San Antonio Creek Watershed Plan

Produced by Southern Sonoma County Resource Conservation District
in collaboration with the citizens of the watershed

March 2008

Acknowledgements

The San Antonio Creek Watershed Plan is a collaborative effort of many individuals. The Plan was completed with valuable input from the landowners and concerned residents of San Antonio Creek. The Southern Sonoma County Resource Conservation District provided project support and technical assistance throughout the process.

Geomorphologist Laurel Collins, of Watershed Sciences, is acknowledged for her contributions. Laurel conducted in-depth geomorphology surveys of the watershed and conducted personal interviews with local landowners on the history and historical flows of San Antonio Creek. From the information Laurel gathered and from landowner meetings we were able to identify many community concerns.

The Southern Sonoma County Resource Conservation District's role in developing this plan was made possible through a grant awarded by the State Water Resources Control Board, from Proposition 13 funds for non point-source projects in the greater San Pablo Bay region. Marin Municipal Water District served as the fiscal agent for the multi-tasked grant awarded to the North Bay Watershed Association in 2006.

San Antonio Creek Watershed Plan

Table of Contents

Page No.

Acknowledgements

1.0 Summary 1

2.0 Introduction 2
- 2.1 Purpose 2
- 2.2 Funding Source and Grant Objective 2
- 2.3 Stakeholder and Public Involvement 3

3.0 Description of the Watershed 4
- 3.1 Location 4
- 3.2 Description 4
- 3.3 History 4
- 3.4 Climate 6
- 3.5 Geology 6
- 3.6 Hydrology and Geomorphology 7
- 3.7 Land Use 8
- 3.8 Natural Resources 9
- 3.9 Water Quality 14
- 3.10 Groundwater Resources and Surface Water Supplies 22

4.0 The Plan 24
- 4.1 Issues of Concern 24
- 4.2 Plan Goals, Objectives and Recommended Actions 25
- 4.3 Potential Restoration Projects & On-going Activities 37
- 4.4 Suggested Studies and Assessments 37

5.0 Other Planning Efforts in the Watershed 38

List of Figures

Figure 1 San Antonio Creek Watershed Map 5
Figure 2 Potential relationships between TMDLs & watershed plans 17
Figure 3 Incorporating EPA's nine minimum elements 21

Tables

Table 1 Special-Status Species Potentially Occurring within the San Antonio Creek Watershed 12

Appendices

A. Application of the San Francisco Estuary Institute Watershed Science Approach to San Antonio (summary), 2000
B. Erosion & Sedimentation- San Antonio Creek, PCI
C. Riparian Plan Community Enhancement- San Antonio Creek, PCI
D. Fisheries Enhancement- San Antonio Creek, PCI

References

State Department of Water Resources' *Evaluation of Ground Water Resources in Petaluma Valley* (Volume 3, Bulletin 118-4) published in June 1982.

Application of the San Francisco Estuary Institute Watershed Science Approach to San Antonio, Laurel Collins, 2000

Soil Survey of Marin County, California, 1985

"Handbook for Developing Watershed Plans to Restore and Protect Our Water," published in October 2005. The reference number is EPA 841-B-05-005. You can find the entire document http://www.epa.gov/owow/nps/pubs.html.

Petaluma River Watershed Master Drainage Plan, Sonoma County Water Agency, June 2003

Petaluma River Tributaries Habitat Assessment Report, California Department of Fish & Game, Draft 2007

1.0 Summary

In compliance with the intent and purpose of the grant funding, the Southern Sonoma County Resource Conservation District (SSCRCD) created this Watershed Plan in partnership with the many dedicated landowners and residents of the San Antonio Creek watershed.

San Antonio Creek has been identified as "impaired for water quality" (EPA 303d listing). Sedimentation is the major impairment directly affecting stream capacity particularly in San Antonio Creek and adjacent tidal areas. Although the precise causes of sedimentation are less readily identifiable than the effects, they can be separated into those attributable to natural sediment load of the streams and those attributable to additional loads created by ongoing human activities.

The primary focus of the Plan is the "issues of concern" (see section 4.1) of the agriculturists and landowners living in the Petaluma River sub-watershed of San Antonio Creek in rural Sonoma and Marin counties. Stakeholders identified the issues of concern and suggested specific and measurable ways to improve water quality and quantity. Highlighted issues include sediment reduction and groundwater resources.

For over two years the RCD met with landowners regularly to discuss their concerns and to identify immediate projects and long term goals for improving the watershed. The majority of the landowners involved in this planning process are ranchers and farmers who care about the health of the watershed. They are committed to participating and contributing to the process of enhancing the watershed and sustaining agriculture in Sonoma and Marin County.

The goals, their accompanying objectives and recommended actions are described in detail with a time line for implementation in Section 4.2. Many actions to achieve the goals and objectives of this plan overlap yet are only shown in one section to keep the plan concise. Proposed goals are listed as follows:

Goal A: Encourage Active and Ongoing Participation in the San Antonio Watershed Group
Goal B: Improve Water Quality and Ground Water Resources and Reduce Flooding and Effects of Increased Velocities during storm events
Goal C: Protect and Enhance Existing Wildlife Habitat
Goal D: Support the Viability of Agriculture in the Community
Goal E: Identify and Implement High Priority Projects and Studies

2.0 Introduction

2.1 Purpose

The purpose of this document is to: 1) identify the existing conditions, 2) determine issues of concern from the perspective of the landowners and residents in the watershed, and 3) establish a set of goals, objectives, management measures and recommended actions with timelines for implementation. The San Antonio Creek Watershed plan is directly linked to the 1999 Petaluma Watershed Enhancement Plan. This watershed and it's "subplan" is vertically aligned with the Petaluma plan which has strong grass roots support from landowners and stakeholders.

In addition to issues identification, the group also established a number of actions and objectives to achieve major goals for San Antonio Creek. The issues and goals identified in this plan show the concern that members of the agricultural community as well as other stakeholders in the watershed have for San Antonio Creek and the larger Petaluma Watershed.

2.2 Funding Source and Grant Objective

Development of this plan and the related public outreach was funded primarily through a state grant, approved by the California voters under Proposition 13, Coastal Nonpoint Source Pollution Control. The grant was awarded by the State Water Resources Control Board to the North Bay Watershed Association, administered by the Marin Municipal Water District as the fiscal managing agent. The grant provided for 8 projects in a consolidated program for the multiple purposes of: 1) protecting and restoring the coastal waters and near-shore habitats of the North Bay targeting erosion sites and sediment sources, 2) controlling urban stream runoff and non-point source pollution using Best Management Practices, and 3) improving in-stream aquatic and wetland habitat improvements.

The Southern Sonoma County Resource Conservation District (SSCRCD) was one of several collaborators funded to perform tasks during 2006 and 2007. The RCD's project was entitled "Petaluma Watershed Restoration and Outreach". This project focused on the San Antonio Creek Watershed and included consultation with property owners and stakeholder agencies to implement projects and develop this plan.

2.3 Stakeholder and Public Involvement

This plan serves as a voice for the local watershed landowners, residents and stakeholders. In general planning terms, the "stakeholder" is an individual or group entity such as a resident/landowner/agency/or other group who has a business, or other interest, responsibility, or jurisdiction regarding the health and well being of the watershed.

Public meetings were held to listen to property owners' concerns and ideas on water quality improvement and land management. The group discussed technical reports and established the goals and objectives for the Watershed Plan.

The purpose of the first public meeting was to discuss and provide an overview of watershed issues which included: existing projects and funding in the San Antonio Creek Watershed, establishing the goals of the stakeholder group and discussion of potential erosion control activities. This first meeting consisting of landowners, residents, ranchers and farmers was held in December 2005, hosted by the owner of Windrush Farm. Landowners were informed about recent technical studies, discussed and prioritized potential projects to be completed with current grant funding and discussed development of a plan for San Antonio Creek watershed.

Four additional landowner outreach meetings were held by the RCD. These meetings were established to discuss:

a) specific projects to be implemented under the current grant
b) development of an enhancement plan
c) landowner issues and concerns of managing land and working within a planning process and regulatory framework
d) exploration of opportunities to install and establish best management practices (BMPs) which could be of ecological benefit and identify future on-the-ground projects
e) data gaps and needed studies to further assess conditions and identify solutions.

The goals and recommendations of the Petaluma Watershed Enhancement Plan (July 1999) were used as the guiding document for developing goals and objectives for the San Antonio Plan.

3.0 Description of San Antonio Creek and Petaluma Watershed

3.1 Location

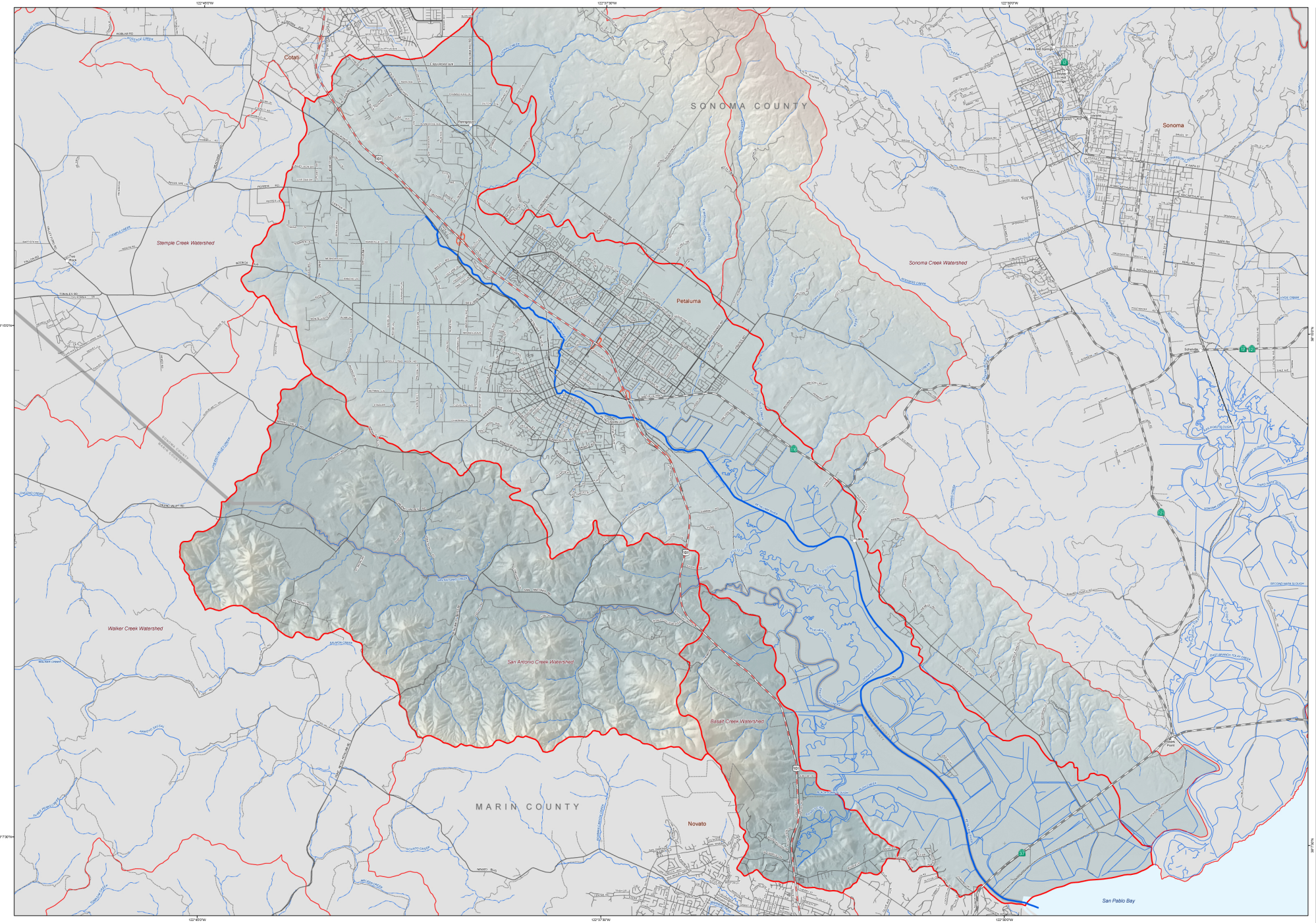
Located in southern Sonoma County, California, and a portion of northeastern Marin County, California, the Petaluma River Watershed encompasses a 146 square mile, pear-shaped basin. The watershed is approximately 19 miles long and 13 miles wide with the City of Petaluma near its center. The largest sub-watershed of the Petaluma River, San Antonio Creek is located south of Petaluma and is one of three major creeks that drain the western side of the watershed. The mainstem of San Antonio Creek delineates a portion of the border between Sonoma and Marin counties. San Antonio Creek flows from near Laguna Lake in Chileno Valley easterly to the Petaluma Marsh. See **Figure 1** for a map of the watershed.

3.2 Description

The mainstem of San Antonio Creek drains approximately 36.5 square miles, which comprises 24% of the entire Petaluma River watershed. The main channel and riparian corridor are approximately 11 miles long with 13 miles of significant tributary on the north side and another 26 miles of significant tributary on the south. "Significant tributary" in this case is a "blueline" stream as found on the USGS 7.5 minute topographic map. The confluence of San Antonio Creek and the Petaluma River is in marshland east of Highway 101 at the Marin-Sonoma county line. In the lower watershed, small tributaries drain into the river and into the Petaluma Marsh.

3.3 History

The Petaluma River is a tidal slough that has been widened and deepened numerous times by the Army Corps of Engineers since the 1880s to maintain navigability. Petaluma Creek (as it was previously known), was officially declared a "River" in 1959 by the United States Congress. In the process of making navigation channel improvements, many old meanders on the eastern banks of the river were filled with dredged material.



San Antonio Creek Watershed
& Neighboring Watersheds

FIGURE 1

MAP PRODUCED BY:
County of Sonoma Information Systems Department GIS Central
2615 PAULIN DRIVE, SANTA ROSA, CA 95403
(707)565-3819 GIS@sonoma-county.org
(01/23/2009)

Watershed of Interest
Other Watersheds
Petaluma River
Perennial
Intermittent
U.S. HWY
STATE HWY
Major Road
Residential Road
Interchange
Tracks
Unnamed St

Index

0 0.25 0.5 1 1.5 2 Miles
0 0.5 1 2 3 4 Kilometers
1:31,680

- Author:
  Southern Sonoma County Resource Conservation District
- Projection & Coordinate System Tics:
  California State Plane Coordinate System, Zone II, NAD 83, US survey feet, Lambert Conformal Conic.
  Some data have been reprojected from other coordinate systems and may not reflect actual ground positions.
- Document Source and Date:
  G:\Projects\SSCRCD\Projects\RCDs\SanAntonioWS_91a.mxd
- Data Source:
  Sonoma County Information Systems Department GIS Group, USGS 10 meter NED DEM USGS 24k Streams, Marin Map CONR. Calvador V 2.3.1

Southern Sonoma County Resource Conservation District

Since European settlement in the 19th century, agriculture has been the dominant land use throughout the watershed. Historical accounts indicate that a great portion of the mainstem of San Antonio Creek was a perennial stream and hosted a significant steelhead fishery, with sightings of fish being common until the mid-1950s (Collins, 2000). While the Petaluma River watershed was never a major salmonid stream like the Russian River, San Antonio Creek may have been the largest steelhead fishery in the watershed.

Historical references are based on personal oral interviews with landowners that were conducted as part of the geomorphology analysis conducted by L. Collins in 2000. Please refer to the hydrology and geomorphology sections of this Plan for more information on history and historical water flows.

3.4 Climate

The climate of the Petaluma River basin is generally characterized as a marine west-coast type climate with cool, wet winters and warm, dry summers with some fog and wind. Localized climatic conditions are strongly affected by the topography, and it is not unusual to have wide variations in climate at locations separated by only a few miles.

Annual temperature means range from roughly 70.6° F maximum and 44.7° F minimum resulting in an average annual temperature of 57.7° F. Extreme recorded temperatures are 17° F and 109° F. Average annual rainfall over the basin ranges from about 20 inches at the mouth of the Petaluma River to about 50 inches at the highest elevations in the drainage basin.

3.5 Geology

The Petaluma River Basin lies within the southern portion of the northern Coast Ranges of California. Basement rock is the Jurassic - Cretaceous Franciscan assemblage, overlain by thick, discontinuous sequences of Tertiary and Quaternary deposits. Prior to the general rise in sea level that occurred in recent geological time, Petaluma Valley was filled with older alluvium consisting of gravels, sands, and clays that were deposited by aggradation along the stream course traversing the area and by sheet wash and other colluvial processes in interstream areas. Well logs indicate these deposits are fairly thin in the upper Petaluma Valley but thicken to over 300 feet near the bay. The rise in

sea level and the subsequent encroachment of the waters of San Pablo Bay resulted in the filling of the lower portion of the valley, extending inland as far as the City of Petaluma, with younger alluvium and soft marine silts and clays which are known as Bay Mud.

Folding and faulting, which occurred in the basin during the late Pliocene and Quaternary periods produced the main structural and topographic features of the area. These processes have continued into recent time. Information on the geological units in the Petaluma Valley and their characteristics is contained in the State Department of Water Resources' *Evaluation of Ground Water Resources in Petaluma Valley* (Volume 3, Bulletin 118-4, June 1982).

The Rodgers Creek fault zone, which has been linked to the active Hayward fault, runs along the easterly ridge of the watershed. The Tolay fault extends along the valley easterly of the City of Petaluma, while the Bloomfield fault is located on the westerly side.

3.6 Hydrology and Geomorphology

In 2000, a geomorphology study of San Antonio Creek was completed by Laurel Collins. The study was entitled *Application of the San Francisco Estuary Institute Watershed Science Approach to San Antonio*, 2000 and is attached as **Appendix A**. Most of the length of San Antonio Creek has a seasonal rather than perennial water regime. Soils along the riparian corridors are Zamora silty loams, Clear Lake clay, and Los Osos clay loam with a slight to moderate erosion hazard rating. On the Marin County side, soils are Ballard gravely loam, Blucher silt loam, Cole clay loam, and Clear Lake Clays (*Soil Survey of Marin County, California, 1985)*. The erosion potential increases in the tributaries with increased slope steepness.

A natural laguna or shallow lake that once existed at the headwaters of San Antonio Creek was drained for agricultural purposes sometime between 1860 and 1885. Following a study of 6.6 miles of mainstem San Antonio Creek in 2000, geomorphologist Laurel Collins surmised that the ditching and draining of this laguna increased the magnitude and frequency of winter peak flows on the mainstem channel and decreased the base flow provided by the laguna in the summer and fall, while lowering the water table throughout the Chileno Valley. For more detail, see **Appendix A**.

Base flow from the laguna would have improved the over-summering conditions of juvenile steelhead by providing cool water in-flows during the hot, dry summer months. Conversely, the larger and more frequent winter peak flows increased sheer stress on the bed and banks, causing bed incision and bank erosion and increasing the sediment load to the mainstem channel. Increased bank erosion, bed scour, and draw down of the adjacent water table resulted in loss of root strength within the riparian zone, further accelerating the rate of bank erosion. Stream incision and bank erosion have been pervasive along most of the mainstem channel, although some of the most severe bank and bed erosion was observed in late summer of 2000 along the upper 2.5 miles of the mainstem channel (Collins, 2000).

Laurel Collins suggests in the key notes of her study that the water table may be lower throughout all the valleys in the San Antonio Creek watershed because most of the tributaries are deeply entrenched. More rainfall is now required to saturate soils and create runoff while changes in land use have increased consumption and retention of water. Winter peak flows have greatly increased from what they were in the early 1800s while total flow from the upland areas has greatly decreased. The cumulative effect of these factors has changed the flow regime from historically perennial to intermittent.

The downstream segment of San Antonio Creek was diverted from its natural tidal slough to the much smaller and shorter Schultz Slough, the confluence of which with the Petaluma River is 5.2 miles upstream of the original slough. Because the base level of the confluence is higher, the gradient of the channel flattened, resulting in increased deposition of gravels and sediment, subsequent aggradation of the channel bed, and decreased tidal influence on San Antonio Creek. The extent of maximum tidal influence has moved nearly a mile downstream (Collins, 2000).

3.7 Land Use

The watershed is in a rural area and San Antonio Creek serves as a county border between Sonoma County to the north and Marin County to the south. Land use is primarily agricultural and rural residential. Several dairies operate in the watershed in addition to many small to medium sized family farms and ranches. A few vineyards and olive orchards have been planted over the past few years. Many residents keep horses and livestock such as llamas, sheep and goats for food and fiber. A native plant nursery exists in Chileno Valley.

Rancho Olampali State Historic Park is located in the watershed with entrance from Highway 101. This 700 acre park preserves the home of a Miwok community leader and provides a foundation for our Native American and California settlement history.

U.S. Highway 101 crosses the lower end of the watershed and serves as the major highway in the North Bay. Some commercial and office uses are located along this highway. Marin County Airport at Gnoss Field, a public airport for small and corporate aircraft, is located east of the highway in the southern portion of the watershed in the baylands area. Redwood Landfill, a regional solid waste facility is located east of Highway 101.

3.8 Natural Resources

The headwaters and ephemeral tributaries of the Petaluma River begin on the steep southwest slopes of Sonoma Mountain, the southern slopes of Mecham Hill, and the eastern slopes of Weigand's Hill and Mt. Burdell. Small drainages in the upper watershed give rise to larger tributaries that feed into creeks and eventually meet the Petaluma River, which flows through Denman Flats into the Petaluma Marsh before reaching the San Pablo Bay. Tidal influence extends upstream of the confluence with Lynch Creek which is higher up in the Petaluma watershed than San Antonio Creek.

Mountainous or hilly upland areas comprise 56% of the Petaluma River watershed. Thirty-three percent of the watershed is valley, and the lower 11% are salt marshes. Sonoma Mountain at 2,295 feet is the highest point in the watershed. The Petaluma River empties into the northwest portion of San Pablo Bay.

The surrounding land use has been agricultural since the early 1800s. The majority of the watershed is now characterized by non-native European annual grasses with scattered oak woodlands and narrow bands of riparian forest. The riparian corridor is utilized by a wide variety of wildlife including resident and migratory bird species including song birds, coyote, deer, mountain lion, raccoon, and skunk.

The Petaluma Marsh. More than 90% of California's original marshland has been degraded, destroyed or "reclaimed" by urbanization, agriculture, and commercial salt operations. In the San Francisco Bay, less than 15% of original tidal marshland remains: much of it highly fragmented or altered. Only 27% of the historic tidal marshes in San

Pablo Bay remain (PWEP, 1999). The northern San Francisco Bay tidelands provide food and shelter for possibly millions of shorebirds and hundreds of thousands of waterfowl that migrate through or winter over every year. Recent tidal land acquisitions by conservation agencies and the development of wetland enhancement projects will undoubtedly increase these numbers.

The Petaluma Marsh is the largest remaining salt marsh in San Pablo Bay, totaling an estimated 5,000 acres. The marsh is surrounded by approximately 7,000 acres of reclaimed wetlands. Prior to reclamation, marshland elevations ranged from mean sea level to 3 feet above mean sea level. San Antonio Creek flows into the Petaluma River and into the Petaluma Marsh.

The marsh has three zones: low marsh of cordgrass or tules, which receives maximum submergence; a middle marsh of pickleweed, alkali bullrush, or cattails; and a high marsh, which is rarely, if ever, covered by tidal action. During extreme high tides, the surrounding uplands are a refuge for a variety of marsh animals.

Fisheries. The Petaluma River's fish population is quite diverse, providing habitat for 25 species of marine, estuarine, and freshwater fish. Twelve of the twenty-five species are native to California. The Petaluma River has never had a historical run of steelhead trout, which are currently listed as "threatened" by the National Marine Fisheries Service. There appears to be no spawning habitat in the mainstem of the Petaluma River.

However, historical accounts seem to indicate that the mainstem of San Antonio Creek was a perennial stream, at least through its lower reaches and perhaps through a much greater portion of its entire length (Collins, 2000). A significant steelhead fishery existed historically, possibly the largest in the Petaluma Valley, with common sightings of fish until the mid 1900s. While a recent site survey (J. Michaud, 2007) noted one sighting on a tributary to San Antonio Creek, such sightings are rare.

Debris at the railway crossing has been removed, eliminating a potential fish barrier. However, sediment deposition continues to accumulate at the lower portion of San Antonio Creek, raising the confluence at the Petaluma River higher than historical levels. During low flow years, additional accumulation could impede movement for both potential spawners, and out-migrating fish.

Riparian Habitat. In San Antonio Creek, riparian vegetation in the lower reaches follows the main channel in a roughly 150-foot wide corridor. The habitat stage is mostly dense, small trees dominated by willow, live oak, buckeye, and California bay. There are patches of non-native eucalyptus as well. This vegetation type graduates into a dense, two-story riparian forest of valley oak and buckeye with willows downstream of D Street.

West of D Street, the character of the riparian corridor changes to a more open or more sparse canopy cover with valley oaks as the dominant riparian woody species. As the land elevation increases in the tributaries and headwaters, the species composition changes to black oak with coast live oak, bay, ash, and willow. These upper riparian corridors west of D Street appear to be the most heavily impacted by agricultural practices.

Historically, the 50 miles of streamside vegetation was most likely a continuous, dense canopy of medium to large riparian trees. Today the riparian corridor has thinned out in many areas with one-third the length of the corridor exhibiting sparse and open canopy cover and some areas converted to annual grassland with no woody canopy.

Also included in the San Antonio Creek subwatershed are the north and south forks of Olompali Creek. These creeks are located within Olompali State Park and are under the jurisdiction of the California Department of Parks and Recreation. The SSCRCD will endeavor to partner with the Marin RCD and the California Department of Parks and Recreation to work on projects in this area.

"Listed" Species. The Petaluma watershed provides habitat for a number of federally listed species. The California Clapper Rail, the California Black Rail and the Salt Marsh Harvest Mouse are completely dependent on marshes. The California Clapper Rail and the Salt Marsh Harvest Mouse are both dependent on tidal marshlands while the California Black Rail lives in freshwater and saltwater marshlands. **Table 1** identifies all federally listed species and species of concern located in the watershed.

Table 1
Special-Status Species Potentially Occurring within the San Antonio Creek Watershed

---

Federally Listed Species
Endangered (E) and Threatened (T)

Mammals	Salt-Marsh Harvest Mouse, *Reithrodontomys raviventris* (E)
Birds	California Clapper Rail, *Rallus longirostris obsoletus* (E) Western Snowy Plover, *Charadrius alexandrinus nivosus* (T)
Amphibians	California red-legged frog, *Rana aurora draytonii* (T)
Fish	Steelhead - Central California Coast ESU, *Oncorhynchus mykiss irideus* (T)
Plants	Sonoma Spineflower, *Chorizanthe valida* [E] Soft Bird's-Beak, *Cordylanthus mollis ssp. mollis* (E) Yellow Larkspur, *Delphinium luteum* [E] Marin Western Flax, *Hesperolinon congestum* [T] Contra Costa Goldfields, *Lasthenia conjugens* [E] Showy Indian Clover, *Trifolium amoenum* (E)

State Listed Species
Endangered (E), Threatened (T), and Rare (R)

Mammals	Salt-Marsh Harvest Mouse, *Reithrodontomys raviventris* (E)
Birds	California Black Rail, *Laterallus jamaicensis coturniculus* (T) California Clapper Rail, *Rallus longirostris obsoletus* (E)
Plants	Sonoma Spineflower, *Chorizanthe valida* [E] Soft Bird's-Beak, *Cordylanthus mollis ssp. mollis* (R) Yellow larkspur, *Delphinium luteum* [R] Marin Western Flax, *Hesperolinon congestum* [T]

California Special Concern Species

Mammals
Pallid Bat, *Antrozous pallidus*
Townsend's Big-Eared Bat, *Corynorhinus townsenddii*
American Badger, *Taxidea taxus*

Birds
Burrowing Owl, *Athene cunicularia*
Saltmarsh Common Yellowthroat, *Geothlypis trichas sinuosa*
San Pablo Song Sparrow, *Melospiza melodia samuelis*

Reptiles
Western Pond Turtle, *Actinemys marmorata*
Northwestern Pond Turtle, *Actinemys marmorata marmorata*

Amphibians
California red-legged frog, *Rana aurora draytonii*
Foothill Yellow-Legged Frog, *Rana boylii*

Fish
Sacramento Splittail, *Pogonichthys macrolepidotus*

California Native Plant Society Listings

Plants
Franciscan Onion, *Allium peninsulare var. franciscanum*
Napa False Indigo, *Amorpha californica var. napensis*
Alkali Milk-Vetch, *Astragalus tener var. tener*
Round-Leaved Filaree, *California macrophylla*
Sonoma Spineflower, *Chorizanthe valida*
Point Reyes Bird's-Beak, *Cordylanthus maritimus ssp. palustris*
Soft Bird's-Beak, *Cordylanthus mollis ssp. mollis*
Yellow Larkspur, *Delphinium luteum*
streamside daisy, Erigeron biolettii
Tiburon buckwheat, *Eriogonum luteolum* var. *caninum*
Fragrant Fritillary, *Frillaria lilacae*
Hayfield tarplant, *Hemizonia congesta* ssp. *leucocephala*
Marin Western Flax, *Hesperolinon congestum*
Contra Costa Goldfields, *Lasthenia conjugens*
woolly-headed lessingia, *Lessingia hololeuca*
Mt. Diablo cottonweed, Micropus amphibolus
Baker's Navarretia, *Navarretia leucocephala ssp. bakeri*
Petaluma Popcorn-Flower, *Plagiobothrys mollis var. vestitus*
Marin Knotweed, *Polygonum marinense*
Point Reyes Checkerbloom, *Sidalcea calycosa ssp. rhizomata*
Suisun Marsh Aster, *Symphyotrichum lentum*
Showy Indian Clover, *Trifolium amoenum*

3.9 Water Quality

The tributaries of the Petaluma River begin in the surrounding hills and meander through areas of varying land uses, each of which contributes some level of pollution.

San Antonio Creek and the Petaluma River are influenced by tidal action from the bay and receive little fresh water inflow from upstream from May to November when there is little or no rainfall. With insufficient fresh water to flush the river during the summer months, temperature and salinity increase and reduce the ability of the water to hold oxygen. Inadequate dissolved oxygen not only contributes to an unfavorable environment for fish and other aquatic life but can also result in objectionable odors from anaerobic decomposition.

Both San Antonio Creek and the Petaluma River have been identified as "impaired for water quality" (EPA 303d listing). Sedimentation is the major impairment directly affecting stream capacity particularly in the Petaluma River, San Antonio Creek and adjacent tidal areas. Although the precise causes of sedimentation are less readily identifiable than the effects, they can be separated into those attributable to natural sediment load of the streams and those attributable to additional loads created by ongoing human activities.

Water quality data collected by the California Department of Fish and Game indicates high levels of ammonia and conductivity (a measure of salts in the water and an indicator of animal waste in freshwater) (PWEP, 1999). Mike Rugg (CDFG) has reported in the past that ammonia levels are high year-round (Collins, 2000). Summer water measurements typically include temperatures ranging from 22 to 26 degrees Celsius – much higher than is optimal for steelhead (PWEP, 1999). Restoring riparian vegetation will be a key component in lowering San Antonio Creek's water temperature and reducing toxic levels of ammonia.

Water Quality Regulations. Water quality in the Petaluma River Basin is under the jurisdiction of the State Water Resources Control Board and regionally, the San Francisco Bay Regional Water Quality Control Board. The Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) is the Board's master water quality control planning document. It designates beneficial uses and water quality objectives for waters of the State, including surface waters and groundwater. It also includes programs of implementation to achieve water quality objectives. The Basin Plan was adopted and approved in 1975 by the State Water

Resources Control Board, U.S. EPA, and the Office of Administrative Law where required. The most recent updates to the Basin Plan were approved in 2007.

Monitoring water quality of the Petaluma River was performed by the Regional Water Quality Control Board in the mid-1970's. Major concerns were dissolved oxygen (DO) readings below minimum standards, with coliform bacteria and unionized ammonia sometimes exceeding maximum standards. Additional field biological studies were conducted and a subsequent report was issued 1981 in conjunction with the City of Petaluma's Wastewater Management Plan. In 1982, the State Water Resources Control Board (SWRCB) reported that "dissolved oxygen and nutrient problems persist (in the Petaluma River) producing seasonal fish kills."

The City of Petaluma upgraded its secondary wastewater treatment facilities and is subject to the following order of the SWRCB:

> "the discharge of wastewater to the Petaluma River is prohibited from May 1 through October 20 of each year. The Executive Officer may authorize discharge prior to October 20 or subsequent to May 1 based upon a demonstration that rainfall has produced adequate flushing flow in the Petaluma River."

It is unknown how this order may change once the City of Petluma upgrades current water treatment from secondary to tertiary treatment (project scheduled for completion in 2009).

303d Listing - Impaired Waterbodies

The Petaluma River is listed as an "Impaired Waterbody" under the California Regional Water Quality Control Board's 303d provision. Decades of urbanization along the river corridor and continued erosion control and flooding problems significantly contribute to the river's impaired status. Ultimate restoration of water quality and de-listing of the river is a primary long term goal of this enhancement plan. To this end, the Watershed Council's focus would be to work towards reducing sedimentation and erosion, and increasing watershed education and landowner outreach efforts on a variety of water quality topics. Ground and surface water quality are fast becoming one of the most important national environmental concerns because of the direct impact on environmental health.

The Petaluma Watershed is listed as impaired for sedimentation, nutrients, and pathogens under Section 303(d) of the Clean Water Act as an impaired water body for sediment, nutrients, pathogens, and pesticides (diazinon). San Antonio Creek is listed separately for diazinon. The San Francisco Bay Regional Water Quality Control Board is given the authority as a state agency to determine the Total Maximum Daily Load (TMDL) for the Petaluma River. The current schedule for identifying this TMDL is now set for completion in 2019.

Landowners in the San Antonio Creek area, through implementing plan goals, can identify studies needed to assess current levels of sedimentation and ways of reducing this sediment. With the current schedule for the TMDL pushed out to 2019, and a goal of improving water quality, landowners through their current restoration endeavors and future work may be able to proactively reduce sediment input and significantly improve water quality. Much can be accomplished in twelve years and the landowners have shown their desire and willingness to protect the water and resources of the creek. It is the desire of the San Antonio Creek landowners to work under the 3rd scenario as discussed in the EPA "Handbook for Developing Watershed Plans to Restore and Protect Our Water." This watershed plan has been developed in the absence of a completed TMDL. If monitoring indicates water quality standards attainment, there is no need for a TMDL (see #3 below in Fig. 2).

Watershed Planning for Impaired Waters

EPA recognizes the need to focus on developing and implementing watershed plans for waters that are impaired in whole or in part by nonpoint sources. For these waterbodies it is imperative to select on-the-ground management measures and practices that will reduce pollutant loads and contribute in measurable ways to the restoration of impaired waters to meet water quality standards.

Below is an overview of Watershed Planning Process from the EPA "Handbook for Developing Watershed Plans to Restore and Protect Our Water," published in October 2005. The reference number is EPA 841-B-05-005. (http://www.epa.gov/owow/nps/pubs.html). The term *pollutant load* refers to the amount of pollutants entering a waterbody. Loads are usually expressed in terms of a weight and a time frame, such as pounds per day (lb/d). Much of the handbook focuses on how to identify pollutant loads and how to determine the load reductions needed to meet water quality goals.

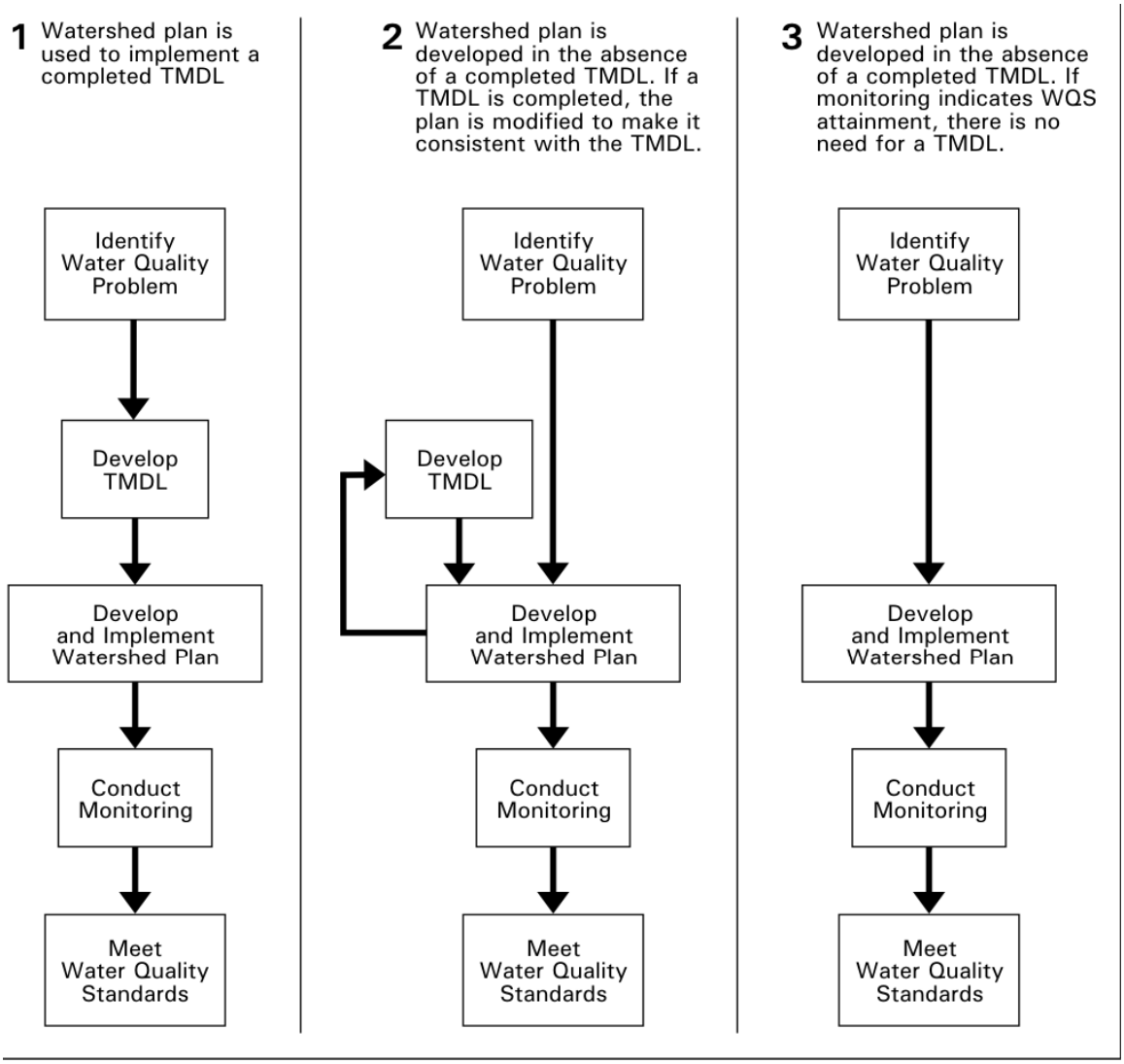


Figure 2. **Potential relationships between TMDLs and watershed plans.**

EPA Guidelines: Including Water Quality Standards in Goal Setting

Each watershed management plan will address different issues and include unique goals and site-specific management strategies to achieve those goals. All plans should also include attainment of water quality standards for surface waters in the management area. Because water quality standards are the foundation of EPA's water quality protection efforts, this handbook includes a brief description of what they are and how they're used in watershed management program.

- Growth and propagation of fish
- Water contact recreation
- Drinking water
- Agricultural water supply
- Industrial supply
- Wildlife
- Swimming

An important cornerstone of the Clean Water Act is the requirement that states, tribes, and territories adopt water quality standards to protect public health, support wildlife, and enhance the quality of life within their jurisdictions. Water quality standards set the goals, pollution limits, and protection requirements for each waterbody. Meeting these limits helps to ensure that waters will remain useful to both humans and aquatic life. Standards also drive water quality restoration activities because they help to determine which waterbodies must be addressed, what level of restoration is required, and which activities need to be modified to ensure that the waterbody meets its minimum standards. Standards are developed by designating one or more beneficial uses for each waterbody, establishing a set of measurable criteria that protect those uses, and implementing policies and procedures that keep higher quality waters from degrading.

Water quality standards are composed of three elements:

1) Designated (beneficial) uses
2) Numeric and narrative criteria
3) Antidegradation policies and procedures

1) Designated Uses

Designated or beneficial uses are descriptions of water quality expectations or water quality goals. A designated use is a legally recognized description of a desired use of the waterbody, such as aquatic life support, body contact recreation, fish consumption, or public drinking water supply. These are uses that the state or authorized tribe wants the waterbody to be healthy enough to fully support. The Clean Water Act requires that waterbodies attain or maintain the water quality needed to support designated and existing uses. State and tribal governments are primarily responsible for designating uses of waterbodies within their jurisdictions. Some water quality agencies have many use designations and differentiate among various categories of uses for aquatic life support, irrigation, and even cultural uses for tribal waters. Other agencies designate uses by broad categories or classes, with uses requiring similar water quality conditions grouped under each class.

2) Criteria

Criteria define minimum conditions, pollutant limits, goals, and other requirements that the waterbody must attain or maintain to support its designated use(s). Criteria describe physical, chemical, and biological attributes or conditions as measurable (e.g., parts per million of a certain chemical) or narrative (e.g., no objectionable odors) water quality components. Together, the various criteria for a particular designated use paint a picture of the water quality necessary to support the use. EPA and states establish water quality criteria for various waterbody uses as part of their water quality standard programs. In general, states and tribes must adopt the minimum federal criteria for uses such as aquatic life support, human health, and contact recreation unless they can demonstrate that site-specific, time-sensitive, or other criteria are appropriate to reflect the unique conditions or uses of a waterbody.

Numeric Criteria. EPA, states, and tribes have set numeric criteria or limits for many common water quality parameters, such as concentrations of bacteria, suspended sediment, algae, dissolved metals, minimum/maximum temperatures, and so on. Numeric criteria for protecting aquatic life are often expressed as a concentration minimum or maximum for certain parameters and include an averaging period and a frequency or recurrence interval. For example, a criterion for a parameter of concern might state that concentrations of the parameter must not exceed 5 parts per million, averaged from five samples collected within a 30-day period, and recurring

more than once in a 3-year period. Criteria for protecting human health are derived from epidemiological studies and laboratory studies of pollutant exposure involving species like rats and mice. Numeric criteria established to prevent *acute* conditions are more strict than those focusing on *chronic* exposure to parameters of concern.

Narrative Criteria. Narrative criteria are nonnumeric descriptions of desirable or undesirable water quality conditions. An example of a narrative criterion is "All waters will be free from sludge; floating debris; oil and scum; color- and odor-producing materials; substances that are harmful to human, animal, or aquatic life; and nutrients in concentrations that may cause algal blooms."

It's important to note that numeric criteria are invaluable when setting specific, measurable goals for waterbody cleanup plans because they provide a very clear indication of when water quality meets the criteria. However, federal, state, and tribal numeric criteria development is complex and expensive in terms of time and resources. Narrative criteria provide a means to convey the context, conditions, and full intent of water quality protection efforts in the absence of numeric criteria development and monitoring efforts.

Biocriteria. A comprehensive assessment of a waterbody might include a description of its biological characteristics. Biological criteria, or "biocriteria," have been developed to quantitatively describe a waterbody with a healthy community of fish and associated aquatic organisms. Components of biocriteria include the presence and seasonality of key indicator species; the abundance, diversity, and structure of the aquatic community; and the habitat conditions required for these organisms. Monitoring of these biological indicators provides a simple and often inexpensive way to screen waters that are supporting their uses without a lot of expensive chemical and other testing. In addition, biological assessments can capture the impacts of intense, shortterm pollution that might go undetected under conventional chemical testing. Even if states have not yet adopted official biocriteria for their waters, biological sampling can be an important part of watershed monitoring to show progress in meeting load reductions and attaining narrative criteria.

3) Antidegradation

The antidegradation requirements cited in federal, state, and tribal water quality standards provide an excellent and widely used approach for protecting waters threatened by human activities that might cause a lowering of water quality. Under these provisions, which are required under the Clean Water Act, a public agency designated as the federally delegated water quality authority must adopt both an antidegradation policy and methods for implementing the policy. The policy must protect existing waterbody uses, i.e., ensure that water quality is sufficient to meet narrative and numeric criteria for all designated uses (Tier I).

There are two other parts or "tiers" of the antidegradation policy. Under Tier II, waters that exceed quality levels necessary to support existing uses must be protected unless the delegated water quality agency (1) determines that there are important economic or social justifications for lowering water quality, and (2) meets relevant public participation and intergovernmental coordination provisions of the state or tribal continuing planning outstanding national resource waters is maintained and protected (Tier III).

Implementation methods or procedures for antidegradation policies generally include antidegradation reviews for all new and expanded regulated activities that might lower water quality, such as wastewater treatment, stormwater, CAFO, and other effluent discharges subject to National Pollutant Discharge Elimination System (NPDES) permits; activities governed by Clean Water Act section 404 "dredge and fill" permits; and other activities regulated by federal, state, tribal, or other authorities. In the past, permit approval processes for these activities mostly focused on whether they would maintain water quality to meet existing uses, i.e., ensure that water quality criteria were met (the Tier I level). However, the Tier II antidegradation provisions require that higher-quality waters be protected unless there is a demonstration of important economic or social development in the area in which the waters are located, and public participation and intergovernmental coordination requirements are met. States often include, as a part of the "Tier II" review, requirements to examine possible alternatives to proposed activities that would lower water quality, and an analysis of the costs associated with the alternatives. For more in-depth descriptions of water quality standards and criteria, go to www.epa.gov/waterscience/standards/.

Nine Minimum Elements to Be Included in a Watershed Plan for Impaired Waters

Although many different components may be included in a watershed plan, EPA has identified a minimum of nine elements that are critical for achieving improvements in water quality. (Go to www.epa.gov/owow/nps/cwact.html for a copy of the FY 2004 *Guidelines for the Award of Section 319 Nonpoint Source Grants to States and Territories*).

EPA strongly recommends these nine elements be addressed in all watershed plans that are intended to remediate water quality impairments. **Figure 3** highlights the nine elements.

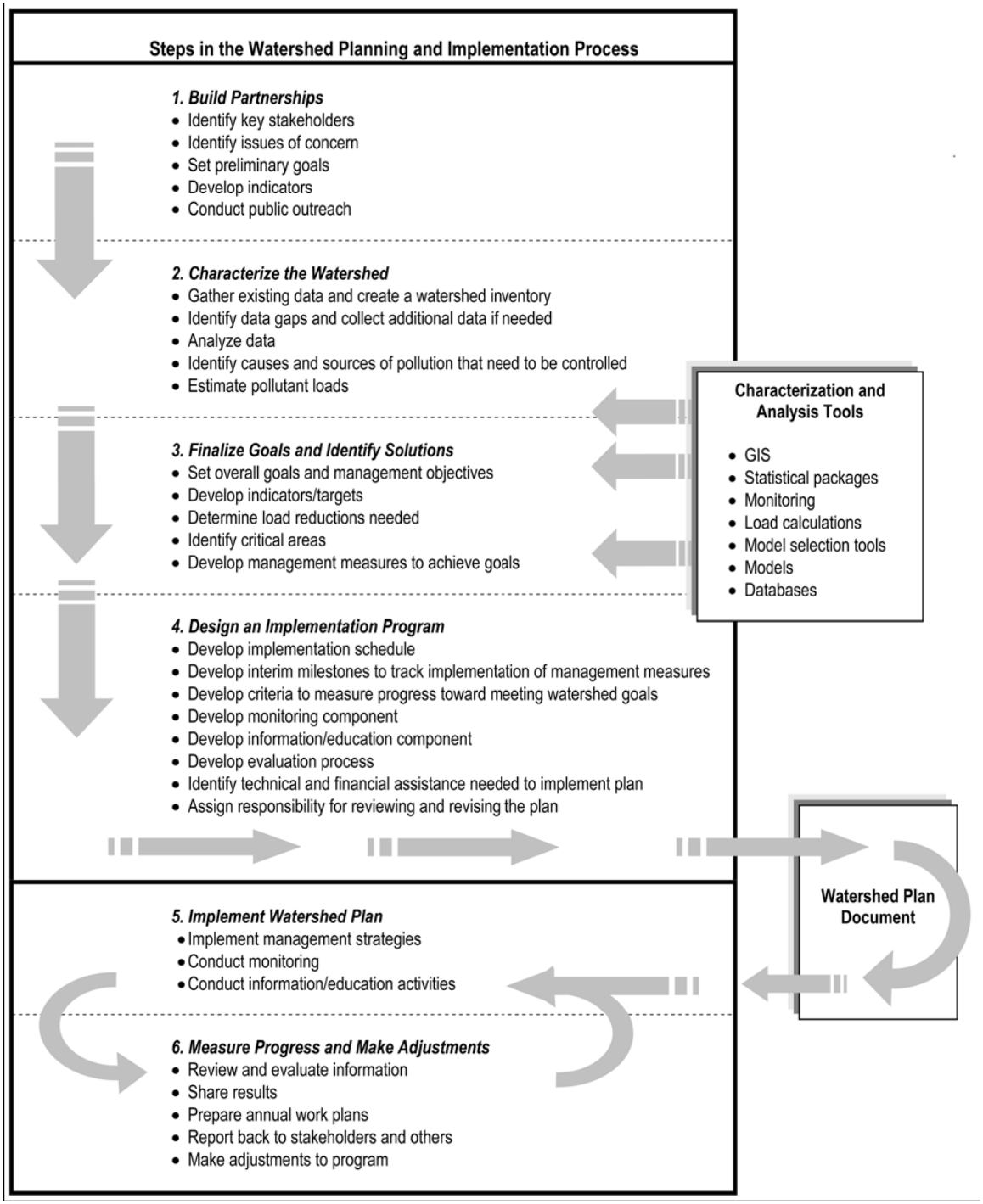


Figure 3. Incorporating the nine minimum elements into your watershed plan.

3.10 Groundwater Resources and Surface Water Supplies

Groundwater is a limited resource in the area and landowners have express serious concerns about its availability. Changes in land use and increased intensive water use by some types of agriculture have impacted existing groundwater levels. In recent decades, normal conditions note little to no summer flow of the creek and it's tributaries. Existence of springs has lessened and many wells appear to be overdrawn with current lack of ability to recharge. No studies by either Marin or Sonoma county departments of water agencies exist to describe the aquifers in the watershed or groundwater resources in the area. Landowners in the watershed have expressed an interest in working with both Marin and Sonoma County water agencies to study groundwater issues, create policies to promote equitable use and ensure long-term water security

Groundwater resources are important in serving the water supply needs of the Petaluma area citizens, commerce, industry, and agriculture. The sustainable use of the aquifers and groundwater quality are vital to the health of the watershed. The stakeholders of San Antonio creek are looking forward to working with the Sonoma County Water Agency and Marin County in preparing a ground water management plan for the entire Petaluma River watershed.

The following provides an overview of the groundwater resources in the Petaluma Watershed summarized from the *Petaluma River Watershed Master Drainage Plan*, Sonoma County Water Agency, June 2003.

Several physical factors control natural recharge of groundwater in an area, including:

- Slope of the land surface
- Permeability of the soils
- Subsurface geology
- Amount of available storage space in the aquifer

The largest concentration of soils suitable for recharge is northwest of the city of Petaluma. These soils have formed on the sandy Merced Formation and cover 28 percent of the land surface in this area. Many soils in this area, not classified as recharge areas, were excluded because land slope exceeded 15 percent. The Merced Formation in this area is essentially one continuous aquifer averaging 450 feet in thickness. Because few creeks cross the recharge areas, the major source of natural recharge to the Merced Formation appears to be from rain falling on suitable soils.

Other recharge areas dot the western uplands and are scattered on the western flank of the Sonoma Mountains. In these areas, most recharge is from rainfall because few streams flow across the recharge areas.

Soils suitable for recharge underlie portions of the city of Petaluma, having formed on top of a thin deposit of alluvium and, to a lesser extent, alluvial fan deposits and the Tolay Volcanics. The Petaluma River flows across some of these recharge areas, however, because there is little storage available in aquifers beneath these recharge areas, the loss of surface water to the ground water body is probably small. Because the Petaluma River is tidal and brackish at the City limits, an increase in river recharge in this area would not be desirable.

Ground water levels near the city of Petaluma dropped from the mid-1950's until the early 1960's, allowing greater intrusion of salt water into the aquifers along the lower Petaluma River. Delivery of Russian River Project water to the City of Petaluma began in 1962 with completion of the Agency's Petaluma Aqueduct (SCWA). This allowed reduction in the volume of municipal groundwater pumped and recovery of ground water levels. Ground water levels have remained relatively steady since that time except during the drought of 1976-77, and no appreciable change appears to have occurred in the last 20 years in the volume of ground water affected by sea water intrusion. As long as ground water pumping near the tidal portion of the Petaluma River does not substantially increase, the volume of affected ground water should not increase.

State Department of Water Resources' computer analysis indicates that the total groundwater storage capacity of the Petaluma Valley is 1,697,000-acre feet. Based on fall 1980 ground water levels, total water in storage was 1,420,000-acre feet – about 84 percent of the total capacity. This figure includes water of all quality types, including brackish water caused by seawater intrusion. The report states that natural topographic constraints prevent the Petaluma Valley ground water basin from filling to more than the 84 percent as indicated by the DWR's computer program. If the basins are more than the 84 percent full, the additional ground water begins to leak out along roadcuts and into streams as "rejected recharge". The report concludes that "The Petaluma Valley basin is therefore, in effect, completely filled at the present time" (DWR, June 1982).

4.0 The Plan

4.1 Stakeholder Issues of Concern

- ***Need for Hydrologic and Hydraulic Assessments and Modeling***
  Determine appropriate implementation projects**.**
- ***Erosion/sedimentation***
  Meet future TMDL criteria for sedimentation, nutrients, pathogens and diazinon. Downcutting along the creek
- **Water Quality**
  Diazinon (San Antonio Creek is listed separately for diazinon)
  Sedimentation.
- ***Groundwater Resources***
  Change in land use to water intensive, larger scale agriculture and the effects on groundwater resources. Descreased spring flow.
  Lack of summer flow in creek and tributaries. Pond development and permitting issues
- ***Habitat Loss/listed species (see Table 1)***
  Salmonids: Canopy and riparian vegetation
  Red Legged Frog
- ***Flooding***
  Undersized County road culverts and consideration of re-designs which do not contribute to continued incision and bank erosion.
  Some flooding in Petaluma Marsh.
  Consider study and plans for upstream storage to reduce effects of flooding in downstream reaches.
  The change in the San Antonio Creek drainage. Higher elevation at confluence of Petaluma River has decreased tidal prism thus allowing increased sedimentation and continued bank incision
- ***Increased Regulatory Requirements***
  TMDL
  Permits or waiver program (RWQCB)
- ***Support for Sustainable Agriculture***
  Significant change in type and intensity of agricultural operations due to land costs and economic changes in ag industry.
  The lengthy permitting process for many projects: work on policy changes at the county and state level for faster permitting process

4.2 Plan Goals, Objectives and Recommended Actions

The San Antonio Creek Enhancement Plan goals and objectives address common issues and needs of the landowners of San Antonio Creek. The landowners identified the general process and program for implementing the goals that they set for improving the health of the creek.

A fundamental assumption in attaining any of the goals in the Plan and/or following through with any of the recommended actions for enhancement in the watershed is the establishment of a Watershed Group.

The intent of the goals is to provide direction for future enhancement efforts in the San Antonio Creek watershed. The goals listed below encompass and share common themes: support local control of future enhancement in the watershed, improve water quality in the larger Petaluma watershed, support the viability of agriculture and enhance existing wildlife habitat. Each goal is broken down into a number of objectives. The objectives are tangible extensions of the goals. Each objective is then assigned recommended actions. The recommended actions are given a probable timeline to complete of 2 years, 5 years, and ongoing.

Goal A:
Encourage Active and Ongoing Participation in the San Antonio Watershed Group

To address the goals of this plan it is the desire by the landowners to continue the existing landowner group to facilitate achievement of the other goals and objectives in this plan. Residents are committed to continuing the landowner watershed group for the purposes of addressing watershed-wide concerns and to increase communication between all stakeholders. The contributing authors of this plan feel that by establishing a strong and active group, a sense of oversight and coordination will occur and a collective voice will be able to effectively communicate the issues, objectives and concerns of this group.

Objective # 1: Continue existing local, citizen-based, watershed group to keep watershed residents informed of watershed planning, funding opportunities and implementation efforts.

Recommended Ongoing Actions:

a) Identifty short and long term goals for the watershed landowners and stakeholders.

b) Conduct regular one-on-one and "kitchen table" outreach meetings to let watershed residents know about how to participate in watershed enhancement efforts and to identify potential watershed enhancement projects.

c) Keep landowners informed of watershed efforts, function as a clearinghouse for information for watershed and urban residents, sponsor enhancement efforts, and assist agencies and citizens in coordinating meetings.

d) Keep landowners informed of upcoming agency plans, new regulatory programs and actions related to San Antonio Creek and the Petaluma Watershed.

e) Attend meetings of agencies and organizations (such as City of Petaluma, County Board of Supervisors, Farm Bureau, etc.) to keep them informed about landowner concerns and efforts.

Objective #2: Encourage local residents to take the lead in developing and implementing enhancement projects.

Recommended Actions

a) Encourage voluntary watershed activities including a student service learning component

b) Assist in developing a TMDL for Petaluma and San Antonio Creeks to develop reasonable water quality standards for a tidal slough.

c) Encourage coordination of efforts for steelhead recovery where practical.

d) Assist agencies and citizens in coordinating meetings.

e) Work collaboratively with the RCD, City of Petaluma, Sonoma County Water Agency and Sonoma County in rural watershed projects.

f) Provide input to RCD for planning and implementation efforts.

Objective #3: Encourage community involvement in developing flood hazard reduction measures, water quality policies, and streamlining of the permitting process that protect the local economy while conserving natural resources.

Recommended Actions

a) Keep informed of the cumulative impact of proposed flood hazard reduction projects on overall watershed resources and comment on proposed plans.

b) Coordinate with urban residents regarding common flooding issues.

c) Work with SCWA and landowners to identify and fund restoration/flood reduction projects to reduce factors contributing to flooding. Recommend incorporating habitat enhancement measures into flood hazard reduction projects.

d) Work on policy changes at the county and state level for faster permitting process.

e) Inform community about impacts of upstream activity on flooding and habitat degradation.

f) Assess conditions of levees in the lower watershed.

g) Identify where limited funding can most effectively be spent.

h) Seek funding for watershed group and enhancement implementation. Provide technical assistance for all willing landowners.

Goal B:
Improve Water Quality and Ground Water Resources and Reduce Flooding and Effects of Increased Velocities During Storm Events

The Petaluma River is listed as an "Impaired Waterbody" under the California Regional Water Quality Control Board's 303d provisions. Decades of urbanization along the river corridor and continued erosion control and flooding problems significantly contribute to the river's impaired status. Ultimate reversal of the listing of the river is one of the

primary goals of this enhancement plan. To this end, the landowner's focus would be to work towards lowering the water temperature, reducing sedimentation and erosion in an effort to meet water quality standards and have the River delisted prior to the requirements of a TMDL (2019).

The health of groundwater and watercourse bodies in the watershed are fast becoming one of the most important local and national environmental concerns because of its direct correlation as an indicator of our environment as a whole.

> *Objective #1:* Determine actual levels of diazinon, nutrients and pathogens in San Antonio Creek.

Recommended Two Year Actions

a) Seek funding for and conduct baseline study for diazinon in creek.

b) Provide information about the sources and impacts of water pollutants including animal waste, fertilizers, household and ranch maintenance products and practices, etc.

> *Objective #2:* Decrease sedimentation prior to TMDL to delist San Antonio Creek - reduce accelerated soil erosion and manage sediment loads.

Recommended Two Year Actions

a) Concentrate erosion control activities in the high priority sub-watershed of San Antonio Creek. See **Appendix B** for more discussion on erosion and sedimentation in San Antonio Creek

b) Seek funding and technical advice for landowners in the watershed for installation and maintenance of erosion control measures.

c) Manage livestock access to creeks and gullies, especially in the wet season.

Five Year Actions

a) Complete stream channel stability, upslope erosion, and geomorphological studies.

Ongoing Actions

a) Provide workshops and conduct outreach for erosion control BMPs. Topics could include "do-it yourself" erosion control, small farm and pasture management, and reducing rill and sheet erosion for pastures and corrals.

b) Maintain drainage ditches, spillways, culverts, etc. to avoid overtopping and delivery of sediment to the streams.

c) Improve upstream waterways for flood and sediment control by planting native species and restore riparian corridors.

d) Maintain erosion control measures throughout the watershed.

Objective #3: Encourage natural stream morphology as a means of flood control and ground water recharge.

Recommended Ongoing Actions

a) Develop and consider upstream storage models to reduce effects of flooding in downstream reaches. Promote water conservation throughout the watershed. Consider and develop on site water storage (pond development) where appropriate.

b) Collect data and projections on changes in land use to water intensive, larger scale agriculture and the potential effects on groundwater resources/recharge. Reduce unnecessary diversions from creeks.

c) Consider re-designs of undersized County road culverts which contribute to continued incision and bank erosion.

d) Encourage channel complexity to maintain summer stream flow- for example, canopy cover. Avoid depleting instream pools of water in the summer.

e) Consider re-establishing the San Antonio Creek drainage at confluence of the Petaluma River to the extent possible to slow winter flows and help reestablish summer flows.

f) Consider spring development and on-site storage for water resources and possible groundwater recharge

Objective #4: Continue and expand current voluntary surface and groundwater monitoring programs.

Recommended Two Year Actions

a) Work closely with the Sonoma County Water Agency and other stakeholders on the Ground Water Management Plan for Petaluma River.

b) Support local coordinator for monitoring outreach and coordination and conduct outreach to landowners about water quality.

c) Encourage U.C. Cooperative Extension and/or the RCD to hold monitoring workshops in the watershed. Empower landowners to engage in self-directed water quality monitoring. Provide water quality monitoring kits to landowners

d) Establish a watershed technical advisory committee to evaluate, interpret, and make recommendations for further monitoring programs in the watershed.

Ongoing actions and outreach

a) Inform landowners of ways to prevent erosion, improve water quality and inform them of new and existing regulations, water quality testing results and improvements.

b) Distribute the Southern Sonoma County Resource Conservation District Creek Care Guide for Petaluma River which includes topics on: erosion control, riparian management, wildlife habitat, nutrient and waste management, road maintenance, and proper drainage.

c) Make the Handbook for Forest and Ranch Roads published by the Mendocino County Resource Conservation District available to watershed residents, free of charge or for a nominal cost.

d) Identify research needs for long-term water supply concerns for rural residents and agricultural operations especially in San Antonio Creek. Consider how increases in water supply or water use will affect natural resources and development.

e) Assist residents in working with both Sonoma and Marin Counties on well and septic installation and management to maintain or improve ground and surface water quality.

Goal C:
Protect and Enhance Existing Wildlife Habitat

This goal focuses on the protection, conservation, and restoration of sensitive and endangered species habitat and riparian corridors along San Antonio Creek. Healthy vegetation within riparian corridors provides shade to help lower water temperatures and can also serve as a successful means of erosion control. These corridors provide excellent habitat and cover protection for a wide variety of terrestrial species, fish (salmonids) and migratory songbirds. Restoring riparian vegetation will be a key component in lowering San Antonio Creek's water temperature and reducing levels of ammonia to eventually restore fisheries if possible. Please refer to DFG draft fisheries study conducted in 2007, *Petaluma River Tributaries Habitat Assessment Report* for more information.

Objective #1: Protect, restore and enhance habitat and riparian corridors in the watershed. Biological objectives include bank stability (erosion control/sediment reduction), restoration and enhancement of riparian habitat for listed species including red-legged frog and salmonids.

Recommended Two Year Actions

a) Compile and distribute list of plants best suited for revegetation efforts.

b) Revegetate gullied areas with appropriate materials.

c) Identify potential projects and select appropriate enhancement projects that conserve or improve the habitat of listed species. Follow any specific terms and conditions set by U.S. Fish and Wildlife Service and National Marine Fisheries Service.

d) Create a comprehensive plan to control non-native invasive plant species.

Ongoing Actions

a) Encourage the use of native plant species for riparian restoration.

b) Protect intact sections of the riparian corridor.

c) Revegetate high and medium priority sites identified in Riparian Plant Community of the Petaluma Watershed Enhancement Plan (see **Appendix C**). Work with willing landowners. High and medium priority sites include the opportunity to provide contiguous riparian forest habitat between an upper and lower reach of a stream, expand existing habitat, fill out areas of sparse cover, and provide cover in areas with a potential for high erosion.

d) Inform community about local threatened and endangered species.

e) Avoid depleting instream pools during the summer.

Objective # 2: Encourage community pride in the watershed as a natural resource.

Recommended Two Year Actions

a) Inform community about local wildlife enhancement potential with brochures and workshops.

b) Conduct outreach regarding the importance and uniqueness of the Petaluma Marsh.

Five Year Actions and outreach

a) Prepare and distribute information to the public about wildlife habitat needs, including steelhead and marsh species, and how residents can help enhance habitat. Include information on reducing summertime water diversions.

b) Create manual on how residents can help enhance and protect existing wildlife habitat.

c) Provide workshops or written materials for residents about the importance of healthy riparian corridors to wildlife, erosion control, and water quality, do-it-yourself revegetation with native plants, how to maintain creek habitats, and available resources and technical assistance.

Ongoing Actions and outreach

a) Encourage community involvement in preservation of anadromous fish habitat.

b) Support efforts to improve habitat for steelhead, songbirds, waterfowl, pond turtles, red-legged frog and other native wildlife species in the watershed.

c) Provide technical assistance to school and community groups working on revegetation projects.

Objective #3: Work with Dept. of Fish & Game to determine feasibility of steelhead habitat recovery in the watershed.

Recommended Two Year Actions

a) Use the Department of Fish and Game protocol to evaluate the quality of steelhead spawning and rearing habitat. Focus on reaches being restored by watershed residents.

b) Incorporate steelhead habitat-related parameters into watershed monitoring (i.e., turbidity sampling, possibly using aerial photographs to identify changes in riparian cover, etc.).

Five Year Actions

a) Focus steelhead restoration efforts on tributaries that do, or potentially can, support steelhead.

Goal D:
Support the Viability of Agriculture in the Community

Past and present, the Petaluma community is founded on agriculture. Currently, increasing land prices and stricter environmental regulations threaten the viability of the agricultural community. One of the most important factors contributing to the quality of life in the community is its history of and continued linkage to agriculture. The majority of the land use in San Antonio Creek is privately owned agricultural production.

This goal seeks to support agricultural viability in San Antonio Creek watershed and supports sustainable practices (BMPs) that protect the natural resources. Stewardship of the land is a significant hallmark of this plan and the sentiments of its contributors. With the formation of a watershed group, agricultural producers have an opportunity to voice collective concerns and to work cooperatively with other stakeholders to promote broad public support for agricultural viability.

> *Objective # 1:* Continue to provide information about technical and financial assistance, regulatory requirements and possible waiver programs for agriculture.

Recommended Two Year Actions

a) Work with the County of Sonoma, the County of Marin, the Regional Water Quality Control Board and other agencies regarding new policies and regulations to find fair and equitable solutions to on-going natural resource issues.

b) Investigate financial incentives for landowners who voluntarily engage in efforts to restore the riparian corridor or voluntarily take land out of production.

c) Seek financial incentives to encourage landowners to leave buffer space along creeks on a voluntary basis.

Five Year Actions

a) Work with diverse agricultural operations to discuss equitable and sustainable water usage. Improve ground water management and storage.

b) Provide assistance to property owners for identifying erosion problems, and developing practical solutions

c) Compile and distribute information on best management practices (BMPs) to ranchette owners and larger agricultural operations.

Ongoing Actions

a) Provide information about upland grazing management.

b) Encourage the use of best management practices for hillside vineyards.

c) Support voluntary programs such as farm succession planning and agricultural and conservation easements to protect farmlands and habitats.

Objective #2: Provide technical information to interested agriculture operators about the potential benefits and detriments of using reclaimed wastewater.

Recommended Two Year Actions

a) Identify best management practices for using reclaimed water if available.

b) Provide information about obtaining reclaimed water and public perception of usage on a variety of crops.

Ongoing Actions

Support users of reclaimed wastewater to develop irrigation management plans.

If appropriate and cost effective, work with the City and County to provide reclaimed water for agricultural use.

Support the availability and responsible use of reclaimed water for interested agricultural users.

Objective #3: Support economic sustainability and stewardship activities of agricultural and rural residents.

Recommended Two Year Actions

a) Hold ranch and vineyard planning workshops for both small and large landowners and managers.

b) Assist rural residents with conservation practices, planning, permitting, and funding to implement conservation projects.

Five Year Actions

a) Work cooperatively with regulatory agencies in streamlining permits for levee and ditch maintenance and agricultural operations.

b) Develop a recognition program that acknowledges historical and current stewardship of the land by agriculture.

c) Provide outreach to the urban community about benefits of agriculture in the watershed.

d) Develop a horse ranch management manual similar to the vineyard management manual.

e) Hold conservation planning workshops for farm and ranchette owners.

Ongoing Actions and outreach

a) Inform residents about the importance of agriculture to the local economy and about farming operations. Provide weekend tours and newsletters, and/or newspaper articles.

b) Support willing levee owners with stewardship practices that conserve or enhance wildlife habitat.

c) Encourage long term, local landowner control of enhancement and implementation actions in the watershed.

d) Support best management practices for manure management and disposal.

Goal E:
Identify and Implement High Priority Projects and Studies

Objective # 1: Determine specific high-impact projects that will enhance the resources of the watershed and ensure success of future projects.

a) Prepare a hydrologic and hydraulic assessment on San Antonio Creek with modeling to determine appropriate restoration and other projects.

b) Conduct a baseline water quality study which addresses diazinon and sediment (coinciding with TMDL listings). Conduct a sediment source analysis.

c) Assess project sites for enhancement implementation and monitor project sites to assess the success of restoration projects.

4.3 Potential Restoration Projects and On-going Activities:

- Seasonal exclusionary fencing
- Increase the length of contiguous riparian corridor by the planting of native perennial grasses and native trees and shrubs
- Bank stabilization at key locations
- Wetlands enhancement
- Pond enhancement for Calif. Red-Legged Frog habitat
- Pond development for groundwater retention and recharge
- Removal of invasive species
- Lined waterways
- Other projects as identified by the landowners/stakeholders
- Identify and apply for grant funding
- Continue stakeholder meetings and watershed outreach through forums/newsletters

4.4 Suggested Studies/Assessments:

- Hydrology and hydraulic assessment (with modeling)
- Water quality monitoring and study addressing diazinon and sediment loads
- Quantification of water quality benefits (sediment load reduction estimates)
- Identification of potential lands for red-legged frog (RLF) habitat conservation and/or restoration projects for RLF habitat mitigation
- Sediment source analysis (L. Collins geomorphology – phase 2)
- Collection of current baseline data (water quality, sensitive plants/animals, fisheries)
- GIS/Mapping of San Antonio Creek Watershed
- Salmonid and habitat survey

5.0 Other Planning Efforts in the Watershed

Several agencies, organizations and cooperatives have identified the Petaluma River agricultural/tidal marsh complex area in restoration and conservation plans including:

- Petaluma River Watershed Enhancement Plan (SSCRCD 1999) to be revised in 2008 - 2009
- Napa/Sonoma Marsh Restoration Project Plan
- Baylands Ecosystem Habitat Goals Plan
- Sonoma County General Plan (Sonoma County)
- San Pablo Bay Watershed Restoration Program
- Sonoma County Agricultural Preservation & Open Space District Strategic Plan
- SFEP Comprehensive Conservation and Management Plan
- Save The Bay Restoration Program
- San Francisco Bay Joint Ventures Implementation Strategy/ North American Waterfowl Management Plan
- Petaluma River Access and Enhancement Plan (City of Petaluma)

Given the numerous plans that identify this area and its well known ecological significance, past,current, and future projects, local state and federal participants and prior collaborative efforts, the opportunities and environment for future collaboration are quite good. The Southern Sonoma County Resource Conservation District has worked extensively with many of organizations and agencies listed above.

The City of Petaluma General Plan has currently been undergoing revision and the city leaders have been pro-active in addressing planning and resource management. A new city department was named “Water Resources and Conservation” to specifically address water resources.

The City of Novato’s urban growth boundary is co-terminous with their city limit line and their sphere of influence is greater than the urban growth boundary. However, consideration of amending the sphere to remain within the urban growth boundary is underway.

Petaluma River Watershed Enhancement Plan (July 1999)

The Southern Sonoma County RCD authored the Petaluma River Watershed Enhancement Plan in 1999 with support from the residents and landowners of the Petaluma watershed. All the elements of this Plan

are incorporated by reference and or relevant excerpts are provided herein to describe and illuminate plans for San Antonio Creek.

Prunuske Chatham, Inc., an environmental consulting firm, specializing in ecological restoration and design, was hired to prepare supporting documentation on key technical subject areas in the 1999 Plan, such as erosion and sedimentation, land use, riparian enhancement, and marsh/bay habitats. These studies were originally entitled "summaries" and they are provided herein in their entirety and found as individual appendices of this document. Important information and analyses from these studies have been incorporated where appropriate, into the body of the Plan document.

Sonoma County General Plan

The County of Sonoma is in the process of updating its General Plan, entitled GP2020, through a series of elements. Several elements note resources and policies pertaining to lands in the watershed and relating to resources there.

A community separator exists south of the City of Petaluma limits along highway 101 south to the Marin County line. This community separator identifies lands (parcels) as open space and viewshed areas which provide distinct visual and development separation between communities and developed land uses.

The lower baylands area, lower Petaluma River is designated with a scenic landscape unit. Several county designated scenic corridors exist in the San Antonio Creek watershed: a) Highway 101 corridor south of the city limits of Petaluma through to Marin County, b) D Street south of Petaluma which becomes Petaluma-Point Reyes Road through the watershed south to is designated as a scenic corridor.

A waterway trail has been designated along the lower Petaluma River from the mouth on San Pablo Bay northward to approximately the confluence of Schultz Slough.

Occurrences of special status plant and animal species, sensitive natural communities, marshes and wetlands and potential range of California Tiger Salamander are located in the watershed and designated by the County. See Section 3.8 Natural Resources for a full listing of protected species in the watershed.

The Petaluma Valley groundwater sub-basin is identified in the County General Plan as a resource and area to consider in planning. This groundwater sub-basin is defined in the San Antonio Creek watershed in the area east and south of Highway 101 to the Marin County line.

The General Plan designates areas in the watershed with several safety hazard types: Tsunami potential, 100-year flood zone, very high landslide potential, high liquefaction, and very violent to strong shaking severity during earthquakes.

Bay Area Integrated Regional Water Management Plan

The Bay Area Integrated Regional Water Management Plan (Bay Area IRWMP) is a multi-stakeholder, nine-county effort to coordinate a strategic approach to regional water resources management. The Plan will build on water resources needs and planning strategies identified throughout the Bay Area, leveraging regional cooperation to more effectively address the needs identified. Building of the plan was funded by the voters through funds from Prop 50. Implementation of the plan (programming and on-the-ground projects) in watersheds such as Petaluma River and San Antonio Creek is focused on such projects that form partnerships and provide multiple benefits. Prop 50 guidelines highlight improved water supply reliability, long-term attainment and maintenance of water quality standards, eliminated or reduced pollution in impaired water and sensitive habitat areas, planning and implementation of multipurpose flood control programs and drinking water and water quality projects that serve disadvantaged communities.

Integrated planning involves local agencies and interest groups working together to coordinate planning activities across jurisdictional boundaries. In this regional approach, individual agencies' efforts are combined in order to leverage resources and meet multiple water resource needs at the same time. For instance, water supply, water quality, and habitat projects might be combined with a flood control project in a manner that benefits a much larger area than the original proponent's area.. The result is a multi-objective approach that multiplies the benefits of any individual agency's single project.

A project entitled "Petaluma Watershed Restoration and Outreach" funded under Prop 13 was commenced in 2004 to provide such multiple benefits of outreach and education, restoration through sediment retention, revegetation and cattle exclusionary fencing. This project was identified and named in the Bay Area IRWMP as a priority project as it

seeks to reduce pollution in the water and improve riparian habitat in the Petaluma River watershed. Restoration efforts were focused in the Petaluma River's largest sub-watershed, along San Antonio Creek. Education and outreach efforts on conservation and water quality improvement goals were widely distributed throughout the greater watershed.

Priority Conservation Areas

Areas are being designated for conservation potential through a program, entitled Focus Vision, led by the San Francisco Association of Bay Area Governments Association. The FOCUS program is a partnership of 4 organizations: SFABAG, Bay Conservation and Development Commission, Metropolitan Transportation Commission, and the SF Bay Regional Water Quality Control Board. The purpose of designating priority conservation areas through the FOCUS Program is to accelerate protection of key natural lands in the San Francisco Bay Area through purchase or conservation easements within the next few years. Conservation will be promoted through regional designation by:

- Coordinating conservation efforts within a regional framework of near-term priorities
- Providing a strong platform on which to leverage public and private resources
- Building upon prior and existing land protection efforts and investments
- Providing opportunities for forging new partnerships

At the time of writing this draft Plan, the SSCRCD has developed a nomination for Priority Conservation Area which includes the lower baylands portion of the San Antonio Creek watershed and also the baylands area of the Petaluma River Watershed. The following text is an excerpt of this nomination text for the *Petaluma Watershed, Southeastern Portion*:

> *Regional Significance*-The West facing slopes of the Southeastern portion of the Petaluma watershed hosts a diverse mosaic of agricultural/grazing lands, tidal marsh and sloughs bordering the eastern banks of the Petaluma River. The agricultural complex is part of the Sonoma/Marin "Dairy Belt" and possesses significant

cultural, open space, scenic and local economic diversity value. Lakeville Highway is also a Sonoma County designated scenic corridor. Many of the parcels in the defined area are privately owned, medium-sized agricultural operations (dairy, grazing, vineyards). Medium-sized family farms are well recognized and important components of the local and regional economy. The farms provide agricultural products and present substantial opportunities for cooperative land stewardship and conservation. The agricultural component is also of importance from an open space value and conservation standpoint. Willing landowners have worked with local resource conservation agencies for decades and maintained productive farms with sound land stewardship. The western banks of the watershed drain into smaller tributaries and creeks which feed into the Petaluma River. Clearly, future land use will have a significant and direct impact on the river and downstream tidal slough/marsh component. In addition, some of these agricultural parcels are known to contain critical habitat for the endangered red legged frog.

Urgency- With its "graying" farmer population, California is in the throes of an agricultural land crisis. According to USDA census data, approximately 60% of the family owned farmland in California will change hands in the next twenty years.
Most farmers could never afford to purchase the farmland that they are now in danger of losing forever. Increasing population, development pressure, skyrocketing land costs as well as economic volatility are threatening the long-term economic viability of agriculture in the region. Turnover or conversion of these agricultural lands creates uncertainty about economic diversity, conservation opportunities for sound land stewardship and impacts on natural resources in the future. The long-term health of the downstream tidal marsh/slough complex will be directly and significantly impacted by land uses in these largely agricultural upland areas.

A proactive approach is needed to create good opportunities for upland conservation, enhancement and/or restoration. Many of the larger agricultural parcels in the area are owned by single families. Having a program and funding in place to address these issues and then proactively reaching out to the landowners with a set of reasonable alternatives instead of having them simply "sell out" will prevent worst case scenarios (i.e sprawling development or conversion to forms of agriculture which have higher environmental impacts) on some of the more ecologically important

parcels. The continued availability of funding for conservation easements or in-fee purchases and sound farm succession planning assistance to foster multigenerational ownership will help to protect these working farms from development or conversion, create new opportunities for protecting and enhancing upland habitat and promote sound land stewardship well into the future.

San Francisco Bay Joint Venture's Habitat Goals Plan

The San Antonio watershed empties into the Petaluma River with hundreds of acres in wetlands. The Goals Plan has direct relevance to protecting and managing these vital estuarine resources.

San Francisco Estuary Wetlands Today

The Bay Estuary's ecological value lies mainly in the wetlands along its edge, and in the riparian habitats of streams and rivers feeding into it. These habitats are essential to the health of the myriad fish and wildlife populations of the region. Millions of shorebirds and waterfowl stop by during their annual migrations between Alaska and South America. Many overwinter here. San Francisco Bay is the only site along the Pacific Flyway where close to a million shorebirds have been counted in a single day. It hosts more shorebirds than all other coastal California estuaries combined. Up to half the populations of migrating West Coast waterfowl, particularly canvasback and sea ducks, winter in the Bay Estuary. The Western Hemisphere Shorebird Reserve Network has designated the San Francisco Bay Estuary as a site of "Hemispheric Importance" (its highest ranking), and the North American Waterfowl Management Plan has listed it as one of 34 waterfowl habitats of major concern in North America.

Sonoma Baylands photo courtesy of Sonoma Land Trust and photographer Stephen Joseph

Nevertheless, these wetlands are but a remnant of what existed a century ago: some 200,000 acres of tidal marshes, 100,000 acres of seasonal wetlands, vernal pools, creeks, and streams. More than 80 percent of these habitats have been lost, and much of what is left has been damaged. As a result, populations of waterfowl, shorebirds, and fish have been

so stressed that 48 species are either listed under the federal Endangered Species Act or are candidates for listing. Development pressures threaten all the lands along the Bay, including wetlands, and - just as importantly - former wetlands that could be restored. Existing wetlands are jeopardized by development impacts, including a decline in water quality caused by water diversions, polluted stormwater runoff, and the loss of adjacent uplands to development. These are problems of urban growth shared by the nation's other major estuaries from Seattle to Boston.

A Blueprint for Action

The Joint Venture has adopted an Implementation Strategy to help SFBJV partners fulfill their shared habitat objectives by building on what has been accomplished and planning for the future. This Strategy is based on an ecosystem perspective that considers the biological requirements of wetlands, along with issues of public health and safety. It establishes region-wide habitat goals and subregional objectives for the restoration of the Bay Estuary using three broad categories: bay habitats, seasonal wetlands, and creeks and lakes.

Over the next two decades partners plan to protect 63,000 acres, restore 37,000 acres, and enhance another 35,000 acres of Bay habitats that include tidal flats, marshes, and lagoons. They will also work to secure habitat values of adjoining seasonal wetlands, with protection and restoration/enhancement goals of 37,000 acres and 30,000 acres respectively. In addition, Joint Venture partners intend to protect 4,000 acres of riparian corridors and restore and enhance over 1,000 miles of creeks, as shown in the table below.