san francisco estuary institute

Final Report

Volunteer Monitoring in the San Francisco Bay Area

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Bay Area Volunteer Monitoring Efforts

Disclaimer

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The following report summarizes the outreach and training efforts to identified groups around the San Francisco Bay area and assesses the success of those efforts. The report focuses attention on two groups, The Lindsay Museum and the Sonoma Ecology Center, chosen by a selection committee of Bay Area volunteer monitoring representatives to expansion "riparian stations".

Bay Area Volunteer Monitoring Groups

Figure 1 on the following page, shows the various watershed groups interested in volunteer monitoring as identified by a questionnaire to local groups which was based upon a survey conducted by the Urban Creeks Council. A total of twelve groups responded to this survey indicating that they were currently involved in or would like to become involved in volunteer monitoring activities and that they would like to receive technical assistance from the San Francisco Estuary Institute and the State Water Resource Control Board.

After an evaluation process, two groups were selected for more focused attention. These groups were encouraged to evaluate their short-term and long-term goals for watershed activities and determine how best to incorporate volunteer monitoring into their programs. This evaluation was based upon a document entitled *What Is a Riparian Station?* (See Page 5). In addition, all groups who requested assistance from assigned Estuary Institute and State Board staff were given some level of programmatic or technical support, described in more detail below.
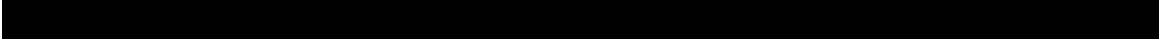
What Is a Riparian Station?

Riparian Stations are facilities or programs within major watersheds designed to coordinate and implement local watershed resource inventories, environmental education, and monitoring. Riparian Stations might exist in public schools, interpretive centers, offices of local agencies or businesses, etc.. Each Riparian Station represents the connective point to a network of substations for smaller watersheds that have their own watershed advisory groups or "Friends of the Creek". Riparian Stations have as their charge to:

☑ Provide direct or indirect scientific, technical, educational, and logistical expertise to involved volunteers or community-based organizations.

☑ Provide information to local agencies for use in appropriate community planning processes.

☑ Develop a local funding base to support ongoing monitoring and educational activities.

☑ Provide volunteers with monitoring protocols and training.

☑ Assure the quality of data collection.

☑ Be the recipient, librarian, and transfer station for data collected by volunteers.

☑ Integrate locally collected data for interpretation.

☑ Function as liaison to one or more regional entities for regional information integration and interpretation.

☑ Encourage and support educators' efforts to incorporate watershed concepts and activities into their curricula.

☑ Provide educational support to the communities they serve.

☑ Organize watershed awareness and involvement activities.

All of these activities need not be undertaken by a riparian station concurrently but any mission statement should include these as organizational goals.

Status of Volunteer Monitoring Groups / Riparian Stations

This section describes the status of volunteer monitoring groups and riparian stations that received assistance by the San Francisco Estuary Institute. The nature of the assistance and the perceived needs of the groups are also indicated.

Sonoma Ecology Center

Riparian Station Status

- Provide direct or indirect scientific, technical, educational, and logistical expertise to involved volunteers or community-based organizations.

  SEC has a Technical Advisory Committee in place with a wide variety of disciplines represented. The SEC also has a state-of-the-art GIS program in place. Educational programs include support for an Adopt-a-Watershed program. Hands-on programs for which SEC provides logistical support include an *Arundo donax* eradication program.

- Provide information to local agencies for use in appropriate community planning processes.

  The GIS program is currently the primary vehicle for informing local agencies. Future programs include close collaboration with the Sonoma RCD on a Sonoma Creek Watershed Plan.

- Develop a local funding base to support ongoing monitoring and educational activities.

  The SEC has had little success in developing a stable funding source for its watershed work. This needs developing.

- Provide volunteers with monitoring protocols and training.

  SEC plans to establish a volunteer-based program for monitoring physical, chemical and biological attributes of the watershed. They have yet to develop a comprehensive inventory or monitoring plan.

- Assure the quality of data collection.

  The Technical Advisory Committee will be a strong component of this task for the SEC.

- Be the recipient, librarian, and transfer station for data collected by volunteers.

  SEC currently serves as a library for technical literature, historic data and other records relating to watershed ecology.

- Integrate locally collected data for interpretation.

  SEC members have performed analyses of historic water quality data and recent data on fish distribution and water quality. SEC is committed to properly analyzed data. The Technical Advisory Committee will again function as a resource for data interpretation.

- Function as liaison to one or more regional entities for regional information integration and interpretation.

  SEC is currently working with a variety of local and regional agencies on its GIS data. The recently completed *Arundo* workshop established other significant linkages.

- Encourage and support educators' efforts to incorporate watershed concepts and activities into their curricula.

  The SEC has focused its educational efforts on it's partnership with the Adopt-a-Watershed program. SEC is working to expand this program to other schools in the region. Functioning of a riparian station would serve to enhance the educational potential of this program.

- Provide educational support to the communities they serve.

  SEC is well along in establishing this task as regular function. Members have delivered presentations on historic watershed conditions. Other activities have included: creek cleanups and storm drain stenciling.

- Organize watershed awareness and involvement activities.

  New programs will include a neighborhood watershed awareness program.

Goals and/or Objectives

The Sonoma Ecology Center's Technical Advisory Committee (TAC) expressed the following resource goals as an outcome of riparian station activities:

- ☑ Restoration of salmonid fish populations.
- ☑ Preservation and restoration of riparian corridors.
- ☑ Preservation and protection of water quality and quantity.

SFEI Activities in Support

SFEI staff met on four occasions with the Technical Advisory Committee and other groups within the organization. Several training sessions were conducted by SFEI staff on thalweg and physical stream measurements. A total of 80 hours of staff time went to support the specific activities of the Sonoma Ecology Center and their efforts in volunteer monitoring.

Ongoing Organizational Needs

Although the Sonoma Ecology Center has done extremely well in establishing

itself in areas of non-native invasive plant control and GIS, the group has not been able to establish a community-based need for monitoring data. Some efforts to get California State Parks to support and use inventory data for creeks flowing through several nearby parks showed promise. Several initiatives to restore wetland habitat in southern Sonoma County may be able to use volunteer-gathered data. It is important for SEC to continue to develop relationships with local agencies in order to identify local data needs and opportunities for program support.

The SEC has a talented and motivated group of technically competent volunteers which will prove to be a tremendous asset to their volunteer activities. However, a core of funded staff is needed to provide consistency and volunteer coordination. Providing for solid funding of their ongoing programs, including new programs in volunteer monitoring should be a high priority for SEC as well as developing local data users.

Lindsay Museum

Riparian Station Status

- Provide direct or indirect scientific, technical, educational, and logistical expertise to involved volunteers or community-based organizations.

  Currently, The Lindsay Museum's technical capabilities lie in the fields of environmental education and wildlife rehabilitation. A significant objective in the Museum's plan includes the identification and acquisition of technical resources.

- Provide information to local agencies for use in appropriate community planning processes.

  The Lindsay Museum does not currently provide monitoring information to local agencies although data being collected by students participating in their Watershed Watchers program could potentially provide useful information on vegetation and water quality.

- Develop a local funding base to support ongoing monitoring and educational activities.

  Although the Museum has had great success in funding educational programs, they have not actively solicited funds for a major volunteer monitoring program. This aspect of their program needs to be developed.

- Provide volunteers with monitoring protocols and training.

  Lindsay staff have provided a solid foundation for school-based inventory and monitoring programs through their Watershed Watchers

program. They will need assistance in developing and supporting an adult-based program.

- Assure the quality of data collection.

  Again, Lindsay staff have instituted good quality control measures for their school-based monitoring programs and, with assistance, could develop equally effective programs for an adult monitoring program.

- Be the recipient, librarian, and transfer station for data collected by volunteers.

  The Museum currently functions as a repository for everything from animals to information. They currently have space allocated for riparian resource material.

- Integrate locally collected data for interpretation.

  Data currently collected by the Watershed Watchers program is stored in paper copy only. Databases need to be created on a computer and ways for exchanging data need to be established. Technical expertise needs to be developed for data interpretation. This area needs further development.

- Function as liaison to one or more regional entities for regional information integration and interpretation.

  This aspect of the Museum's program has not been developed at this time although a pending proposal for watershed GIS development would move the Museum forward on data integration.

- Encourage and support educators' efforts to incorporate watershed concepts and activities into their curricula.

  The outstanding educational programs currently underway at the Museum are exceptional examples of this riparian station function. Expansion of the program to cover more aspects of watershed ecology will only strengthen current activities.

- Provide educational support to the communities they serve.

  Again, the Museum's educational outreach programs are first-rate. Plans for inclusion of field-collected data and displays in the Museum will serve to increase the Museum's focus on watershed issues.

- Organize watershed awareness and involvement activities.

The Museum's Watershed Watchers program certainly provides ample awareness and involvement opportunities and will provide a solid foundation for additional programs involving adults.

Goals and/or Objectives

The Board of Directors of the Lindsay Museum identified the following riparian station goals:

- ☑ Identify possible funding that will secure the long-term development of the program.

- ☑ Determine technical assistance needs.

- ☑ Provide scientifically valid data that will be used in local decision-making processes.

- ☑ Assess local watershed resources, assisted by the San Francisco Estuary Institute, The State Water Resources Control Board and others.

- ☑ Create a phased approach to outreach that includes primary, secondary, tertiary spheres of influence within Contra Costa and Alameda Counties.

- ☑ Create a sustainable educational model that will maximize resources and potential partnerships. The three elements will include outreach into secondary schools and the in-house Lindsay Museum program along with developing an adult (age 22+) monitoring program. All three of the Watershed Watchers programs will incorporate the following components:
  A. Provide direct or indirect educational and technical expertise to all volunteers and community-based environmental education organizations within our sphere of influence.
  B. Provide real-world skills training through exposure to agency and corporate mentors who will instruct participants in conducting proper protocols for monitoring and data collection.
  C. Cross-age mentoring, where older participants who have received the appropriate training, will teach younger participants about proper collection of data and interpretation of the results.

- ☑ Develop an exchange program that will allow monitoring groups from different areas in California to meet and share ideas, discuss protocols and tour various monitoring sites.

- ☑ Using the extensive volunteer and member base of the Museum, develop an adult monitoring program that mirrors existing programs at other riparian stations.

- ☑ Be able to receive and distribute data electronically to local

data users and regional data repositories.

- ☑ Use collected data to build local GIS data layers to aid in watershed management programs.

- ☑ Assist local agencies such as the Contra Costa County Flood Control District to understand water and ecosystem issues that face the county.

- ☑ Capitalize on the unique setting and facility potential (exhibit hall and public education space) to become a site that can be utilized by all riparian stations in Northern California.

  SEC anticipates a need for assistance in the following: 1) development of a training program, 2) fundraising and development assistance, 3) provide explicit technical assistance on ongoing basis.

SFEI Activities in Support

SFEI staff have met on several occasions with Youth Outreach Coordinator Jeff Hicks to identify opportunities for local support of monitoring activities. Several meeting with local stormwater agency personnel were organized to develop an understanding of their data needs. In addition, a donated computer was upgraded and installed at the Museum and a database was developed and installed on this computer to record and analyze existing Watershed Watchers data. A total of 60 hours were spent supporting the Lindsay Museum.

Ongoing Organizational Needs

The Lindsay Museum is well-funded and is well regarded within the local community. This gives it quite an advantage in establishing new programs. The Museum's current Watershed Watchers program, if expanded to include adult participation, is ideally suited as a focal point for monitoring activities in the Contra Costa area.

Ongoing negotiations with Contra Costa County Flood Control and the Contra Costa County Clean Water Program to conduct an inventory of riparian habitat in the county, will hopefully yield opportunities for the Museum to fund new or expanded monitoring and inventory programs.

Other Bay Area Groups

Marin County

A number of very active monitoring groups have surfaced in Marin County. These groups received substantial assistance from SFEI staff in order to capitalize on emerging opportunities and community interest. In particular, a

program (partially funded by the San Francisco Bay Regional Water Quality Control Board through an EPA Environmental Education grant) to train teachers in the Corte Madera Creek watershed was very successful.

A total of 35 teachers from nine different schools within the watershed were given nine four-hour training sessions on water quality parameters. The RWQCB grant paid for each school's equipment. A World Wide Web site was developed and partially implemented which will allow students and teachers to enter their data via the WWW and track water quality changes from one part of the watershed to another. This program could serve as a model for other such programs involving schools located near creeks.

SFEI staff spent 75 hours assisting RWQCB staff in implementing this program (over and above reimbursed costs).

Additional support was provided to citizen groups in Marin County including the Friends of Corte Madera Creek (who were heavily involved in supporting the teacher training program for that watershed), the Mill Valley Watershed Project and the Bay Model.

An emerging coalition, called the Watershed Collaborators, is promoting a structure to support volunteer monitoring in eastern Marin County. This coalition was convened by the Marin Conservation League in cooperation with the Bay Model, and brings together the above groups with agency representatives in dialogue. This effort has been catalyzed in part by the Marin Community Foundation, which wishes to support organized watershed conservation activities. A Watersheds Workshop targeting the needs of Marin County watersheds is under consideration. Support for volunteer monitoring programs has been expressed by representatives from the new Marin County Stormwater Pollution Prevention Program and from the Marin County Flood Control District. A proposal to fund the development of a citizen-based GIS program is under consideration by the stormwater program.

An additional 40 hours has been spent by SFEI staff in support of this emerging coalition.

Alameda County

Several groups in Alameda County were given assistance. These groups included the Friends of San Leandro Creek, who received an upgraded computer and several training sessions on fish habitat, birds and water quality protocols and the Friends of Horseshoe/Lion Creek who were assisted in planning a program of water quality and riparian habitat monitoring.

SFEI staff conducted training sessions on thalweg profiling in support of monitoring activities being conducted by the Alameda County Resource Conservation District. Initial meetings were also conducted between SFEI

staff, State Board staff and staff of Sunol Regional Open Space to consider establishing a riparian station at the Park headquarters.

Approximately 60 hours of SFEI staff time were spent supporting Alameda County monitoring groups.

Santa Clara / San Mateo County

Two groups active in both counties were provided staff assistance. These groups included the Coyote Creek Riparian Station and Bay Area Action. SFEI staff continued to work with staff at CCRS to refine protocols and solidify relationships with local agencies. Several important ancillary projects in which SFEI staff participated aided the increased recognition of volunteer monitoring. These projects (Local Government Pollution Prevention Program and the Coyote Creek Pilot Project of the Regional Monitoring Program) demonstrated the need for more information on sediment sources and transport and that volunteer monitoring data could help fill those information gaps. The newly established Watershed Management and Planning Initiative will also provide a vehicle for increased use and support of volunteer monitoring data.

Assistance was also provided to Bay Area Action through participation in joint planning meetings with the San Francisquito Creek Coordinated Resource Management Plan (CRMP) staff to determine the scope of an upper watershed inventory program. This program will be funded by a 319(h) grant to the CRMP during the coming year.

Approximately 120 hours were provided to assist the various activities in Santa Clara and San Mateo County.

Napa County

Due to the considerable efforts of the Napa Resource Conservation District, a well funded and administered volunteer monitoring is under way in Napa County focused on the more rural upper watersheds of the Napa River. This efforts are led by a competent staff and so SFEI involvement in Napa County was minimal. Occasional meeting occurred to discuss different strategies for increased participation and to evaluate new monitoring efforts such as a bird banding program

Approximately 40 hours were spent by SFEI staff in collaboration with Napa Resource Conservation District personnel.

Training Sessions and General Assistance in Support for Volunteer Monitoring Programs

As part of assisting various Bay-Area community groups in incorporating volunteer monitoring into their activities, a widely advertised Volunteer Monitoring Conference was held in May of 1996. The database containing more than 1300 addresses of community groups and individuals is available for follow-up. More than 120 people attended the conference that included training break-out sessions covering data and information management and addressing teachers' needs. Three subsequent field trips that followed the conference served as training sessions for volunteers. One field trip was held in Napa County to familiarize local volunteers from the Sonoma/Napa area with monitoring protocols, a second training session was held at Sausal Creek in Oakland to attract the volunteer pool from the Lindsay Museum service area and other fledgling Riparian Stations in Contra Costa and Alameda Counties, and the third training session was coordinated with the Coyote Creek Riparian Station in Santa Clara County. Different topics were covered at each, with volunteers given an opportunity to learn about a wide spectrum of monitoring protocols.

Lessons Learned

During the course of working with volunteers and staff of the Bay Area monitoring groups we were struck by their enthusiasm and commitment to the basic principles of volunteer monitoring, i.e., that trained and supported community members can and will spend their precious free time to gather information about their local environment. Time and time again we have seen that enthusiasm channeled into sometimes arduous work to count one last bird or survey one last section of creek bank or measure one last tree. Even those individuals who have, in the past, resorted to strong advocacy or, in some cases, legal action are willing to set aside more confrontational tactics to devote their energies to unbiased data acquisition.

Beyond the experience of being outdoors and learning something new, what seems to motivate people to take part in volunteer monitoring programs is hope that the information they gather will be used to improve the environment they care so much about. In short, volunteers want to see their efforts yield results in a positive manner or at the very least that their data are being used by someone to better understand their environment.

An important lesson which should be learned from this initial attempt at fostering regional volunteer monitoring is that local and regional resource agencies will need to develop mechanisms for accepting and utilizing volunteer-derived information for resource decisions. Once people devote significant time and energy to the volunteer monitoring process they will expect to see results.

Bay Area Regional Watershed Network

In an effort to increase communication and technology transfer, an informal organization of watershed monitoring groups was formed in the Bay Area. Called the *Bay Area Watershed Network*, this assemblage of groups received funding from the San Francisco Foundation and the National Park Service's Rivers, Trails and Conservation Assistance Program. The Network sponsors a bi-monthly forum entitled "Talks in the Hallway" to share monitoring techniques and program successes and challenges and is planning the next volunteer monitoring conference. Unfortunately, no continued funding has been secured for this important inter-organizational group. The role which this network has played in bringing volunteer groups together will be sorely missed unless some other means of support is found.

Need for Context

Volunteer monitors have expressed a need to see their efforts result in meaningful change in the environment of their watershed. In order for this to happen, volunteer monitoring must be a part of an ongoing process of directed awareness which values monitoring activities as a part of an overall strategy of environmental improvement. Currently that strategy does not exist in the Bay Area. Although tremendous strides have been made in cooperative monitoring programs within the Estuary such as the Regional Monitoring Program for Trace Substances, such a cooperative program does not exist for upland environments.

Recent efforts by the Environmental Protection Agency and the San Francisco Bay Regional Water Quality Control Board to foster broad-scale watershed management initiatives within the region have begun to provide a mechanism for utilizing volunteer inventory and monitoring data.

What appears to be needed in the Bay Area is a process for integrating professionally-collected environmental data and volunteers' data with the outcome being a set of environmental goals and specific objectives. The resulting goals and objectives then need a governmental process of implementation the success of which can be tracked by ongoing monitoring (by both environmental professionals and volunteers).

A basic framework for such a process is presented in a report entitled *A Watershed Characterization Strategy* which was produced by the San Francisco Estuary Institute as a part of its volunteer monitoring support contract with the State Water Resources Control Board. This framework of adaptive watershed management, if enabled on a region-wide basis with suitable financial support, could provide the context needed for volunteer monitoring to be an effective tool for environmental improvement and satisfy the desires of volunteers to see their data put to good use. The Watersheds Science Plan, produced by the San Francisco Estuary Institute, represent the science road map for the kinds of information pieces that are necessary to support adaptive management, improve watershed awareness, and produce a regional perspective on local watersheds.

Balance Between Staff and Volunteers

Volunteer monitoring programs are extremely cost effective, expanding the "eyes and ears" of regulators and resource managers many fold. These programs, however, are not free. They require the continued diligence of a dedicated staff to insure continuity and accuracy, the hallmark of a good monitoring program. Another important lesson learned as a result of this program in the Bay Area is that without a stable group of professionals helping to recruit, train, supervise, motivate, and schedule volunteers, a

program can easily stall or disintegrate. Also, once data begin to accumulate, a knowledgeable staff is paramount in order for volunteer data to be stored, analyzed, quality control checked and made available to data users in a timely fashion.

Several groups around the Bay are hampered by the lack of skilled staff to provide the necessary "anchors" for the programs they wish to start or keep functioning. Depending upon the scale of their monitoring efforts, groups have need for volunteer coordinators, skilled trainers and data managers. A relatively small staff, however, can handle a fairly large corps of trained volunteers once the program is underway.

One of the primary lessons learned from the Bay Area volunteer experience was that while the potential and desire of local groups are high, the lack of consistent staff support currently forces many groups to put off or abandon volunteer monitoring programs.

Need for Long-term Funding

As mentioned above, volunteer monitoring is cost effective but not free. The biggest hurdle facing many groups, unable to provide for ongoing staff, equipment and data management needs, is stable, directed funding for their monitoring programs.

The most successful programs, the Coyote Creek Riparian Station, The Lindsay Museum, the Friends of San Leandro Creek, and the Mill Valley Watershed Project have been able to generate some funding locally. The Coyote Creek Riparian Station has had success providing data to the Santa Clara Valley Water District on a watershed by watershed basis. Recent efforts to secure long-term funding, however, have been unsuccessful. The Lindsay Museum has supported its school-based Watershed Watchers program through local school district funding and through grants from charitable foundations. The Museum has not, however, been successful in generating funding sources from local agencies for a broader adult-focused inventory program. The Friends of San Leandro Creek have enough funding and support from the City of San Leandro to maintain a part-time staff person and an office in a public building. A long-term monitoring program, however, has not been funded by the City or the Alameda Clean Water Program which provided the group's initial funding. The Mill Valley Watershed Project is funded solely by one wealthy watershed resident who is also funding the ongoing monitoring program of the project. This individual has also expressed an interest in supporting an effort to establish a county-wide network of riparian stations.

Although many avenues of funding are currently being explored by the Sonoma Ecology Center for its proposed monitoring program on Sonoma

Creek, no consistent local sources of funding have been found. The Napa Resource Conservation District's funding for monitoring programs is primarily generated by local funding sources.

Need for Infrastructure

The above discussions of lessons learned can be distilled into one overarching lesson. And that is, that without some established mechanism for watershed programs which links volunteer data gathering, resource needs and governmental decision-making, it is unlikely that an enduring volunteer monitoring program in the Bay Area will emerge.

The Watershed Management Initiative (WMI) process fostered by the State Water Resources Control Board has the potential to help solidify disparate local efforts into a unified program of watershed management. At this point with efforts just beginning in Napa and Santa Clara Counties, it is too early to determine the likelihood of success, although volunteer monitoring was featured as a recommended component in the San Francisco Bay Regional Water Quality Control Board's revised issue paper on the WMI.

In summary, working with the dozen or so groups of dedicated citizens throughout the Bay Area, we were struck by the determination these groups showed for collecting information which would make a difference in the environment of their watersheds. Although some tremendous hurdles stand in the way of a broad-scale implementation of volunteer monitoring in the Bay Area, this corps of determined individuals, with the proper support and guidance, could form the basis for long-term and meaningful watershed management.

The following outline for a Statewide Volunteer Monitoring Program is the outcome of lessons learned in the San Francisco Bay Area and is submitted in the hope that the energy evident in existing volunteer monitoring programs can be tapped to bring about true community involvement.

Developing a Statewide Volunteer Monitoring Program

The Need for a Statewide Program

California has made tremendous strides in the last several decades to understand and protect its diverse environment. Unfortunately, continuing pressures from a continually expanding population and new environmental crises, such as global warming and ozone depletion, require renewed efforts to monitor environmental change. Although California has many monitoring programs that track changes in the environment linked to public health issues, monitoring activities that yield data on overall environmental health trends have, for the most part, been discontinued because of budgetary restraints.

This trend in decreased environmental monitoring is in sharp contrast to the increased interest by the general public in environmental health issues. In many parts of the country, groups of citizens have banded together to form environmental "watch" programs to track water, air and natural habitat quality changes in their neighborhoods. Beginning in the 1980's, many state governments recognized the opportunity to form cost-effective partnerships with these local groups to collect basic information on environmental conditions. These programs have flourished and in a recent inventory conducted by the U.S. Environmental Protection Agency, there were over 500 volunteer monitoring programs throughout the U.S. with state support in some form afforded to monitoring groups in 45 states (USEPA. 1994. National Directory of Volunteer Environmental Monitoring Programs. EPA 841-B-001). In fact, California is one of the last states to not provide sanctions or monetary support for volunteer monitoring programs.

One reason that has been given for the lack of support for volunteer monitoring was concern for the validity of data collected by non-professionals. Non-standard methods for assessing environmental conditions, the potential for bias, and the potential for citizen lawsuits based upon monitoring data have also been viewed as roadblocks to acceptance of a State-sponsored volunteer monitoring program.

In an effort to establish standard procedures and to evaluate the usefulness of volunteer monitoring, the San Francisco Estuary Institute received a contract

through the State Water Resources Control Board to develop a pilot monitoring program in the San Francisco Bay Area.

The results of this program indicate that a carefully implemented plan of volunteer monitoring throughout the State of California focused on water and watersheds could provide valuable and reliable data which could provide State and local resource managers with the ability to track long-term changes in environmental condition.

A fundamental requirement if such a program is to be successful is the development of public/private partnerships between monitoring groups, data users, and technical experts locally, regionally and statewide. Implicit in such a relationship is the recognition of the importance and validity of volunteer community involvement by those in and outside of government. Also crucial is the willingness of volunteer groups to work with rather than against government and other segments of the community which the volunteer groups may feel are the causes of some of their observed problems or concerns.

The following report outlines a plan for establishing such a program in the State.

Technical Resources Available and Technical Needs

In order to provide reliable and scientifically verifiable data for tracking environmental change, standard methods (protocols) for collecting and analyzing the data need to employed. When non-professionals are employed, careful consideration must be given to the types of data which can be suitably collected by volunteers and specific instructions need to be developed which clearly explain data collection processes (which avoid the use of technical jargon). All of the above are necessary to insure that data comparability and accuracy are as high as possible.

The following section describes the current state of protocol development as well as programs developed or planned which will insure that volunteer-collected environmental data are reliable.

Bay Area Watersheds Science Plan

The Bay Area Watersheds Science Plan was developed by the San Francisco Estuary Institute to help provide the scientific information required to protect and manage local watersheds. It represents a blueprint for information collection based on the following three basic steps: 1) develop an understanding of the environmental past, the present, and change; 2) based upon the understanding of change, develop quantitative resources objectives for the future; 3) monitor progress toward the objectives, and monitor the risk that the objectives might not be achieved. Step one involves scientific

inventories that, when considered as a whole, allow a watershed to be visualized and compared over time with other watersheds. Step two involves integration and scientific assessment of the inventories. Step three involves monitoring as a scheme of successive inventories through time to assess progress or regress relative to the resource goals and objectives. Trained volunteers may play a role in all three steps.

Standard Protocols

Standardized methods or protocols used to measure environmental parameters have been and are being developed by nonprofit groups and governmental agencies. Many of these efforts developed in response to a specific need for information, while some protocols were developed as part of a collaborative effort to build a foundation for consistent data gathering in localized areas.

It should be noted however, that in most cases initial efforts within a defined area (watershed, creek, lake, shoreline) will be focused upon characterization of current condition. In other words, a baseline must be established as a "yardstick" to measure environmental change. In rare instances will there be enough environmental information of a locally specific nature to permit accurate monitoring of environmental change. Therefore the protocols listed below have focused upon developing an accurate baseline characterization of the area of interest.

San Francisco Bay area protocols (TIER 1,2,3)

In 1993, the Coyote Creek Riparian Station (CCRS) was awarded an EPA grant to develop guidelines for and conduct a citizen-based stream inventory a demonstration project to support implementation of the San Francisco Estuary's Comprehensive Conservation and Management Plan. This pilot project, in part funded by a local water and flood control district, developed a set of locally specific protocols which focused on documenting the condition of instream and terrestrial wildlife habitats as well as basic water quality parameters. Several other groups including the Napa Resource Conservation District and the Mill Valley Watershed Project have also developed useful protocols or protocol revisions. Several local environmental consulting firms also contributed greatly to the development and testing of these protocols.

The protocols developed by CCRS were adopted by a regional volunteer monitoring steering committee for the San Francisco Bay Area and adapted for the entire region by San Francisco Estuary Institute staff through funding provided by the EPA via the State Water Resources Control Board. In addition, these regional protocols were categorized into a tiered structure to provide a hierarchical approach to monitoring programs.

This tiered approach can be seen in the table below:

Protocol Level	Title	Author(s)	Status	Review Status	Database Develop.	QA/QC Standards
One						
	Watershed Map	TBD	Not Started	NA	NA	NA
	Watershed Background	TBD	Draft	NA	NA	NA
	Stream Survey	Mill Valley Watershed; FS&W	Field Testing	Needed	Needed	Needed
	EPA Streamwalk	EPA	Complete	Complete	Needed	Yes
Two						
	Thalweg Profile	SFEI	Field Testing	Complete	Complete	Needed
	Bank Characteristics	SFEI	Field Testing	In Prog.	In Prog.	Needed
	Land Use Zonation	SFEI	Not Started	NA	NA	NA
	Rainfall	CCRS, Napa RCD	Complete	Complete	Complete	Complete
	Basic Water Quality	CCRS	Complete	Complete	Complete	Complete
	Beginning GIS	SFEI; GreenInfo Network	Not Started	NA	NA	NA
Three						
	Channel Cross-sections	Napa RCD, CCRS	Complete	Needed	Complete	Needed
	Stream Flow	Napa RCD, CCRS, SFEI	In Prog.	Needed	Needed	Needed
	Habitat Characterization					
	Birds	CCRS	Complete	Complete	Complete	Complete
	Vegetation	CCRS	Complete	Complete	Complete	Complete
	Reptiles & Amphibian.	CCRS	Complete	Complete	Complete	Complete
	Riparian Habitat	CCRS	Complete	Complete	Complete	Complete
	Fisheries	CCRS	Complete	Partial	Complete	Complete
	Invertebrates	CCRS	Draft	In Prog.	In Prog.	In Prog.
	Land Use Inventory	TBD	Not Started	NA	NA	NA
	Full GIS	TBD	Not Started	NA	NA	NA

Macroinvertebrates

Many state-sponsored volunteer programs include sampling of stream invertebrates as a measure of water quality. Unfortunately, with California's varied climatic conditions (Mediterranean and desert microclimates characterized by seasonal stream flow) it has been difficult to develop broadly applicable standardized procedures for invertebrate sampling.

The California Department of Fish and Game has recently addressed these

issues in their plan for rapid stream bioassessment. This process involves the careful establishment of sampling sites

The Coyote Creek Riparian Station is currently developing a procedure for volunteer-based invertebrate sampling. At this writing the methods are still under review by a technical advisory group but preliminary results of quality assurance tests indicate that the procedures produce reliable results.

Protocol Needs: toxicity testing, bacteriological

Additional data describing the characteristics of California's waters will probably always be needed as our understanding of environmental influences expands. Currently identified needs include methods for large-scale testing of biotoxicity of instream and runoff water sources. A preliminary protocol for toxicity testing has been developed by environmental scientists at Woodward-Clyde Consultants in Oakland and will be included in a statewide protocol "toolbox" when quality assurance testing is completed.

Another currently identified need is for a reliable and inexpensive test for bacteriological testing. Bacterial contamination, while in some instances can be caused by animal use of streams and is not necessarily detrimental to the environment or human health, can also result from leaky septic systems or sewer lines and can be a risk to human health. Community concern over elevated bacterial levels is growing and there is a need for developing reliable tests for human-derived bacterial contamination. New immunological testing methods which are both inexpensive and accurate are now becoming available, however, a protocol for sampling and data interpretation needs to be developed based upon these new technologies.

Standard Monitoring Design

The following sections describes the recommended application of available protocols in a variety of different environmental settings. A common theme however, is the application of protocols in a structured, tiered approach from relatively simple qualitative processes to more quantitative and scientifically rigorous protocols. In this manner, groups of volunteers are not overwhelmed with technically demanding efforts while they are gaining a basic understanding of their watershed, stream or shoreline. As the group's volunteer base expands and as their understanding of their informational needs develops, volunteer groups can develop the technical resources to undertake more intensive monitoring tasks.

Natural Creeks

Tier 1: Watershed Survey
A reconnaissance-level survey of the watershed should be conducted which

would include current land use practices, flood control and water supply features (major water diversions, stormdrain conveyances), major vegetation types, existing rainfall and stream flow data, geology and soil types. A watershed map (based upon standard 1:24,000 topographic maps) delineating major sub-basins should be developed.

Additionally, historical records of major catastrophic events such as fire, flooding and earthquakes should be assembled as well as historical photographs and maps depicting previous watershed conditions. These resources will be invaluable as the understanding of current conditions depends in large part upon the group's understanding of human and ecological change in the watershed.

Prior to the implementation of additional inventory programs, the monitoring group should establish the scope of their future activities. They should determine whether to examine the entire stream, watershed, shoreline, etc. or whether they should establish "reference areas". This decision should be made after consultation with regional or local experts.

Tier 2: Water Chemistry and Physical Stream Measurements
The basic nature of the physical and chemical properties of the water and the channel through which it flows are the focus of the next level of characterization.

A set of five water quality measurements should be gathered in one or more locations within a stream for a period of at least one year with a sampling interval of at least every other week. The parameters measured include temperature, dissolved oxygen, pH, conductivity, and turbidity. An important adjunct to this program is the establishment of one or more rainfall stations within the drainage area of water quality monitoring station(s). The rainfall data provide insights into runoff features which may influence instream water quality data.

In order to understand the natural physical processes influencing the morphology of the stream, longitudinal and cross-sectional profiles of the stream should be gathered. These measurements along the length and across the channel yield important information on channel capacity, sediment types and sizes, and gradient change. In addition, these parameters will lead to establishing priorities for future surveys related to important biological habitat conditions such as significant deep water pools, and riffles (potential spawning areas for anadromous fish such as steelhead and salmon and breeding habitat for reptiles and amphibians).

Tier 3: Biological Inventory
Based upon the results of the watershed survey, locations for sampling habitat conditions and wildlife populations can be established. Current

protocols include methods for surveying birds, reptiles and amphibians, fisheries habitat, vegetation, and ecological community classification. Monitoring of arameters in this category requires considerable training. Wildlife biologists, fisheries biologists, ecologists, and botanists are needed to assist volunteer groups in quality control and volunteer training.

Advanced

As the characterization of the stream progresses and becomes more focused on areas of concern or interest, inventory programs should evolve into ongoing monitoring programs to assess ecological change. Additional technical resources should be developed to allow integration of data into a Geographic Information System (GIS) to assist in interpreting geographic relationships of various environmental parameters and permit forecasting of cause effect relationships.

As new protocols are developed, such as toxicity testing and macroinvertebrate sampling, these protocols can also be incorporated into a volunteer monitoring program.

Highly Urbanized Waterways

In many portions of urban California, stream channels and their surrounding watersheds are highly modified and require a different inventory and monitoring strategy. One of the major problems affecting monitoring programs is the lack of access to these often highly controlled areas. Because of liability and vandalism concerns, public works agencies maintain strict access control of flood control channels, water supply reservoirs and similar areas. In some cases, arrangements can be made for access by monitoring groups on a regular or irregular basis. However, during periods of high flow, these agencies may be reluctant to grant access because of real or perceived dangers to the monitors. It is therefore necessary to develop alternative methods for gaining information on water and habitat quality.

Observation Sheet

Volunteers can periodically observe conditions in a channel or other water body and record their observation on a form developed in conjunction with urban storm water programs. This form can inform local agencies of problems such as habitual dumping, non-storm flows from storm drain outlets, or other illegal or detrimental activities.

Catch Basin Assessments

Another valuable monitoring activity in urban areas is the monitoring of storm water catch basins. Volunteers could be assigned a series of catch basins within their neighborhoods to monitor on a regular basis during rainy periods. Data collected could include basin type, type and extent of debris,

or evidence of non-permitted dumping of oil or other toxic substances.

StreamKeeper Program

A more formalized program which incorporates extensive training and liaison with local agencies is the StreamKeeper program developed by the Coyote Creek Riparian Station. Similar to other "keeper" programs, StreamKeepers monitor and report activities illegal or ecologically harmful activities to storm water or public agency personnel and attempt to educate fellow residents about the harmful effects of these activities.

Beaches

Beaches are an important recreation site for Californians. Their sandy and intertidal zones provide unique habitat for a diversity of marine life. Clearly, protocols designed for riverine systems need to be modified to assess saltwater habitats. Monitoring protocols could include:

- ☑ Observation Sheets
- ☑ Bacteriological Analysis
- ☑ biological surveying
- ☑ Water Chemistry

Development of these protocols is beginning in the Los Angeles Region. A Southern California Volunteer Monitoring Manual will include both marine and freshwater monitoring.

Standard Quality Assurance Plans

If inventory and monitoring data are to be taken seriously and relied upon to help guide management activities, the quality of the data must be continually measured and guidelines must be established for the acceptability of the data. Quality Assurance Project Plans (QAPPs) are already needed for any monitoring program which is funded by the U.S. Environmental Protection Agency. These plans are patterned after those used to document the reliability of laboratory analyses. Unfortunately, data describing environmental conditions often rely upon observational data whose accuracy and precision limits are often difficult (but not impossible) to measure.

In order to assist these local groups and to insure acceptance of volunteer collected data, a standard quality assurance plan should be developed, based upon the range of protocols now available, which could easily be adapted by each volunteer group depending upon the requirements of the data users.

Certified Training Sessions

A key element in insuring quality data is a unified approach to training

prospective volunteers. It is vitally important that a consistent approach be taken when dealing with volunteers so that there is a minimum of confusion about techniques used and the manner in which data are recorded.

Manual for Trainers

An obvious first step in insuring uniformity of training programs is the development of a standardized training manual. An example of a well considered teaching tool can be found in *Texas Watch Volunteer Environmental Monitoring Trainer's Manual*. This manual provides complete guidelines for training volunteers so that a regional coordinator and/or local partners could readily implement training programs quickly and efficiently. A similar manual needs to be developed for California volunteers and their partner agency or organizations.

Certification Process

In order to provide recognition and to insure ongoing data quality, a certification process should be developed which would recognize the skills and abilities of qualified trainers in specific protocols. A list of certified trainers should be kept and updated as a resource for local groups and institutional partners. Criteria should be developed for insuring long-term data quality through re-certification programs which foster continuing learning principles.

Quality control sessions for certified trainers should be instituted on a regular basis in addition to certification programs to insure "intercalibration" of training procedures.

Data Storage and Retrieval Mechanism

The information generated by volunteer monitoring groups will be useful not only for local environmental resource evaluation programs, but will also be useful for regional and statewide programs. It will therefore, be important to provide for secure yet accessible data storage and retrieval. Provisions need to be made and data standards established which will insure that these goals will be realized. At present, no specific plan has been adopted for storage and use of volunteer monitoring data statewide.

In the San Francisco Bay Area, the San Francisco Estuary Institute (SFEI) is developing guidelines for regional storage and accessibility of monitoring data using World Wide Web (WWW) programs and procedures. Regular updates and demonstrations of WWW capabilities can be found by accessing SFEI's Web site at *http://www.sfei.org*.

Partnership Documents

Various documents are necessary to provide to potential supporters of volunteer monitoring programs. These documents would outline the responsibilities of the partners and the volunteers so that everyone is certain of their roles. A signed agreement would formalize the partnership. Brochures are needed to help reach potential partners.

Volunteer Monitoring Groups Documents

Similar documents would help community groups understand the responsibilites involved in a monitoring program. A How to Manual has been written that describes important organizational issues (e.g. administrative support, recruiting volunteers, liability).

State and Regional Conference

A state as large and diverse (both ecologically and socially) as California requires that volunteers be brought together in a variety of ways to learn from their locally applied experiences. In some cases techniques which work well in northeastern California may need considerable adaptation to be useful and accurate in the deserts of southern California. By bringing volunteers together they can share collective experiences and learn from one another. At this writing, there has not been a statewide meeting of volunteer monitors.

Equally important are opportunities to share experiences on a regional basis. By bringing volunteers together regionally, in areas of similar environmental characteristics, data collection methods which are locally appropriate can be compared and evaluated. At this point there have been regional meetings of volunteers in the San Francisco Bay Area and in the northwestern portion of the state in conjunction with meetings of restoration groups. A regional meeting of groups in the southern California area is planned.

Administrative Resources

Many of the techniques and protocols for measuring environmental change have been developed by independent groups within California or have been adapted from programs in other states. In order for these data gathering programs to be truly successful, an administrative support structure needs to be developed. The key elements of this support structure are described below. This structure would depend upon locally derived data needs and support. It would require a minimum amount of support from State or Federal personnel or funding sources.

Advisory Council

Efforts to provide reliable environmental data for decision-making and management will require trainers, quality assurance personnel, and advisors

from a broad range of scientific and engineering disciplines. It will be important to create advisory councils of technical experts at various levels of organization. Regional Advisory Councils should be established to deal with common geographical or ecological issues. Enlisting local technical experts from both the private sector and educational institutions to assist in training and data interpretation also provides inroads into the community. Recruiting regional experts also spreads the responsibility for organizational support and technical input.

A statewide advisory council should also be established to insure the applicability and uniformity of data and data collection processes throughout the State. Such an advisory council could contain representatives from State and federal resource agencies and would provide linkages which would insure the use of volunteer data in major resource monitoring programs.

Regional Partnership Program

As was stated at the beginning of this report, in order for volunteer monitoring to be successful, regional and local partnerships need to be established among various segments of the community including data users (such as local storm water programs, flood control agencies, public works departments) resource managers (local Department of Fish and Game personnel, regional and State Park resource managers), educators (teachers and academicians) private enterprise (companies monitoring storm water under the State Industrial Storm Water Permit, engineering firms) and special interest environmental groups (local Audubon Society chapters, California Native Plant Society, Cal Trout).

Regional Partners would agree to support volunteer monitoring on a regional basis and would provide the necessary support to insure initial and continued program support.

Technical Staff

In an effort to focus activities at a local level, State funded support positions should be kept to a minimum. It is important, however, that staff employed by other state and federal departments be allowed and encouraged to participate at appropriate levels of volunteer monitoring programs. The ability to call upon technical staff within the State Department of Fish and Game, State Water Resources Control Board and it's regional Board staff for quality assurance and logistical support, will be absolutely critical to program success. There should be at least one fully funded position at the State level to oversee and coordinate volunteer monitoring activities throughout the State.

Statewide Coordinator

It will be the primary responsibility of the State Volunteer Coordinator to

support the ongoing activities of volunteer monitoring groups throughout the State. It will also be the responsibility of this position to plan and implement an annual or semi-annual conference of volunteer monitoring groups.

Regional Coordinators

As volunteer monitoring activities in the State grow both in the number of volunteers involved and in the number of watersheds being monitored, it will become critically important to provide guidance and coordination at a regional level. Experience gained during a pilot project in the San Francisco Bay Area indicates that groups beginning inventory or monitoring programs will need a high level of involvement from a knowledgeable monitoring program expert. It is apparent from the interest generated by programs in both northern and southern California that the demand for initial assistance will be substantial. These groups will need support in evaluating program goals, recruiting volunteers, selecting protocols, and establishing training programs.

The need for consistent program support will not lessen appreciably as groups begin collecting data. These experienced groups will need ongoing assistance in data management, data evaluation and quality control/quality assurance. These groups will also need encouragement and assurance that their considerable efforts will affect, in a positive way, the health of their target stream and watershed. This assurance must come from both local and state personnel with some legislative or regulatory authority.

All of these factors point to the need for regional coordinators to be assigned to support the needs of the growing number of volunteer monitors.

The following are anticipated duties of a Regional Coordinator. Some duties may be provided or supported by regional partners and/or leaders of local volunteer monitoring groups.

Technical Duties
a. provide support in evaluating program goals, recruiting volunteers, selecting protocols, and establishing training programs.

b. provide ongoing assistance in data management, data evaluation and quality control/quality assurance.

c. enlist technical experts from both the private sector and educational institutions to assist in training and data interpretation.

d. train volunteer leaders in monitoring procedures and quality assurance techniques

e. assist the Technical Advisory Team in holding periodic "Calibration Celebrations" to insure accuracy and to promote pride in data quality.

f. maintain lending library of basic equipment such as water test kits, measuring tapes, etc.

g. develop relationships with local surveyors and contractors for use of surveying levels, tripods and stadia rods as a first step in getting access to more expensive equipment.

h. develop a local certification program to insure quality data and a sense of the importance of training.

i. review volunteer monitoring data to ensure regional consistency, and to assess regionwide trends and status of watersheds.

Organizational Duties
a. coordinate school efforts at all educational levels. Team up here with the Adopt-A-Watershed program.

b. plan and conduct regular training sessions for new volunteer <u>leaders</u> and those wanting to develop expertise in new areas.

c. organize annual regional conference.

d. establish good working relationships with other state and federal agencies in order to promote a mutually beneficial data exchange process. The coordinator should identify which agencies and which programs might have useful information for watershed planning.

e. provide inroads into community. Spread the responsibility for organizational support and technical input.

Equipment and Supplies

Protocols have been designed which require a minimum of field equipment. In some cases, inexpensive yet reliable equipment can be made and substituted for more expensive commercially made equipment. However, a minimum of equipment and replacement supplies is required for virtually all field measurements.

In many cases, local monitoring groups, through partnerships within their communities, will be able to acquire test and field equipment for their use. In those instances where a local group cannot afford to purchase equipment and supplies and a local partner is not available to support those needs, a regional equipment pool should be established. This equipment pool may be more needed in the more rural areas of northeastern or southwestern California.

Regional Equipment Pool

A regional equipment pool should contain replacement chemicals and thermometers for the initial tiers of a monitoring program. It is in these initial stages when a volunteer group may not have established local partnerships or have secured funding to acquire enough test kits to conduct monitoring in multiple locations.

A regional equipment pool should also contain more sophisticated and expensive equipment that may require specialized training or frequent calibration. Equipment such as global positioning satellite (GPS) receivers, survey levels and advanced water quality test kits would be among those items more suitable for a Regional Equipment Pool.

Steps in Making a Statewide/Regional Volunteer Monitoring Structure a Reality

Here are some potential steps to take in making the statewide volunteer monitoring structure a reality.

- ☑ **Package statewide program**
- ☑ **State Water Board approval.**
- ☑ **Regional Water Boards approval**
- ☑ **Funding**
- ☑ **Regional Coordinators on-line**
- ☑ **Form Advisory Council**
- ☑ **Adv. Council approval of statewide program**
- ☑ **Solicit regional partners**
- ☑ **Develop documentation and training infrastructure (ongoing after initial approval)**