UPPER SAN ANTONIO CREEK WATERSHED
GIANT REED REMOVAL
WATER QUALITY MONITORING PLAN

County of Ventura Watershed Protection District

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1.0 INTRODUCTION

In 2007, the Watersheds Coalition of Ventura County, of which the Ventura County Watershed Protection District (VCWPD) is a participating agency member, was awarded an Integrated Regional Water Management Planning Program (IRWMP) Proposition 50 grant to complete several projects associated with the Ventura River Watershed Protection Project (V-1). A specific project approved under the grant is a watershed plan for San Antonio Creek, including implementation of giant reed removal from San Antonio Creek and tributaries thereto. San Antonio Creek is a tributary of the main branch of the Ventura River and is part of the river's regional watershed. San Antonio Creek and its tributary creeks contain several areas populated by giant reed, as well as other non-native invasive plant species.

The goal of the Upper San Antonio Creek Watershed Giant Reed Removal Project (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 re-colonization of native vegetation and restoration of native habitats. Implementation of the Project will be guided by the Upper San Antonio Creek Watershed Giant Reed Removal Project Mitigated Negative Declaration and Initial Study (District/Aspen Environmental Group 2009), which includes the use of herbicides and other activities that have the potential to affect water quality in San Antonio, McNell, Thacher, and Reeves Creeks. More specifically, contractors will follow the specifications and plan sheets. To protect water quality in the upper San Antonio watershed, the District will conduct regular monitoring of the surface water in these creeks. The water quality monitoring will be guided by this Water Quality Monitoring Plan (Monitoring Plan) and the upper San Antonio Creek 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 District has not conducted water quality monitoring in the Project area; however, the Stream Team has over 9 years of baseline water quality data collected directly downstream of the Project area.

1.1 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 Upper San Antonio Creek Watershed Monitoring Program QAPP, which will be submitted to the SWRCB in June 2010. 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 the Regional Water Quality Control Board (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.

1.2 DATA MANAGEMENT

Water quality data will be stored by the District for a period of at least 20 years from the date of sampling. Laboratory results will be posted online within one month of receipt from the laboratory. Water quality data from certified laboratories will be periodically uploaded to CEDEN (California Environmental Data Exchange Network) and posted online on the District's website at www.vcwatershed.org. Water quality data will be entered and evaluated on a monthly basis or more frequently, as required.

1.3 REPORTING

The District will prepare biannual reports and a final report of the water quality monitoring activities throughout the work period from March 2010 to March 2012 (final date of treatment depends on funds). The biannual and final reports will be submitted to SWRCB within six weeks of the end of the reporting period. The reports will include a discussion of water quality impacts based on data collected. Throughout the Project, water quality data will be made available to stakeholders, regulatory agencies, and the general public through the VCWPD website (www.vcwatershed.org). Data will be posted on the Project website within one month 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 climate of this 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 REGIONAL 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. Glyphosate is one of the world's most widely used agrochemical herbicides (Meyer et al) and as such may already be present in the watershed due to local agricultural and urban weed control. 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 Ventura River watershed.

2.4 THE UPPER SAN ANTONIO CREEK WATERSHED

The upper San Antonio Creek watershed is located within the Ojai Valley of Ventura County, California. The Ojai Valley is approximately 12 miles north (inland) of the City of Ventura, and is accessed via State Highways 33 and 150.

2.5 PROJECT AREA

The project will remove giant reed where it occurs along upper San Antonio, McNell, Thacher and Reeves Creeks. The distribution of giant reed within these creeks is patchy; overall, its percent cover relative to other vegetation is fairly low (less than about 20 percent). However, there are a few locations where its percent cover is as much as 76 percent. Figure 1 provides a giant reed distribution map of the proposed project area, and Table 1 provides estimates of the percent coverage, by acreage, for the sites targeted for giant reed removal. The project also involves the opportunistic removal of castor bean in areas where it occurs in close proximity to the giant reed.

Table 1. Estimated Acreage, By Percent Cover, for Targeted Giant Reed Removal Sites*

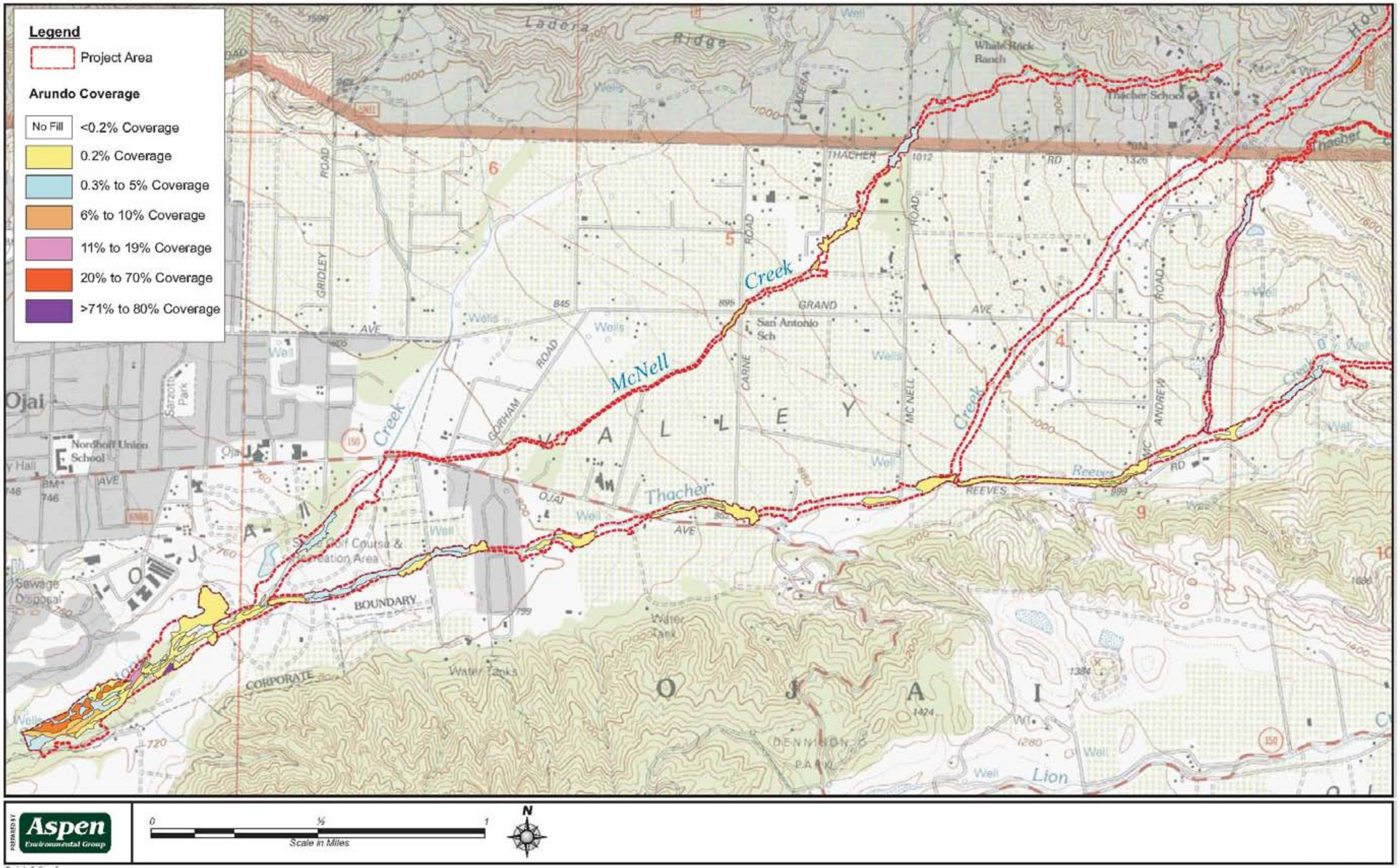
Percent Coverage	Estimated Acreage
Less than 0.2	139.56
0.3 to 5	59.71
6 to 10	4.31
11 to 19	3.69
20 to 70	4.49
Greater than 70	0.35
Total	212.10

* Estimates based on October 2008 and June 2009 surveys (Aspen Environmental Group, 2008 and 2009)

The project area includes those portions of upper San Antonio, McNell, Thacher, and Reeves Creeks that extend between the southwest boundary of Soule Park and private in-holdings within Los Padres National Forest, which is located northeast and east of Soule Park. Although some segments of these creeks traverse through the jurisdictional boundaries of the City of Ojai (Ojai), no creek reaches targeted for giant reed removal would occur within Ojai's city limits. Similarly, some segments of McNell and Thacher Creeks are located north of the Los Padres National Forest boundary, however, proposed removal activities along these creek reaches would occur on private lands that fall under the jurisdiction of Ventura County. A total of 212 acres are targeted for giant reed removal.

McNell, Thacher and Reeves Creeks are non-perennial and treatment is restricted to times when surface water is not present. Four sampling sites have been selected for representational water quality monitoring for this Project.

Figure 1. Giant Reed Percent Cover and Distribution



3.0 PARAMETERS OF CONCERN

Water samples will be collected by Stream Team or District staff in accordance with the sampling methods 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 pH range of 6.5 to 8.0. If pH is altered beyond an organism's normal range it will seek another location with tolerable conditions. 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 can rapidly change 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 measurement for 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 (µS/cm) or millisiemens per centimeter (mS/cm). Distilled water has a conductivity in the range of 0.5 to 3 µS/cm. The conductivity of rivers in the United States generally ranges from 50 to 1,500 µS/cm. Drinking water usually has to meet a standard of 500 mg/L TDS – a conductivity of roughly 1,000 µS/cm. Conductivity in Santa Barbara and Ventura streams is usually above 1,000 µs/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 constituent 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, AMPA, and GLUFOSINATE

The *Initial Study for the Upper San Antonio Creek Watershed Giant Reed Removal Project* (Aspen, 2009) describes glyphosate as a broad-spectrum, non-selective, post-emergent herbicide that readily and completely biodegrades in soil and has little potential for leaching into groundwater. Its half-life in soil can range from three to 130 days, depending on site-specific soil structure, moisture, and temperature. Its half-life in water is estimated to range from a few to 63 days, depending on site-specific conditions. The reference dose (RfD) determined by the USEPA is 2 milligrams per kilogram per day (mg/kg/day), meaning that a person could receive a dose of 2 mg/kg/day throughout every day of his or her life without an adverse health effect. Short-term or acute exposures above the chronic RfD can occur without any known adverse health effect. The estimated lethal dose of glyphosate in humans is 445 mg/kg/day.

A glyphosate-based herbicide that is approved and labeled for use near and in open water, such as Aquamaster®, will be used in this Project and will be applied to the target species by “cut and daub” methods. The Project methods do not include the aquatic application of glyphosate and have been revised to exclude foliar application. No surfactant will be used in the application of the herbicide and therefore surfactants will not be tested for. A non-toxic colorant such as Blazon® will be added to the herbicide to mark the canes that have been treated. There are no regulatory limits for Blazon and it will not be tested for. BMPs will be implemented to minimize the potential for glyphosate to enter open water, as described in the Initial Study.

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[1] 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. Due to the strong adsorption to soil particles, glyphosate generally moves out of the water column within 48 hours. Glyphosate will be monitored pre-treatment, during treatment, and post-treatment by the Stream Team and VCWPD.

Aminomethylphosphonic acid (AMPA) is a breakdown product of glyphosate as the result of microbial metabolism. The laboratory method used to analyze for AMPA also measures glyphosate and glufosinate. Glufosinate is similar to glyphosate in its chemical structure and use.

[1] LC50 refers to the lethal concentration of a chemical that kills 50 percent of test animals in a given time period.

4.0 SAMPLING SITES

4.1 ROUTINE SAMPLING

Four routine sampling sites have been selected within the Project Area to achieve the objectives of this water quality monitoring program (Figure 2). These sites were chosen as being representative of the treatment areas. Water samples collected from all sites will be tested for temperature, pH, turbidity, DO, conductivity, stream flow, and glyphosate. Site 1/1A will also be tested for AMPA and glufosinate. All GPS coordinates are given in WGS 84.

Site 1
Site 1 is located southwest of Soule Park above the confluence of San Antonio Creek and Stewart/Fox Canyon (Pirie Creek), downstream of the densest giant reed population to be targeted in this Project. Two sites have been selected for representational monitoring of Site 1:
SACGRRP-1/VR10 Altitude: 640 feet Lat: 34°26'55.54"N Long: 119°11'5.82"W
SACGRRP-1/VR10 is an existing Stream Team monitoring site (VR10). The Stream Team has collected over ten years of data at VR10 and will continue to monitor at this site. The channel at this site is approximately 15 feet in width and the streambed is composed mostly of large cobbles and gravel. The vegetation comprises mostly willow, oak, and grasses.
SACGRRP-1A Altitude: 640 feet Lat: 34°26'5.30"N Long: 119°14'47.68"W
Site 1A is located approximately 100 yards upstream of VR10 where the Saddle Mountain Homeowners Association's private road crosses San Antonio Creek. This site was selected for monitoring by the District as it should remain accessible during times of heavy flow, whereas access to SACGRRP-1/VR10 requires wading Pirie Creek. The San Antonio Creek channel at this site is approximately 12 feet in width and the streambed is composed of mostly large cobbles and gravel. Vegetation at this site is willows and grasses.

Site 2 (SACGRRP-2) Altitude: 640 feet Lat: 34°26'56.11"N Long: 119°13'29.68"W
Site 2 is located at the San Antonio Creek Crossing on Ojai Avenue, near the entrance to Soule Park Golf Course. The site is on the south side (downstream) of the bridge. The channel width at this site is approximately 70 feet; however the creek migrates in the channel during low flows and is dry during much of the year. The streambed is mostly cobbles and gravel. The vegetation in this area has recently been cleared for the construction of the bridge, but downstream it supports mostly willows. Giant reed infestation in this area is generally low.

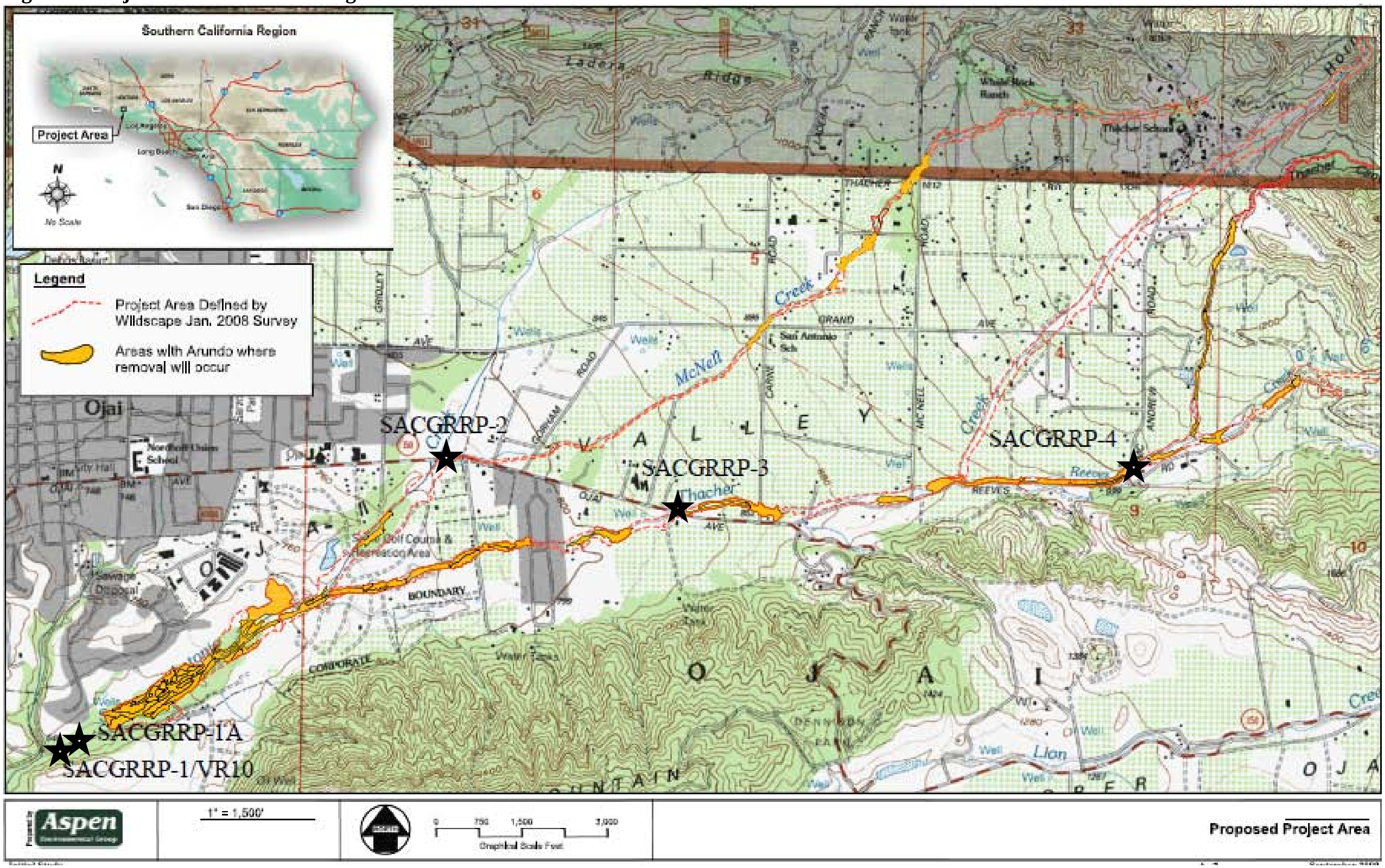
Site 3 (SACGRRP-3) Altitude: 775 feet Lat: 34°26'47.43"N Long: 119°12'41.13"W
Site 3 is located on the downstream side of the Thacher Creek crossing of Ojai Avenue, just south of the bridge. The channel width at this site is approximately 12 feet and is dry during most of the year. The stream bed is mostly cobbles and gravel and willows have colonized the stream banks. Giant reed infestation in this area is generally low.

Site 4 (SACGRRP-4) Altitude: 985 feet Lat: 34°26'55.54"N Long: 119°11'5.82"W
Site 4 is located at the Reeves Creek crossing on McAndrew Road on the eastern (upstream) side of the bridge. The channel width at this site is approximately 20 feet and is dry during most of the year. The stream bed under the bridge has been paved with concrete, but the streambed upstream and downstream of the bridge is large cobbles and gravel. The vegetation in this area is mostly oak. Giant reed infestation is generally low; some moderate to high density patches of giant reed are located upstream.

4.2 GRAB SAMPLING

Periodic grab sampling allows for more targeted sampling immediately adjacent to work as it is conducted throughout the site, however treatments cannot occur near standing or flowing water or within 24 hours of rain, which limits the feasibility of sample collection during treatment. Periodic grab samples will be taken as circumstances allow as described in Section 5.2.

Figure 2. Project Area and Monitoring Sites



5.0 SAMPLING SCHEDULE

Routine dry weather and periodic storm event grab sampling will provide consistent and targeted data throughout the treatment periods. Water quality sampling will be conducted before, during, and after treatment events if water is present at the sampling sites.

5.1 PRE-TREATMENT SAMPLING PERIOD

Baseline samples will be collected at the four monitoring sites prior to the beginning of the treatment program, if water is present. The District will collect samples for glyphosate and AMPA at Site 1 and samples for glyphosate at Sites 2-4 during the last week of April 2010, prior to the beginning of the Project. The Stream Team will collect a sample for glyphosate at Site 1 (VR10) on the first Saturday of March, 2010, and the first Saturday of May 2010. Field measurements of temperature, pH, turbidity, DO, conductivity, and stream flow, will also be taken at the time of sample collection. Additional pre-treatment data are available for Site 1/VR10 from the Stream Team's existing water quality monitoring program. The data collected during this sampling period, in conjunction with the data already collected by the 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 re-treatment periods. The initial treatment period includes the cut and daub work along the entire project area and is anticipated to begin in May 2010. The re-treatment periods target isolated patches of re-sprouts and will occur approximately quarterly throughout the two year monitoring period. The intensity of the re-treatments will be substantially less than the initial treatment.

All sampling is constrained by the need for surface water to be present for the collection of samples. Routine sampling at designated sites will occur during and after the initial treatment and each subsequent re-treatment if surface water is present at the sampling site. The Stream Team will sample for glyphosate at Site 1/VR10 on the first Saturday of each month in which treatment has occurred, and the first Saturday of the month following the completion of a treatment. The District will sample for glyphosate at Sites 1-4 within five days of the first Saturday of each month in which the Stream Team is scheduled to sample, if water is present. The District will sample for AMPA at Site 1 before treatment begins and after all re-treatments are completed each calendar year.

Scheduled random grab samples cannot be taken during the treatment periods as treatment cannot occur if surface water is present. Storm event monitoring will occur each year as soon as possible after rain begins for one 0.5" or greater predicted rain event that results in flow in the treatment areas. Sites 1-4 will be targeted for storm event sampling, with an additional sample taken in Soule Park where the majority of the treatment work will occur due to the high density of giant reed cover. Sites 1-4 will be sampled for glyphosate and Site 1 and Soule Park will also be sampled for AMPA. Soule Park site selection will depend on flow and access. Grab samples will be collected as soon as possible after water begins to flow at the sampling sites. Grab samples will also be taken immediately following a spill where water is present 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 are necessary.

Monitoring results will be posted online on the District's website www.vcwatershed,org within one month of receiving the results from the laboratory. Biannual and annual progress reports, including collected data, will be produced each December and June, respectively, for the life of the project beginning with the December 2010 biannual report. At the completion of the project, the District will produce a final report with a listing and summary of the data collected.

6.0 SAMPLING METHODOLOGY

Sampling for temperature, pH, turbidity, DO, conductivity, and stream flow will follow standard Stream Team sampling methodology. Calibration and operation procedures may differ depending on make and model of meter. The Stream Team's sampling methodology is excerpted below. Glyphosate sampling for this program will be conducted in accordance with USEPA Method 547. AMPA, glyphosate, and glufosinate will be in accordance with USGS Method LCGY.

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.
6. Insert the turbidity tube into the chamber.
7. Close the lid. Push the READ button. The turbidity in NTU units will be displayed within 5 seconds.
8. 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).
9. 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 (use the mode button to switch between conductivity and TDS):
    a. Conductivity measured in microsiemens (μS) or millisiemens (mS)
    b. TDS measured in parts per million (ppm) or parts per thousand (ppt)
    c. Temperature measured in °C
5. Repeat steps 3 and 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.
6. Press on/off button when finished. Always rinse electrode with distilled water and shake dry.
7. 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:

Stream flow = velocity x 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 a minimum of 1-foot intervals across the width of the stream. Alternatively, a velocity meter and stadia rod may be used to measure flow velocity and water depth at a minimum of 1 foot increments across the stream.

Procedures for determining Cross-Sectional Area:

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

1. Ideally it should be 20-feet long, but if this is not appropriate you may use a 10-foot section.
2. The section should be fairly straight and should have a fairly uniform width.
3. Water should be flowing evenly within this section without turbulence, obstacles or other disturbances.
4. This section of the stream should be shallow enough for you to safely wade across and conduct the stream flow test.

Once you have selected a cross-section for your measurements:

1. To measure the cross sectional area of a stream, place a pair of stakes at the wetted edges on each stream bank, 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 ¼ 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

Sample bottle type depends on analyte and laboratory. For glyphosate analysis, FGL Environmental, Inc. requires one 125 ml amber glass bottle with a Teflon lid and Weck Laboratories, Inc. requires two full (no air space) 125 ml amber glass vials with Teflon lids. For AMPA, glyphosate, and glufosinate, the USGS laboratory requires two 125 ml amber glass bottles with Teflon lids filled to the shoulder. You will be provided with the 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:
    a. 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 stream banks.
    b. 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.
    c. 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. Submerge the sample container until it fills with water. Try not to get any air bubbles if possible. Replace cap.
4. Make sure bottles are labeled with the correct site name.
5. Make sure to record the time you took the samples on the bottom of the Chemical Parameters datasheet.
6. Put all samples on ice in the cooler as soon as possible.

6.2 ANALYTICAL 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.

6.2.1 EPA Method 547 (Glyphosate) Sampling Methodology

1. Samples will be collected according to USEPA Method 547 in a 40 ml amber glass VOA (Weck Laboratories, Inc.) or a 125 mL amber glass sampling container (FGL Environmental, Inc.) – with $Na_2S_2O_3$ if chlorinated. Samples will be collected by direct submersion of sample bottles to approximately mid-stream and mid-depth.
2. 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.
3. Holding time for delivery to the analytical laboratory should not exceed 7 days.

6.2.2 USGS Method LCGY (AMPA, Glyphosate, and Glufosinate) Sampling Methodology

1. Samples shall be collected in two baked, 125-mL amber glass bottles with Teflon-lined lids. DO NOT RINSE BOTTLES. Do not fill bottles beyond shoulder.
2. Samples are to be collected by direct submersion of sample bottles to approximately mid-stream and mid-depth.
3. Samples will be analyzed for glyphosate, glufosinate, and AMPA using USGS method LCGY.
4. Per USGS analytical methods, all samples will be kept cool (between 0 and 4°C) from time of collection to receipt by the analytical laboratory. Samples are to be shipped immediately via overnight services to the USGS laboratory in Kansas. Samples must be collected or shipped Monday-Wednesday to allow for holding time limitations.
5. Holding time for delivery to the analytical laboratory should be ASAP, but must not exceed 3 days.
6. Chain of Custody must state that samples have not been filtered. Samples are to be filtered through a nominal 0.7 µm glass-fiber filter with Teflon lines upon receipt at laboratory per USGS methods.

7.0 THRESHOLD AND ACTION PLAN

The District will evaluate the water quality data as they become available. For temperature, pH, turbidity, dissolved oxygen, 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 minor short term impacts to water quality as a result of the Project, but there will be an overall beneficial effect to the watershed in the long-term (USACE 2004). Glyphosate and AMPA testing results will be evaluated by the District and appropriate action will 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.

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

7.1.2 AMPA Threshold

AMPA is a byproduct of glyphosate degradation. There are no aquatic regulatory thresholds for AMPA.

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 two to three 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.
2. If the District determines that BMPs were not adequately followed, the District will take corrective actions against the contractor.
3. 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.
4. The District will notify the SWRCB and residents that could be potentially affected by the exceedance.
5. The District will conduct another glyphosate sampling immediately and within 2 weeks of implementing corrective measures to evaluate the effectiveness of the corrective actions.
6. In addition to the response actions outlined above, the District will immediately stop treatments 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 treatment would safeguard water quality while the District evaluates and takes appropriate corrective actions to bring the glyphosate levels to below the threshold.

8.0 WATER QUALITY BMPS AND SPILL RESPONSE

Water quality BMPs have been established to protect water quality in the San Antonio, McNell, Thacher, and Reeves Creeks and the Ventura River. The following BMPs will be implemented in the San Antonio Creek Giant Reed Removal Plan:

- All cut non-native plant biomass shall be immediately removed from the work area and shall not be left overnight within the stream channel. Cut biomass, chipped or unchipped, shall be stockpiled at the designated staging and stockpile location for a maximum of 10 days, and shall then be removed to a location identified by the Ventura County Parks Department within the Ventura River Watershed. All chipped material shall become the property of the County of Ventura. No other disposal methods or location will be permitted without the express written approval of the Project Manager.
- Herbicide shall not be used within 24 hours prior to, during, or within 24 hours following a rain event.

- No project related activities shall be conducted during periods of surface flow in the creek reaches targeted for giant reed and castor bean removal. All standing and flowing water shall be avoided.
- Aquatic application of herbicide is strictly prohibited. All applications of herbicide are to utilize the cut and daub method. No work shall be conducted in individual subreaches if surface water is present in any particular subreach. If surface water is present in that particular subreach, work must be postponed until all water in that particular subreach is absent.
- Work shall not be conducted within the breeding, nesting, and fledging season for most migratory birds (March 1 to September 15) without prior surveys resulting in a negative finding.
- 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.
- The Contractor shall not conduct any herbicide application activities when rainfall is forecast within 24 hours, or occurring, or when surface water is present in individual subreaches. All work crews shall be equipped with and trained in the use of spill cleanup kits for all equipment fueling, herbicide mixing, and herbicide application. All work crews shall be provided with California Department of Fish and Game's Office of Spill Prevention and Response (OSPR) contact phone number and the Contractor shall call OSPR immediately in the event of a fuel or herbicide spill. 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.
- All equipment used in the application of herbicide shall be in proper working order and free of leaks.
- 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.

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