

**QUALITY ASSURANCE PLAN**

**for**

**CITIZEN MONITORING/STREAM INVENTORY  
SANTA CLARA COUNTY, CALIFORNIA**

**prepared by**

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**prepared for**

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REGION IX WATER MANAGEMENT DIVISION**

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## **QUALITY ASSURANCE PROJECT PLAN**

**for**

### **CITIZEN MONITORING/RIPARIAN INVENTORY SANTA CLARA COUNTY, CALIFORNIA**

- 1. PROJECT NAME:** Citizen Monitoring/Riparian Inventory, Santa Clara County  
California
- 2. PROJECT REQUESTED BY:** U.S. EPA Region IX
- 3. DATE OF REQUEST:** 25 June, 1992
- 4. DATE OF PROJECT INITIATION:** 1 October, 1992
- 5. PROJECT OFFICER:** Mr. Tim Vendlinski  
**PROJECT DIRECTOR:** Mr. Michael Rigney
- 6. QUALITY ASSURANCE OFFICER:** Ms. Kira Piyatt-Lynch

## **7.0 PROJECT DESCRIPTION**

The Coyote Creek Riparian Station will organize and implement a citizen-based stream inventory program in Santa Clara County. This project will employ trained volunteers to gather baseline information on wildlife use, botanical resources and water quality of six major streams in Santa Clara County (San Francisquito Creek, Matadero Creek, Adobe Creek, Permanente Creek, Stevens Creek, and Coyote Creek) which flow into the San Francisco Estuary. Information gathered during this study would allow a determination of remaining riparian resources in the County and will provide a method for ranking areas of significant habitat value for protection or future enhancement. This method of habitat evaluation will be based upon quantitative measurements taken at 500 meter intervals along the length of each creek. At each point, data will be gathered on botanical resources, bird use, fisheries habitat, and physical stream characteristics. Sampling techniques will be appropriate to each data category. Baseline water quality information will be gathered at one location on each stream, up stream from major urban runoff sources. This project is proposed to cover an 18 month period from October, 1993 to March, 1994.

A pilot study will be conducted on San Francisquito Creek to determine the feasibility of methodologies before implementation on the other nine major streams. Recognizing that public education is a principal component in achieving habitat protection, a "Creek Care Guide" will be developed which will address the opportunities and constraints of creek protection. A model guide will be developed for San Francisquito Creek and a more generic guide will be developed for the county as a whole.

### **Objective and Scope**

The San Francisco Estuary receives water not only from the Pacific Ocean and the Sacramento River, but also from numerous rivers, streams and creeks in the immediate Bay Area. These typically small and intermittent waterways are important areas for groundwater recharge, and pollution and sediment containment. They are also important for a wide variety of wildlife and fish species which depend upon the dense riparian habitat and creek channels for breeding, spawning or as a migratory pathway. However, little information currently exists on the extent and health of the remaining fraction of natural rivers, streams and creeks which still exist in the highly urbanized areas bordering the estuary. Furthermore, there is currently no focused effort on developing regulations or planning tools for the protection of remaining riparian habitat.

This project proposes to provide data, collected by trained volunteers, which will describe the extent and condition of riparian and fisheries habitat in ten streams emanating from Santa Clara County. To provide for greater public awareness and to build a core group of people to act as stream guardians, we will recruit, train and provide quality assurance for citizen monitoring groups whose focus is on individual creeks.

Specific objectives of this project are to: 1) conduct training workshops on habitat and water quality sampling for interested citizens; 2) establish sampling points along each creek to be inventoried, 3) coordinate scheduling of volunteer field crews, act as data coordinator and analyst and compile report of stream characteristics and baseline water quality data; 4) devise, based upon data analysis, a ranking system for determination of preservation priorities; 5) produce a stream

care guide for the pilot project stream (San Francisquito Creek) and a general guide for all county streams.

## **Data Usage**

### ***Water Quality Data***

Water Quality data will be used to:

- 1) Establish baseline conditions within each stream. Sampling will be conducted at one location up stream of major urban runoff influences.
- 2) Basic stream chemistry information will be incorporated into "Stream Care Guides" which will be produced for each creek.
- 3) Data will supplement information being collected by other agencies, e.g., Santa Clara Valley Non-Point Source Control Program, City of Palo Alto, and San Jose/Santa Clara Water Pollution Control Plant.

### ***Habitat Inventory Data***

Habitat Inventory data will be used to:

- 1) Establish baseline habitat characteristics for each stream. Plant and animal data will be used to document occurrence of specific species and determine relative abundance indices.
- 2) Allow comparisons with previous studies conducted in similar habitats locally and regionally. These data will also allow comparisons with statewide habitat use models such as the Department of Fish and Game's *Wildlife Habitat/Relationships* data base (WHR).
- 3) Describe important habitat elements in "stream care guides".
- 4) Develop a quantitative ranking system to determine important habitat characteristics or specific portions of streams which warrant protection based upon "beneficial use" criteria.
- 5) Compare present habitat conditions and degree of use to future conditions.
- 6) Provide rationale and justification for enactment of local and regional "riparian protection" ordinances.

## **Design and Rationale**

### ***Water Quality Data***

Water sampling will be conducted weekly at a single location on each stream through the wet season, October 1992 to May 1993. These individual sampling locations will be established well upstream of major urban runoff sources to afford reasonable baseline conditions and a spot where water is deep enough to allow the sampling bottle to be completely submerged. Weekly sampling on each creek will provide approximately 32 data sets. Single samples will be taken using a LaMotte Water Sampling Bottle (Model No. 3-0026) and basic water quality tests (temperature, turbidity, pH, conductivity, dissolved oxygen, ammonia, nitrate/nitrite, and orthophosphate) will be conducted and data recorded (sample data sheet can be found in water chemistry protocol) onsite. The volunteer methods (meters and purchased test kits) were chosen to balance ease of use and appropriateness for volunteers with minimal training and cost. Many of the methods chosen were reported to be appropriate for use by other volunteer monitoring programs. The tests and methods were also chosen with differing ranges in difficulty from easy (temperature, turbidity), relatively easy (pH, conductivity), moderately easy (ammonia), moderately difficult (dissolved oxygen, nitrate/nitrite) and difficult (orthophosphate).

The test kit method will be verified for accuracy by conducting two quality control sessions. Volunteers will test purchased standard solutions twice during the year (January and April) to determine inter-volunteer variability and effect of experience.

The test kits will be verified for precision by having concurrent samples collected and analyzed by a laboratory using EPA approved test methods. This testing will only be conducted during the pilot project on San Francisquito Creek. The volunteer data and lab results will be compared by correlation analysis. The schedule, frequency, and number of samples tested by the laboratory is yet to be determined.

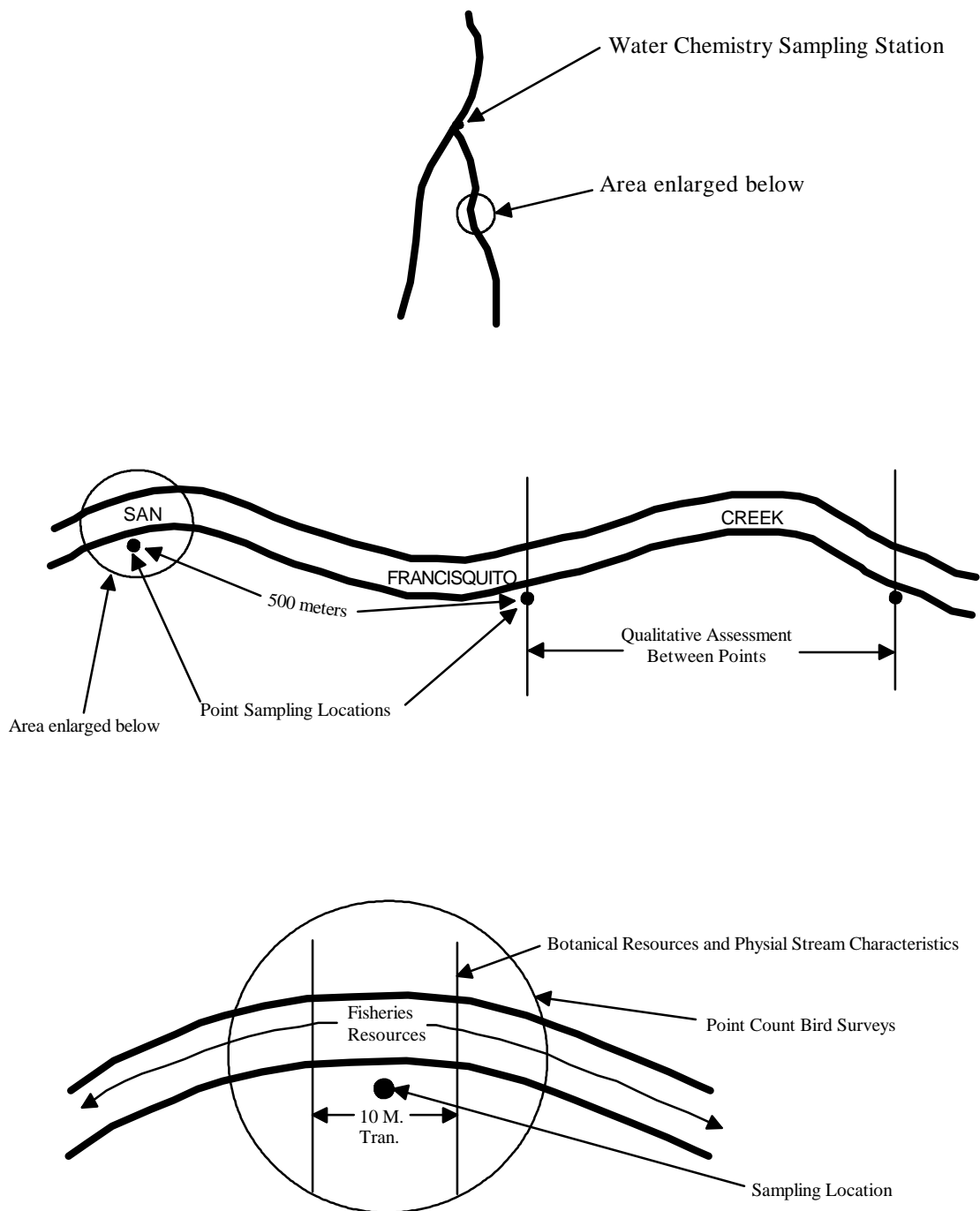
Rainfall totals will be recorded by volunteers only in conjunction with the pilot project. Other rainfall data for use with testing on subsequent streams will be gathered either from U.S.G.S. stations or stations operated by the Santa Clara Valley Water District.

### ***Habitat Inventory Data***

The major focus of the inventory phase of this project is a multifaceted, holistic approach to the characterization of riparian habitat. Teams of trained volunteers will gather discreet habitat data at points established 500 meters apart along each creek. The 500 meter interval was chosen because, in most areas of Santa Clara County, major elevational changes on the valley floor occur at approximately 500 intervals. These elevational changes may be related to changes in habitat conditions.

Each point is permanently marked by a numbered wooden stake driven into the ground. A fluorescent "tassel" survey marker is attached to the top of the stake to make finding the stake easier.

**Figure 1. Representative Sampling Regime**



Distances between points are measured along the top of the stream bank using a metric "Precisimeter" rolling tape measure. For more permanent reference, each stake will be located using "Global Satellite Positioning" equipment provided by the Santa Clara Valley Water District.

The primary categories of data collected include physical stream characteristics (bank slope, gradient, sinuosity, wetted channel width, etc.), fisheries habitat characteristics, (riffle, pool, run, glide, instream and bank cover, canopy closure, substrate character, etc.), botanical resources (species, number, height and diameter of trees, dominant and subdominant understory vegetation, location within creek channel, etc.), bird use (number and kinds of birds encountered while observing at a specific location for a specified period), reptile and amphibian use (number and kinds of reptiles and amphibians encountered during a search of a specified period). Volunteers will also be encouraged to note evidence of illegal dumping or vegetation removal, contamination, and illicit drain lines, or any other occurrence which could jeopardize the biological or physical integrity of the stream.

Habitat characterizations and wildlife use observations will be conducted using a system of uniformly distributed points established along each creek. These points will provide "anchors" for observations. **Figure 1** illustrates a representative characterization scheme for San Francisquito Creek. Data sheets for recording habitat variables and wildlife use are provided in the various protocols. Training handbooks, which describe the use of field equipment and the sampling protocols, are currently being developed which will supplement in-field training courses. Essentially the same protocol would be used on all creeks pending the outcome of the pilot project.

Plant life will be characterized within a 10 meter wide transect, centered on a 500-meter point, extending perpendicular to the creek and from the top of each bank. All woody vegetation more than 2 meters in height and having a diameter at breast height of greater than 4 centimeters will be identified to genus or species and measured for height above ground and diameter. The location within the channel of each measured tree will also be recorded (i.e., left or right bank slope [facing downstream], channel bottom, top of bank). The dominant and subdominant understory (non-tree) vegetation (genus or species) will be determined by relative frequency of occurrence.

Bird use information will be gathered between dawn and 11:00 am using quarterly point counts. Knowledgeable volunteers will count every bird seen or heard (unlimited distance) for a ten minute period at least once at each point in the fall, winter, spring and summer. Each bird will be identified to genus or species. To insure comparability to other studies on bird habitat use, observers will specify whether the bird was within or outside a 50-meter radius of the observer and will tally species for observation blocks of three minutes, five minutes and ten minutes.

Fishery habitat assessments will be based upon stream conditions at the time of the survey. That is, if the stream is not flowing or is dry, habitat characterization will be based upon present condition. No attempt will be made to extrapolate habitat type under flowing conditions. Using the 500-meter point, fish habitat will be described in a variable-length transect extending four habitat units upstream and four downstream. For the purpose of this survey, a habitat unit is defined as a change from riffle, pool, run or glide to another habitat type. Habitat variables such as unit length and width, substrate size, water temperature, and cover vegetation of each habitat unit will be measured and recorded.

Reptile and amphibian (herptile) populations will be surveyed using a time-constrained search technique. Trained observers will search creek channels, banks, and bank tops for reptiles and amphibians beginning at each 500-meter point and proceed downstream for a period of ten minutes. Likely hiding places for herptiles will be examined methodically and all species observed will be identified to genus or species and recorded on a data sheet.

Descriptive information on the type and quality of riparian habitat will be gathered between 500-meter points along each stream. This information will be map based using standard 1"=100' assessor maps. Major plant associations (e.g., cottonwood-willow, willow-alder, oak-buckeye-laurel, scrub-grass) and their extent will be mapped. Also indicated on these maps will be, flood control and erosion control structures, stormdrain outlets, areas of severe erosion, illegal dump sites and apparently unauthorized drain lines.

## Monitoring Parameters and Collection Frequency

### *Water Quality Data*

Water samples will be tested once per week at a single location on each stream according to the schedule outlined in Table 1.

### *Habitat Inventory Data*

Habitat inventory data will be taken on a schedule appropriate to the biological forms being measured. Table 2 summarizes monitoring parameters and collection frequency.

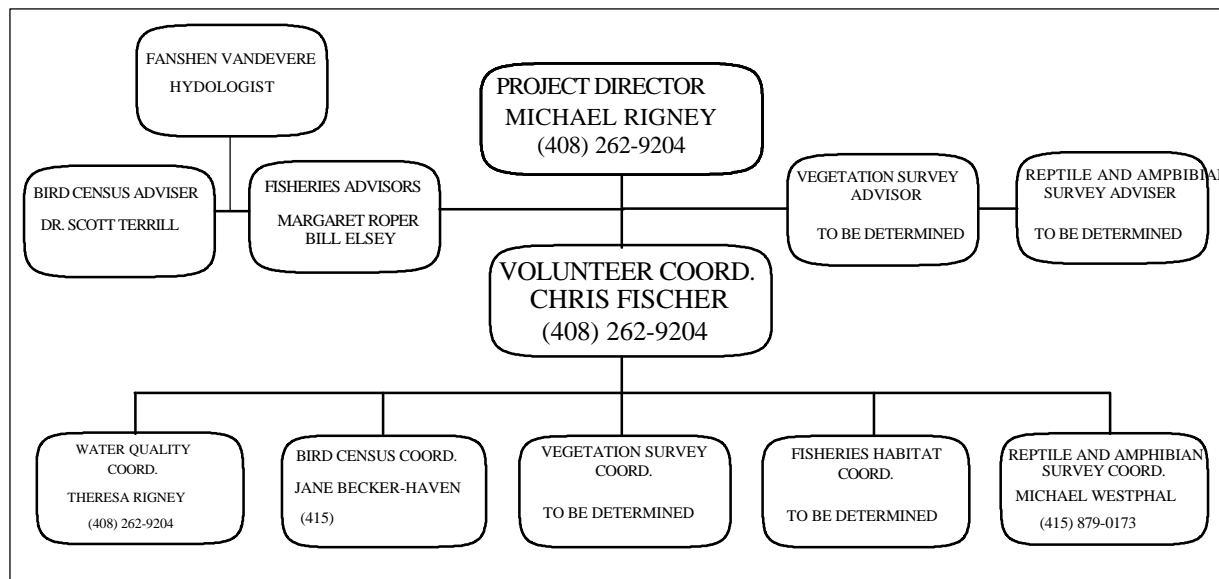
**Table 1. Water Quality Sampling Parameters and Collection Frequency**

Parameter	Sample Volume (liters)	Sample Container	Test Frequency	Immediate Processing or Storage
Temperature	0-1	Plastic or glass	Weekly	Stat, no storage
pH	0-1	Plastic or glass	Weekly	Stat, 2 hrs
Turbidity	0-1	Plastic or glass	Weekly	Stat, or store in dark for up to 24 hrs.
Conductivity	0-1	Plastic or glass	Weekly	Stat, refrigerate up to 48 hrs
Dissolved Oxygen	0-1	Glass, using modified Kremmerer Bottle	Weekly	Fix sample immediately; 8 hrs.
Ammonia	0-1	Plastic or glass	Weekly	Stat, refrigerate up to 48 hrs
Nitrate/Nitrite	0-1	Plastic or glass	Weekly	Stat, refrigerate up to 48 hrs
Orthophosphate	0-1	Glass rinsed with nitric acid	Weekly	Stat, filter immediately, refrigerate up to 48 hrs.
Rainfall		Plastic rain gauge	Daily during storm events	N/A



## 10.0 PROJECT ORGANIZATION AND RESPONSIBILITY

Figure 3. Project Organizational Chart



Michael Rigney (Coyote Creek Riparian Station, P.O. Box 1027, Alviso, CA 95002, Tel. (408) 262-9204) will be the principal investigator for this project. He will be directly responsible to the EPA for the quality and timely completion of the project. He will also be responsible for data interpretation and submission of reports to the EPA.

Mr. Rigney will be assisted by volunteer coordinator, Chris Fischer. Ms. Fischer will, in turn, be assisted by program coordinators for the different field components of the project. Chris will coordinate overall logistical tasks of the project including correspondence with land owners to secure permission for field survey crews to enter private property, and overall volunteer coordination.

Each program coordinator (e.g., vegetation coordinator, bird census coordinator) will be responsible for organizing field survey crews, coordinate timing of field surveys, conveying data sheets to the project leader, assume responsibility for training new volunteers, and answer (or seek guidance from project advisers) volunteer questions regarding field methodologies.

A team of project advisers has been assembled to assist the project leader and program coordinators. These advisers will assess program methodology, check data consistency, conduct initial training classes for program coordinators and conduct periodic volunteer field evaluations. Each project adviser is a professional or well-qualified amateur in their respective disciplines. Dr. Terrill is a Senior Project Manager and ornithologist for H.T. Harvey and Associates, an environmental consulting firm. Margaret Roper and Bill Elsie are fisheries biologists with the consulting firm of John Stanley and Associates. Fanshen Vandevere is a professional hydrologist, also with the consulting firm of H.T. Harvey and Associates. Michael Westphal is a State Park Naturalist and an expert on amphibians and reptiles of the Santa Cruz Mountains.

## 11.0 DATA QUALITY REQUIREMENTS AND ASSESSMENTS

### Precision

#### *Water Quality Data*

Precision is the degree of agreement of repeated measurements of the same parameter expressed quantitatively as the standard deviation computed from the results of a series of controlled determinations<sup>1</sup>. Anticipated precision goals for the water quality monitoring phase of the project are summarized in Table 3. For water quality data there will be two quality control sessions where purchased standard solutions will be tested by volunteers involved in the water quality program. The first session will be held in February and the second in April. The results of each session will be analyzed for range, mean, and standard deviation and tested for significance by using the paired two-sample for means *t*-test<sup>2</sup>. Range can be defined as the numerical values, from high to low, for any given test. Mean is expressed by the following formula:

$$\bar{x} = \frac{\sum x_i}{n}$$

where  $\sum x_i$  is the sum of observed of the  $i_n$  sample and  $n$  is the number of values in the sample. Standard deviation of samples will be calculated using the following

$$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$$

where  $\bar{x}$  is the sample mean and  $(x_i - \bar{x})$  indicates the difference between individual measurements from the mean. The paired two-sample for means *t*-test will determine whether the controlled testing conducted by the laboratory is significantly different than the results achieved by citizen monitoring. The testable hypothesis is that there will be no real difference between the means of the two sampling methods ( $H_0 : \bar{x}_A = \bar{x}_B$ ) The formula used to determine the calculated *t* value is as follows:

$$t_{calc} = \frac{\bar{x}_A - \bar{x}_B}{(s^2 d)^{1/2} / n}$$

with (n-1) degrees of freedom

where  $\bar{x}_A, \bar{x}_B$  = the mean of groups A and B

n = sample size

$s^2 d$  = the variance of the paired-sample differences (d) between groups A and

B

$$s^2 d = \frac{\sum d^2 - \frac{(\sum d)^2}{n}}{n-1}$$

<sup>1</sup> ASTM D1129-90, *Standard Terminology Related to Water*.

<sup>2</sup> Stednick, J.D. 1991. *Wildland Water Quality Sampling and Analysis*. Academic Press. NY. 217 pp.

Table 3  
PRECISION, ACCURACY AND COMPLETENESS OBJECTIVES

Parameter	Method/Range	Units	Sensitivity	Precision	Accuracy	Completeness	Calibration	Lab Test
Temperature	Thermometer -5 to +45C	Degrees C	0.5 degrees C	± 1.0	± 0.5	80%	with NBS certified thermometer	EPA Method 170.1
Dissolved Oxygen	Micro-Winkler Titration	mg/l	0.1 mg/l	<± 1.0	<± 1.0	80%	Use of dissolved oxygen standard	EPA Method 150.1
pH	pH meter 2-14	Standard pH units	0.1	<± .05	<± .05	80%	pH standardized buffer pH 7.0 ± 0.02	EPA Method 120.1
Conductivity	Conductivity sensor 100 to 19,900 µ Siemen	µ Siemen	100 µ Siemen	± 200 µ Siemen	± 200	80%	NIST Conductivity Calibration Standard	EPA Method 180.1
Turbidity	Octet Comparator 25-400 NTU	NTU	8 cells (25, 50, 75, 150, 200, 300, 400, >400 NTU)	± 25%	± 25%	80%	Comparison to standard that are matched to formazin standard	EPA Method 360.1
Ammonia	Nessler reagent, color disc comparison 0-3 mg/l	mg /l	0.1 mg/l	± 0.5	± 0.5	80%	Nitrogen, ammonia standard	EPA Method 350.2
Nitrate	Color disc, cadmium reduction, 0-50 mg/l	mg /l	1.0 mg/l	± 5	± 5	80%	Nitrate standard	EPA Method 300.0
Nitrite	Color disc, diazotination, 0-0.5 mg/l	mg /l	0.01 mg/l	± 0.05	± 0.05	80%	Nitrite standard	EPA Method 300.0
Ortho-phosphate	Color disc with ascorbic acid, 0-5 mg/l	mg /l	0.2 mg/l	± 0.5	± 0.5	80%	Phosphorus standard	EPA Method 4500-PD

All precision and accuracy objectives are based upon vendor and other volunteer monitoring programs listed below. Part of this study will be to determine accuracy and precision levels appropriate for these tests methods by comparison to standard solutions and paired laboratory testing.

Hach Company, 1992., Water Analysis Handbook. 2nd Edition.

Ellett, K. 1988. Providing credible information. Proceedings of the National Workshop on Citizen Volunteer Monitoring. Alliance for the Chesapeake Bay.

Stednick, J.D. 1991. Wildland water quality sampling and analysis. San Diego. Academic Press.

The statistics from the two sessions will be compared to determine if precision increases with experience.

### ***Habitat Inventory Data***

In order to measure the precision of habitat measurements gathered by volunteers, 15% of all sampling points will receive dual sampling sessions. During these sessions, project advisors will accompany teams into the field and conduct simultaneous data collections for each of the habitat parameters being assessed. The results of these data sets will be analyzed for range, average, and standard deviation (calculated as above) and the results will be tested for significance using an unpaired samples *t*-test. The calculated value of (*t*) for unpaired groups is:

$$t = \frac{\bar{x}_A - \bar{x}_B}{\sqrt{\frac{s_p^2(n_A + n_B)}{n_A n_B}}}$$

where  $\bar{x}_A$  and  $\bar{x}_B$  = the means for groups A and B,  
 $n_A$  and  $n_B$  = the number of observations in groups A and B, and  
 $s^2$  = the pooled within-group variation.

### **Accuracy**

#### ***Water Quality Data***

Accuracy is the measure of the degree of conformity of a value generated by a specific procedure to the assumed or expected true value, and includes both precision and bias<sup>3</sup>. Accuracy will determinations will be based upon two types of testing. First, accuracy will be checked using standard (known value) solutions (as described in the various parameter tables). Percent recovery statistics comparing the results of the field test method to the standard values will be performed<sup>4</sup>. The use of standard solutions insures that the test kit procedures are capable of obtaining valid values. Second, accuracy will be measured by comparing volunteer test data to data obtained by a professional laboratory. Matched pair samples (two samples taken at the same time and place) will be tested using the test kits and an accredited laboratory. We will be working with the San Francisco Bay Regional Water Quality Control Board for the laboratory testing. This accuracy comparison will be conducted 4-10 times (dependent upon SFB-RWQCB budget) and a correlation analysis performed on the two methods to determine accuracy and bias.

#### ***Habitat Inventory Data***

When sampling wildlife and plant communities, accuracy is typically defined as "a measure of the closeness of a statistic obtained using a certain sampling procedure to the true value of a population parameter."<sup>5</sup> Unfortunately, "true values" or "standards" exist for such population

<sup>3</sup> ASTM D1129-90, *ibid*.

<sup>4</sup> ASTM D3856-88, *Standard Guide for Good Laboratory Practices in Laboratories Engaged in Sampling and Analysis of Water*, paragraph 11.10.

<sup>5</sup> J.A. Ludwig and J.F. Reynolds. 1988. *Statistical Ecology*. John Wiley & Sons.

parameters as species occurrence and abundance in only the most primitive (closed ecosystems) or harshest (Antarctic ice floes) environments. Periodic replicate sampling utilizing project advisors will help determine observer bias and thus lead to more accurate habitat sampling.

In addition, results of wildlife surveys will be compared to a habitat suitability model developed by the California Department of Fish and Game. The *Wildlife Habitat/Relationships System* provides a predictive model of wildlife species occurrence based upon a community-level description of the existing wildlife habitat<sup>6</sup>. Thus, a statistical comparison may be made between species observed and species expected which will, in turn, yield a measure of sampling accuracy when related to the predictive model.

## **Representativeness**

### ***Water Quality Data***

The water chemistry tests use grab samples<sup>7</sup> representative of the water quality at the specified time and place. A water sampling apparatus is lowered from a bridge or walkway to mid stream locations and submerged to avoid surface scum. Locations are chosen where water is sufficiently mixed, avoids major outfalls and shoreline turbulence, and conforms to local conditions. Sampling is repeated weekly to provide a reasonable estimate of seasonal cyclic variation.

Water quality testing near the headwaters of each creek on a weekly basis should be representative of water conditions as it flows from the upper watershed. Because some urban or rural development has taken place above the testing locations, some runoff contamination is likely. However, the sites should be free of major urban runoff contaminants and thus, would serve as baseline conditions for any future comparisons of conditions downstream.

### ***Habitat Inventory Data***

Habitat measurements taken 500 meters apart along the length of any given stream should fairly represent the actual variation of habitat types and quality. Small areas of disturbed or altered stream channel may be missed through this sampling procedure, however, descriptive assessments between points will yield valuable anecdotal information for overall stream characterizations.

## **Comparability**

### ***Water Quality Data***

The methods chosen for this study are comparable to methods cited in the EPA Volunteer Lake Monitoring Methods Manual<sup>8</sup>, The Monitor's Handbook<sup>9</sup>, Volunteer Water Monitoring: A Guide

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<sup>6</sup> K.E. Mayer, W.F. Laudenslayer. 1988. *A Guide to Wildlife Habitats of California*. California Department of Fish and Game.

<sup>7</sup> ASTM D1129-90, *ibid*.

<sup>8</sup> *Volunteer Lake Monitoring: A Methods Manual*. U.S. Environmental Protection Agency, Office of Wetlands, Oceans, and Watershed Protection, WH-553.

<sup>9</sup> *The Monitor's Handbook*, LaMotte Co. #1507, Chestertown, MD.

for State Managers<sup>10</sup>, and the citizen's monitoring programs in Washington<sup>11</sup> and the Eastern United States<sup>12</sup>.

### ***Habitat Inventory Data***

The sampling techniques utilized in this study have been used extensively by field biologists. Point Counts for birds follow guidelines suggested by Ralph, et al. 1981<sup>13</sup>; plant sampling techniques follow guidelines suggested by Hays, et al., 1981<sup>14</sup>; reptile and amphibian sampling follow guidelines suggested by Cooperrider, et al., 1986<sup>15</sup>; and fisheries habitat surveys follow guidelines suggested by Fosi, et al., 1992<sup>16</sup>.

### **Completeness**

#### ***Water Quality Data***

Completeness will be measured as the percentage of total samples collected that are completely analyzed. It is anticipated that there will be data for each sampling period since repeat sampling and testing can be performed directly at the field location if a sample is lost or compromised. If, however, a data point is considered unreliable by the coordinator, it will be reported as such. The goal of the program is to have 80% of the planned samples for each creek tested and reported.

#### ***Habitat Inventory Data***

Completeness for habitat sampling will be established by percent of 500 meter points sampled for all habitat-related variables (bird use, reptile and amphibian use, botanical characteristics, and fisheries habitat characteristics). The goal of the program is to sample 90% of all points on each target creek.

## **12.0 SAMPLING AND ANALYTICAL METHODS**

#### ***Water Quality Data***

Water samples will be gathered using a LaMotte type grab sampler that incorporates a dissolved oxygen bottle and additional test water. The sampler will be lowered from a bridge to midway in the water column. A trip line is pulled and the dissolved oxygen sample bottle begins filling and overflowing. The contents of the bottle are exchanged approximately 3 times before the

<sup>10</sup> *Volunteer Water Monitoring: A Guide for State Managers*, U.S. Environmental Protection Agency, Office of Water, EPA 440/4-90-010, August, 1990.

<sup>11</sup> Yates, Steve. 1988. *Adopting a Stream, A Northwest Handbook*, Adopt-A-Stream Foundation, Seattle, WA.

<sup>12</sup> The Izaak Walton League of America.

<sup>13</sup> C.J. Ralph and J.M. Scott, eds. 1981. *Estimating Numbers of Terrestrial Birds*. Studies in Avian Biology #6. Cooper Ornithological Society.

<sup>14</sup> Hays, R.L., C. Summers, and W. Seitz. 1981. *Estimating Wildlife Habitat Variables*. U.S.D.I. Fish and Wildlife Service. FWS/OBS-81/47.

<sup>15</sup> A.Y. Cooperrider, R.J. Boyd, and H.R. Stuart. 1986. *Inventory and Monitoring of Wildlife Habitat*. U.S.D.I. Bureau of Land Management.

<sup>16</sup> G.L. Fosi and F.L. Reynolds. 1992. *California Salmonid Stream Habitat Restoration Manual*. C.D.F.G.

apparatus is filled. During retrieval, the water pressure prevents exchange of air in the water sample. A thermometer is placed in the sampler ancillary chamber for in-stream water temperature measurements. The excess water in this chamber is used for the other water chemistry tests.

Written procedures are used by the volunteers which incorporate the manufacturers' procedures and also include helpful hints developed by the coordinator. The written procedures have diagrams, units of measure for each test and calculations in a format which is easy to follow and understand. This procedure manual is used to train new volunteers in the water chemistry program.

### ***Habitat Inventory Data***

A variety of analytical and statistical tests will be employed to determine wildlife use patterns as they relate to physical and botanical characteristics at each point on a stream. Statistical comparisons will also be made between and across points and streams. The ultimate goal of these comparisons is to develop a set of criteria, based upon quantitative field data, to rank habitat quality of various rivers, streams and creeks.

## **13.0 SAMPLE CUSTODY PROCEDURES**

### ***Water Quality Data***

The water quality monitoring tests do not require specific custody procedures since they will, in most cases, be conducted immediately by the same person who performs the sampling. In certain circumstances (such as driving rain or extreme cold) samples will be taken to a nearby residence for analysis. The dissolved oxygen samples will be fixed prior to transport.

The professional lab samples will be performed under their chain of custody procedures with their labels and documentation protocols.

### ***Habitat Inventory Data***

No samples will be collected as a routine method or a part of any of the habitat assessment techniques. It may be necessary to collect portions of some plants for latter identification by botanists. Each plant sample will be inserted in a plastic sealable bag with a waterproof label inside the bag which indicates sample point, date collected, verbal description of plant, person collecting, and approximate location within the plant transect. After identification, the specimen will be discarded unless it is determined that the plant specimen is unusual or of some importance. The specimen will then be mount on herbarium grade paper and pressed with a plant press. If needed, the specimen will be deposited at a suitable herbarium with documentation.

## **14.0 CALIBRATION PROCEDURES AND PREVENTATIVE MAINTENANCE**

### ***Water Quality Data***

No major pieces of equipment are used to conduct the water quality tests. The volunteer equipment is in kit form and reference standards will be used during the quality control sessions. Replacement kits will be ordered if the constituents are contaminated or broken. Under such circumstances, it may be necessary to borrow equipment from other labs until replacements are obtained. In either case, there is the possibility that one or two sampling dates maximum may be missed.

### ***Habitat Inventory Data***

Data gathered during the course of the habitat assessment program utilizes a variety of field instruments which require frequent adjustment or calibration. In particular, optical range finders, clinometers, pocket levels and compasses will be checked after each use and recalibrated as necessary. An operations manual for point counts can be found in bird survey protocol. The remaining manuals for fisheries assessment, botanical resource inventory, and reptile and amphibian surveys are currently available as individual protocols.

## **15.0 DOCUMENTATION, DATA REDUCTION AND REPORTING**

### **Documentation**

#### ***Water Quality Data***

The raw sampling data will be recorded on a pre-formatted data sheet (see Water Chemistry protocol). These data sheets will be retained by the Water Quality Coordinator.

#### ***Habitat Inventory Data***

Habitat inventory data will be recorded in the field by volunteers using pre-defined data sheets examples of which may be found in the individual protocols. Each volunteer has received training in the field by the program advisors and coordinators in order to recognize and categorize the important habitat features of each sub-program. Operations manuals for these assessments are currently being developed.

### **Data Reduction and Reporting**

#### ***Water Quality Data***

The raw data will be entered into an IBM-PC compatible computer in a standard spreadsheet format. Standard data statistics such as mean, median, mode, range, standard deviation, and

variance will be reported on the replicate sample results. Matched pair correlations will be conducted on the samples tested by the lab and volunteers. Tables, flowcharts, pie charts, bar graphs and line graphs will be used to present the relationship between variables over the course of the study. See water sampling operations manual in the Water Chemistry protocol for data reduction protocols.

### ***Habitat Inventory Data***

Habitat data will be presented in several forms. A habitat map showing the type and extent of riparian vegetation along each creek at a scale of 1"=100' will be provided. Summary data for bird, reptile and amphibian sightings will be reported in tabular form. Summary data for fisheries and botanical resources will also be presented in tabular form. Comparisons will be made between sampling sites based upon summary statistics for the stream as a whole.

To avoid errors in data entry, program coordinators will review data sheets submitted by field teams and will immediately clarify any illegible or questionable data before it is entered into the computer, the Project Director will periodically review data sheets to insure reliability and accuracy.

The Project Director will be directly responsible for data reporting for both the water quality and habitat inventory phases of this program.

## **16.0 DATA VALIDATION**

### ***Water Quality Data***

As soon as possible after receipt of data sheets, they will be screened for errors in identification, decimal placement, dates, times, units, legibility and completeness by the water chemistry coordinator. Volunteers will be contacted by telephone to correct any problems or procedural errors as soon as possible. Computer data will be printed and cross-checked with field data forms to insure accuracy of data entry. At the discretion of the Project Director, data which do not meet the data quality requirements will either not be reported or will be reported with an explanation of associated problems.

### ***Habitat Inventory Data***

A two-tiered approach to data quality will be employed as habitat inventory data are gathered. All habitat and wildlife use data will be screened by the program coordinators and the project manager for errors in data entry and transcription. In addition, the project coordinators and the project manager will review data sheets to insure that the requirements for data quality assessments, equipment calibration and observer competency are met. At the discretion of the project manager, data which do not meet these requirements will either be discarded and the point resurveyed or the data will be reported with an explanation of the associated problems.

## **17.0 PERFORMANCE AND SYSTEMS AUDITS**

### ***Water Quality Data***

Adherence to performance criteria will be made essentially with the verification testing which will be conducted by an laboratory using EPA approved methodologies and testing of volunteers through the use of standard solutions. A project review with recommendation for improvement will be made midway through and at the end of the pilot project.

### ***Habitat Inventory Data***

Major problems with sampling protocols, should they occur, will be identified and adjustments made on an ongoing basis through data review by project coordinators and the project manager. An evaluation of data collection techniques will be made midway through and at the end of the pilot project.

## **18.0 CORRECTIVE ACTION**

### ***Water Quality Data***

The water quality coordinator is responsible for initiating corrective actions which are deemed necessary by the project manager. Regular quality checks through laboratory testing (10 times during the year) and the use of standards should insure that any problems are identified quickly and procedures changed accordingly. Should the results of data validation measures indicate that the integrity of data associated with a sample set are questionable, the analyses for that particular data set will be discarded. Quality assurance audits of the program, referenced earlier under Section 11, have been proposed in the work plan to insure that work is performed by individuals who understand the objectives and methods to be used. Audit results will be documented and reported to the project manager who will be responsible for implementing all necessary corrective actions.

### ***Habitat Inventory Data***

The various project coordinators are responsible for first level screening of data. In addition, 15% of all field sessions will be receive duplicate sampling by project coordinators. Should problems arise, and in consultation with the project manager, corrective action will be taken promptly to insure valid data. Proposals for quality assurance through periodic dual sampling with project coordinators, have been made in this document.

## **19.0 REPORTS**

### ***Water Quality Data***

Water quality data will be reported to the EPA and the Santa Clara Valley Water District in quarterly progress reports in mid-January, April, July, and October. A final report will be submitted in

January, 1994. Data reports will be in graphic and narrative form concentrating on correlation studies between laboratory testing and testing using standard solutions. The final report will detail findings of baseline water chemistry testing and correlation studies with recommendations for technique improvements.

### ***Habitat Inventory Data***

As with the water quality data, quarterly reports will be submitted which summarize current findings. A final report will be issued in January, 1994 with results of the various habitat measurements collected. A focus of this report will be a detailed analytical and statistical evaluation of habitat variables and suggestions for development of a habitat ranking system based upon field data. A set of maps will accompany each the report submitted for each stream and a completed database of habitat characteristics for each creek.

Included in this report will also be a general "stream care guide" and specific stream care guides for each of the targeted streams. This guide, upon approval, will be printed in a limited run for distribution to decision makers and interested local citizens. Future publication of these guides will be at the discretion of the EPA and the Santa Clara Valley Water District.