

# **MATILIJA DAM GIANT REED REMOVAL WATER QUALITY MONITORING PLAN**

## **County of Ventura Watershed Protection District**

800 S. Victoria Ave.,  
Ventura, California 93009

Contact: Tom Lagier, Project Manager



## **EcoSystems Restoration Associates**

8954 Rio San Diego Drive  
Suite 610  
San Diego, CA 92108  
619.291.1475

Contact: Julie Simonsen-Marchant, Project Manager

June 2007

## TABLE OF CONTENTS

<b>1.0</b>	<b>INTRODUCTION.....</b>	<b>1</b>
1.1	Monitoring Plan Objectives .....	1
1.2	Existing Data .....	1
1.3	Quality Assurance and Quality Control for Water Quality Data Collected .....	1
1.4	Data Management.....	1
1.5	Reporting.....	3
<b>2.0</b>	<b>WATERSHED OVERVIEW .....</b>	<b>3</b>
2.1	Geology .....	3
2.2	Land Uses .....	4
2.3	Vegetation .....	4
2.4	The Ventura River .....	4
2.5	Project Area .....	5
<b>3.0</b>	<b>PARAMETERS OF CONCERN.....</b>	<b>5</b>
3.1	Temperature.....	5
3.2	pH.....	5
3.3	Turbidity .....	6
3.4	Dissolved Oxygen (DO) .....	6
3.5	Conductivity (Total Dissolved Solids).....	6
3.6	Stream Flow .....	7
3.7	Glyphosate and Surfactant .....	7
<b>4.0</b>	<b>SAMPLING SITES.....</b>	<b>8</b>
4.1	Routine Sampling.....	8
4.2	Grab Sampling .....	9
<b>5.0</b>	<b>SAMPLING SCHEDULE .....</b>	<b>9</b>
5.1	Pre-treatment Sampling Period.....	9
5.2	During Treatment Sampling Period.....	9
<b>6.0</b>	<b>SAMPLING METHODOLOGY .....</b>	<b>9</b>
6.1	Stream Team Sampling Methodology.....	9
6.1.1	Air Temperature .....	10
6.1.2	Dissolved Oxygen .....	10
6.1.3	pH .....	11
6.1.4	Turbidity .....	11
6.1.5	Conductivity (Total Dissolved Solids) .....	11
6.1.6	Stream Flow.....	12
6.1.7	Collecting Stream Samples .....	13
6.2	Glyphosate Sampling Methodology .....	14
<b>7.0</b>	<b>THRESHOLD AND ACTION PLAN .....</b>	<b>14</b>
7.1	Threshold .....	14
7.1.1	Glyphosate Threshold .....	14
7.1.2	Surfactant Threshold .....	15
7.2	Action Plan .....	15
7.2.1	Glyphosate Action Plan .....	15
7.2.2	Surfactant Action Plan .....	15
<b>8.0</b>	<b>WATER QUALITY BMPS AND SPILL RESPONSE .....</b>	<b>15</b>
<b>9.0</b>	<b>REFERENCES.....</b>	<b>16</b>

## FIGURES

Figure 1	Water Quality Monitoring Locations .....	2
----------	--	---

## APPENDIX

Appendix A	Quality Assurance Project Plan
------------	--------------------------------

## **1.0 INTRODUCTION**

The Giant Reed Removal Project (Project) is one component of the larger Matilija Dam Ecosystem Restoration Project, which is the result of more than five years of collaboration with stakeholders and experts. The Project is sponsored by the Ventura County Watershed Protection District (District) and being conducted under the Proposition 40 Consolidated Grant from the California State Water Resources Control Board. The goal of the Project is to substantially reduce the abundance and distribution of invasive plants which consume large quantities of water, displace native vegetation and wildlife, disperse readily during floods, and exacerbate flooding, erosion, and fire intensity. The outcome of the Project is recolonization of native vegetation and restoration of native habitats.

Implementation of the Project will be guided by the Matilija Giant Reed Removal Plan (District 2007), which includes the use of herbicides, construction of temporary access roads, and other activities that have the potential to affect water quality in Matilija Creek and Ventura River. More specifically, contractors will follow the specifications and plan sheets. To protect water quality in the Matilija Creek and Ventura River watershed, the District will conduct regular monitoring of the surface water in these rivers. The water quality monitoring will be guided by this Water Quality Monitoring Plan (Monitoring Plan) and the Ventura River Watershed Monitoring Program Quality Assurance Project Plan (QAPP).

### **1.1 MONITORING PLAN OBJECTIVES**

This Monitoring Plan will be implemented to provide the District with information on the effectiveness of water quality protection best management practices (BMPs) utilized during the Project. This Monitoring Plan is designed specifically to monitor the short-term water quality trends within the Project area (Figure 1).

### **1.2 EXISTING DATA**

This Monitoring Plan will be implemented in conjunction with the more comprehensive Ventura River Watershed Monitoring Program conducted by the Ventura River Stream Team (Stream Team). The Stream Team has over 5 years of baseline water quality data in the watershed.

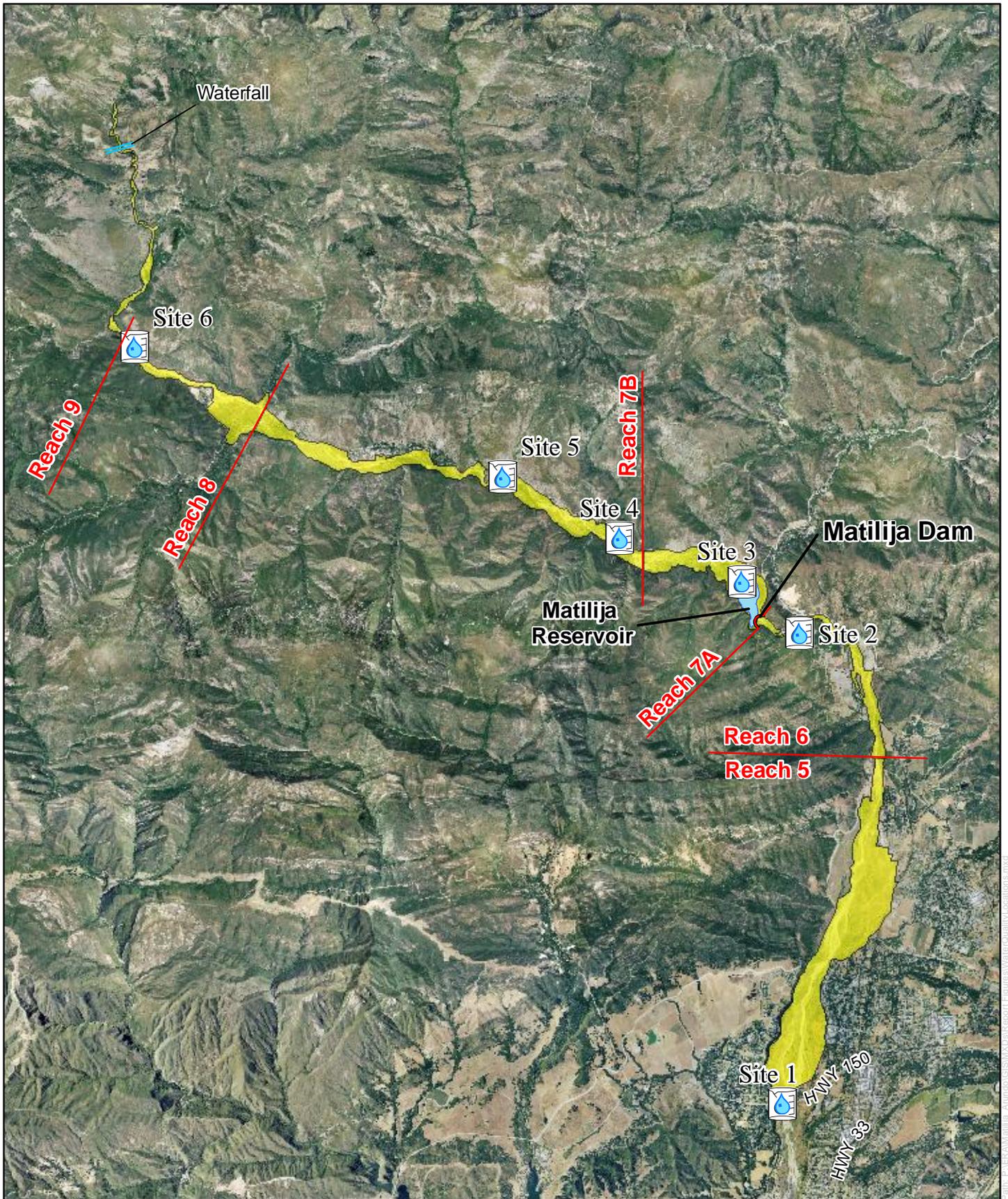
### **1.3 QUALITY ASSURANCE AND QUALITY CONTROL FOR WATER QUALITY DATA COLLECTED**

Quality assurance and quality control of the data collected under this Monitoring Plan will be performed pursuant to the QAPP, which was approved by the Los Angeles Regional Water Quality Control Board (RWQCB) in October 2004 (Appendix A). The QAPP outlines the data quality objectives, training requirements, documentation and records retention, sampling design and methods, sample handling and custody procedures, analytical methods, quality control, and data management.

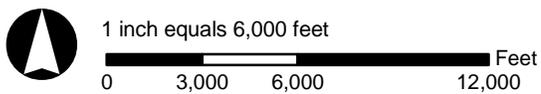
The QAPP is consistent with and was prepared in accordance with the Surface Water Ambient Monitoring Program (SWAMP) guidelines set forth by the U.S. Environmental Protection Agency (USEPA), the State Water Resources Control Board (SWRCB), and RWQCB. SWAMP is a state-wide monitoring effort designed to assess the conditions of surface waters throughout the state of California. Data collected in accordance with this Monitoring Plan and the QAPP will be SWAMP compatible.

### **1.4 DATA MANAGEMENT**

Water quality data will be entered, evaluated, and stored in the District's existing water quality database. The RWQCB has determined that the District's database is SWAMP compatible. Water quality data from certified laboratories will be directly imported into the District's database.



Source: AirPhoto USA 2005



 Project Area

## Water Quality Monitoring Locations

Figure 1

Data collected in the field will be manually entered into the District's database or imported from the Stream Team database. Water quality data will be entered and evaluated on a monthly basis or more frequently, as required.

## 1.5 REPORTING

The District will prepare quarterly reports and a final report of the water quality monitoring activities throughout the work period from September 2007 to August 2008. The quarterly and final reports will be submitted to SWRCB and RWQCB within six weeks of the end of the reporting period. The reports will include a discussion of water quality impacts based on the data collected.

Throughout the Project, water quality data will be made available to stakeholders, regulatory agencies, and the general public through the Project website ([www.matilijadam.org](http://www.matilijadam.org)). These data will be posted on the Project website within one week of being made available to the District. The timely dissemination of water quality data will allow stakeholders to participate in the evaluation of water quality in their community.

## 2.0 WATERSHED OVERVIEW

The Project is located within the South Coast hydrologic region. The climate of this hydrologic region, from Point Conception to Ventura, is generally Mediterranean: typified by relatively mild winters, hot dry summers, and coastal fog during the early days of summer. Rain generally occurs between the months of November to April and temperatures at lower elevations are almost always above freezing. High pressure systems which develop over Utah and Nevada are strong enough to keep the weather warm and sunny for much of the summer and fall. They also keep rain away and there is little summer precipitation. The upper watershed may have summer daytime temperatures of 85 to 100 degrees Fahrenheit, while the coastal regions will generally be about ten to fifteen degrees cooler. Fall daytime temperatures generally are 70 to 90 degrees Fahrenheit in the inland areas, but considerably colder at night. In the fall, Santa Ana winds blow hot and dry from the desert. These warm winds and the prevalent dry conditions often combine to exacerbate natural wild fires, which are a natural part of the ecosystem. Winter is characterized by periodic bouts of heavy rainfall, often several inches in each storm. The upper mountainous regions of watersheds see more rainfall than the lower coastal areas, as Pacific storms are uplifted over the coast range. The foothills, on average, see about 22 to 29 inches of rain a year, while the amounts near the ocean are closer to 15 inches. Snow can fall at upper elevations during particularly cold winter storms.

## 2.1 GEOLOGY

South Coast drainages lie within the western Transverse ranges of California, mountain ranges notable for easily eroded sedimentary rocks. These ranges have been produced by clockwise crustal rotations between the Pacific and North American plates. Regional tectonics have produced numerous faults and folds and some of the youngest sedimentary rocks have been deformed until they stand nearly vertical. The rocks near the surface are usually recent sedimentary layers of marine origin (Cenozoic – younger than 65 million years): hard sandstones alternating with weak shales and mudstones. The surrounding geology is responsible for much of the character of the local streams: steep mountains with easily eroded rocks yield “flashy” creeks (quick to rise as rain begins, quick to fall when it ends) with huge sediment loads – per unit area, some of the highest in the world; and fragile marine sediments cause high background conductivities and total dissolved solids (high in sulfate, calcium, magnesium and chloride).

## 2.2 LAND USES

Land use in the region is primarily open space, agriculture, and urban. Higher elevations are usually native chaparral with areas of oak woodland, exotic grasses and riparian woodland corridors. In the foothills, many areas have been converted to exotic grass rangeland and avocado and citrus orchards. The coastal lowlands have been put to numerous uses, including urban, agriculture (row crops and greenhouses), and orchards; light industry and oil production exist in some areas. Nearly half the coastal watershed – mainly upper elevation areas – is within the boundaries of the Los Padres National Forest. A number of coastal margin wetlands can be found at the mouths of streams.

## 2.3 VEGETATION

Numerous plant communities are found within South Coast watersheds: non-native annual grasslands, Venturan coastal sage scrub, chaparral, coast live oak woodland, and three types of riparian woodland (south coast live oak, central coast cottonwood-sycamore, and southern willow scrub). Elevation, aspect (shade or sun), rainfall, and water availability are the primary determinants of where each community exists. Plants play a crucial role in the ecology of the watershed. They provide the habitat, food, and shelter for the various animal species which inhabit the region. Plants help to prevent soil erosion by holding the soil together with their root systems. The leaf and branch canopies also reduce the impact of rain, and by absorbing rainfall from the soil, they help to reduce runoff too. One problem for the native vegetation in these watersheds is the invasion of non-native species of plants, foreign plant species that have been introduced, intentionally or unintentionally, and then thrive in the local environment, often because of the absence of natural predators. In the process of replacing native species, they often harm local animals not adapted to living with and on these invaders. Invasive, non-native species such as giant reed, scotch broom, tamarisk, and pepper trees negatively affect the biodiversity of the Matilija Creek and Ventura River watershed.

## 2.4 THE VENTURA RIVER

The Ventura River watershed, with headwaters in the Santa Ynez Mountains north of the City of Ventura, has an area of 222 square miles. The river can be divided into three zones: (1) the mountainous areas of the basin; (2) the main stem of the river, from the confluence of Matilija and the North Fork of Matilija creeks to the river delta or estuary; and (2) the delta which is about 2 miles wide at the coast and extends about a mile upstream, almost to the Main Street Bridge.

The mountainous areas produce most of the sediment and water in the river. The major tributary watersheds in this zone are Matilija Creek (55 square miles), North Fork of Matilija Creek (16 square miles) and San Antonio Creek (51 square miles). Coyote and Santa Ana creeks (41 square miles) are also in this zone, but almost no runoff, stormwater, or sediment from these drainages flow into the Ventura River since the completion of Lake Casitas (1959, a 285-foot earthen dam that stores 254,000 acre-feet). The Matilija dam, built in 1948, was designed to store 5,000 acre-feet; however, sedimentation has reduced its capacity to 500 acre-feet.

The topography of the Ventura watershed is composed of approximately 45 percent mountains, 40 percent foothills, and 15 percent valley. Approximately 75 percent of the watershed is classified as rangeland covered with shrub and brush, and 20 percent is classified as forest (half of the catchment is within the Los Padres National Forest). While the basin is mostly undeveloped, urbanization, cattle-raising and oil production dominate the coastal plain and adjacent foothills. The average annual rainfall is 20 inches and the seasonal and inter-annual variation in river runoff is extreme: mean annual flows vary from 5 to 3400 cfs. More than 90 % of the rainfall occurs between November and April, and a majority of the annual runoff usually occurs over 3 to 7 days. The river is hydrologically “flashy” and responds within hours to storms and changes in rainfall.

## 2.5 PROJECT AREA

The Project Area includes the floodplain of Matilija Creek and the Ventura River, beginning at the downstream end at Highway 150 and extending upstream approximately 2,000 feet past the falls. Matilija Creek and the Ventura River were divided into a series of reaches for the EIS/EIR for the Matilija Dam Ecosystem Restoration Project, with Reach 1 beginning at the Ventura River Estuary and Reach 9 extending into the upper Matilija Creek watershed. This Project's area includes Reaches 5 through 9 with Reach 7 split into two sections: Reaches 7A and 7B (Figure 1). The Project Area comprises approximately 1,274 acres and 14.9 river miles. Giant reed removal downstream of Highway 150 will be completed with other funding at a later date along the Ventura River.

The Project reaches are defined as follows.

- Reach 5: Highway 150 Bridge to the upstream end of Robles Diversion Facilities, approximately 3.3 river miles.
- Reach 6: Robles Diversion to the Matilija Dam; approximately 2.1 river miles.
- Reach 7A: Matilija Reservoir from the dam upstream approximately 1.3 river miles.
- Reach 7B: Begins approximately 1.3 river miles from the Matilija Reservoir dam and extends approximately 4 river miles upstream.
- Reach 8: Begins approximately 5.3 river miles upstream of the Matilija Reservoir dam and continues approximately 1.6 river miles upstream to the confluence of Old Man Creek and Matilija Creek.
- Reach 9: Begins at the confluence of Old Man Creek and Matilija Creek and continues approximately 2.6 river miles upstream.

## 3.0 PARAMETERS OF CONCERN

Water samples will be collected by Stream Team or District staff in accordance with the sampling methodologies described in Section 4.0. The following parameters will be recorded for each sample.

### 3.1 TEMPERATURE

Water temperature directly affects biological and chemical processes. Some fish species, such as steelhead trout, prefer colder waters, while others prefer warmer waters. For example, trout need temperatures lower than 19 °C (66 °F) to do well and lower than 9 °C (48 °F) to spawn, but can stand temperatures as high as 24 °C (75 °F) for short periods. Water temperature affects the oxygen content of water; the higher the temperature the less oxygen it can hold. Fish and benthic macro-invertebrates will move about in the stream to find their optimal temperature. Temperature can be affected by many human activities. For example:

- Building dams or artificial stream channels alter the flow rate, which in turn can affect temperature.
- Removing streamside vegetation reduces shade which would normally keep the water cool.
- Construction or other human activities near streams can increase sedimentation, which traps more heat in the water.
- Water effluent from industrial sources such as power plants can drastically change water temperatures.

### 3.2 PH

pH is a relative measure of alkalinity and acidity, it is an expression of the number of free hydrogen atoms present. pH is measured on a scale of 1 to 14, with 7 indicating neutral – neither acid nor base; lower numbers show increasing acidity, whereas higher numbers indicate more alkaline waters. Blood (pH of 7.4), seawater (8.0) and household ammonia (11.5) are all alkaline or basic; milk (6.5), coffee (5.0), and

cola (2.5) are acidic. pH numbers represent a logarithmic scale so small differences in numbers can be significant: a pH of 4 is a thousand times more acidic than a pH of 6. Most species of life have a specific pH range in which they can survive. A wide variety of aquatic animals prefer a range of 6.5 to 8.0 pH. If pH is altered beyond an organism's normal range it will suffer and soon die off. Many pollutants push pH readings toward the extremes of the scale. A change of more than two points on the scale can kill many species of fish. Low pH can also allow toxic elements and compounds to become mobile and available for uptake by aquatic plants and animals.

### 3.3 TURBIDITY

Turbidity is a measure of water clarity. Turbidity is affected by suspended particles, or solids that cannot dissolve, including clay, silt, sand, algae, and plankton. Natural factors such as intense rain fall, wave action, changes in seasonal light intensity, and erosion, can alter turbidity. However, oftentimes turbidity is increased by human activities. For example, clear cut logging, construction, and mining increase unnatural soil erosion which rapidly changes turbidity. Regular monitoring of turbidity can help detect trends that might indicate increasing erosion from these activities. Changes in turbidity can have dramatic impacts on the aquatic ecosystem. Examples include:

- Suspended sediments trap heat, raising the temperature of the water and decreasing the amount of oxygen it can hold.
- When turbidity levels are high, less light passes through the water, and photosynthesis slows, decreasing oxygen levels and primary productivity.
- Water that is highly turbid can clog the gills of fish and bury their eggs.

### 3.4 DISSOLVED OXYGEN (DO)

Aquatic organisms rely on the presence of oxygen in streams; not enough oxygen and they will move, weaken or die. In water, oxygen is a dissolved gas. Water temperature, altitude, time of day, and season can all affect the amount of oxygen in the water; water holds less oxygen at warmer temperatures and high altitudes. DO is measured either in milligrams per liter (mg/L) or "percent saturation." Milligrams per liter is the amount of oxygen in a liter of water. Percent saturation is the amount of oxygen in a liter of water relative to the total amount of oxygen that the water can hold at that temperature. As dissolved oxygen levels in water drop below 5 mg/L, aquatic life is put under stress. Colder water fish such as trout require DO levels above 6 mg/L for normal activities and above 7 mg/L for spawning. Warm water fish can tolerate DO levels as low as 4 mg/L. Oxygen levels that remain below 1 to 2 mg/L for a few hours can result in large fish kills. Oxygen is both produced and consumed in a stream. Because of constant churning, flowing water in a stream has higher DO than the still water found in pools. Aquatic plants and algae affect DO concentrations by releasing oxygen underwater during photosynthesis – DO is at a maximum in the late afternoon of a sunny day. Throughout the night, the same plants and algae, joined by the other aquatic organisms, remove oxygen through respiration, reducing levels of DO to their lowest by early morning. Generally, early mornings, during periods of hot weather and low flows, are the best times to determine the low point of DO in a stream.

### 3.5 CONDUCTIVITY (TOTAL DISSOLVED SOLIDS)

Water is a good solvent and has the ability to dissolve a large number of solids. Many of these solids when put into solution carry an electrical charge. For example, chloride, nitrate and sulfate carry negative charges, while sodium, magnesium and calcium have a positive charge. These dissolved substances increase water's conductivity – its ability to conduct electricity. Therefore, measuring the conductivity of water indirectly indicates the amount of total dissolved solids (TDS). It is not a perfect measure because some substances, particularly organic compounds like oil, alcohol or sugar do not conduct electricity well and have low conductivity, but conductivity is a rough approximation of TDS. Each stream tends to have a relatively constant range of conductivity that, once established, can be used as a baseline for comparison with regular conductivity measurements. Significant changes in conductivity could then be an indicator that a discharge or some other source of pollution has entered a stream. Conductivity tends to

decrease in the winter when heavy rainfall and runoff increase the amount of fresh water flow. With more water, mineral concentrations are more dilute. In late summer and fall, especially during periods of drought, the dissolved solids are more concentrated, and conductivity rises. Conductivity is also affected by temperature; the warmer the water, the higher the conductivity. For this reason, conductivity is reported as conductivity at 25 degrees Celsius. The basic unit of measurement is the siemen. Conductivity is measured in microsiemens per centimeter ( $\mu\text{S}/\text{cm}$ ) or millisiemens per centimeter ( $\text{mS}/\text{cm}$ ). Distilled water has a conductivity in the range of 0.5 to 3  $\mu\text{S}/\text{cm}$ . The conductivity of rivers in the United States generally ranges from 50 to 1,500  $\mu\text{S}/\text{cm}$ . Drinking water usually has to meet a standard of 500 mg/L TDS – a conductivity of roughly 1,000  $\mu\text{S}/\text{cm}$ . Conductivity in Santa Barbara and Ventura streams is usually above 1,000  $\mu\text{S}/\text{cm}$  because of high mineral content in the easily eroded marine sediments that form the coastal mountains.

### 3.6 STREAM FLOW

Stream flow is the volume of water that moves past a fixed point during a specific interval of time. The usual unit in which flow is measured is cubic feet per second (cfs) – the number of cubic feet of water moving down the stream channel in one second. Knowing the flow is critical in calculating the amount of a contaminant in a stream. When a water sample is tested for bacteria or nutrients or total dissolved solids, the result is expressed as a concentration of that constituent in the water. The actual amount of the constituent being carried through the system is determined by multiplying the flow by the concentration. Among the various ways in which stream flow affects water quality:

- Flow influences the ability of a stream to dilute pollution; large, swift rivers have a greater ability to dilute pollution than smaller streams.
- Flow and velocity affect the available oxygen level in water: higher velocities and flows generate higher levels of turbulence which in turn, cause more air to be mixed within the flow. Streams with higher flows generally have more oxygen available for aquatic organisms.
- Flow affects the amount of sediment that is transported in a stream. Streams with higher velocities and larger flows can transport greater amounts of sediment.

### 3.7 GLYPHOSATE AND SURFACTANT

Glyphosate is a broad-spectrum, non-selective systemic herbicide. Glyphosate can be used to treat all the target species, but the effectiveness on Scotch broom, pepper tree and salt cedar is lower than with the other selected herbicides. The USEPA and USFWS have approved Rodeo® and Aquamaster® for use in aquatic environments, making glyphosate the primary herbicide currently available for use throughout the Matilija Creek and Ventura River work areas. The Project methods do not include the aquatic application of glyphosate and do include BMPs to minimize the potential for overspray onto open water, as described in the Removal Plan.

Glyphosate is usually formulated as an isopropylamine salt. While it can be described as an organophosphorus compound, glyphosate is not an organophosphate ester but a phosphanoglycine, and it does not inhibit cholinesterase activity. Glyphosate can be moderately toxic to fish under certain circumstances. In rainbow trout, for instance, the 96-hour LC50<sup>1</sup> is 86 mg/l, in bluegill sunfish the LC50 is 120 mg/L, and in harlequin the LC50 is 168 mg/L.

There is a very low potential for glyphosate to build up in the tissues of aquatic invertebrates or other aquatic organisms. Glyphosate has very little chance of being leached into the groundwater table due to its strong adsorption to soil particles, including soil structure with low organic material and low clay content. The half-life of glyphosate ranges from 1 to 174 days.

---

<sup>1</sup> LC50 refers to the lethal concentration of a chemical that kills 50 percent of test animals in a given time period.

Surfactants are used in conjunction with glyphosate applications to achieve a more uniform spray coverage and aid in herbicide penetration. Nonylphenol is commonly used as a surfactant for glyphosate application. However, to protect water quality along Matilija Creek and Ventura River, nonylphenol surfactants will not be used on this Project. Instead, safer surfactants such as Agri-dex or LI-700 will be used. Agri-dex is a non-ionic surfactant consisting of a paraffin base petroleum oil, polyol fatty acid esters, and polyethoxylated derivatives of the fatty acid esters. LI-700 contains phosphatidylcholine (lecithin), which is a naturally occurring lipid that biodegrades readily. LI-700 also contains methylacetic acid and alkyl polyoxyethylene ether. Both of these surfactants break down within several days.

Glyphosate will be monitored pre-treatment, during treatment, and post-treatment. Due to the strong adsorption to soil particles, glyphosate generally moves out of the water column with 48 hours. All glyphosate samples will also be analyzed for surfactant products used.

## **4.0 SAMPLING SITES**

### **4.1 ROUTINE SAMPLING**

Six routine sampling sites have been selected within the Project Area to achieve the objectives of this water quality monitoring program (Figure 1). These sites were chosen to represent each major treatment area. Water samples collected from all sites will be tested for temperature, pH, turbidity, DO, conductivity, stream flow, and glyphosate and surfactant products.

#### **Site 1**

Site 1 is an existing Stream Team monitoring site located in Reach 5 of the Ventura River under the Highway 150 Bridge. The Ventura River channel at this site is approximately one hundred yards in width. The streambed is composed of mostly large cobbles and boulders, and is moderately covered with vegetation. Giant reed infestation upstream of this site is generally low to moderate.

#### **Site 2**

Site 2 is an existing Stream Team monitoring site located in Reach 6 of the Ventura River, approximately 0.5 mile downstream of the Matilija Dam, near a flood gauging station with an overhead cable car. Access is down a short, steep trail. Vegetation at this site is routinely cleared to maintain access. Giant reed infestation between this site and the dam is generally low to moderate.

#### **Site 3**

Site 3 is located at the upstream side of the Matilija Reservoir, near where the main channel of Matilija Creek enters the reservoir. This site is representative of Reach 7A of Matilija Creek, where the highest infestation of giant reed within the Project Area occurs.

#### **Site 4**

Site 4 is an existing Stream Team monitoring site located in the downstream end of Reach 7B of Matilija Creek, approximately 1.5 mile upstream of Matilija Dam. The giant reed infestation in the mile upstream of this site is generally moderate.

#### **Site 5**

Site 5 is located approximately 2.5 miles upstream of Matilija Dam, in the middle portion of Reach 7B. This giant reed infestation upstream of this area is relatively low, generally between 0 and 10 percent.

## Site 6

Site 6 is located in the middle of Reach 8 of Matilija Creek. Access to this site is along an unpaved road through Blue Heron Ranch, and permission may be required from private property owners. Giant reed infestation upstream of this site is low, between 0 to 5 percent.

### 4.2 GRAB SAMPLING

Periodic grab sampling throughout the project area will occur during the treatment events. This allows for more targeted sampling immediately adjacent to work as it is conducted throughout the site.

## 5.0 SAMPLING SCHEDULE

Water quality sampling will be conducted before, during, and after treatment events.

### 5.1 PRE-TREATMENT SAMPLING PERIOD

Pre-treatment data will be provided by Stream Team's existing water quality monitoring program, which includes Sites 1, 2, and 4. Glyphosate monitoring at all sites will begin in August 2007. The data collected during this sampling period, in conjunction with the data already collected by Stream Team, will form the baseline water quality data.

### 5.2 DURING TREATMENT SAMPLING PERIOD

The during treatment sampling period consists of the initial treatment period and the follow up treatment period. The initial treatment period includes the majority of the work along the entire project area and is anticipated to occur from September 2007 through December 2007. The follow up treatment period targets isolated patches of resprouts and will occur throughout the 5-year monitoring period, as necessary (District 2007). The intensity of the follow up treatments will be substantially less than the initial treatment.

Routine sampling at designated sites (as described in Section 4.1) will occur monthly during the initial treatment period, and quarterly from January 2008 to August 2008 during the follow up treatment period. Additionally, grab samples will be taken frequently throughout the initial and follow up treatment periods when work is conducted adjacent to open water. Grab samples will also be taken immediately following a spill and periodically afterwards to track chemical dissipation.

The routine and grab sampling will provide consistent and targeted data throughout the treatment periods. Water quality data obtained from the sampling will be used to test the efficacy of BMPs and determine whether additional BMPs would be necessary.

## 6.0 SAMPLING METHODOLOGY

Sampling for temperature, pH, turbidity, DO, conductivity, and stream flow will follow standard Stream Team sampling methodology. The Stream Team's sampling methodology is excerpted below. Glyphosate sampling at this site will be conducted in accordance with USEPA Sampling Method 547.

### 6.1 STREAM TEAM SAMPLING METHODOLOGY

The Stream Team methodology for water quality sampling is described for each of the parameters below.

## 6.1.1 Air Temperature

### Testing Procedure

1. Using the air temperature thermometer, hang the thermometer in the shade on a tree limb or other object by its lanyard. The thermometer must have 3 minutes to stabilize before reading.
2. Take the air temperature twice, once at the beginning of the testing period, and again at the end. Record on the Site Conditions field sheet.

## 6.1.2 Dissolved Oxygen

### Calibrating the DO Meter

Because DO can be affected by altitude, the DO meter must be calibrated at each site before beginning testing to reflect the altitude of each site.

1. Make sure the meter has been turned on for at least 15 minutes before beginning calibration.
2. Simultaneously press and release the two arrow keys.
3. The LCD will prompt you to enter the altitude in hundreds of feet for your monitoring station. The altitude for each site is written in the binder, on the tabbed divider page for that site.
4. Use the arrow keys to enter the altitude of the monitoring station. The up arrow will increase the altitude and vice versa. Entering 12 indicates 1,200 feet.
5. When the correct altitude is displayed press the ENTER button. The meter should display CAL in the lower left of the LCD and the calibration value in the lower right of the LCD. The main display will show the current DO before calibration.
6. Wait a few seconds for the main display to stabilize and hit the ENTER key again.
7. The LCD will prompt you to enter the approximate salinity of the water you will be sampling. As you will be monitoring fresh water, enter a value of zero. When zero appears on the LCD hit the ENTER key.
8. Repeat this calibration process each time you travel to a new monitoring station (leave the DO meter on until you have taken the last DO reading at the last station).

### Testing Procedure

1. Remove the probe from the calibration chamber. Lower the probe in the water halfway between the surface and the bottom of the creek. Be careful not to let the probe hit the bottom of the stream.
2. If the water is fairly still, move the probe tip through the stream at a rate of one foot per second by creating circles in the water (try to keep your circles the same size and move your probe at a consistent speed).
3. Once the meter stabilizes, record three things:
  - Dissolved oxygen measured in mg/L
  - Dissolved oxygen measured in % saturation
  - Temperature measured in °C(Use the "mode" button to switch between % saturation and mg/L. )
4. Repeat steps 1 through 3 two more times, in two different areas of the stream (always in the center of the stream). In the end, you should have taken 3 different readings 3 times.
5. Rinse the probe with the distilled water provided in the Stream Team Field Kit. Remember to leave the DO meter on after you are finished, but put the probe back into the calibration chamber when not in use.

### 6.1.3 pH

#### Testing Procedure

1. Turn the pH meter on by pressing the ON/OFF button.
2. Carefully remove the pH meter probe from the probe storage bottle
3. Dip the pH meter directly into the stream, and let the meter stabilize.
4. Record the pH reading on the field sheet.
5. Repeat steps 2 through 3 two more times in different parts of the stream (always in the center of the stream). In the end, you should have 3 separate pH readings.
6. Turn off the meter by pressing the ON/OFF button.
7. Rinse the electrode with distilled water provided in the Stream Team Field Kit.
8. Replace the probe in the probe storage bottle.

### 6.1.4 Turbidity

#### Testing Procedure

1. Rinse two empty turbidity tubes and caps with sample water three times. Shake out excess water.
2. Fill both turbidity tubes to the neck so that there are no air bubbles. Make sure to take the "cleanest" sample you can, by going upstream of any other team members that might be clouding the water.
3. Cap the tubes and wipe them dry. Make sure they are dry and clean--no fingerprints.
4. Hold one tube upside-down before inserting it into the meter. Be careful not to create bubbles.
5. Open the meter lid. Align the indexing arrow on the tube with the indexing arrow on the meter. Insert the turbidity tube into the chamber.
6. Close the lid. Push the READ button. The turbidity in NTU units will be displayed within 5 seconds.
7. Repeat steps 4 through 6 two more times with the first tube. Then repeat steps 4 through 6 three times with the second tube. In the end, you should have a total of 6 turbidity readings (3 for each tube).
8. To turn the meter off, hold the READ button down for several seconds until the display says "off".

### 6.1.5 Conductivity (Total Dissolved Solids)

#### Testing Procedure

1. Connect the probe to the conductivity meter by aligning the slots at the top of the meter and end of probe, and then screwing the "collar" down to hold it in place.
2. Turn the meter on by pressing the "on/off" button.
3. Dip the probe into the water, making sure that the two silver bands are submerged.
4. Once the meter stabilizes, you will record three things:
5. Conductivity measured in microsiemens ( $\mu\text{S}$ ) or millisiemens (mS)
6. TDS measured in parts per million (ppm) or parts per thousand (ppt)
7. Temperature measured in  $^{\circ}\text{C}$
8. (Use the mode button to switch between conductivity and TDS.)
9. Repeat steps 3 through 4 two more times in two different areas of the stream (always in the center of the stream). In the end, you should have taken 3 different readings 3 times.

10. Press on/off button when finished. Always rinse electrode with distilled water and shake dry. Disconnect probe from meter when storing in case.

### 6.1.6 Stream Flow

Stream flow is measured by calculating the volume of water that passes a particular point in a stream within a specified amount of time. To calculate flow you must know two things: how much water a section of stream holds (volume) and how fast that water is moving (velocity). Stream flow can be determined by measuring the velocity of water and the cross sectional area of the stream. The formula to use when calculating stream flow is:

$$\text{Stream flow} = \text{velocity} \times \text{cross sectional area}$$

To measure velocity, use something that floats (an orange peel) to determine how fast the water is flowing. To calculate the cross sectional area of the stream, a stadia rod will be used to measure water depth at 1-foot intervals across the width of the stream.

#### Procedures for determining Cross-Sectional Area:

Pick a section of stream for your measurements, keeping the following things in mind:

- Ideally it should be 20-feet long, but if this is not appropriate you may use a 10-foot section.
  - The section should be fairly straight and should have a fairly uniform width.
  - Water should be flowing evenly within this section without turbulence, obstacles or other disturbances.
  - This section of the stream should be shallow enough for you to safely wade across and conduct the stream flow test.
1. To measure the cross sectional area of a stream, place a pair of stakes at the wetted edges on each streambank, with the string tight across.
  2. Hold the tape measure along the string, from one stake to the other. Measure the “wetted width” of the stream and record on the Stream Flow Data Sheet. This will be your “starting line” for your velocity trials.
  3. Have one person take the stadia rod to measure the depth of the water at one foot intervals across the stream. Use the tape measure to establish these points. Call out the depth measurements at every 1-foot interval so it can be recorded on the Stream Flow Data Sheet.
  4. Repeat steps 1-4 again for the second pair of stakes. These stakes should be 20 feet (or 10 feet where appropriate) downstream from where the first cross section was measured (make sure to record the exact distance on the data sheet under “length of reach”). This will be your “finish line” for your velocity trials.

#### Procedures for determining Velocity:

1. Measure the length of the stream between your start and finish line--should be 10 or 20 feet (you should have already done this in step 4 above).
2. To start the trials, you need at least 3 team members present. One team member stands in the stream at the starting line with an orange peel. Another team member stands downstream at the finish line waiting to retrieve the orange peel as it crosses the finish line. A third team member is standing on the bank next to the finish line with stopwatch and clipboard.
3. The team member at the starting line drops an orange peel and as it passes the starting line, yells

“go”. The person in the bank starts the stopwatch. When the orange peel passes the finish line the watch is stopped, the peel retrieved, and the time recorded.

4. Repeat this test five times moving across the stream along the line. Doing this will give you a more representative depiction of stream flow along that section of stream. Record the results on the Stream Flow Field Sheet each time.

### Reading the Stadia Rod

The stadia rod measures in feet and inches, and quarter inches. Each small line is  $\frac{1}{4}$  inch. Hold the stadia rod plumb (straight up and down). Take measurements at every foot along the tape measure that is stretched across the stream. Record the level on the rod that the water surfaces touches.

### 6.1.7 Collecting Stream Samples

Stream Team collects several different water samples for bacteria, nutrient and other analyses. You will be provided with several bottles for taking these samples. Please follow these instructions for taking samples.

1. Choose a place to take your samples. Keep the following in mind:
  - You want to take the samples in an area that best represents your whole site. For example, if most water at your site is flowing quickly, do not take the samples in a stagnant pool. The best place is in the center, away from streambanks.
  - Collect water in an area of the stream that is fast flowing but does not have turbulence or white water and is at least 6 to 8 inches deep. Do not collect water in stagnant water or in rapids, unless the whole site is like this.
  - Take the samples upstream of where other team members are working.
2. Take all bottles with you and slowly wade to the center, so as not to kick up sediments. Face upstream while collecting samples.
3. For the sterile bacteria bottle (small, clear, sealed bottle) follow these procedures:
  - Remove the plastic seal from the cap, but leave the cap on.
  - When you are ready to take your sample, quickly remove cap, fill bottle, and replace cap. This is a sterile bottle so please make sure you do not stick your fingers inside.
  - Make sure the bottle cap is labeled with the correct site name.
4. For the smallest bottle with the blue label, you must filter the sample using the following directions:
  - Rinse the syringe three times with creek water: Pull out the plunger, fill syringe with water, replace plunger, swirl water around, and empty. Do this three times. Rinse the filter/filter holder once: Pull out plunger, fill syringe with water, place filter/filter holder on the end, and gently run at least half of the water through the filter. When done, make sure to remove the filter holder before pulling the plunger out, otherwise you will damage the filter.
  - Rinse your sample bottle with filtered sample three times.
  - Remove filter holder, remove plunger, fill syringe, replace filter holder and plunger, and gently filter water into the small sample bottle until it is about half full. Replace the cap loosely, shake bottle, and empty (just as you would rinse other bottles). Make sure to rinse the sample bottle three times using this method.
  - Once everything is rinsed using the steps above, you can now fill your sample bottle with your filtered sample.
  - You can use the same filter for 2 sites, then replace with a new filter.
5. For all other bottles, follow these procedures:
  - Rinse the container and cap well 3 times with stream water.

- Submerge the sample container until it fills with water. Try not to get any air bubbles if possible. Replace cap.
  - Make sure bottles are labeled with the correct site name.
6. Make sure to record the time you took the samples on the bottom of the Chemical Parameters datasheet.
  7. Put all samples on ice in the cooler as soon as possible.

## 6.2 GLYPHOSATE SAMPLING METHODOLOGY

All samples for this Project will use “clean sampling techniques” in order to minimize the potential for contamination, loss, or change in the chemical form of the constituents on interest.

1. Samples will be collected in a 125 mL VOA, unpreserved sampling container, according to USEPA Method 547.
2. Samples will be collected by direct submersion of sample bottles to approximately mid-stream and mid-depth.
3. Per USEPA analytical methods, all samples will be kept cool (between 0 and 6 °C) from time of collection to receipt by the analytical laboratory.
4. Holding time for delivery to the analytical laboratory should not exceed 7 days, which will allow for the samples to be analyzed for surfactant products used.

## 7.0 THRESHOLD AND ACTION PLAN

The District will evaluate the water quality data as they become available. For temperature, pH, turbidity, DO, conductivity, and stream flow, the District will determine whether the data are within the normal range of the baseline data. It is anticipated that there may be some short term impacts to water quality as a result of the Project, but there would be an overall beneficial effect to the watershed in the long-term (USACE 2004).

Glyphosate and surfactant testing results would be evaluated by the District and appropriate action would be taken as necessary. The thresholds and response actions for glyphosate exceedances are described below.

### 7.1 THRESHOLD

#### 7.1.1 Glyphosate Threshold

The USEPA has promulgated a Primary Maximum Contamination Level (MCL) of 700 µg/L for glyphosate that is applicable for drinking water sources or water bodies with an MUN (municipal and domestic supply) beneficial use designation. This is the level of protection that the USEPA believes would not cause potential short-term or long-term health effects. The SWRCB has adopted the USEPA Primary MCL for its Aquatic Pesticides General Permit (Water Quality Order No. 2004-0009-DWQ). Therefore, as a protective measure, the threshold for glyphosate for this Monitoring Plan is also set at 700 µg/L for glyphosate.

The 700 µg/L threshold for glyphosate is the equivalent of 700 parts per billion (ppb); in other words, 700 parts of glyphosate to 999,999,300 parts of water. This threshold refers to a 100 percent solution of glyphosate; however, a solution of 6 to 8 percent glyphosate will be used to treat giant reed. As a visual aid, the amount of 7 percent glyphosate solution that would be required to exceed this threshold is equivalent to one 12-ounce soda can of glyphosate solution in a stretch of river 25 feet long by 20 feet wide by 2.5 feet deep.

The example above is useful for visualizing the scale of the glyphosate threshold. However, the Project Area is not a closed system. Within the context of the Project, the constant fresh water stream flow would dilute incidental overspray, with the concentration quickly decreasing downstream.

### 7.1.2 Surfactant Threshold

Nonylphenol is commonly used as a surfactant for glyphosate application. The SWRCB has adopted a threshold of 6.6 µg/L as the freshwater chronic criterion for this chemical. However, nonylphenol surfactants will not be used for this Project. Instead, safer surfactants such as Agri-dex or LI-700 will be used. Agri-dex is a non-ionic surfactant consisting of a paraffin base petroleum oil, polyol fatty acid esters, and polyethoxylated polyol fatty acid ester emulsifier. LI-700 contains phosphatidylcholine (lecithin), which is a naturally occurring lipid that biodegrades readily. LI-700 also contains methylacetic acid and alkyl polyoxyethylene ether. Both of these surfactants break down within several days. There are no aquatic regulatory thresholds for these chemicals.

## 7.2 ACTION PLAN

### 7.2.1 Glyphosate Action Plan

Glyphosate testing cannot be conducted in the field; therefore, water samples will need to be sent to a laboratory for testing, which typically takes one to two weeks to obtain the results. The following actions will be taken if the glyphosate threshold is exceeded and if there is a spill in or adjacent to open water.

1. The District will immediately investigate the cause of the exceedance, including interviewing contractors and monitors to determine whether BMPs were followed.
  - If the District determines that BMPs were not adequately followed, the District will take corrective actions against the contractor.
  - If the District determines that BMPs were followed, but were inadequate to protect water quality, the District will modify or implement additional BMPs to correct the exceedance.
2. The District will notify RWQCB and residents that could be potentially affected by the exceedance.
3. The District will conduct another glyphosate sampling immediately and within 2 weeks of implementing corrective measures to evaluate the effectiveness of the corrective actions.

In addition to the response actions outlined above, the District will immediately stop spraying within 100 feet of any monitoring site that exceeds the threshold by twice the limit (i.e., if the glyphosate level is greater than 1,400 µg/L). This automatic stoppage in spraying would safeguard water quality while the District evaluates and takes appropriate corrective actions to bring the glyphosate levels to below the threshold.

### 7.2.2 Surfactant Action Plan

Random glyphosate samples will be tested for the more toxic nonylphenol surfactant to verify that it is not being used along the Matilija Creek and Ventura River. If nonylphenol is detected in the water samples, the District will investigate the source of the nonylphenol. If the source of nonylphenol is found to be from Project-related activities, the District will immediately take corrective actions to prevent further use of the nonylphenol surfactant.

## 8.0 WATER QUALITY BMPS AND SPILL RESPONSE

Water quality BMPs have been incorporated into the Matilija Dam Giant Reed Removal Plan (ERA 2007) to protect water quality. The BMPs place restrictions on handling of glyphosate to prevent accidental spill and overspray into Matilija Creek and Ventura River, including:

- Contractor shall be responsible for preparing and implementing a Stormwater Pollution Prevention Plan.
- Erosion control measures (e.g., silt fencing, mulch, matting, soil binder, seeding) will be implemented as appropriate to inhibit sediment transport into the waterways.

- Stockpiles shall only be allowed in designated staging areas. Chipped plant material shall not be stockpiled on site for more than one month.
- No work shall occur during rain events.
- Herbicide storage during application and the fueling and lubrication of mechanical equipment shall be confined to designated staging areas.
- Vehicles and equipment shall not be left in the stream channel overnight.
- Spill kits shall be maintained on site and shall be adequately stocked for the amount of fuel and herbicides to be handled.
- Refueling of vehicles/equipment and mixing of herbicides shall occur at designated staging areas at least 100 feet from riparian and wetland habitats where feasible. Where it is not feasible to refuel vehicles/equipment and mix herbicides in designated staging areas due to topographical constraints, these activities shall occur as far away from riparian and wetland habitats as feasible.
- Appropriate spill containment devices (e.g., spill mats, tarpaulins) shall be used when refueling vehicles/equipment or mixing herbicides.
- In the event of a hazardous material spill within the floodplain, wetland or riparian area associated with the Project Area, USFWS must be contacted within 24 hours to determine the proper course of action and clean-up methods. If a spill occurs on a weekend or late Friday, USFWS must be contacted by close of business the following Monday.
- All vehicles and equipment used within the floodplain or associated riparian area of Project Area must be inspected daily to ensure they are free of any leaks of fuel, cooling, lubricating or other potentially polluting fluid.
- No vehicles or other heavy equipment shall be rinsed or cleaned within the waters, floodplain or associated riparian areas of Project Area. All necessary precautions must be taken to prevent release of any toxic substances into the waters or onto soils of the Project Area.

In addition to these BMPs, the contractor will be responsible for implementing a Stormwater Pollution Prevention Plan, which will include a spill response plan.

## 9.0 REFERENCES

Ventura County Watershed Protection District (District). 2007. Matilija Dam Giant Reed Removal Plan. Prepared for Ventura County Watershed Protection District.

US Army Corps of Engineers (USACE). 2004. Matilija Dam Ecosystem Restoration Project Feasibility Study Environmental Impact Statement/Environmental Impact Report.

**APPENDIX A**

**VENTURA RIVER WATERSHED MONITORING PROGRAM  
QUALITY ASSURANCE PROJECT PLAN (QAPP)  
SANTA BARBARA CHANNELKEEPER**

# Ventura River Watershed Monitoring Program Quality Assurance Project Plan (QAPP)

## Santa Barbara Channelkeeper

August 2004

OUTLINE PREPARED BY:

First Edition: Gwen Starrett, SWRCB, 1998

Second Edition: Dominic Gregorio, SWRCB, 2001

COMPLETED PLAN PREPARED BY:

Jessica Altstatt and Leigh Ann Grabowsky, Santa Barbara Channelkeeper

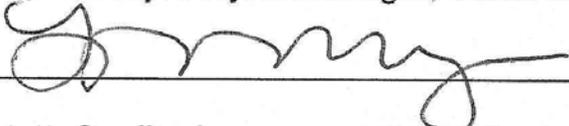
Refer correspondence to:

Erick Burres  
State Water Resources Control Board  
Clean Water Team  
320 West 4<sup>th</sup> Street, Suite 200  
Los Angeles, CA 90013  
(213) 576-6788  
eburres@rb4.swrcb.ca.gov

Leigh Ann Grabowsky  
Santa Barbara Channelkeeper  
714 Bond Avenue  
Santa Barbara, CA 93103  
(805) 563-3377 x3  
lag@sbck.org

### APPROVAL SIGNATURES

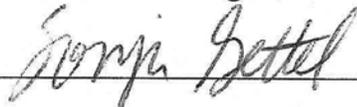
Leigh Ann Grabowsky, Project Manager, Santa Barbara Channelkeeper

Signature:  Date: 11/8/04

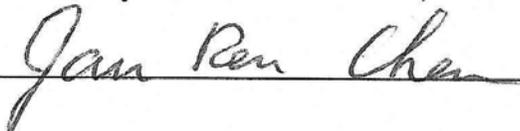
Jessica Altstatt, Quality Assurance Officer, Santa Barbara Channelkeeper

Signature:  Date: 4/8/04

Sonja Gettel, Contract Manager, State Water Resources Control Board

Signature:  Date: 10/26/04

Jau Ren Chen, Quality Assurance Officer, Los Angeles Regional Water Quality Control Board

Signature:  Date: Oct. 6, 2004

2. Table of Contents

**QUALITY ASSURANCE PROJECT PLAN ..... ERROR! BOOKMARK NOT DEFINED.**

**1. TITLE AND APPROVAL PAGE ..... ERROR! BOOKMARK NOT DEFINED.**

**2. TABLE OF CONTENTS .....3**

**3. DISTRIBUTION LIST .....5**

**4. PROJECT ORGANIZATION .....5**

**4.1 Technical Advisory Committee .....5**

**5. PROBLEM DEFINITION/BACKGROUND .....6**

**5.1. Problem Statement .....6**

**5.2. Intended Usage of Data .....6**

**6. PROJECT/TASK DESCRIPTION .....6**

**6.1 General Overview of Project .....6**

**6.2. Project Timetable .....9**

**7. DATA QUALITY OBJECTIVES .....9**

**7.1. Accuracy .....10**

**7. 2. Comparability .....9**

**7. 3. Completeness .....11**

**7. 4. Precision .....11**

**7. 5. Representativeness .....10**

**7. 6. Method Detection Limit and Sensitivity .....12**

**8. TRAINING REQUIREMENTS .....12**

**9. DOCUMENTATION AND RECORDS .....13**

**10. SAMPLING PROCESS DESIGN .....12**

**10.1. Rationale for Selection of Sampling Sites .....12**

**10.2. Sample Design Logistics .....13**

**11. SAMPLING METHOD REQUIREMENTS .....13**

**12. SAMPLE HANDLING AND CUSTODY PROCEDURES .....14**

12.1. Sample Handling .....	14
12.2. Custody Procedures .....	14
12.3. Disposal .....	16
13. ANALYTICAL METHODS REQUIREMENTS .....	16
14. QUALITY CONTROL REQUIREMENTS.....	17
14.1. Blanks, Replicates, Duplicates, Split Samples and Standardization.....	17
15. TESTING, INSPECTION AND MAINTENANCE REQUIREMENTS.....	18
15.1. Temperature .....	18
15.2. Dissolved oxygen.....	18
15.3. pH and conductivity.....	18
15.4. Turbidity.....	19
16. INSTRUMENT CALIBRATION AND FREQUENCY.....	18
17. INSPECTION/ACCEPTANCE REQUIREMENTS.....	19
18. DATA ACQUISITION REQUIREMENTS.....	19
18.1. Professional Analytical Data.....	19
18.2. Geographical Information/ Mapping.....	20
19. DATA MANAGEMENT .....	19
20. ASSESSMENT AND RESPONSE ACTIONS.....	20
21. REPORTS.....	21
22. DATA REVIEW, VALIDATION AND VERIFICATION .....	20
23. VALIDATION AND VERIFICATION METHODS .....	21
24. RECONCILIATION WITH DQOS .....	21
25. APPENDIX 1. DATA QUALITY FORMS.....	22
26. APPENDIX 2. DATA AND OBSERVATIONAL FORMS.....	26
27. APPENDIX 3. MAP OF SAMPLING SITES.....	30

### 3. Distribution List

All group leaders, and technical advisors will receive copies of this Quality Assurance (QA) Project Plan, and any approved revisions of this plan. Once approved, this QA plan will be available to any interested party by requesting a copy from Santa Barbara Channelkeeper and/or Erick Burre (see address on title page).

### 4. Project Organization

The Ventura River Watershed Monitoring Program (VRWMP) is managed by Santa Barbara Channelkeeper (SBCK) , in a partnership with the Ventura Chapter of the Surfrider Foundation. The Project will monitor discrete locations within the Ventura watershed. Organizations involved with the project include:

1. **Santa Barbara Channelkeeper: Leigh Ann Grabowsky, Director of Watershed Programs.** Responsibilities include project management, recruitment and training of volunteers, equipment and supply upkeep and calibration, data management, quality assurance and quality control, and field data collection.
2. **Ventura Chapter of the Surfrider Foundation: Paul Jenkin, Environmental Director.** Responsible for recruitment of volunteers, field data collection, and quality assurance/quality control.

Several resource agencies have assisted in the development of this project from its conception. Additional partnerships will be developed to ensure adequate technical support to all participating groups. The QA plan reflects the diversity of monitoring and organizational support involved in this project. For the elements of this QA plan, we have addressed aspects that are shared with all groups as well as those aspects that are unique to individual groups. While the goals of monitoring may vary, the data quality objectives are consistent, allowing us to compare data collected by different organizations.

#### 4.1. **Technical Advisory Committee:**

1. Brian Brennan, Mayor, City of Ventura
2. Erick Burre, Clean Water Team, State Water Resources Control Board
3. Bill Carey, Ventura County Watershed Protection District
4. Paul Jenkin, Environmental Chair, Ventura Chapter of the Surfrider Foundation
5. Allen Leydecker, researcher, University of California Santa Barbara
6. Ron Sheets, Ojai Valley Sanitary District
7. Karen Waln, City of Ventura
8. Damon Wing, Program Director, Ventura Coastkeeper
9. Darla Wise, Ventura County Watershed Protection District

## **5. Problem Definition/Background**

### **5.1. Problem Statement**

Currently, there is insufficient information to adequately assess the status of water quality in the Ventura River watershed. Adequate data quality assurance will ensure that the Ventura River Watershed Monitoring Program will collect valuable information for watershed management and pollution prevention.

#### **5.1.1. Regional Citizen Monitoring Mission and Goals**

##### **5.1.1.1. Mission**

The VRWMP is a volunteer-based water quality monitoring program targeting the Ventura River watershed. The VRWMP informs and engages the community in effective watershed stewardship.

##### **5.1.1.2. Program Goals**

The goals of this program include:

- recruiting and training a network of citizen volunteer monitors,
- establishing a baseline dataset of water quality parameters for sites throughout the watershed,
- use monitoring information to track and identify sources of pollution.

This project will supplement the existing agency information by monitoring streams in the Ventura Watershed. The focus of the project is on chemical, physical and biological parameters as measures of water quality. Data will be collected in the field with test kits and field instruments. Other data will be obtained through laboratory procedures. This information will be provided to the regulatory agencies. Data will also be provided to the public. It is the responsibility of the agencies to ensure that adequate and valid data are collected to meet their regulatory requirements. Additionally, citizen monitors build awareness of water quality issues, aquatic resources and pollution prevention.

### **5.2. Intended Usage of Data**

The data will be used by SBCK for general watershed assessment. Data will be made available to the public for informational purposes. Data will be made available to regulatory and resource management agencies such as City of Buenaventura, the County of Ventura, State Water Resources Control Board or the Los Angeles Regional Water Quality Control Board to supplement their existing data collection effort. The main database will be maintained by SBCK and a back-up copy will be stored off-site.

## **6. Project/Task Description**

The Ventura River Watershed Monitoring Program's "Stream Team" monitors water quality in the Ventura watershed. Physical, chemical and biological parameters are measured. Table 6.1 identifies the program's monitoring. Samples will be taken by volunteers and staff. Certain parameters will be measured in the field, or the in-house laboratory at SBCK's office.

### **6.1. General Overview of Project**

The following paragraphs identify the specific overviews of the citizen monitoring projects included in this plan.

This QA plan only addresses data quality objectives for the following parameters:

- Temperature
- Dissolved Oxygen
- pH
- Conductivity
- Turbidity
- Total Coliform Bacteria
- E. coli Bacteria
- Enterococcus Bacteria

Flow will be determined for streams and storm drains by using the protocol described in the Ventura Watershed Monitoring Manual (*VRWMP Manual*) and/or in the U.S. EPA Volunteer Stream Monitoring Manual.

In addition to collecting quantitative data, the VRWMP has provisions for recording observational data. Chemical, physical, and biological parameters will be monitored using protocols outlined in the *VRWMP Manual*. This program has a systematic method recording visual and other qualitative observations. A Visual Observation sheet, with instructions, is included in the Ventura Watershed Monitoring Manual. Observational data include water color, clarity and odor, algal cover and color, presence of oil or tar, trash, and foam.

Stream habitat quality will be assessed for each site, at least once per year, using the California Dept. of Fish and Game Physical Habitat Assessment Form. This form allows for observational data including epifaunal substrate/available cover, embeddedness, velocity/depth regimes, sediment deposition, channel flow status, channel alteration, frequency of riffles, bank stability, vegetative protection, and riparian vegetative zone width.

Analysis for the following parameters are not addressed in this QA plan:

- Nutrients
- Metals
- Oil and Grease and PAH's
- Pesticides and other synthetic organic compounds

Samples for these and other parameters will be taken by volunteers and staff, and sent to a certified or approved agency, commercial, or academic laboratory for analysis. The agency or laboratory should adhere to SWAMP QA/QC standards at a minimum. Samples will be collected in dedicated bottles provided by the professional, agency or academic laboratory, and will be labeled and handled as specified (see Table 11.1 for requirements on bottles and holding times).

**Table 6.1 Summary of Monitoring Design**

Parameter	Type	Frequency
Flow	Field	Monthly
Temperature	Field	Monthly
Dissolved Oxygen	Field	Monthly
pH	Field	Monthly
Conductivity / TDS	Field	Monthly
Turbidity	Field	Monthly
Odor and Visual Observations	Field	Monthly
Bacteria (Total Coliform, E. Coli and Enterococcus)	In-house Laboratory	Monthly
Ammonia-Nitrogen	Professional Laboratory	Monthly
Nitrate-Nitrogen	Professional Laboratory	Monthly
Nitrite-Nitrogen	Professional Laboratory	Monthly
Ortho-Phosphate	Professional Laboratory	Monthly
Metals	Professional Laboratory	Seasonal, irregular
Oil and Grease	Professional Laboratory	Seasonal, irregular
Inorganics	Professional Laboratory	Seasonal, irregular
Organics	Professional Laboratory	Seasonal, irregular

### 6.1.1. Monitoring

Volunteer citizens will measure physical, biological, and chemical parameters at sites throughout the Ventura Watershed using techniques covered by this QAPP. Field data will be measured and reported on field data sheets. All instruments used in the assessment of the river will be calibrated and tested using known standard concentrations to prevent errors.

### 6.1.2. Analysis

Chemical, physical, and biological parameters will be monitored using protocols outlined in the *VRWMP Manual*. Flow, pH, temperature, Dissolved Oxygen, turbidity and conductivity will be measured directly in the field. Water samples collected by the volunteers will be analyzed in-house at SBCK for nutrients (nitrate, nitrite and orthophosphate) and bacteria (Total, E. Coli, and Enterococcus).

Data reduction and analysis will be done by Santa Barbara Channelkeeper.

Twice a year, in a ‘wet’ and ‘dry’ season, water samples will be sent to a professional laboratory for the “full suite” analysis of metals, organics, inorganics, volatiles and oil and grease. Section 10 of this plan contains references and instructions for the collection of samples for the following substances: Total Organic Carbon, Metals, Oil and Grease, PAH’s, Pesticides and other synthetic organic compounds, and Toxicity. It has been determined that there will be no project-specific quality assurance and data quality objectives developed for the data generated. Samples may be sent to any laboratory capable of performing analysis that will adhere to SWAMP QA/QC standards at a minimum. The project accepts the data generated that is within the analyzing laboratory’s internal quality assurance program and the project will not comment on its quality relative to data from the same test generated by other laboratories.

### 6.1.3. Reporting

Data resulting from each sampling event will be stored in a database kept at the Santa Barbara Channelkeeper office. A final “Status of the River” report will be produced and distributed after one year of sampling has occurred.

## 6.2. Project Timetable

Table 6.2 identifies the schedule of major activities associated with this project.

**Table 6.2 Project Timetable**

Activity	Date
Identify monitoring leaders	October 2004, as needed thereafter
Obtain training for monitoring leaders	October 2004, as needed thereafter
Recruit monitors	October 2004, continuous thereafter
Obtain and check operation of instruments	October 2004, continuous thereafter
Train monitors	October 2004, continuous thereafter
Initiate monitoring	November 2004, monthly thereafter
Initiate data entry	November 2004, monthly thereafter
Calibration and quality control sessions	November 2004, monthly thereafter
Review data with technical advisors	December 2004, quarterly thereafter

## 7. Data Quality Objectives

This section identifies how accurate, precise, complete, comparable, sensitive and representative our measurements will be. These terms are defined in the following section. Data quality objectives were derived by reviewing the QA plans and performance of other citizen monitoring organizations (e.g. Southern California Citizen Monitoring Steering Committee, Heal the Bay Malibu StreamTeam), by considering the specifications of the instruments and methods we will employ, and by considering the utility of the data.

Data quality objectives are summarized in Tables 7.1. and 7.2. Whenever possible the methods with the greatest sensitivity and lowest detection limit will be employed as the primary methods. Methods with lesser sensitivity and higher detection limits will be used for field confirmations or as back-up methods in the case that the primary methods are not available or functioning properly for a particular sampling event.

**Table 7.1. Data Quality Objectives for Conventional Water Quality Parameters**

Parameter	Method/range	Units	Detection Limit	Sensitivity	Precision	Accuracy	Completeness
Air Temperature	Thermometer (-30° to 120°)	°F	-30°F	1 °F	± .5°C	± .5°C	90%
Water Temperature	Electronic meter/probe	°C	-5°C to 45°C	0.1°C	± .5°C	± .5°C	90%
Dissolved oxygen	Electronic meter/probe	mg/l	0.1 mg/l	0.01 mg/l	± 10%	± 10%	90%
pH	pH meter	pH units	1	0.1 pH	± .2 pH	± .2 pH	90%
Conductivity TDS	conductivity meter	mhos/cm	10	10 μ mhos/cm	± 10%	± 10%	90%
Turbidity TSS	Nephelometer/ Turbidity Meter	NTU's	<0.1	0.1	± 10%	± 10%	90%

**Table 7.2. Data Quality Objectives for Biological Parameters**

Parameter	Method/range	Units	Detection Limit	Resolution	Precision	Accuracy	Completeness
Total Coliform Bacteria	Colilert 18 hour	MPN/100 ml	10	See IDEXX quantitray tables	Duplicates within 95% confidence limits	Positive standard within ½ of an order of magnitude	90%
Fecal Coliform Bacteria	Colilert 18 hour	MPN/100 ml	10	See IDEXX quantitray tables	Duplicates within 95% confidence limits	Positive standard within ½ of an order of magnitude	90%
Enterococcus Bacteria	Enterolert 24 hour	MPN/100 ml	10	See IDEXX quantitray tables	Duplicates within 95% confidence limits	Positive standard within ½ of an order of magnitude	90%

**7.1. Accuracy**

Accuracy describes how close the measurement is to its true value. Accuracy will be tested through the measurement of a sample of known concentration and comparing the known value against the measured value.

**7.1.1. Chemical and Physical Parameters**

The accuracy of chemical measurements will be checked by performing tests on standards at quality control sessions held twice a year. A standard is a known concentration of a certain solution. Standards can be purchased from chemical or scientific supply companies. Standards might also be prepared by a professional partner, e.g. a commercial or research laboratory. The concentration of the standards should be within the mid-range of the equipment. SBCK’s VRWMP Database calibration form will be completed to record equipment accuracy and adjustments.

For all chemical water quality parameters volunteers should obtain results within 10% of the true value, when the true value is within the mid-range of the expected values.

**7.1.2. Biological Parameters**

Accuracy for bacterial parameters will be determined by completing the following analysis:

- 1 field blank per trip
- 1 lab blank per batch
- 1 lab duplicate per 10 samples, or 1 per batch
- 1 lab positive control sample per reagent lot number
- 1 lab negative control sample per reagent lot number

**7.2. Comparability**

Comparability is the degree to which data can be compared directly to similar studies. SBCK will use methods to ensure that our data can be compared to others, including:

- U.S. EPA’s Volunteer Monitoring Manuals (Streams, Lakes and Estuaries)

- Heal The Bay's Malibu Creek Stream Team Monitoring Protocols
- SWRCB Clean Water Team Compendium For Water Quality Monitoring and Assessment

Before modifying these methods, or developing alternative or additional methods, technical advisors will evaluate and review the effects of the potential modification. It will be important to address their concerns about data quality before proceeding with the monitoring program.

### **7.3. Completeness**

Completeness is the fraction of planned data that must be collected in order to fulfill the statistical criteria of the project. There are no statistical criteria that require a certain percentage of data. However, it is expected that 90% of all measurements could be taken when anticipated. This accounts for adverse weather conditions, safety concerns, and equipment problems.

We will determine completeness by comparing the number of measurements we planned to collect compared to the number of measurements we actually collected that were also deemed valid. An invalid measurement would be one that does not meet the sampling methods requirements and the data quality objectives. Completeness results will be checked quarterly. This will allow us to identify and correct problems. The Data Quality Form: Completeness found in Appendix A, will be used to record completeness.

### **7.4. Precision**

Precision describes how well repeated measurements agree. The precision objectives described here refer to repeated measurements taken by either different volunteers on the same sample (at quality control sessions) or the same volunteer analyzing replicate samples in the field. Additional variability would be expected if comparisons were made between different samples taken at the same location.

#### **7.4.1. Chemical and Physical Parameters**

These precision objectives apply to duplicate and split samples taken as part of the quality control session or as part of periodic in-field QC checks. For most parameters, measurements on the same sample read by different volunteers using the same equipment should be within 10% of each other.

#### **7.4.2. Biological Parameters**

Precision for bacterial parameters will be determined by having the same analyst complete the IDEXX procedure for two or more duplicates of the same sample. At a minimum this should be done once for every 20 samples, or 5%. The results of the duplicates should be within the confidence limits supplied by the manufacturer.

### **7.5 Representativeness**

Representativeness describes how relevant the data are to the actual environmental condition. Problems can occur if:

- Samples are taken in a stream reach that does not describe the area of interest (e.g. a headwaters sample should not be taken downstream of a point source),
- Samples are taken in an unusual habitat type (e.g. a stagnant backwater instead of in the flowing portion of the creek),
- Samples are not analyzed or processed appropriately, causing conditions in the sample to change (e.g. water chemistry measurements are not taken immediately).

Representativeness will be ensured by processing the samples in accordance with Section 10, 11 and 12, by following the established methods, and by obtaining approval of this document.

### **7. 6. Method Detection Limit and Sensitivity**

The method detection limit is the lowest possible concentration the instrument or equipment can detect. This is important to record because we can never determine that a pollutant was not present, only that we could not detect it. Sensitivity is the ability of the instrument to detect one concentration from the next. Sensitivities are noted in Tables 7.1. - 7.2.

## **8. Training Requirements**

Each citizen monitoring sampling team is led by a Team Captain. All Team Captains must participate in at least two hands-on training sessions on monitoring conducted by the Santa Barbara Channelkeeper. Additional training may be acquired through other organizations (e.g., Heal The Bay). The following topics are covered under this training:

- General hydrology
- Ecology
- Safety
- Quality Assurance and Quality Control Measures
- Sampling Procedures
- Field Analytical Techniques
- Data recording.

Team Captains will be trained to train rank-and-file volunteers. Individual trainees are evaluated by their performance of analytical and sampling techniques. By comparing their results to known values, and to results obtained by trainers and other trainees.

In addition to completion of the above-described training course citizen monitoring leaders must participate in semi-annual quality control sessions. These quality control sessions will be supervised by QC trainers, and will provide an opportunity for citizen monitoring groups to check the accuracy and precision of their equipment and testing techniques. Trainers are defined as water quality professionals from the U.S. Environmental Protection Agency, the State Water Resources Control Board, and the Regional Water Quality Control Boards. Additional qualified trainers will be recruited and designated by these agencies from experienced citizen monitoring organizations, universities and colleges, commercial analytical laboratories, and other federal, state, and local agencies.

The monitor will bring VRWMP equipment to the session. The monitor will conduct duplicate tests on all analyses and meet the data quality objectives described in Section 7. If a monitor does not meet the objectives, the trainer will re-train and re-test the monitor. If there is insufficient time at the QC session to re-train and re-test monitors, the monitor will be scheduled for an additional training session. The monitor will be encouraged to discontinue monitoring for the analysis of concern until training is completed.

The quality control trainer will examine kits for completeness of components: date, condition, and supply of reagents, and whether the equipment is in good repair. The trainer will check data quality

by testing equipment against blind standards. The trainer will also ensure that monitors are reading instruments and recording results correctly. Sampling and safety techniques will also be evaluated. The trainer will discuss corrective action with the volunteers, and the date by which the action will be taken. The citizen monitoring leader is responsible for reporting back that the corrective action has been taken. Certificates of completion will be provided once all corrective action has been completed.

## **9. Documentation and Records**

All field results will be recorded at the time of completion, using the data sheets (see Appendix 2). Team Captains will review data sheets for outliers and omissions before leaving the sample site, and will be signed after review by the Monitoring Leader. Data sheets will be stored in hard copy form at the SBCK office. Field sheets are archived for three years from the time they were collected.

If data entry is performed at another location, duplicate data sheets will be used, with the originals remaining at the headquarters site. Hard copies of all data as well as computer back-up disks are maintained at the SBCK office. An additional back-up disk of all electronic data will be stored at an offsite facility.

A maintenance log will also be kept by SBCK. This log details the dates of equipment inspection, battery replacement and calibrations, as well as the dates reagents are replaced. The log, along with other forms detailing the dates of equipment purchase, warranty information, etc., are included in the Santa Barbara Channelkeeper Monitoring Database. This database will be maintained as described above.

## **10. Sampling Process Design**

### ***10.1. Rationale for Selection of Sampling Sites***

Sampling sites are indicated on the map in Appendix 3. The following criteria were evaluated when choosing sampling locations:

- access is safe,
- permission to cross private property where applicable,
- sample can be taken in main river current or where homogeneous mixing of water occurs,
- sample is representative of the part of the river of interest,
- location complements or supplements historical data,
- location represents an area that possesses unique value for fish and wildlife or recreational use.

Reference sites are chosen upstream of any potential impact. A site chosen to reflect the impact of a particular discharge, tributary or land use should be located downstream of the impact where the impact is completely integrated with the water, but upstream of any secondary discharge or disturbance.

Prior to final site selection, permission to access the stream is obtained from all property owners. If access to the site is a problem, the citizen monitoring leader will select a new site. Safety issues are included in the Monitoring Handbook.

Volunteers are instructed to work in teams of at least two people. If a scheduled team cannot conduct the sampling together, the available team member will call an additional member.

Sample sites will be periodically reviewed by the leader. A narrative description, photographs, maps and driving directions will be included for each site in the VRWMP monitoring Handbook Sample Design Logistics

### 10.2. Sample Design Logistics

Volunteers are instructed to work in teams of at least two people. If a scheduled team cannot conduct the sampling together, the team captain is instructed to contact the citizen monitoring leader so that arrangements can be made for a substitute trained volunteer.

Safety measures will be discussed with all volunteers. No instream sampling will be conducted if there are small creek flood warnings or advisories. Gloves and waterless hand cleaner is provided in all field backpacks. It is the responsibility of SBCK to ensure the safety of their volunteer monitors. Safety issues are included in the Ventura Watershed Monitoring Manual.

## 11. Sampling Method Requirements

The VRWMP Monitoring Handbook describes the appropriate sampling procedure for collecting samples for water chemistry. Whenever possible, the instrument probe will be held directly in the stream. If the procedure requires that a sample be drawn first then samples will be taken by dipping a container into midstream.

Sample containers (that are not pre-sterilized and do not include preservatives/fixing agents) will be rinsed three times with sample water prior to taking each sample. If safety becomes a concern, the collector will sample from a bridge. All samples are taken in mid-stream, at least one inch below the surface. Whenever possible, samples will be collected such that the creek is not disturbed from wading. If it is necessary to wade into the water, the sample collector stands downstream of the sample, taking a sample upstream. If the collector disturbs sediment when wading, the collector will wait until the effect of disturbance is no longer present before taking the sample. All samples will be taken from flowing water unless indicated otherwise.

The following table describes the sampling equipment, sample holding container, sample preservation method and maximum holding time for each parameter.

**Table 11.1 Sampling Method Requirements**

Parameter	Sampling Equipment	Preservation and Holding Times
<i>Conventional Parameters</i>		
Temperature	plastic or glass container or sample directly	immediately
Dissolved oxygen	measure directly from stream	
pH	plastic or glass container, or sample directly	immediately
Conductivity/TDS	plastic or glass container or sample directly	immediately / refrigerate up to 28 days
turbidity	plastic or glass container	immediately / store in dark for up to 24 hr.

<i>Biological Samples</i>		
Bacteria	125 ml sterile plastic container	refrigerate in the dark; start analysis within 6 hours
<i>Nutrients</i>		
Ammonia	Van Dorn, LaMotte or plastic sampling bottle	immediately
Nitrates	Van Dorn, LaMotte or plastic sampling bottle	immediately / refrigerate in dark for up to 48 hr.
Phosphate	Van Dorn, LaMotte or plastic sampling bottle	Immediately, filter
<i>Laboratory Analysis of Chemical Parameters</i>		
Total Organic Carbon	polyethylene or glass container	Cool to 4°C HCl or H2SO4 or H3PO4, to pH<2. send to lab immediately. max holding time 28 days.
Metals (Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Silver, Thallium, Zinc)	plastic or glass container	HNO3 to pH<2. send to lab immediately. max holding time 28 days.
Oil and Grease	glass container	Cool to 4°C, HCl or H2SO4 to pH<2. send to lab immediately. max holding time 28 days.
PAH's	glass container, teflon-lined cap	Cool to 4°C, 0.008% Na2S2O3. send to lab immediately. max holding time 7 days until extraction, 40 days after extraction.
Pesticides and other synthetic organic compounds	glass container	Cool to 4°C, pH 5-9. send to lab immediately. max holding time 1 year.

## 12. Sample Handling and Custody Procedures

### 12.1. Sample Handling

Identification information for each sample will be recorded on the field data sheets (see Appendix 2) when the sample is collected. Identification information will also be written on the bottle, including Date, Time, Station ID, Sample Number, Name of Person Collecting Sample, and Test Type. The station IDs are recorded in the Monitoring database with all necessary metadata. The Monitoring Leader will keep records of stations covered by each volunteer for each sampling event.

### 12.2. Custody Procedures

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 may be taken to a nearby residence or residence for analysis. Samples requiring chemical preservations will be fixed prior to transport.

When samples are transferred from a volunteer or from the VRWMP to an outside professional laboratory, then the Chain of Custody form supplied by the lab should be used. This form identifies the waterbody name, sample location, sample number, date and time of collection, sampler's name, and method used to preserve sample (if any). It also indicates the date and time of transfer, and the

name and signature of the sampler and the sample recipient. In cases where the sample remains in the custody of SBCK, then the sample collection field data sheet may be allowed to double as the chain of custody form.

When a sample leaves the custody of SBCK, then the Chain of Custody form used will be the one provided by the outside professional laboratory. Similarly, when a professional lab performs quality control checks, their samples will be processed under their chain of custody procedures with their labels and documentation procedures.

**12.3. Disposal**

All analyzed samples including used reagents, buffers or standards will be collected in a plastic bottle clearly marked “Waste” or “Poison”. This waste material will be disposed of according to appropriate state and local regulations.

Liquid waste from the cadmium reduction nitrate test will be kept separate and disposed of at a facility that is permitted to handle, transport, or dispose Cadmium waste. Waste from the salicylate ammonia test can be held in the regular waste container and disposed of as described in the previous paragraph.

**13. Analytical Methods Requirements**

Water chemistry is monitored using protocols outlined in the VRWMP Monitoring Handbook. The methods were chosen based on the following criteria:

- capability of trained staff and volunteers to use methods,
- methods that will produce data of known quality,
- ease of use,
- methods can be compared to professional methods in *Standard Methods*.

If modifications of methods are needed, comparability will be determined by side-by-side comparisons with a US EPA or APHA Standard Method on no less than 50 samples. If the results meet the same precision and accuracy requirements as the approved method, the new method will be accepted.

Table 13.1 outlines the methods to be used, any modifications to those methods, and the appropriate reference to a standard method.

**Table 13.1. Analytical Methods for Water Quality Parameters**

Parameter	Method	Modification	Reference (a)
Temperature	Thermometric	Mercury-filled thermometer marked in 1.0 °C increments	2550 B.
Dissolved Oxygen	Membrane Electrode	None	4500-O G.
pH	Electrometric	None	4500-H B.
Conductivity/TDS	Electrometric	None	2520 B.
Turbidity	Nephelometric	None	None
Total Coliform Bacteria	Colilert 18 hour	None	9223
E. coli Bacteria	Colilert 18 hour	None	9223
Enterococcus Bacteria	Enterolert 24 hour	None	IDEXX Corp.

All of the above cited methods, with the exception of enterococcus bacteria, are described in Standard Methods for the Examination of Water and Wastewater, prepared and published jointly By American Public Health Association, American Water Works Association, Water Environment Federation, 20th edition, Washington, DC : American Public Health Association, 1998. *Enterolert* is an official ASTM method (#D6503-99).

## 14. Quality Control Requirements

Quality control samples will be taken to ensure valid data are collected. Depending on the parameter, quality control samples will consist of field blanks, replicate samples, or split samples. In addition, quality control sessions (a.k.a. intercalibration exercises) will be held twice a year to verify the proper working order of equipment, refresh volunteers in monitoring techniques and determine whether the data quality objectives are being met.

Observational data sheets have few numerical values, therefore are difficult to standardize. We will conduct a Quality Control Session for Observational Data collection at least once a year. At least 3 volunteers and one Team Leader will separately fill out a data sheet, and will compare results. Any deviations will be discussed.

Flow measurements will be compared to data collected by Ventura County Flood Control staff gauges where possible. At least once a year, we will measure flow using our 'orange peel' technique in a side-by side comparison with an actual flow meter. Past tests indicate that our technique produces data within 15% of manual and electronic flow meters.

### 14.1. Blanks, Replicates, Duplicates, Split Samples and Standardization

Table 14.1 describes the quality control regimen.

Our methodology includes blanks, duplicate /replicate samples, split samples, trip blanks, and temperature blanks.

Field/Laboratory Blanks: For turbidity and specific chemical analysis (see Table 14.1) performed in the field Field blanks (a.k.a. reagent blanks) will be taken once every 20 samples, or quarterly whichever comes first except for nutrient sampling.

For bacterial analysis performed at SBCK, a laboratory blank will be performed for each sampling/analysis event. If more than 50 samples are expected in one day, an additional blank will be analyzed.

*Instructions for Field and Lab Blanks*: Distilled water is taken into the field or used in the laboratory and handled just like a sample. It will be poured into the sample container and then analyzed. Field blanks are recorded on the normal sampling datasheet. For bacterial analysis, the reagents are added to distilled water (in the same manner as for a field sample) and that "blank" is then sealed in a quantitray and incubated along with the field samples. The blank should be below detection limits at the end of the incubation period.

Replicate/Duplicate Field Samples: Replicate samples are 2 or more samples collected at the same time and place. When there are only two replicates, they are referred to as duplicates. These samples are collected for checking the preciseness of the sampling process. For chemical, physical, and bacterial analysis duplicate field samples will be taken at one randomly chosen site at every sampling event (monthly). Replicate samples are collected at the same time and from the same source as the study samples.

**Split Samples:** These samples are taken to check analytical performance. The sample is taken in one container, mixed thoroughly, and split into another container. Both halves are now samples that represent the same sampling point. One half will be analyzed as usual by SBCK, the other will either be sent to a certified lab or to another monitoring organization (e.g. Heal The Bay).

**Spiked Split Samples:** Twice a year, split spiked samples (standards) will be analyzed as part of the Quality Control (Intercalibration) Session. These split samples will contain a known concentration of a standard analyte. Split standards will be analyzed by the volunteers, and sent to a professional laboratory (except for dissolved oxygen, temperature, and pH), before the maximum sample handling time is exceeded. Volunteers will analyze the split standard normally and will perform at least three analyses on that same sample. From these results accuracy and precision will be determined. The professional laboratory will analyze the sample using the method referenced in Table 13.1

For turbidity, split field samples will be analyzed as part of the QC session. The two results will be compared to ensure proper use, calibration and function of the turbidimeter.

For bacteria, split field samples or split positive controls will be analyzed by the citizen monitoring group and an outside professional laboratory twice annually. In addition, at the intercalibration session different analysts from the citizen monitoring group(s) will each read a minimum of the three quantitrays and compare their results. These results should be within  $\pm$  one well for concentrations of less than 1000 MPN/100 ml, and within  $\pm$  two wells for concentrations of greater than 1000 MPN/100ml.

**Trip Blanks:** Twice a year, trip blanks will be analyzed in-house along with the collected bacteria and nutrient samples. These blanks consist of sample bottles filled with distilled water that are taken into the field with the sealed sample bottles, and then are brought back and analyzed along side the collected samples.

**Temperature Blanks:** Twice a year, temperature blanks will be tested to ensure proper storage of sample bottles. Temperature blanks consist of sample bottles filled with distilled water that are taken into the field and kept inside the cooler along with the samples obtained in the field. Before sample analysis, the temperature of the blank is measured to ensure that samples are at or below 4°C.

**Table 14.1. Summary of Quality Control Requirements**

Parameter	Blank	Duplicate Sample	Split Sample to lab	QC session (intercal.)
<i>Misc.</i>				
Site Observations	none	Compare volunteer obs. with Team leader obs.		Once a year
Flow	none	Perform technique and compare with flowmeter		Once a year
<i>Water quality</i>				
Temperature	none	5% or a minimum of once a year	none	twice a year
Dissolved oxygen	none	5% or a minimum of once a year	none	twice a year
pH	none	5% or a minimum of once a year	none	twice a year
conductivity	5%	5% or a minimum of once a year	twice a year	twice a year
turbidity	5%	5% or a minimum of once a year	twice a year	twice a year
<i>Nutrients (colorimeters or spectrophotometers)</i>				
Ammonia	daily	5% or a minimum of once a year	twice a year	twice a year
Nitrate	daily	5% or a minimum of once a year	twice a year	twice a year
Phosphate	daily	5% or a minimum of once a year	twice a year	twice a year
<i>Biological Parameters</i>				

Total & E. Coli	daily	5% or a minimum of once a year	twice a year	twice a year
Enterococcus	daily	5% or a minimum of once a year	twice a year	twice a year

## 15. Instrument/Equipment Testing, Inspection and Maintenance Requirements

The SBCK group leader keeps an instrument, methodology and calibration log. These logs record the dates of instrument and sampling gear purchase, inspection, calibration, battery replacement, the dates reagents and standards are replaced, and any problems noted with instruments, samples or reagents. Instruments are calibrated within a day of the monitoring event, except for the pH meters that are calibrated immediately beforehand. Calibration information is recorded on the datasheets.

### 15.1. Temperature

Before each use, thermometers are checked for breaks in the column. If a break is observed, the alcohol thermometer will be placed in nearly boiling water so that the alcohol expands into the expansion chamber, and the alcohol forms a continuous column. Verify accuracy by comparing with a calibrated or certified thermometer.

### 15.2. Dissolved oxygen

Before each use, DO meters are checked to see if they are clean and in good working order. Membranes are replaced each month before the scheduled sampling event, according to manufacturer's recommendation.

### 15.3. pH and conductivity

Before each use, pH and conductivity meters are checked to see if they are clean and in good working order. pH and conductivity meters are calibrated before each use. pH buffers and conductivity standards are replaced at least annually. Conductivity standards are stored with the cap firmly in place and in a dry place kept away from extreme heat. Do not re-use pH or conductivity standards.

### 15.4. Turbidity

Turbidity meters are calibrated to two standards each month. The turbidity standard will be replaced annually. Before each use, turbidity tubes are checked to ensure that they are clean. Wipes for removing smudges and fingerprints are supplied in each case.

## 16. Instrument Calibration and Frequency (chemical and physical parameters)

Instruments will be calibrated accordingly to the following schedule. Standards will be purchased from a chemical supply company or prepared by a laboratory certified by U.S. EPA for chemical analysis of water or wastewater. Calibration records will be kept at the SBCK office, where they can be easily accessed before and after equipment use.

**Table 16.1. Instrument Calibration and frequency**  
Conventional Water quality Parameters

Equipment Type	Calibration Frequency	Standard or Calibration Instrument Used
Temperature	Every 6 months	NIST calibrated or certified thermometer

Dissolved Oxygen meter	Calibrated to elevation at each sampling site	At a minimum, water saturated air, according to manufacturer's instructions.
pH	Every sampling day	pH buffer 7.0 and 10.0
conductivity	Every sampling day	conductivity standard 700 $\mu$ S and 2060 $\mu$ S
Turbidity meter (nephelometer)	Every sampling day	For clear ambient conditions use an 1.0 NTU standard, for turbid conditions use an 10.0 NTU standard

## 17. Inspection/Acceptance Requirements

Upon receipt, buffer solutions, standards, and reagents used in the field kits will be inspected by the citizen monitoring leader for leaks or broken seals, and to compare the age of each reagent to the manufacturer's recommended shelf-life. All other sampling equipment will be inspected for broken or missing parts, and will be tested to ensure proper operation.

Before usage, thermometers are inspected for breaks. Breaks can be eliminated by heating (see Section 15.1). If not, they will be returned to the manufacturer.

Reagents are replaced before they exceed manufacturer's recommended shelf life. These shelf lives are typically one to two years. However, specific replacement dates can be determined by providing the reagent lot number to the Hach Company by phone at (800) 227-4224. Reagent replacement dates are noted in the maintenance log.

## 18. Data Acquisition Requirements

### 18.1. Professional Analytical Data

Only certified analytical laboratories or academic laboratories (with approval of State and/or Regional Board staff) will be used for quality assurance checks. The Technical advisory Committee (TAC) or technical advisors will review these laboratories' data as well as the volunteers. They may also review the lab's own quality control data to ensure data validity.

### 18.2. Geographical Information/ Mapping

The discrete location of each sampling site will be mapped by SBCK with a hand-held GPS unit. USGS maps will be used to verify watershed boundaries and river courses. Photo catalogues of each sampling station are maintained by the monitoring leader. Additional information on distribution of natural resources will be obtained from the National Park Service and the CDFG's Biodiversity database. Land use information will be obtained from local planning offices. When information is requested, the agency will be asked to provide appropriate metadata and any information on data limitations. This information will be maintained with the data files.

## 19. Data Management

Field data sheets are checked for completeness in the field by each Team Captain before leaving each site. The citizen monitoring leader will identify any results where holding times have been exceeded, sample identification information is incorrect, samples were inappropriately handled, or calibration information is missing or inadequate. Such data will be marked as unacceptable by the monitoring leader and will not be entered into the electronic database.

Independent laboratories will report their results to Santa Barbara Channelkeeper. Monitoring leaders will verify sample identification information, review the chain-of-custody forms, and identify the data appropriately in the database. These data are also reviewed by the technical advisors quarterly.

The data management coordinator will review the field sheets and enter the data deemed acceptable by the citizen monitoring leader and the technical advisors. Data will be entered into either a spreadsheet or a database, or both. Once the data is entered, the data sheets will be archived. The data coordinator will review electronic data, compare to the original data sheets and correct entry errors. After performing data checks, and ensuring that data quality objectives have been met, data analysis will be performed.

Raw data will be provided electronically to the California SWB and Los Angeles RWB at least once every two years so that it can be included in the 305(b) report. Appropriate quality assurance information may be provided upon request.

## **20. Assessment and Response Actions**

Review of all field and data activities is the responsibility of the citizen-monitoring leader, with the assistance of the technical advisory committee. Volunteers will be accompanied by the citizen monitoring leader or a technical advisor on at least one of their first 5 sampling trips. If possible, volunteers in need of performance improvement will be retrained on-site. If errors in sampling technique are consistently identified, retraining may be scheduled more frequently. Volunteers' ability to perform sampling will be continuously reviewed by the monitoring leader.

Annually, SWRCB staff, or its designee, will evaluate field and laboratory performance and provide a report to the citizen monitoring group. All field and laboratory activities, and records may be reviewed by state and EPA quality assurance officers as requested.

## **21. Reports**

The technical advisors will review draft reports to ensure the accuracy of data analysis and data interpretation. Raw data will be made available to data users per their request. SBCK will report their data to their constituents after quality assurance has been reviewed and approved by their technical advisors. Every effort will be made to submit data and/or a report to the SWRCB and/or RWQCB staff in a fashion timely for their data uses, e.g. 305(b) report or special watershed reports.

## **22. Data Review, Validation and Verification**

Data sheets or data files are reviewed twice a year by the technical advisors to determine if the data meet the Quality Assurance Project Plan objectives. They will identify outliers, spurious results or omissions to the citizen monitoring leader. They will also evaluate compliance with the data quality objectives. They will suggest corrective action that will be implemented by the citizen monitoring leader. Problems with data quality and corrective action will be reported in final reports.

## **23. Validation and Verification Methods**

As part of standard field protocols, any sample readings out of the expected range will be reported to the citizen monitoring leader. A second sample will be taken as soon as possible to verify the condition. If the data is invalid, then the point will be noted (flagged) on the datasheet. We will take further actions to trace the sources of error, and to correct these problems. If the error is a result of improper monitoring procedures, then we may re-train volunteer monitors until their performance is acceptable. It is the responsibility of the citizen monitoring leader to re-train volunteers until performance is acceptable.

## **24. Reconciliation with Data Quality Objectives**

The Technical Advisory Committee working with the Volunteer Leader will review data at least twice a year to determine if the data quality objectives (DQOs) have been met. They will suggest corrective action. If data do not meet the project's specifications, the following actions will be taken. First, the technical advisors will review the errors and determine if the problem is equipment failure, calibration/maintenance techniques, or monitoring/sampling techniques. If the problem cannot be corrected by training, revision of techniques, or replacement of supplies/equipment, then the technical advisors and the TAC will review the DQOs and determine if the DQOs are feasible. If the specific DQOs are not achievable, they will determine whether the specific DQO can be relaxed, or if the parameter should be eliminated from the monitoring program. Any revisions to DQOs will be appended to this QA plan with the revision date and the reason for modification. The appended QA plan will be sent to the quality assurance panel that approved this plan. When the appended QA plan is approved, the citizen monitoring leader will work with the data coordinator to ensure that all data meeting the new DQOs are entered into the database. Archived data can also be entered.

## APPENDIX 1. Data Quality Forms

**Data Quality Form: Accuracy**

**Quality Control Session**

Ventura River Watershed Monitoring Program Team #_____	Type of Session (field or lab)
Your Name	Quality Assurance Leader
Date	

Parameter/ units	Sensitivity	Accuracy Objective	Standard Conc.	Analytical Result	Estimated Bias	Meet Objective? Yes or No	Corrective action planned	Date Corrective Action taken
Temperature °C								
Dissolved Oxygen (mg/l)								
pH standard units								
Conductivit y (µmhos/cm)								

**Comments:**

**Data Quality Form: Completeness**

**Quality Control Session**

Ventura River Watershed Monitoring Program Team #_____			Type of Session (field or lab)	
Your Name			Quality Assurance Leader	
Date				
Parameter	Collection Period	No. of Samples Anticipated	No. Valid Samples Collected and Analyzed	Percent Complete
Temperature °C				
Dissolved Oxygen (mg/l)				
pH standard units				
Conductivity (µmhos/cm)				

**Comments:**

**Data Quality Form: Precision**

**Quality Control Session**

Ventura River Watershed Monitoring Program Team # _____	Type of Session (field or lab)
Your Name	Quality Assurance Leader
Date	

Parameter/ units	Mean (x)	Standard Deviation (s.d.)	s.d./x	Precision Objective	Meet Objective? Yes or No	Corrective action planned	Date Corrective Action taken
Temperature °C							
Dissolved Oxygen mg/l							
pH standard units							
Conductivity (µmhos/cm)							

**Comments:**

## **APPENDIX 2. Data and Observation Sheets**

## Stream Team Water Chemistry Testing

### Site Conditions Field Sheet

**Date:** \_\_\_\_\_ **Site Number:** \_\_\_\_\_ **Location:** \_\_\_\_\_  
**Time:** \_\_\_\_\_ **Team 1 2 3 Recorder:** \_\_\_\_\_

***Team members:***

**Weather Conditions:**

Clear  Partly Cloudy  Overcast  Showers  Rain  other \_\_\_\_\_

Wind speed and direction (est.) \_\_\_\_\_

Starting Air Temperature \_\_\_\_\_ C / F at \_\_\_\_\_ am / pm @ **start** of testing

Ending Air Temperature \_\_\_\_\_ C / F at \_\_\_\_\_ am / pm @ **end** of testing

Comments:

**Type of Flow:**

None  intermittent  trickle  steady  heavy  flooding

Comments:

**PROPERTIES OF STREAM**

**Water Clarity:**

clear  cloudy  milky  muddy  other \_\_\_\_\_

**Water Color:**

clear  red  brown  yellow  green  grey  other \_\_\_\_\_

**Odors:**

none  rotten eggs  sewage  chlorine  musty  ammonia  other \_\_\_\_\_

**Floatables:**

none  oily sheen (rainbow colored)  garbage  sewage  other \_\_\_\_\_

**Biological Floatables:**

**algae** suspended  only on rocks  est. % coverage in stream \_\_\_\_\_ color \_\_\_\_\_

**foam** color \_\_\_\_\_ height \_\_\_\_\_ % coverage \_\_\_\_\_ consistency \_\_\_\_\_

comments:

***DEBRIS***

**Density of Trash in general site area:**

None  Light  Moderate  High  Approx. # of pieces \_\_\_\_\_

**Type of Trash: (% type of item)**

\_\_\_\_\_ % organic (food items) \_\_\_\_\_ % plastics

\_\_\_\_\_ % Recyclables (non plastic) \_\_\_\_\_ % large items (cars, appliances, etc.)

comments:

**Density of trash on stream banks or in water:**

None  Light  Moderate  High  Approx. # of pieces \_\_\_\_\_

**Type of Trash: (% type of item)**

\_\_\_\_\_ % organic (food items) \_\_\_\_\_ % plastics

\_\_\_\_\_ % Recyclables (non plastic) \_\_\_\_\_ % large items (cars, appliances, etc.)

comments:

## Stream Team Water Chemistry Testing

### Chemical Parameters Field Sheet

Date: \_\_\_\_\_ Site Number: \_\_\_\_\_ Site Name: \_\_\_\_\_  
 Time: \_\_\_\_\_ Team 1 2 3 Name of Recorder: \_\_\_\_\_

List all Team members: \_\_\_\_\_

**\*\*\* For all parameters Take THREE readings in different (but similar) stretches of stream\*\*\***

**Dissolved Oxygen** calibrate to Site Elevation: \_\_\_\_\_ Comments: \_\_\_\_\_

reading	Mg/L	% Saturation	Water Temp	Time	Name of Sampler
<b>1</b>					
<b>2</b>					
<b>3</b>					

**pH:** take 3 measurements, please from stream  or sample bottle

**1.** \_\_\_\_\_ **2.** \_\_\_\_\_ **3.** \_\_\_\_\_ Sampler Name: \_\_\_\_\_

**TURBIDITY (TSS):** \*make sure bottle is clean and aligned properly!  
 Fill two Sample Vials, take three readings each. Units are in NTU

Vial#1 1. \_\_\_\_\_ 2. \_\_\_\_\_ 3. \_\_\_\_\_ Sampler: \_\_\_\_\_  
 Vial#2 1. \_\_\_\_\_ 2. \_\_\_\_\_ 3. \_\_\_\_\_ Sampler: \_\_\_\_\_

**CONDUCTIVITY and TDS:** These are two different parameters, with the same instrument.  
 \*\* press the MODE button once to get TDS readings (ppm or ppt), and twice to get back to CONDUCTIVITY  
 \* if screen reads 9.99 or 99.9, etc., the instrument may not be auto-adjusting the range. Try pressing "range"

Readings taken from stream  or from sample bottle  Sampler Name \_\_\_\_\_

Conductivity (Circle) uS or mS	Water temp C / F	Time	am / pm	TDS (circle) ppm or ppt
<b>1.</b> _____	_____	_____	_____	_____
<b>2.</b> _____	_____	_____	_____	_____
<b>3.</b> _____	_____	_____	_____	_____

**COLLECT SAMPLE FOR NUTRIENT TESTING:**  bottle # \_\_\_\_\_ time collected \_\_\_\_\_  
 time put on ice \_\_\_\_\_ Relinquished by: \_\_\_\_\_ time: \_\_\_\_\_

**COLLECT SAMPLE FOR BACTERIA:**  bottle # \_\_\_\_\_ time collected: \_\_\_\_\_  
 time put on ice \_\_\_\_\_ Relinquished by: \_\_\_\_\_ time: \_\_\_\_\_

Sample bottles received by: \_\_\_\_\_ time: \_\_\_\_\_

Comments:

## Stream Team Water Chemistry Testing Stream Flow

Velocity and cross sectional area of the stream need to be determined in order to calculate stream flow. The data you gather will be helpful in understanding the relationship between stream flow, sedimentation, dissolved oxygen, and pollution concentrations. The results after calculation will be stream flow in Cubic Feet per Second (CFS).

**Team #:** \_\_\_\_\_

**Date:** \_\_\_\_\_      **Site #** \_\_\_\_\_ **Site Name:** \_\_\_\_\_

**Time:** \_\_\_\_\_      **Recorder:** \_\_\_\_\_

**UPSTREAM Wetted Width of Stream** \_\_\_\_\_ (feet, inches)

**Cross Sectional Area** (measure points at every foot across width of stream, start at opposing side)

Point #	depth						
1		11		21		31	
2		12		22		32	
3		13		23		33	
4		14		24		34	
5		15		25		35	
6		16		26		36	
7		17		27		37	
8		18		28		38	
9		19		29		39	
10		20		30		40	

**DOWNSTREAM Wetted Width of Stream** \_\_\_\_\_ (feet, inches)

**Cross Sectional Area** (measure points at every foot across width of stream, start at opposing side)

Point #	depth						
1		11		21		31	
2		12		22		32	
3		13		23		33	
4		14		24		34	
5		15		25		35	
6		16		26		36	
7		17		27		37	
8		18		28		38	
9		19		29		39	
10		20		30		40	

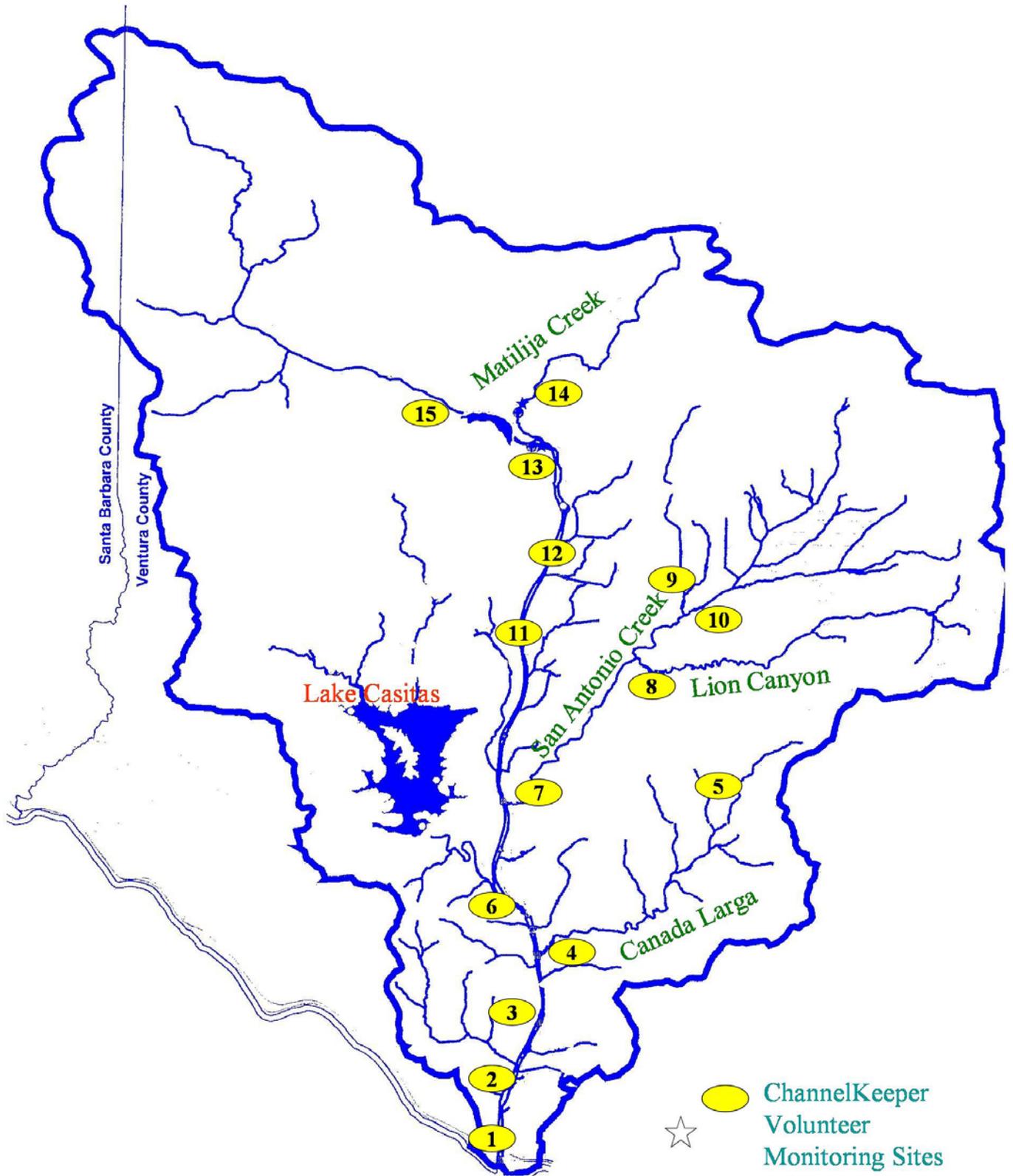
**Velocity Float Trials**      length of reach (distance along stream) \_\_\_\_\_ should be 20ft

Trial#	1	2	3	4	5
<b>Time</b>					

comments: \_\_\_\_\_  
\_\_\_\_\_

## **APPENDIX 3. Map of Sampling Sites**

# VENTURA RIVER DRAINAGE AREA



Prepared By:  
Ventura County Flood Control District  
Stormwater Quality Section - JLL  
July 2000

