in Table 5.

Tissue Bioaccumulation - Fish or shellfish samples are collected to assess presence of chemicals which bioaccumulate in tissues. Sampling sites are generally located at the confluences of major tributaries and on the main stem. Corbicula clams or surrogate bioaccumulators are placed at selected sites during winter runoff by the State Mussel Watch Program. Clams are generally transplanted from the Russian River and held at Aptos Creek until deployment. They are placed in mesh bags at each station and secured to a rebar stake pounded into the substrate. Clams remain in the creeks for a minimum of four weeks before retrieval. The standard analyte list for the State Mussel Watch Program and Toxic Substances Monitoring Program is shown in Table 6.

Table 5. Analytes for Monthly Conventional Water Quality Data Collection

Analyte	Units	Typical MDL
pH	pH units	n/a
Conductivity	US/cm	1.0
Turbidity	NTU	0.1
Dissolved Oxygen	Ppm	0.01
Oxygen Saturation	% Saturation	n/a
Water Temperature	Celsius	n/a
Air Temperature	Celsius	n/a
Total Coliform Bacteria	MPN/100 ml	2
Fecal Coliform Bacteria	MPN/100 ml	2
Nitrate-N	mg/l	0.02
Nitrite-N	mg/l	0.01
Total Kjeldahl Nitrogen	mg/l	0.1
Ammonia-NH_3	mg/l	0.02
Ortho Phosphate	mg/l	0.01
Total Phosphate	mg/l	0.06
Chlorophyll a	ug/l	0.1
Total Suspended Solids	mg/l	0.5
Fixed Suspended Solids	mg/l	0.5
Total Dissolved Solids	mg/l	4.0
Fixed Dissolved Solids	mg/l	4.0
Volatile Solids	mg/l	5.0
Volatile Suspended Solids	mg/l	0.5
Salinity	mg/l	1
$CaCO_3$	mg/l	5
Chloride	mg/l	0.06
Boron	mg/l	0.05
Calcium	mg/l	0.01
Magnesium	mg/l	0.02
Sodium	mg/l	0.06
Corridor Shading	%	n/a
Algal Cover	%	n/a
Plant Cover	%	n/a
Flow	cfs	n/a

Table 6. Trace Metals, Synthetic Organic Compounds, and Polynuclear Aromatic Hydrocarbons Analyzed by the State Mussel Watch Program

Trace Elements	
Aluminum	Nickel
Arsenic	Lead
Cadmium	Selenium
Chromium	Silver
Copper	Titanium
Mercury	Zinc
Manganese	
Synthetic Organic Compounds	
aldrin	ethion
cis-chlordane	HCH, alpha
trans-chlordane	HCH, beta
chlordene, alpha	HCH, gamma
chlordene, gamma	HCH, delta
chlorpyrifos	heptachlor
dacthal	heptachlor epoxide
DDD, o, p'	HCB
DDD, p, p'	methoxychlor
DDE, o, p'	cis-nonachlor
DDE, p, p'	trans-nonachlor
DDMU, p, p'	oxadiazon
DDT, o, p'	oxychlordan
DDT, p, p'	parathion, ethyl
diazinon	parathion, methyl
dichlorobenzophenone-p, p'	PCB 1248
dicofol (Kelthane)	PCB 1254
dieldrin	PCB 1260
endosulfan I	tetradifon (Tedion)
endosulfan II	toxaphene
endrin	
Polynuclear Aromatic Hydrocarbons (PAHs)	
naphthalene	fluoranthene
1-methylnaphthalene	pyrene
2-methylnaphthalene	benz[a]anthracene
biphenyl	chrysene
2,6-dimethlynaphthalene	benzo[b]fluoranthene
acenaphthylene	benzo[k]fluoranthene
2,3,5-trimethylnaphthalene	benzo[e]pyrene
fluorene	benzo[a]pyrene
phenanthrene	perylene
anthracene	indeno[1,2,3-cd]pyrene
1-methylphenanthrene	dibenz[a,h]anthracene
benz[ghi]perylene	

Benthic Macroinvertebrate Sampling - Benthic macroinvertebrate assemblages are indicators of stream health. Different species of invertebrates respond differently to water pollution and habitat degradation and provide information on biological integrity.

Benthic invertebrate communities are sampled using California Rapid Bioassessment Protocols and quality assurance guidance for non-point source assessments (Harrington, 1996). Three riffle locations are selected randomly from within stream reaches associated with water and sediment sampling. Benthic invertebrates are collected in spring at selected sites. When stream morphology limits riffle habitat, a low gradient protocol is adopted which includes sampling of stream margins. The creek reach of interest is characterized according to geomorphic parameters, including bankful width, slope, drainage area, upstream river miles, particle size and other features. Geomorphic characteristics are considered during data evaluation.

Physical habitat quality is assessed at each sampling reach according to state protocols, using scoring as indicated in Table 7. This assessment is qualitative in nature and can be subjective. Therefore, field crews intercalibrate their assessments prior to conducting field work.

Table 7. Habitat Parameters used to assess habitat quality, from California Rapid Bioassessment Protocols

Habitat Parameter	**Condition**			
	Excellent	**Good**	**Fair**	**Poor**
Primary-Substrate and Instream Cover				
1. Instream Cover	16-20	11-15	6-10	0-5
2. Epifaunal Substrate	16-20	11-15	6-10	0-5
3. Embeddedness	16-20	11-15	6-10	0-5
4. Channel Flow	16-20	11-15	6-10	0-5
Secondary - Channel Morphology				
5. Channel Alteration	16-20	11-15	6-10	0-5
6. Sediment Deposition	16-20	11-15	6-10	0-5
7. Riffle Frequency	16-20	11-15	6-10	0-5
Tertiary - Riparian and Bank Vegetation				
8. Bank Vegetation	16-20	11-15	6-10	0-5
9. Bank Stability	16-20	11-15	6-10	0-5
10. Riparian Zone	16-20	11-15	6-10	0-5
TOTALS	**151-200**	**101-150**	**51-100**	**0-50**

Sediment Chemistry - Sediment samples are collected at each Rapid Bioassessment site, and are analyzed by a commercial laboratory. Sampling targets fine grain sediments. Laboratory analysis includes particle size distribution, as well as Total Organic Carbon. Laboratory analysis includes the parameters listed in Table 8.

Table 8. Analyte List for Sediment Samples

Analyte	EPAMethod	Units		Analyte	EPAMethod	Units
% Clay	Plumb	%		Benzo(k)fluoranthene	8270B	ug/Kg
% Sand	Plumb	%		beta-BHC	8080A	ug/Kg
% Silt	Plumb	%		Chrysene	8270B	ug/Kg
% Solids	160.3	%		delta-BHC	8080A	ug/Kg
Azinphos-methyl	8140	ug/Kg		Dibenzo(a,h)anthracene	8270B	ug/Kg
Bolstar	8140	ug/Kg		Dieldrin	8080A	ug/Kg
Cadmium	6020	mg/kg		Endosulfan-I	8080A	ug/Kg
Chlorpyrifos	8140	ug/Kg		Endosulfan-II	8080A	ug/Kg
Chromium	6020	mg/kg		Endosulfan-Sulfate	8080A	ug/Kg
Copper	6020	mg/kg		Endrin	8080A	ug/Kg
Coumaphos	8140	ug/Kg		Endrin Aldehyde	8080A	ug/Kg
Demeton-O	8140	ug/Kg		Endrin Ketone	8080A	ug/Kg
Demeton-S	8140	ug/Kg		Flouranthene	8270B	ug/Kg
Diazinon	8140	ug/Kg		Flourene	8270B	ug/Kg
Dichlorvos	8140	ug/Kg		gamma-BHC	8080A	ug/Kg
Disulfoton	8140	ug/Kg		gamma-Chlordane	8080A	ug/Kg
Ethoprop	8140	ug/Kg		Heptachlor	8080A	ug/Kg
Fensulfothion	8140	ug/Kg		Heptachlor-Epoxide	8080A	ug/Kg
Fenthion	8140	ug/Kg		Indeno(1,2,3-cd)pyrene	8270B	ug/Kg
Lead	6020	mg/kg		Methoxychlor	8080A	ug/Kg
Mercury	7471	mg/kg		Naphthalene	8270B	ug/Kg
Merphos	8140	ug/Kg		PCBs	8080A	ug/Kg
Mevinphos	8140	ug/Kg		Phenanthrene	8270B	ug/Kg
Naled	8140	ug/Kg		Pyrene	8270B	ug/Kg
Nickel	6020	mg/kg		Toxaphene	8080A	ug/Kg
Parathion-methyl	8140	ug/Kg		4,4'-DDD	608	ug/L
Particle Size Wt.(<0.002mm)	Plumb	gm		4,4'-DDE	608	ug/L
Particle Size Wt.(>.0156mm)	Plumb	gm		4,4'-DDT	608	ug/L
Particle Size Wt.(>0.002mm)	Plumb	gm		Aldrin	608	ug/L
Particle Size Wt.(>0.0039mm)	Plumb	gm		alpha-BHC	608	ug/L
Particle Size Wt.(>0.0078mm)	Plumb	gm		alpha-Chlordane	608	ug/L
Particle Size Wt.(>0.0313mm)	Plumb	gm		Azinphos-methyl	614	ug/L
Particle Size Wt.(>0.0625mm)	Plumb	gm		beta-BHC	608	ug/L
Particle Size Wt.(>0.125mm)	Plumb	gm		Cadmium	200.8	ug/L
Particle Size Wt.(>0.25mm)	Plumb	gm		Chromium	200.8	ug/L
Particle Size Wt.(>0.5mm)	Plumb	gm		Copper	200.8	ug/L
Particle Size Wt.(>16mm)	Plumb	gm		delta-BHC	608	ug/L
Particle Size Wt.(>1mm)	Plumb	gm		Demeton-O	614	ug/L
Particle Size Wt.(>2mm)	Plumb	gm		Diazinon	614	ug/L
Particle Size Wt.(>32mm)	Plumb	gm		Dieldrin	608	ug/L
Particle Size Wt.(>4mm)	Plumb	gm		Disulfoton	614	ug/L
Particle Size Wt.(>8mm)	Plumb	gm		Endosulfan-I	608	ug/L
Phorate	8140	ug/Kg		Endosulfan-II	608	ug/L
Ronnel	8140	ug/Kg		Endosulfan-Sulfate	608	ug/L
Stirphos	8140	ug/Kg		Endrin	608	ug/L
Tokuthion	8140	ug/Kg		Endrin Aldehyde	608	ug/L
Trichloronate	8140	ug/Kg		Endrin Ketone	608	ug/L
Weight Coarse	Plumb	gm		Ethion	614	ug/L
Weight Fine	Plumb	gm		gamma-BHC	608	ug/L
Weight Total	Plumb	gm		gamma-Chlordane	608	ug/L

Analyte	EPAMethod	Units		Analyte	EPAMethod	Units
Zinc	6020	mg/kg		Hardness	130.2	mg/L
4,4'-DDD	8080A	ug/Kg		Heptachlor	608	ug/L
4,4'-DDE	8080A	ug/Kg		Heptachlor-Epoxide	608	ug/L
4,4'-DDT	8080A	ug/Kg		Lead	200.8	ug/L
Acenaphthene	8270B	ug/Kg		Malathion	614	ug/L
Acenaphthylene	8270B	ug/Kg		Mercury	200.8	ug/L
Aldrin	8080A	ug/Kg		Methoxychlor	608	ug/L
alpha-BHC	8080A	ug/Kg		Nickel	200.8	ug/L
alpha-Chlordane	8080A	ug/Kg		Parathion-ethyl	614	ug/L
Antracene	8270B	ug/Kg		Parathion-methyl	614	ug/L
Benzo(a)fluoranthene	8270B	ug/Kg		PCBs	608	ug/L
Benzo(a)pyrene	8270B	ug/Kg		Toxaphene	608	ug/L
Benzo(b)fluoranthene	8270B	ug/Kg		Zinc	200.8	ug/L
Benzo(g,h,i)perylene	8270B	ug/Kg				

Watershed Assessment

Monitoring data is evaluated in consideration of hydrogeomorphic information, land use information, and other data to develop a watershed scale assessment. The assessment is utilized to update the 305(b) report, 303(d) report, and support permit review and nonpoint source activities, etc. In addition to surface water quality, relationships between groundwater and surface water quality will be examined by Basin Planning staff.

Data is also used to develop recommendations for action and for future research and monitoring needs. For example, when benthic invertebrate sampling results indicate possible chemical impairment from upstream sources, sediment and/or water toxicity studies and Toxicity Identification Evaluations may be conducted to identify the nature of the problem and potential sources.

Watershed assessments are made available on the CCAMP web site. Data is also made available online, and can be downloaded for further analysis.

3.1.2. Water Quality Indicators

Table 9. List of indicators for CCAMP Monitoring

Beneficial Use	Monitoring Objectives[1]	Category	Indicator
Water Contact	1	Contaminant exposure	Total coliform bacteria Fecal coliform bacteria
Drinking Water	2 and 3	Contaminant exposure	Inorganic water chemistry Nutrients Total coliform bacteria Fecal coliform bacteria
Fish and Shellfish Contamin-ation	4, 5, 6, 7, and 8	Contaminant exposure	Fish tissue chemistry Shellfish tissue chemistry Fecal coliform bacteria in water
Aquatic Life	9, 10, 12, and 13	Biological response	Chlorophyll-a Macroinvertebrate assemblages Periphyton (qualitative) Sediment toxicity
		Pollutant exposure	Sediment toxicity Organic and inorganic sediment chemistry Total organic carbon Shellfish or fish tissue chemistry Nutrients Turbidity Inorganic water chemistry

[1] The number refers to the monitoring objective discussed in Attachment 1, SWAMP site-specific monitoring objectives.

Beneficial Use	Monitoring Objectives[1]	Category	Indicator
		Habitat	Dissolved oxygen Sediment grain size Sediment organic carbon Water flow Water temperature Channel morphology Instream structure Substrate composition Riparian vegetation Electrical conductivity Salinity Ammonia
Sufficient Flow	14 and 15	Habitat	Water flow Instream habitat Water temperature Dissolved Oxygen
		Biological response	Macroinvertebrate assemblages
Agricultural Supply	16 and 17	Pollutant Exposure	Inorganic chemistry Electrical conductivity
Industrial Supply	18 and 19	Pollutant Exposure	Organic and inorganic chemistry Temperature Electrical conductivity Turbidity
Aesthetic Condition	20 and 21	Pollutant Exposure	Presence of odor, scum, nuisance algae

Adapted from: SWRCB, 1993; SPARC, 1997; SCCWRP, 1998; Stephenson et al., 1994; CalEPA, 1998; CABW, 1998; CDFG, 1998; Noble et al., 1999; AB 982 Scientific Advisory Group, personal communication, August, 2000.

4. Specific Activities Planned For FY 2002-03: Specific technical approach and scope of work to be performed

The work planned for FY 2002-03 is described in this section. The scale of sampling activities may be modified based on available funding. Planned sampling includes funding from several sources other than SWAMP, including State Mussel Watch Program, Toxic Substances Monitoring Program, CCAMP Endowment, and State Mussel Watch Endowment.

Several special projects are anticipated, which will be funded through other sources and are not described in detail in this work plan. An assessment project in the Avila Beach area is being conducted to determine the extent for contamination by petroleum byproducts there, as a followup to UNOCAL cleanup activities. Another project is being conducted to examine the effectiveness of using the Department of Pesticide Regulation's Pesticide Application database for preselecting sites which are most likely to be impaired by toxicity. Depending on the outcome of this study, the method may be applied in the future for selecting a subset of SWAMP monitoring sites to conduct more detailed toxicity and chemistry evaluations. Finally, funds are supporting work by the California Department of Fish and Game to analyze sea otter tissues for bioaccumulated chemicals. This work will complement CDFG's pathology analysis and data will ultimately be used to determine if high tissue burdens of chemicals are associated with impaired immune function and increased rates of mortality from disease.

4.1. Water Bodies to be sampled in FY 2002-03

Table 10 includes a list of water bodies to be sampled in FY 2002-03. Several of the water bodies listed below are sampled only at the creek mouth, particularly sites located on small coastal streams or those sampled as part of the Coastal Confluences project. Figure 2 shows the spatial distribution of sites to be sampled in FY 2002-2003. Coastal confluences monitoring occurs at 32 creek and river mouths throughout the region. Figure 3 shows the location of sites in the Pajaro/ North Coast watershed rotation.

Table 10. Water bodies to by sampled during FY 2002-03 sampling rotation.

Rotation Year	Hydrologic Sub Area	WaterBody
2002	30700	Carmel River
2002	30700	Tularcitos Creek
2002	30800	Big Sur River
2002	30800	Garapata Creek
2002	30800	Limekiln Creek
2002	30800	Little Sur River
2002	30800	Mill Creek
2002	30800	San Jose Creek
2002	31011	San Carpoforo Creek
2002	31013	Pico Creek
2002	31013	San Simeon Creek
2002	31014	Santa Rosa Creek
2002	31015	Villa Creek
2002	31016	Cayucos Creek
2002	31017	Old Creek
2002	31018	Toro Creek
2002	31021	Morro Creek
2002	31022	Chorro Creek
2002	31024	Prefumo Creek
2002	31024	San Luis Obispo Creek
2002	31024	Stenner Creek
2002	31025	Coon Creek
2002	31031	Arroyo Grande Creek
2002	31031	Los Berros Creek
2003	30411	Scott Creek
2003	30412	Bear Creek
2003	30412	Boulder Creek
2003	30412	Branciforte Creek
2003	30412	Newell Creek
2003	30412	San Lorenzo River
2003	30412	Zayante Creek
2003	30413	Aptos Creek
2003	30413	Soquel Creek
2003	30413	Soquel Creek
2003	30413	Valencia Creek
2003	30510	Corralitos Creek
2003	30510	Harkins Slough
2003	30510	Pajaro River
2003	30520	Pajaro River
2003	30530	Pajaro River
2003	30510	Salsipuedes Creek
2003	30510	Watsonville Slough
2003	30530	Llagas Creek
2003	30530	Tequisquita Slough
2003	30530	Uvas Creek
2003	30540	Pacheco Creek
2003	30550	San Benito River
2003	30550	Tres Pinos Creek
Ongoing	30411	Scott Creek
Ongoing	30411	Waddell Creek
Ongoing	30412	San Lorenzo River
Ongoing	30413	Aptos Creek
Ongoing	30413	Soquel Creek
Ongoing	30420	Gazos Creek
Ongoing	30510	Pajaro River
Ongoing	30700	Carmel River
Ongoing	30800	Big Creek
Ongoing	30800	Big Sur River
Ongoing	30800	Willow Creek
Ongoing	30910	Old Salinas River
Ongoing	30910	Salinas River (Lower)
Ongoing	30910	Tembladero Slough
Ongoing	31012	Arroyo de la Cruz Creek
Ongoing	31013	San Simeon Creek
Ongoing	31014	Santa Rosa Creek
Ongoing	31022	Chorro Creek
Ongoing	31024	San Luis Obispo Creek
Ongoing	31026	Pismo Creek
Ongoing	31031	Arroyo Grande Creek
Ongoing	31210	Santa Maria River
Ongoing	31300	San Antonio Creek
Ongoing	31410	Santa Ynez River(lower)
Ongoing	31510	Canada de la Gaviota
Ongoing	31531	Atascadero Creek(315)
Ongoing	31532	Arroyo Burro Creek
Ongoing	31532	Mission Creek
Ongoing	31534	Carpinteria Creek
Ongoing	31534	Franklin Creek
Ongoing	31534	Rincon Creek

Figure 2 - Monitoring sites, FY 2002-2003

(Sites included in the rotation year 2001/2002 are shown as triangles, sites included in the rotation year 2002/2003 are shown as circles and sites samples as part of the Coastal Confluences are shown as squares.)

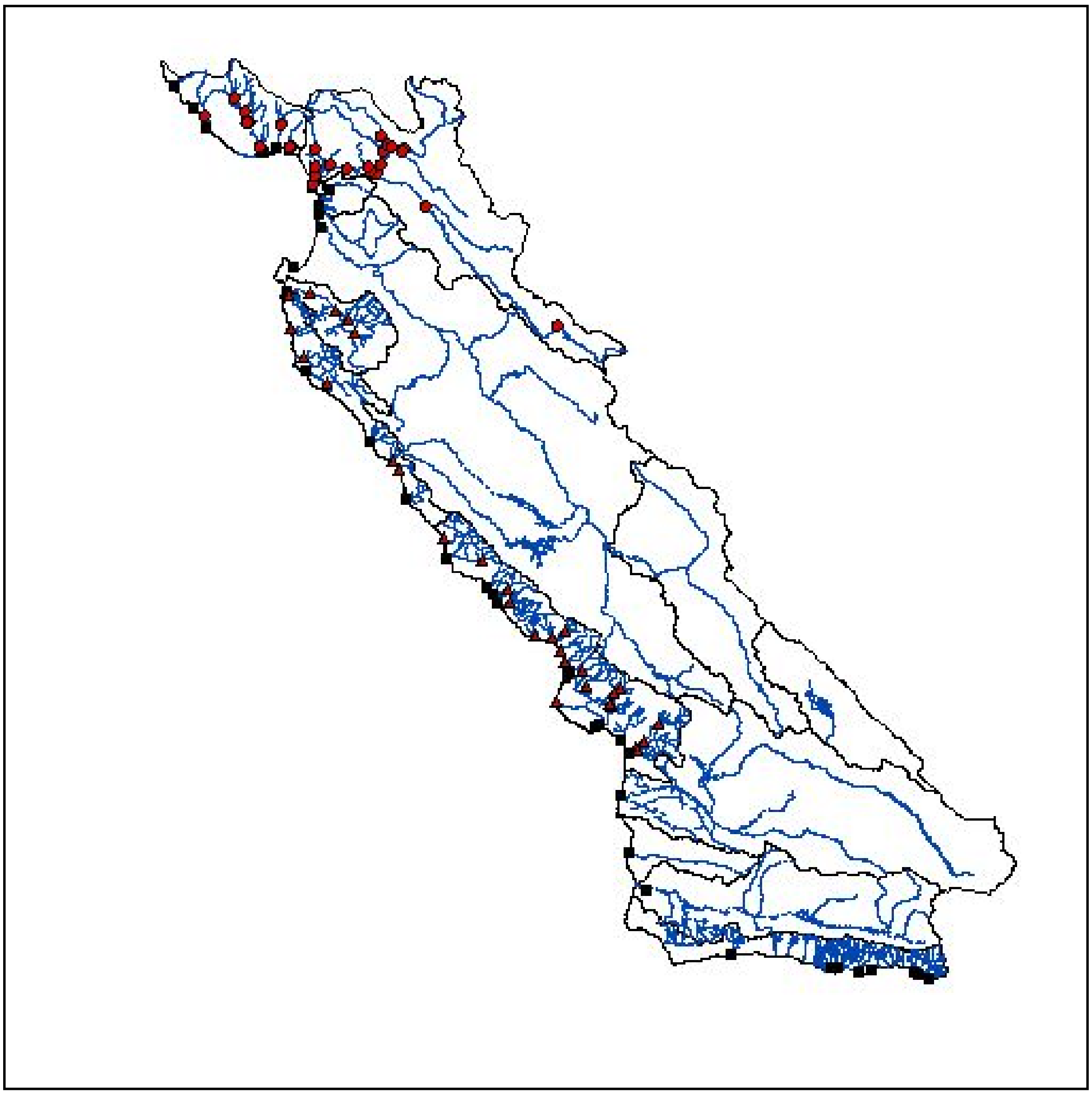
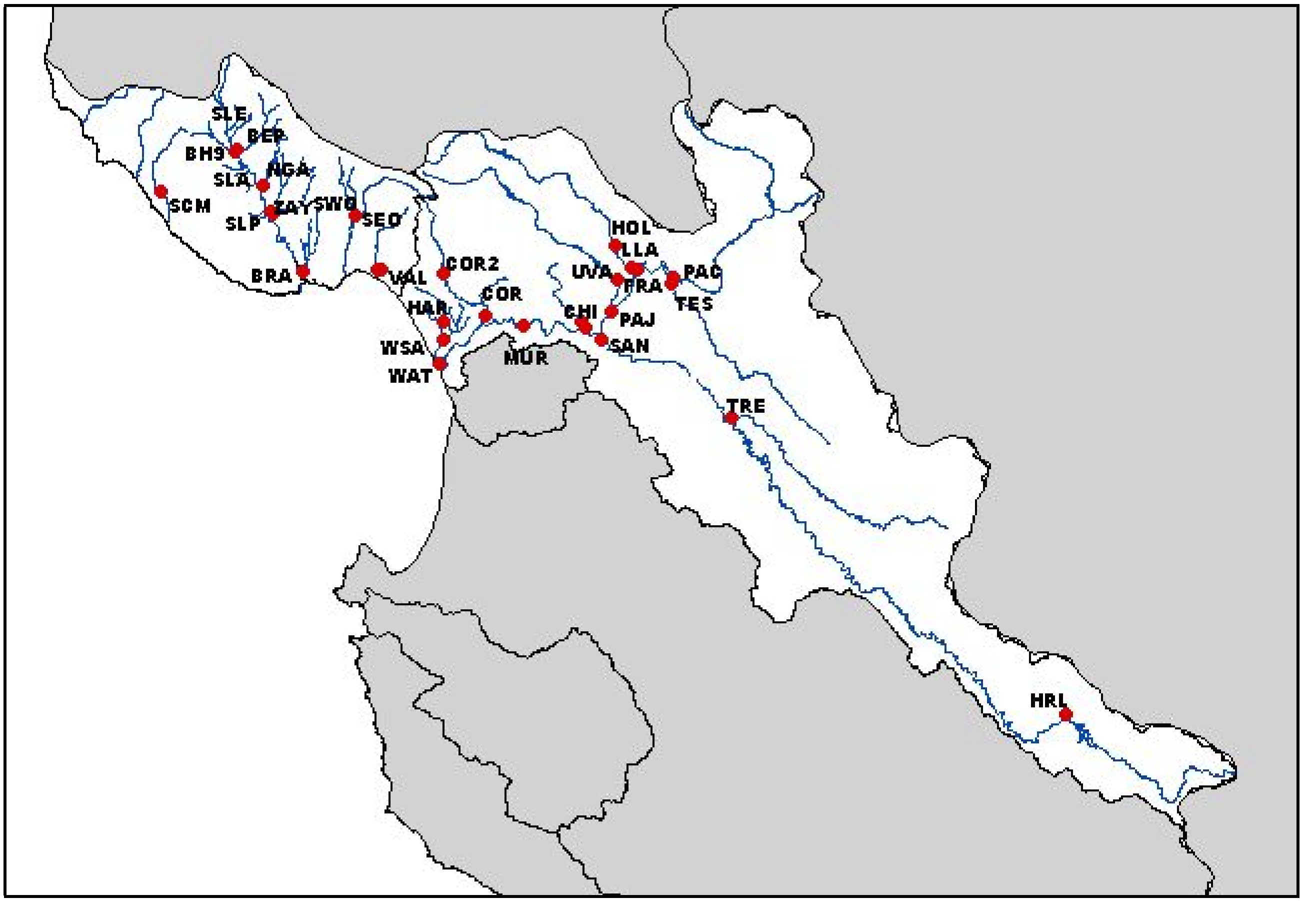


Figure 3 – Sites in the Pajaro/North Coast Watershed Rotation



4.2. Review of available information

The 2002 Watershed Characterization area is a complex one. The northern most watersheds are relatively small, coastal watersheds, such as Gazos Creek in San Mateo County, and Waddell, Scott, and Davenport creeks in northern Santa Cruz county. Most of these creeks support important steelhead and cojo salmon runs, have relatively little urban development and row crop agriculture, and have relatively good water quality. Timber Harvest tends to be an important issue in these watersheds because of the extensive fir and redwood forests found in this part of the region. The San Lorenzo River in the vicinity of the City of Santa Cruz is a much larger system, which flows through the City of Santa Cruz. Aptos and Soquel Creeks, south of the San Lorenzo, have modest development in the lower watersheds and timber harvest in the upper watersheds. The Pajaro Watershed is a very large and complex watershed, with extensive areas of row crop agriculture, several urban areas, diverse climate, and a multiplicity of water quality issues. Larger watersheds will be described in more detail below. Extensive literature is available for San Lorenzo and Pajaro watersheds. Much less background information is available for some of the smaller watersheds.

Table 11 summarizes monitoring activities which are underway in the Pajaro/North Coast watershed rotation area.

Pajaro River Watershed – Hydrologic Unit 305

The Pajaro River watershed, unlike other watersheds in the 2002 watershed rotation area, was sampled by the CCAMP program in 1998. This was the first watershed sampled by CCAMP, and because of limited resources, other more northerly watersheds in the rotation area were not sampled at that time. Much of the following description of water quality issues stems from data collected by CCAMP in 1998.

The Pajaro watershed, and waterbodies contained within it, are listed on the 1998 303(d) list as follows:

Pajaro River	Nutrients Sedimentation
Watsonville Slough	Oil and Grease Metals Sedimentation Pathogens Pesticides
Llagas Creek	Nutrients Sedimentation
Rider Gulch	Sedimentation
San Benito River	Sedimentation
Clear Creek	Mercury
Hernandez Reservoir	Mercury
Schwan Lake	Nutrients Pathogens

General Watershed Description - The Pajaro River watershed encompasses over 1,300 square miles of central California. The major direct tributaries to the Pajaro River include San Benito River, Tequisquita Slough, Pacheco Creek, Llagas Creek, Uvas Creek, and Corralitos Creek (See Figure 1 for a map of the Pajaro River watershed). The Pajaro River flows to Monterey Bay.

The Pajaro River watershed encompasses parts of four counties: San Benito County (about 65% of the watershed area), Santa Clara County (about 20% of the watershed), Santa Cruz County (about 10% of the watershed) and Monterey County (less than 5% of the watershed). There are five incorporated cities within the watershed: Watsonville, Gilroy, Morgan Hill, Hollister, and San Juan Bautista. The Pajaro River watershed contains a wide variety of land uses, including row crop agriculture, livestock grazing, forestry, industrial, and rural/urban residential. The watershed also contains significant amounts of natural vegetative cover, which provides habitat to numerous native bird and wildlife species.

Pajaro River watershed flow patterns are characteristic of a Mediterranean climate, with higher flows during the wetter, cooler winter months and low flows during the warmer, drier summer months. Principal water sources for the Pajaro River and its tributaries are surface runoff, springs, subsurface flow into the channels, and reclaimed water entering the creek through percolation from water discharged by South County Regional Wastewater Authority (SCRWA). The first three water sources are subject to large flow variations due to climatic influences, while the discharge from the SCWRA tends to influence flow year-round.

Water Quality Findings - The Pajaro River watershed was monitored (water, sediment, and tissue samples) by the Central Coast Regional Water Quality Control Board (RWQCB) and subcontract laboratories from December 1997 through January 1999 to assess the relative contribution of conventional pollutants (nutrients, sediment, etc.), toxins, metals, and other pollutants from major tributary streams to document ambient water quality. The water quality monitoring design followed the "watershed characterization" approach adopted by the RWQCB Central Coast Ambient Monitoring Program (CCAMP). Water quality monitoring stations for the Pajaro River watershed Characterization were selected using the CCAMP tributary-based approach. Stations were located along the main stem of the Pajaro River and at the lower end of each major tributary. Additional stations were placed on Llagas Creek to support Total Maximum Daily Load (TMDL) development.

On a monthly basis, the Regional Water Quality Control Board, Central Coast Region (RWQCB) collected water samples at numerous sites (see Table 1) in the Pajaro River watershed. The water samples were analyzed for nutrients (nitrogen and phosphorus), pH, temperature, dissolved oxygen, total dissolved solids, conductivity, turbidity, total suspended solids, total volatile solids, chlorophyll *a*, total coliform, and fecal coliform. During the water quality monitoring events, RWQCB staff documented field observations to assess eutrophic and/or aesthetic impairment conditions. Included in the field observations were percent terrestrial plant cover, algal cover, and habitat evaluation.

Chemical testing to determine the concentrations of synthetic organic chemicals and metals in sediment, in the water column, and in the tissue of aquatic organisms was conducted at a number of sites in the watershed. Twelve tissue sites, five sediment sites, and ten water chemistry sites were evaluated. At several sites clams (*Corbicula fluminea*), roach (*Hesperoleucus symmetricus*) and crayfish were also deployed to examine the relationships in chemical uptake in different species.

In addition to water, sediment, and tissue quality evaluation, ten sites in the Pajaro River and its tributaries were assessed for benthic invertebrate community structure using California Rapid Bioassessment Protocols.

Conventional Water Quality - CCAMP has documented levels of pH, nutrients (nitrate and ammonia), dissolved oxygen, and total dissolved solids in the Pajaro River watershed that do not meet Central Coast Water Quality Control Plan (Basin Plan) water quality criteria. CCAMP has also determined that other water quality parameters of concern include temperature, algae (attached and suspended), sediment, and bacteria.

Sedimentation has been documented as a problem in portions of the watershed in other studies (Balance Hydrologics, 1990; Phillip Williams and Associates, 1996; Golder, 1997). Much of this is due to bank sloughing, land slides of sandstone and shales in headwater areas, and sheet and rill erosion from adjacent land uses. The lower portion of the San Benito River is degrading as a result of gravel mining, and is in a state of disequilibrium, which can result in erosion of banks (Applied Science Engineering, et al, 1999). CCAMP monitoring in 1998 did not address instream impacts of sedimentation in a detailed way, but did assess sediment impacts as part of bioassessment habitat analysis. That ”snapshot” view indicated that lower Llagas Creek and the Pajaro River at Betabel Road were most severely impacted by sediment.

CCAMP monitoring documented specific violations of Basin Plan pH criteria (mean values greater than standard of 8.3 pH units) at two sites in the Pajaro River watershed (Tres Pinos Creek (305TRE) and Pajaro River at Frazier Lake Road (305FRA)). Limited pH data has been collected on the San Benito and Pajaro Rivers. Dynamac Corporation (1998) reported “background concentrations” of pH data collected in the San Benito River up stream and down stream of the confluence with Clear Creek (upper San Benito River) exceeded regulatory limits (pH values from 8.4 to 8.8). Similarly, Williamson (1994) documented a pH range of 7.8 to 9.3 at the Frazier Lake Road site. A report by Greenlee (1981) contained 1978 Pajaro River surface water data collected by the State Water Resources Control Board showing pH values ranging from 6.6 to 9.4. This range of pH values in the Pajaro River is supported by historical data from the Chittenden station (USGS and DWR data summarized by Williamson (1994)).

Water samples from three stations along the southern portion of Llagas Creek exceeded the State nitrate drinking water objective of 10 mg/L (NO_3 as N) on multiple occasions, and ranged as high as 31.7 mg/l at Holsclaw Road. Williamson (1994) reported similar elevated nitrate levels at two sampling stations (17.7 and 19.0 mg/L NO_3 as N) on Llagas Creek. Similarly, James Montgomery Consulting Engineers (1993) documented nitrate levels on Llagas Creek between 4.5 and 17.0 mg/L NO_3 as N. Historical data (1955 through 1991) from various stations on Llagas Creek show nitrate levels on Llagas Creek ranging between 0.1 and 10.3 mg/L NO_3 as N (sources include USGS 1982 – 1990 Water Resources Data Reports, Regional Water Quality Control Board 1983 Staff Report, Department of Water Resources). Haase (Appled Science Engineering et al., 1999) theorized that a reducing substance was infiltrating into the reach where seepage from the City of Gilroy’s treatment plant is prevalent (from Holsclaw Road downstream to Bloomfield Road), because of the declining nitrate levels and sometimes increased ammonia levels across this reach.

The Basin Plan standard of 0.025 mg/L NH3 as N was exceeded once at the Tequisquita Slough (305TES) site reaching 0.072 mg/L NH3 as N. Limited ammonia data has been collected in the Pajaro River watershed. James Montgomery Consulting Engineers (1993) documented ammonia levels on Llagas Creek between 0.0007 and 0.0014 mg/L NO_3 as N. Williamson (1994) reported similar ammonia levels (a limited review of the data revealed ammonia levels from 0.011 to 0.032 mg/L NH3 as N) at six sampling stations in the Pajaro River watershed. The levels documented are typically below the 0.025 mg/l NH3 as N limit and indicate no problem with ammonia toxicity.

Over 35 violations of Basin Plan dissolved oxygen criteria for the COLD beneficial use (minimum values less than standard of 7.0 mg/L) were observed at twelve sites in the Pajaro River watershed. Williamson (1994) reported similar dissolved oxygen levels (a limited review of the data revealed 11 dissolved oxygen measurements below 7.0 mg/L) at six sampling stations (four on Llagas Creek and two on the Pajaro River) in the Pajaro River watershed. James Montgomery Consulting Engineers (1993) also documented 16 dissolved oxygen measurements below 7.0 mg/L on Llagas Creek, Miller Canal, and Pajaro River. The Greenlee (1981) report containing 1978 Pajaro River surface water data collected by the State Water Resources Control Board documented one instance of dissolved oxygen below 7.0 mg/L.

Three violations of Basin Plan dissolved oxygen criteria for the WARM beneficial use (minimum values less than standard of 5.0 mg/L for WARM) were observed at the Tequisquita Slough (305TES) site in the Pajaro River watershed. Of the data reviewed, no others documented dissolved oxygen levels lower than this value in water bodies designated as WARM.

All but two sites sampled in the Pajaro River watershed had samples that violated the Basin Plan oxygen saturation criteria of 85 percent at some point during 1998. Many of the sites had multiple violations, with the Tequisquita Slough (305TES) site and the Pajaro River sites at Betabel Road (305PAJ) and Thurwachter Bridge (305THU) violating the oxygen saturation criteria 50 percent of the time. Of other data sources reviewed, none recorded oxygen saturation levels.

Average Total Dissolved Solids (TDS) levels, at all Llagas Creek sites, exceeded Basin Plan surface water quality objective of 200 mg/L. On the San Benito River, at the Y Road (305SAN) site, TDS levels exceeded the Basin Plan surface water quality objective of 1400 mg/L in September and October 1998. TDS values at the lower Pajaro River sites at Chittenden Gap (305CHI) and Murphy's Crossing (305MUR) reached or exceeded Basin Plan surface water quality objective of 1000 mg/L for TDS in August, September, and October 1998.

James Montgomery Consulting Engineers (1993) documented a range of average TDS values of 736 to 848 mg/L on Llagas Creek. Only two samples out of 25 collected were below the water quality objective of 200 mg/L. James Montgomery Consulting Engineers (1993) also observed an average range of TDS values of 829 to 839 mg/L on Pajaro River. The average TDS values reported for this section of the Pajaro River were below the Basin Plan surface water quality objective of 1000 mg/L. However, six individual TDS measurements were over the water quality objective of 1000 mg/L.

<u>Metals</u> – State Mussel Watch Program tissue data collected during the 1998 CCAMP sampling from the San Benito River Y Road (305SAN) site had the highest values of all sites for several different metals, notably aluminum, cadmium, chromium, copper, mercury, nickel, silver, and zinc, impying metals may be a problem in this watershed. Chromium, copper and zinc levels in tissue were high throughout the watershed compared to Median International Standards. Chromium levels were also elevated throughout the watershed in sediment samples. Chromium concentrations are commonly high in areas with serpentine soils.

Manganese levels in tissue were high throughout the Pajaro watershed overall compared to the Mussel Watch EDL 95 for transplanted freshwater clams, and in Llagas Creek samples were particularly high. Historical data from the Pajaro Valley Water Management Agency has shown manganese to also be elevated in Corralitos Creek (Applied Science Engineering et al.,1999)

On the Pajaro River at Betabel Road several metals (lead, copper, nickel and zinc) were above criteria in a single water sample taken in March. Metals data from the Chittendon Gap site on the Pajaro River have historically been elevated for both mercury and lead. Mercury and lead are also periodically elevated on Llagas Creek (Applied Science Engineering et al., 1999).

A management plan developed for Watsonville Slough identified copper, nickel and zinc at high levels in tissue and sediment in the slough (Questa Engineering, 1995). Lead at potentially toxic levels has also been detected repeatedly over the years (Applied Science Engineering et al., 1999).

Mercury was elevated over the California Toxics Rule water quality objective at sites on the San Benito watershed, in samples collected in water for CCAMP by the State Mussel Watch Program both on Clear Creek and on the San Benito River. It was also elevated (exceeding the NOAA ERL) in sediment in the upper San Benito watershed. There are a number of historical references to elevated mercury levels in this watershed (Applied Science Engineering, 1999). Both Clear Creek and Hernandez Reservoir are listed on the 303(d) list for mercury.

A Clear Creek study conducted for the Bureau of Land Management (Dynamac, 1998) found elevated levels of chromium, nickel and copper in water quality samples. Sediment samples were high in cobalt, nickel and mercury at several sites, and antimony, chromium, cadmium, copper, and arsenic at a few sites. Clear Creek also has references to elevated barium (Applied Science Engineering, 1999).

Synthetic Organic Chemicals - Legacy organochlorine pesticides and several currently applied organophosphate pesticides can be found in most tributaries of the Pajaro River system. DDT compounds were widespread in CCAMP samples, with levels in clam tissue exceeding the MTRL in all samples. Several main stem sites had elevated levels of DDT, dieldrin, and chlordane compounds. The Betabel Road (305PAJ) site had the highest values of Dieldrin and Toxaphene. Chittendon Gap (305CHI) had relatively high levels of Dieldrin and Toxaphene as well as Chlordane compounds. Llagas Creek also had relatively high levels of Chlordane compounds.

Salsipuedes Creek (305COR) stands out in CCAMP data for the relatively large number of chemicals that were present in clam tissue. DDT compounds were found at levels exceeding several criteria at this site in sediment, water and tissue. Relatively low levels of diazinon and chlorpyrifos were found in sediment, water, and/or tissue. Other chemicals included dieldrin, chlordane, and oxadiazon (sediment and tissue); and toxaphene, heptachlor epoxide, and ethyl parathion (tissue only).

The most prevalent findings related to currently applied pesticides were relatively high values of diazinon in clam tissue collected in several main stem Pajaro River sites, particularly at Betabel Road (305PAJ). Pacheco Creek (305PAC) also had somewhat elevated levels of ethyl parathion, which though being phased out, is still applied to certain crops.

Toxicity Identification Evaluation studies conducted in the lower Pajaro watershed by J. Hunt et al in 1998 suggested that toxicity found on the main stem and in some of the agricultural drains were attributable to organochlorine pesticides. 78% of samples collected from drainage ditches were acutely toxic. Sampling by M. Swanson and the Habitat Restoration Group in the winter of 91/92 identified 4'4'DDE and endosulphan sulphate in the Pajaro lagoon. The Questa Engineering study (1995) confirmed elevated levels of diazinon and DDT/DDE in water quality samples. State Mussel Watch data confirms that Watsonville Slough has had extremely high levels of organochlorine pesticides in past years, particularly DDT, chlordane, dieldrin, endosulphan, toxaphene, hexachlorobenzene and PCBs; some of these levels are the highest documented in the State.

Oil and Grease – Recent stormwater data collected from Watsonville Slough (RWQCB, 2001) indicate that oil and grease are found there at levels that are sometimes of concern. Watsonville Slough is listed as impaired by oil and grease.

San Lorenzo River Watershed – Hydrologic Subarea 304.12

The San Lorenzo River is listed on the 1998 303(d) list as impaired by nutrients, pathogens and sedimentation. The San Lorenzo River estuary is also listed for pathogens and sedimentation. Carbonera and Lompico Creeks are also listed for pathogens, nutrients and sedimentation. Shingle Mill Creek is listed for nutrients and siltation. Schwan Lake, which is also in the watershed, is listed for nutrients and pathogens. Revisions to the list currently under consideration would add a number of the tributaries specifically for sediment, but would delist the San Lorenzo for nutrients. The Regional Water Quality Control Board has recommended that it be delisted for nutrients.

General Watershed Description – The San Lorenzo River is a 25 mile long river which drains to the Pacific Ocean at the northern end of Monterey Bay. It drains a 115 square mile watershed which is mostly a steep, heavily forested landscape on the west slope of the central Santa Cruz mountains. Average rainfall is about 47 inches, most of which falls between December and April (County of Santa Cruz, 1979; Phillip Williams & Assoc., 1989).

The San Lorenzo River is a perennial stream with average summer flows typically under 10 cfs but flood flows recorded as high as 35,000 cfs. The lower 2.2 miles of the stream have been channelized and levied for flood control purposes, as the stream flows through downtown Santa Cruz. This reach of stream does not have a well-shaded canopy, though vegetation restoration projects have begun to improve bank vegetation along the levees. The San Lorenzo River lagoon provides critical summer habitat for juvenile steelhead. Breaching of the lagoon to prevent flooding is an ongoing management concern for protection of steelhead habitat.

As of 1970, 23.2% of the watershed was in suburban land use. Besides the City of Santa Cruz, the San Lorenzo River and its tributaries flow past the communities of Boulder Creek, Ben Lomond, Felton, Lompico, Zayante, Mount Hermon, and the City of Scotts Valley (County of Santa Cruz, 1979). Besides urban, suburban and timber harvest uses, others include recreation (including golf courses), range and pasture land, and small animal holding facilities.

The main tributaries to San Lorenzo River include Carbonera Creek (7.4 sq. mi.), Zayante Creek (13.8 sq. mi.), Bear Creek (16.2 sq. mi.), Boulder Creek (10.2 sq. mi.), Newell Creek (9.7 sq. mi.), and Branciforte Creek (18.1 sq. mi.). Branciforte Creek is channelized in its lowest mile before it joins the San Lorenzo River. Loch Lomond is an impoundment on Newell Creek, formed in 1961 (County of Santa Cruz, 1979).

Conventional Water Quality findings - Though nitrate levels in the San Lorenzo system are relatively low compared to other agriculture dominated watersheds in the area (such as the Pajaro River), it was listed as impaired by nitrate based on impacts to taste and odor in the municipal water supply.

CCAMP Coastal confluences monitoring rank the San Lorenzo River among the lowest in the Region for nitrate concentrations; it averaged 0.07 mg/L (NO3 as N) and never exceeded 0.16 mg/L (unlike the Pajaro River, which averaged 4.48 mg/L near its mouth). The San Lorenzo watershed has relatively rich natural sources of phosphorus (County of Santa Cruz, 1979); coastal confluence monitoring indicated an average value of 0.133 mg/L. The low nitrogen to phosphorus ratio indicates that the watershed is nitrate limited, which is why controls on nitrate are important to control the taste and odor problem originating from algal growth.

The CCAMP program has acquired and reviewed the extensive water quality data collected by the Santa Cruz County Environmental Health Department. Virtually no indications of problems from nitrite or ammonia were found. An examination of dissolved oxygen levels over a twenty year period of record showed no excursions below 7.0 mg/L (the Basin Plan criteria for cold water fish) for many of the tributaries and only three violations in total on tributaries. Violations were on Bear Creek, Gold Gulch and Kings Creek. No measurements were recorded below 6.4 mg/L. On the main stem of the San Lorenzo violations were more common, with measurements dropping below 7.0 mg/L 10.3% of the time. However, most violations were from one of the 18 sites monitored on the San Lorenzo; this was Station 1-01-002 below Boulder Creek, which violated 52% of the time, but never dropped below 5.3. Two violations were recorded at Waterman Gap and 1 at Irwin Way check dam. Overall, dissolved oxygen levels in the watershed appear to be in good condition.

CCAMP Coastal Confluences data show the San Lorenzo River to have the highest fecal coliform levels of all confluences measured, which include 30 major watershed systems of Region 3. The fecal coliform geomean at the lower end of the river was 13,611 MPN/100 ml, and ranged as high as 92,000. This site violated the CCAMP attention level of 200 MPN/100ml in 89% of all samples taken (8 of 9 samples). Fecal coliform appears to be a significant problem in almost all tributaries according to data collected by the County of Santa Cruz Environmental Health Department. Fall Creek and Clear Creek rarely or never exceeded 200 MPN/100 ml, the CCAMP attention level. All other tributaries and the San Lorenzo proper exceeded this value regularly. For example, of the 100 samples taken along the main stem over the twenty-five year period of record, 49 samples exceeded 200 MPN/100 ml and the geometric mean of all samples was 6749 MPN/100 ml. The worst site on the San Lorenzo River mainstem was at Big Trees, where it violated 67% of all samples and had a geomean of . Branciforte Creek, Carbonera Creek, Camp Evers tributary, and Schwann Lake also had relatively high percent violations. High fecal coliform levels are attributable at least in part to old and failing septic systems in the upper watershed.

Metals - State Mussel Watch Program data indicates that some metals may exceed Median Internation Standards (MIS) in mussel tissue in the Santa Cruz area. Samples have been collected from a number of locations in the San Lorenzo watershed and in the Santa Cruz Harbor. The MIS for copper was exceeded on the San Lorenzo River at Big Trees in the early 1980's. This same sample also exceeded the MTRL for cadmium on one occasion. Newell Creek also had cadmium values over the Maximum Tissue Residual Level. Santa Cruz Harbor exceeded MIS standards in shellfish on several occasions for cadmium, chromium, copper, and zinc.

The County of Santa Cruz sampled for metals in water throughout the San Lorenzo watershed on a number of occasions. The Basin Plan standard for cold water fish (0.03) was exceeded on several occasions in urban runoff, and in Corcoran Lagoon and Moran Lake for both cadmium and chromium.

Habitat – Sediment is a problem in a number of locations in the watershed and is the subject of several TMDL analyses. Sediment in spawning gravels results in reduction in carrying capacity for anadromous fish, and can severely reduce fish populations. Several studies describe the problem in detail (Leonard, 1972, SCCPD, 1979, Swanson Hydrology, 2001, and Soil Conservation Service, 1990) and Regional Board staff has compiled a literature review of studies related to the problem (Jagger et al., 1993). Sedimentation sources are various and the problem is a complex one. The major sources of erosion defined in the Zayante Creek Sedimentation study (Swanson Hydrology, 2001) are from roads (from timber harvest, private, and public purposes), active timber harvest, mass wasting, channel erosion and other urban and rural land uses. This study estimated that the Zayante watershed yielded 115,116 tons per year of sediment, of which 23% is potentially controllable. Hecht (1998) indicates that stream conditions have not improved since the Watershed Management Plan, developed in 1979 by the County of Santa Cruz, was written. The proportion of bed material composed by baserock used for road surfacing has increased over the years, indicating significant wasting of roads in the upper watershed. The bed material in general is composed of finer material, with proportionally less material originating in the upper watershed, and more from the lower, sandier areas.

Algal growth has been documented as excessive in the lower San Lorenzo River. Studies have been done to assess the extent of the algal growth problem in the watershed. Species found at Boulder Creek and Ben Lomond were particularly indicative of a nutrient enrichment problem. Relatively low dissolved oxygen levels at Boulder Creek support this finding. As the river moves downstream through Henry Cowell State Park this condition improves substantially (County of Santa Cruz, 1979).

Fish and Game surveys (CDFG, 1996) indicate that water diversions from the City Water Department and riparian users significantly impact summer stream flow, to the point that dewatering occurs at times. Loch Lomond reservoir also results in a reduction of flows to the lagoon. Also, channelization, riparian habitat removal, and lack of wood debris greatly reduce habitat quality in the lower reaches of the river. The same surveys describe numerous problems in tributary streams, including siltation, degradation of stream flow from water diversion, removal of riparian vegetation, improper placement of culverts, and degradation of water quality from septic systems.

Aptos Creek – Hydrologic SubArea 304.13

Aptos Creek is located in southern Santa Cruz County and is approximately 24.5 square miles in size. It drains to Monterey Bay south of the City of Santa Cruz. Its main tributaries are Valencia Creek, Mangles Gulch, and Bridge Creek. Both Aptos and Valencia Creeks are listed on the 303(d) impaired waterbodies list for siltation and pathogens, and are the subject of a Total Maximum Daily Load analysis.

The entire upper watershed was logged during the late 1800s, and 140 million board feet of first-growth redwood was removed. Much of the land that was logged is now known as Niesene Marks State Park (Powell, 1986). The California Department of Fish and Game (1977) conducted inventories of fisheries resources and found that factors limiting steelhead populations in the creek include temperature, sedimentation, barriers to fish passage, inadequate woody debris, and inadequate canopy cover. Titus et al. (1994) indicate that declining fish populations are primarily caused by sedimentation in Aptos Creek. He indicated that a disastrous flood in 1982 created landslides and mass wasting, as well as debris jams which blocked passage. The 1982 steelhead year-class was essentially eliminated. Surveys in 1999 (Nelson, 2000) documented a number of steelhead once again present in the creek

Montgomery (1979) indicated that data for Aptos Creek is limited. However, the County of Santa Cruz has continued to monitor sites on Aptos and Valencia Creek since 1975. Their data shows that both creeks are fairly alkaline compared to other creeks they monitor, averaging 242 and 229 mg/L, respectively. Conductivity is also higher than on many of the other coastal streams monitored.

One of the County's sites, at the Spreckels Drive Bridge, exceeded the CCAMP Attention level for fecal coliform (200 MPN/100 ml) 57% of the time, though other sites in the watershed were relatively clean. CCAMP Coastal Confluences monitoring found that 88% of fecal coliform samples from Aptos Creek exceedence the CCAMP attention level of 200 MPN/100 ml. The geomean of all samples was 462 MPN/100 ml. Nitrate levels are relatively low, with nitrate averaging 0.17. Orthophosphate (as P) levels on the other hand were slightly elevated, averaging 0.223. This compares well with the County's data. Oxygen levels are fully saturated with a relatively narrow range of values.

Conventional water quality has been monitored by volunteer monitors from the Coastal Watershed Council. Findings from the spring and summer of 2000 indicate that most parameters met water quality standards. However, turbidity was elevated on Valencia Creek, and flow was low at the confluence of Valencia Creek with Aptos Creek.

Mussel Watch data shows single Maximum Tissue Residual Level exceedences of chromium, arsenic, and mercury in fish tissue collected from Aptos Creek.

Soquel Creek – Hydrologic SubArea 304.13

The Soquel Creek Lagoon is listed on the 303(d) impaired waterbodies list for pathogens, nutrients, and siltation. Montgomery (1979) indicated that water quality influences on the watershed are primarily from urban runoff and residential development in the upper watershed with its associated septic system use. Forestry practices in the upper watershed contribute to the sedimentation problem. A watershed assessment of sediment impacts to the East Branch of Soquel Creek has been completed by Cafferata and Poole (1993).

USGS conducted water sampling at their gaging station between 1953 and 1966, which gives an indication of general mineral composition of Soquel Creek water; hardness and dissolved solids are relatively high, but are comparable to ground water supply in the area. County of Santa Cruz data show that Soquel Creek, along with Aptos and Valencia, have among the highest alkalinity levels of all creeks sampled by their program, and averages 210 mg/L in Soquel Creek.

CCAMP Coastal Confluences monitoring found that 88% of fecal coliform samples from Soquel Creek exceedence the CCAMP attention level of 200 MPN/100 ml. The geomean of all samples was

717 MPN/100 ml. Nitrate levels were very low, averaging 0.02 mg/L. Orthophosphate (as P) averaged 0.116 mg/L. Dissolved oxygen levels showed no signs of depression. However, the maximum value was 13.88, which may indicate supersaturation. pH occasionally exceeded 8.3 (the Basin Plan criteria for domestic supply), but averaged 8.17. County data generally supports these findings.

Other Watersheds in the 2002 Watershed Rotation Area

Major issues in the Gazos/Scott Creek area include siltation, water diversions, migration barriers and loss of riparian habitat. Data has been gathered at various locations in the smaller watersheds of this area for a number of years by the County of Santa Cruz. In addition, several volunteer monitoring programs are collecting data in various watersheds.

CCAMP data for most of the other smaller watersheds along the coast indicate few water quality problems. However, the CCAMP program is not currently geared to assess instream sediment impacts, which are some of the more likely impacts in these watersheds.

Coastal Confluences data are collected from the mouths of Gazos, Waddell, and Scott Creeks (in addition to San Lorenzo, Soquel, Aptos, and Pajaro Rivers, discussed above). Gazos Creek lagoon had one dissolved oxygen value below the Basin Plan criteria for cold water fish of 7.0 mg/l; this value was taken before dawn in August. Most sites had occasional excursions above the Basin Plan pH criteria for domestic use of 8.3. Gazos reached 8.9; this measurement was taken on the same day it peaked for dissolved oxygen, at 13.18 mg/L in October. One relatively high winter turbidity measurement was also taken on Gazos Creek, at 1000 mg/L. There was no evidence of temperature problems at any sites.

Table 11. Review of Monitoring Activities in the Study Area

Program	Monitoring Activity	Status
Federal		
NOAA Status and Trends	Several mussel monitoring sites are maintained in the vicinity	Data will be collected by the CCLEAN program
EMAP	California nearshore monitoring in 2003. Inland sampling did not include sites in this area.	Undetermined
NOAA Monterey Bay Marine Sanctuary Integrated Monitoring Network (SIMON)	This is an ecological monitoring program which primary coordinates existing research, and initiates new monitoring in Monterey Bay	Program is new and has not yet begun collecting data. CCAMP has coordinated with the program and is considered a primary water quality data gathering program within SIMON
State		
RWQCB	CCAMP monitoring in 1998 in Pajaro watershed	Data in electronic format.
RWQCB	CCAMP Coastal Confluences monitoring at creek mouths	Ongoing. Data in electronic format.
RWQCB	TMDL monitoring for loading assessments in Pajaro, Aptos, San Lorenzo, and a number of tributary streams.	Data being collected over the next several years. Data in electronic format.
State Mussel Watch Program/Toxic Substances Monitoring Program	Monitoring in association with CCAMP program	Ongoing. Data acquired.
State Mussel Watch Program, Univ of California, Santa Barbara	Sand Crab tissue bioaccumulation monitoring coastwide	This program will be utilizing the CCAMP data format and will provide data.
California Department of Fish and Game	CDFG has monitoring data from stream surveys and from Marine Protected Areas	Data not acquired.
Cal Poly State University	Sampling paired watersheds for effectiveness of Best Management Practices related to timber harvest in Scott Creek watershed.	Project being initiated.
Wilder and Waddell State Parks	Flow and water quality, and benthic invertebrate monitoring	Data will be sent to CCAMP when study is completed

Local		
City of Watsonville	Maintains surface water quality monitoring sites for conventional pollutants and pesticides.	Some data obtained.
Santa Cruz County Environmental Health Department	Extensive network of conventional water quality monitoring sites throughout Santa Cruz County with many years of record.	Data obtained through 1999, in electronic format and GIS.
Hollister WWTP	Percolation ponds adjacent to San Benito River.	Data available in hard copy.
South County Municipal Wastewater Treatment Authority	Percolation ponds adjacent to Llagas Creek. Monitoring sites above and below ponds.	Data acquired for TMDL development
City of Santa Cruz and Watsonville Municipal WWTPs	Discharge to nearshore areas. Plants participate in regional monitoring activities through the Central Coast Long-term Environmental Assessment Program (CCLEAN). Includes shoreline mussel and coliform sampling, rivermouth monitoring, and nearshore sediment monitoring.	Program has just been initiated. Data will be collected in CCAMP format.
County of Santa Cruz AB 411 monitoring	Ongoing collection of shoreline bacteria data	Data being acquired electronically through the CCLEAN program.
University		
PISCO – Univ of California, Santa Cruz and Santa Barbara	Intertidal and subtidal monitoring along the California Coast	Ongoing, with a number of stations in the Central Coast area. Data will be available online.
Univ. of California, Santa Cruz	Ongoing research on nutrients in the Pajaro watershed, particularly related to surface/groundwater interactions	Data not yet acquired.
Cabrillo College Geography Dept.	Basic water quality, fecal coliform and salinity monitoring in Aptos Creek	

Volunteer		
Scott Creek Watershed Council	Basic water quality monitoring on Scott and Little Creek	Data to be acquired in CCAMP format by National Marine Sanctuary Volunteer Coordinator
Coastal Watershed Council	Water quality, flow, benthic invertebrates, stream morphology – Arana, Soquel, and Gazos Creek	Data acquired in CCAMP format by National Marine Sanctuary Volunteer Coordinator
Santa Cruz Blue Water Task Force	Ocean monitoring of E coli and total coliform	Data not acquired
Friends of Soquel Creek	Summer baseflow monitoring	Data to be acquired in CCAMP format by National Marine Sanctuary Volunteer Coordinator
San Lorenzo Valley Unified School District Charter 25-Home School Program	Visual assessment of riparian corridor, flow, benthic invertebrate communities in Soquel Creek	
Arana Gulch Watershed Alliance	Watershed education	
San Lorenzo Valley High School Watershed Academy	Water quality, fecal coliform, riparian birds	
San Lorenzo Watershed Caretakers	Watershed education and implementation	
California Dept. of Fire and Forestry	Benthic macroinvertebrates and steelhead counts in Soquel Creek	
City of Santa Cruz Urban Watch Program	Stormwater monitoring using EPA pollution detection kit	Data acquired in CCAMP format by National Marine Sanctuary Volunteer Coordinator

4.3 Monitoring Activities Planned for the 2002/03 Fiscal Year

Specific monitoring to be conducted at each site is specified in Table 12. New sites to address this year's watershed rotation include those in Hydrologic Units 305 and 305. Other sites listed include those from the Santa Lucia Watershed Rotation (Hydrologic Units 308 and 310) because monitoring will not be completed at these locations until March, 2003. In addition, Coastal Confluence sites which are monitored in an ongoing fashion are also listed.

Table 12. Sampling sites and activities to be conducted for Fiscal Year 2002/2003 monitoring

Hydrologic Sub Area	WaterBody	Site Tag	Site Name	Conventional Water QualityQ	Water Toxicity	Sediment Toxicity and Chemx	Rapid Bioassessment	Mussel Watch Toxic Substances Monitoring
30700	Carmel River	307CMD	307CMD-Carmel River @ Schulte Road	1			1	
30700	Carmel River	307CMN	307CMN-Carmel River @ Nason Road, Community Park	1				
30700	Carmel River	307CMU	307CMU-Carmel River @ Esquiline Road	1			1	
30700	Tularcitos Creek	307TUL	307TUL-Tularcitos Creek @ Carmel Valley Road	1				
30800	Big Sur River	308BSU	308BSU-Big Sur River @ Pfeiffer, Weyland camp	1			1	
30800	Garrapata Creek	308GAR	308GAR-Garrapata Creek @ Garrapata Creek Road	1			1	
30800	Limekiln Creek	308LIM	308LIM-Limekiln Creek @ Limekiln State Park	1			1	
30800	Little Sur River	308LSR	308LSR-Little Sur River @ Highway 1	1				
30800	Little Sur River	308LSU	308LSU-Little Sur River @ Old Coast Road	1				
30800	Mill Creek	308MIL	308MIL-Mill Creek @ Mill Creek Picnic Area	1				
30800	San Jose Creek	308SJC	308SJC-San Jose Creek @ Private Road Access	1				
31011	San Carpoforo Creek	310SCP	310SCP-San Carpoforo Creek @ Highway 1	1				
31013	Pico Creek	310PCO	310PCO-Pico Creek @ Highway 1	1				
31013	San Simeon Creek	310SSU	310SSU-San Simeon Creek @ San Simeon Road	1			1	
31014	Santa Rosa Creek	310SRU	310SRU-Santa Rosa Creek @ Main Street	1			1	
31015	Villa Creek	310VIA	310VIA-Villa Creek us Highway 1	1			1	
31016	Cayucos Creek	310CAY	310CAY-Cayucos Creek @ Cayucos Creek Road	1				
31017	Old Creek	310OLD	310OLD-Old Creek @ Cottontail Creek Road	1				
31018	Toro Creek	310TOR	310TOR-Toro Creek us Highway 1	1			1	
31021	Morro Creek	310MOR	310MOR-Morro Creek @ Lila Keiser Park	1				
31022	Chorro Creek	310CAN	310CAN-Chorro Creek @ Canet Road	1			1	
31022	Chorro Creek	310CAN	310CAN-Chorro Creek @ Canet Road	1			1	
31024	Prefumo Creek	310PRE	310PRE-Prefumo Creek @ Calle Joaquin	1			1	
31024	San Luis Obispo Creek	310SLC	310SLC-San Luis Obispo Creek @ Cuesta Park	1				
31024	San Luis Obispo Creek	310SLM	310SLM-San Luis Obispo Creek @ Mission Plaza	1			1	
31024	San Luis Obispo Creek	310SLV	310SLV-San Luis Obispo Creek @ Los Osos Valley Road	1			1	
31024	Stenner Creek	310SCN	310SCN-Stenner Creek @ Nipomo street	1				
31025	Coon Creek	310COO	310COO - Coon Creek @ Pecho Valley Road	1				
31031	Arroyo Grande Creek	310AGB	310AGB-Arroyo Grande Creek @ Biddle Park	1			1	
31031	Arroyo Grande Creek	310AGF	310AGF-Arroyo Grande Creek @ Fair Oaks	1			1	
31031	Arroyo Grande Creek	310AGS	310AGS-Arroyo Grande Creek @ Strother Park	1				

31031	Los Berros Creek	310BER	310BER-Los Berros Creek @ Valley Road	1					
30411	Scott Creek	304SCM	304SCM-Scott Creek d/s Mill Creek	1					
30412	Bear Creek	304BEP	304BEP-Bear Creek @ Elks Park	1					
30412	Boulder Creek	304BH9	304BH9-Boulder Creek @ Highway 9	1					
30412	Branciforte Creek	304BRA	304BRA-Branciforte Road @ Ocean Street	1					
30412	Newell Creek	304NGA	304NGA-Newell Creek @ Glen Arbor	1	1	1	1		
30412	San Lorenzo River	304RIV	304RIV-San Lorenzo River @ River Street	1					
30412	San Lorenzo River	304SLA	304SLA-San Lorenzo River @ Alder	1	1				1
30412	San Lorenzo River	304SLE	304SLE-San Lorenzo @ Elks Park	1					
30412	San Lorenzo River	304SLP	304SLP-San Lorenzo River @ Graham Hill Road	1	1	1	1		1
30412	Zayante Creek	304ZAY	304ZAY-Zayante Creek @ Graham Hill Road	1					
30413	Aptos Creek	304APS	304APS-Aptos Creek @ Soquel Road	1	1	1			
30413	Soquel Creek	304SEO	304SEQ-Soquel East @ Olive Spring	1					
30413	Soquel Creek	304SWO	304SWO-Soquel West @ Olive Spring	1					
30413	Valencia Creek	304VAL	304VAL-Valencia Creek @ Soquel Road	1					
30510	Corralitos Creek	305COR2	305COR2-Upper Corralitos Creek	1					
30510	Harkins Slough	305HAR	305HAR-Harkins Slough @ Harkins Slough Road	1	1		1		
30510	Pajaro River	305CHI	305CHI-Pajaro River @ Chittenden Gap	1	1	1		1	
30510	Pajaro River	305MUR	305MUR-Pajaro River @ Murphy's Crossing	1	1	1	1	1	
30510	Salsipuedes Creek	305COR	305COR-Salsipuedes Creek - Down stream of Corralitos Creek	1			1		
30510	Watsonville Slough	305WAT	305WAT-Watsonville Slough	1			1	1	
30510	Watsonville Slough	305WSA	305WSA-Watsonville Slough @ San Andreas Road	1				1	
30520	Pajaro River	305PAJ	305PAJ-Pajaro River @ Betabel Road	1					
30530	Llagas Creek	305HOL	305HOL-Llagas Creek @ Holsclaw Road	1			1	1	
30530	Llagas Creek	305LLA	305LLA-Llagas Creek @ Bloomfield Avenue	1	1	1	1	1	1
30530	Pajaro River	305FRA	305FRA-Pajaro River @ Frazier Lake Road	1					
30530	Tequisquita Slough	305TES	305TES-Tequisquita Slough	1	1		1		
30530	Uvas Creek	305UVA	305UVA-Uvas Creek @ Bloomfield Avenue	1	1		1		
30540	Pacheco Creek	305PAC	305PAC-Pacheco Creek	1	1	1	1		
30550	San Benito River	305HRL	305HRL-San Benito River below Hernandez Reservoir	1	1		1	1	
30550	San Benito River	305SAN	305SAN-San Benito @ Y Road	1	1	1	1		1
30550	Tres Pinos Creek	305TRE	305TRE-Tres Pinos Creek	1			1	1	1
30411	Scott Creek	304SCO	304SCO-Scott Creek lagoon	1					
30411	Waddell Creek	304WAD	304WAD-Waddell Creek lagoon	1					
30412	San Lorenzo River	304LOR	304LOR-San Lorenzo Estuary	1					
30413	Aptos Creek	304APT	304APT-Aptos Creek lagoon	1					1
30413	Soquel Creek	304SOQ	304SOQ-Soquel Creek lagoon	1					
30420	Gazos Creek	304GAZ	304GAZ-Gazos Creek Lagoon	1					
30510	Pajaro River	305THU	305THU-Pajaro River @ Thurwachter Bridge	1	1	1		1	
30700	Carmel River	307CML	307CML-Carmel River @ Highway 1	1					
30800	Big Creek	308BGC	308BGC-Big Creek @ Highway 1	1					
30800	Big Sur River	308BSR	308BSR-Big Sur River @ Andrew Molera	1					
30800	Willow Creek	308WLO	308WLO-Willow Creek @ Highway 1	1					
30910	Old Salinas River	309OLD	309OLD-Old Salinas River @ Monterey Dunes Way	1					
30910	Salinas River (Lower)	309DAV	309DAV-Salinas River @ Davis Road	1					
30910	Tembladero Slough	309TDW	309TDW-Tembladero Slough @ Monterey Dunes Way	1					
31012	Arroyo de la Cruz Creek	310ADC	310ADC-Arroyo de la Cruz @ Highway 1	1					
31013	San Simeon Creek	310SSC	310SSC-San Simeon Creek @ State Park foot bridge	1					

31014	Santa Rosa Creek	310SRO	310SRO-Santa Rosa Creek @ Moonstone Drive	1	1
31022	Chorro Creek	310TWB	310TWB-Chorro Creek @ South Bay Boulevard	1	
31024	San Luis Obispo Creek	310SLO	310SLO-San Luis Obispo Creek @ lagoon	1	
31025	San Luis Obispo Creek	310SLB	310SLB-San Luis Obispo Creek @ San Luis Bay Drive	1	1
31026	Pismo Creek	310PIS	310PIS-Pismo Creek above Highway 101	1	1
31031	Arroyo Grande Creek	310ARG	310ARG-Arroyo Grande Creek @ 22nd Street	1	1
31210	Santa Maria River	312SMA	312SMA-Santa Maria River @ Estuary	1	
31300	San Antonio Creek	313SAC	313SAC-San Antonio Creek @ Rail Road Bridge, u/s lagoon	1	
31410	Santa Ynez River(lower)	314SYN	314SYN-Santa Ynez River @ 13th Street	1	
31510	Canada de la Gaviota	315GAV	315GAV-Canada de la Gaviota @ State Park entrance	1	
31531	Atascadero Creek(315)	315ATA	315ATA-Atascadero Creek @ Ward Drive	1	
31532	Arroyo Burro Creek	315ABU	315ABU-Arroyo Burro Creek @ Cliff Drive	1	
31532	Mission Creek	315MIS	315MIS-Mission Creek @ Montecito Street	1	
31534	Carpinteria Creek	315CRP	315CRP-Carpinteria Creek @ 6th Street	1	
31534	Franklin Creek	315FRC	315FRC-Franklin Creek @ Carpenteria Avenue	1	
31534	Rincon Creek	315RIN	315RIN-Rincon Creek @ Bates Road, u/s Highway 101	1	

Table 13. Specific sampling information associated with monthly conventional water quality sampling

(Methods are those which have been used for CCAMP sampling prior to SWAMP funding. New methods and detection limits to be determined by the SWAMP Quality Assurance Plan)

Analyte	Units	MDLs	Sampling Approach	Sample volume/comments/Preservation
PH	pH units	N/a	DataSonde 4a	Sample taken in sufficent depth to submerge datasonde, preferably at approximately 0.6 of total depth, in thalweg or at least away from bank in areas of higher flow velocities
Conductivity	US/cm	1.0	DataSonde 4a	"
Turbidity	NTU	0.1	DataSonde 4a	"
Dissolved Oxygen	Ppm	0.01	DataSonde 4a	"
Oxygen Saturation	% Saturation	n/a	DataSonde 4a	"
Water Temperature	Celsius	n/a	DataSonde 4a	"
Air Temperature	Celsius	n/a	Thermometer (^{o}C)	Taken in shade at least two feet from ground surface.
Total Coliform Bacteria	MPN/100 ml	2	25-tube dilution	Sealed, sterile, 100-ml plastic bacteria containers with Na2S2O3 preservative. Kept at 4^{o}C. 6 hour holding time desirable; 24 hour required.
Fecal Coliform Bacteria	MPN/100 ml	2	25-tube dilution	"
Nitrate-N	mg/l	0.02	EPA 300.0	1-liter plastic bottle. Kept at 4^{o}C. 48 hour holding time.
Nitrite-N	mg/l	0.01	EPA 353.2	"
Ortho Phosphate	mg/l	0.01	EPA 365.1	"
Total Kjeldahl Nitrogen	mg/l	0.1	EPA 351.2	1-liter plastic bottle. Kept at 4^{o}C. 28 day holding time.
Total Ammonia-NH_3	mg/l	0.02	EPA 350.1	"
Total Phosphate	mg/l	0.06	EPA 365.4	"
Chlorophyll a	ug/l	0.1	DataSonde 4a	500 ml plastic amber bottle. Kept in dark at 4^{o}C
Total Suspended Solids	mg/l	0.5	EPA 160.2	1-liter plastic bottle. Kept at 4^{o}C. 7 day holding time.
Fixed Suspended Solids	mg/l	0.5	EPA 160.2	"
Total Dissolved Solids	mg/l	4.0	EPA 160.1	"
Fixed Dissolved Solids	mg/l	4.0	EPA 160.4	"
Volatile Dissolved Solids	mg/l	5.0	EPA 160.4	"
Volatile Suspended Solids	mg/l	0.5	EPA 160.4	"
$CaCO_3$	mg/l	5	SM-2340B	1-liter plastic bottle. Kept at 4^{o}C. 28 day holding time.
Chloride	mg/l	0.06	EPA 300.0	"
Boron	mg/l	0.05	EPA 6010	"
Calcium	mg/l	0.01	EPA 6010	"
Magnesium	mg/l	0.02	EPA 6010	"
Sodium	mg/l	0.06	EPA 6010	"
Corridor Shading	%	n/a	Visual estimate	Percent of flowing stream channel that is shaded
Algal Cover	%	n/a	Visual estimate	Percent of flowing stream channel that is covered with algae (periphyton or filamentous)
Instream Plant Cover	%	n/a	Visual estimate	Percent of flowing stream channel that is covered with rooted vegetation
Flow	Cubic Feet per Second	n/a	Pygmy gurley or Cross-sectional profile with stage height, 3-point calibration	Flow measurements taken each month. For sites estimated using cross sectional profile, transects are surveyed each spring. At least 3 flow measurements are collected at low, medium and high flows to calibrate curve. Each month height is measured from fixed point to water surface to estimate water surface height and flow.

4.3. Laboratory Analysis

Laboratory analytical work to be performed is as described in Section 3.1.1. Because the CCAMP program is striving to develop a broad ambient picture of water quality conditions in the Region, consistency is applied in the suite of analytical parameters collected from year to year and site to site.

4.4. Data quality evaluation and data reporting

CCAMP data quality considerations are (or will be) described in the SWAMP QAPP and Region 3 QAPP/SOP. The maximum variation that is acceptable within the limits of quality assurance is discussed in these documents. Any variation greater than these limits is brought to the attention of the project manager who will evaluate data, calibration and maintenance records for trends or possible outliers. The project manager will decide if any results will be discarded due to instrument or laboratory error.

Field equipment is calibrated prior to each sampling day according to CCAMP Standard Operating Procedures. Post calibration checks of field equipment are conducted at the contract laboratory upon return from the field. A blank sample is tested using field probes and subsequently tested for pH, conductivity, turbidity and salinity using the facilities at the commercial laboratory. Measurements should vary less than 10%. Instrument maintenance or replacement will occur if the standard variation requirement is not met following basic maintenance procedures.

Duplicate samples are collected and analyzed to insure performance and assess both field and laboratory variability. Blind duplicate field samples are collected at 10% of all sites sampled. Duplicate data is evaluated for percent difference, and where this exceeds acceptable performance standards (see QAPP) appropriate action is taken depending upon the parameter. A quality assurance report will be included with each annual report and hardcopy data reports.

To the extent possible data is entered into the CCAMP database utilizing electronic transfer protocols to reduce the incidence of data entry errors. All commercial laboratory data is electronically uptaken, and information which is stored (for each data element) includes probable quantification limit, minimum detection limit or reporting limit, units of measurement, and method. Data from multi-analyte probes is both collected in hard copy and downloaded and electronically uptaken into the CCAMP database. The hard copy is compared with the electronic download to ensure that site tags are correctly associated with data. The only data which is entered by hand are field parameters like air temperature, % algal cover, and notes.

Data is screened for obvious errors both by graphing data and by screening for exceedance of user-defined minimum and maximum values. All data is checked against hard copy lab data sheets for errors.

4.5. Deliverable products

The following products will be delivered to the State Board:

Annual Task Orders and Workplans
Hardcopy and Electronic Data Reports
Master Contractor Data Reports
QA/QC Summary Report
Final Annual Report

4.6. Desired milestone schedule for the Pajaro/North Coast water rotation year (2003)

Start of conventional water quality sampling	January 1 2003
Start of Flow measurements for Watershed sites	January 1 2003
Benthic Invertebrate sampling for Santa Barbara and Santa Lucia watershed rotations	March 15, 2003 – April 15, 2003
Pre-dawn DO measurements	July, August, September 2003
Sediment Sampling	Preferably synoptic with benthic invertebrate sampling, but may be dictated by fund availability at end of fiscal year (June, 2003)
Pajaro/North Coast hardcopy data report (draft)	June 2004
Pajaro/North Coast data delivery (final)	June 2005 (depends on delivery schedule from Master Contractor)
Pajaro/North Coast Report delivery (draft)	August 1, 2004
Pajaro/North Coast Report delivery (final)	August 1, 2005 (depends on data delivery schedule from Master Contractor)

4.7. Desired "sample throughput schedule"

Conventional Water Quality data (comm. lab)	30 days from time of collection
Benthic Invertebrate data (Master Contract)	6 months from time of delivery
Fish and Mussel tissue data (SMW, TSM)	9 months from time of collection
Sediment Chemistry data (Master Contract)	9 months from time of collection
Sediment Chemistry data (commercial lab)	2 months from time of collection
Toxicity data (Master Contract)	4 months from time of collection

4.8. Budget

The Region 3 allotment from the SWAMP program for FY 2002/2003 is $272,565. Other funding sources applied toward monitoring activities include State Mussel Watch, State Mussel Watch endowment, and CCAMP endowment. Budget allocations to different elements of the program are shown. Because funds are provided on a fiscal year basis and sampling rotation years are managed on a calendar year basis, the budget reflects completion of the 2001/2002 sampling year in the Santa Lucia watershed rotation area and initiation of the sampling year in the Pajaro/North Coast watershed rotation area. Table 14 shows the CCAMP budget for FY 2002/2003, including all currently available funding sources.

Table 14. CCAMP 2002/2003 Budget

CCamp Budget 02/03	Sites	Duplicate samples/event	Quality Assurance Sites/Event	$/Sample	$/QA Sample	Samples events/yr	Total Samples	Total	CCAMP Endowment	State Mussel Watch	SWAMP funds	RWQCB Lab	State Mussel Watch Endowment	San Jose State Foundation	SubTotal
Santa Lucia Watershed															
Conventional Water Quality	32	3	3	177	73	9	315	**57726**			56530	1196			**57726**
Rapid Bioassessment	15			1059		1	15	**15885**			15885				**15885**
Pajaro/North Coast Watersheds															
Conventional Water Quality	31	3	3	177	73	6	204	**37422**			37422				**37422**
Sediment Chemistry	7			2052		1	7	**14364**			14364				**14364**
Sediment toxicity Hyalella (28-day)	7			1050		1	7	**7350**			7350				**7350**
Water Toxicity (SWAMP)	13	1		1430		2	28	**40040**			40040				**40040**
Bioaccumulation(bivalves) SMW	8			3418		1	8	**27344**		27344					**27344**
Bioaccumulation(fish) TSM	6			3156		1	6	**18936**		18936					**18936**
Rapid Bioassessment	15			1059		1	15	**15885**			15885				**15885**
Toxicity Identification Evaluation	5			3885		1	5	**19425**			19425				**19425**
Watershed Characterization subtotal								**254377**	**0**	**46280**	**206901**	**1196**	**0**	**0**	**254377**
Coastal Confluences															
Conventional Water Quality	32	3	3	177	73	12	420	**76968**			76968				**76968**
Sediment Chemistry	1			728		1	1	**728**			728				**728**
Sediment toxicity Hyalella (28-day)	1			1050		1	1	**1050**			1050				**1050**
Rapid Bioassessment	4			1059		1	4	**4236**			4236				**4236**
Bioaccumulation(bivalves) SMW	1			3418		1	1	**3418**		3418					**3418**
Water Toxicity (SWAMP)	1			1430		2	2	**2860**			2860				**2860**
Coastal Confluences subtotal								**89260**		**3418**	**85842**	**0**	**0**	**0**	**89260**
Nearshore															
Bioaccumulation Mussel Watch Endowment	3			3418		1	3	**10254**					10254		**10254**
Nearshore Subtotal								**10254**	**0**	**0**	**0**	**0**	**10254**	**0**	**10254**
Special Studies															
Chemistry funds to support Toxicity Testing by UCD								**20000**						20000	
Special Studies Subtotal								**20000**	**0**	**0**	**0**	**0**	**0**	**20000**	**20000**
Misc															
SWAMP Overhead								1262							1262
Misc Subtotal								**1262**		**0**	**1262**	**0**	**0**	**0**	**1262**
Hardware															
Misc.								**5000**	5000						**5000**
Logging DO meters								**7600**	7600						**7600**
Hardware Subtotal								**12600**	**12600**	**0**	**0**	**0**	**0**	**0**	**12600**
															0
Support Staff	**Number**	**Weeks**		**$/Hr**		**Hrs/Wk**	**Total**								**0**
Students	4	52		15		20	62400	**62400**	62400						**62400**
Data management	1	1		25000				**25000**	25000						**25000**
Support Staff Subtotal								**87400**	**87400**	**0**	**0**	**0**	**0**	**0**	**87400**
															0
CCamp Total Expenditures								**475153**	**100000**	**49698**	**294005**	**1196**	**10254**	**20000**	**475153**
Sources of Funding															
SWAMP Funding								**272565**							
SWAMP Funding (2001 carryover)								**22499**							
MusselWatch/TSM								**50000**							
SMW Endowment								**10254**							
CCAMP Endowment(NFWF)								**100000**							
R3 Lab Budget								**1196**							
San Jose State Foundation								**20000**							
Total Sources of Funding								**476514**							
Total Costs								**475153**							
Net								**1361**							

5. Working Relationships

Table 15. Working relationships between State Water Resources Control Board staff, Regional Water Quality Control Board staff and Contractors.

Task	Responsible Organization		
	SWRCB	RWQCBs	Contractors
Develop contract(s) for monitoring services.	●	●	●
Identify water bodies or sites of concern and clean sites to be monitored.		●	
Identify site-specific locations with potential beneficial use impacts or unimpacted conditions that will be monitored.		●	
Decide if concern is related to objectives focused on location or trends of impacts.		●	
Select monitoring objective(s) based on potential beneficial use impact(s) or need to identify baseline conditions.		●	
Identify already-completed monitoring and research efforts focused on potential problem, monitoring objective, or clean conditions.		●	

Task	Responsible Organization		
	SWRCB	RWQCBs	Contractors
Make decision on adequacy of available information.		●	
Prepare site-specific study design based on monitoring objectives, the assessment of available information, sampling design, and indicators.	● (Work Plan Review Role)	●	●
Implement study design. (Collect and analyze samples.)		●	●
Track study progress. Review quality assurance information and make assessments on data quality. Adapt study as needed.	● (Review Role)	●	●
Report data through SWRCB web site.	●	● (Coordination Role)	●
Prepare written report of data.	●	●	●

6. Other information and list of attachments

Attachment 1 – SWAMP Program Objectives

Attachment 2 – Bibliographic References

Attachment 1. SWAMP Program Objectives

From the November, 2000 Report to the Legislature, "Proposal for a Comprehensive Ambient Surface Water Quality Monitoring Program"

Monitoring Objectives

In developing the SWAMP monitoring objectives, the SWRCB used a modified version of the model proposed by Bernstein et al. (1993) for developing clear monitoring objectives. The model makes explicit the assumptions and/or expectations that are often embedded in less detailed statements of objectives such as those presented in the SWRCB Report to the Legislature on comprehensive monitoring submitted in February 2000 (SWRCB, 2000). This section is organized by each major question posed in the January 2000 report.

Is it safe to swim?

Beneficial Use: Water Contact Recreation

1. Throughout water bodies that are used for swimming, estimate the concentration of pathogenic contaminants above and below screening values, health standards, or adopted water quality objectives.

2. Estimate the percent of beach area that poses potential health risks of exposure to pathogens in streams, rivers, lakes, nearshore waters, enclosed bays, and estuaries using several critical threshold values of potential human impact (pathogen indicators).

3. Throughout water bodies that are used for swimming, estimate the concentration of bacterial contaminants from month-to-month above and below screening values, health standards, or adopted water quality objectives.

Is it safe to drink the water?

Beneficial Use: Municipal and Domestic Water Supply

4. Throughout water bodies, estimate the area of lakes, rivers, and streams that are sources of drinking water where the concentration of microbial or chemical contaminants are above and below screening values, drinking water standards, or adopted water quality objectives used to protect drinking water quality.

5. Throughout water bodies that are used as a source of drinking water, estimate the concentration of microbial or chemical contaminants from month-to-month above and below screening values, drinking water standards, or adopted water quality objectives used to protect drinking water quality.

Is it safe to eat fish and other aquatic resources?

Beneficial Uses: Commercial and Sport Fishing, Shellfish Harvesting

6. Estimate the area of streams, rivers, lakes, nearshore waters, enclosed bays, and estuaries where the concentration of chemical contaminants in edible fish or shellfish tissue exceeds several critical threshold values of potential human impact (screening values or action levels).

7. Assess the geographic extent of chemical contaminants in selected size classes of commonly consumed target species that exceed several critical threshold values of potential human impact (screening values or action levels) (Adapted from USEPA, 1995).

8. Throughout water bodies (streams, rivers, lakes, nearshore waters, enclosed bays, and estuaries), estimate the concentration of chemical contaminants in fish and aquatic resources from year to year using several critical threshold values of potential human impact (advisory or action levels).

9. Throughout water bodies that are used for shellfish harvesting, estimate the concentration of bacterial contaminants from month to month above and below health standards or adopted water quality objectives.

10. Throughout water bodies that are used for shellfish harvesting, estimate the concentration of bacterial contaminants above and below health standards or adopted water quality objectives.

Are aquatic populations, communities, and habitats protected?

Beneficial Uses: Cold Freshwater Habitat; Estuarine Habitat; Inland Saline Water Habitats; Marine Habitat; Preservation of Biological Habitats; Rare, Threatened or Endangered Species; Warm Freshwater Habitat; Wildlife Habitat

11. Estimate the percent of degraded water area in lakes, nearshore waters, enclosed bays, and estuaries using several critical threshold values of toxicity, water or benthic community analysis, habitat condition, and chemical concentration.

12. Estimate the percent of degraded sediment area in rivers, lakes, nearshore waters, enclosed bays, and estuaries using several critical threshold values of toxicity, benthic community analysis, habitat condition, and chemical concentration.

13. Identify the areal extent of degraded sediment locations in rivers, lakes, nearshore waters, enclosed bays, and estuaries using several critical threshold values of toxicity, benthic community analysis, habitat condition, and chemical concentration.

14. Estimate the percent of degraded sediment area from year to year in rivers, lakes, nearshore waters, enclosed bays, and estuaries using several critical threshold

values of toxicity, benthic community analysis, habitat condition, and chemical concentration.

15. Estimate the percent of degraded water area from year to year in rivers, lakes, nearshore waters, enclosed bays, and estuaries using several critical threshold values of toxicity, water column or benthic community analysis, habitat condition, and chemical concentration.

Beneficial Use: Spawning, Reproduction and/or Early Development

16. Estimate the area of degraded spawning locations and water or sediment toxicity associated with toxic pollutants in rivers, lakes, nearshore waters, enclosed bays, and estuaries using critical threshold values of early life-stage toxicity, chemical concentration, and physical characteristics

17. Estimate the area degraded spawning locations and water or sediment toxicity associated with toxic pollutants from year to year in rivers, lakes, nearshore waters, enclosed bays, and estuaries using critical threshold values of early life-stage toxicity, chemical concentration, and physical characteristics.

Is water flow sufficient to protect fisheries?

Beneficial Use: Migration of Aquatic Organisms; Rare, Threatened or Endangered Species; Wildlife Habitat

18. Throughout water bodies, estimate the area with the conditions necessary for the migration of aquatic organisms, such as anadromous fish, using measures of habitat condition including water flow, watercourse geomorphology, sedimentation, temperature, and biological communities.

19. Throughout water bodies, estimate the area with the conditions from month to month necessary for the migration of aquatic organisms, such as anadromous fish, using measures of habitat condition including water flow, watercourse geomorphology, sedimentation, temperature, and biological communities.

Is water safe for agricultural use?

Beneficial Use: Agricultural supply

20. Throughout water bodies, estimate the area of lakes, rivers and streams that are used for agricultural purposes where the concentration of chemical pollutants are above or below screening values or adopted water quality objectives used to protect agricultural uses.

21. Throughout waterbodies that are used for agricultural purposes, estimate the concentration of chemical pollutants from year-to-year above or below screening

values or adopted water quality objectives used to protect agricultural uses.

Is water safe for industrial use?

Beneficial Use: Industrial Process Supply; Industrial Service Supply

22. Throughout water bodies, estimate the area of coastal waters, enclosed bays, estuaries, lakes, rivers and streams that are used for industrial purposes where the concentration of chemical pollutants are above or below screening values or adopted water quality objectives used to protect industrial uses.

23. Throughout water bodies that are used for industrial purposes, estimate the concentration of chemical pollutants from year to year above or below screening values or adopted water quality objectives used to protect industrial uses.

Are aesthetic conditions of the water protected?

Beneficial Use: Non-Contact Water Recreation

24. Throughout water bodies, estimate the area of coastal waters, enclosed bays, estuaries, lakes, rivers and streams where the aesthetic conditions are above or below screening values or adopted water quality objectives used to protect non-contact water recreation.

25. Throughout water bodies, estimate the aesthetic condition from year-to-year above or below screening values or adopted water quality objectives used to protect non-contact water recreation.

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