Contra Costa County

Watershed Atlas

Prepared by the Contra Costa County Community Development Department in cooperation with the Contra Costa County Public Works Department
under the direction of the Contra Costa County Board of Supervisors.

Project conceived by the Contra Costa Watershed Forum.

Funded by the State Water Resources Control Board, the CALFED Bay-Delta Program, the Contra Costa County Fish and Wildlife Committee, the Contra Costa County Community Development Department, the Contra Costa County Flood Control and Water Conservation District, and the Contra Costa GIS Policy Committee.

November 2003
Reprinted January 2004
Available Digitally May 2004

Acknowledgements

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Funding
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CALFED Bay-Delta Program
Contra Costa County Fish and Wildlife Committee
Contra Costa County Community Development Department
Contra Costa County Flood Control and Water Conservation Department
Contra Costa County GIS Policy Committee

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California Academy of Sciences
Canyon Unified School District
City of Lafayette Creeks Committee
City of Pinole
City of San Pablo
Contra Costa County Agriculture Department
Contra Costa County Flood Control and Water Conservation District
Contra Costa Water District
East Bay Municipal Utility District
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Save Mount Diablo
Urban Creeks Council

For more information visit: www.cocowaterweb.org or contact the Contra Costa County Community Development Department at (925) 335-1290.

Disclaimers

Prop 13: "Funding for this project has been provided in full or in part through an Agreement with the State Water Resources Control Board (SWRCB) pursuant to the Costa-Machado Water Act of 2000 (Proposition 13) and any amendments thereto for the implementation of California's Nonpoint Source Pollution Control Program. The contents of this document do not necessarily reflect the views and policies of the SWRCB, nor does mention of trade names or commercial products constitute endorsement or recommendation for use."

Maps and statistics presented in this document are based on the best available information at the time of printing. Though we have attempted to provide the most accurate information possible, there may be unintentional errors or omissions.

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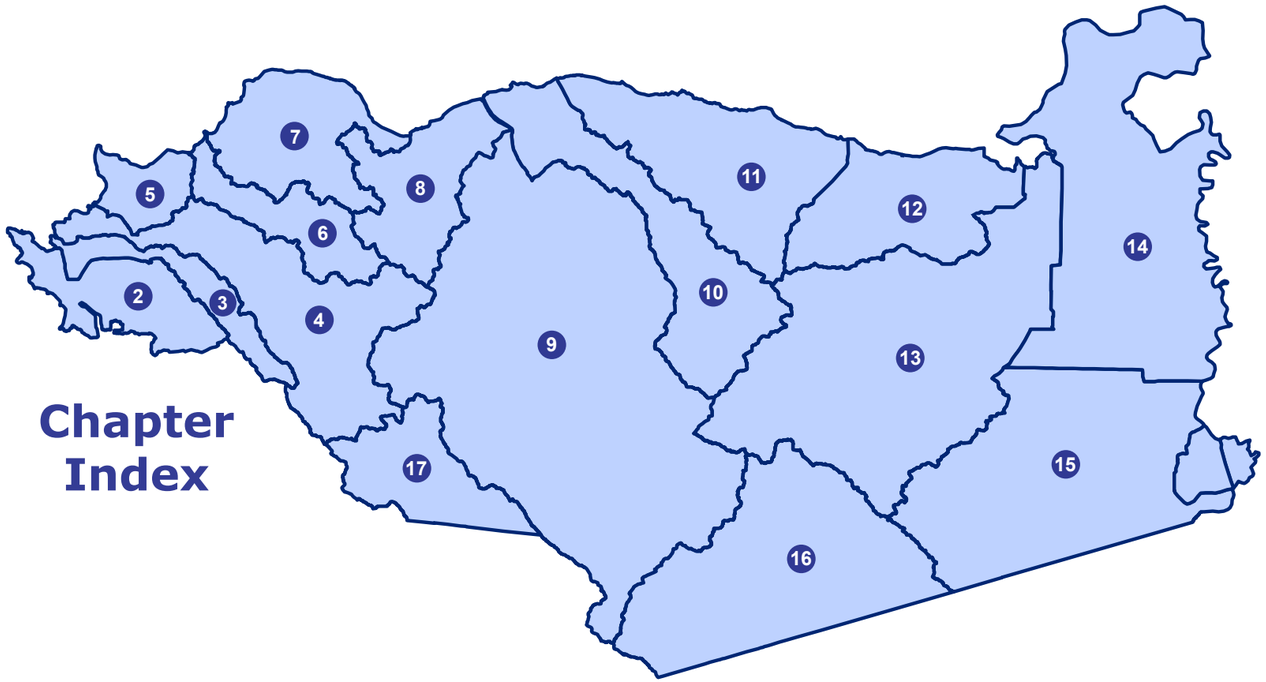

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Stephen Joseph

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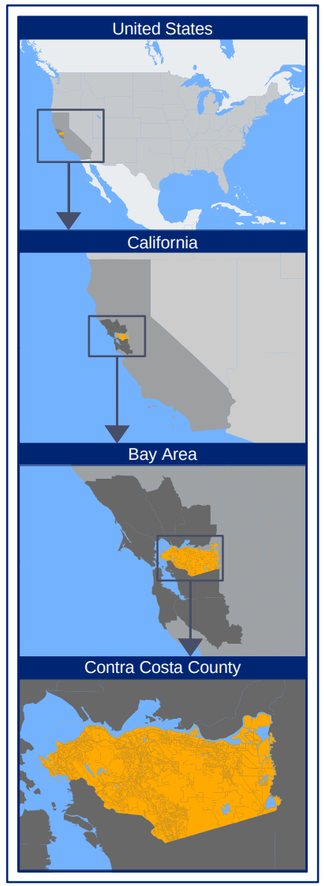
Stephen Joseph

Contra Costa County and the Contra Costa Watershed Forum

Located in the San Francisco Bay Area, Contra Costa County is home to almost one million people, beautiful landscape, and important natural resources. Because creeks are a primary connection between the human and natural environments, community groups, local non-profits and local governments have become increasingly concerned with the health of watersheds. These groups have formed a multi-stakeholder coalition, the Contra Costa Watershed Forum.

The Contra Costa Watershed Forum (CCWF) is an outgrowth of the first county-wide Creek and Watershed Symposium in 1999. The Forum is an open committee of some fifty organizations, including federal, state, and local agencies; local governments; professional watershed research organization; local non-profit environmental and education organizations; community volunteer groups; and private citizens. This diverse group of stakeholders is united by their concern for the watersheds of Contra Costa County.



Creeks that flow through urban communities provide a tangible connection to the natural landscapes upstream. The work of CCWF participants is premised on the notion that actions in a watershed are inter-related and, therefore, that broad participation and cooperation is needed to affect change. The members of the CCWF work together to find common approaches to making our variety of water resources into healthy, functional, attractive, and safe community assets.

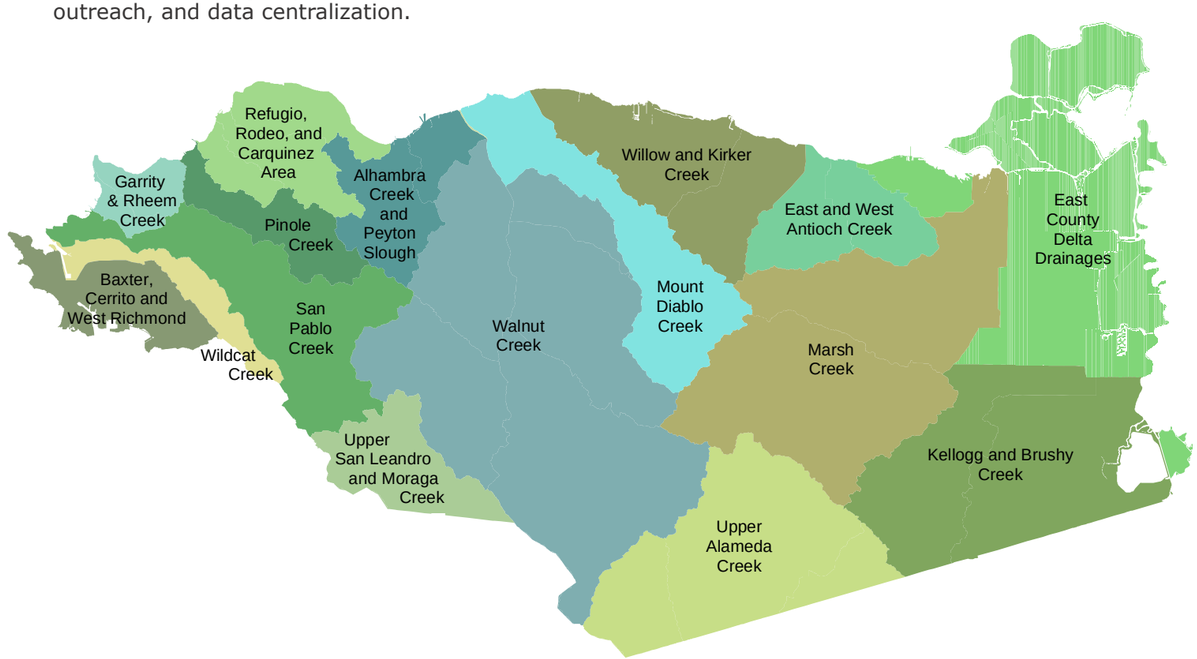
Since the inception of the CCWF, there has been a marked increase in watershed restoration and preservation activities, activism, and awareness. Earthday festivals are held at creek restoration sites, new volunteer groups have formed, and programs to educate, research and document the health of creeks and watersheds are more widely available. Persistence and perseverance of community groups, as well as hard work from local agencies and governments resulted in an effective and productive coalition of organizations concerned with the health of Contra Costa County watersheds.

A culmination of this collective effort is the convening of the 2003 Creek and Watershed Symposium: Progress, Opportunities and Challenges in the Watersheds of Contra Costa County, and the release of the *Contra Costa Watershed Atlas.*

Contra Costa Watershed Atlas

In preparation for the 2nd Quadrennial Creek and Watershed Symposium in 2003, members of the Watershed Forum combined forces to create the *Contra Costa Watershed Atlas* (Atlas). Through the process of creating the *Atlas*, organizations, agencies, and volunteers came together to centralize, create, and share GIS data; consolidate databases; and provide text and graphics for the Atlas.

These efforts have been realized at many different levels, each representing important developments in the cooperation involved with effective watershed management. Strong community volunteer groups have surveyed miles of creeks through a Global Positioning System (GPS) data collection program launched by the CCWF. Governmental, regulatory, and local agencies have fostered relationships to share GIS data. This data has been compiled in the first *Contra Costa Watershed Atlas*. In effect, the Atlas provided the catalyst for these groups to collaborate to create a resource for restoration coordination, education and outreach, and data centralization.



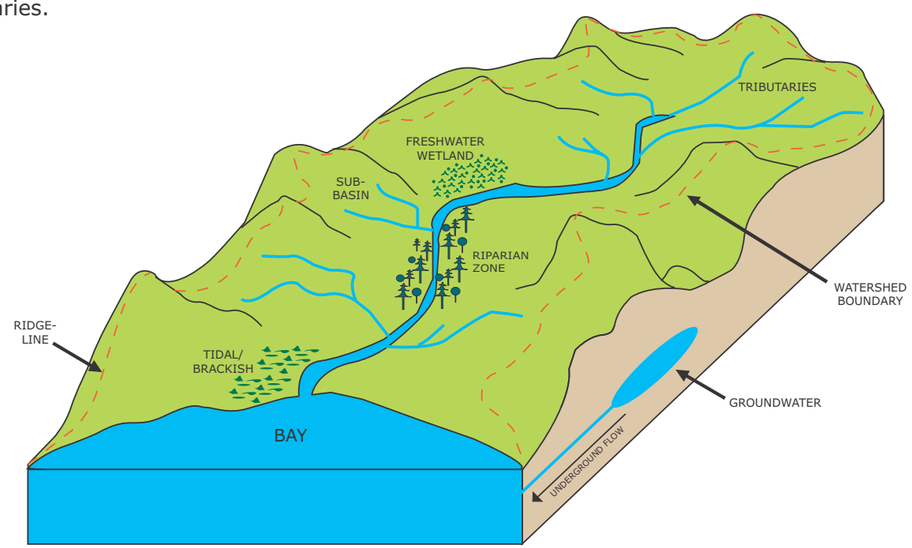
How the Atlas is Organized

Though focused on the state of natural ecosystems on a watershed scale, the Atlas also provides information about the human community and the county as an eco-region. The first chapter provides an overview of the county. Subsequent chapters document individual watersheds. Smaller watersheds have been grouped with neighboring watersheds. Walnut Creek, a very large watershed, includes additional data on its major sub-basins.

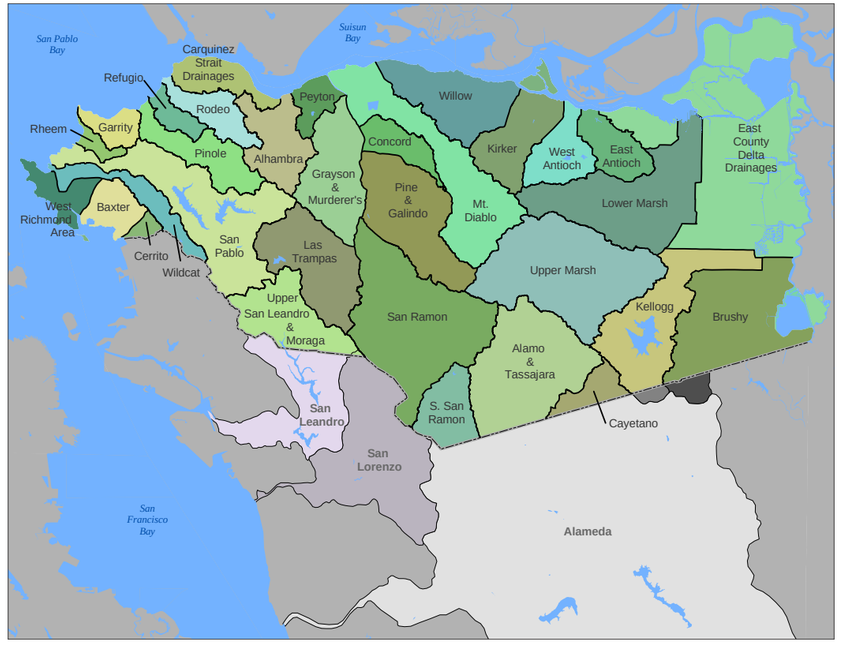
The first chapter, *Contra Costa County Watersheds Overview,* presents data that is pertinent at a county-wide scale. This first chapter also introduces some key concepts in understanding watershed ecology. Chapters 2 - 17 display data at a watershed scale. Some watersheds have been grouped together, as illustrated in the map above. Data tables, scattered through out the document presented as one comprehensive resource in *Appendix 1: Statistical Comparisons of Contra Costa County Watersheds*.

What is a Watershed?

A watershed is the basic geographic unit that is defined by hydrology. It is an area of land that drains water to a given reference point, typically a confluence with another major creek or large water body. All land is part of a watershed. Defined by their natural hydrological functions, watershed do not follow state, county, or city boundaries.



Contra Costa County has 31 major watersheds that drain to the Bay or Delta. Additionally, Contra Costa County includes the headwaters of creeks that drain through other counties before reaching the Bay.



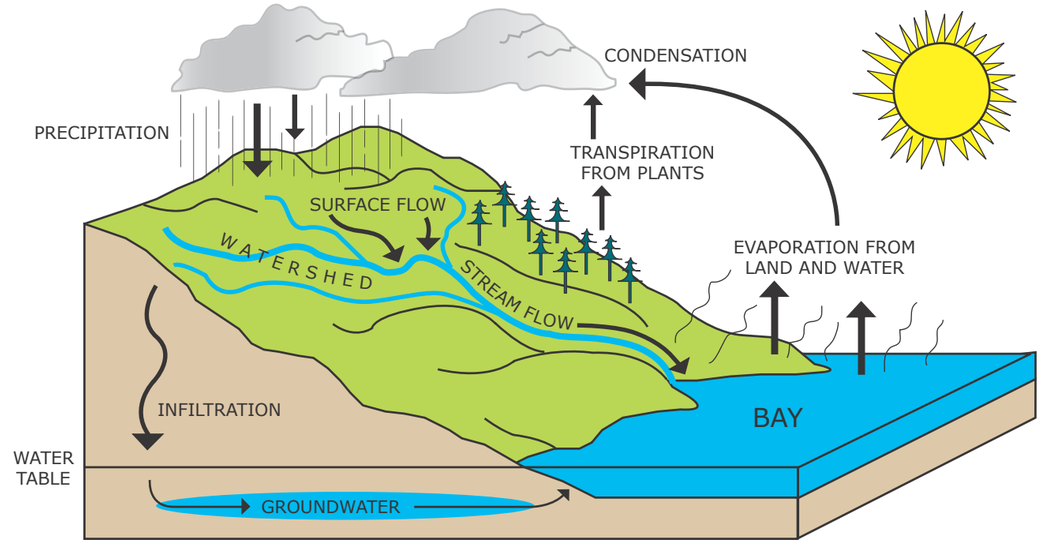
Watersheds outside Contra Costa County are approximate and based on USGS maps.

Hydrologic Cycle

There are five distinct processes that make up the hydrologic cycle: evaporation and transpiration (shortened to evapotranspiration), condensation, precipitation, run-off, and infiltration. Interruptions of the hydrologic cycle can have effects that can dramatically affect water quality, habitat integrity, and climate.

Evapotranspiration is a combination of two processes. Evaporation describes the transforming of water into a vapor by energy in light and heat. Transpiration is the release of water in vapor form through plants and animals. You can see water vapor in your breath on a cold day.

As water vapor in the atmosphere cools, it clings to fine particles in the air to form clouds. This is called **condensation**. Depending on temperature and topography, clouds laden with moisture can release water in the form of rain, hail or snow. This process is called **precipitation**.

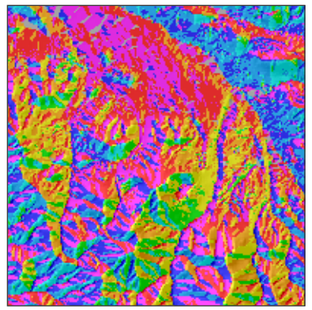


Water released from clouds can take a few different routes to complete the hydrologic cycle. Water may evaporate immediately and in vapor form return to the atmosphere. If the water reaches the ground, it can funnel off land into natural or man-made drainages. This step is called **run-off**. Alternately, water can be absorbed into the ground through a process called **infiltration**. Water that infiltrates recharges groundwater resources. The groundwater storage is the source of well water and dry season water for creeks in the watershed. When water eventually returns to vapor form, it completes the hydrologic cycle.

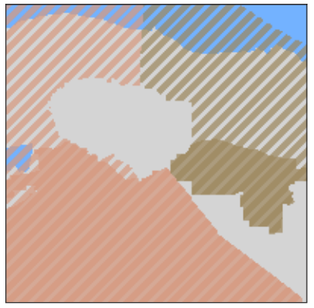
Watershed Protection Approach

This strategy for protecting and restoring aquatic ecosystems is based on the premise that many water quality and creek problems are best solved at the watershed scale rather than at the individual waterbody or discharger level. Major components of the Watershed Protection Approach are: geographic focus, integration of new science as it is available, and a high level of stakeholder involvement.

Almost all data presented in the following chapters is specific to Contra Costa County. Though we recognize that watersheds and creeks do not adhere to political boundaries, unfortunately most of our data does. Where possible we have included data across Contra Costa County's border into Alameda County (to the south) and San Joaquin County (to the east). All map data is projected in NAD 83, CA Stateplane Zone III.

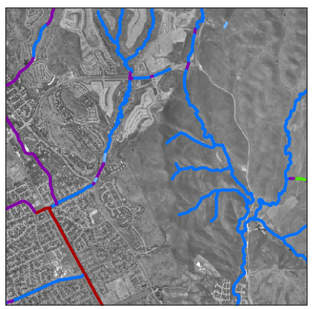


Aspect: Aspect is the compass direction that a slope faces, measured counterclockwise in degrees from 0 (North) to 360 (North again). This aspect layer was created from a countywide Digital Elevation Model (DEM) which was generated from digital aerial photography and surveys performed by the County and the Contra Costa Clean Water Program in May of 2000.



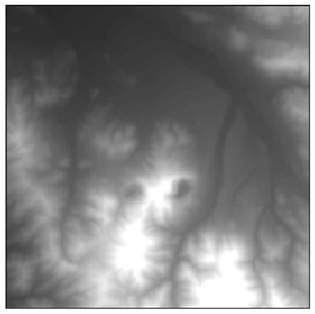
City limits and Spheres of Influence (SOI): Contra Costa County Community Development Department has created electronic maps of these boundaries based on the official paper maps maintained by the County Assessor. City Limits and SOIs were drawn using the Public Works parcel data as a base map. The terms are further defined in Chapter One.

Contours: Elevation contours are a common means for representing topography and should be familiar to anyone who has used a U.S. Geological Survey Quad Map. The County has created 10-foot and 50-foot interval contours from digital aerial photography and elevation surveys performed by the County and the Contra Costa Clean Water Program in May of 2000. Maps in the Atlas display contours at 50 and 100-foot intervals.

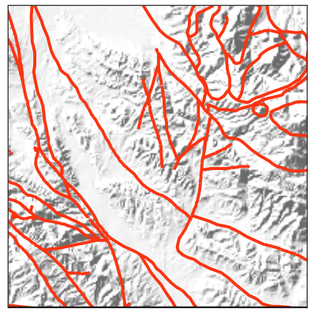


Creeks and Drainages: The Community Development and Public Works Departments worked together to generate a new creeks and drainages layer for use in this Atlas (to name one purpose). The layer was mapped by interpreting orthographic photographs, 10' contours, and storm drain data. USGS creek data (NHD High, where available, and NHD Medium in other areas) were used to help determine the drainages that should be mapped, but substantial drainages absent from USGS maps were included. Draft data were "ground-truthed" and proofread extensively both by staff and by CCWF volunteers knowledgeable of each watershed. Though storm drains often discharge to creeks, the detailed storm drain network is not a part of the Creeks and Drainages data set, though pipes or drains that connect to creeks at both ends are. The data are referred to as "Creeks and Drainages" because the term "creek" usually refers to a channel with bed and bank, and based on the methods used to develop the data, it is impossible to know where bed and bank exists in the drainage lines that were mapped. No attempt was made to characterize the drainages by perennial, seasonal, or intermittent flow pattern. There are more names labeled on creeks than are available through USGS data. Local knowledge and conventions have been recorded. Though these names are listed – they are not confirmed as the 'official' names of creeks.

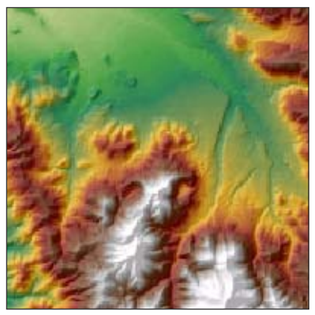
Demography (Population Density): Demographic data used was provided by the U.S. Census Bureau. Census tracts and blocks displayed reflect the units used in the 2000 census. Unless otherwise noted, demographic data on population, race and ethnicity, income, and education is from the 2000 Census. Population density maps displayed for each watershed (such as shown in this image), use Census blocks, the smallest geographic unit at which the Census Bureau collects data.



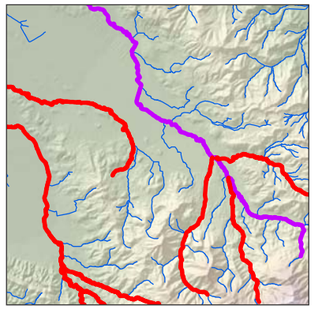
Digital Elevation Model (DEM): This DEM layer is a grid of 30 by 30-foot square cells, each containing an elevation value. It is based on elevation information generated by digital aerial photography and elevation surveys performed by the County and the Contra Costa Clean Water Program in May of 2000. Like elevation contours, a DEM is basically one alternative means for representing elevation and topography, but it can be more useful for certain types of analysis and 3-dimensional modeling. The DEM can be color-coded with a variety of color schemes to display elevation value.



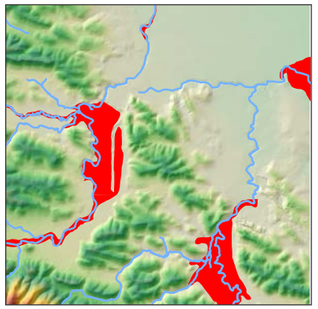
Earthquake Fault lines: U.S. Geological Survey information on the location of fault lines is presented in the Atlas. Fault line classifications have been simplified in consultation with the County's geologist. It is important to note that many fault lines are classified as inactive.



Elevation: See Digital Elevation Model. For the purposes of display in the Watershed Atlas, elevation has been represented using the Digital Elevation Model, color-coded by elevation using a standard physical relief map color spectrum. The hillshade data (see below) shows through the DEM to provide a 3D feel.

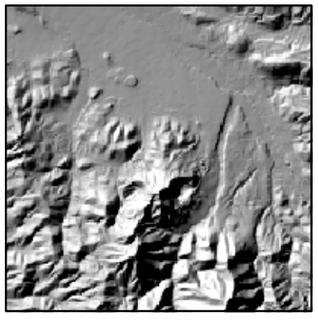


Fish (historical and present steelhead populations): Data were provided by the Center for Ecological Management and Research, 2003. Information on current populations is based mainly on sampling by Rob Leidy (between 1992 and 2002) and other researchers. Historical information is based on published and unpublished survey reports, museum specimens, interviews, and scientific collection permit reports. Data were digitized by the Contra Costa County Public Works staff in 2003. Fish maps are not for planning purposes. The maps are subject to revision.

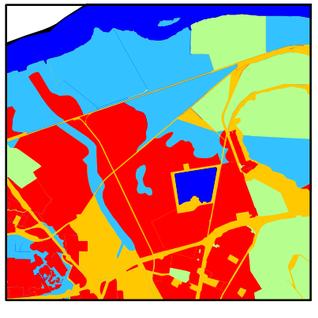


Flood Plains: Information on flood plains was developed by the Federal Emergency Management Agency (FEMA). FEMA has estimated flood risk by identifying those areas that are at risk of flooding at least once every 100 years ("Special Flood Hazard Area") FEMA maps are frequently revised and were not developed to align with the County's detailed base maps. These data are only displayed at a countywide scale and should be used for planning purposes.

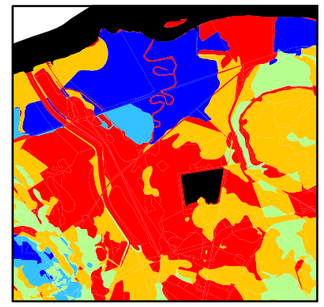
GPS data collection (CCWF Volunteers): The Contra Costa Watershed Forum launched a Global Positioning System (GPS) data collection on local creeks in Summer 2001. Volunteers are trained in data collection protocols and GPS and collect detailed information on a variety of physical creek features. Select queries from the collected data are presented in watershed chapters. For more information, contact Kae Ono, Contra Costa County at kono@cd.cccounty.us.

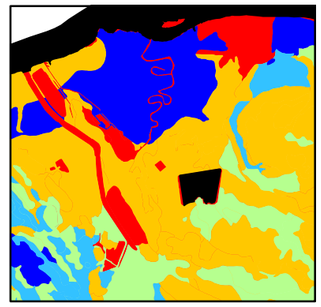


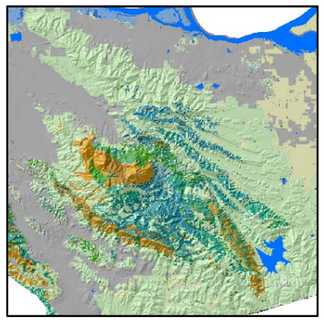
Hillshade: Hillshade models the amount of sun or shadow falling on a slope, given a fixed azimuth (compass direction) and altitude of the sun. This hillshade layer was made by the Contra Costa County Community Development department from the countywide DEM. Each cell in the raster stores a number value between 0 (black) and 255 (white) depending on how much light or shade it is receiving from the sun at that moment.

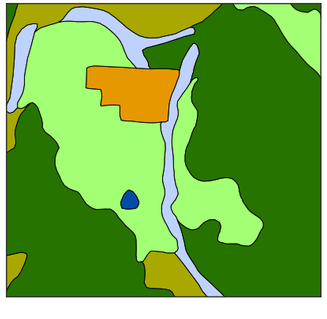


Impervious Surface: Percent impervious has been estimated from Planned Land Use. With guidance from staff at the County Public Works Department, the percent of impervious surface was estimated for different land use categories based on past evaluations of specific areas. These impervious estimates were applied to the Planned Land Use data to create the map in the upper right corner of this page. Please note that this method produces a rough estimate of percent impervious at build-out.









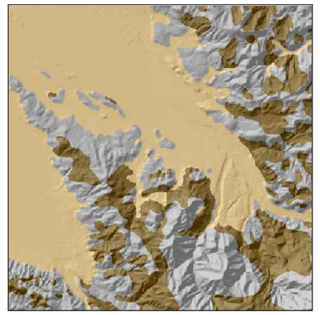
Soil permeability: The U.S. Department of Agriculture's soil data (see Soils) were displayed according to the permeability ratings designated for each soil type. The soil data estimate the hydrological properties of soil types in various ways. The "Perm_Low" designation was used for the Atlas.

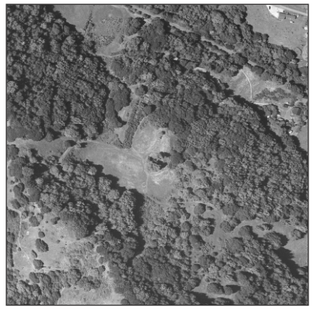
Soil permeability (composite): To illustrate one manner in which natural and constructed conditions influence watershed hydrology, the Soil Permeability and the Impervious Surface were combined to form the map at the bottom center of this page. To combine the maps, the soil permeability was reduced in proportion the estimated percent of impervious surface above the soils. Staff at the Contra Costa County Flood Control and Water Conservation District provided assistance and guidance for this analysis.

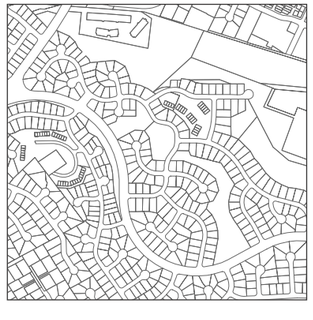
Land-cover (county-wide): The land-cover maps show the predominant vegetative cover in the County. Such maps are often referred to as land-cover maps rather as vegetation maps because some classifications, such as "urban", do not relate to vegetation. The California Department of Forestry and Fire Protection's Fire and Resources Assessment Program provides the land-cover data used in countywide maps. The map information used in the Atlas was updated in October of 2002. These and other data are available at http://frap.cdf.ca.gov/data/frapgisdata/select.asp.

Land-cover - Detailed (East Contra Costa County): Detailed land-cover data was created for use in the development of the East Contra Costa County Habitat Conservation Plan (HCP). For more information on the HCP see www.cocohcp.org. The data were created by interpreting the color and black and white orthographic photographs. Field visits were used to correlate and confirm photo interpretation.

Landslides: Data displayed in the Atlas on past landslides was collected by the U.S. Geological Survey (USGS). The USGS mapped past landslide locations by examining topographic shapes to recognize landslide "signatures". Most of the historic slides they mapped range in size from a few acres to several square miles and most show no evidence of recent movement. Detailed background information on the USGS landslide data can be accessed at: http://wrgis.wr.usgs.gov/open-file/of97-745/ccdl.html





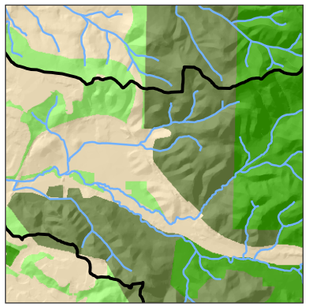


Orthographic photos, Black and White: Aerial photographs were taken May of 2000 of the County and the Contra Costa Clean Water Program. The photographs are orthographically corrected and projected for use in a GIS—that is, they have been carefully pulled and stretched to correct for the curvature of the earth and align with flat maps. The pixel size in the photos is one-half foot in urban areas and one foot in rural areas. Elevation and topography modeling was an additional component of the aerial survey and enabled creation of the 10 foot contours.

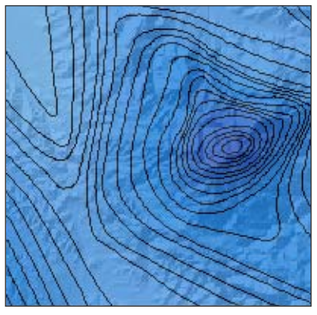
Orthographic photos, Color: Aerial photographs were taken in the March of 2003 and were purchased by the County shortly thereafter. The photographs are orthographically corrected and projected for use in a GIS in a manner similar to that used for the black and white aerials.

Parcels: The Contra Costa County Public Works Department parcel data layer is displayed in the Atlas in conjunction with Planned Land Use. This detailed and precise data set serves as a base map or point of reference for nearly all other data layers developed by the County.

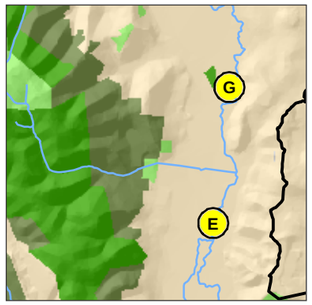
Planned Land use: The Planned Land Use map layer presents information distilled from the Draft Digital Contra Costa County General Plan Map, which was created by the Contra Costa County Community Development Department. In the Planned Land Use data, similar General Plan land use designations have been combined to create a simpler map. The County General Plan Map attempts to represent City General Plan policies in a common category system, but is not the official land use map for incorporated areas. In summary, the Planned Land Use data are not an actual representation or measurement of land use regulations, but a generalized estimation of various land use plans.



Public, Protected and Agricultural lands: Locations were excerpted from the Contra Costa County general Plan. Facility names were provided by Community Development Department staff.

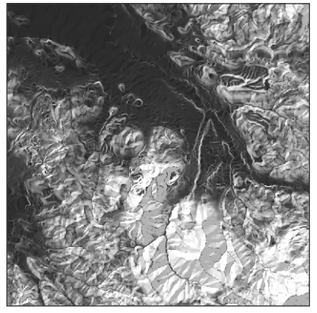


Rainfall: Rainfall isohyetals (contours) were created by hydrologists at the Contra Costa County Flood Control and Water Conservation District. The isohyetals were based on observed rainfall measurements at gauge stations throughout the County, and were interpolated based on topographic considerations. The isohyetals were digitized (mapped in a computer) by the Contra Costa County Public Works department and converted from the original CAD files in 2003 by the Contra Costa County Community Development Department.

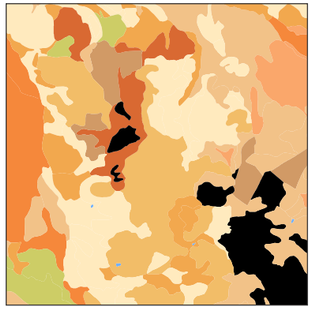


Restoration Projects: Restoration project information was collected from a variety of sources including: Contra Costa Watershed Forum Restoration Project Database, San Francisco Bay Joint Venture Restoration Project Database, East Bay Municipal Utility District, East Bay Regional Parks, Contra Costa County Flood Control and Water Conservation District, and local creek and watershed volunteer groups. Data were digitized by Contra Costa County Community Development, 2003.

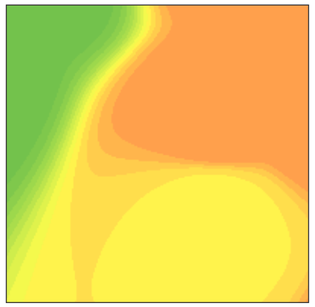
Roads: Thomas Brothers, a mapping and cartography company created the road data used. The 2003 version of the road data were used.



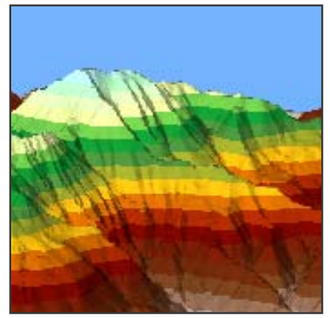
Slope: The slope layer was developed by the Contra Costa County Community Development Department from the countywide DEM. Like the DEM, the slope is represented with a grid system. Each cell in the grid contains a value from 0 (flat) to 223 percent (the steepest slope measured in the County by this method), depending on the steepness of the slope.



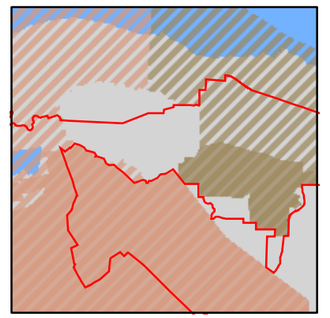
Soils: The U.S. Department of Agriculture's Natural Resources Conservation Service leads the National Cooperative Soils Survey. The data displayed is from the Soil Survey Geographic (SSURGO) database. Information and data can be downloaded from http://www.ca.nrcs.usda.gov/mlra02/.



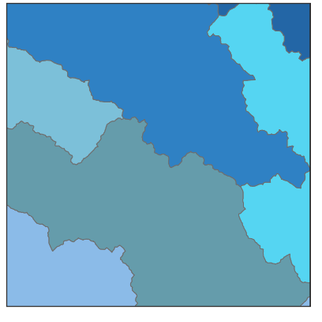
Temperature: A geographic display of summer and winter high and low temperatures was developed by the Contra Costa County Community Development Department using temperature data from the National Weather Service. Thirteen temperatures gauge stations in Contra Costa County provided the base temperature data. Using ESRI 3D Analyst, the base data was interpolated for other county areas.



TIN (Triangulated Irregular Network): A TIN is another means for representing topography. A TIN is created by connecting sample elevation points with lines to form an elevation surface made of contiguous, non-overlapping triangles. This countywide TIN was made from 10-foot contour lines, and is one approach used to make three-dimensional illustrations of the County such as appear in the Atlas.



Urban Limit Line (ULL): Approved by County voters in 1990 and amended by the Board of Supervisors in 2000, the ULL designates areas where the County is prohibited from approving urban land uses. The computer map of the ULL was created by the Contra Costa County Community Development Department in 2003.



Watershed Boundaries: Updated watershed boundaries were created by the Contra Costa County Public Works Department using ESRI's ArcHydro in combination with a 10-foot digital DEM dataset and Contra Costa County streams layer. Boundaries in flat and developed areas were edited using additional background data including: the storm drain inventory, 10-foot contours, formed drainage areas and digital orthophotos (2000). These and other questionable areas were delineated by interpretation (and input from CCC Flood Control Hydrologists and Engineers).

Watershed Vital Statistics

Watershed Size: The area of the watershed was determined by measuring the polygon shape in the GIS Watersheds map layer.

Length of Longest Branch of Creek: The longest continuous stream reach in each watershed was calculated using the Creeks and Drainages map layer. Segments of this longest stream reach may have differing names, but are connected by the flow of water.

Total Channel Length in Watershed: The length of all mapped Creeks and Drainage segments in a watershed were combined to determine the total channel length.

Average Annual Rainfall: Rainfall was estimated by overlaying the Rainfall map layer with the Watersheds, and taking a weighted average of areas between the rainfall isohyetals or contours within each watershed.

Estimated Mean Daily Flow: Mean Daily Flow has been estimated at the mouth of major creeks using formulas developed by staff at the Contra Costa County Flood Control and Water Conservation District. The formulas were derived by correlating observed stream flow records at eight stream gauges in Contra Costa County. The correlation was based on flow records, drainage area, and estimated percent developed. Please note that the Mean Daily Flow estimates represent the average flow per day during an average year. Flows during the wet season or during a wet year would be much higher. Flows during the dry season or during a dry year would be much lower. High-intensity, short-duration rainfalls can significantly increase instantaneous flows and these flows should not be used for design of drainage facilities.

Estimated 100-Year Flood Flow: The predicted flow during a rainfall event so large that it is estimated to occur only once every 100 years. Flood risk and the effectiveness of flood protection measures and facilities is normally gauged against 100 year flood events. Staff from the Contra Costa County Flood Control and Water Conservation District provided estimates of the expected 100-year flood flow at various points throughout the County. The 100-year flood flow estimates may be for creek reaches upstream of the mouth and flows at the mouth would likely be higher. Note the significant difference in the magnitude of the estimated mean daily flow and the 100-year flood flow.

Guide to the Data Tables
The data tables and graphs presented in the Atlas were created by querying the various map layers described on the previous pages. Geographic Information System computer software was used to measure the area and length of features in the map layers. To cross-tabulate map information such as population or land use by watershed, map layers were stacked on top of each other, cut or sorted by the map layer(s) above, and the resulting combined map layer was queried to provide the desired statistics. The sources and disclaimers on the data in the data tables are explained more fully below.

Wildcat Creek Watershed Vital Statistics

Watershed Size	6,848	acres
Length of Longest Branch of Creek	13.43	miles
Total Channel Length in Watershed	22.22	miles
Average Annual Rainfall	24	inches
Estimated Mean Daily Flow	7.7	cfs
Estimated 100-Year Flood Flow	2,280	cfs*
Highest Elevation in Watershed	1905	feet
Population (estimated)	24,000	people
Estimated Percent Impervious	20	%
Recognized Pollutants of Concern	Diazinon**	

* At 23rd Street (5,300 acres upstream, or 77% of watershed)
** Wildcat Creek is listed as an Impaired Water Body in the State's 303(d) list. Diazinon is the Pollutant of Concern.

Highest Elevation: These heights were located using the Elevation Contours map layer. Names provided on topographic maps were inferred from the USGS base maps for the County.

Population: Population was determined by overlaying the U.S. Census Bureau Census Blocks (2000) map layer with the Watersheds, and apportioning the population of Census Blocks spanning more than one watershed between the watersheds based on the portion of the Census Block area within each watershed. Since population is not distributed evenly within Census Blocks, the resulting figures should be considered rough estimates only.

Estimated Percent Impervious: Estimated by overlaying the Impervious Surface map layer with the Watersheds and taking a weighted average, these numbers are approximate only. Please note, the Impervious Surface map layer was developed using Planned Land Use--not actual land use--and may reflect development planned but not built. Discrepancies between planned and actual land use and the uncertainty involved in predicting impervious cover based on land use designations lead to significant uncertainty in the impervious estimates. Consider these figures as ballpark estimates only.

Recognized Pollutants of Concern: Pollutants identified by the State Water Resources Control Board (SWRCB) in their 303(d) list of Impaired Water Bodies for water bodies within this watershed are included in the chart. The SWRCB prepares this list in accordance with requirements of the federal Clean Water Act. If the watershed in question contains no water bodies designated as "Impaired" by the SWRCB, no recognized pollutants of concern are listed. This does not mean such watersheds are free of pollution. For example, the SWRCB has determined that urban streams in the Bay Area are impaired for Diazinon. But the "Impaired" designation can only apply to water bodies identified in the SWRCB Basin Plan for the San Francisco region, and not all minor water bodies are identified in the Basin Plan.

One acre is equivalent to 43,560 square feet, 1/640th of a square mile, or just under one football field (minus the end zones).

Cfs stands for cubic feet per second. For comparison purposes, the flow from a typical 3/4 inch garden house may be about 1/50th of a cfs (approximately 9 gallons per minute) when the valve is fully open.

Channel Length Statistics

The Creeks and Drainages map layer was queried by watershed to develop these statistics. Storm drains and any features missed when compiling the Creeks and Drainages map layer are not reflected.

Type of Bank or Channel: When the Creeks and Drainages map layer was created, aerial photo interpretation, surveys of the flood control channels, and some field-checking by staff and watershed organizations were used to classify/estimate the character of the creek banks or channel type. For instance, if the aerial photo and/or channel design plans for constructed channels showed the creek going underground, that segment of the creek and drainage was classified as "underground". If surveys or aerial photo interpretation revealed that the creek ran through a concrete structure, that segment was classified as "concrete". Bank type and channel condition features less than 100 feet in length were not mapped. Otherwise, bank type was designated as "natural (no obvious reinforcements)". Given the limits of the methodology, the 100 foot minimum on classifying segments, the difficulty of compiling data on more than 1300 miles of creeks, and the omission of storm drain collectors from the data, the bank channel figures clearly underestimate the extent of "non-natural" channel conditions.

Natural (not obviously reinforced): Banks presumed to be in either a natural condition or to not be obviously constructed or reinforced.

Concrete: Banks lined with concrete. Underground segments were also classified as concrete, though in fact the underground segments may be either concrete or metal pipes.

Earth (constructed): Channel banks are made of earth but have been constructed to convey water efficiently and/or prevent bank erosion. Typically, the banks are constructed to a uniform slope and bank vegetation may be frequently managed.

Riprap: Banks lined with large rocks or boulders.

Underground: Creek or drainage flows below the surface. This feature was tracked and queried separately from bank type. The sum of percent natural, concrete, constructed earth, and riprap is 100%. Percent underground overlaps with percent concrete.

Creek Profile

Creek profiles illustrate the gradient of the main stem of the creek channel. That is, these graphs show the elevation of the creek bed at specific distances from the creek mouth. Distance from the creek mouth is not measured in a straight line. It is measured along the creek itself and reflects the sinuosity of the channel. Major landmarks are labeled in the profiles.

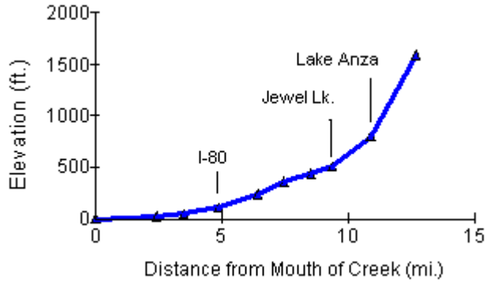
Wildcat Creek Channel Length Statistics*

	Miles	Percent
Length of Longest Branch of Creek	13.43	
Total Channel Length in Watershed	22.22	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	19.98	89.9%
Concrete	0.36	1.6%
Earth (constructed)	1.75	7.9%
Riprap	0.14	0.6%
Underground	0.28	1.3%

*Data relate to mapped channels only. Does not include storm drains. Bank type for segments shorter than 100 feet was not mapped.

Planned Land Uses *Wildcat Creek Watershed*	Acres
Agricultural Lands	52
Business Parks and Offices	0
Commercial	33
Industrial	657
Mixed Use	160
Multiple Family Residential	99
Open Space	252
Parks and Recreation	4,309
Public/ Semi-Public	270
Single Family Residential	828
Water	164
Watershed (Public)	25
Total	**6,848**

Wildcat Creek Profile



Demographic Profiles

Demographic profiles are presented for cities and unincorporated communities (Census Designated Places) in or near the subject watershed. Statistics are provided on population, race and ethnicity, education, and income. The percentage figures for education reflect a subset of the overall population, namely persons 25 years of age or older. The source for all data in the Demographic Profiles is the U.S. Census Bureau's 2000 U.S. Census.

Planned Land Use Tables and Pie Charts

These figures were created by overlaying the Planned Land Use map layer with the Watersheds. As explained previously, the Planned Land Use map layer and data were extrapolated from the Draft Digital County General Plan Map by combining similar categories of land use designations. The Planned Land Use data are not an actual representation or measurement of land use regulations, but a generalized estimation of various land use plans.

Most of the Planned Land Use type categories are self-explanatory, but a few merit further explanation.

The Agricultural Lands category encompasses several similar General Plan designations that restrict minimum parcel size to five or more acres, but lands with such designations may not actually be used for agricultural purposes.

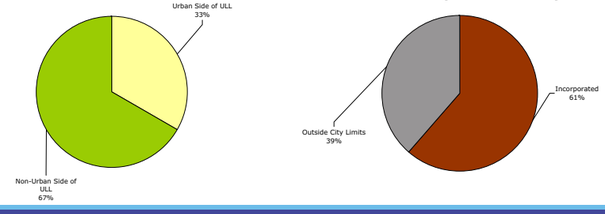
The Public/Semi-Public category covers a variety of uses, from large public transportation facilities like freeways, to government offices, to schools, to private facilities with a public purpose, such as hospitals and cemeteries.

The Watershed (Public) category encompasses open lands owned and maintained by water districts for the purpose of protecting water quality upstream of drinking water reservoirs.

Political Jurisdiction Pie Charts

Incorporated/Unincorporated Pie Charts compare the percentage of the watershed within city limits to the percentage outside city limits. Cities regulate land use within city limits. The County regulates land use outside city limits (see below).

Urban Limit Line Pie Charts compare the percentage of the watershed within the County Urban Limit Line (ULL) [i.e., the "urban side" of the ULL] to the percentage outside the ULL [the "non-urban" side of the ULL]. The County cannot redesignate lands outside the ULL to an urban land use (see below).



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Chapter 1
Contra Costa County Watersheds Overview

This chapter provides an introduction to Contra Costa County and its watersheds. As one might expect in a document dedicated to watersheds, much of the countywide information in this chapter focuses on creeks. The health and character of a watershed is a reflection of the health and character of the communities within it. To help paint a broader picture, information is also presented on political geography, planned land use, demographics, topography and natural hazards. Finally, a series of maps illustrate how different features and forces within the watersheds interact to affect current conditions and indicators of watershed health.

Stephen Joseph

Countywide Creek and Watershed Vital Statistics[1]		
Total Area of All County Watersheds	465,473	acres[2]
Length of Longest Creek in County	34.57	miles[3]
Total Length of All Creeks & Drainages in Contra Costa County	1349.63	miles
Average Annual Rainfall	18	inches
Estimated Total Mean Daily Flow for All Creeks in Contra Costa County	334.2	cfs
Estimated 100-Year Flood Flow for Walnut Creek	25,600	cfs[4]
Highest Elevation in County (Mt. Diablo)	3849	feet
Population (estimated)	948,800	people
Estimated Percent Impervious	35	%
Recognized Pollutants of Concern[5]	Diazinon, Mercury & Metals	

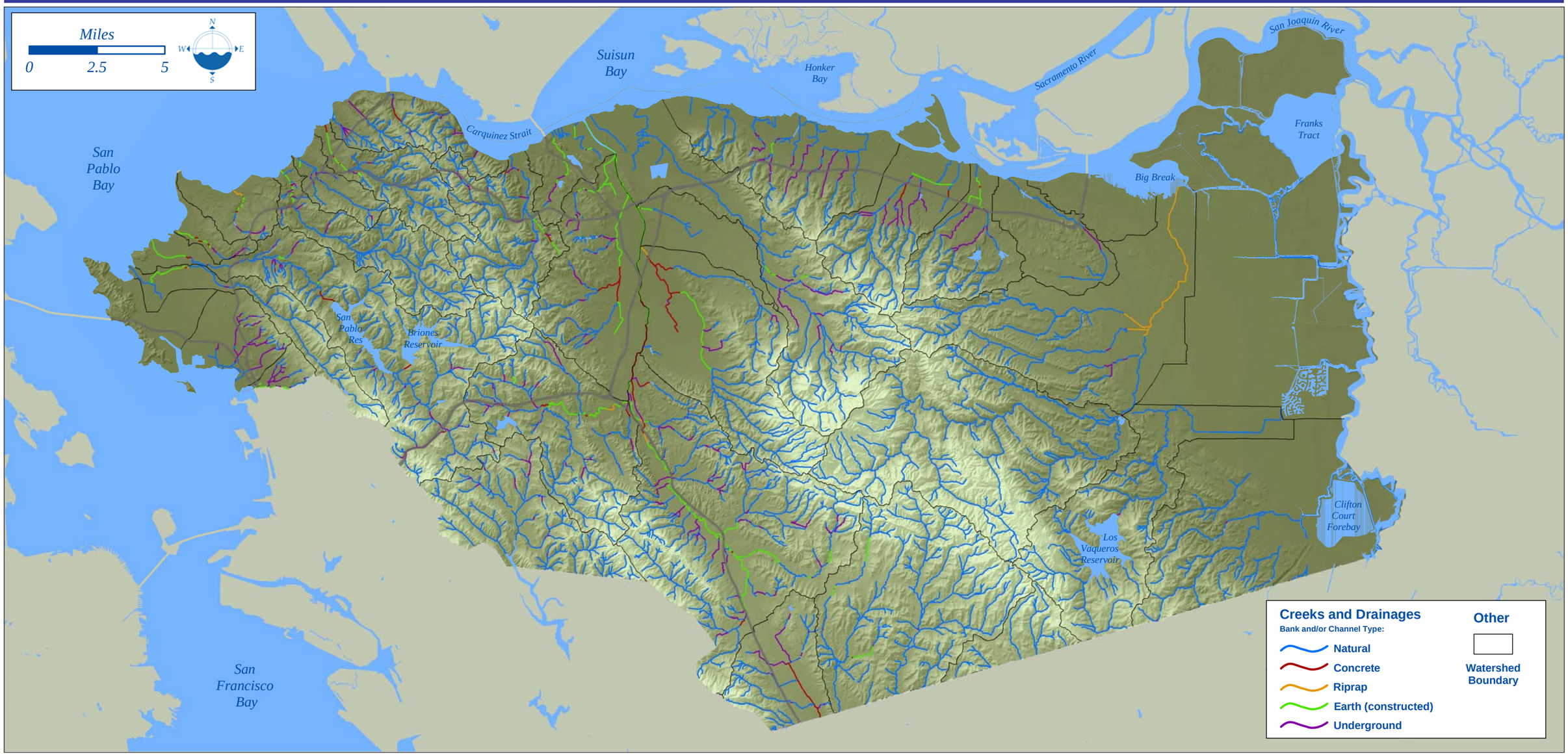
[1] Statistics reflect Contra Costa County portion of watersheds that span multiple counties (e.g. Alameda, Cerrito, San Leandro).

[2] Excludes tidal waters and some Delta islands.

[3] Marsh Creek is the longest creek entirely within the County.

[4] Downstream of confluence with Grayson (largest estimated flood flow in the County).

[5] Twelve water bodies in the County are listed as Impaired Water Bodies in the State's 303(d) list. Diazinon, Mercury and Metals are the Pollutants of Concern for one or more water bodies.



Countywide Creek Channel Length Statistics*

	Miles	Percent
Length of Longest Creek in County **	34.57	
Total Length of Creeks & Drainages in County	1,349.63	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	1,148.16	85.1%
Concrete	133.34	9.9%
Earth (constructed)	56.31	4.2%
Riprap	11.13	0.8%
Underground	112.56	8.3%

Notes on Channel Length Statistics Table:

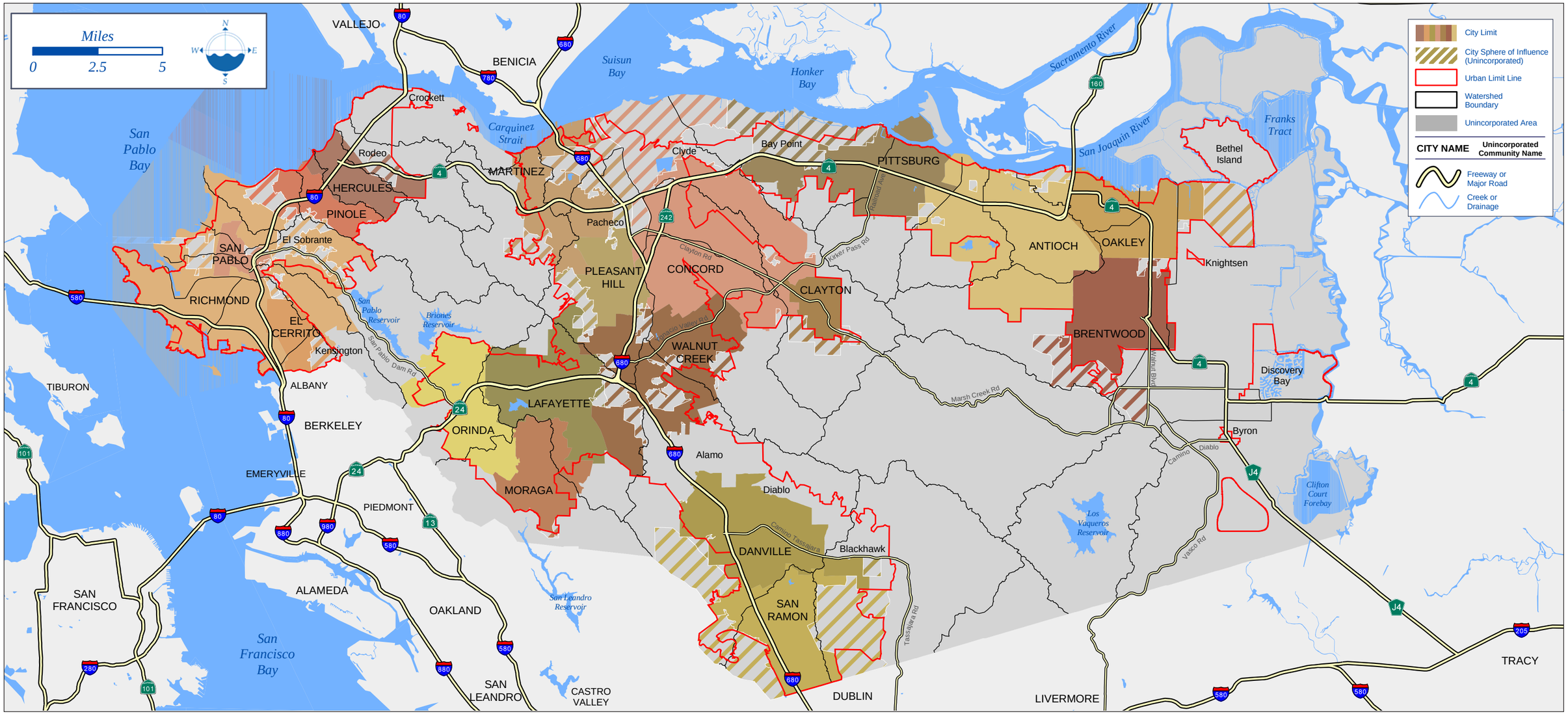
*Data relate to mapped channels only. Does not include storm drains. Bank type for segments shorter than 100 feet was not mapped.

** Marsh Creek is the longest creek entirely within the County.

The Creeks and Watersheds of Contra Costa County

Contra Costa County has 31 major watersheds and sub-watersheds containing more than 1300 miles of creeks and drainages. All but eight of these watersheds are entirely within Contra Costa County. While the Walnut Creek Watershed is very large (93,556 acres) and spans many cities, many of the other watersheds are conveniently "community-sized". For instance, Alhambra and Pinole Creeks are closely identified with (and are important features of) the Cities of Martinez and Pinole respectively.

Creeks and drainages in low-lying urban areas often have concrete-lined or constructed earth banks, or they may actually run underground through pipes and culverts. Such constructed features are designed to manage flood risks and/or minimize the land area necessary to convey water downstream, but may lack the aesthetic and ecological values of a more natural creek system.

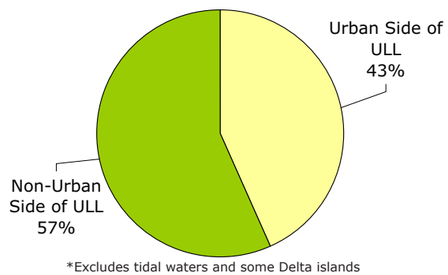


Boundaries in a Watershed

Most watersheds cross political boundaries. City limits, parcel lines, spheres of influence, the urban limit line, and the county boundary were generally created independent of the natural hydrology of the region. As a result, resolving water quality and other issues can demand the cooperation of many different individuals and political jurisdictions.

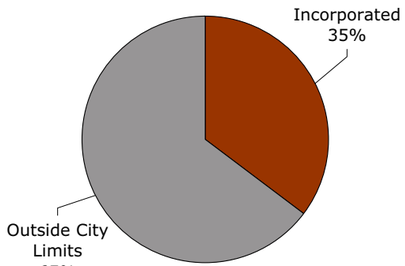
The creeks and watersheds of Contra Costa County are no exception. As illustrated in this map, County political boundaries do not follow creeks or watershed boundaries. The charts below provide information on how much of watersheds fall inside and outside of the key political boundaries in the County.

Portion of Contra Costa County Watersheds Within Urban Limit Line*



*Excludes tidal waters and some Delta islands

Portion of Contra Costa County Watersheds Inside Cities*



What are the Political Boundaries?

City Limits: The boundary of the legal influence of a city government.

Sphere of Influence: The probable ultimate physical boundaries and service area of a city as determined by the Local Agency Formation Commission (LAFCO) .

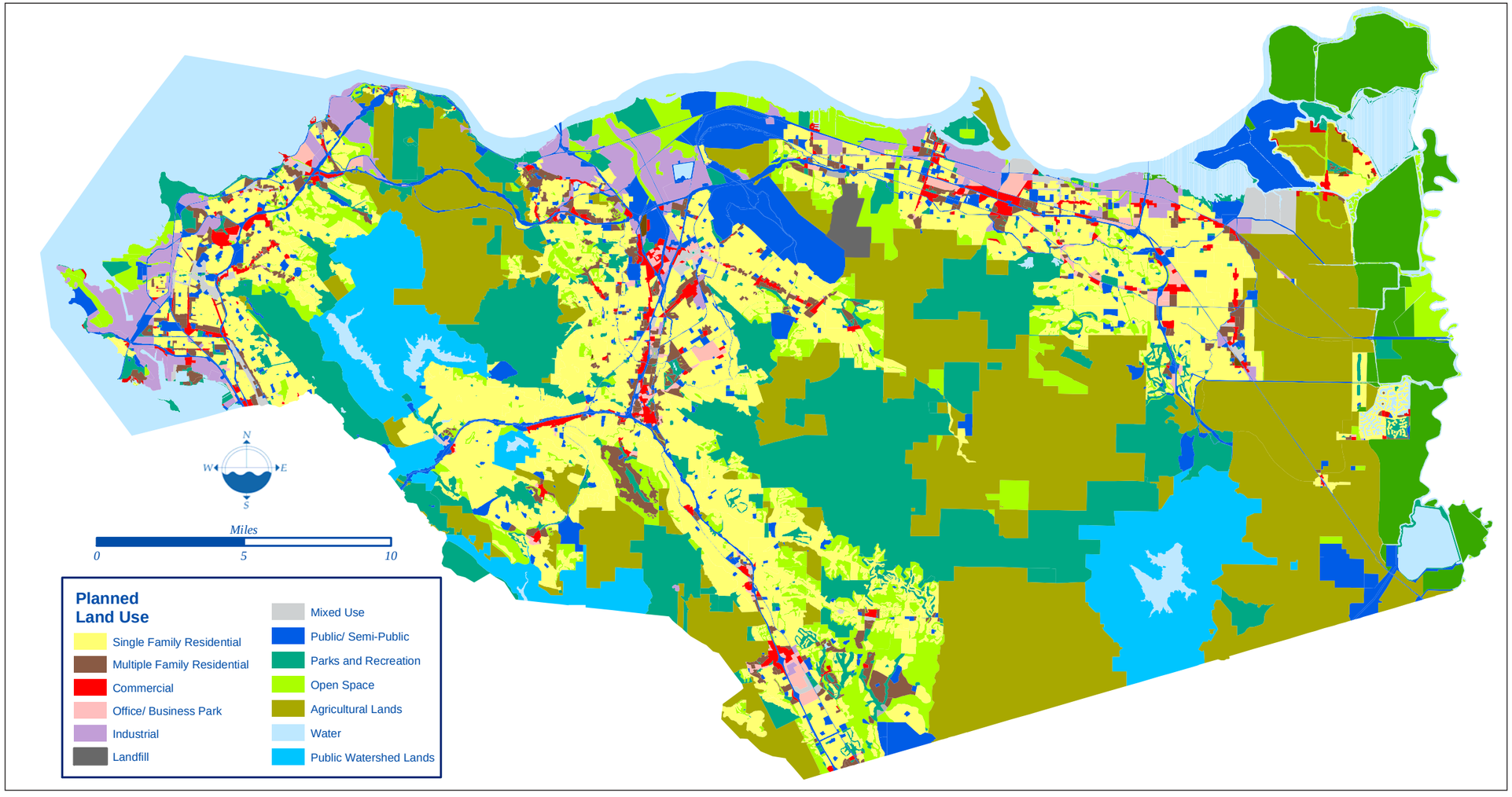
Urban Limit Line: Approved by County voters in 1990 and amended by the Board of Supervisors in 2000, the ULL designates areas where the County is prohibited from approving urban land use.

Planned Land Use in Contra Costa County

Land use in Contra Costa County is planned and regulated by nineteen cities and the County. The cities regulate land use within city limits and the County regulates land use in unincorporated areas. Though the County maintains land use authority within a city's Sphere of Influence, the County and cities cooperate on planning for such areas. Development plans for such areas are often accompanied by annexation application. The map on this page is a simplified, composite representation of Planned Land Use in Contra Costa County. Please consult the Guide to the Map Layers in the Introduction for more information on how this map was created.

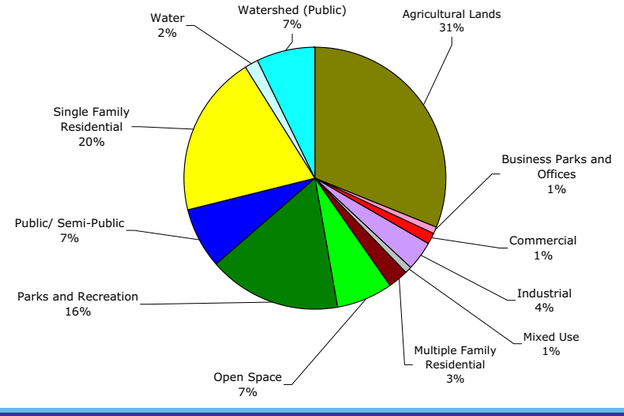
Comparison of this map with the topographical maps presented elsewhere in this Chapter illustrates what may be an obvious point: new and existing development in Contra Costa County is concentrated in valley floors and coastal plains. Major transportation facilities traverse and connect these flatter, more intensively developed areas. Major urban centers in the County include the Interstate 80 corridor along the shore of San Francisco Bay, San Ramon Valley, Ygnacio Valley and other valleys traversed by Interstate 680 and Highway 24 in the central portion of the County, and the plains south and west of the Delta and along Highway 4 and the partially completed State Route 4 Bypass in the eastern portion of the County.

An extensive system of regional parks and public watershed lands has emerged in the County, providing numerous recreation opportunities and protecting the scenic character of the region. Most of these public lands have been acquired by the East Bay Regional Park District (EBRPD), a two-county agency formed by citizens at the height of the Great Depression to purchase and operate parks. Other major providers of parks and public watershed lands include the California Department of Parks and Recreation, the East Bay Municipal Utility District, and the Contra Costa Water District. Detailed maps of protected lands are provided in each watershed chapter.



Current and future efforts to shape land use policy confront significant challenges. Housing remains in short supply and economic development is a constant priority. However, traffic congestion and environmental problems may be aggravated if growth is not managed carefully. Land use planning agencies in the County are now attempting to work together to solve creative solutions to these problems. One approach may be to direct future growth inward and adjacent to existing transportation facilities, thereby providing housing and jobs while protecting open space and maximizing transportation efficiency.

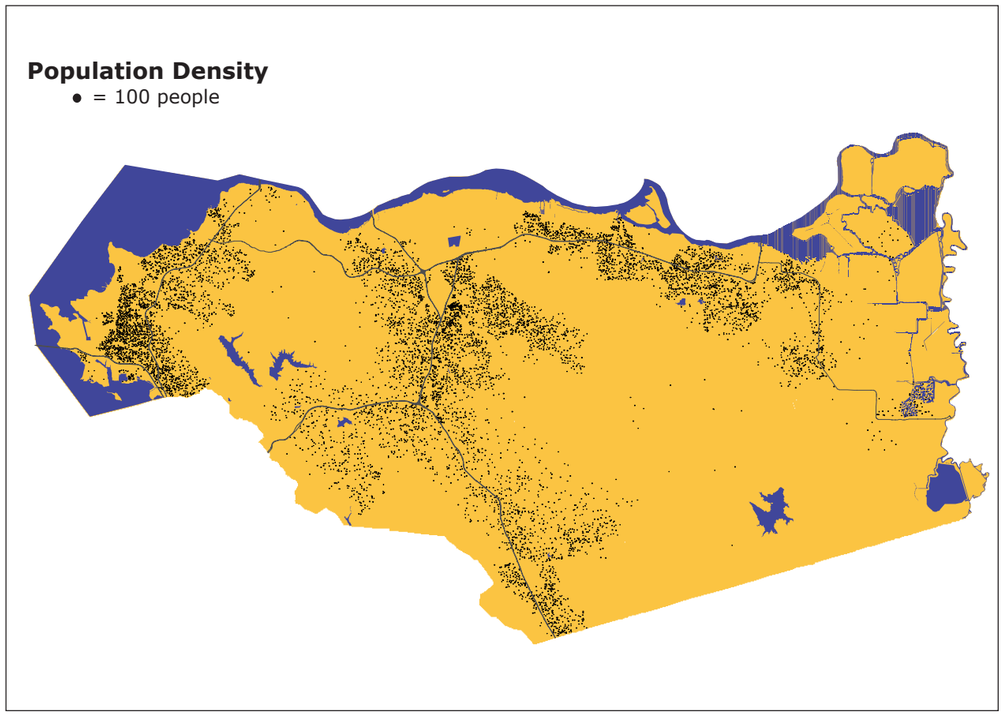
Planned Land Uses in Contra Costa County	Acres
Agricultural Lands	144,888
Business Parks and Offices	3,644
Commercial	6,808
Industrial	16,399
Mixed Use	3,909
Multiple Family Residential	11,802
Open Space	31,991
Parks and Recreation	76,654
Public/ Semi-Public	34,261
Single Family Residential	93,709
Water	7,782
Watershed (Public)	33,622
Total	**465,473**



The People of Contra Costa County

Viewed in the past either as a bedroom community for urban job centers outside the County or as the home for manufacturing facilities and their workers, Contra Costa County today presents a more complicated picture.

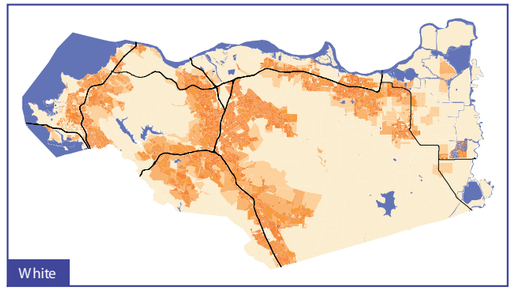
With a population that has increased almost ten-fold since the start of World War II, the County has grown both in numbers and in variety. Burgeoning office and commercial centers now complement the County's residential and industrial backbone. Like the Bay Area, the State, and the U.S. as a whole, Contra Costa County is also increasingly diverse in terms of race and ethnicity. Contra Costa County residents are prosperous relative to the region, state, and country, but more than 7% of residents live below poverty.

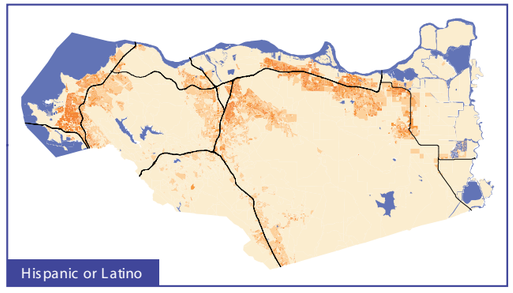


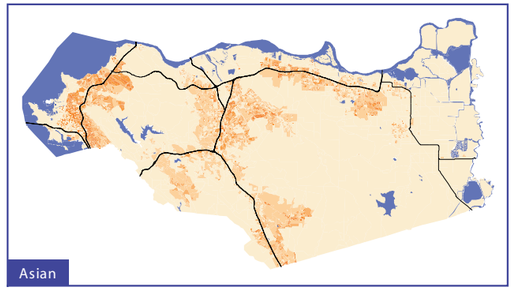
Demographic Profile	United States	California	Bay Area	Contra Costa County
Population	**United States**	**California**	**Bay Area**	**Contra Costa County**
Total Population	281,421,906	33,871,648	6,783,760	948,816
Percent Male	49.06%	49.82%	49.81%	48.83%
Percent Female	50.94%	50.18%	50.19%	51.17%
Population by Race	**United States**	**California**	**Bay Area**	**Contra Costa County**
White	69.13%	46.70%	50.00%	57.90%
Hispanic or Latino	12.55%	32.38%	19.39%	17.68%
Black or African American	12.06%	6.44%	7.33%	9.15%
Asian	3.60%	10.77%	18.85%	10.82%
Some Other Race	1.04%	1.05%	1.13%	0.99%
Two or More Races	1.64%	2.67%	3.30%	3.44%
Income	**United States**	**California**	**Bay Area**	**Contra Costa County**
Per Capita Income	$ 21,587	$ 22,711	$ 30,934	$ 30,615
Median Household Income	$ 41,994	$ 47,493	$ 62,024	$ 63,675
Median Family Income	$ 50,046	$ 53,025	$ 71,333	$ 73,039
Poverty Status	**United States**	**California**	**Bay Area**	**Contra Costa County**
Individuals Living Above Poverty	87.62%	85.78%	91.40%	92.37%
Individuals Living Below Poverty	12.38%	14.22%	8.60%	7.63%
Urban vs. Rural Living	**United States**	**California**	**Bay Area**	**Contra Costa County**
Individuals Living in Urban Areas	79.01%	94.44%	97.42%	97.91%
Individuals Living in Rural Areas	20.99%	5.56%	2.58%	2.09%

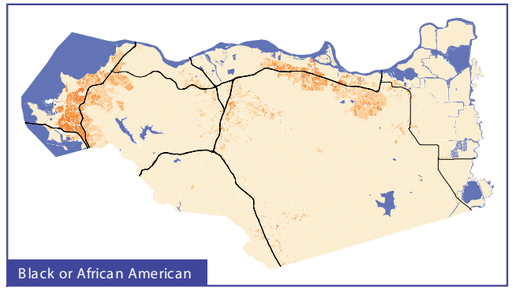
Source: US Census Bureau, Census 2000 Data.

Population Density by Race and Ethnicity





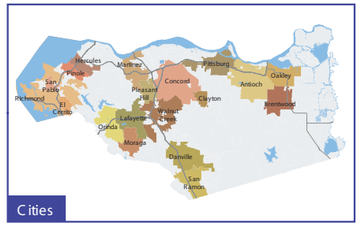




Population Density
(persons per square mile)

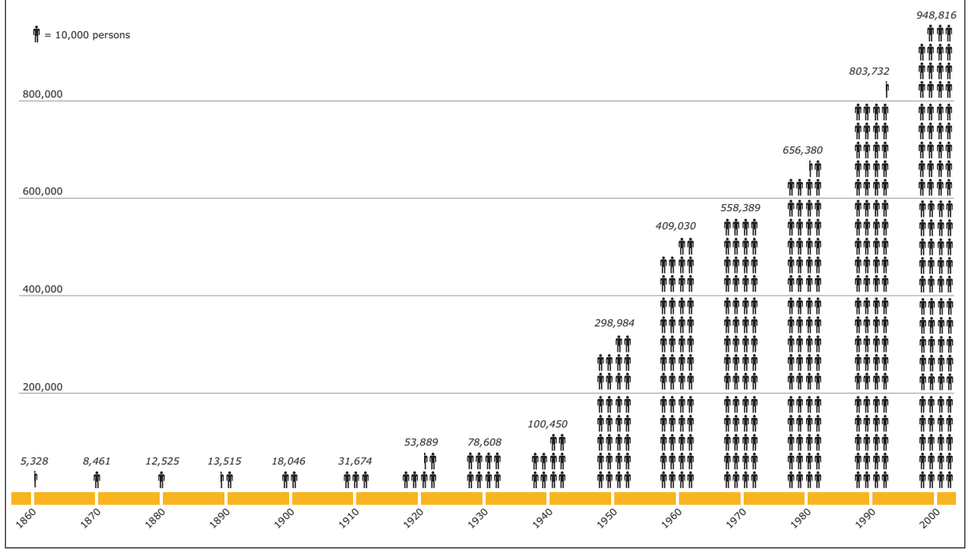
- 0-100
- 101-500
- 501-1000
- 1001-2000
- 2000+

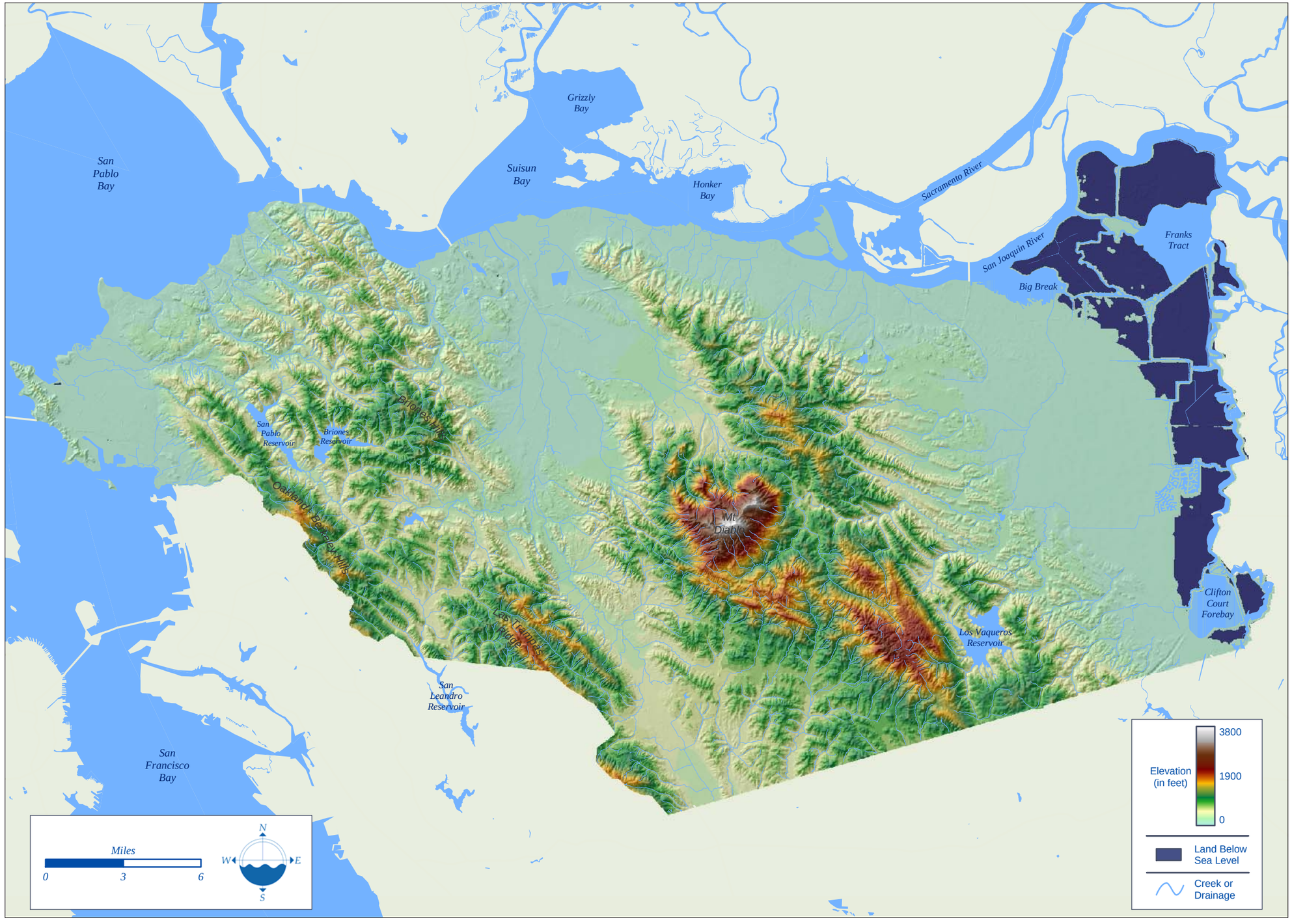
These maps show data for individuals classified as "Hispanic or Latino," along with "non-Hispanic or Latino" individuals in the 3 most predominant racial categories in Contra Costa County, namely "White," "Asian," and "Black or African American." The figures are specific to the census block level.



Source: US Census Bureau, Census 2000 Data.

Population Growth: 1860 - 2000



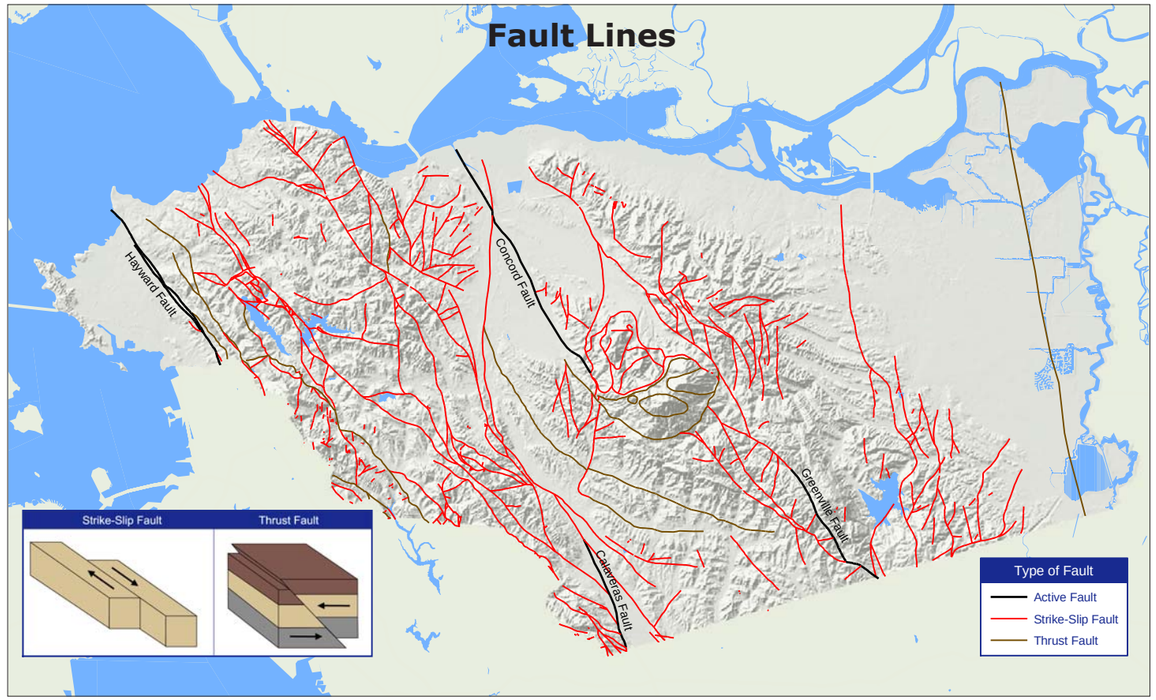


Major Landforms

Two major complexes of mountains, ridges, and hills define the physical and hydrological landscape of the County and shape where residents live and work. The first of these ridgeline complexes centers on Mount Diablo, which rises to 3,849 feet above sea level near the center of the County, and extends south to the Altamont Pass area and the remainder of the Diablo Range in Alameda County. The second major complex of hills and ridges lies between the eastern shore of San Francisco Bay and the major valleys in the center of the County. Las Trampas Ridge, the Oakland Berkeley Hills, and the Briones Hills are some of the well-known features in this second area.

Tectonic processes created these mountain and ridge complexes. As the Pacific Plate has slipped northward past the North American Plate, hills and mountains have been created over the millennia. Like a piece of fabric that folds and creases when the edges are pulled in different directions, the surface of Contra Costa County has been pulled northward on the bay shore and southward along the edge of the Central Valley, creating a series of folds and creases that become ridges and valleys. Due to the orientation of the tectonic movement, ridgelines in the County often run from the northwest to the southeast.

These mountain and ridge complexes form the headwaters for nearly all the creeks in the County. Most of these headwater areas have rugged terrain and are not heavily populated or developed. Many headwater areas are used for private rangeland, public parks and watershed land. As creeks flow down to major valleys and coastal plains, the surrounding watershed becomes increasing developed. This trend--light development in the upper watershed and heavier development in the lower watershed--is common in Contra Costa County.



(Continued from left)
At the north of the County, the hills and land ultimately recede to San Francisco Bay, the Carquinez Straits, Suisun Bay and the Sacramento-San Joaquin Delta. Water that falls in the Great Central Valley of California and in most of the Sierra Nevada Mountains ultimately flows to the Pacific Ocean through these water bodies and along the shorelines of Contra Costa County. More than half of California's water needs (and a large portion of the County's) are met with water pumped from the Delta in Eastern Contra Costa County (Clifton Court Forebay is the primary diversion point). All of these Bays and much of the Delta is tidally influenced. Delta islands are kept dry by peripheral levees—the interiors of these islands have subsided below sea level as soils reclaimed from marsh have oxidized. Major levee breaks have created new water bodies such as Franks Tract and the aptly named Big Break.

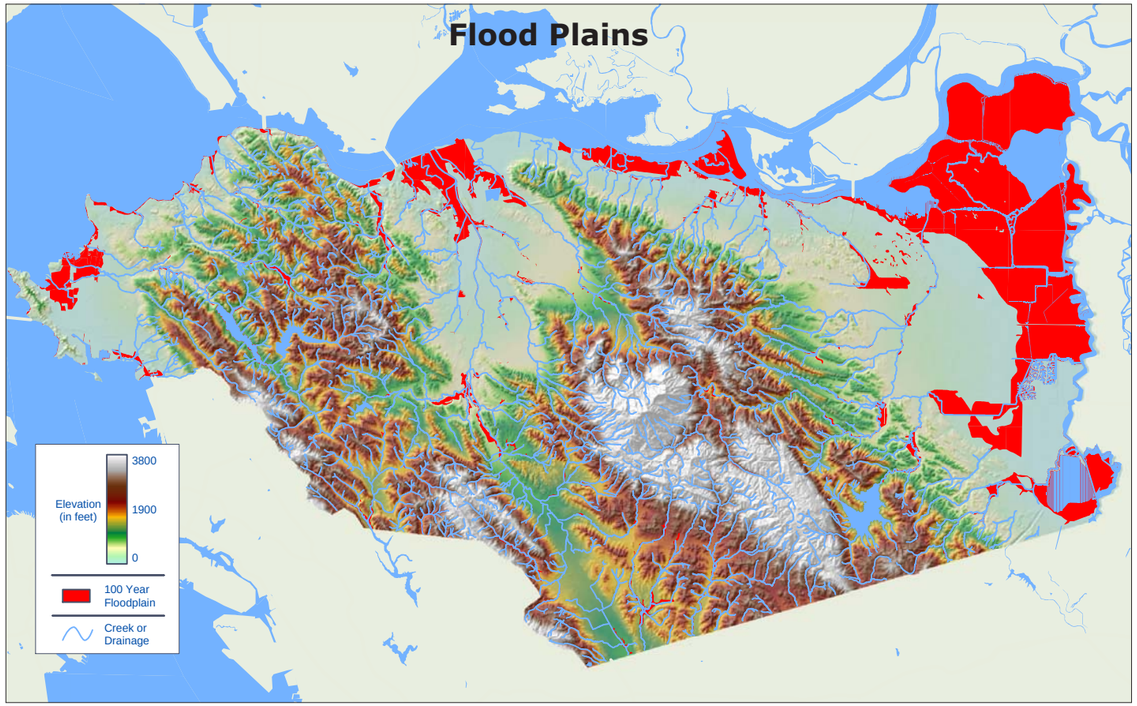
Natural Hazards

Some of the natural hazards confronting Contra Costa County are illustrated on this page. Each map is briefly explained below.

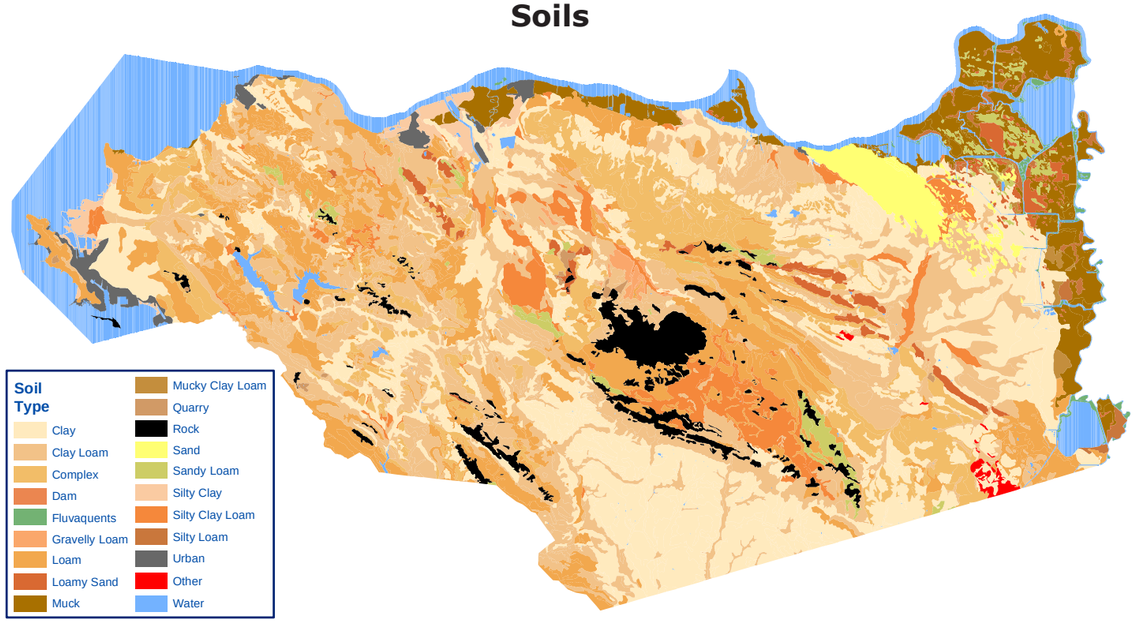
Earthquake Fault Lines: As the Pacific and North American Plates move in different directions, the earth's crust fractures along fault lines and occasionally ruptures, causing earthquakes. U.S. Geological Survey information on the location of fault lines is presented above.

Slides and Earth Flows: There are many different types of landslides; some slow and creeping, some more violent. Soil saturation due to heavy rain is a common cause of landslides. One way to predict future landslides is to examine past landslides. The U.S. Geological Survey has prepared such a study in Contra Costa by examining topographic shapes to recognize landslide signatures. Most of the historic slides they mapped range in size from a few acres to several square miles, and most show no evidence of recent movement.

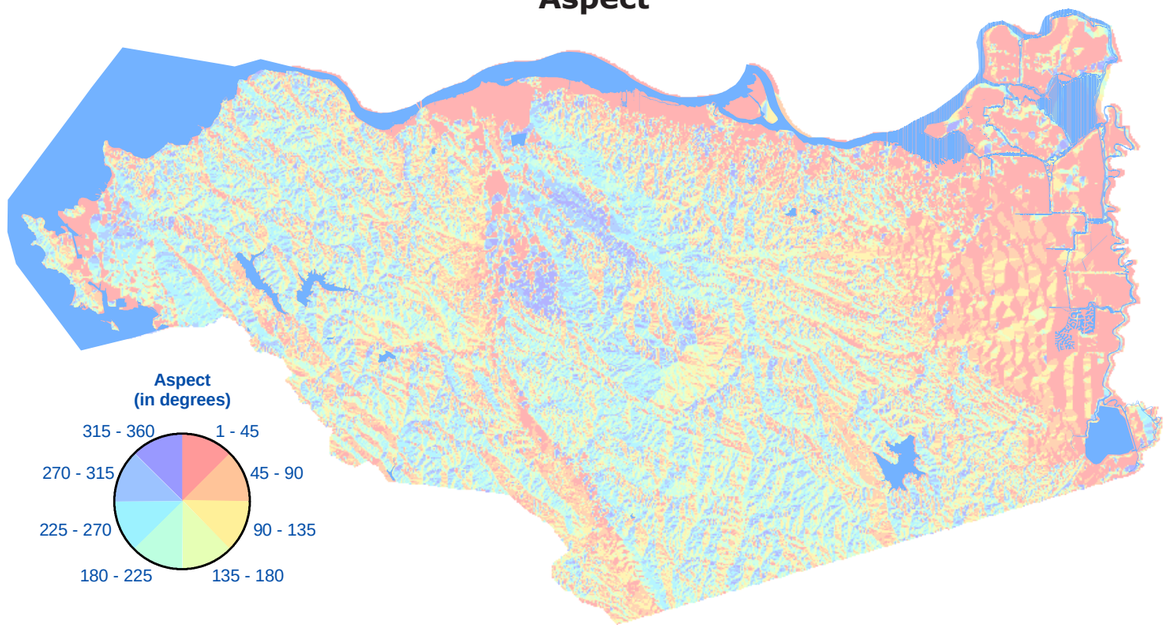
Flood Plains: Low-lying areas near water bodies have an increased risk of flooding. The Federal Emergency Management Agency has estimated flood risk by identifying those areas that are at risk of flooding at least once every 100 years. "Special Flood Hazard Area" is the official name for the areas marked as 100-Year Flood Plain on the map.



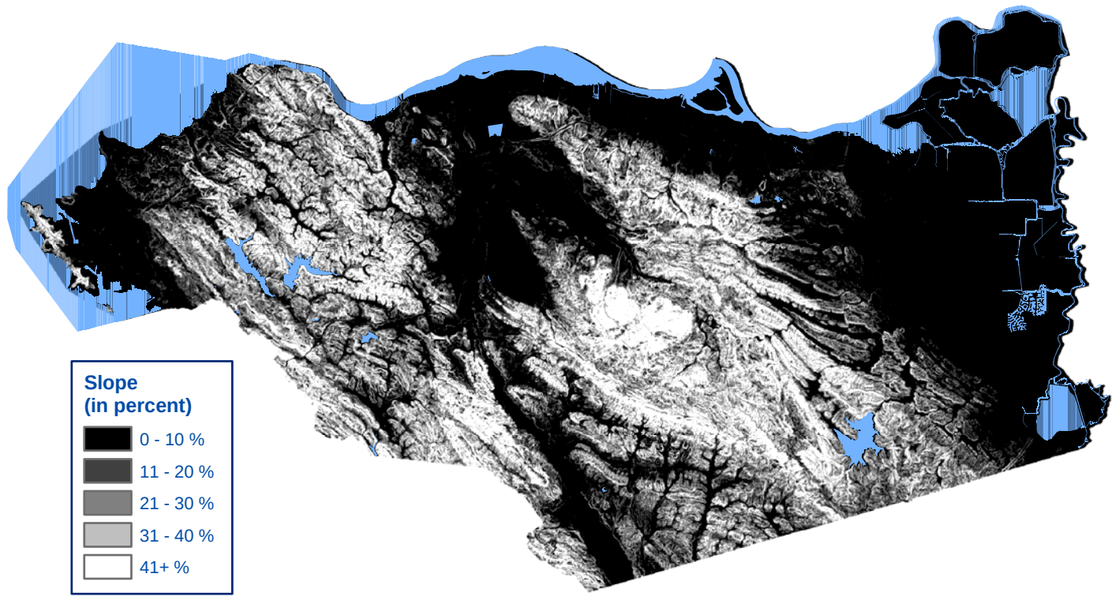
Soils



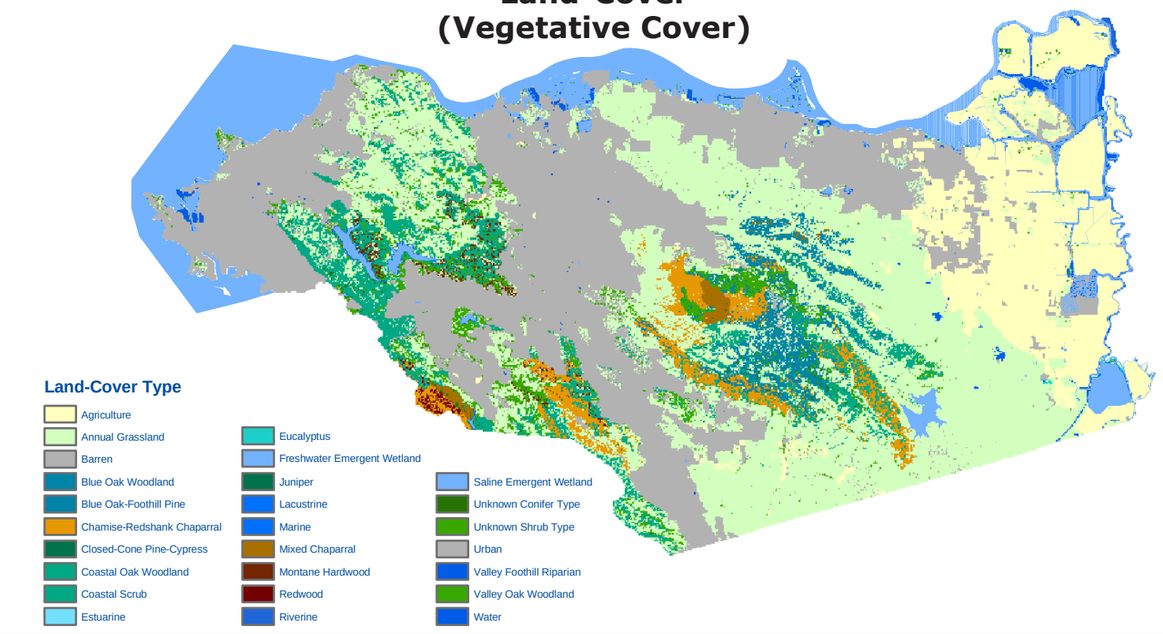
Aspect



Slope



Land-Cover (Vegetative Cover)



Soils, Slope, Aspect, and Land-cover

The four maps on the previous page illustrate three important and related physical features of the landscape and one feature, land-cover, that is strongly influenced by physical conditions.

Soils: The map on the facing page is a simplified representation of Natural Resource Conservation Service data on soil types. Discrete soil types have been combined into broader type categories.

Slope: Steeper slopes are shown with lighter colors. Darker colors indicate flatter areas. Many planning agencies restrict development on slopes greater than 26%.

Aspect: Aspect refers to the compass direction toward which land tilts. For instance, slopes facing south and east are colored yellow and greenish yellow. Slopes facing the opposite direction, to the north and west, are colored different shades of blue.

Land-cover: The land-cover map shows the predominant vegetative cover in the County, based on data from the California Department of Forestry and Fire Prevention. Such maps are often referred to as land-cover maps rather than as vegetation maps because, in addition to features such as patches of oak woodland and annual grassland, such maps also identify categories such as "urban" that are not vegetation types.

Relationships Between Soil, Slope, Aspect and Land-cover

The series of figures on this page illustrate how topography can influence soil and land-cover in a small area of ridges and valleys in eastern Contra Costa.

Map 1, Aerial View: This is an aerial view from directly overhead. Note the striped character of the vegetation.

Map 2, Oblique Aerial View: This is an aerial view of the same area, but represents the vantage one might have from a helicopter flying just south of the land in the photo.

Map 3, 3D Aerial View: In this figure, the image in Map 2 has been represented in three dimensions. This was done with special software that drapes flat map layers over a three-dimensional model of elevation. Note that, when viewed from the south, some of the wooded slopes nearly disappear from view.

Map 4, 3D View of Aspect: The orientation of the hillsides is more obvious here. Blue colors face south and west. Pink and red colors face north and east.

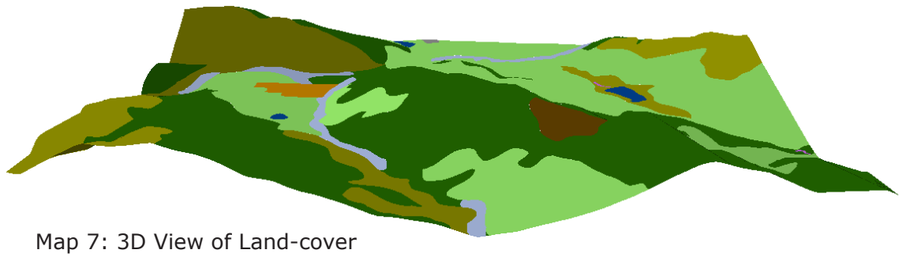
Map 5, 3D View of Slope: Steeper slopes (white and light gray) are found on the sides of the ridges. The valley floors are flatter (black).

Map 6, 3D View of Soils: Note that soil types also have a striped appearance that corresponds with locations and orientations of ridges and valleys. Valleys floors often have richer, deeper soils than ridgelines because soil particles accumulate in valleys after having been washed down from the hills.

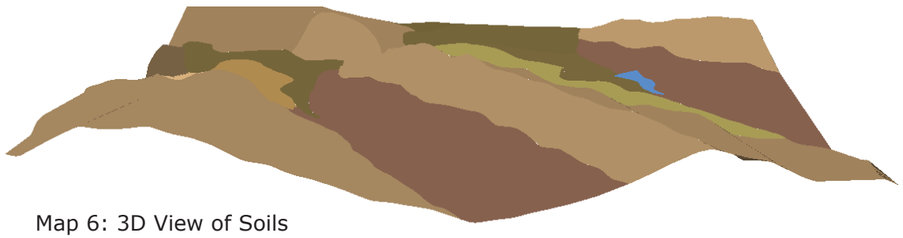
Map 7, 3D View of land-cover: Valley floors and ridgelines of different orientations support very different vegetation types. The sun is usually in the southern sky at this latitude, so vegetation types adapted to hotter, drier conditions typically populate south-facing slopes, while those favoring moister, cooler conditions favor north facing slopes. Grassland (light green) is found on flatter and many south-facing slopes, oak woodland (darker greens) predominates in north-facing slopes, and riparian vegetation (blue-gray) is found at bottom of valleys where the streams are. Of course, many other factors such as climate also affect vegetation, but the correlation between aspect and vegetation is especially striking in much of Contra Costa County.

Map 1: Aerial view of ridge and valley complex in eastern Contra Costa County

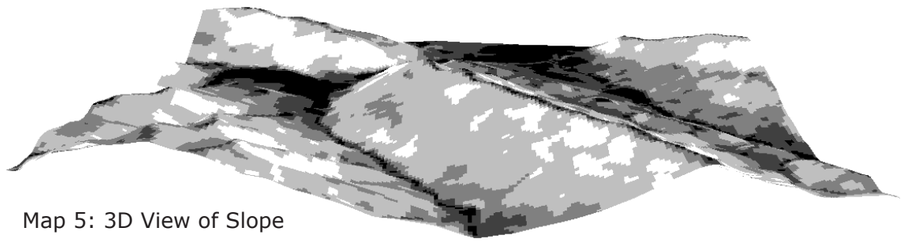
Map 2: Oblique view



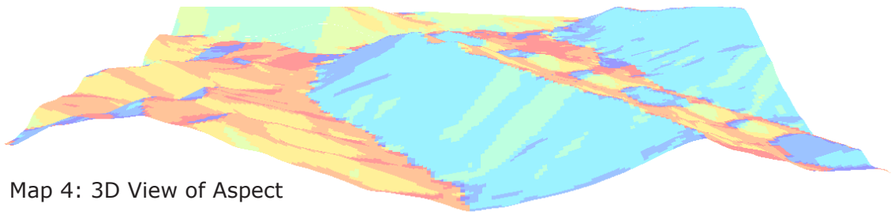
Map 7: 3D View of Land-cover



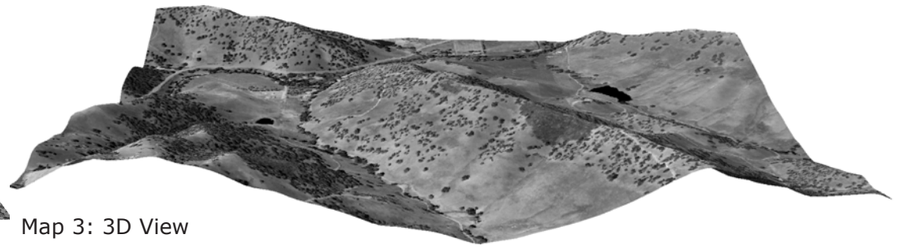
Map 6: 3D View of Soils



Map 5: 3D View of Slope



Map 4: 3D View of Aspect



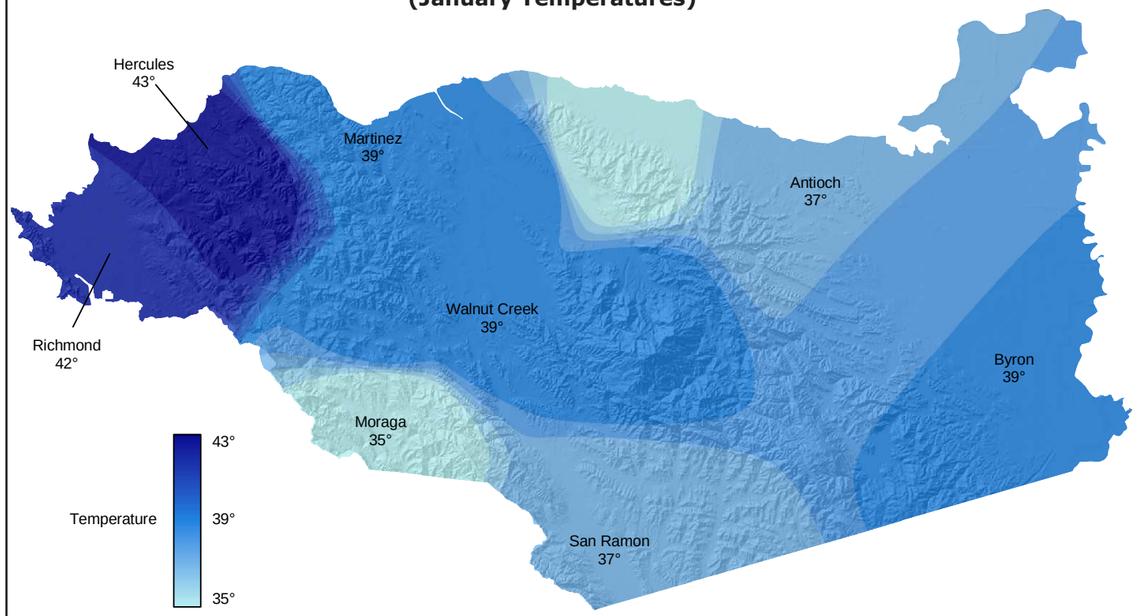
Map 3: 3D View

Temperature

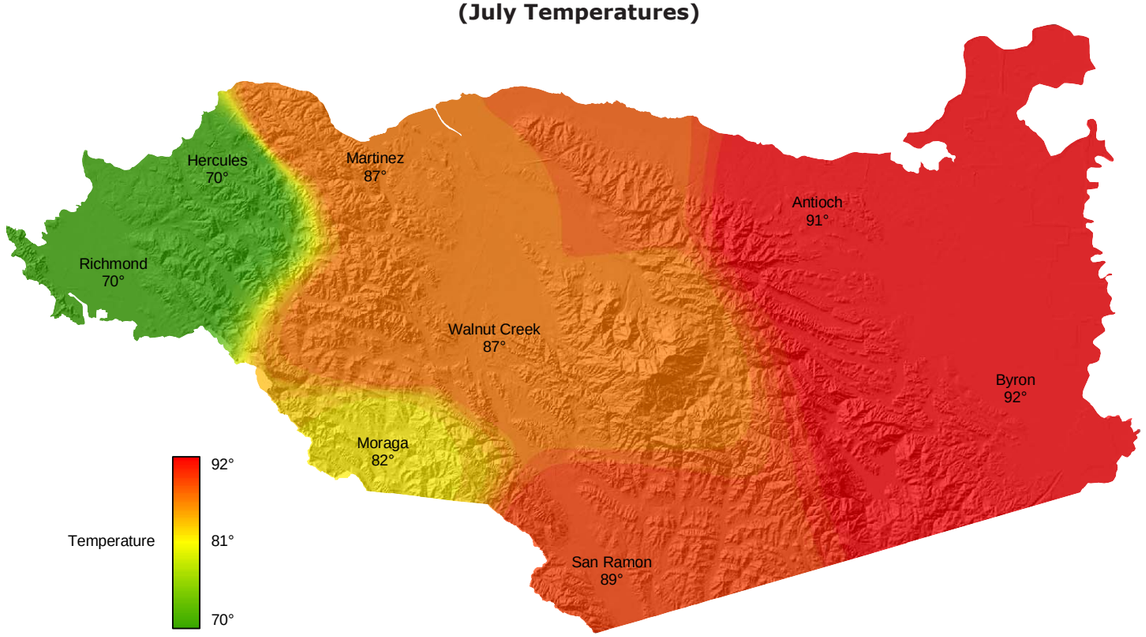
Though considered to have a "Mediterranean" climate with mild winters and hot dry summers, Contra Costa County's climate is distinctly varied across the landscape. Seasonally more temperate and mild temperatures occur in the western part of the county. The more extreme temperatures are seen the eastern part of the county, with winter lows in the upper 30's and summer highs above 90 degrees Fahrenheit.

The consistently cool waters of the Pacific Ocean and San Francisco Bay moderate the summer and winter temperatures in Contra Costa County, though this influence diminishes with distance. Topography also plays an important role. The hills east of Richmond and around Mount Diablo can hold back cool, coastal fog in the summer. In the winter, the hills partially block cold air and tule fog that settles in the inland valleys.

Average Winter Lows (January Temperatures)



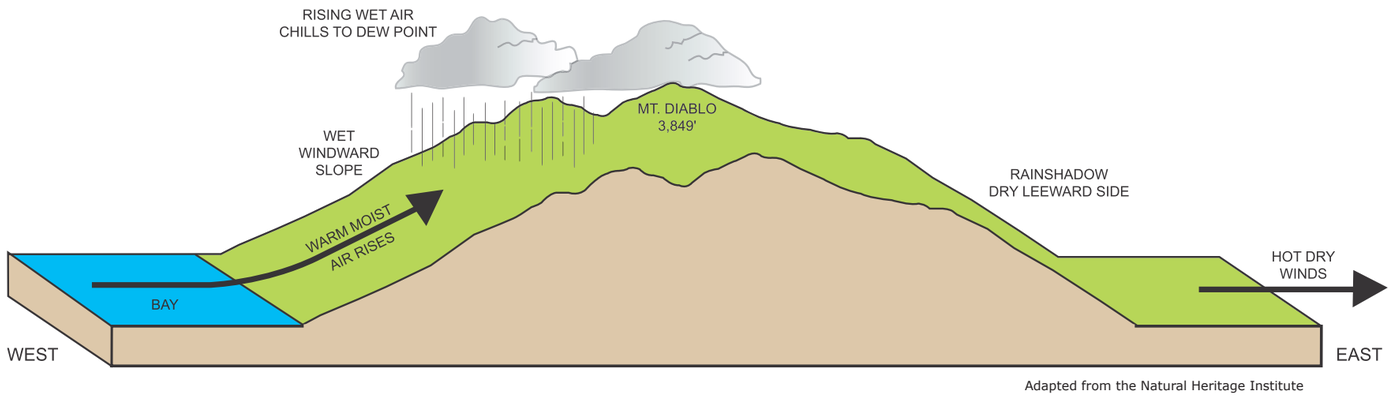
Average Summer Highs (July Temperatures)



Rain

Just as seasonal temperature varies greatly across the county, so does precipitation. During the wettest months of the year, parts of the county receives up to 8 inches of rain per month, while during dryer Summer months areas of the county receive little to no monthly rainfall.

The amount of rain that falls in the County depends on the season, location, and the topography. Generally, the western part of the county receives more rain than the eastern part. The East Bay Hills provide the first topographical barrier that moisture-rich clouds encounter, forcing them to release water. This phenomenon is called orographic precipitation.



Adapted from the Natural Heritage Institute

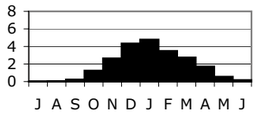
Rainshadow Effect

Orographic precipitation occurs when humid air is forced to rise up the slopes of hills and mountains. As the air rises on the windward side of the mountain, it cools. If the temperature drops to its dew point, condensation occurs, and clouds form and release moisture (rain). As the rising air passes the top of the range, it begins to descend the leeward side. As it descends, the temperature rises and condensation stops, as does precipitation. This leeward side of the range is in the rain shadow of the mountain. There are consecutive rainshadow effects in the county: first as moisture encounters the East Bay Hills, and second as remaining moisture meets Mount Diablo.

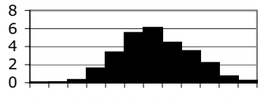
Average Annual Rainfall Totals

(1/2 inch interval contours)

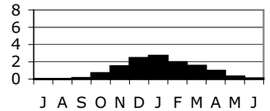
Richmond
Annual Average: 22"



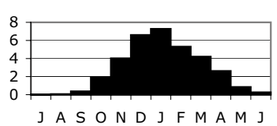
Mount Diablo
Annual Average: 28"



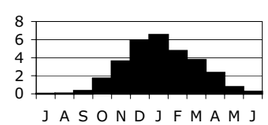
Brentwood
Annual Average: 12.5"



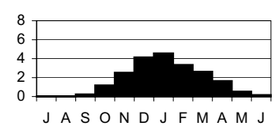
Tilden Park
Annual Average: 33.5"



Orinda
Annual Average: 30"



Walnut Creek
Annual Average: 21"



Rainfall (inches per year)

9.75 — 35

Rain Gauge Station

Miles

0 — 5 — 10

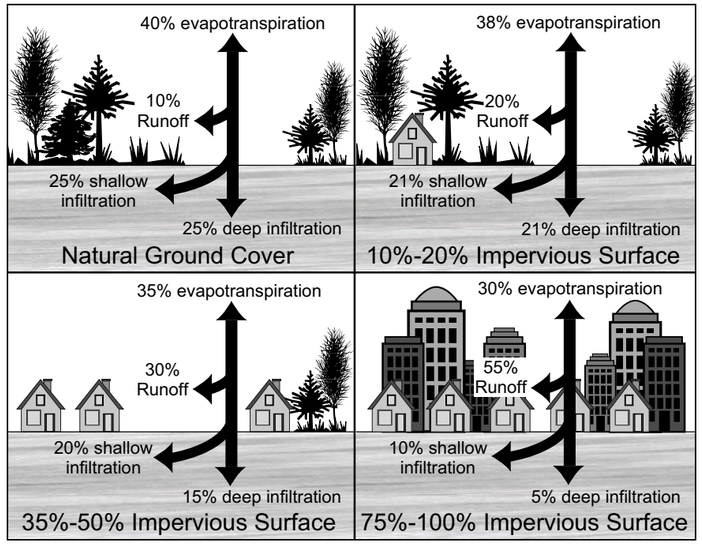
N W E S

Impervious Surface and Runoff

When storm water reaches the earth's surface, it can do one of three things: 1) evaporate into the atmosphere, 2) infiltrate the soil or 3) run off as surface flow. The information on this page concerns the latter two routes water can take.

Water that filters through the soil, and is not absorbed by plants, recharges natural underground aquifers. This long-term storage system provides the base flow for creeks during dry periods. Impervious surfaces (paved roads, houses, asphalt parking lots, etc.) prevent water from reaching aquifers by creating an impenetrable layer between the water and the soil.

Water that does not evaporate or infiltrate, runs off as surface flow. This process naturally occurs when soils are saturated. Water flows overland to natural drainages and creeks, and then flows to the Bay. This process is amplified and accelerated by impervious surfaces in the watershed. The water is rapidly funneled into gutters, constructed storm water networks and natural creek drainages.



Adapted from US EPA and Leopold from the Natural Heritage Institute

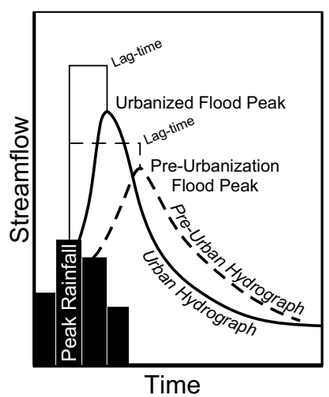
The rate at which water runs off or infiltrates the ground is determined by a number of factors: landcover, imperviousness, soil type, slope, and soil saturation. The maps on the facing page illustrate the natural permeability of the soils in the county, the human-created impervious surfaces in this county, and the resulting overall permeability.

How Impervious Surfaces Impact Watersheds

Water arrives in creeks at a much greater volume and much more quickly than it would in an unaltered watershed. The short-term increased flow in creeks from a storm event can cause channel erosion, damage riparian areas, increase flooding and wash more pollutants and sediment into creeks and other water bodies.

One way to understand the impacts of increased runoff from impervious surface on stream flow is through the use of a hydrograph. A hydrograph plots the rate of runoff against time. A storm event (rainfall) is also often represented on the graph.

In the hydrograph shown to the right, a storm event is represented with a bar graph. There is a natural lag time between peak rainfall and the peak flow in the creek. The longer this lag time is, the lower the corresponding peak flow, and thus risk of flooding and degradation of riparian habitat. Two scenarios are illustrated in the hydrograph: pre-urbanized (dashed line), and urbanized (solid line). This very generalized hydgograph illustrates the change in lag time and peak flow as a watershed is urbanized.



The varied hydrologic conditions, soil patterns, and human-created impervious surface across the county result in different run-off patterns. In a comparison of undeveloped and developed parcels of land in Pleasant Hill, Richmond and Brentwood illustrate not only the naturally occurring difference in ground drainage, but also the impact of increased urbanization.

Comparison of a Developed Acre in Pleasant Hill, Richmond, and Brentwood

Storm Parameters: 3-Hour, 10-Year Storm - Mean Seasonal Precipitation Zone = 18.75"

Comparison Of An Undeveloped and Developed Acre Parcel - Pleasant Hill Area

Results:

Undeveloped Acre Runoff:	17,380 gallons -- 0.053 Acre-feet
Single Family Housing:	26,340 gallons -- 0.081 Acre-feet
Commercial:	28,785 gallons -- 0.088 Acre-feet

Conclusions:

An acre of land in the Pleasant Hill area will have an increase of runoff of 52% when developed to Single Family Housing and 66% when developed to commercial.

Comparison Of An Undeveloped and Developed Acre Parcel - Richmond Area

Storm Parameters: 3-Hour, 10-Year Storm - Mean Seasonal Precipitation Zone = 22.0"

Results:

Undeveloped Acre Runoff:	22,000 gallons -- 0.068 Acre-feet
Single Family Housing:	30,960 gallons -- 0.095 Acre-feet
Commercial:	33,400 gallons -- 0.103 Acre-feet

Conclusions:

An acre of land in the Richmond area will have an increase of runoff of 41% when developed to Single Family Housing and 52% when developed to commercial.

Comparison Of An Undeveloped and Developed Acre Parcel - Brentwood Area

Storm Parameters: 3-Hour, 10-Year Storm - Mean Seasonal Precipitation Zone = 12.0"

Results:

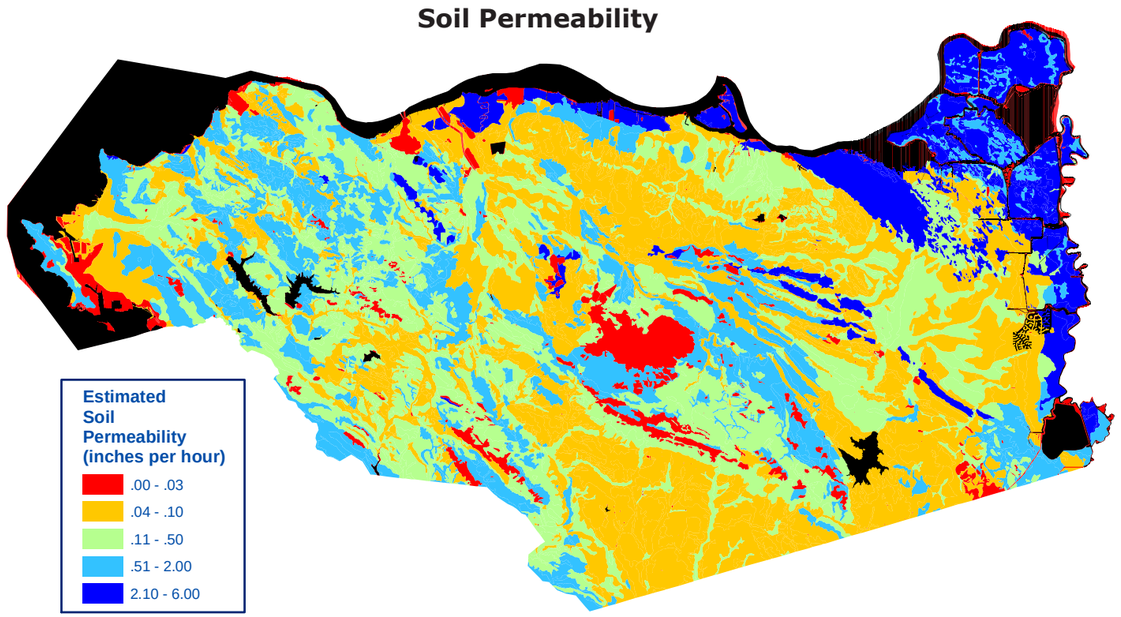
Undeveloped Acre Runoff:	7,875 gallons -- 0.024 Acre-feet
Single Family Housing:	16,837 gallons -- 0.052 Acre-feet
Commercial:	19,281 gallons -- 0.059 Acre-feet

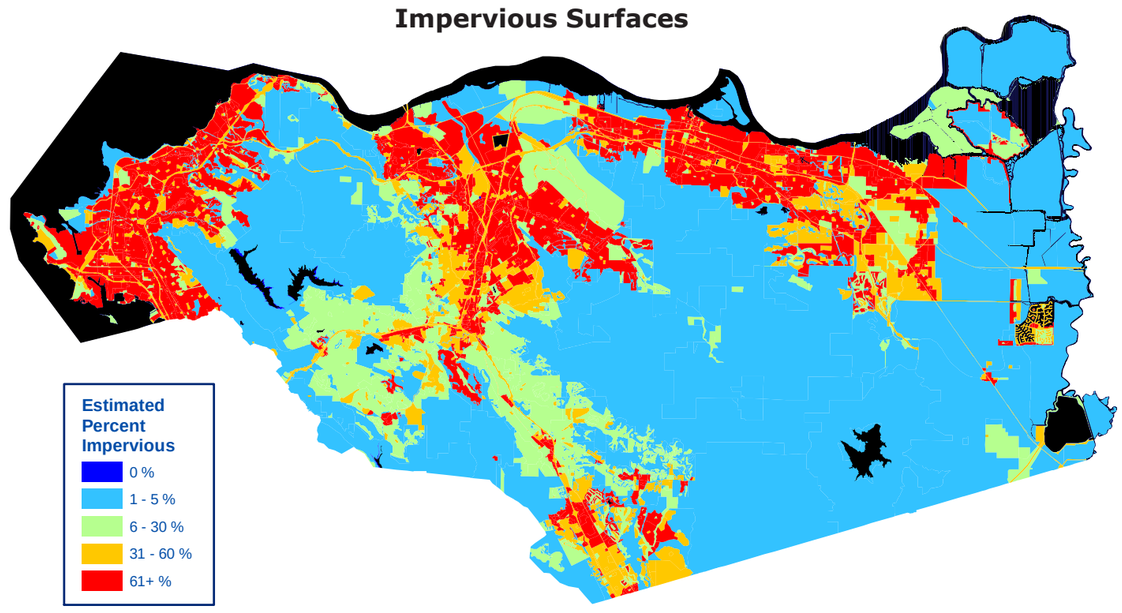
Conclusions:

An acre of land in the Brentwood area will have an increase of runoff of 114% when developed to Single Family Housing and 145% when developed to commercial.

Source: Mal Weston, CCC Flood Control

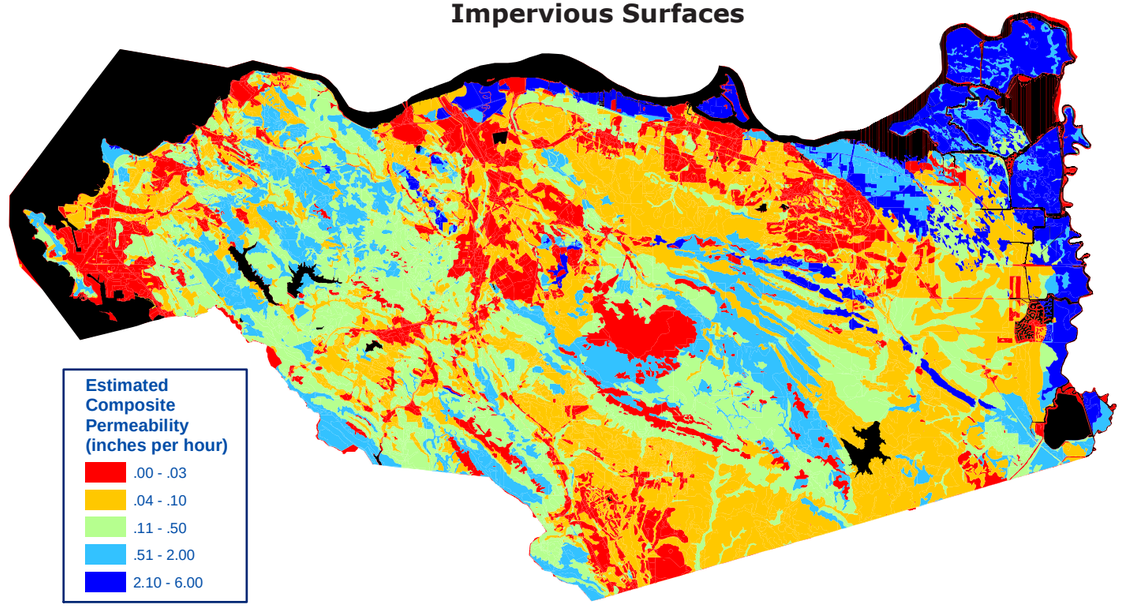
The amount of impervious surface in a watershed is an important factor in predicting creek and flood plain health. As the area of impervious surface in a watershed increases, creeks and flood plains can be affected by rapid increased flow and decreased water quality.





Soil Permeability: Some soil types can absorb water more rapidly than others. Rock can absorb little or no water, while sandy soils absorb water very quickly. The map in the upper left of this page presents the soil permeability ratings for the Natural Resource Conservation Service soil data. Red areas have very low permeability and correspond with rocky areas such as Mount Diablo. Dark blue areas are very permeable.

Impervious Surface: Percent impervious has been estimated from Planned Land Use. With guidance from staff at the County Public Works Department, the percent of impervious surface was estimated for different land use categories based on past evaluations of specific areas. These impervious estimates were applied to the Planned Land Use data to create the map in the upper right corner of this page. Please note that this method produces a rough estimate of percent impervious at buildout.



Composite of Soil Permeability and Impervious Surface: To illustrate one manner in which natural and constructed conditions influence watershed hydrology, the Soil Permeability map and the Impervious Surface map were combined to form the map at the bottom center of this page. To combine the maps, the soil permeability was reduced in proportion to the estimated percent of impervious surface above the soils.

The composite map shows the influences of both components. Though undeveloped, Mount Diablo (at center) already had a low permeability rating and thus continues to appear red or fairly impermeable in the composite. However, areas of the County with significant impervious surfaces (red) fall on areas with mixed natural soil permeability (many colors) reducing the composite permeability (many more reds and yellows in the map at bottom as compared to the map at the upper left). Areas such as the extreme eastern edge of the County that have high soil permeability (blue) and low percent impervious (blue) continue to have a high composite permeability (blue).

Information displayed on the maps below show what is known of the historical status and current distribution of *Oncorhynchus mykiss.* This species is known as both steelhead and rainbow trout, depending on whether an individual matures in the ocean (steelhead) or in fresh water (resident rainbow). Steelhead have a more plastic life history than many other Pacific salmon species in that they are known to have the resident (non-anadromous) form and also can repeat spawn in some instances, a process known as iteropary.

Although steelhead are seen migrating through very degraded channels, they generally use "high quality" habitat areas for spawning and rearing. Steelhead spawn between December and April in small, often well-shaded streams with shallow, cool water moving over a suitably sized substrate of gravels or cobbles. Water velocities in spawning areas are often in the range of two feet per second, allowing oxygenation of the eggs within steelhead nests, or "redds."

Steelhead eggs hatch in approximately 30 days, and the fry emerge from the gravel four to six weeks after hatching. Hatching success is highest when temperatures are 56 degrees Fahrenheit or less, with temperature tolerance increasing somewhat with maturation. (*Oncorhynchus mykiss* juveniles and adults may withstand water temperatures of up to 70 degrees Fahrenheit for shorter times.) Juveniles move to portions of creeks and streams with appropriate cover and food supply. Ideal rearing habitat for *O. mykiss* typically has cold water that persists, at least in pools, throughout the year. Steelhead may live between one and three years in freshwater before migrating to the ocean. In the ocean, steelhead may spend one to four growing seasons before retuning to freshwater to spawn.

Alterations to creek channels in Contra Costa County have blocked steelhead passage to historical spawning and rearing areas, both reducing the range of the species and decreasing its abundance. Water diversion, sediment loading, pollution and other factors can degrade habitat and harm surviving populations. Efforts to restore steelhead populations to Contra Costa County include initial projects focused on barrier modifications to allow access to historical habitat areas. In-stream and riparian habitat improvements like providing flows, restoring vegetation and decreasing upstream sources of sediment and pollutants also are being addressed.

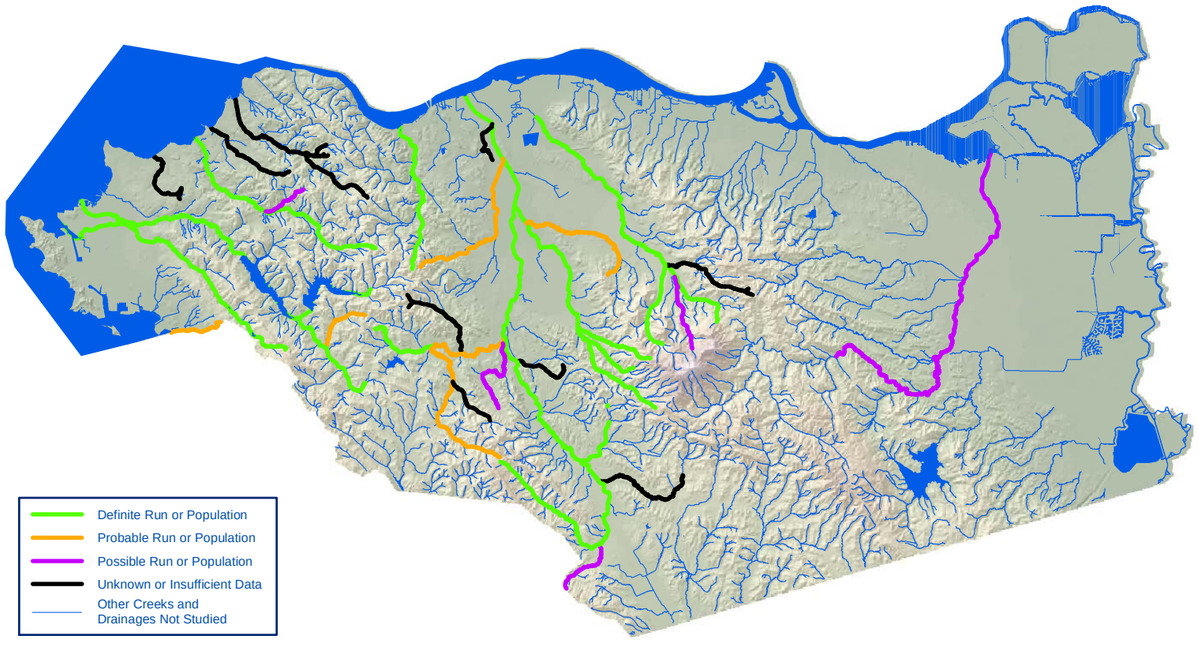
Steelhead in Contra Costa County are listed as "threatened" under the federal Endangered Species Act. It is illegal to harass, harm, or kill steelhead. For information about trout fishing regulations in Contra Costa County, please consult the California Department of Fish and Game.

Information presented here was developed with support from: NOAA Fisheries, U.S. Environmental Protection Agency Region IX, California State Coastal Conservancy, As You Sow Foundation, Rose Foundation, Marin County Public Works Agency, Fish and Wildlife Committees of Alameda, Contra Costa, San Mateo, and Santa Clara Counties, and the William H. Donner Foundation.

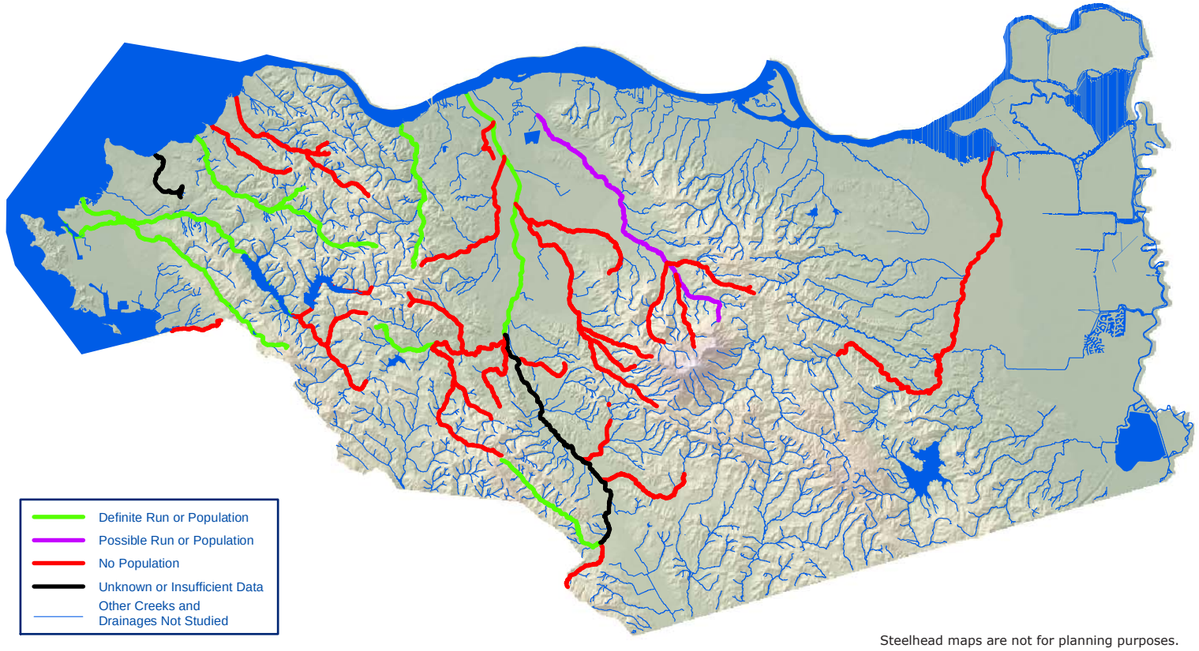
Juvenile salmonids

This information is part of a larger study of 278 streams in 59 major watersheds that drain to the San Francisco Estuary, bounded on the east by Marsh Creek in Contra Costa County and Suisun Creek in Solano County. Historical data was collected from published and unpublished survey reports, museum specimens, interviews, scientific collection permit reports and other sources. Sampling by Robert A. Leidy of the U.S. EPA and other researchers between 1992 and 2002 determined the current *O. mykiss* distribution. Information regarding *O. mykiss* life history was derived primarily from: McEwan, D.R. 2001. Central Valley Steelhead. In Brown, R.L. ed. Contributions to the biology of Central Valley salmonids. Calif. Department of Fish and Game Bull. No. 179. vol. 1: 1-43.

Historical Steelhead Populations



Present Steelhead Populations



Steelhead maps are not for planning purposes.

Volunteer Opportunities (Countywide Contacts)

This is not a comprehensive list of organizations that are active on creek and watershed issues in Contra Costa County. They are some organizations that frequently have volunteer opportunities and/or sponsor programs for people interested in creek and watershed issues. Additional organizations working in specific watersheds are listed in the corresponding chapters.

Aquatic Outreach Institute
1327 South 46th Street #155
Richmond, CA 94804
Phone: (510) 231-5655
Email: staff@aoinstitute.org
Website: www.aoinstitute.org

Contra Costa County Flood Control and Water Conservation District
255 Glacier Drive
Martinez, CA 94553
Phone: (925) 313-2000

Contra Costa Clean Water Program
Phone: (925) 313-2360
Email: ccleanwater@pw.co.contra.costa.ca.us
Website: www.cccleanwater.org

Contra Costa County Clean Water Program
Phone: (925) 313-2313
255 Glacier Drive
Martinez, CA 94553

Contra Costa Resource Conservation District
5552 Clayton Road
Concord, CA 94521
Phone: (925) 672-6522 x106
Website: www.ccrcd.org

Contra Costa Water District
P.O. Box H20
Concord, CA 94524
Phone: (925) 688-8000
Website: www.ccwater.org

Contra Costa Watershed Forum
Contra Costa County – Community Development
651 Pine Street, 4th Floor, North Wing
Martinez, CA 94553
Phone: (925) 335-1230
Email: kono@cd.cccounty.us
Website: www.cocowaterweb.org

East Bay Municipal Utility District
375 11th Street
Oakland, CA 94607
Phone: (510) 287-1380
Website: www.EBMUD.com

East Bay Regional Park District
2950 Peralta Oaks Court
P.O. Box 5381
Oakland, CA 94605
Phone: (510) 635-0135
Email: volunteers@ebparks.org
Website: www.ebparks.org

Friends of the San Francisco Estuary and the Watershed Assessment Resource Center
1515 Clay Street, Suite 1400
Oakland, CA 94612
Phone: (510) 622-2337
Email: sc@reb2.swrcb.ca.gov

Lindsay Wildlife Museum
1931 First Ave
Walnut Creek, CA 94597
Phone: (925) 935-1978
Website: www.wildlife-museum.org

Natural Heritage Institute /Delta Science Center
2140 Shattuck Ave, 5th Floor
Berkeley, CA 94704
Phone: (510) 644-2900
Website: www.n-h-i.org

San Francisco Bay Joint Venture
5030 Alameda del Prado, #139
Novato, CA 94949
Phone: (415) 833-3850
Website: www.sfbayjv.org

State Water Resources Control Board - Clean Water Team
Phone: (510) 622-2470
Email: rk@rb2.swrcb.ca.gov
Website: www.swrcb.ca.gov/nps/volunteer.html

Urban Creeks Council
1250 Addison Street, #107-C
Berkeley, CA 94702
Phone: (510) 540-6669
Email: UCC_Berkeley@earthlink.com
Website: www.urbancreeks.org

Selected Resources

Fateman and Yin (2002), *Community-Based Volunteer Data Collection on Creeks Using GPS*. Ann Arbor, Michigan.

National Park Service, Rivers, Trails, and Conservation Assistance Program [online] *Creek Care Guide for Residents and Businesses – Rivers, Trails and Conservation Assistance Program*. http://www.nps.gov/pwro/rtca/ . (November 2003).

Riley, Ann (1998). *Restoring Streams in Cities: A Resource for Planners, Policymakers, and Citizens.* Island Press, Washington, D.C.

State Water Resources Control Board, The Clean Water Team [online]. *Currents*. www.swrcb.ca.gov/nps/volunteer.html. (November 2003).

Urban Creeks Council, *Creek Currents* (Newsletter). Berkeley, CA.

Photos from top: Friends of the Creeks wade into Walnut Creek to collect data on Arundo, 2001. A volunteer with Friends of Five Creeks collects GPS data in Cerrito Creek, 2001. Students from Pinole Valley High School Environmental Academy assist Friends of Pinole Creek Watershed collect data, 2001. Friends of Lafayette Creeks pause to compare notes, 2001. Friends of Alhambra Creek download and review the data they just collected, 2001.

Volunteer Activities

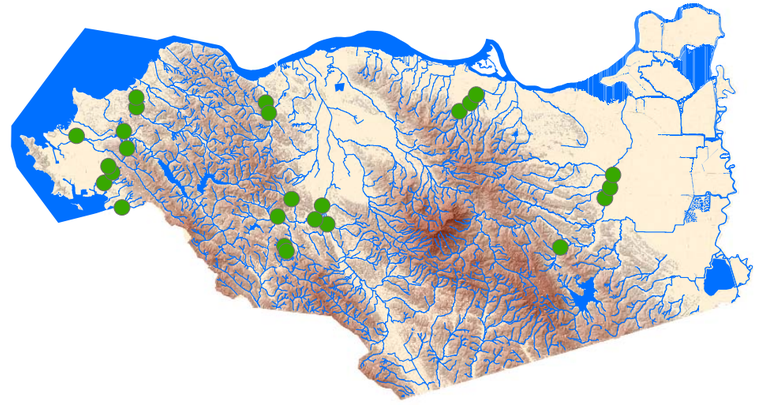
There are many different types of volunteer projects that are scheduled every month on creeks in county watersheds. Projects are varied and there are opportunities for young children, veteran creek walkers, aquatic scientists and heavy lifters. Many local creeks groups sponsor regular creek clean-ups, invasive weed removal projects, and native planting programs. Some projects can involve heavy duty restoration efforts to stabilize banks, or remove log jams, but there is usually a job for everyone who wants to help. Most projects only require a bit of enthusiasm and a sense of humor. If you are interested in volunteer activities in your local watershed, contact information is listed at the end of each watershed chapter.

Volunteers Using GPS

In 2001 Contra Costa Watershed Forum launched an innovative Global Positioning Systems (GPS) data collection program for volunteers. A pilot project conducted Summer 2001 in Contra Costa County demonstrated a successful model for the collection of GPS data on urban creeks by grassroot volunteers. The pilot project produced scientifically defensible GPS data that is useful to a variety of groups -- from resource managers to community organizations.

The program has expanded and participants in the first summer of the project are now trained as data collection leaders. Where available, samples of the GPS data are displayed in individual watershed chapters. There are well over 100 volunteers that have been trained and have participated in the GPS Data collection program. For more information on the program, you can visit the Contra Costa Watershed Forum's website: www.cocowaterweb.org.

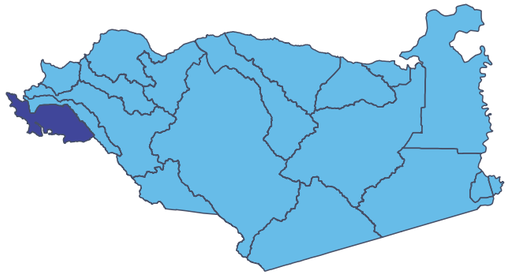
Locations of GPS Data Collections Efforts
(Through September 2003)
● = Data Collection Event



Contra Costa County, March 2003

Chapter 2

Baxter, Cerrito and West Richmond Watersheds



This 11,832-acre area is a series of sub-basins containing two historically important East Bay waterways: Baxter Creek and Cerrito Creek. The headwaters of these creeks are in the northern extent of the East Bay Hills. Wildcat Creek Watershed forms this region's northern boundary. The Contra Costa County line follows Cerrito Creek along the watershed's southern boundary.

Friends of Baxter Creek

Maryann Aberg

Friends of Five Creeks

Baxter Creek Watershed Vital Statistics	
Watershed Size	5,530 acres
Length of Longest Branch of Creek	2.87 miles
Total Channel Length in Watershed	14.44 miles
Average Annual Rainfall	22 inches
Estimated Mean Daily Flow	8.2 cfs
Estimated 100-Year Flood Flow	N/A
Highest Elevation in Watershed	1010 feet
Population (estimated)	58,400 people
Estimated Percent Impervious	65 %
Recognized Pollutants of Concern	N/A *

Cerrito Creek Watershed Vital Statistics**	
Watershed Size	1,322 acres
Length of Longest Branch of Creek	2.44 miles
Total Channel Length in Watershed	5.82 miles
Average Annual Rainfall	22 inches
Estimated Mean Daily Flow	N/A cfs
Estimated 100-Year Flood Flow	N/A
Highest Elevation in Watershed	910 feet
Population (estimated)	13,300 people
Estimated Percent Impervious	65 %
Recognized Pollutants of Concern	N/A *

*Baxter and Cerrito Creeks have not been specifically identified in the State's 303(d) list of Impaired Water Bodies.
**Statistics reflect Contra Costa County portion of watershed only.

Many creeks in the Baxter and Cerrito Creek Watersheds (including Wildcat Creek and San Pablo Creek Watersheds to the north) were lined or culverted during the first half of the 20th century to accommodate the new urbanization and prevent flooding in the lower watersheds. This relatively level area between the Berkeley Hills and Point Richmond is now drained by an extensive municipal stormwater system.

The Richmond flatlands were first drained for agricultural use. Later, following the introduction of the railroad, this area became the site of industry in the region.

Volunteers record GPS data where Baxter Creek emerges from an underground culvert and flows into Booker T. Anderson Park in Richmond, 2001.

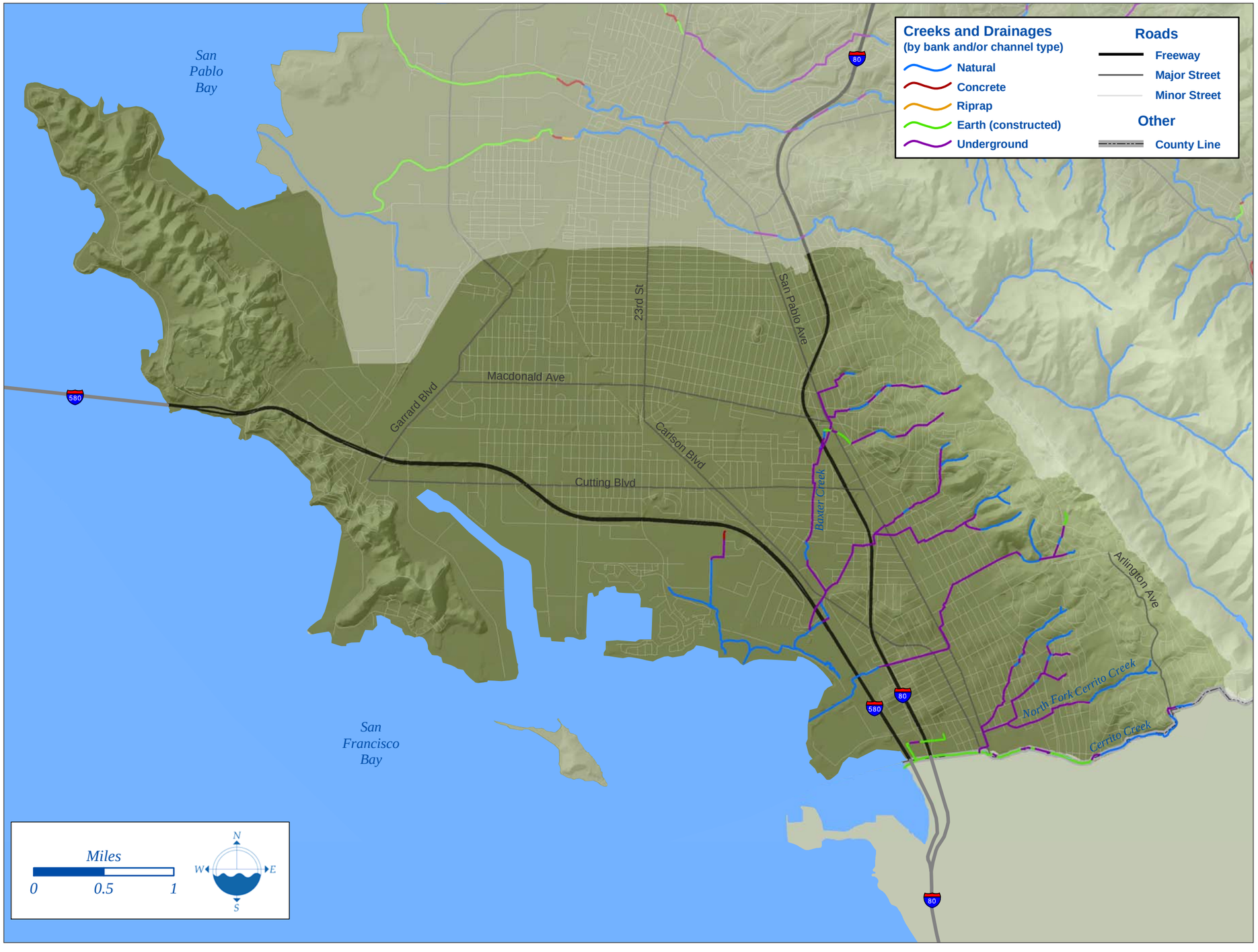
Baxter Creek Channel Length Statistics*

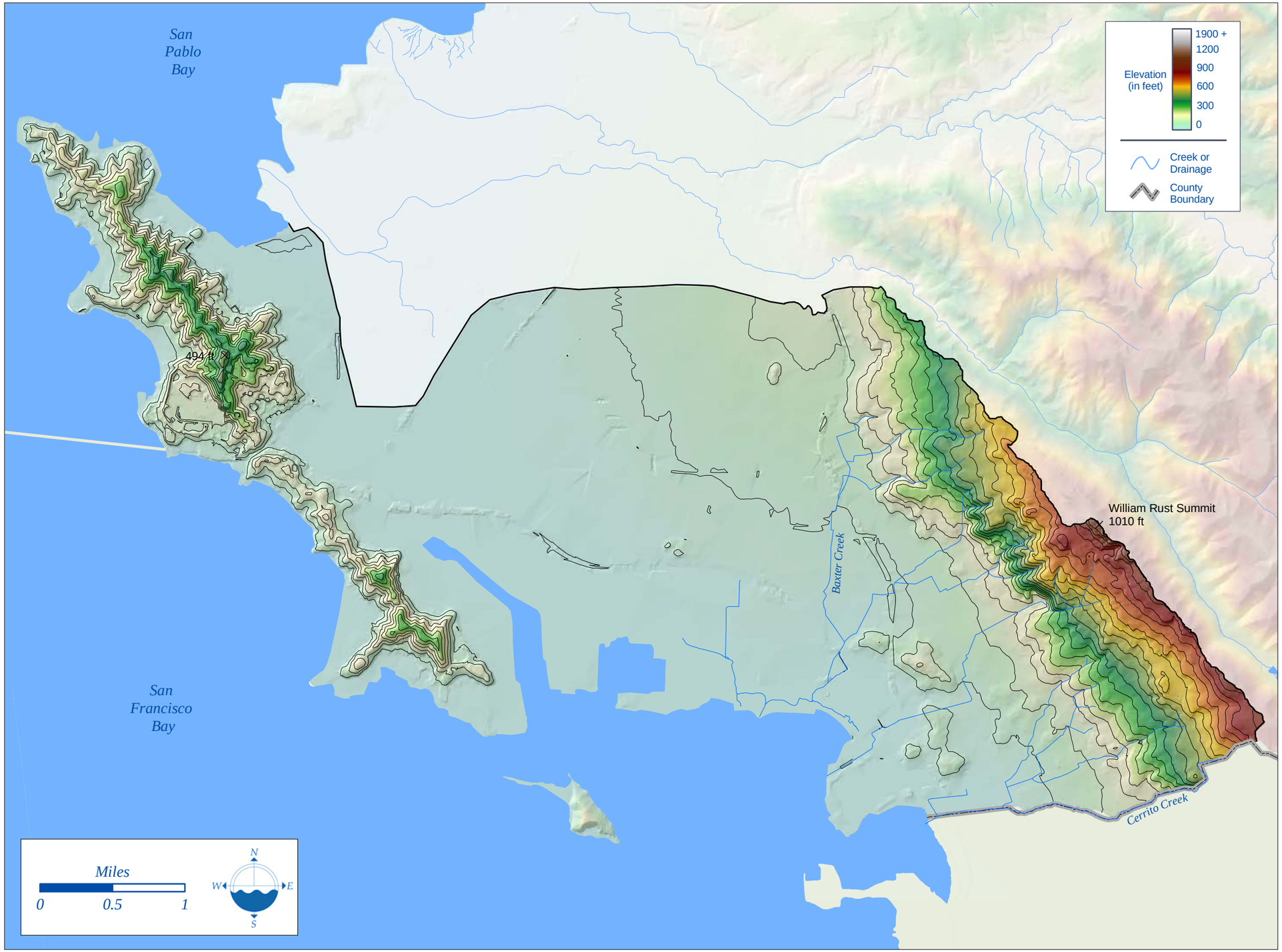
	Miles	Percent
Length of Longest Branch of Creek	2.87	
Total Channel Length in Watershed	14.44	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	5.96	41.2%
Concrete	8.21	56.9%
Earth (constructed)	0.28	1.9%
Riprap	0.00	0.0%
Underground	8.15	56.4%

Cerrito Creek Channel Length Statistics* **

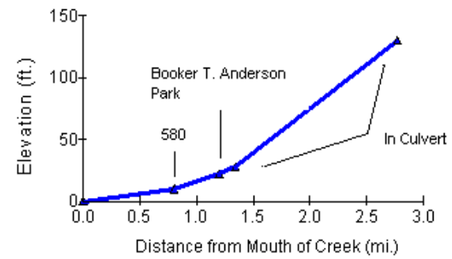
	Miles	Percent
Length of Longest Branch of Creek	2.44	
Total Channel Length in Watershed	5.82	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	1.77	30.4%
Concrete	3.13	53.8%
Earth (constructed)	0.92	15.8%
Riprap	0.00	0.0%
Underground	3.12	53.7%

*Data relate to mapped channels only. Does not include storm drains. Bank type for segments shorter than 100 feet was not mapped.
**Statistics reflect Contra Costa County portion of watershed only.





Baxter Creek Profile

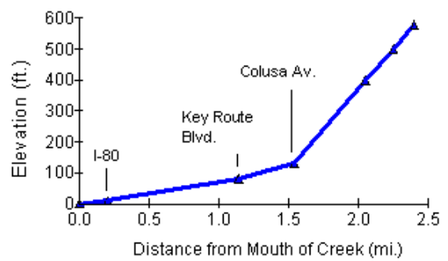


Baxter Creek and its tributaries (14.44 miles) originate in underground springs beneath El Cerrito's Mira Vista Golf Course and flow down from the hills in three branches. After running through a series of neighborhood parks, the creeks join near the Gateway Property at San Pablo and Macdonald Avenues. The creek then flows through Richmond into Stege Marsh and San Francisco Bay.

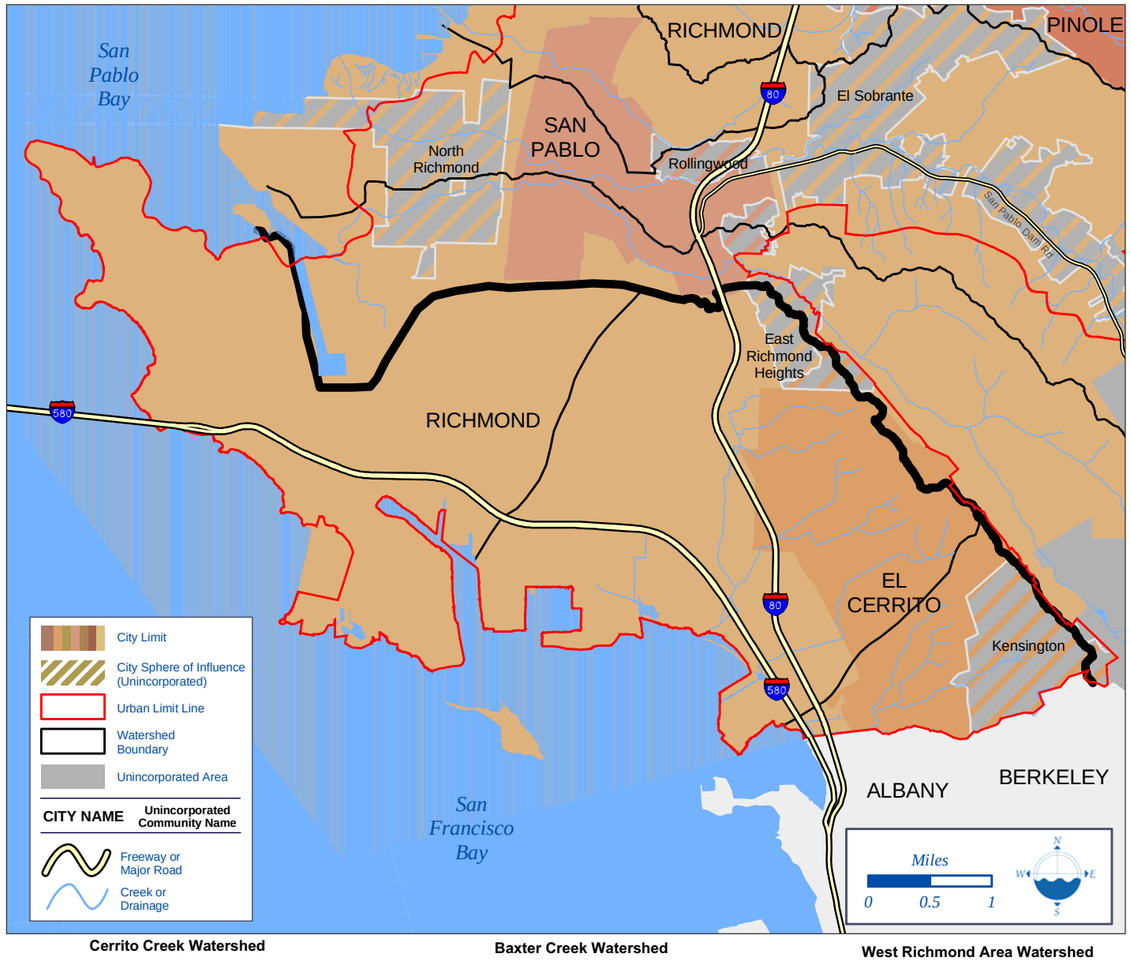
Cerrito Creek (5.82 miles) straddles the Contra Costa - Alameda County border, draining the hills of El Cerrito and the unincorporated Community of Kensington before emptying into the Albany Flats and the Bay, just south of Point Isabel Regional Shoreline.

Betty Buginas

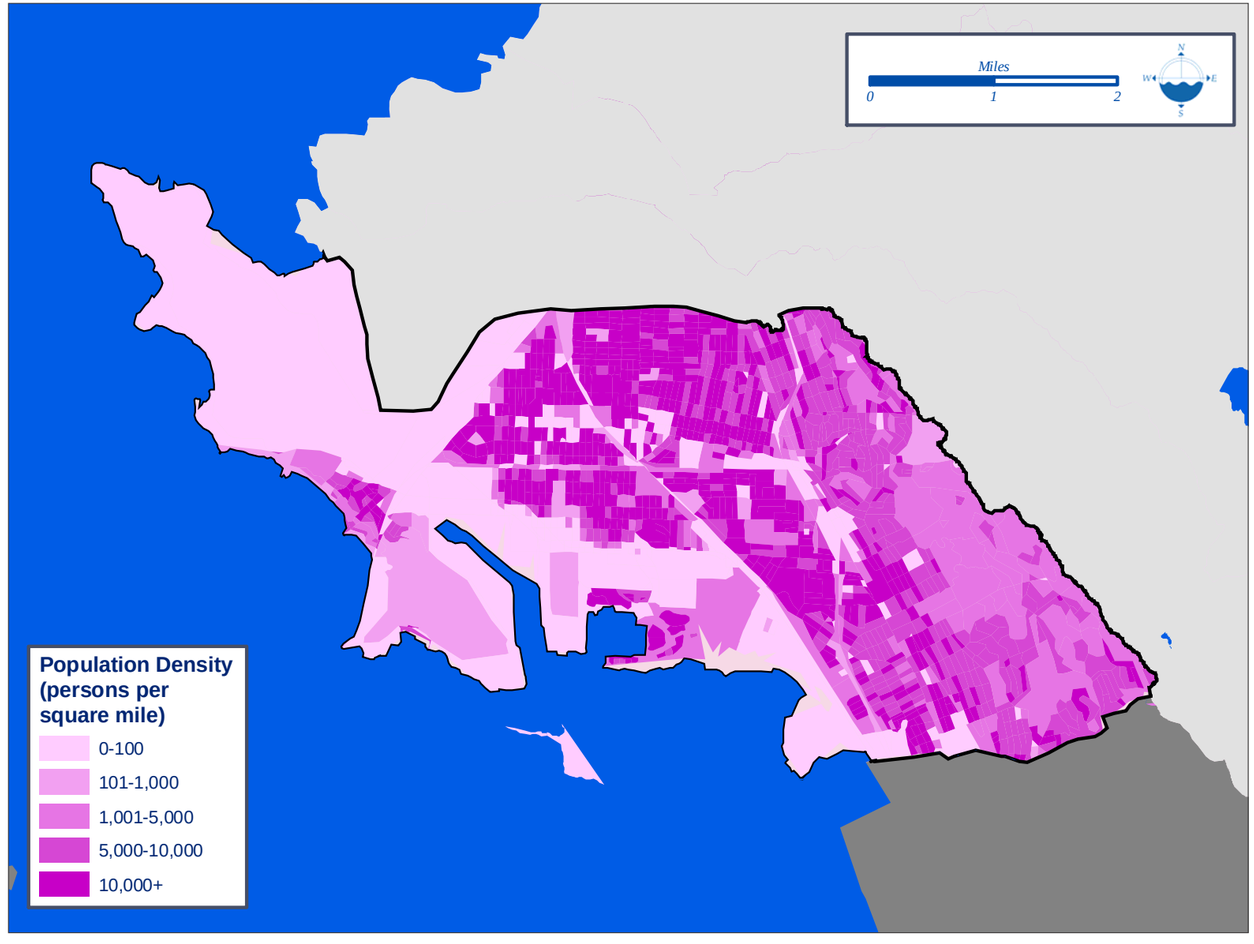
Cerrito Creek Profile



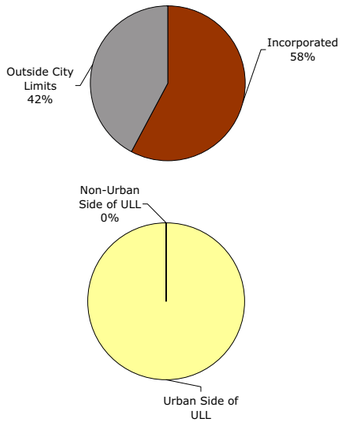
Political Boundaries



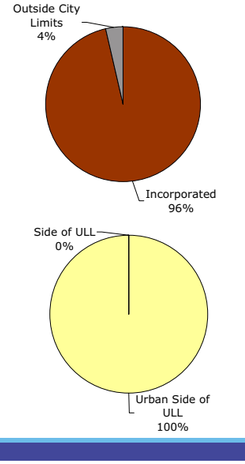
Population Density



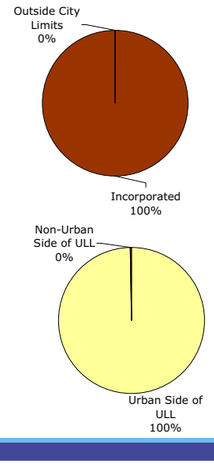
Cerrito Creek Watershed



Baxter Creek Watershed

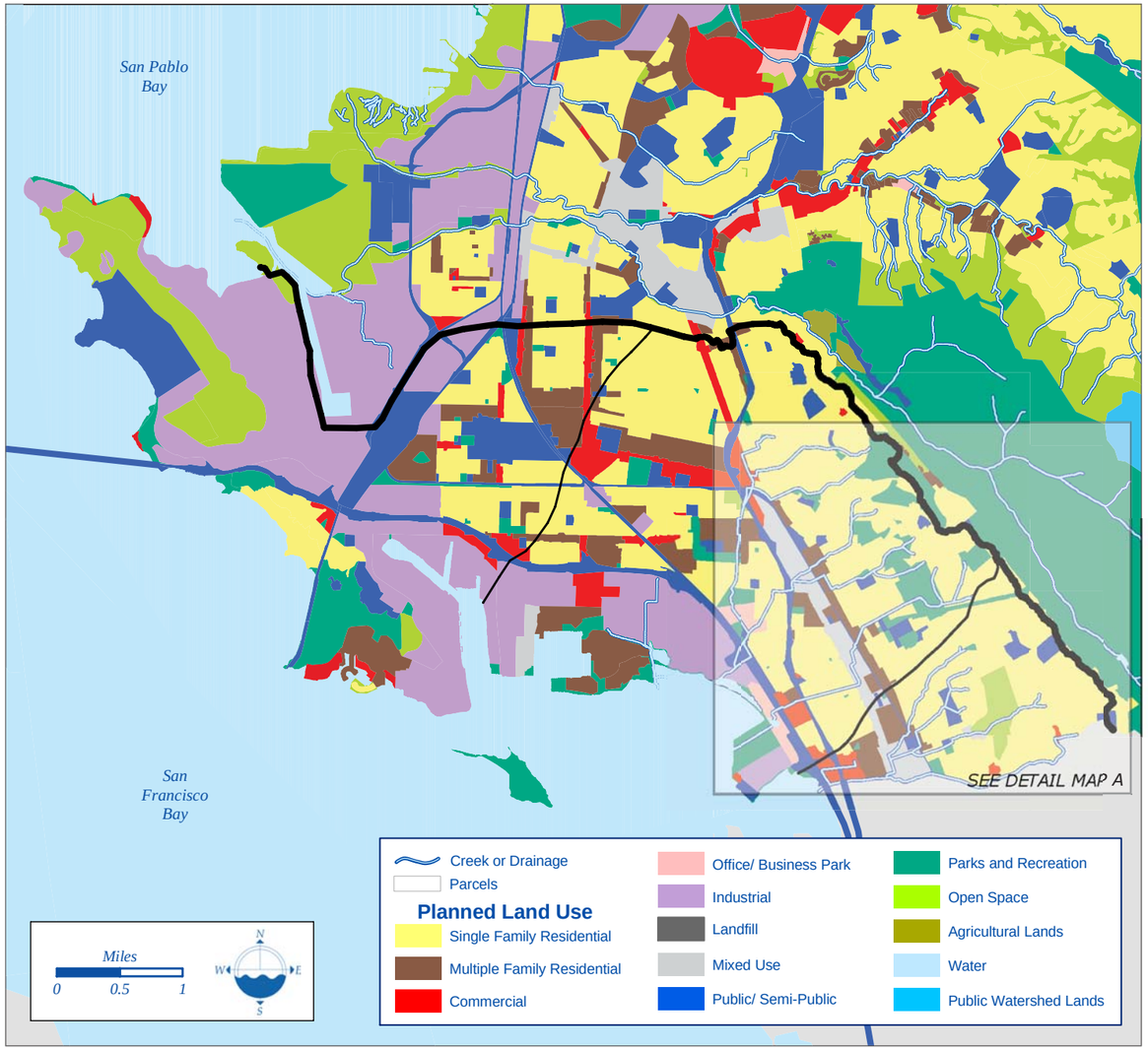


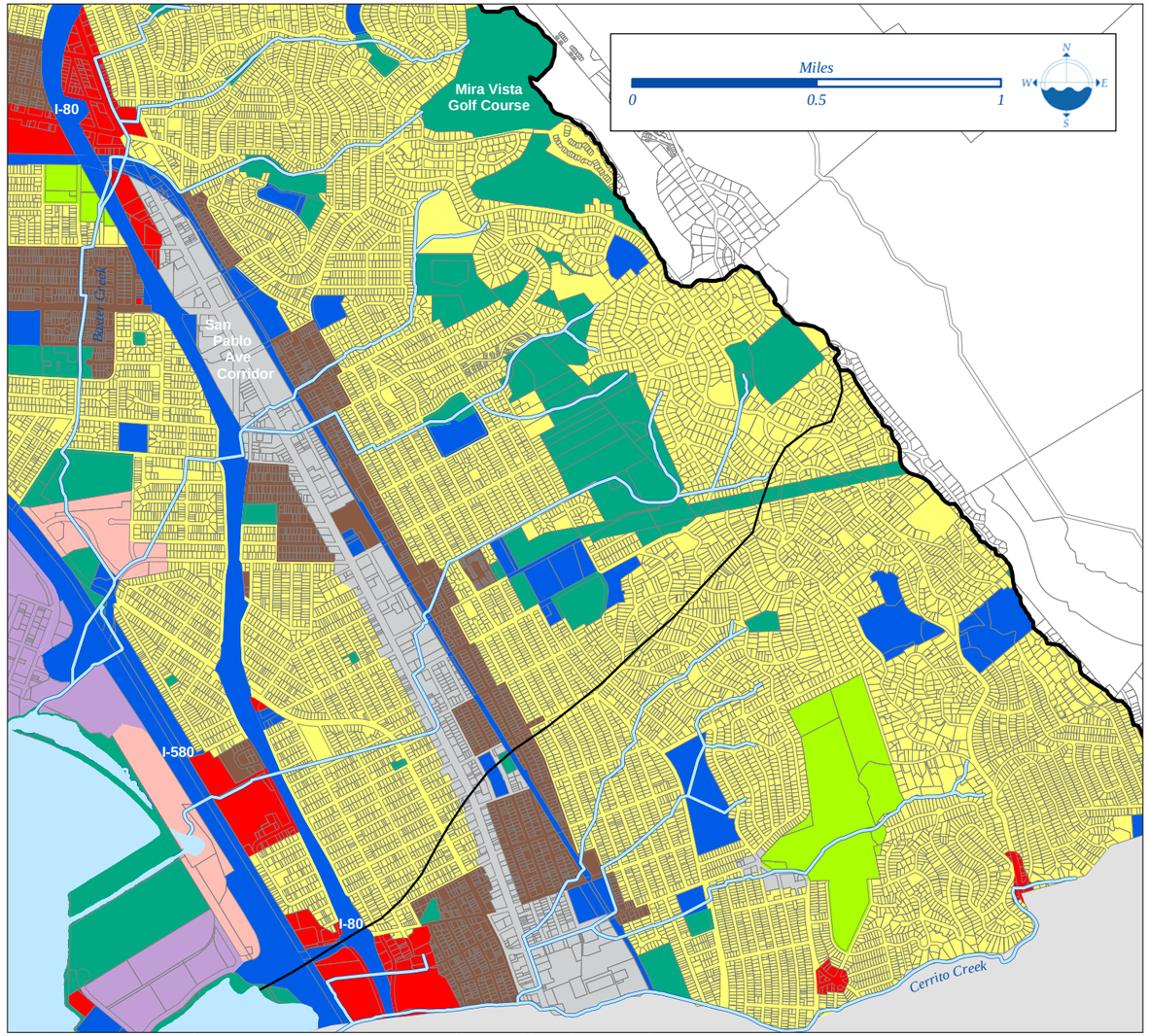
West Richmond Area Watershed



Demographic Profile for Selected Communities In or Near Baxter, Cerrito and West Richmond Area Watersheds

Population	El Cerrito	Kensington	Richmond
Total Population	23,179	4,849	99,716
Race and Ethnicity	**El Cerrito**	**Kensington**	**Richmond**
White	53.5%	79.8%	21.3%
Hispanic or Latino	7.9%	2.9%	26.8%
Black or African American	7.8%	3.2%	35.3%
Asian	24.3%	9.8%	12.1%
Some Other Race	1.4%	0.4%	0.9%
Two or More Races	5.1%	3.9%	3.5%
Education (maximum level attained)	**El Cerrito**	**Kensington**	**Richmond**
No High School Diploma	7.4%	2.2%	24.6%
High School Diploma or Equivalent	30.6%	16.4%	46.2%
Associate Degree	6.1%	3.4%	6.8%
Bachelor's Degree	30.3%	34.9%	14.1%
Master's or Professional School Degree	19.0%	32.3%	7.2%
Doctorate Degree	6.7%	10.8%	1.1%
Income	**El Cerrito**	**Kensington**	**Richmond**
Median Household Income	$57,253	$93,247	$44,210

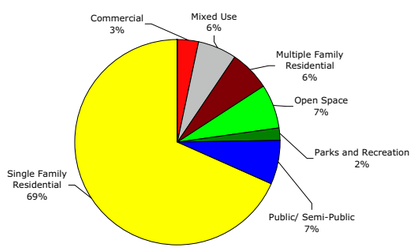




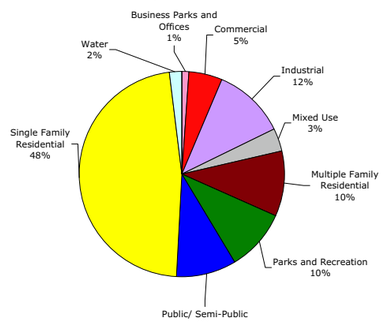
Detail Map A: Baxter and Cerrito Creeks in the El Cerrito and Richmond area

Planned Land Uses *Cerrito Creek Watershed**	Acres
Agricultural Lands	0
Business Parks and Offices	0
Commercial	44
Industrial	0
Mixed Use	80
Multiple Family Residential	84
Open Space	91
Parks and Recreation	27
Public/ Semi-Public	92
Single Family Residential	904
Water	0
Watershed (Public)	0
Total	**1,322**

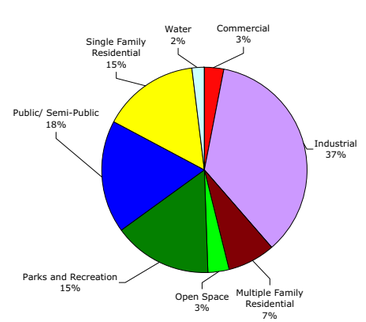
*Contra Costa County portion of watershed only.



Planned Land Uses *Baxter Creek Watershed*	Acres
Agricultural Lands	0
Business Parks and Offices	69
Commercial	290
Industrial	629
Mixed Use	193
Multiple Family Residential	565
Open Space	12
Parks and Recreation	530
Public/ Semi-Public	518
Single Family Residential	2,612
Water	112
Watershed (Public)	0
Total	**5,530**



Planned Land Uses *West Richmond Watershed*	Acres
Agricultural Lands	0
Business Parks and Offices	0
Commercial	151
Industrial	1,767
Mixed Use	0
Multiple Family Residential	370
Open Space	172
Parks and Recreation	771
Public/ Semi-Public	890
Single Family Residential	759
Water	96
Watershed (Public)	0
Total	**4,976**



Baxter Restoration Projects

(A) East Stege Marsh Remediation: Improve habitat for the endangered California Clapper Rail and enhance the shoreline by removing non-native plant species and planting native species. Site Investigations began in 1998 under the guidance of the San Francisco Bay Regional Water Quality Control Board. This project is funded by UC Berkeley. The California Coastal Conservancy is an additional potential funder. Lead Agency: UC Berkeley Offices of Capital Projects and Environment, Health & Safety partnered with Aquatic Outreach Institute and UC Berkeley's Environmental Sciences Teaching Program. Anticipated completion of contaminated soil removal from the upland areas and parts of Western Stege Marsh is Fall 2006. Other components of the marsh restoration are on-going.

(B) Baxter Creek Restoration (Booker T. Anderson Park): Re-shaped channel, re-vegetated banks and riparian area. Funded by the SF Foundation, the California Coastal Conservancy, and the California Department of Water Resources. Lead Agency: Urban Creeks Council partnered with Friends of Baxter Creek. Completed 1999.

(C) Baxter Creek Restoration (Booker T. Anderson Park): Increase the ecological function of the 800-foot riparian corridor by enhancing habitat and educating the public to increase stewardship activities. This project is seeking funding. Lead Agency: Aquatic Outreach Institute partnered with the City of Richmond and the Urban Creeks Council. This project is in progress and the anticipated completion date is unknown.

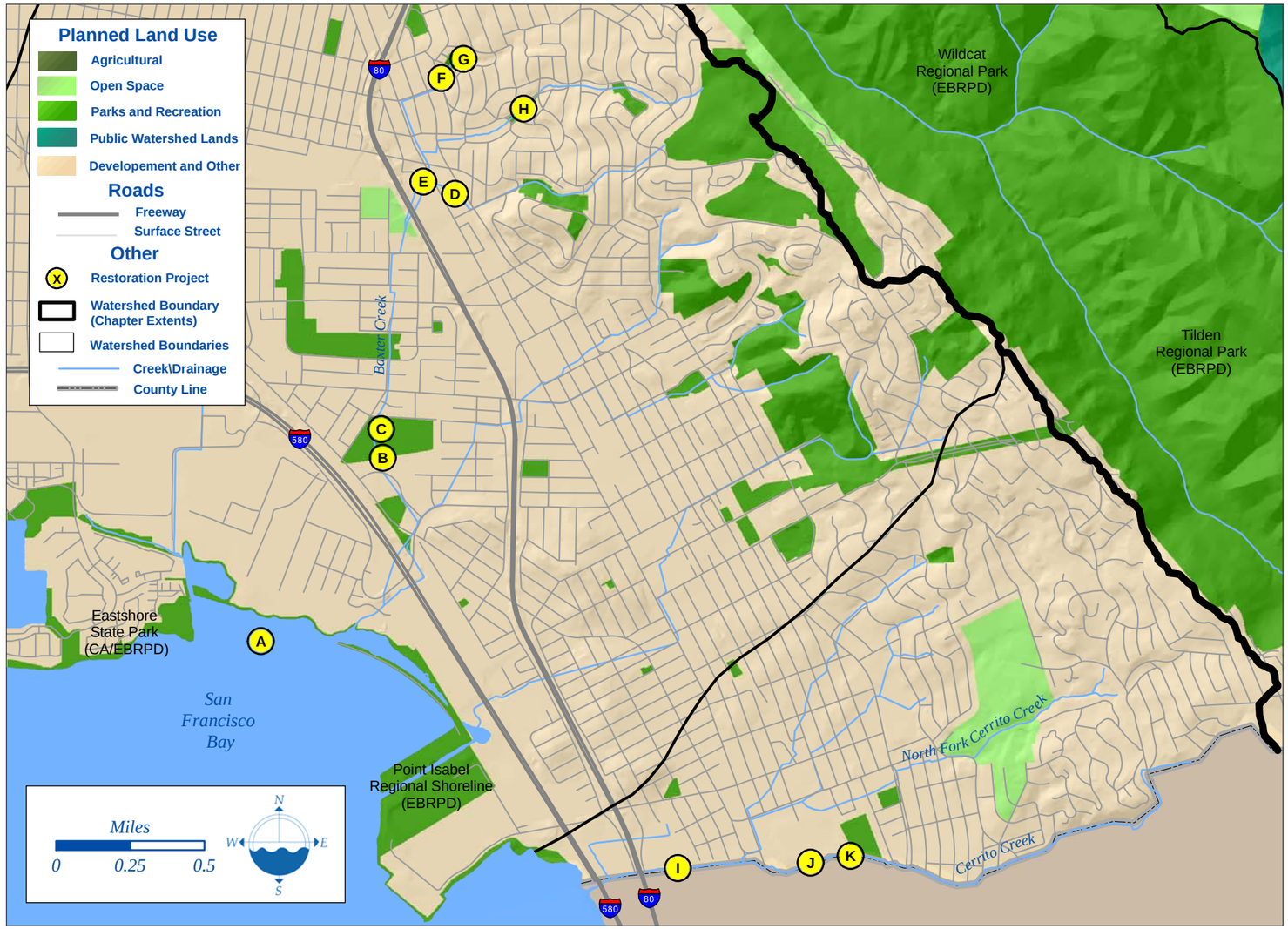
(D) Property Acquisition and Creek Restoration at Gateway: Obtain easement for the restoration of Baxter Creek and use of a linear greenway adjacent to the creek. Clean up trash, remove structures on creek banks, and re-vegetate the riparian corridor. Initial funds for this project were provided by Pacific Infinity Corporation mitigation funds, however the project is seeking additional funding. Lead agency: Friends of Baxter Creek partnered with the Aquatic Outreach Institute and the City of Richmond. The anticipated project completion date is unknown.

(E) Baxter Creek Restoration and Bicycle/Pedestrian Greenway: Create a green area that will provide creek access and a recreation area. Construct a bicycle and pedestrian trail. This project is funded by the National Park Service, the City of El Cerrito and Friends of Baxter Creek. This project is in progress and the anticipated completion date is unknown.

(F) Baxter Creek Restoration at Mira Vista Park: Remove non-native invasive plant species and re-vegetate with native riparian species. Remove trash and install erosion control measures. This project is funded by CALFED and the California Coastal Conservancy. Lead Agency: Aquatic Outreach Institute partnered with the City of Richmond and the Mira Vista Neighborhood Watch. Anticipated project completion: 2005.

(G) Baxter Creek Watershed Uplands Restoration & Children's Wildlife Habitat Garden (at Mira Vista Park): Restore a remnant parcel of serpentine grassland habitat and a freshwater seep. Create a Children's Wildlife Garden within the school. This project is funded by the California Coastal Conservancy. Lead Agency: Aquatic Outreach Institute partnered with Mira Vista School and Mira Vista Field Neighborhood Association. Project is on-going.

(H) Pointsett Park Restoration: Daylighted (approximately 200 feet) Baxter Creek through Pointsett Park. Reshaped channel and re-vegetated banks. Funding provided by the City of El Cerrito. Lead Agency: Urban Waterways Institute. Project completed in 1997.



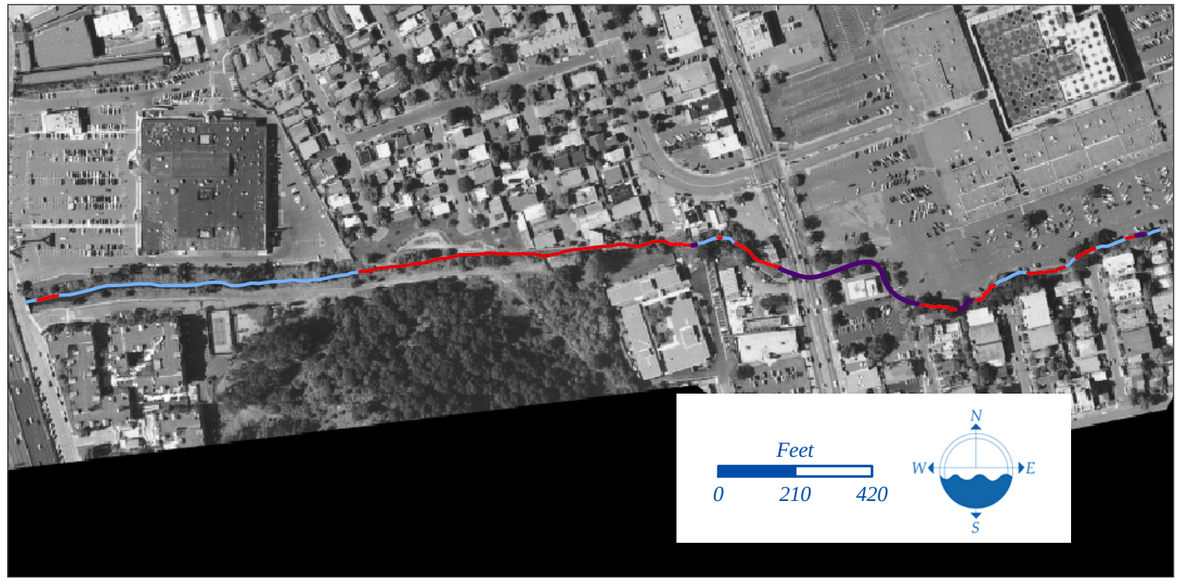
Cerrito Restoration Projects

(I) Cerrito Creek Native Plant Restoration (at Pacific East Mall): Removed non-native invasive plants. Reintroduced native plants to the area. This project is part of the Cerrito Creekside Greenway project. Funding for this project comes from Pacific Infinity Corporation mitigation funds. Lead Agency: Friends of Five Creeks partnered with the Urban Creeks Council. Project completion date: 2003.

(J) Cerrito Creek Bank Restoration (at El Cerrito Plaza): Remove concrete from creek channel. Re-contour creek and re-vegetate with native riparian species. This project is part of the Cerrito Creekside Greenway project and is funded by the California Coastal Conservancy. Lead Agency: City of El Cerrito partnered with the City of Albany and Friends of Five Creeks. Anticipated project completion: 2004.

(K) Cerrito Creek Riparian Rehabilitation (at Ohlone Greenway): Removed non-native invasive plants and re-vegetated banks. Created a seating area to view the creek. This project is part of the Cerrito Creekside Greenway project and was funded by the Strong Foundation. Lead Agency: Friends of Five Creeks. Project completed: 2002.

Mapping Unnatural Channel Conditions

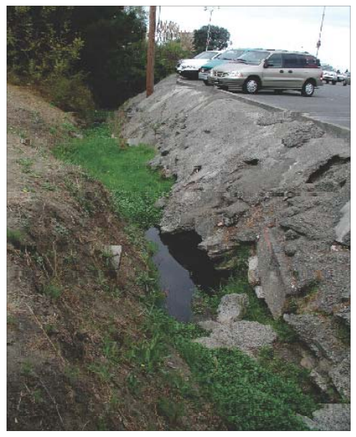


Note: The black area of the background photo is in Alameda County, and data was not available for this area.

Natural/Earth Channel

Constructed Channel

Underground Channel / No GPS data recorded due to



A section of Cerrito Creek near El Cerrito Plaza exhibiting undercut concrete banks. This area is in the process of being restored by Friends of Five Creeks, 2003.

Just north of Albany Hill, near the Pacific East Mall, Friends of Five Creeks successfully restored the creek to a natural channel with native vegetation, 2003.

Friends of Five Creeks volunteers have been working to restore the riparian ecosystem of Cerrito Creek. Their efforts include water monitoring, non-native plant removal, native plantings, and natural channel construction. Additionally, the group organizes projects to increase awareness of Cerrito Creek and make the creek an amenity to the community. They have worked on constructing creekside trails and viewing areas.

Friends of Five Creeks participated in the 2001 Pilot GPS data collection program sponsored by the Contra Costa Watershed Forum. Above, data collected on channel conditions is displayed. The data collected makes clear the prevalence of unnatural/ constructed creek channels (displayed in red on the map above). These areas have been targeted for restoration.

Volunteers provide much of the motivation, know-how and sweat to complete restoration projects. Occasionally, when money is available or specialized skills are needed, volunteer efforts are augmented by professionals such as engineers from local city agencies, staff from the Urban Creeks Council, private consultants or fields crews from the East Bay Conservation Corps.

Organizations Active in the Watershed

Baxter Creek

Aquatic Outreach Institute and
Friends of Baxter Creek Watershed
1327 South 46th Street #155
Richmond, CA 94804
Phone: (510) 231-5655
Email: staff@aoinstitue.org
Website: www.aoinstitute.org/ or
www.creativedifferences.com/baxtercreek

Friends of Five Creeks after a day collecting GPS data on Cerrito Creek, 2001.

A work party in Booker T. Anderson Park helps maintain the restored Baxter Creek channel.

Cerrito Creek

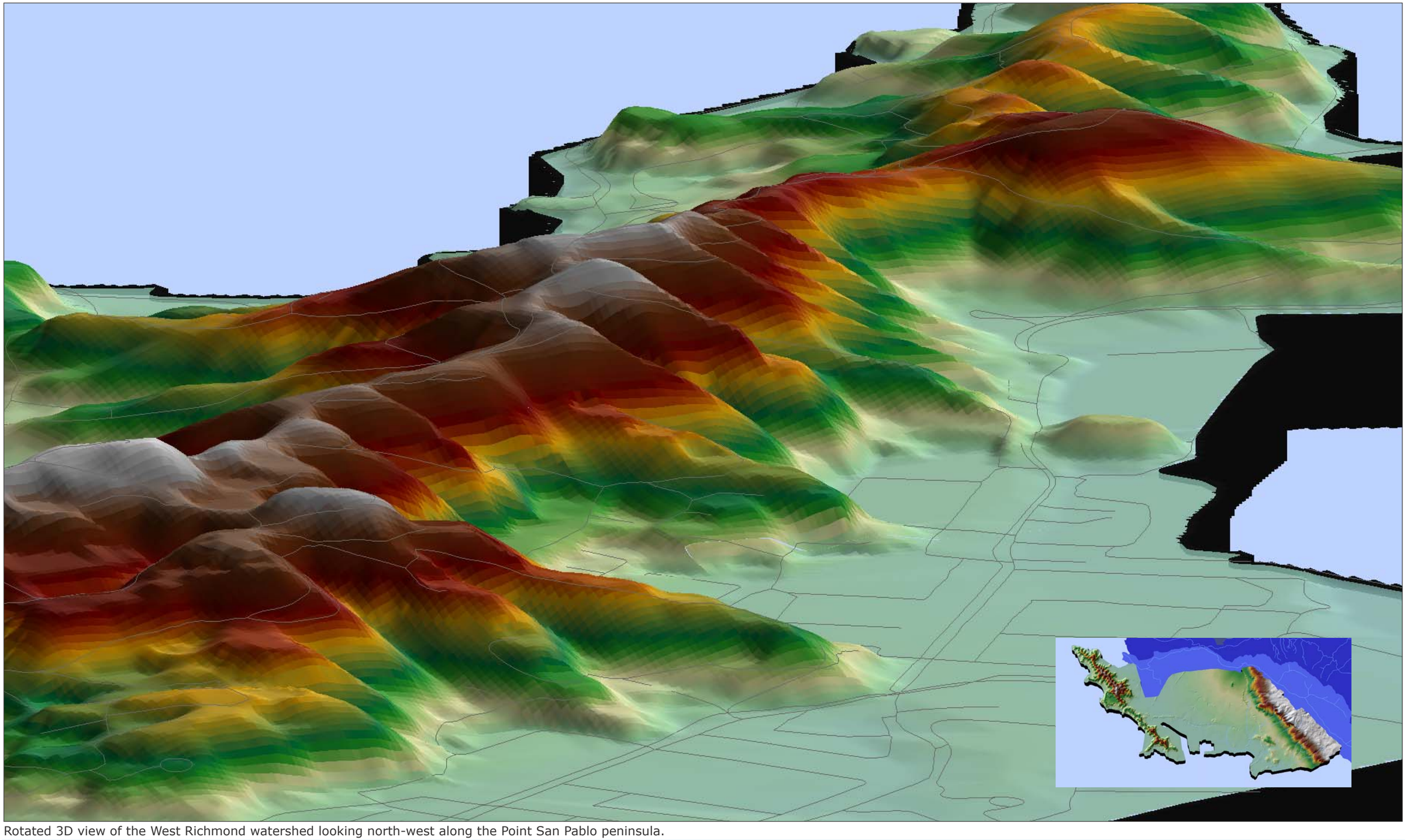
Friends of Five Creeks
Susan Schwartz
1236 Oxford
Berkeley, CA 94709
Phone: (510) 848-9358
Email: f5creeks@aol.com
Website: www.fivecreeks.org

Students assist with creek clean-up and planting projects on Baxter and Cerrito Creeks.

Selected Resources

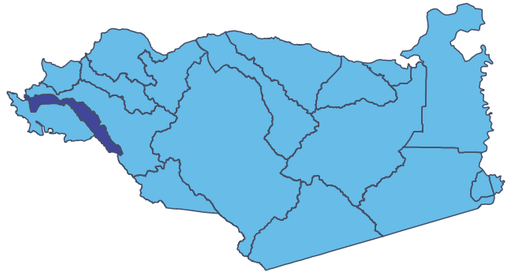
Aquatic Outreach Institute, A Natural and Cultural History of the Baxter Creek Watershed, 2003.

City of El Cerrito, Caring for Your Creek: A Guide for El Cerrito Residents, 2003.



Rotated 3D view of the West Richmond watershed looking north-west along the Point San Pablo peninsula.

Chapter 3
Wildcat Creek Watershed



The Wildcat Creek Watershed drains a 6,848-acre area. The upper watershed is contained in Wildcat Canyon (EBRPD). The lower watershed, enters the alluvial plain at Alvarado Park in the city of Richmond. Wildcat Creek then flows through San Pablo and Richmond to the San Francisco Bay.

The geologic characteristics affecting the 13.43 mile Wildcat Creek are complex. Trending parallel to the Hayward Fault, the creek leaves the Berkeley Hills and enters the massive alluvial fan. Repeated drought and flood events have caused changes in the shape of the fan and the course of the creek.

Wildcat Creek Watershed Vital Statistics	
Watershed Size	6,848 acres
Length of Longest Branch of Creek	13.43 miles
Total Channel Length in Watershed	22.22 miles
Average Annual Rainfall	24 inches
Estimated Mean Daily Flow	7.7 cfs
Estimated 100-Year Flood Flow	2,280 cfs*
Highest Elevation in Watershed	1905 feet
Population (estimated)	24,000 people
Estimated Percent Impervious	20 %
Recognized Pollutants of Concern	Diazinon**

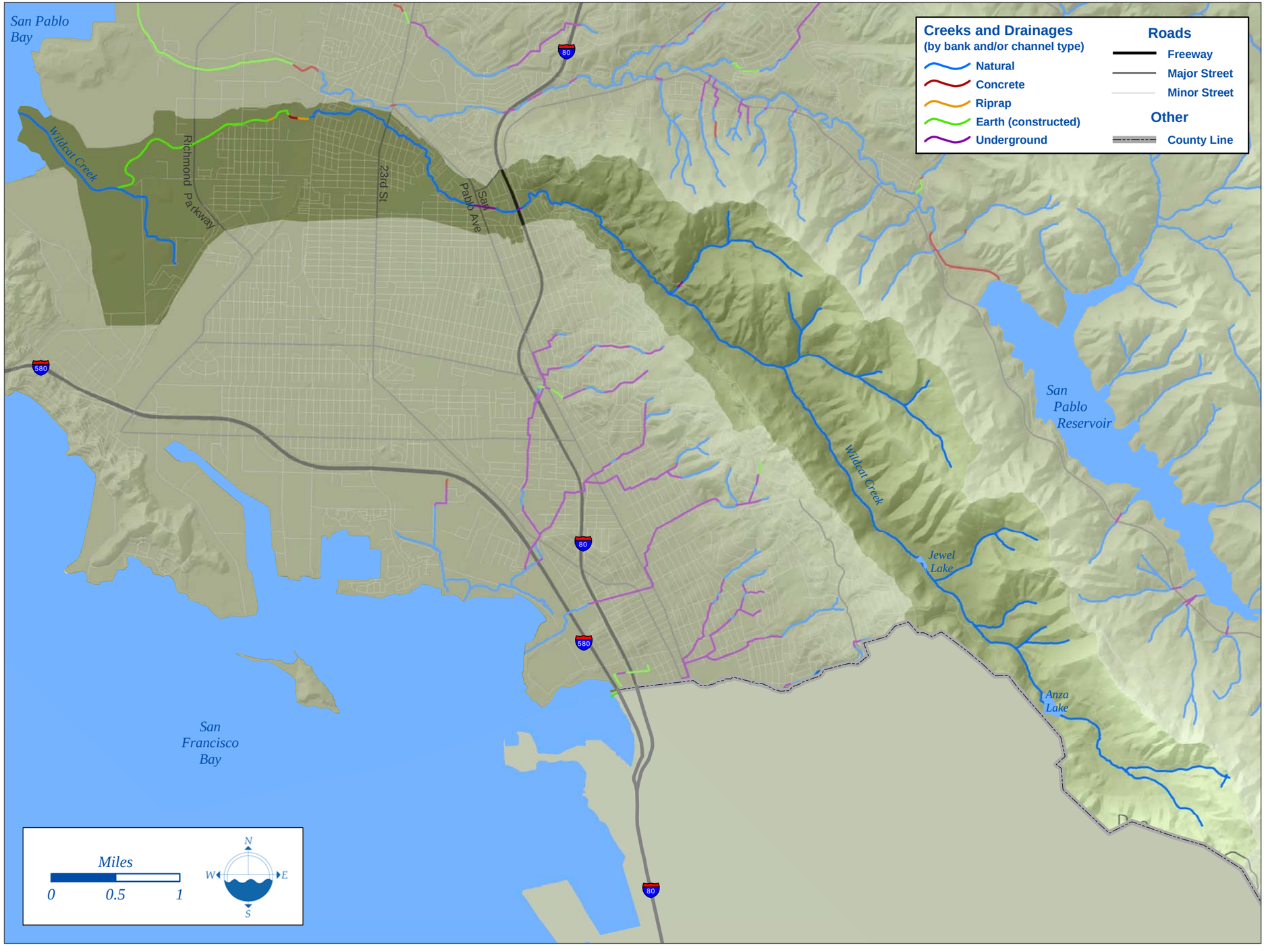
* At 23rd Street (5,300 acres upstream, or 77% of watershed)

** Wildcat Creek is listed as an Impaired Water Body in the State's 303(d) list. Diazinon is the Pollutant of Concern.

Rancho San Pablo included most of the Wildcat Creek watershed. The rich sediments in the alluvial fan supported farming of fruits and vegetables. The middle and upper watershed provided pasture for livestock and horses.

Urban Creeks Council

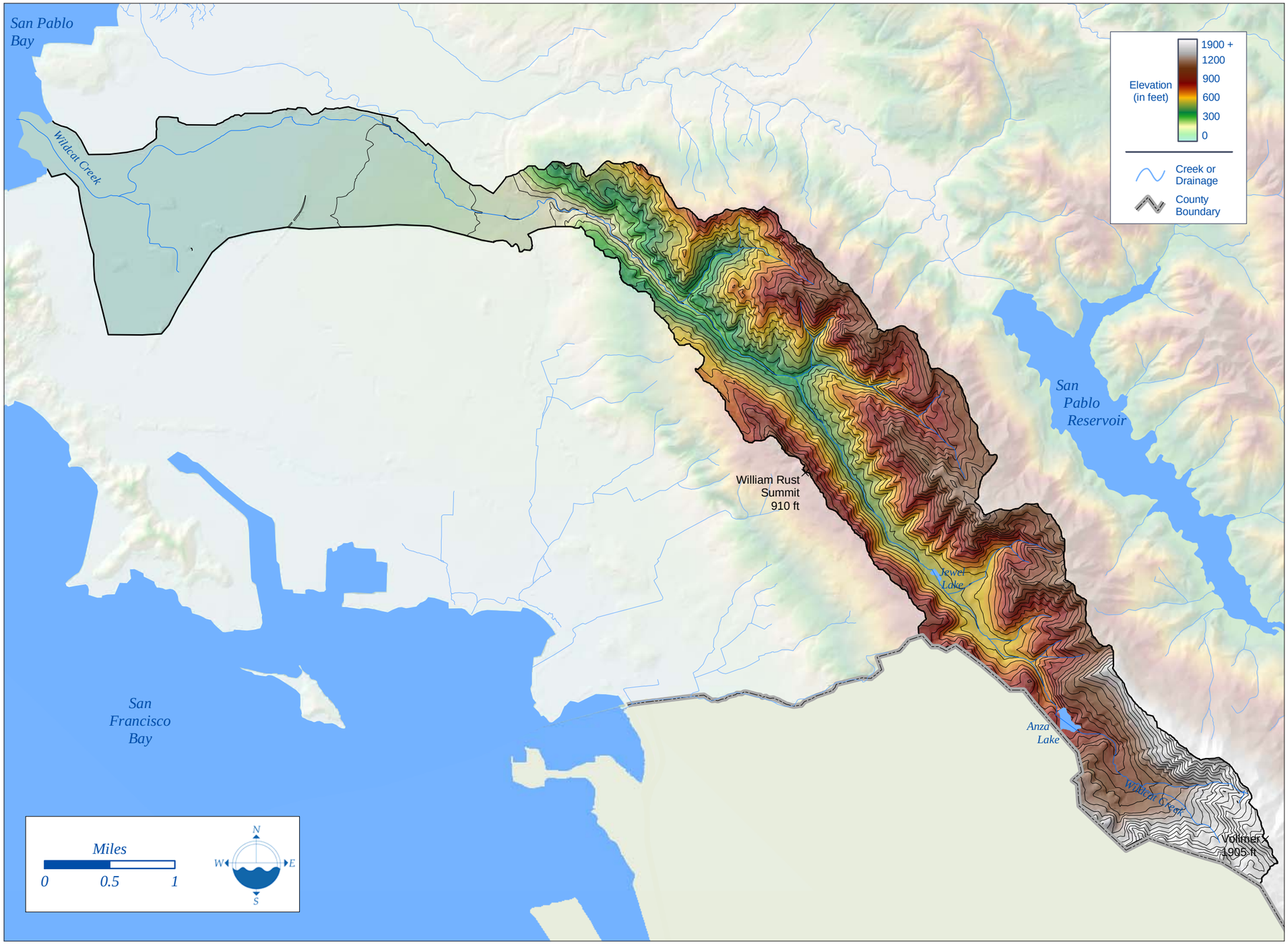
Urban Creeks Council



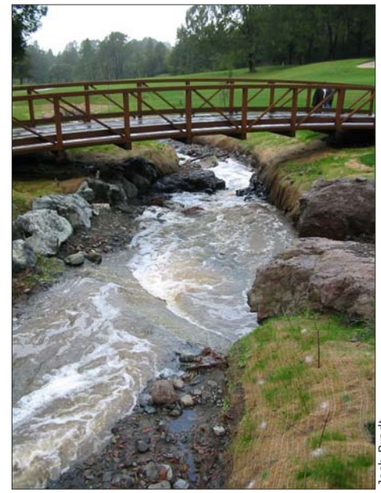
Wildcat Creek Channel Length Statistics*

	Miles	Percent
Length of Longest Branch of Creek	13.43	
Total Channel Length in Watershed	22.22	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	19.98	89.9%
Concrete	0.36	1.6%
Earth (constructed)	1.75	7.9%
Riprap	0.14	0.6%
Underground	0.28	1.3%

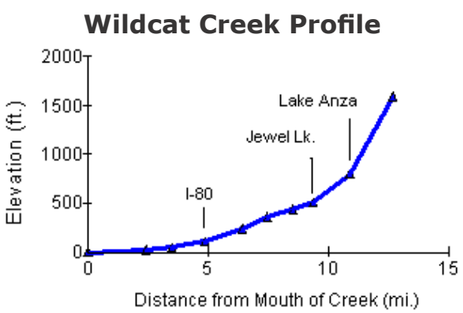
*Data relate to mapped channels only. Does not include storm drains. Bank type for segments shorter than 100 feet was not mapped.



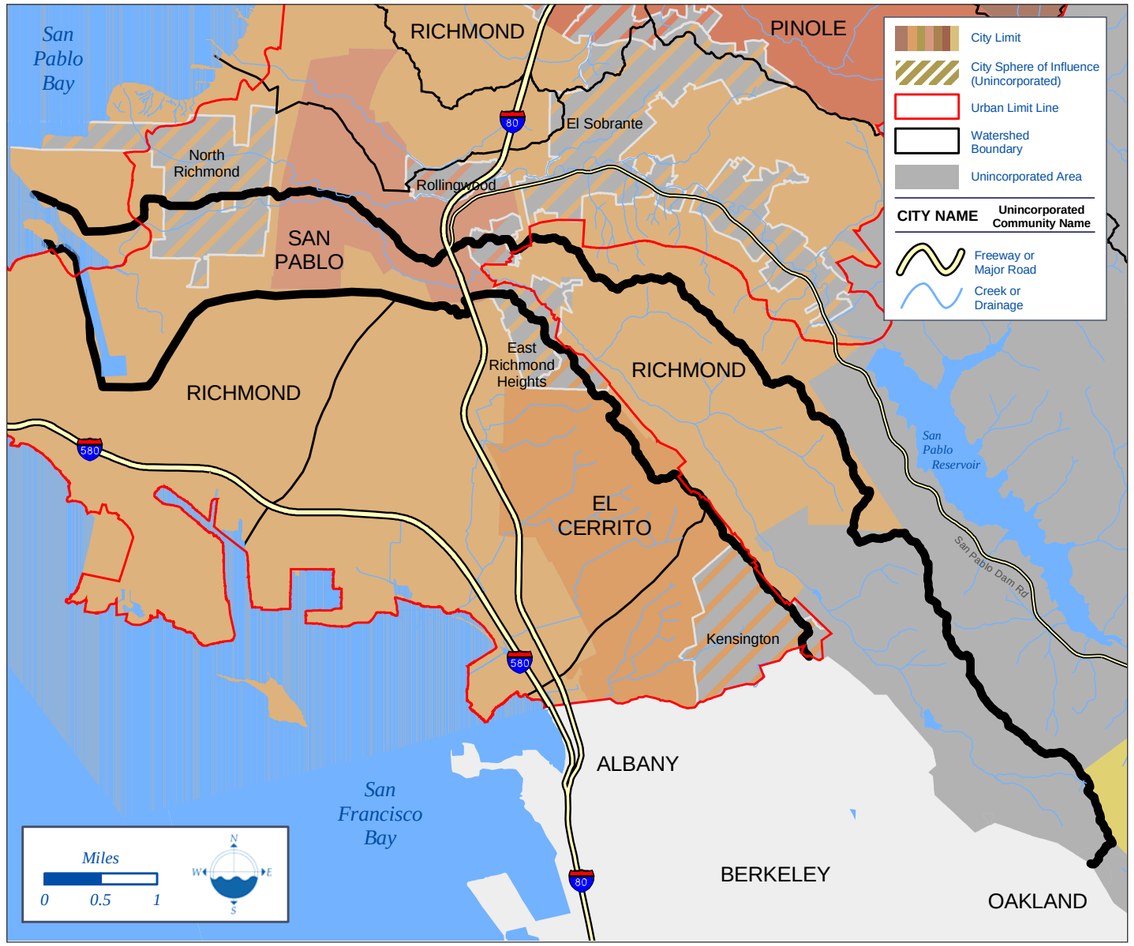
After a deep water port was established at Point Richmond, land use in the area dramatically changed. Farms gave way to industry and manufacturing. The endpoint on the Santa Fe Railroad line was established in the region further encouraging this land use transition. Oil refining was introduced as an industry in 1900, and remains a major industry in the area today.



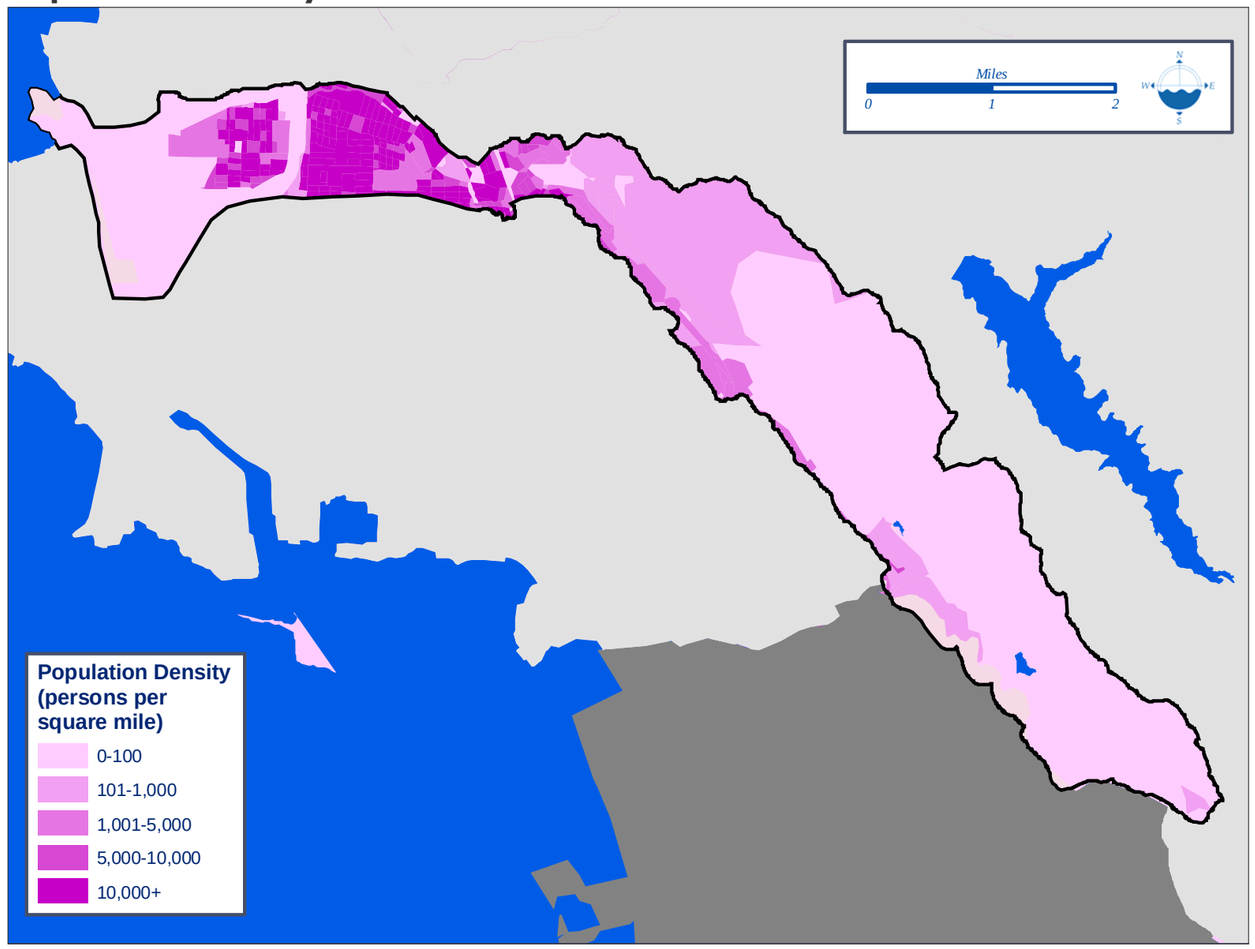
Josh Bradt



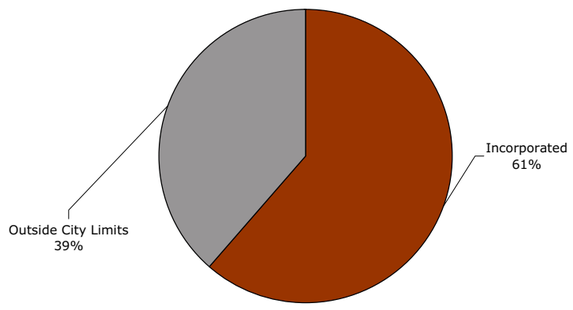
Political Boundaries



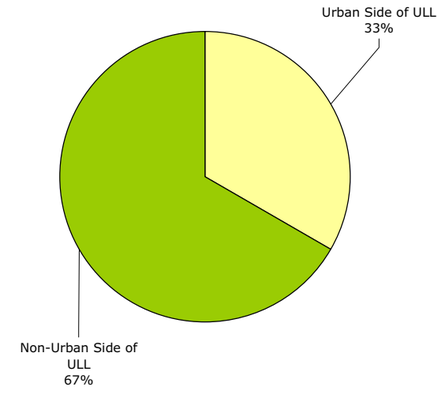
Population Density



Wildcat Creek Watershed



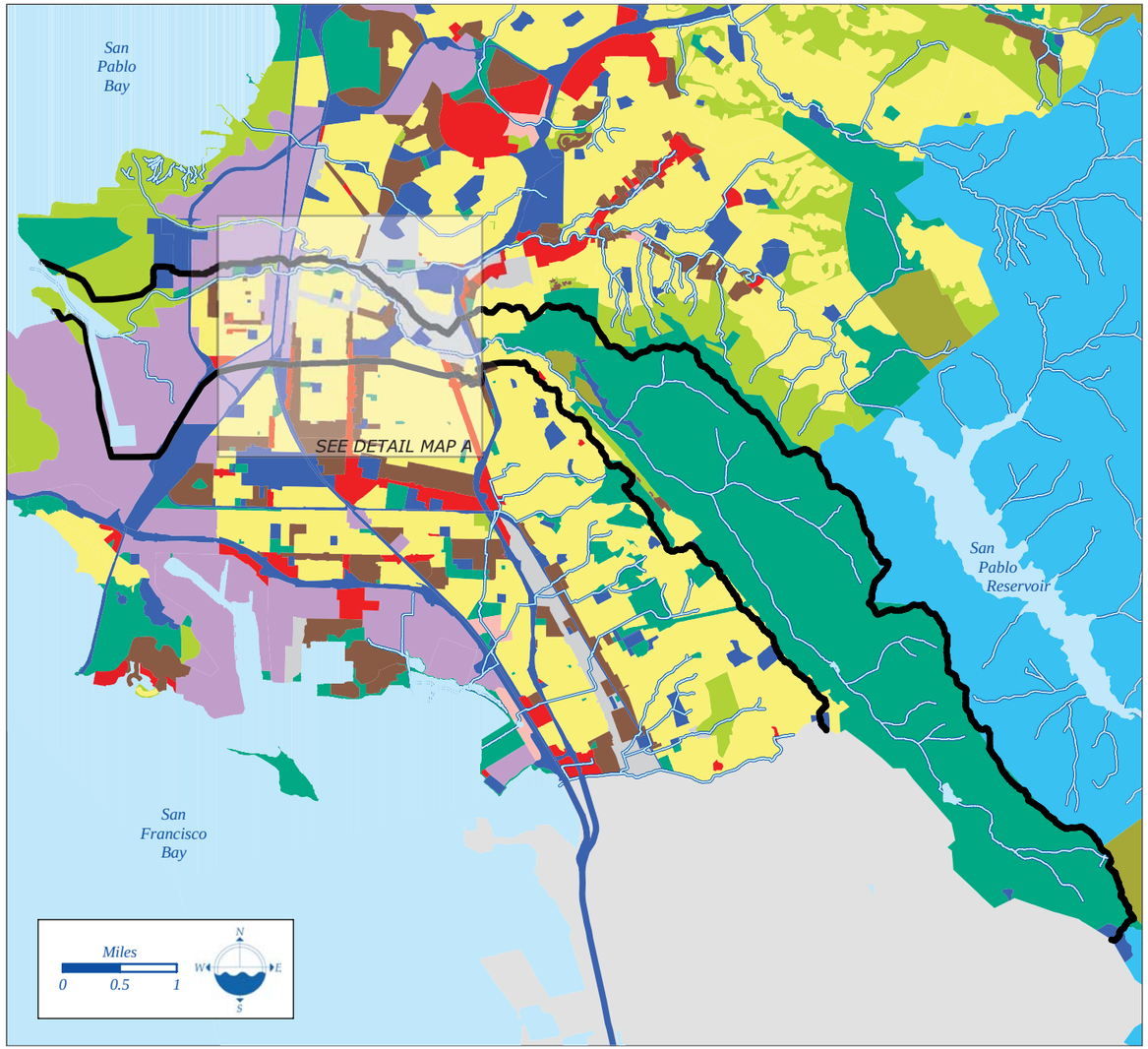
Wildcat Creek Watershed

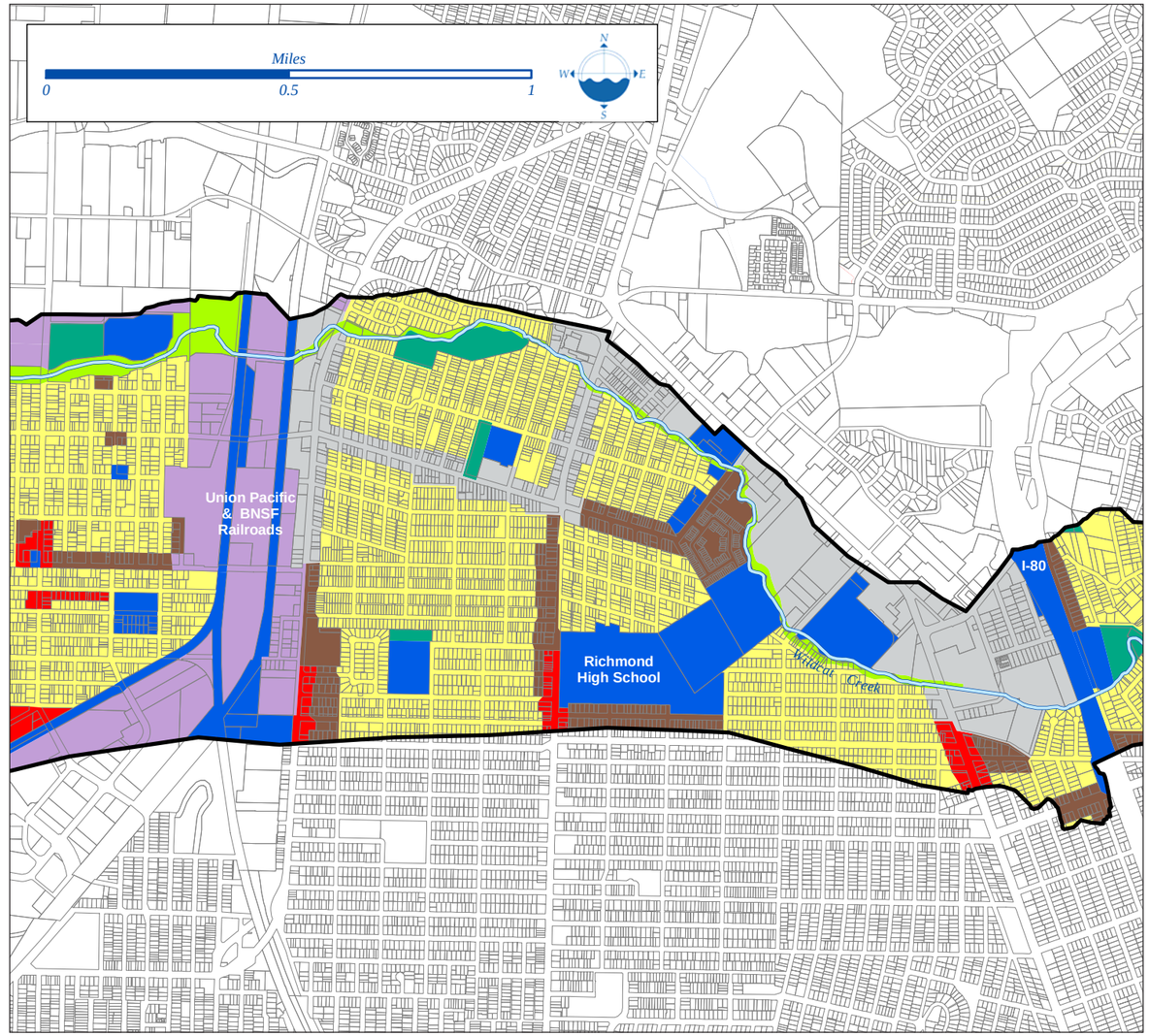


Demographic Profile for Selected Communities In or Near the Wildcat Creek Watershed

Population	East Richmond Heights	Richmond	San Pablo
Total Population	3,495	99,716	30,121
Race and Ethnicity	**East Richmond Heights**	**Richmond**	**San Pablo**
White	56.6%	21.3%	16.1%
Hispanic or Latino	11.8%	26.8%	44.5%
Black or African American	15.3%	35.3%	18.0%
Asian	11.0%	12.1%	16.2%
Some Other Race	1.9%	0.9%	1.2%
Two or More Races	3.4%	3.5%	3.9%
Education (maximum level attained)	**East Richmond Heights**	**Richmond**	**San Pablo**
No High School Diploma	8.5%	24.6%	37.6%
High School Diploma or Equivalent	42.9%	46.2%	47.3%
Associate Degree	6.1%	6.8%	4.7%
Bachelor's Degree	24.6%	14.1%	8.0%
Master's or Professional School Degree	15.0%	7.2%	2.1%
Doctorate Degree	2.9%	1.1%	0.3%
Income	**East Richmond Heights**	**Richmond**	**San Pablo**
Median Household Income	$57,500	$44,210	$37,184

Planned Land Use





Detail Map A: Wildcat Creek in the San Pablo and Richmond areas

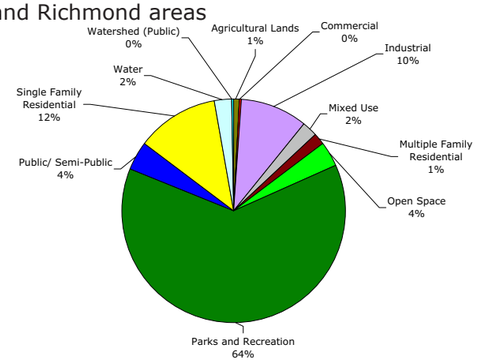
Planned Land Uses *Wildcat Creek Watershed*	Acres
Agricultural Lands	52
Business Parks and Offices	0
Commercial	33
Industrial	657
Mixed Use	160
Multiple Family Residential	99
Open Space	252
Parks and Recreation	4,309
Public/ Semi-Public	270
Single Family Residential	828
Water	164
Watershed (Public)	25
Total	**6,848**

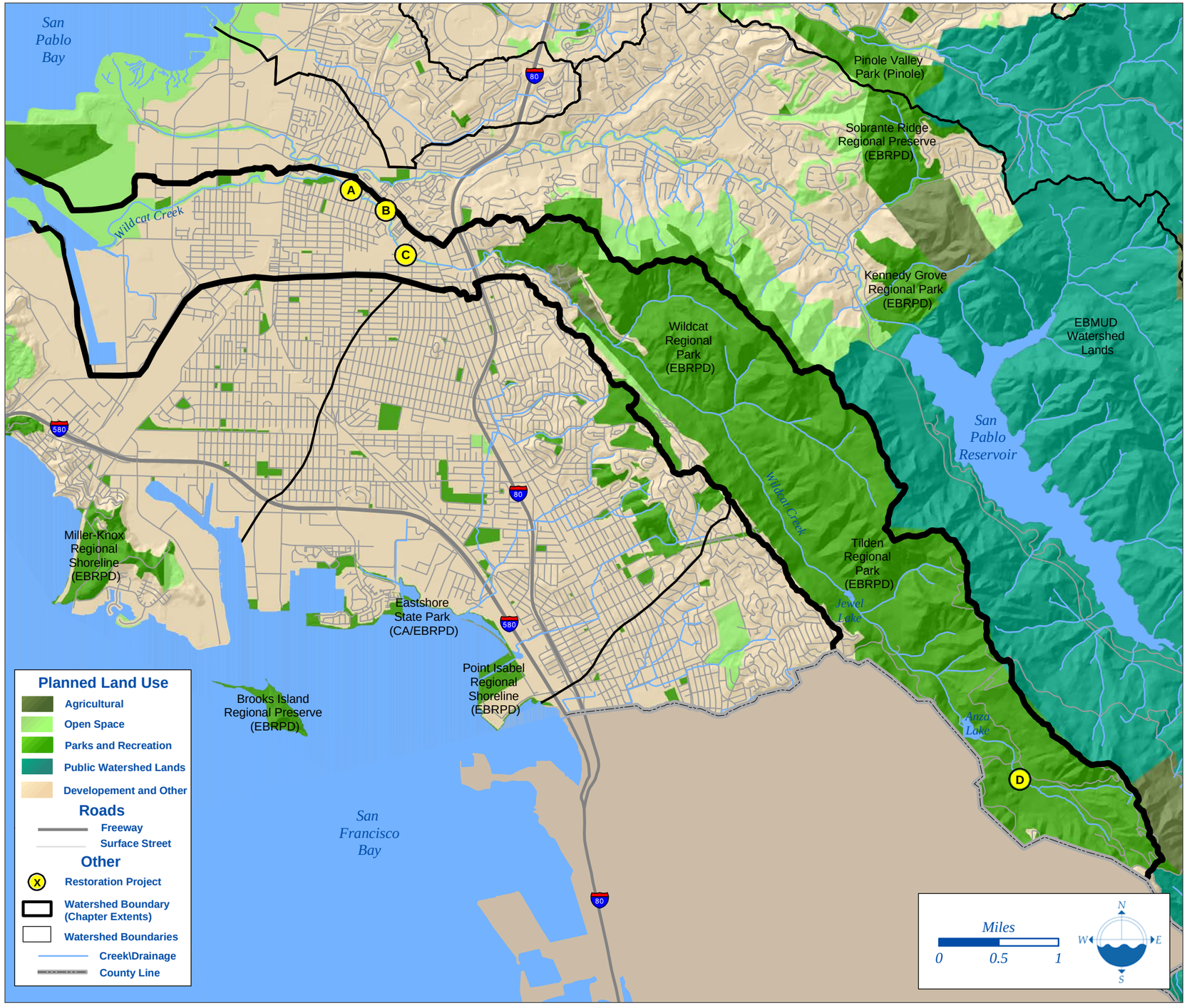
Creek or Drainage

Parcels

Planned Land Use

- Single Family Residential
- Multiple Family Residential
- Commercial
- Office/ Business Park
- Industrial
- Landfill
- Mixed Use
- Public/ Semi-Public
- Parks and Recreation
- Open Space
- Agricultural Lands
- Water
- Public Watershed Lands





Restoration Projects

(A) Wildcat Creek Restoration (23rd Street): Restored a 350-linear foot section of degraded stream and failing concrete banks. Stabilized banks using soil-bioengineering techniques (brush-layering). Planted native riparian trees and graded a trail along one bank. This project was funded by the California Department of Water Resources Urban Streams Restoration Program. Lead Agency: Urban Creeks Council, partnered with the City of San Pablo. The East Bay Conservation Corps was supervised by the Urban Creeks Council. Project completed: 2000.

(B) Wildcat Creek Restoration (Church Lane): Restore approximately 200 linear feet of creek by removing concrete and stabilizing banks. Plant native riparian vegetation. Funding for this project provided by the California Department of Water Resources and the City of San Pablo. Lead Agency: Urban Creeks Council partnered with the City of San Pablo. Project completed 2002.

(C) Wildcat-San Pablo Planning: Design a flood damage reduction plan as an alternative to the U.S. Army Corps plan. The Wildcat-San Pablo Watershed Council is guiding this process. The design would outline plans to restore riparian habitat and provide flood protection. This project is planning and design only. This project is funded by CALFED. Lead Agency: Urban Creeks Council. Anticipated project completion: 2006.

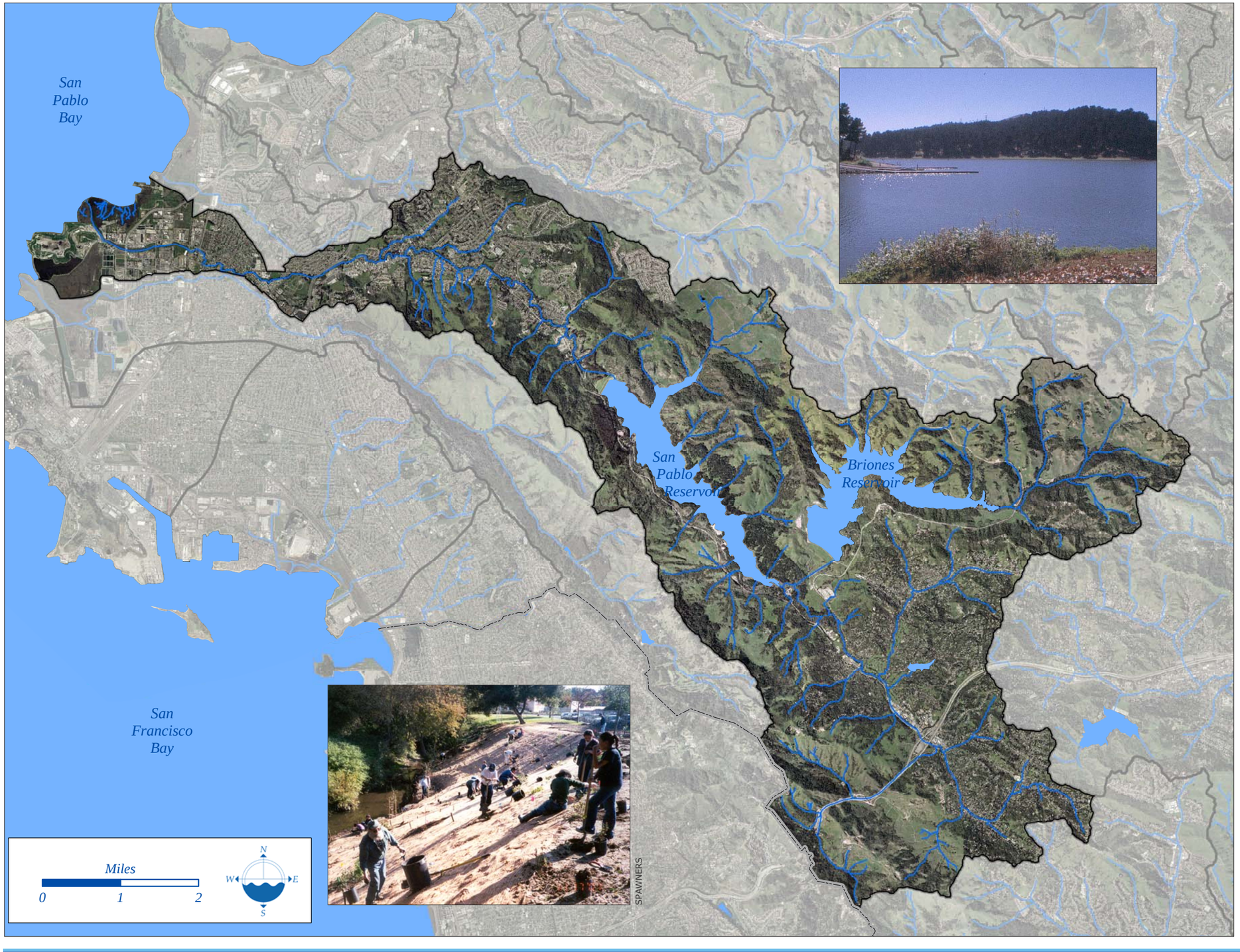
(D) Wildcat Creek Restoration at Tilden Golf Course: Removed six check dams that were obstructing the water flows of wildcat creek in the upper watershed. Restored the creek to its original channel and planted Willow, Coast Live Oak, Bigleaf Maple, California Buckeye. This project was funded by American Golf Corporation. Lead Agency: Waterways Restoration Institute partnered with Urban Creeks Council and East Bay Regional Parks. The Urban Creeks Council supervised work by the East Bay Conservation Corps. Project completed: 2002.

Organizations Active in the Watershed

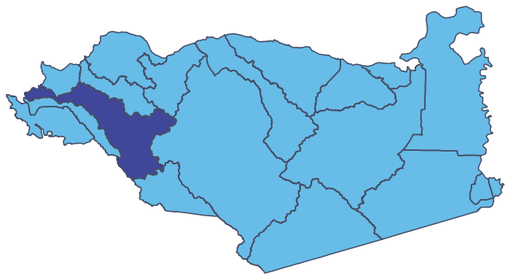
Wildcat-San Pablo Watershed Council
Tim Jensen
Contra Costa County Public Works
255 Glacier Drive
Martinez, CA 94553
Phone: (925) 313-7008
Email: tjensen@pw.co.contra-costa.ca.us

Selected Resources

San Francisco Estuary Institute, Wildcat Creek Landscape Change: A History of Sediment-Water Relations and the Role of People in the Wildcat Watershed, Contra Costa County, California. Online at www.sfei.org. Richmond, CA. 2002.



Chapter 4
San Pablo Creek Watershed



The San Pablo Creek Watershed is 27,640 acres in the heart of western Contra Costa County. This area is the site of one of the East Bay's earliest ranchos, Rancho San Pablo (landgrant - 1823). The rancho covered 18,000 acres, and, in addition to raising livestock and horses, the rancho also grew fruit, vegetables and wheat.

SPAWNERS

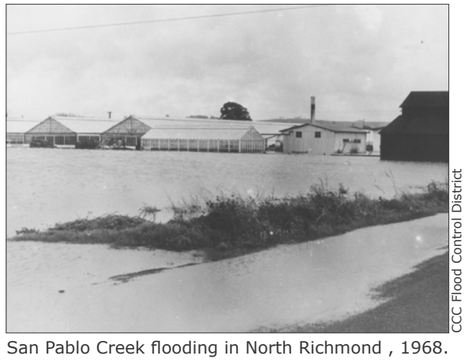
Cinda Mackinnon

San Pablo Creek Watershed Vital Statistics		
Watershed Size	27,640	acres
Length of Longest Branch of Creek	19.65	miles
Total Channel Length in Watershed	108.60	miles
Average Annual Rainfall	27	inches
Estimated Mean Daily Flow	32.1	cfs
Estimated 100-Year Flood Flow	N/A	
Highest Elevation in Watershed	1905	feet
Population (estimated)	47,100	people
Estimated Percent Impervious	20	%
Recognized Pollutants of Concern	Diazinon*	

* San Pablo Creek is listed as an Impaired Water Body in the State's 303(d) list. Diazinon is the Pollutant of Concern. San Pablo Reservoir has been listed as impaired for mercury.

The headwaters of San Pablo creek are in the City of Orinda. The headwaters cross into land administered by EBMUD and flow into the San Pablo Reservoir. Tributary headwaters to the north enter the Briones Reservoir and are regulated by EBMUD as well.

As water leaves the San Pablo Reservoir, it flows through first rural and then heavily urbanized residential and commercial areas before reaching the saltwater marshes adjacent to SF Bay.



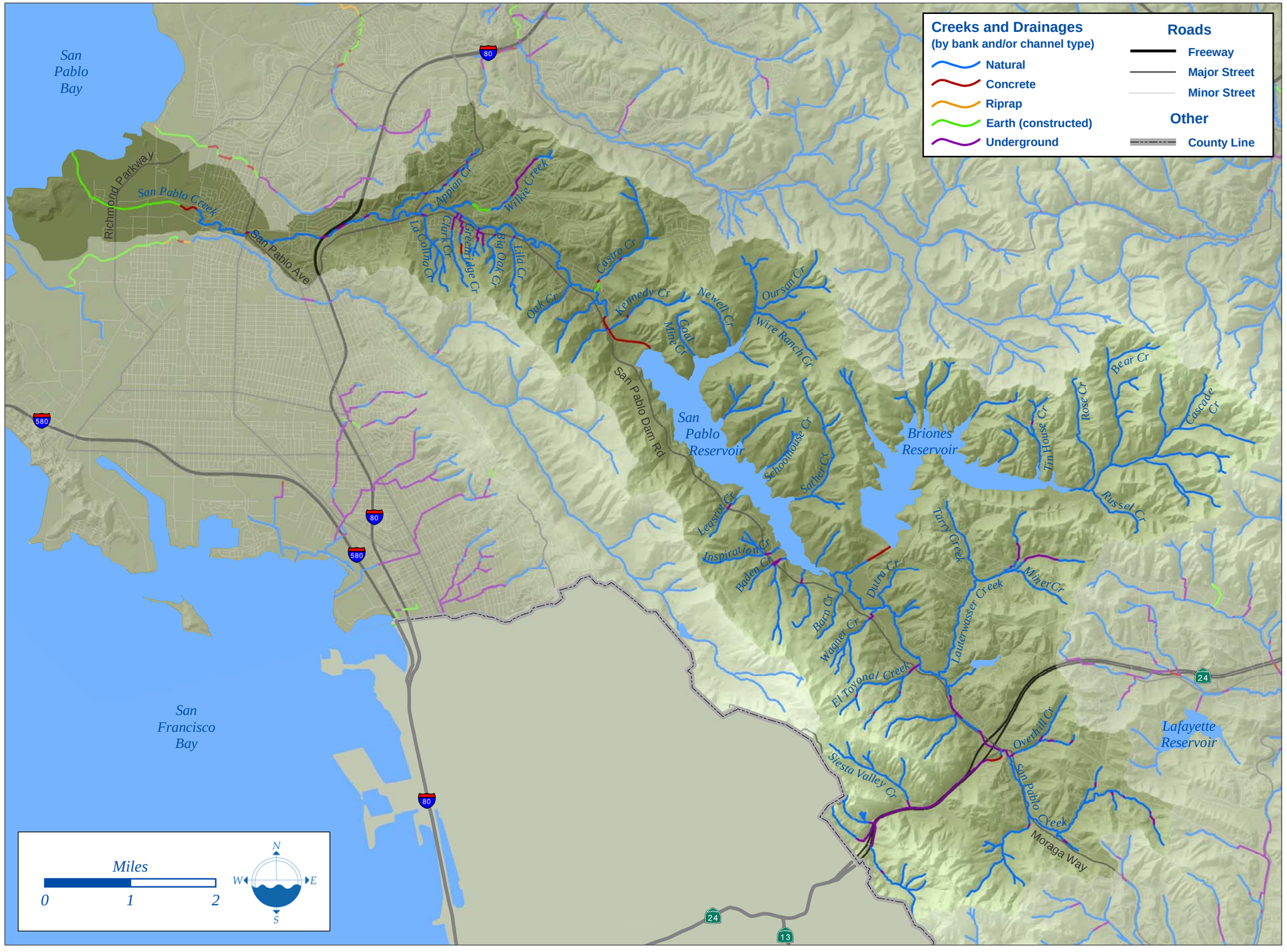
CCC Flood Control District

San Pablo Creek flooding in North Richmond , 1968.

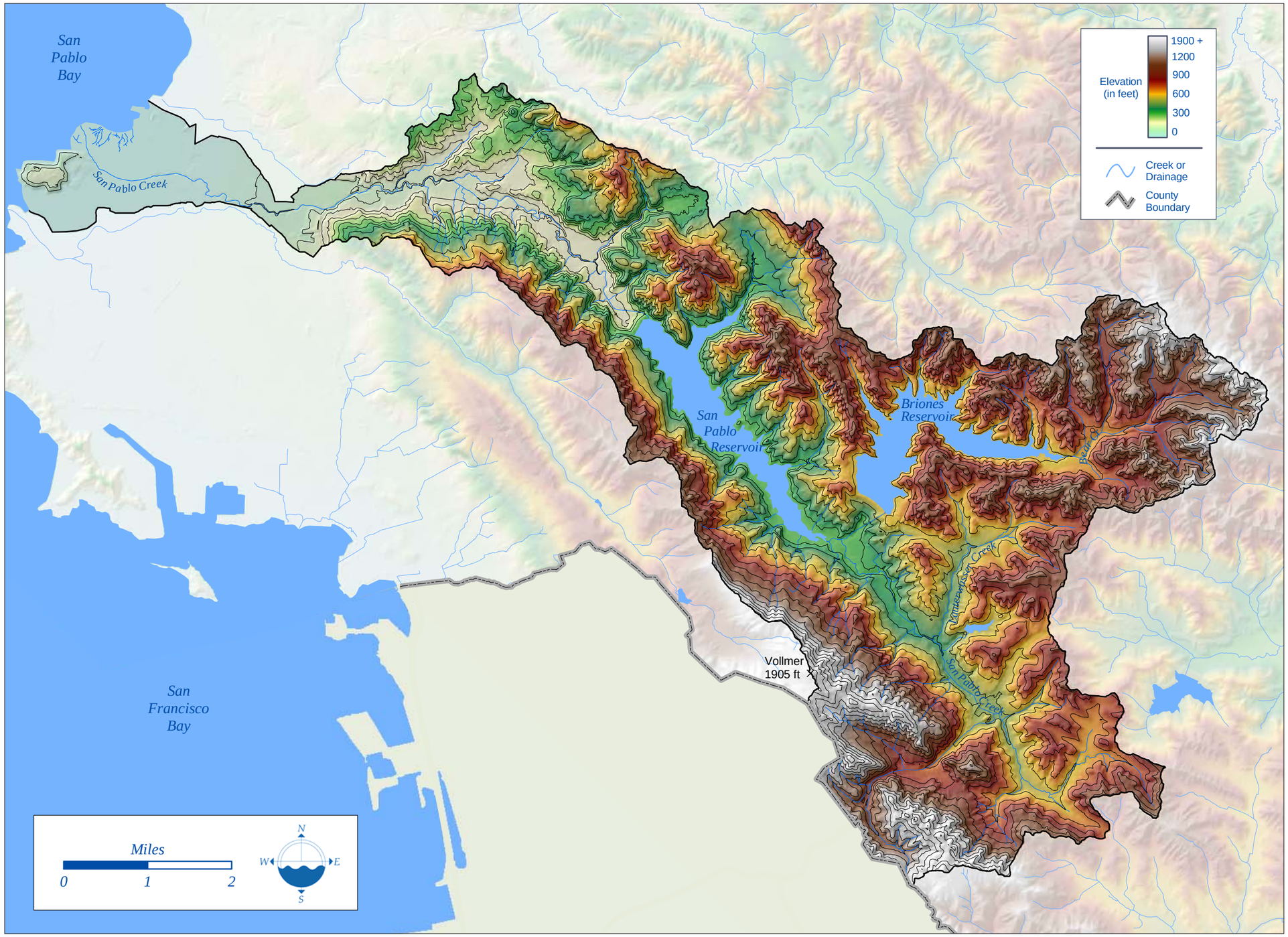
San Pablo Creek Channel Length Statistics*

	Miles	Percent
Length of Longest Branch of Creek	19.65	
Total Channel Length in Watershed	108.60	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	97.09	89.4%
Concrete	9.45	8.7%
Earth (constructed)	2.07	1.9%
Riprap	0.00	0.0%
Underground	7.80	7.2%

*Data relate to mapped channels only. Does not include storm drains. Bank type for segments shorter than 100 feet was not mapped.



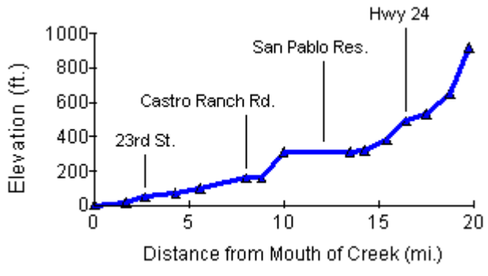
Topography and Hydrology



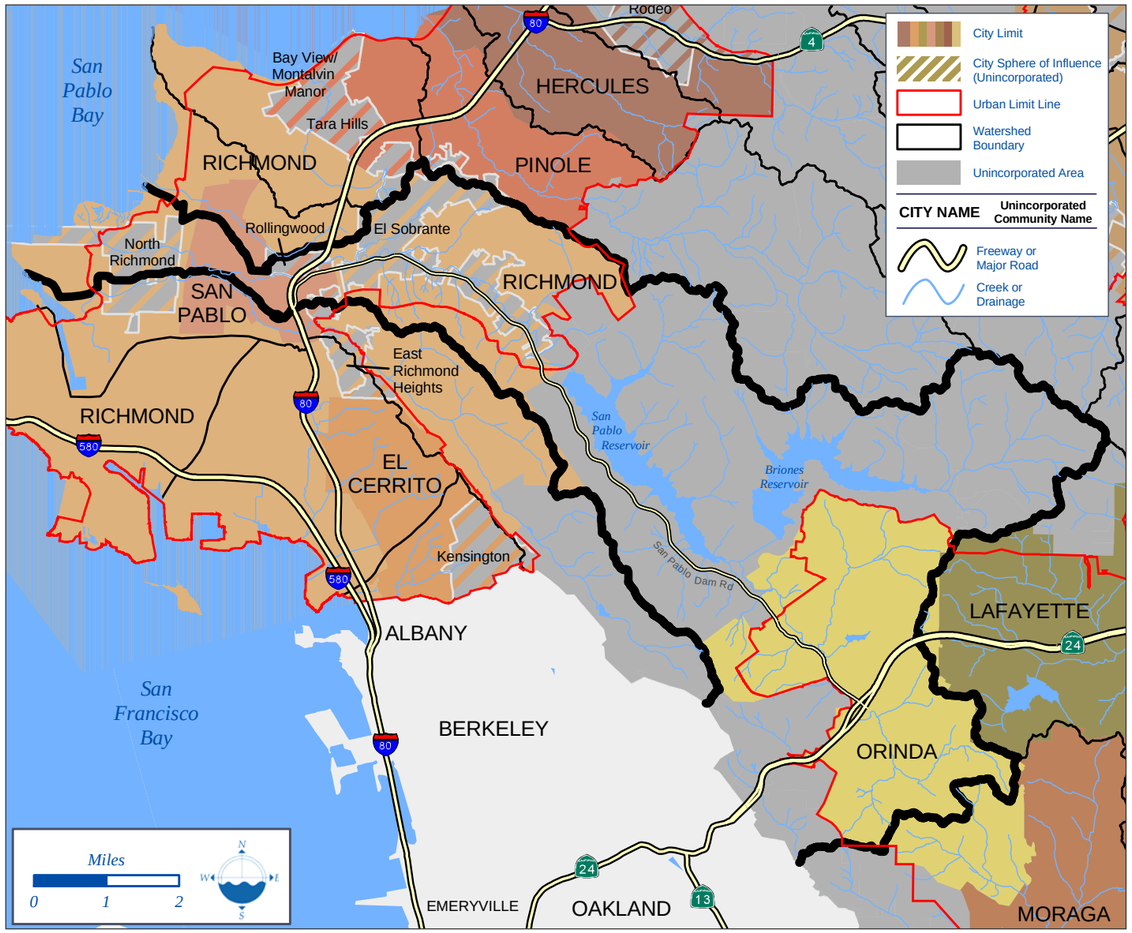
San Pablo Creek's flow regime and steep banks have kept the creek from relegation to culverts, providing the Cities of San Pablo and Richmond, and the community of El Sobrante with a natural reminder of the surrounding watershed. From its headwaters in the City of Orinda, San Pablo Creek flows approximately 20 miles before reaching the San Francisco Bay.

City of Lafayette Parks and Recreation Department

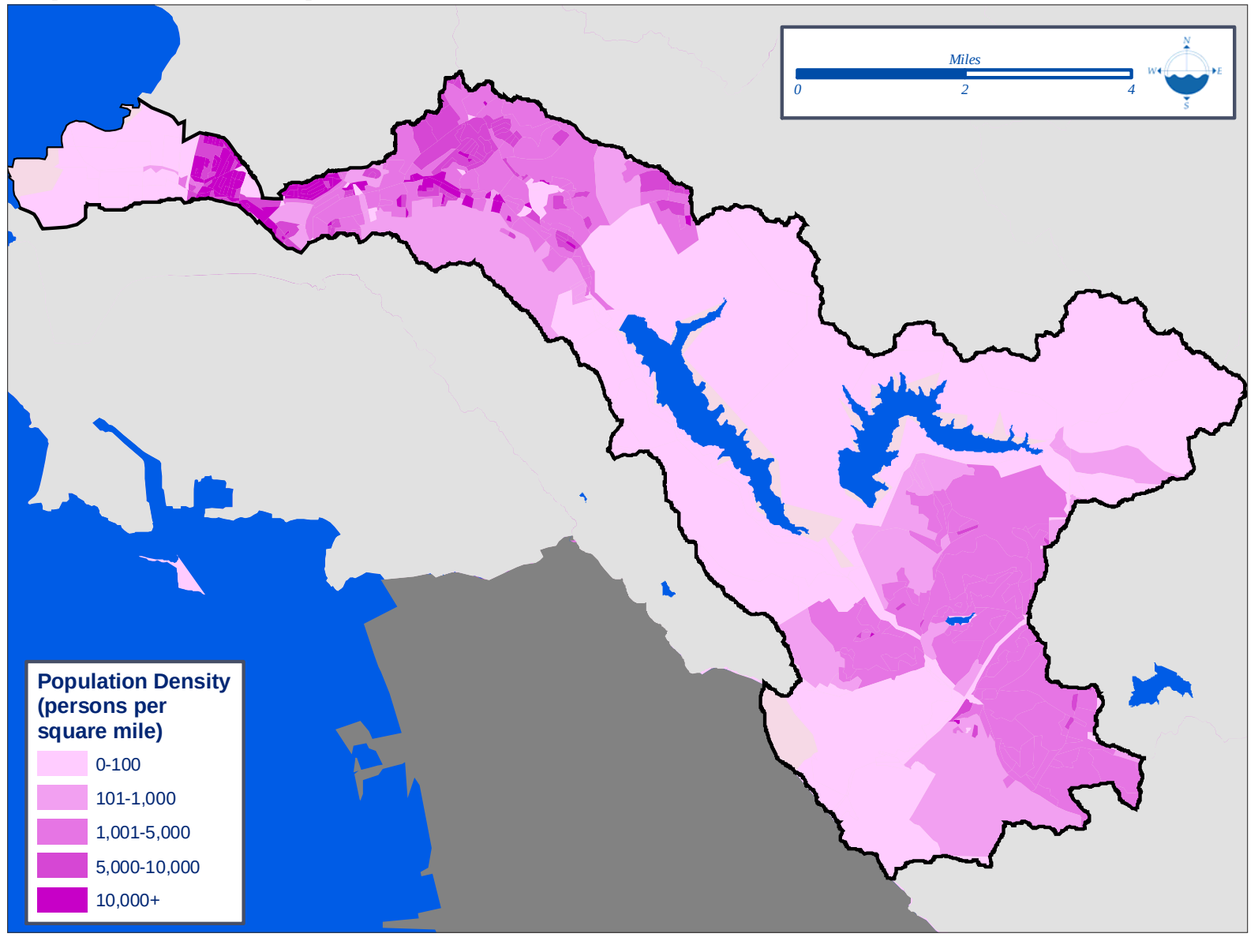
Cinda MacKinnon



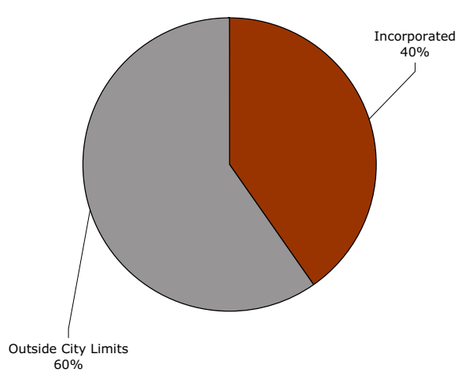
Political Boundaries



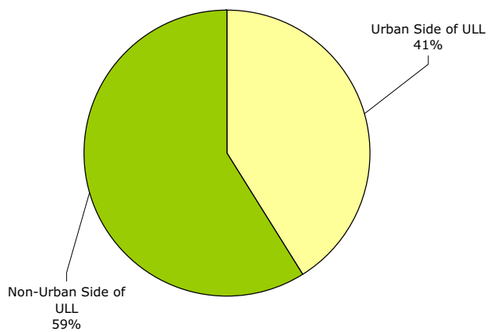
Population Density



San Pablo Creek Watershed



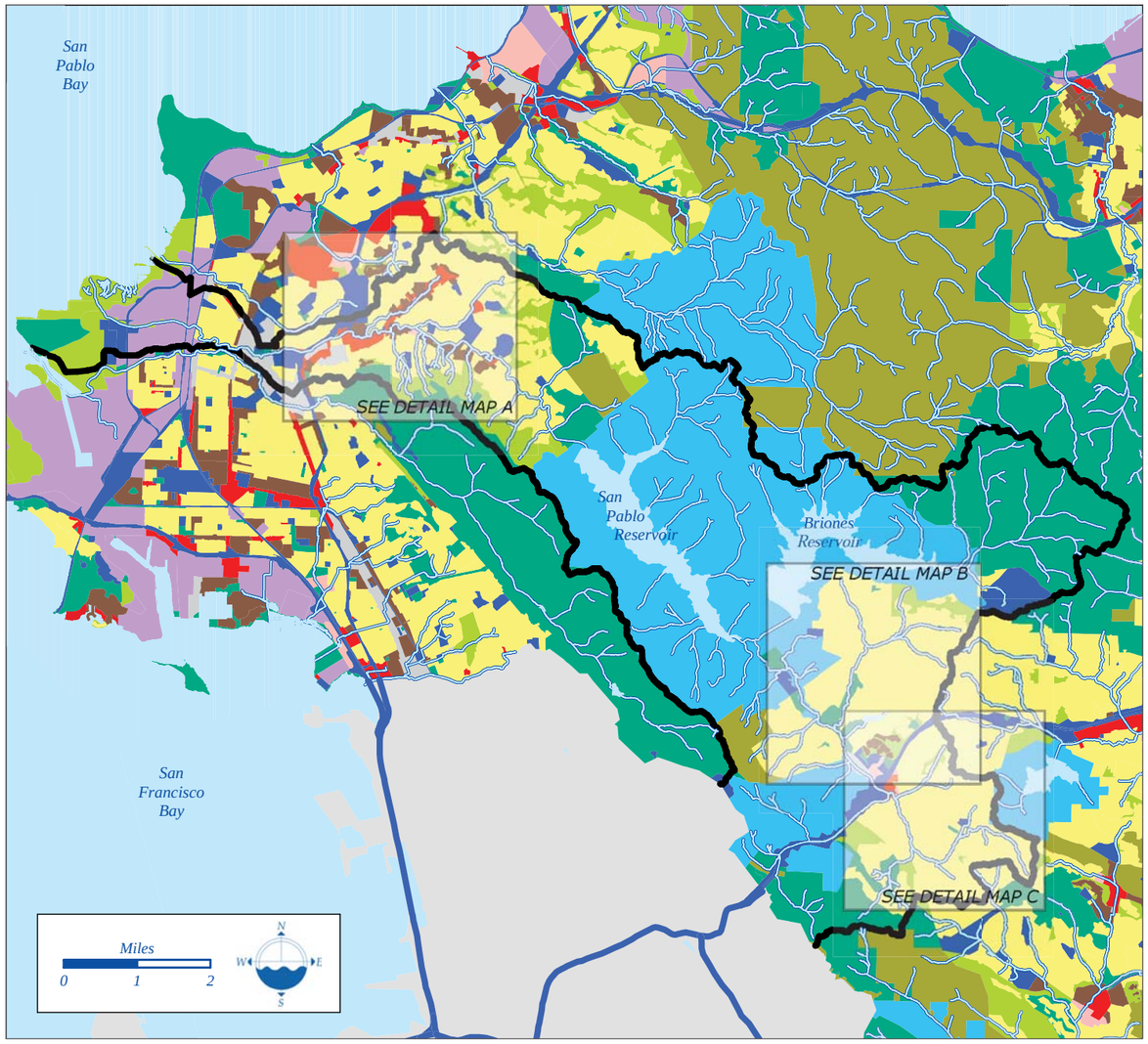
San Pablo Creek Watershed

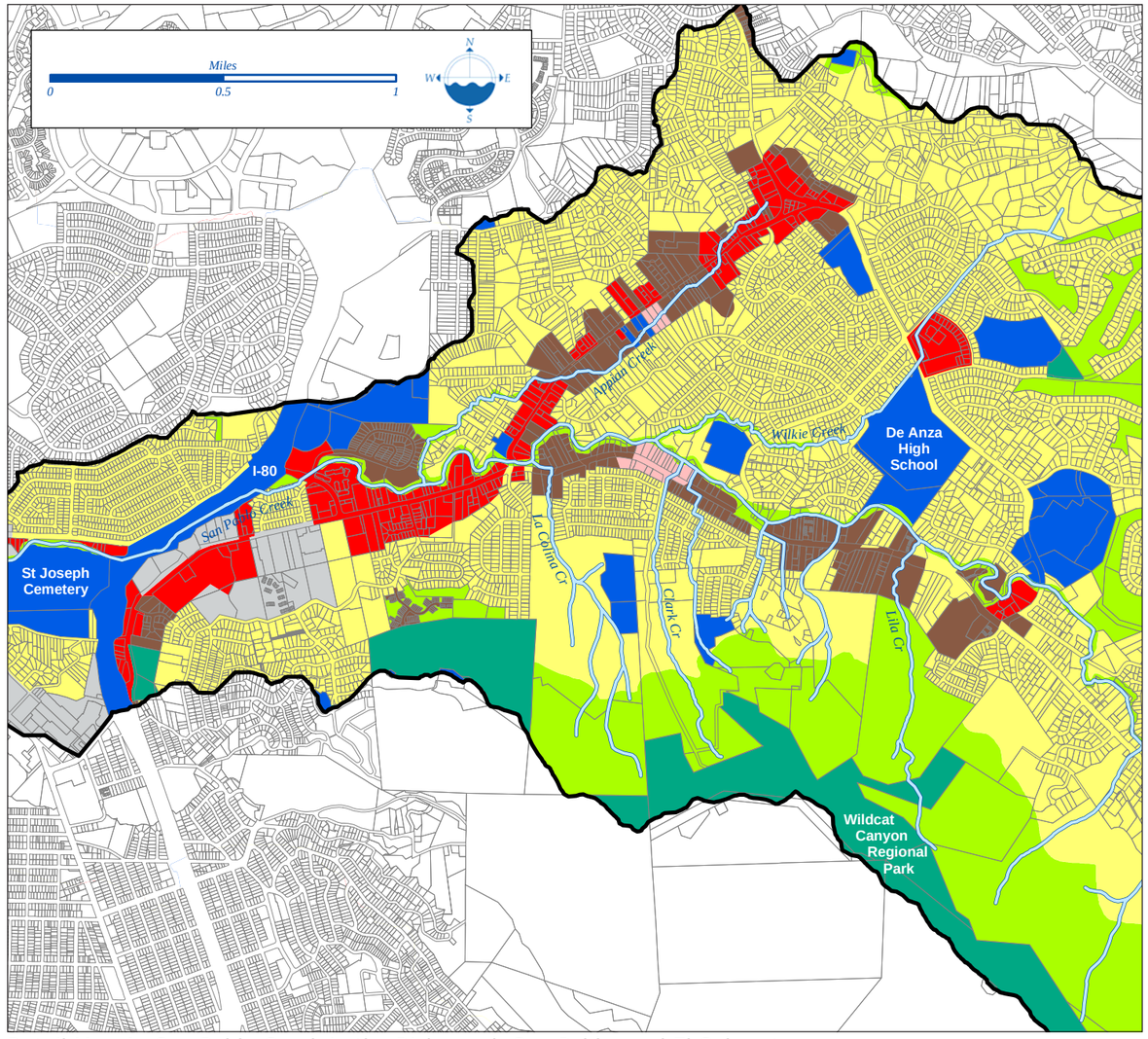


Demographic Profile for Selected Communities In or Near the San Pablo Creek Watershed

Population	El Sobrante	Orinda	San Pablo
Total Population	11,605	17,446	30,121
Race and Ethnicity	**El Sobrante**	**Orinda**	**San Pablo**
White	55.6%	84.1%	16.1%
Hispanic or Latino	13.5%	3.5%	44.5%
Black or African American	10.5%	0.3%	18.0%
Asian	11.6%	8.7%	16.2%
Some Other Race	1.0%	0.7%	1.2%
Two or More Races	7.9%	2.7%	3.9%
Education (maximum level attained)	**El Sobrante**	**Orinda**	**San Pablo**
No High School Diploma	13.6%	2.2%	37.6%
High School Diploma or Equivalent	56.6%	18.2%	47.3%
Associate Degree	9.1%	5.7%	4.7%
Bachelor's Degree	14.4%	39.6%	8.0%
Master's or Professional School Degree	5.0%	29.2%	2.1%
Doctorate Degree	1.4%	5.1%	0.3%
Income	**El Sobrante**	**Orinda**	**San Pablo**
Median Household Income	$48,272	$117,637	$37,184

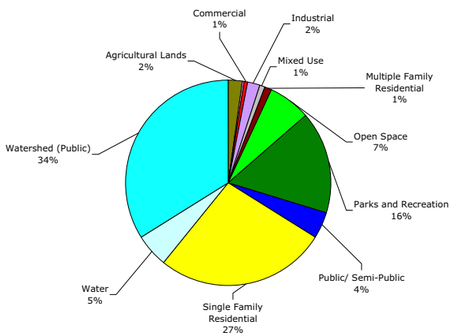
Planned Land Use





Detail Map A: San Pablo Creek in the Richmond, San Pablo, and El Sobrante areas

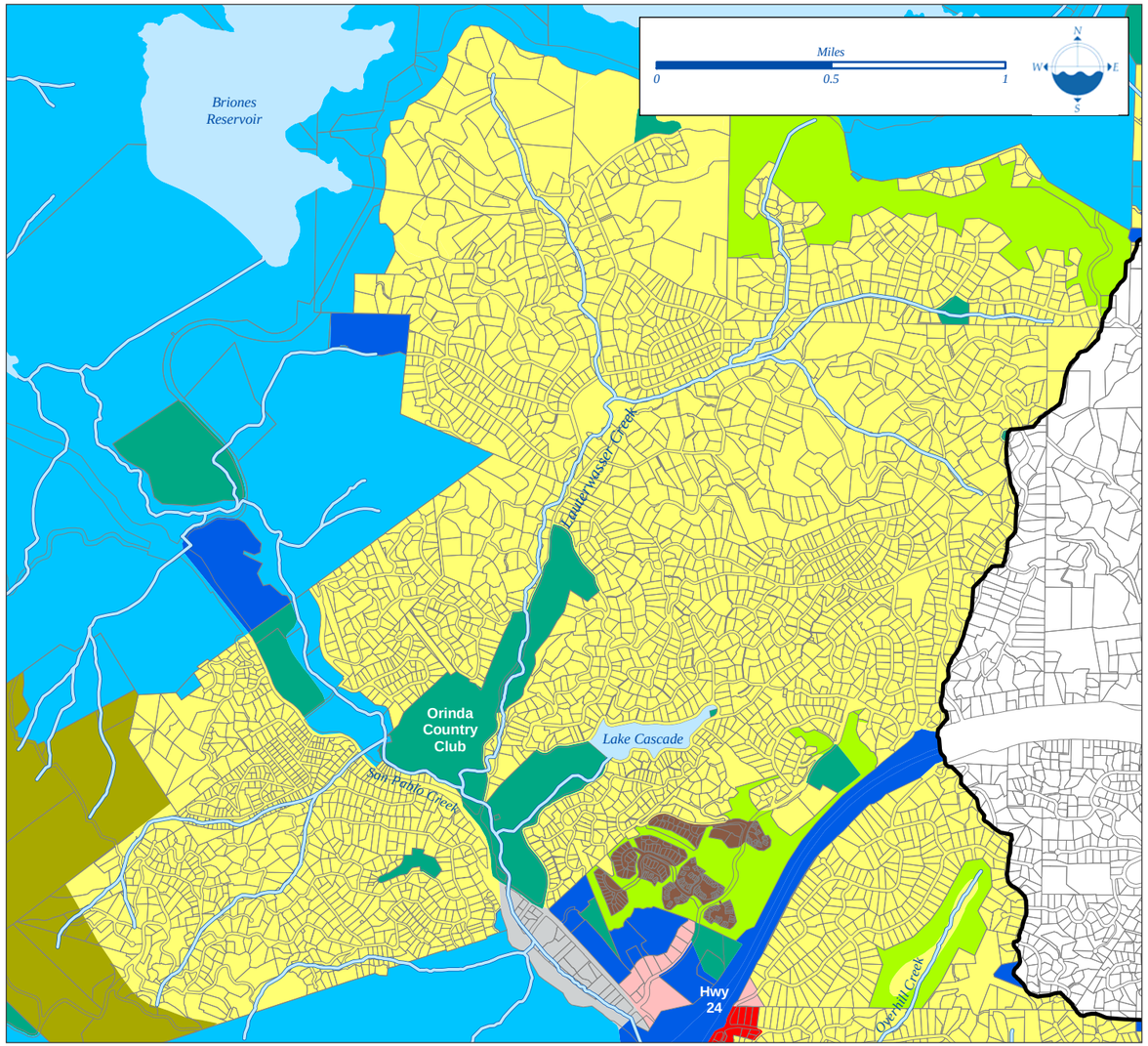
Planned Land Uses *San Pablo Creek Watershed*	Acres
Agricultural Lands	633
Business Parks and Offices	35
Commercial	202
Industrial	507
Mixed Use	254
Multiple Family Residential	259
Open Space	1,859
Parks and Recreation	4,495
Public/ Semi-Public	1,139
Single Family Residential	7,399
Water	1,479
Watershed (Public)	9,379
Total	**27,640**



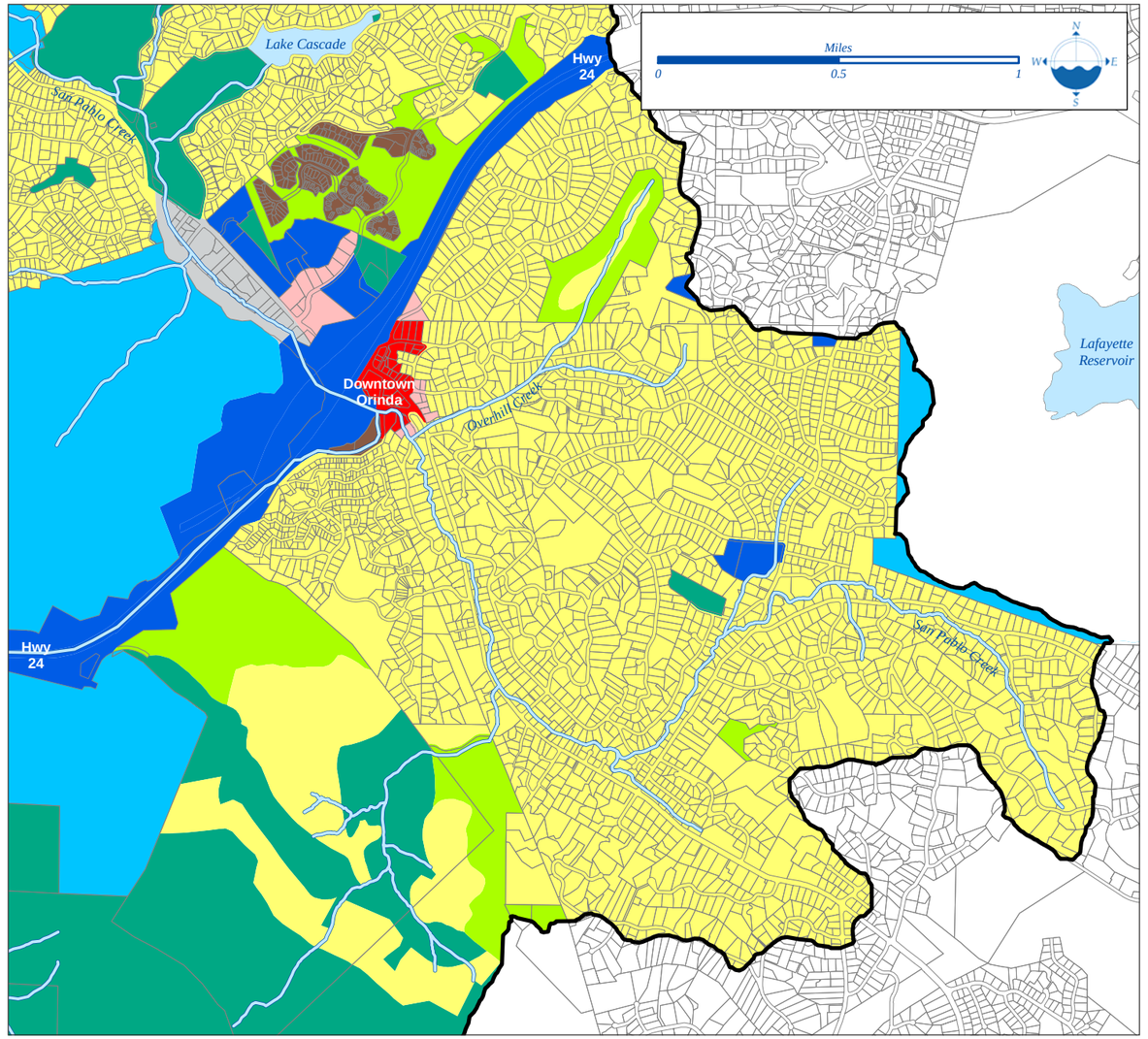
Creek or Drainage
Parcels

Planned Land Use

- Single Family Residential
- Multiple Family Residential
- Commercial
- Office/ Business Park
- Industrial
- Landfill
- Mixed Use
- Public/ Semi-Public
- Parks and Recreation
- Open Space
- Agricultural Lands
- Water
- Public Watershed Lands



Detail Map B: San Pablo Creek in the Orinda North area

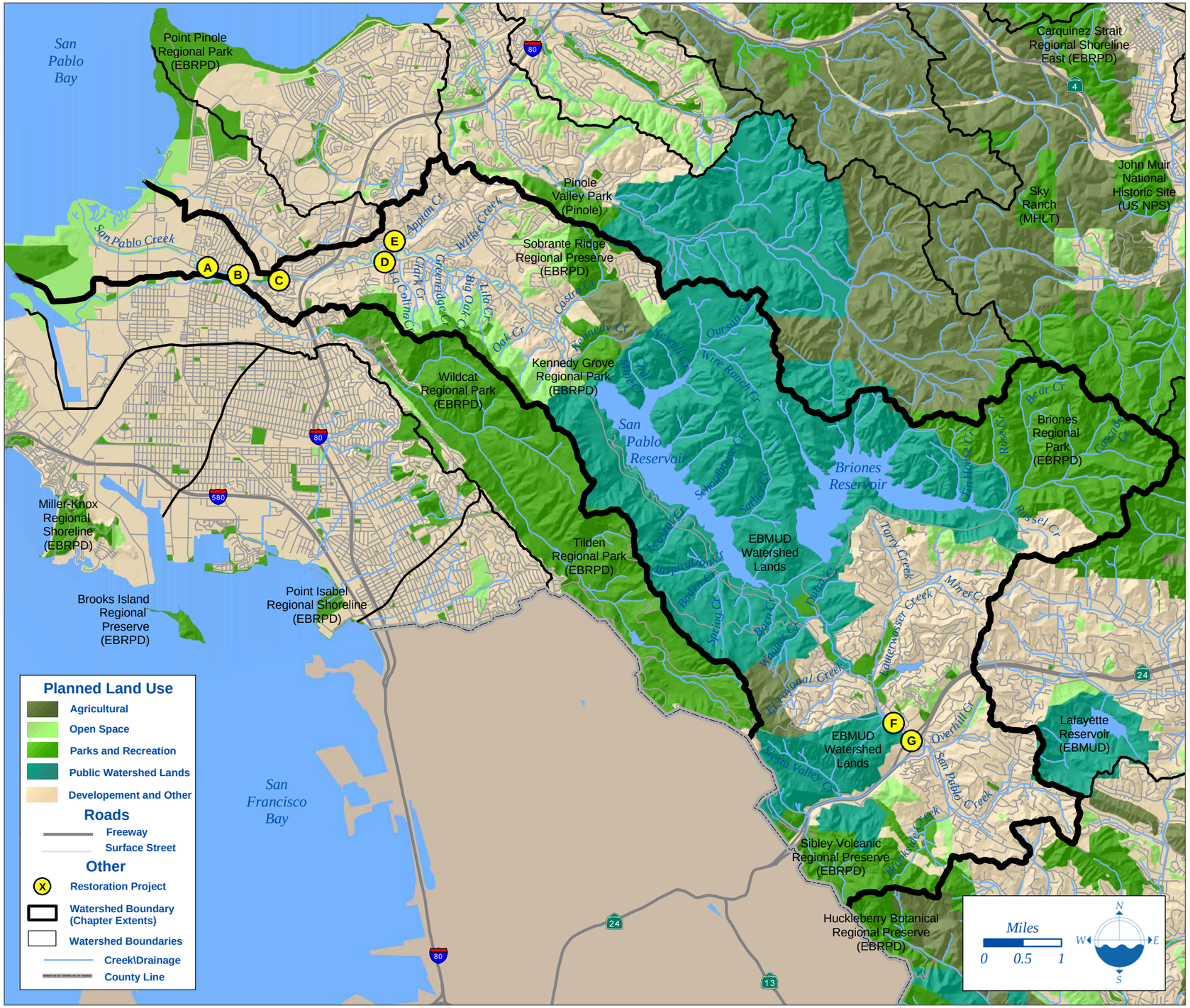


Detail Map C: San Pablo Creek in the Orinda South area

Creek or Drainage
Parcels

Planned Land Use

- Single Family Residential
- Multiple Family Residential
- Commercial
- Office/ Business Park
- Industrial
- Landfill
- Mixed Use
- Public/ Semi-Public
- Parks and Recreation
- Open Space
- Agricultural Lands
- Water
- Public Watershed Lands



Restoration Projects

(A) Wildcat-San Pablo Planning: Design a flood damage reduction plan as an alternative to the U.S. Army Corps plan. The Wildcat-San Pablo Watershed Council is guiding this process. The design would outline plans to restore riparian habitat and provide flood protection. This project is planning and design only. This project is funded by: CALFED. Lead Agency: Urban Creeks Council. Anticipated project completion: 2006.

(B) Bank Stabilization: Re-engineered bank slope, installed sub-drains, and re-vegetated the riparian area. Funded by the Habitat Conservation Fund and the City of San Pablo. Lead Agency: City of San Pablo partnered with the Urban Creeks Council. Project completed in 2002.

(C) Wildcat/San Pablo Creek 1135 Modification: Restore downstream reaches of both Wildcat and San Pablo creeks to increase the riparian and wildlife habitat in the area. The Wildcat San Pablo Creek Watershed Council is seeking funding to complete the project. This project is partially funded by the U.S. Army Corps of Engineers. Lead Agency: U.S. Army Corps and Contra Costa County Flood Control. Anticipated project completion: 2007.

(D) El Sobrante Library Creek Restoration Project: Establish a native riparian plant demonstration garden behind the El Sobrante library. The native plant garden at the top of the creek bank has been successful, and exotic plant removal and re-vegetation is extending down the bank to San Pablo Creek. Lead Agency: Aquatic Outreach Institute and SPAWNERS. This project is funded by the California Coastal Conservancy and CALFED. Anticipated project completion: 2006.

(E) Appian Creek Restoration Project: Remove exotic plants and re-vegetate native plants along Appian Creek in El Sobrante. Proposed (not funded) addition to the project is to add a meander to the creek channel. Funded by: California Coastal Conservancy and CALFED. Lead Agency: Aquatic Outreach Institute and SPAWNERS. Anticipated project completion: 2007.

(F) San Pablo Creek Re-vegetation: Removed invasive plants from two 100-foot stretches of the downtown creek. Replanted these areas with riparian natives raised by Friends of Orinda Creeks and Wagner Ranch Nature area with help from Orinda Garden Club. Funding provided by Association of Bay Area Governments and San Francisco Estuary Project. Project completed: 2003.

(G) Upper San Pablo Creek Restoration: Restore San Pablo Creek as it runs through downtown Orinda. Remove exotic plant species including Scotch and French Broom, Himalayan Blackberry, English Ivy, and Periwinkle (Vinca). Re-introduce and encourage native plants to grow in the riparian area. This project is still awaiting funding. Lead Agency: Friends of Orinda Creeks with the City of Orinda. Anticipated completion: 2010.

Ivy on the Banks

Ivy on the right bank

Ivy on the left bank

Creek or Drainage

Dots are sized proportionally to the size (length along creek corridor) of Ivy. Length along the creek corridor was measured from the downstream end of the stand. Size of stands range from 2 feet to 150 feet in length.

English Ivy

Steve Donnelly of the Urban Creeks Council wades through deep water in San Pablo Creek as he assists with GPS data collection, 2001.

SPAWNERS has organized a number of GPS data collection events in the San Pablo Creek Watershed. In 2001, the group collected GPS data on Appian Creek. The map above displays data collected on invasive German and English Ivy. Ivy, introduced as an ornamental plant, has escaped the manicured gardens of the area and is now common along riparian corridors.

Ivy can grow along the ground and shade out native riparian plants. It can also wrap around tress and eventually kill them. SPAWNERS can use this data to target restoration efforts and monitor progress in this area.

Organizations Active in the Watershed

Aquatic Outreach Institute and
San Pablo Watershed Neighbors Education and Restoration Society (SPAWNERS)
1327 South 46th Street #155
Richmond, CA 94804
Phone: (510) 231-5655
Email: staff@aoinstitue.org
Website: http://www.aoinstitute.org/

Friends of Orinda Creeks
Maya Rappaport
Phone: (925) 253-1997
Email: mayarapp@comcast.net

SPAWNERS collect water chemistry data on San Pablo Creek, 2003.

SPAWNERS smile as they complete a GPS survey of lower San Pablo Creek, 2001.

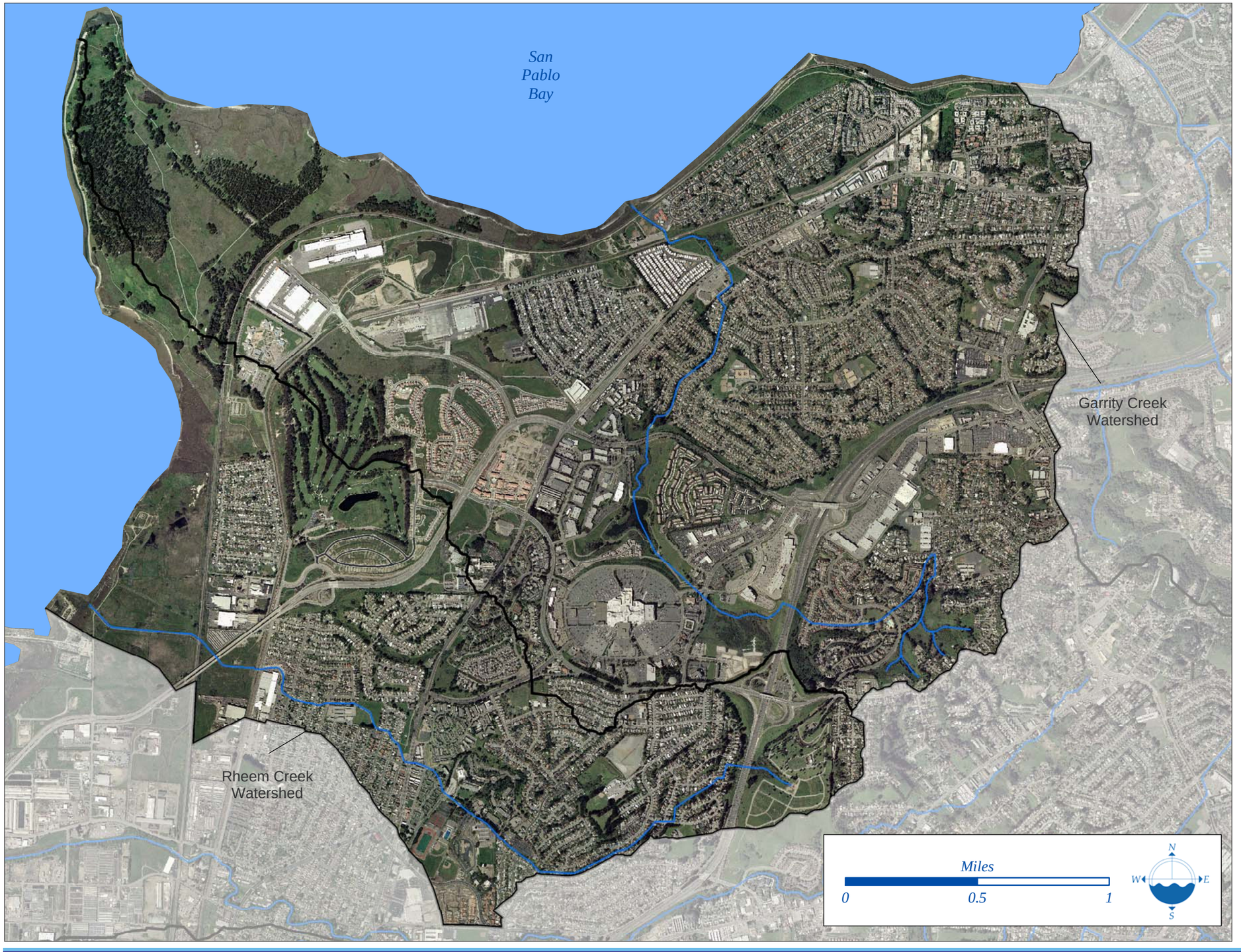
Selected Resources

Friends of Orinda Creeks, San Pablo Creek: Restoring our Natural Heritage in the Heart of Orinda, July 2001.

MacKinnon Environmental Consulting, Downtown Creek Survey, San Pablo Creek, Orinda, 1999.

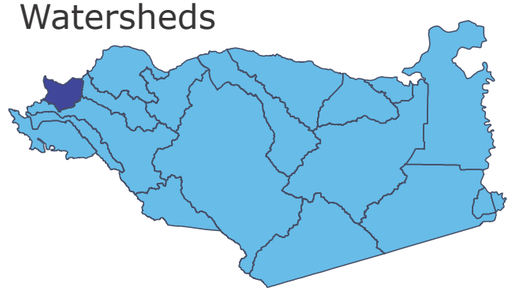
Owens-Viani, Lisa. The Cultural and Natural History of the San Pablo Creek Watershed, 2000.

Waterways Restoration Institute and Far West Restoration Engineering, San Pablo Creek Through Downtown Orinda: Preliminary Restoration Plan, July 2001.



Chapter 5

Rheem and Garrity Creek Watersheds



This 1,790-acre area includes the watersheds of Rheem Creek (3.36 miles) and Garrity Creek (3.67 miles). Located in western Contra Costa County, these watersheds include sections of the Cities of Richmond, Pinole and San Pablo, as well as a small portion of unincorporated County (El Sobrante). Point Pinole Regional Shoreline is located at the western-most tip of the area, providing 632 acres of parkland to the watershed, and marking the northern-most boundary of the historic Rancho San Pablo (1832).

Rheem Creek Watershed Vital Statistics		
Watershed Size	1,790	acres
Length of Longest Branch of Creek	3.36	miles
Total Channel Length in Watershed	3.36	miles
Average Annual Rainfall	22	inches
Estimated Mean Daily Flow	2.3	cfs
Estimated 100-Year Flood Flow	1060	cfs*
Highest Elevation in Watershed	360	feet
Population (estimated)	13,900	people
Estimated Percent Impervious	50	%
Recognized Pollutants of Concern	N/A	**

Garrity Creek Watershed Vital Statistics		
Watershed Size	3,850	acres
Length of Longest Branch of Creek	3.67	miles
Total Channel Length in Watershed	4.10	miles
Average Annual Rainfall	20	inches
Estimated Mean Daily Flow	5.4	cfs
Estimated 100-Year Flood Flow	N/A	
Highest Elevation in Watershed	1,483	feet
Population (estimated)	58,900	people
Estimated Percent Impervious	60	%
Recognized Pollutants of Concern	N/A	**

*At BNSF railroad tracks(1100 acres upstream; 62% of watershed)

**Rheem & Garrity Creeks have not been specifically identified in the State's 303(d) list of Impaired Water Bodies.

The Giant Powder Company, one of the first American Companies to produce dynamite, moved to the area (now the regional park) in 1892. Explosives were produced at the factory until 1960. The company town, quickly made this area a populated, industrial center. The Carquinez Golf Club leased land just east of the explosive factory in 1934, and presently the Richmond Country Club occupies 180 acres of open space in the region.

The headwaters of Rheem Creek begin just east of Interstate 80 in a residential neighborhood of Richmond. On its route to San Pablo Bay it passes into the City of San Pablo for one mile before entering the City of Richmond again, continuing its course to SF Bay. One third of the creek is culverted under residential areas, while the other two-thirds are above ground but contained in concrete and earthen channels. Flowing through a variety of industrial and residential areas, it reaches the Bay a half mile south of Point Pinole Regional Shoreline.

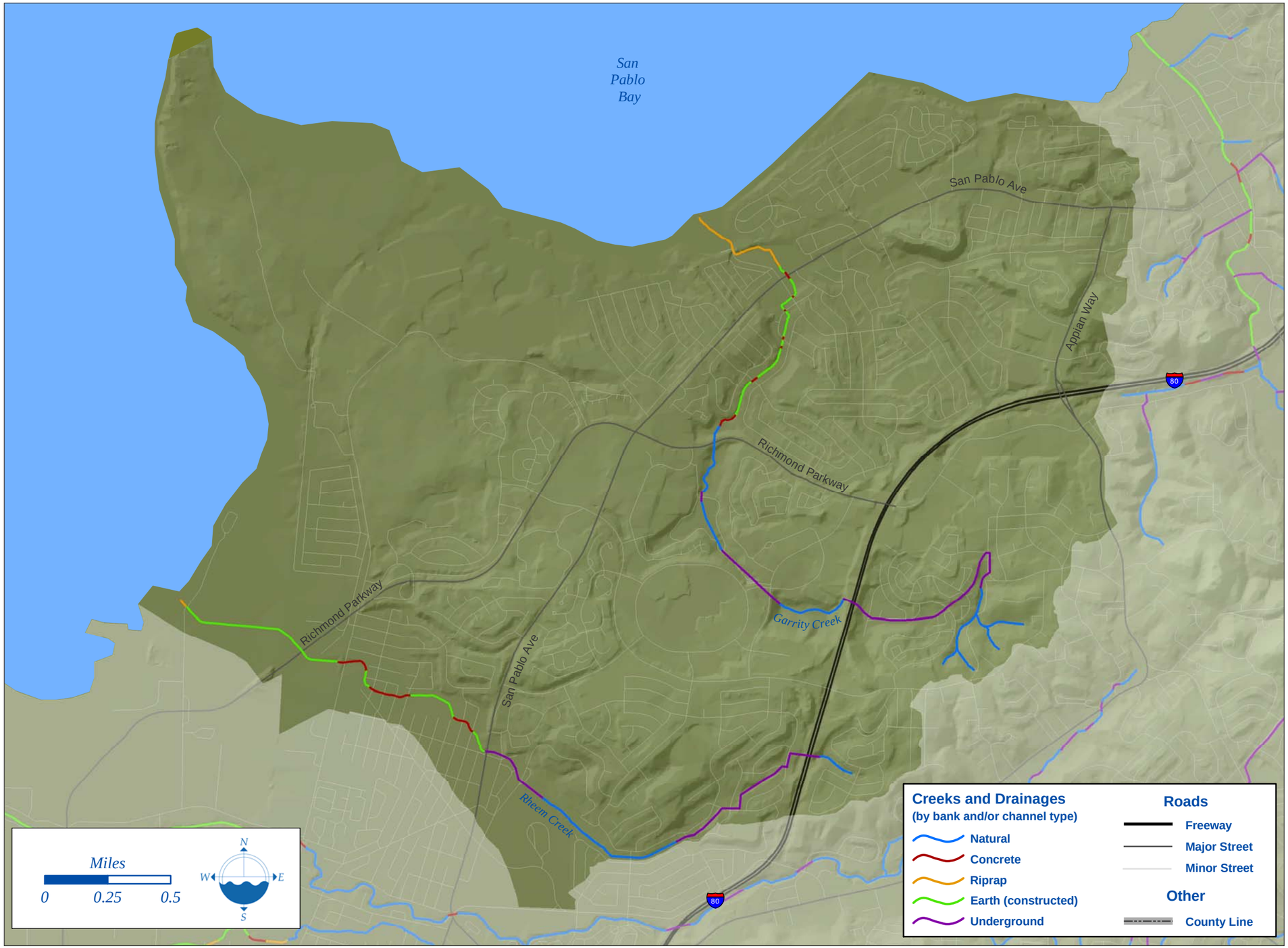
Rheem Creek Channel Length Statistics*

	Miles	Percent
Length of Longest Branch of Creek	3.36	
Total Channel Length in Watershed	3.36	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	0.78	23.1%
Concrete	1.48	44.2%
Earth (constructed)	1.06	31.7%
Riprap	0.03	1.0%
Underground	1.07	31.8%

Garrity Creek Channel Length Statistics*

	Miles	Percent
Length of Longest Branch of Creek	3.67	
Total Channel Length in Watershed	4.10	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	1.62	39.5%
Concrete	1.43	34.8%
Earth (constructed)	0.62	15.1%
Riprap	0.43	10.6%
Underground	1.24	30.3%

*Data relate to mapped channels only. Does not include storm drains. Bank type for segments shorter than 100 feet was not mapped.



San Pablo Bay

Garrity Creek

Rheem Creek

El Centro Road
360 ft

Miles
0 0.25 0.5

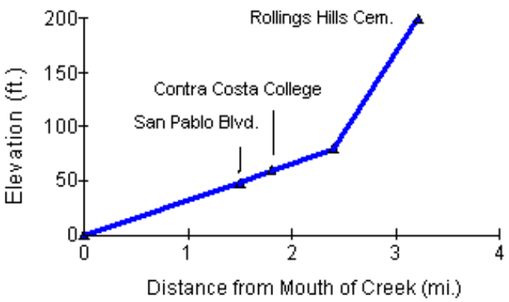
N W E S

Elevation (in feet)
1900 +
1200
900
600
300
0

Creek or Drainage

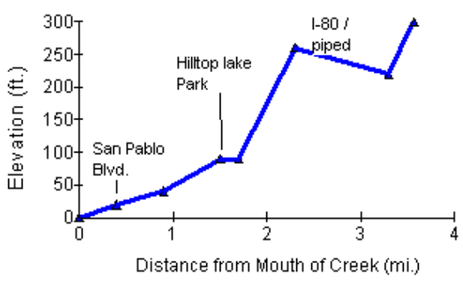
County Boundary

Rheem Creek Profile

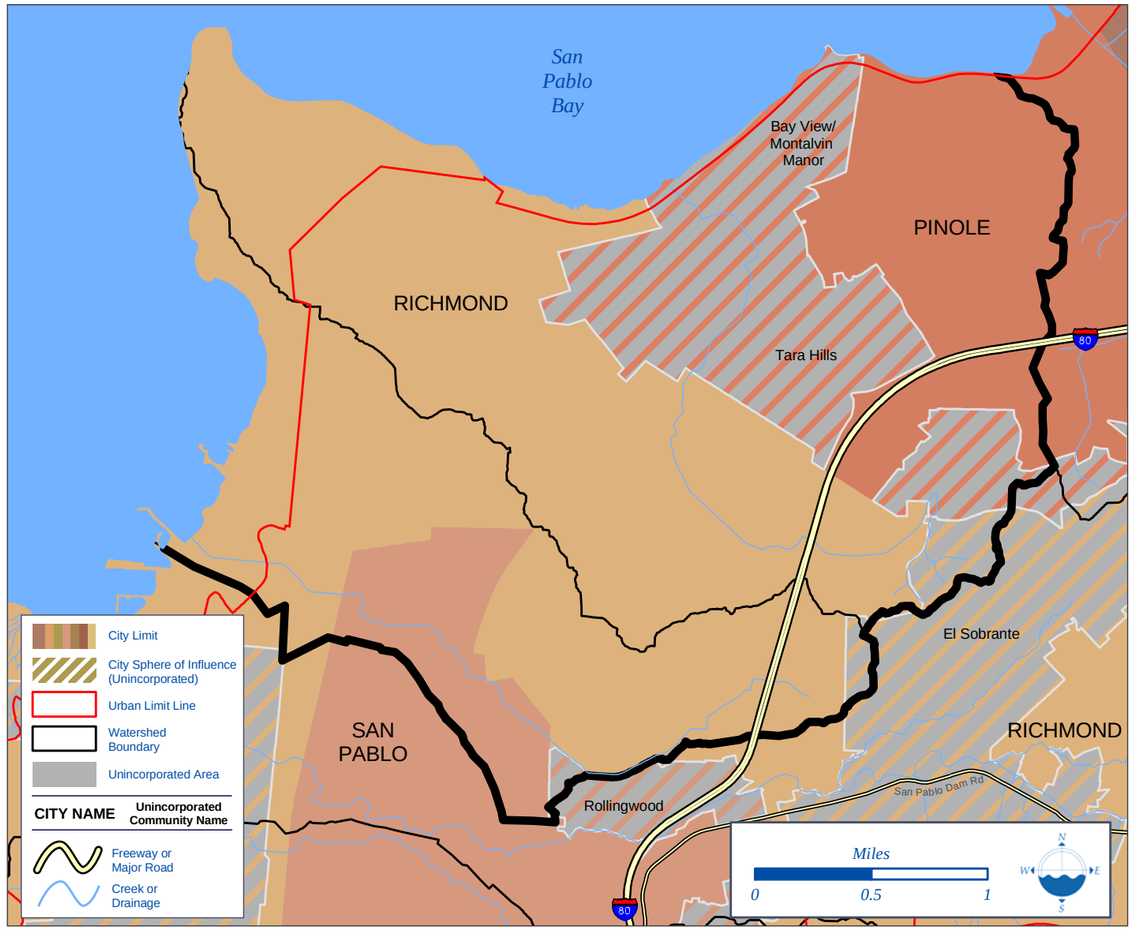


Friends of Garrity Creek

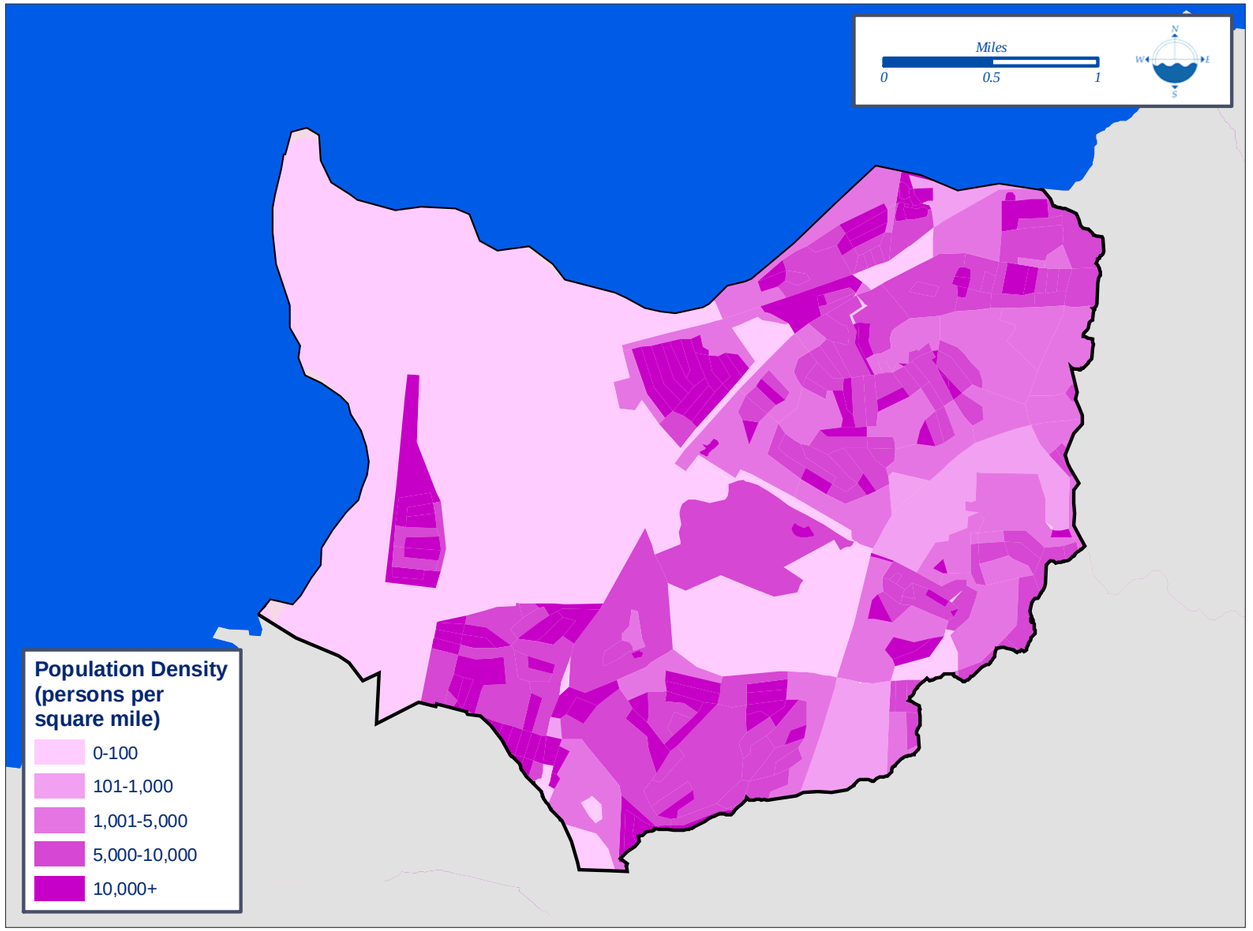
Garrity Creek Profile



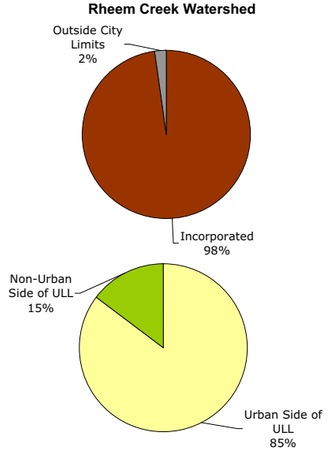
Political Boundaries



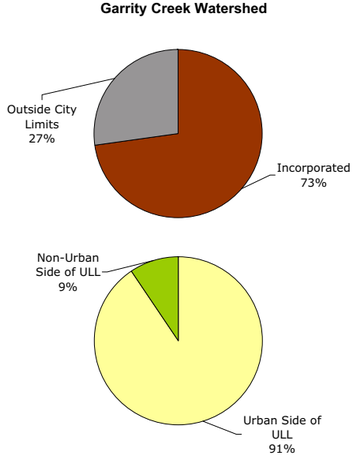
Population Density



Rheem Creek Watershed

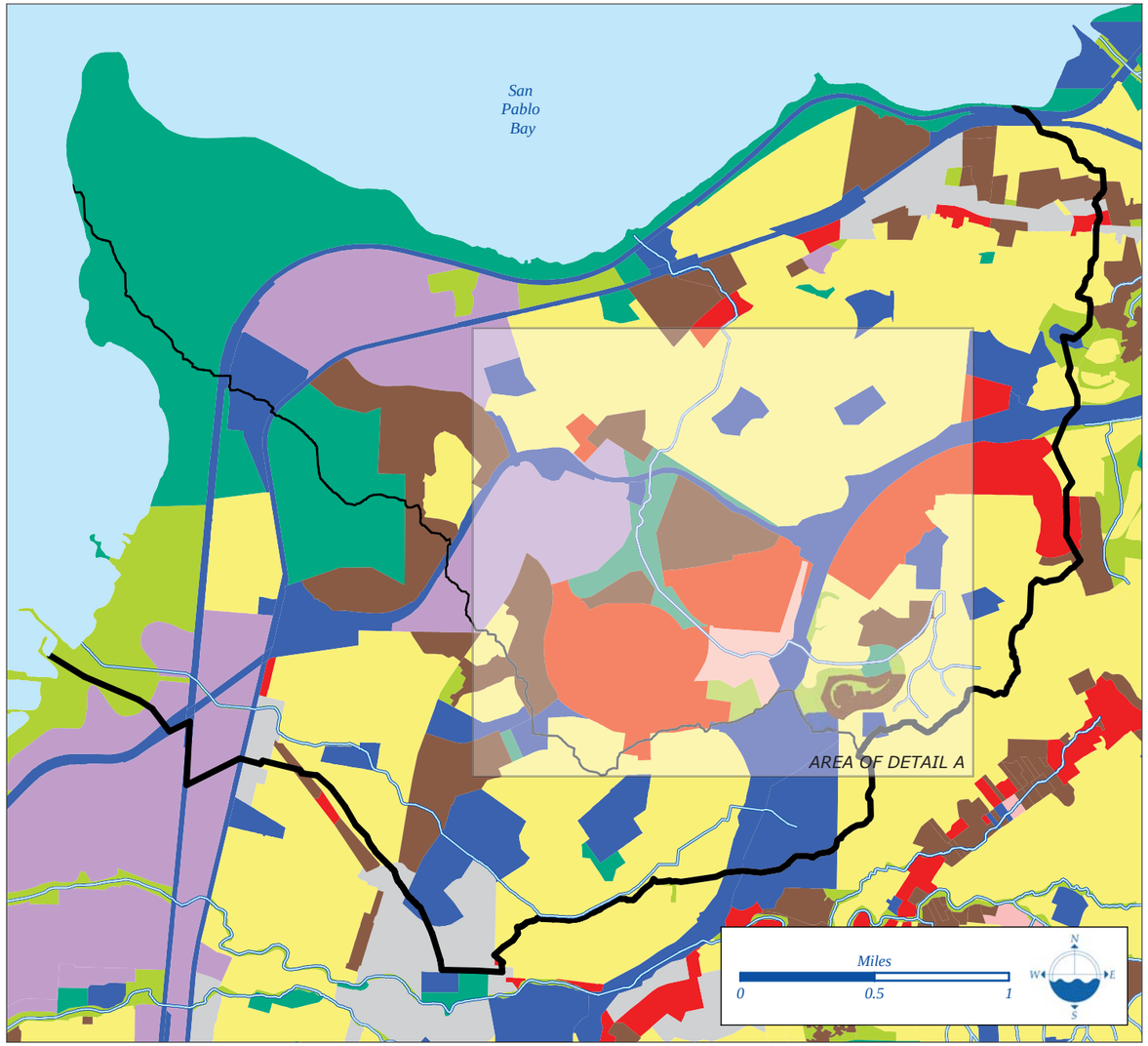


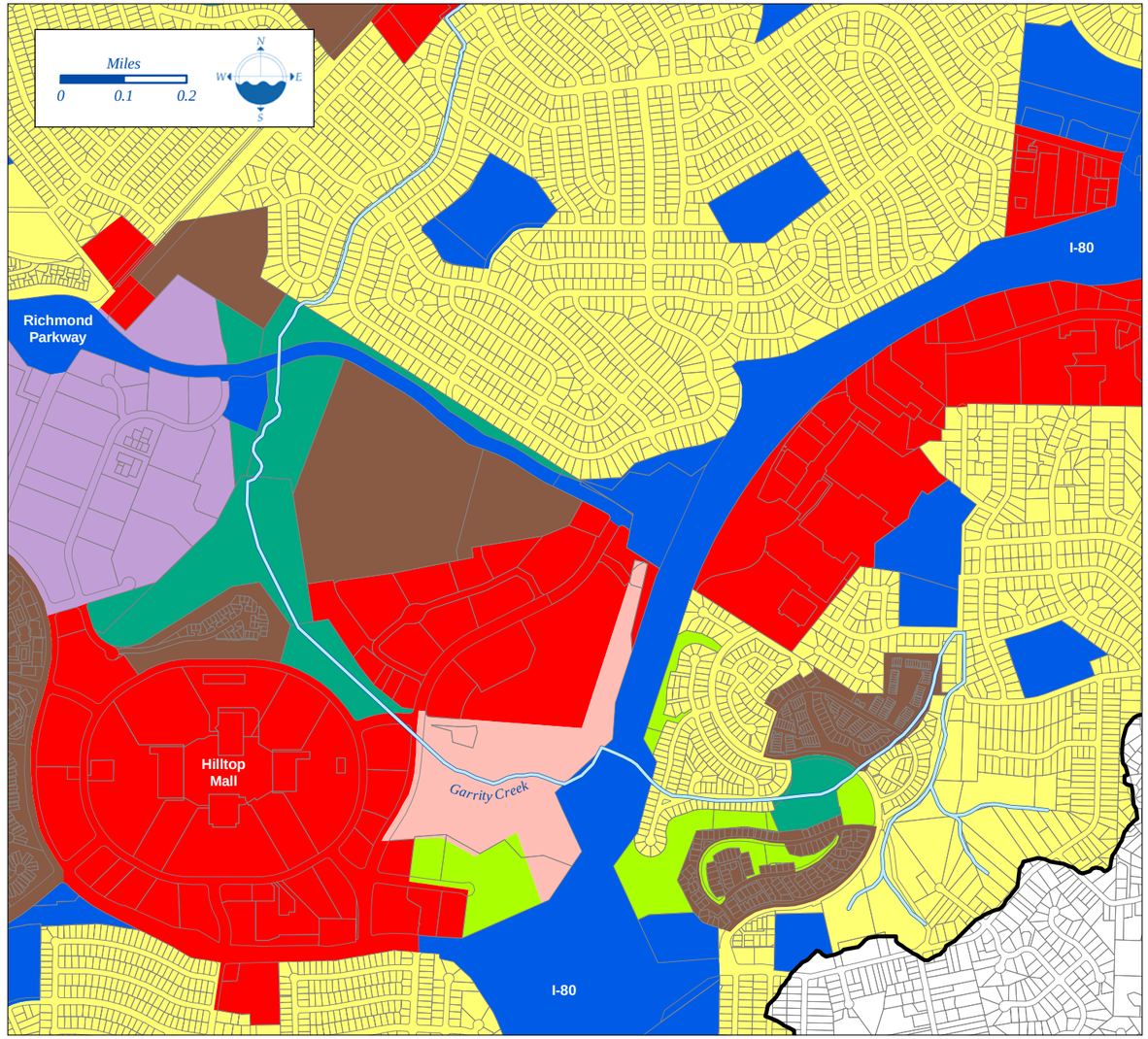
Garrity Creek Watershed



Demographic Profile for Selected Communities In or Near the Rheem and Garrity Creek Watersheds

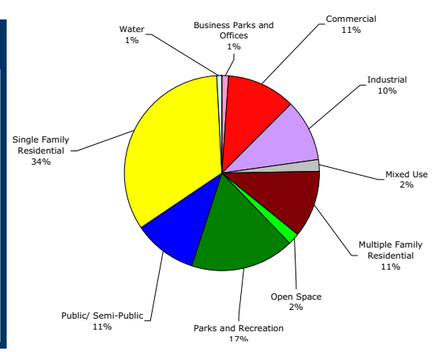
Population	Bay View-Montalvin	Richmond	Tara Hills
Total Population	4,959	99,716	5,354
Race and Ethnicity	**Bay View-Montalvin**	**Richmond**	**Tara Hills**
White	35.2%	21.3%	41.4%
Hispanic or Latino	35.3%	26.8%	22.2%
Black or African American	13.1%	35.3%	14.6%
Asian	12.9%	12.1%	12.6%
Some Other Race	0.7%	0.9%	2.9%
Two or More Races	2.9%	3.5%	6.4%
Education (maximum level attained)	**Bay View-Montalvin**	**Richmond**	**Tara Hills**
No High School Diploma	24.4%	24.6%	23.1%
High School Diploma or Equivalent	56.4%	46.2%	57.7%
Associate Degree	5.1%	6.8%	5.4%
Bachelor's Degree	9.1%	14.1%	11.4%
Master's or Professional School Degree	4.9%	7.2%	2.3%
Doctorate Degree	0.0%	1.1%	0.0%
Income	**Bay View-Montalvin**	**Richmond**	**Tara Hills**
Median Household Income	$50,750	$44,210	$56,380





Detail Map A: Richmond area

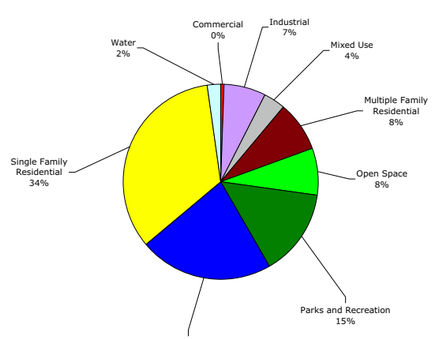
Planned Land Uses *Garrity Creek Watershed*	Acres
Agricultural Lands	0
Business Parks and Offices	43
Commercial	435
Industrial	401
Mixed Use	71
Multiple Family Residential	426
Open Space	77
Parks and Recreation	662
Public/ Semi-Public	408
Single Family Residential	1,296
Water	32
Watershed (Public)	0
Total	**3,850**



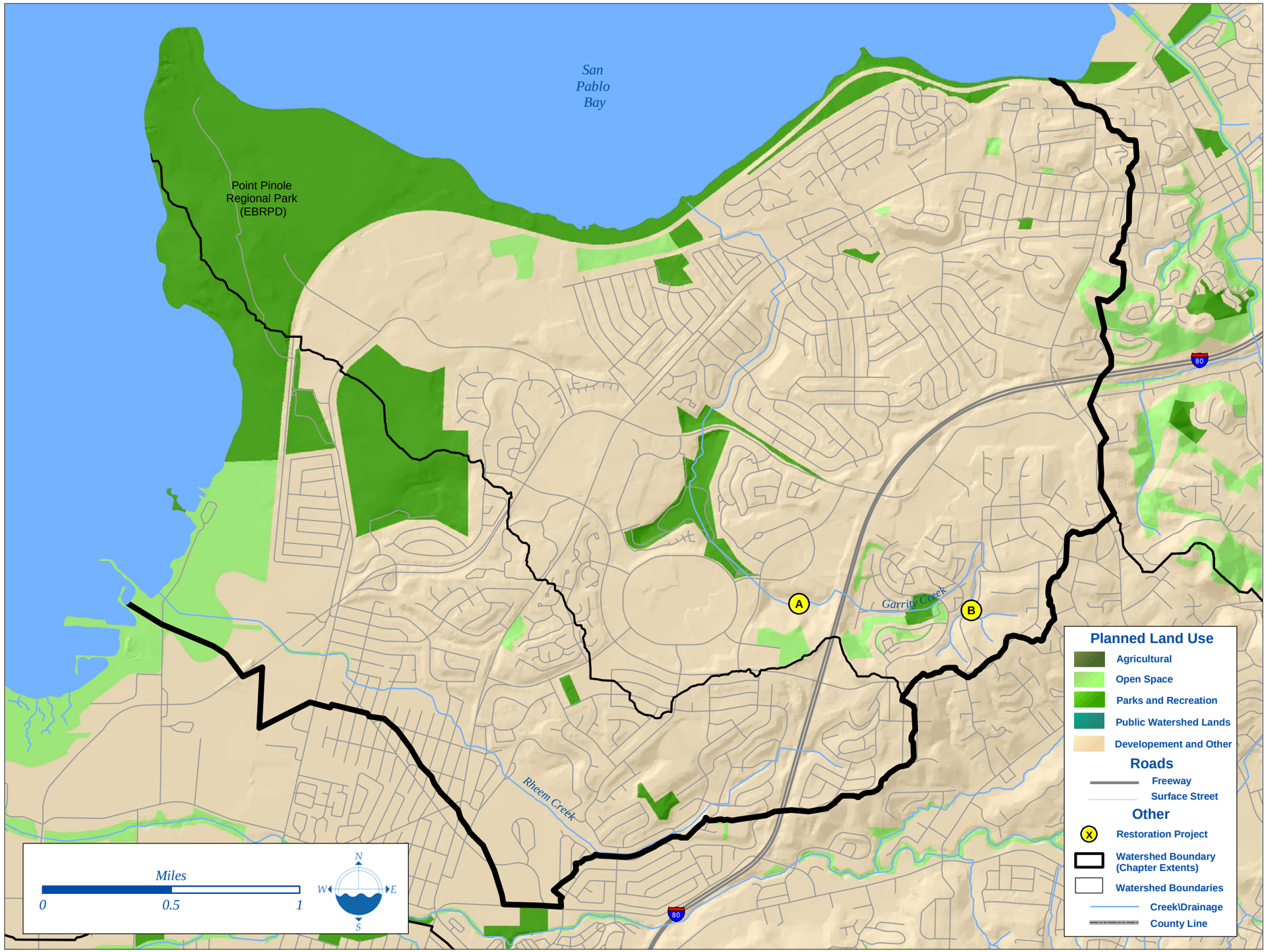
Creek or Drainage
Parcels

Planned Land Use

- Single Family Residential
- Multiple Family Residential
- Commercial
- Office/ Business Park
- Industrial
- Landfill
- Mixed Use
- Public/ Semi-Public
- Parks and Recreation
- Open Space
- Agricultural Lands
- Water
- Public Watershed Lands



Planned Land Uses *Rheem Creek Watershed*	Acres
Agricultural Lands	0
Business Parks and Offices	0
Commercial	8
Industrial	129
Mixed Use	63
Multiple Family Residential	149
Open Space	136
Parks and Recreation	262
Public/ Semi-Public	397
Single Family Residential	604
Water	42
Watershed (Public)	0
Total	**1,790**



Restoration Projects

(A) Restoration of Garrity Creek: Remove trash, re-vegetate native riparian plants, and create a natural flow channel. This project is awaiting funding. Lead Agency: Friends of Garrity Creek partnered with Urban Creeks Council and Aquatic Outreach Institute. Project is on-going.

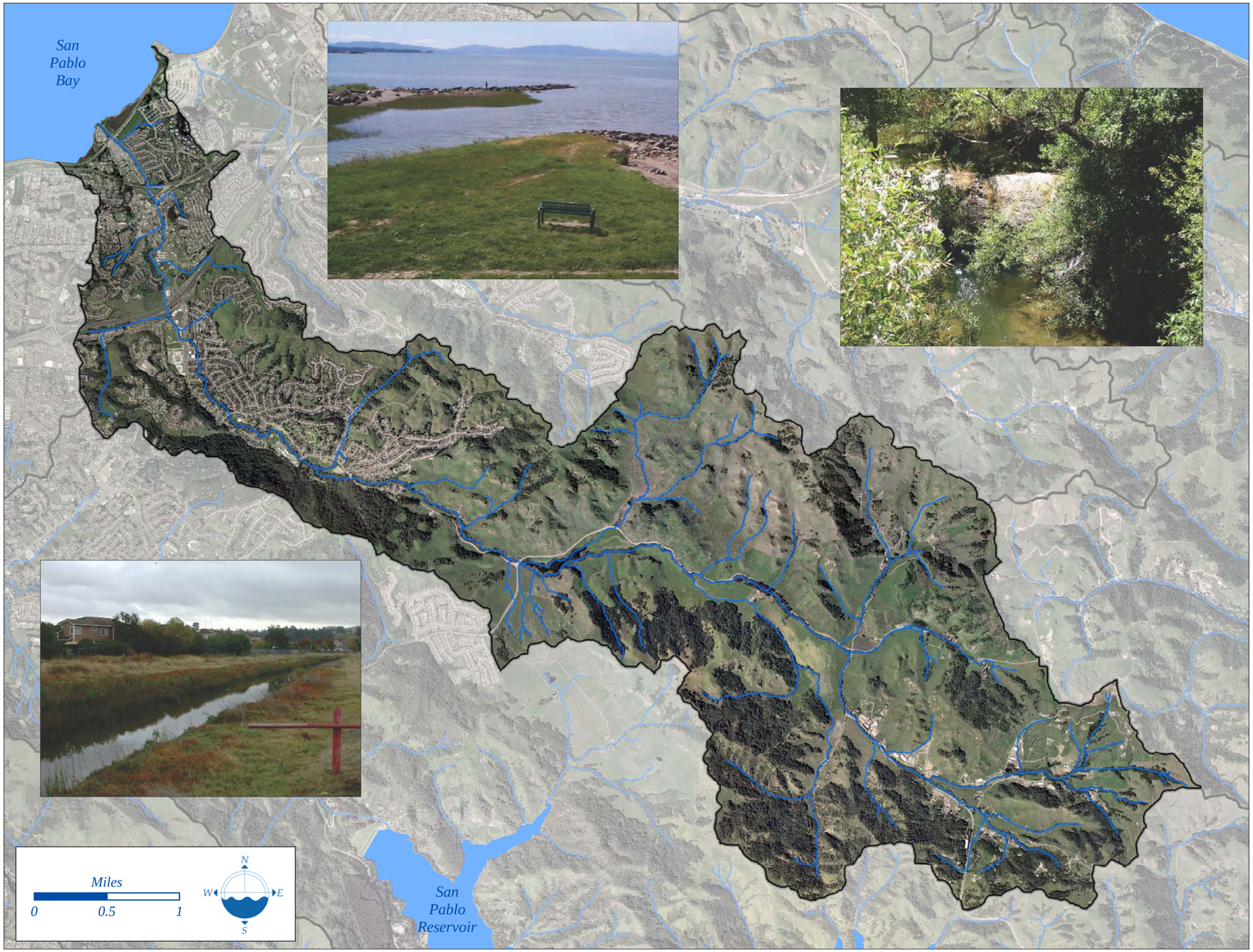
(B) Awareness of Garrity Creek: Outreach and public education about Garrity Creek and the watershed. Lead Agency: Friends of Garrity Creek partnered with Urban Creeks Council and Aquatic Outreach Institute. Anticipated Project completion: 2003.

Organizations Active in the Watersheds

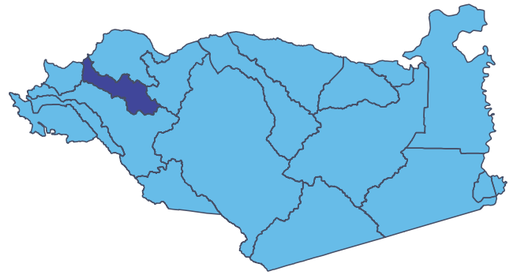
Hilltop Neighborhood Association and Friends of Garrity Creek
Barbara Pendergrass
Phone: (510) 223-6091
Email: rpender970@aol.com
Website: www.geocities.com/hilltopcreek/hilltop

Natural Heritage Institute
Rheem Creek
Rich Walkling
2140 Shattuck Ave, 5th Floor
Berkeley, CA 94704
Phone: (510) 644-2900
Website: www.n-h-i.org

Friends of Garrity Creek



Chapter 6
Pinole Creek Watershed



Pinole Creek is a perennial stream that drains a 9,705-acre watershed in western Contra Costa County. The creek is an important feature of the City of Pinole, and the city government is closely involved with the work of organizations such as the Friends of Pinole Creek, County Flood Control, and the U.S. Army Corps of Engineers to restore the creek through the center of town.

The Pinole Creek Watershed is lightly developed compared to other watersheds in Western Contra Costa County. One reason for this is that a drinking water reservoir was at one time planned for construction in the center of the watershed. The East Bay Municipal Utility District (EBMUD) purchased thousands of acres of land in the area to prepare for this possibility. However, plans for the new reservoir were ultimately set aside and the public watershed land remains and continues to be managed by EBMUD.

Pinole Creek Watershed Vital Statistics	
Watershed Size	9,705 acres
Length of Longest Branch of Creek	10.95 miles
Total Channel Length in Watershed	46.64 miles
Average Annual Rainfall	23 inches
Estimated Mean Daily Flow	10.4 cfs
Estimated 100-Year Flood Flow	4,170 cfs*
Highest Elevation in Watershed	1240 feet
Population (estimated)	15,700 people
Estimated Percent Impervious	15 %
Recognized Pollutants of Concern	Diazinon**

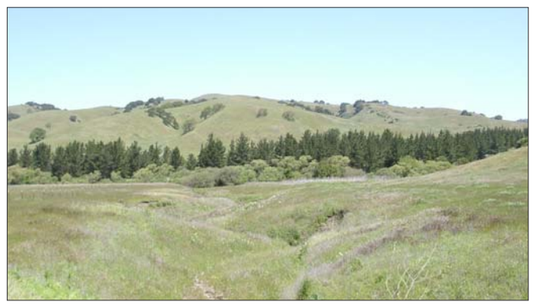
*At mouth of creek (100% of watershed upstream)
**Pinole Creek is listed as an Impaired Water Body in the State's 303(d) list. Diazinon is the Pollutant of Concern.

The City of Pinole occupies the northern third of the watershed. Pinole was incorporated in 1903 (population 1,500) after being the site of one of the earliest ranchos in the East Bay, Rancho Pinole (landgrant - 1823). The city was originally settled in the broad, alluvial floodplain of Pinole Creek, close to transport provided by shipping on the Bay and the new railroad (1878).

Interstate 80 forms a man-made margin where Pinole Creek leaves the confines of the East Bay Hills. From this point to the Bay, U.S. Army Corps of Engineers carried out extensive work on the Pinole Creek channel in the 1950's to control flooding in the downtown area.

The middle third of the watershed is owned and managed by the East Bay Municipal Utility District. Various restoration projects along the tributaries that feed Pinole Creek (such as the Pavon Creeks restoration project) have provided shade and habitat to areas previously denuded by grazing and erosion.

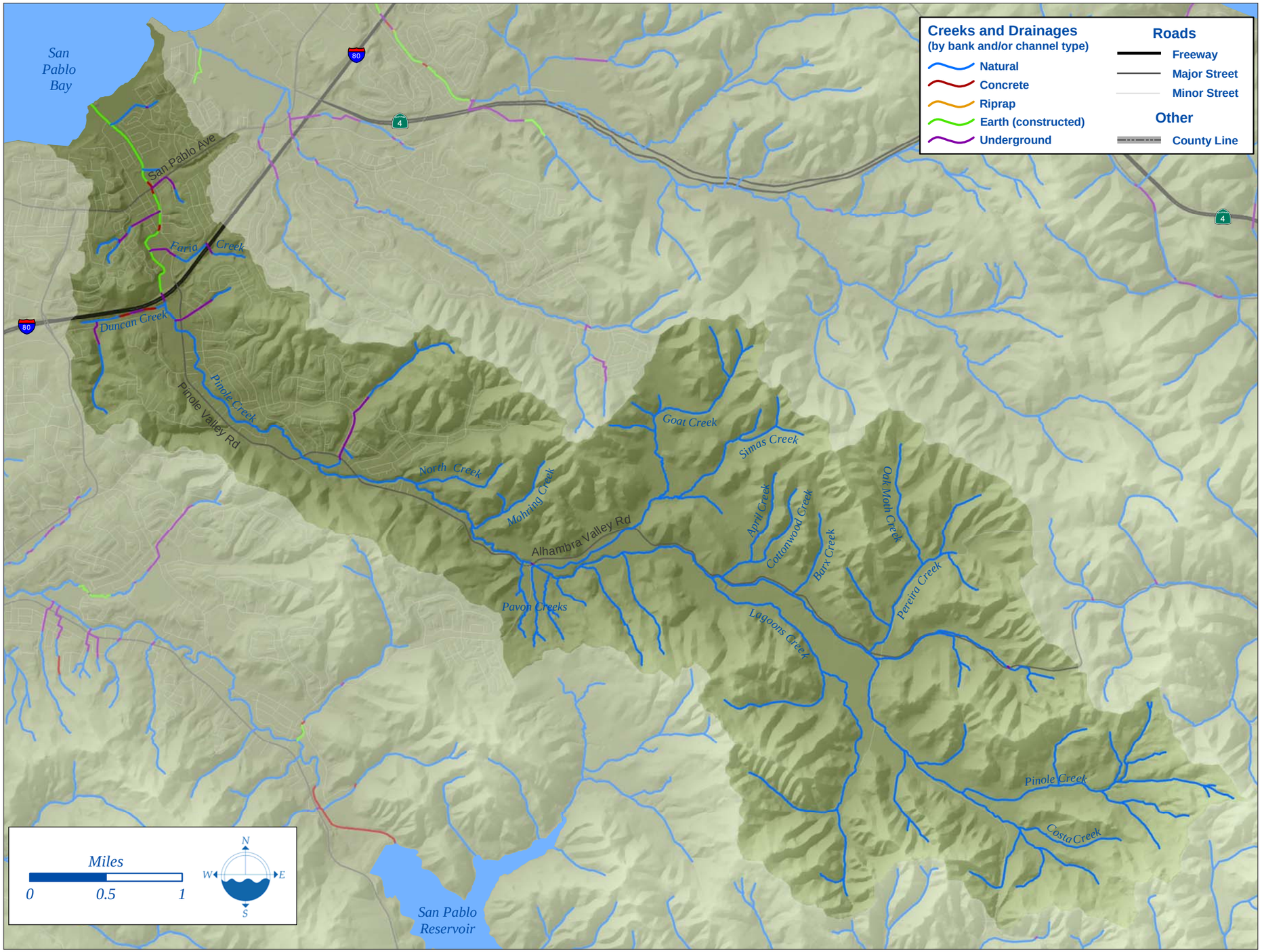
The upper watershed is comprised of private ranchlands and ranchettes, and remains a beautiful Northern California Oak woodlands and grasslands landscape. The very tip of the upper watershed is part of Briones Regional Park and is owned by the East Bay Regional Park District.



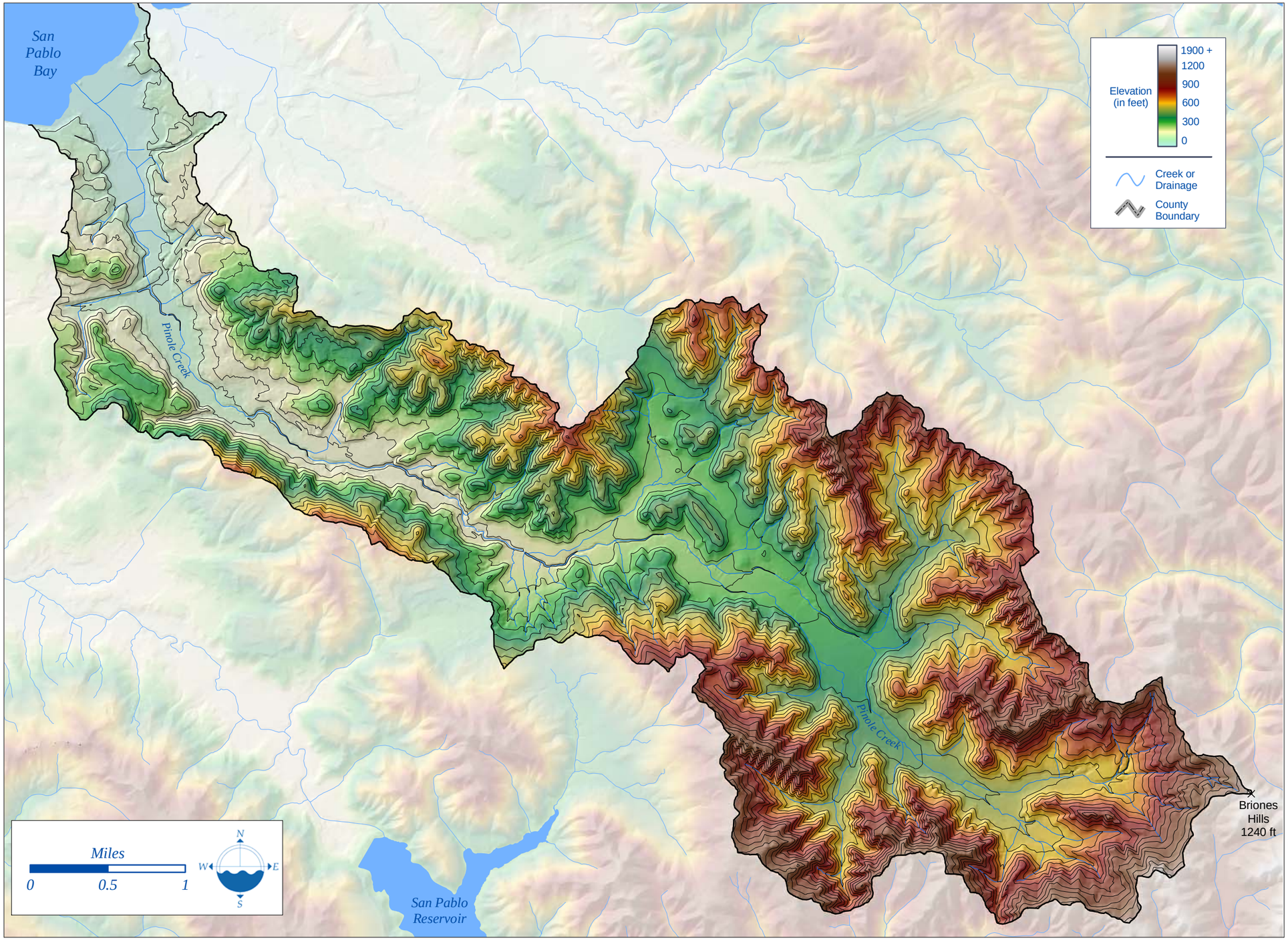
Pinole Creek Channel Length Statistics*

	Miles	Percent
Length of Longest Branch of Creek	10.95	
Total Channel Length in Watershed	46.64	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	43.05	92.3%
Concrete	2.20	4.7%
Earth (constructed)	1.39	3.0%
Riprap	0.00	0.0%
Underground	1.93	4.1%

*Data relate to mapped channels only. Does not include storm drains. Bank type for segments shorter than 100 feet was not mapped.



Topography and Hydrology

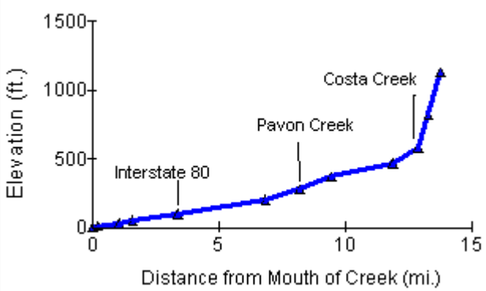


The headwaters of Pinole Creek are located in the Briones Hills (elevation 1,240 feet). The creek follows a northwesterly trend for approximately 11 miles before reaching its outlet at San Pablo Bay. The central reaches of Pinole Creek and its tributaries meander through a broad, open valley and have a relatively intact flood plain, a somewhat unique feature in this part of the County.

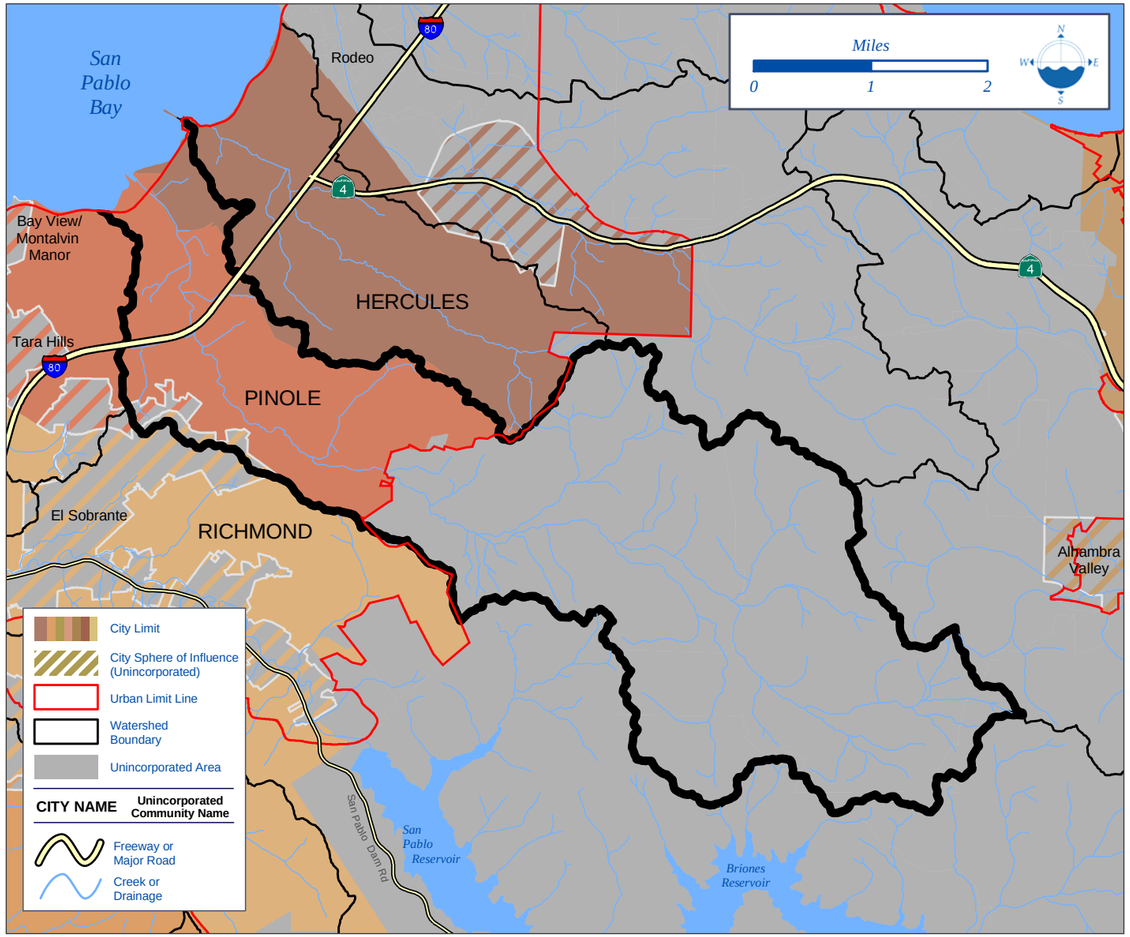
Patricia Matthews

City of Pinole

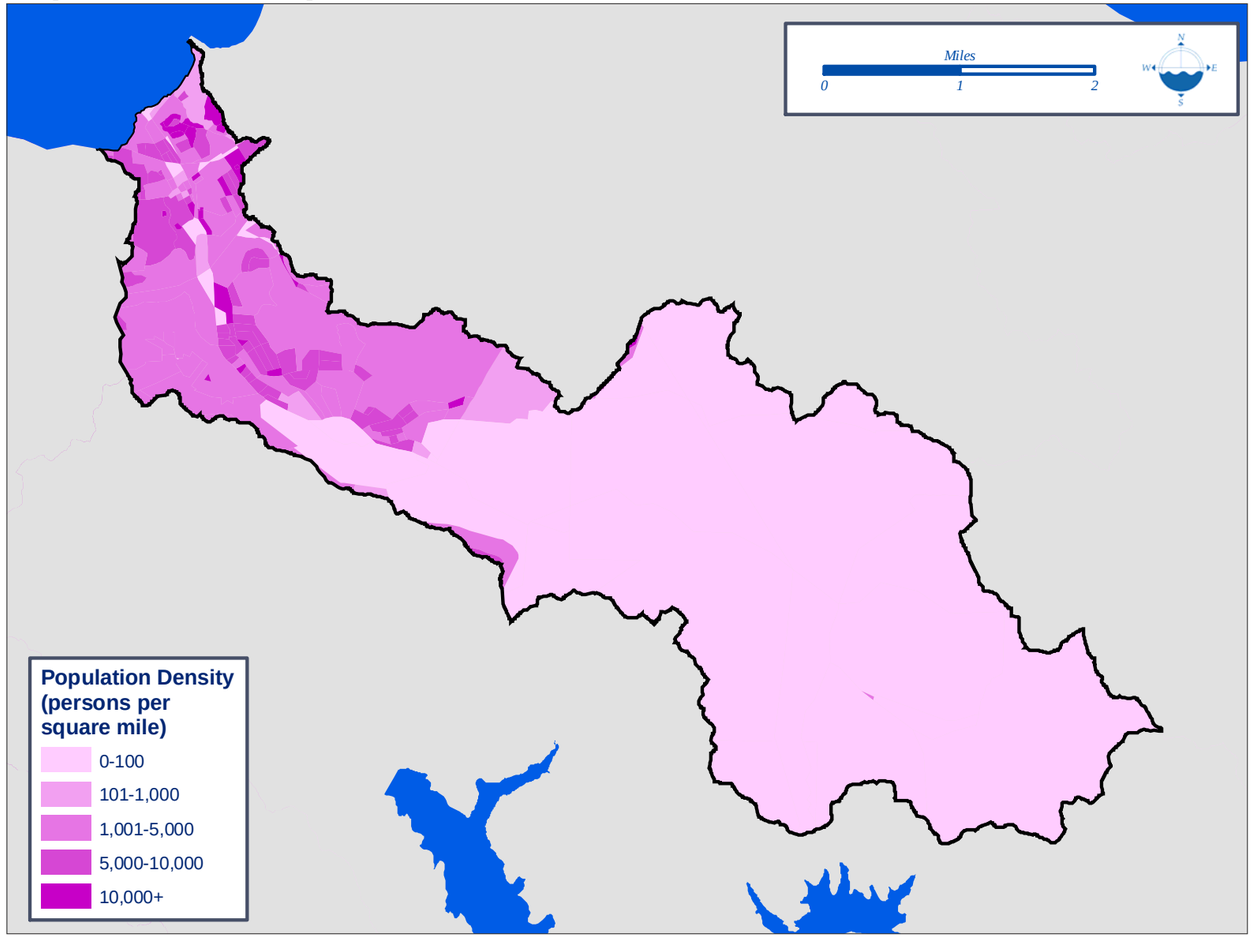
Pinole Creek Profile



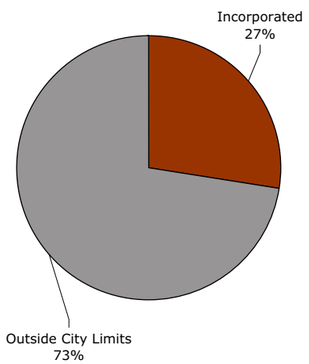
Political Boundaries



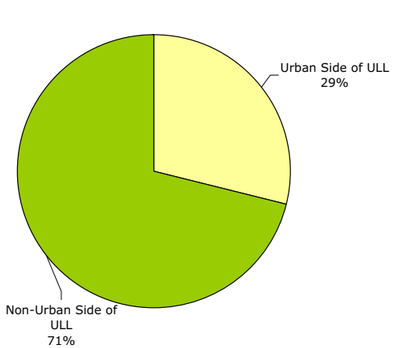
Population Density



Pinole Creek Watershed

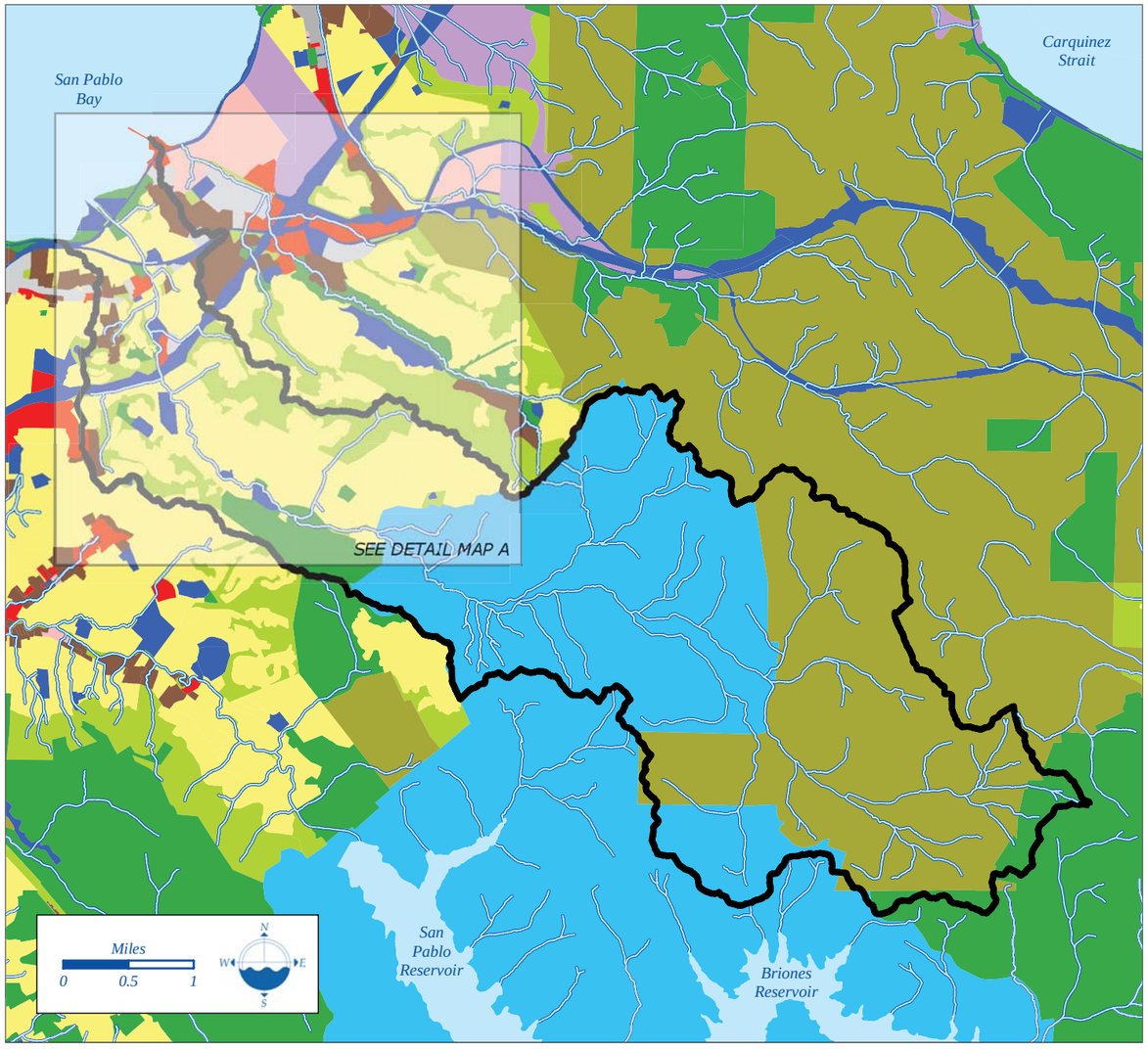


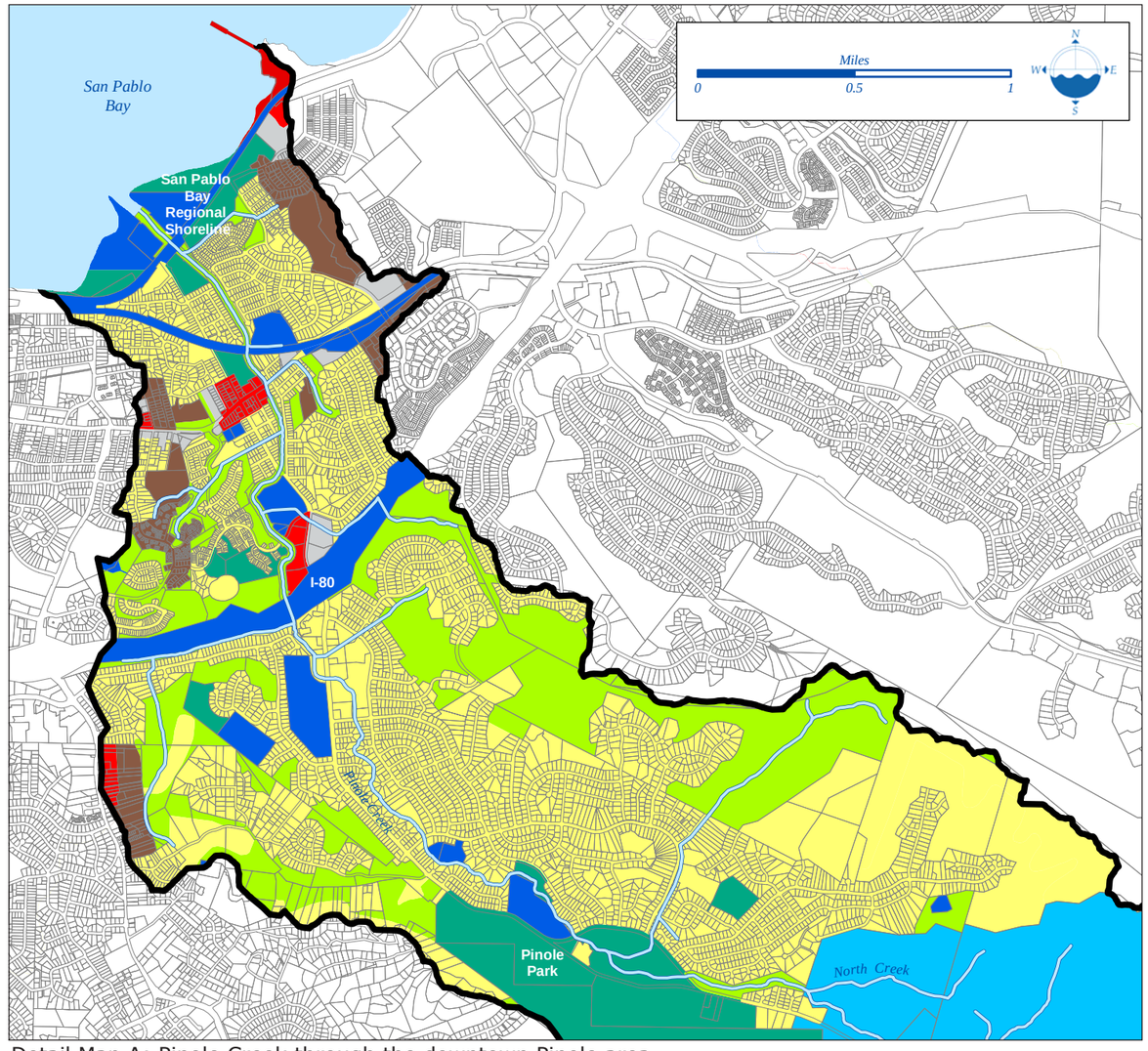
Pinole Creek Watershed



Demographic Profile for Selected Communities In or Near the Pinole Creek Watershed

Population	El Sobrante	Hercules	Pinole
Total Population	11,605	19,299	19,394
Race and Ethnicity	**El Sobrante**	**Hercules**	**Pinole**
White	55.6%	23.0%	48.0%
Hispanic or Latino	13.5%	10.8%	14.4%
Black or African American	10.5%	18.4%	10.8%
Asian	11.6%	42.6%	21.0%
Some Other Race	1.0%	1.2%	1.0%
Two or More Races	7.9%	4.0%	4.7%
Education (maximum level attained)	**El Sobrante**	**Hercules**	**Pinole**
No High School Diploma	13.6%	9.5%	11.7%
High School Diploma or Equivalent	56.6%	44.0%	52.2%
Associate Degree	9.1%	10.6%	8.5%
Bachelor's Degree	14.4%	27.3%	19.4%
Master's or Professional School Degree	5.0%	8.4%	7.2%
Doctorate Degree	1.4%	0.2%	1.0%
Income	**El Sobrante**	**Hercules**	**Pinole**
Median Household Income	$48,272	$75,196	$62,256





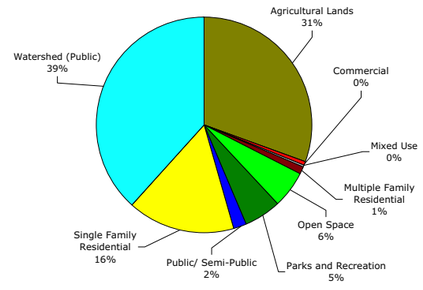
Detail Map A: Pinole Creek through the downtown Pinole area

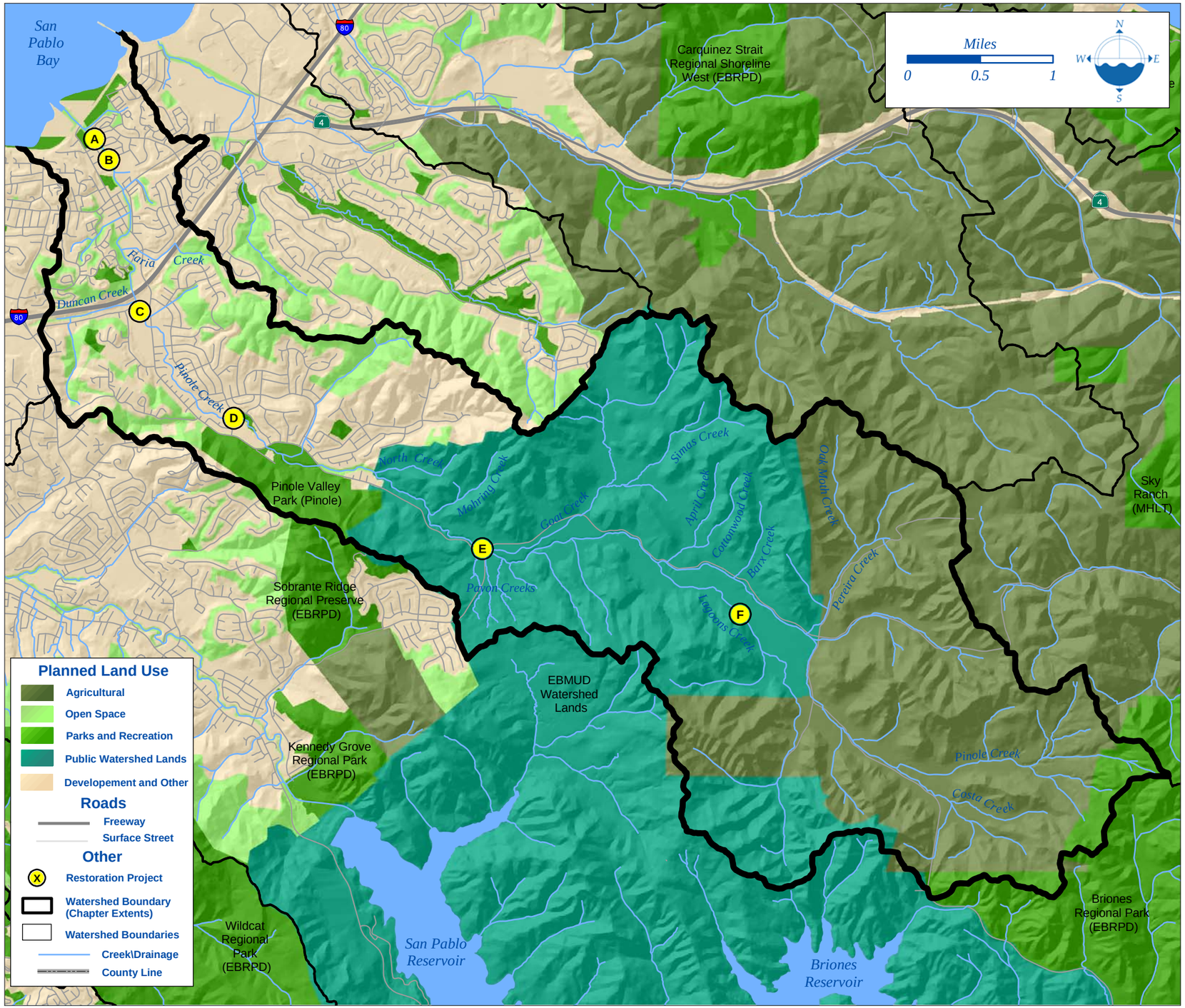
Planned Land Uses *Pinole Creek Watershed*	Acres
Agricultural Lands	2,972
Business Parks and Offices	0
Commercial	36
Industrial	0
Mixed Use	34
Multiple Family Residential	113
Open Space	551
Parks and Recreation	522
Public/ Semi-Public	199
Single Family Residential	1,569
Water	1
Watershed (Public)	3,708
Total	**9,705**

Creek or Drainage
Parcels

Planned Land Use

- Single Family Residential
- Multiple Family Residential
- Commercial
- Office/ Business Park
- Industrial
- Landfill
- Mixed Use
- Public/ Semi-Public
- Parks and Recreation
- Open Space
- Agricultural Lands
- Water
- Public Watershed Lands





Restoration Projects

(A) Pinole Creek Section 1135 Lower Channel Restoration: Restore and enhance Pinole Creek's aquatic and riparian habitat and wildlife resource between I-80 and SF Bay. Create permanent wetlands, enhance seasonal and permanent wetlands, and re-vegetate native plants. This project is funded by the U.S. Army Corps of Engineers and the Pinole Redevelopment Agency. Lead Agency: U.S. Army Corps of Engineers and Contra Costa County Flood Control. Anticipated project completion: 2007.

(B) Pinole Creek Lower Channel Restoration Design: Develop a design alternative for the Army Corps 1135 Restoration program for restoring habitat in Corps project areas. Design would restore riparian habitat and provide flood protection. One component of this is the creation of the Pinole Watershed Vision Plan. This project is planning and design only and is funded by the California Coastal Conservancy and the Pinole Redevelopment Agency. Lead Agency: Urban Creeks Council of California. Anticipated project completion: 2003.

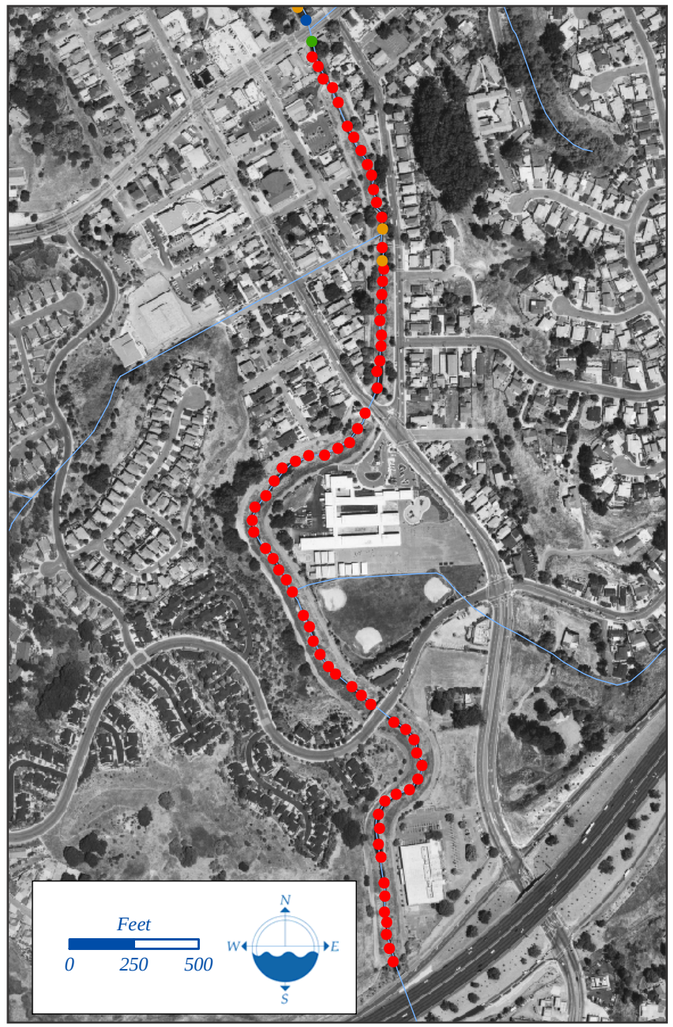
(C) Pinole Creek Restoration and Demonstration Project: Create a bay-friendly, native plant gardening classroom. Improve riparian habitat and water quality and reduce erosion. Remove exotic invasive plants from the area. This project is funded by the Pinole Redevelopment Agency, CALFED, and the California Coastal Conservancy. Lead Agency: Friends of Pinole Creek Watershed and Aquatic Outreach Institute. Anticipated project completion: 2006.

(D) Watershed Inventory: Watershed natural resources inventory with special emphasis on erosion and sedimentation. Funded by Natural Resources Conservation Service, through a Congressional appropriation. Lead Agency: Contra Costa Resource Conservation District. Anticipated project completion: 2005. Additionally, a fisheries assessment has been proposed by the Center for Ecosystem Management and Research (CEMAR), funding is pending.

(E) Pavon Creeks Restoration: Restore a stable channel and reduce erosion on Pavon Creeks, tributaries to Pinole Creek. This project is funded by East Bay Municipal Utility District (EBMUD) and the U.S. Army Corps of Engineers. Lead Agency: U.S. Army Corps of Engineers. Estimated project completion: 2006.

(F) Pinole Creek Watershed Erosion Containment Project: Pinole Creek is currently suffering from an annual deposition of excess sediment in the downstream portion. This project would provide financial assistance and resources for constructing erosion containment projects on private property throughout the upper watershed, which is 90% open space, or ranch land. Additionally, a detention basin upstream of Pinole could reduce storm flows in the creek and allow planting of trees along the creek. This project is seeking funding. Anticipated project completion is unknown.

How Warm is the Water?



Creek or Drainage

Amount of Shade Cover

- Less than 10%
- 11-50%
- 51-75%
- 75-100%

Pinole Valley High School Environmental Studies Academy students assist Friends of Pinole Creek Watershed with GPS data collection, 2001.

Friends of Pinole Creek Watershed chose to survey Pinole Creek north of Interstate 80. From the highway to the Bay and over the course of three data collection events, information was collected on over 20 different parameters. This section of Pinole Creek flows through a flood control channel. The wide earth and occasionally riprap channel winds through downtown Pinole.

Historically, anadromous fish such as steelhead used Pinole Creek. Recent studies also indicate that there are fish that travel the channel to breed in headwaters.

Challenges maintaining native fish populations in Pinole Creek can be, in part, determined by the existence of appropriate habitat in the creek and along the riparian corridor. A number of factors are important to the survival of fish including: water chemistry, substrate, the presence of food, and water temperature.

Shade cover is important to riparian species. Organic debris from trees and other foliage provide important nutrients for aquatic life. Additionally, the shade provided by creekside vegetation protects the creek from rising daytime temperatures. Native fish in Pinole Creek prefer to live in and migrate through water averaging 65 degrees Fahrenheit.

GPS data collected by Contra Costa Watershed Forum volunteers and Friends of Pinole Creek Watershed can be displayed to illustrate the amount of shade cover over the creek.

Organizations Active in the Watershed

Aquatic Outreach Institute and Friends of Pinole Creek Watershed
1327 South 46th Street #155
Richmond, CA 94804
Phone: (510) 231-5655
Email: staff@aoinstitue.org
Website: http://www.aoinstitute.org/

Contra Costa Resource Conservation District
5552 Clayton Road
Concord CA, 94521
Phone: (925) 672-6522 x 4
Website: www.ccrcd.org

Friends of Pinole Creek Watershed
Dr. Joe Mariotti
President
100 Tennent Ave
Pinole, CA 94564
Phone: (510) 724-1235

Friends of Pinole Creek Watershed pose after a long day working in the creek, 2001.

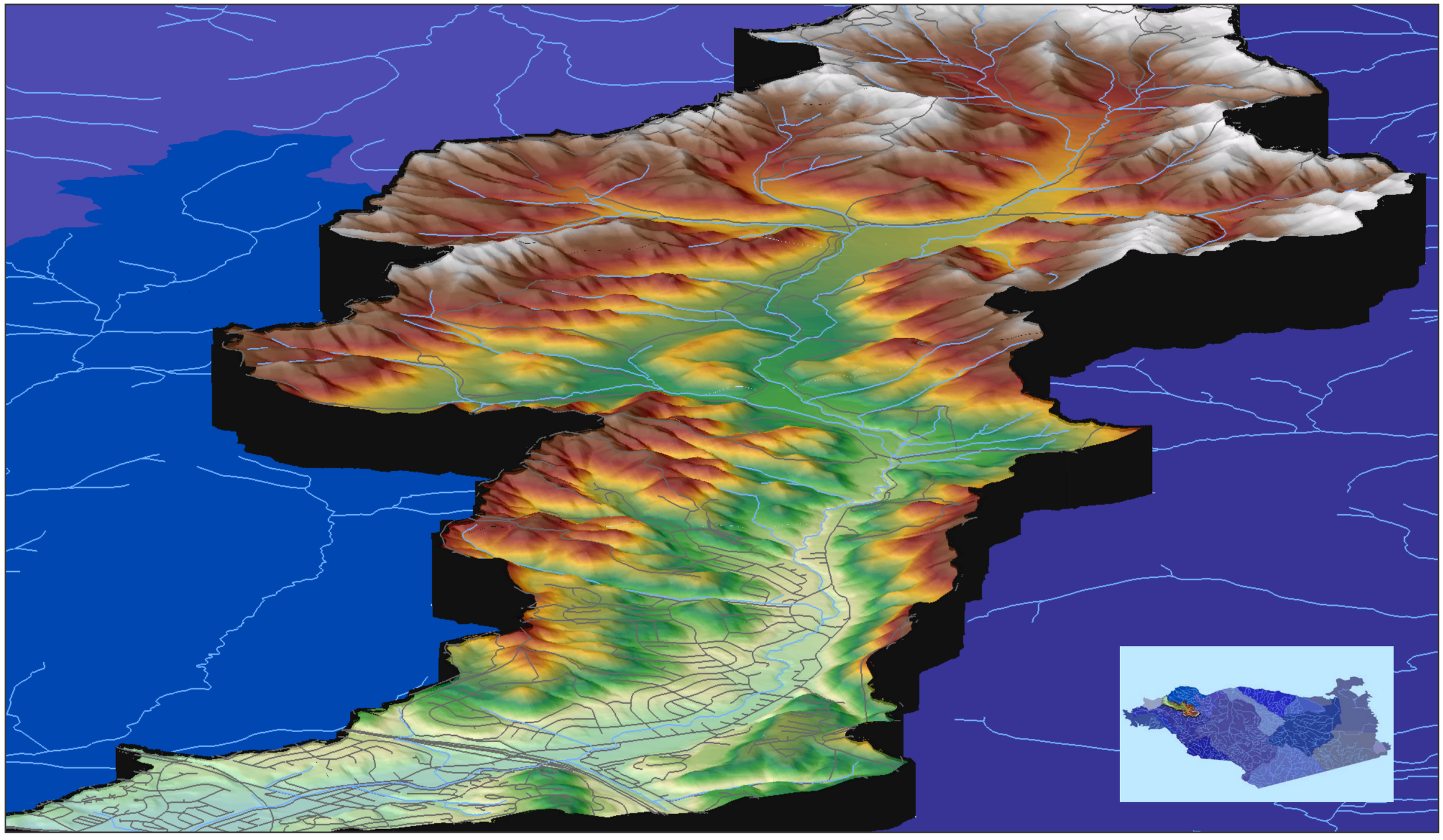
Selected Resources

Cressey & Associates and EOA, Inc. for the Contra Costa Clean Water Program, Contra Costa Monitoring and Assessment Plan, 2002 Rapid Bioassessment Project, 2002.

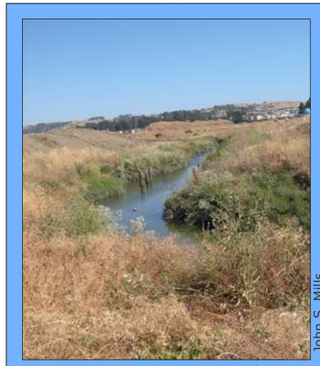
LSA Associates, Tito Patri & Associates and Clearwater Hydrology for the City of Pinole, Final Bayfront Park Wetlands Restoration Project, March 1977.

Urban Creeks Council, Pinole Creek Watershed Vision Plan: A Community Vision, September 2003.

US Army Corps of Engineers, Pinole Creek Channel Modification Section 1135, Preliminary Restoration Plan, 2001.



Pinole Creek Watershed 3D: Looking south-east into the headwaters.

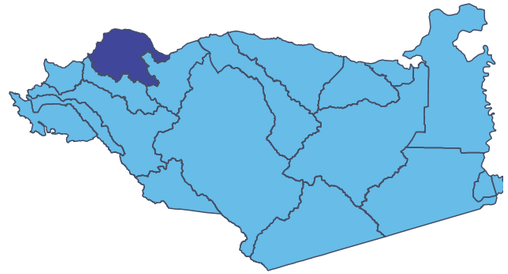


John S. Mills

John S. Mills

Chapter 7

Refugio, Rodeo and Carquinez Area Watersheds



Refugio Creek, Rodeo Creek and the various drainages that flow into the Carquinez Strait are located in northwest Contra Costa County. Together, the watersheds encompass 16,348 acres of diverse landcover including pristine oak-covered hills, an interstate highway, ranches, heavy industry, towns and new residential development. The City of Hercules and the communities of Rodeo, Crockett and Port Costa are located in the watershed.

Refugio Creek Watershed Vital Statistics		
Watershed Size	3,116	acres
Length of Longest Branch of Creek	4.52	miles
Total Channel Length in Watershed	9.17	miles
Average Annual Rainfall	19	inches
Estimated Mean Daily Flow	4.2	cfs
Estimated 100-Year Flood Flow	N/A	
Highest Elevation in Watershed	780	feet
Population (estimated)	15,400	people
Estimated Percent Impervious	50	%
Recognized Pollutants of Concern	N/A	*

Rodeo Creek Watershed Vital Statistics		
Watershed Size	6,657	acres
Length of Longest Branch of Creek	8.35	miles
Total Channel Length in Watershed	31.64	miles
Average Annual Rainfall	21	inches
Estimated Mean Daily Flow	7.0	cfs
Estimated 100-Year Flood Flow	N/A	
Highest Elevation in Watershed	1,100	feet
Population (estimated)	8,900	people
Estimated Percent Impervious	20	%
Recognized Pollutants of Concern	Diazinon**	

*Refugio Creek has not been specifically identified in the State's 303(d) list of Impaired Water Bodies.

**Rodeo Creek is listed as an Impaired Water Body in the State's 303(d) list. Diazinon is the Pollutant of Concern.

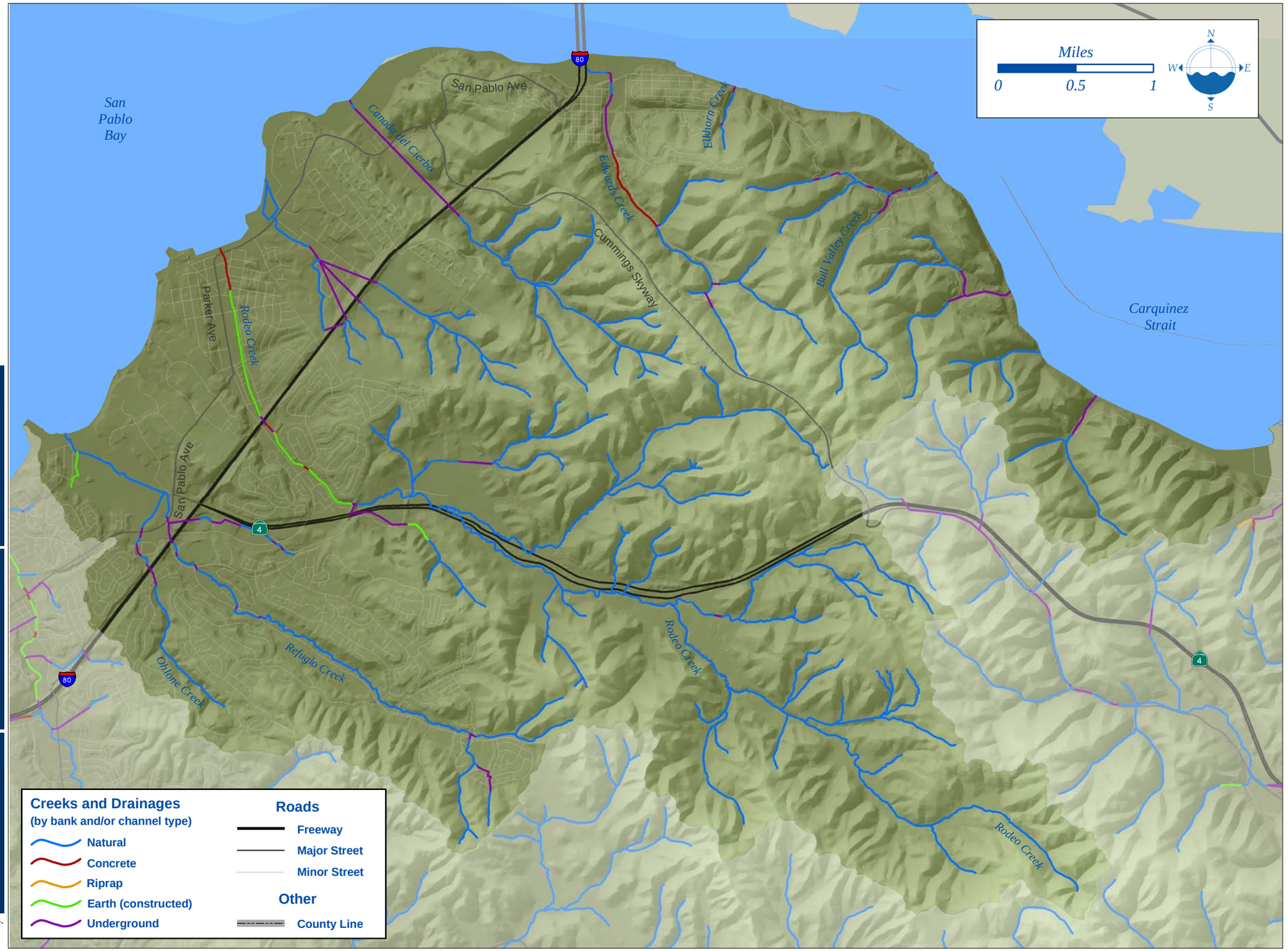
John S. Mills

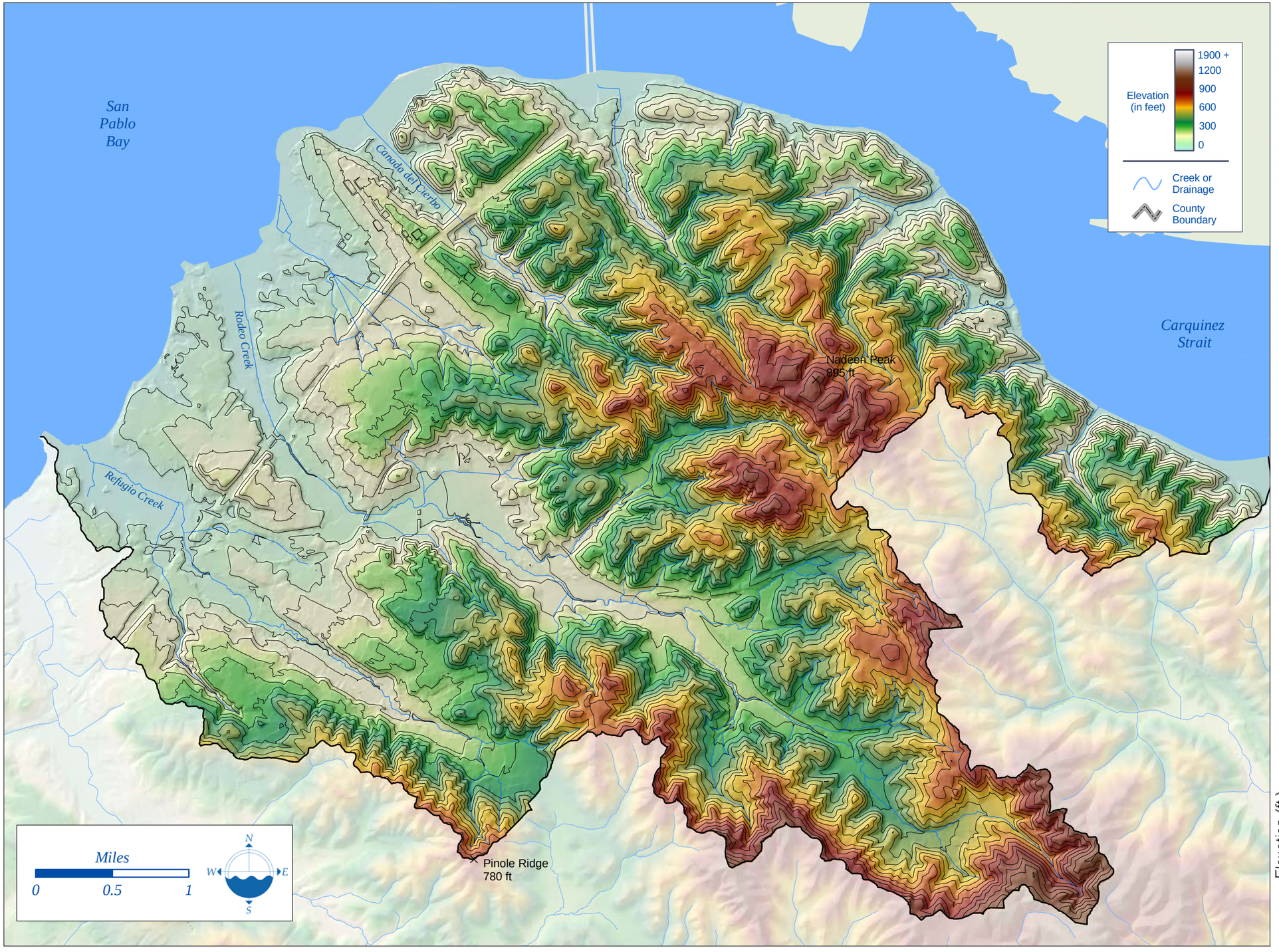
Refugio Creek Channel Length Statistics*	Miles	Percent
Length of Longest Branch of Creek	4.52	
Total Channel Length in Watershed	9.17	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	7.58	82.7%
Concrete	1.33	14.6%
Earth (constructed)	0.25	2.7%
Riprap	0.00	0.0%
Underground	1.33	14.6%

Rodeo Creeks Channel Length Statistics*	Miles	Percent
Length of Longest Branch of Creek	8.35	
Total Channel Length in Watershed	31.64	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	28.71	90.7%
Concrete	1.25	3.9%
Earth (constructed)	1.50	4.7%
Riprap	0.00	0.0%
Underground	0.88	2.8%

Carquinez Area Channel Length Statistics*	Miles	Percent
Length of Longest Branch of Creek	2.86	
Total Channel Length in Watershed	26.95	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	21.81	80.9%
Concrete	5.13	19.1%
Earth (constructed)	0.00	0.0%
Riprap	0.00	0.0%
Underground	4.56	16.9%

*Data relate to mapped channels only. Does not include storm drains. Bank type for segments shorter than 100 feet was not mapped.

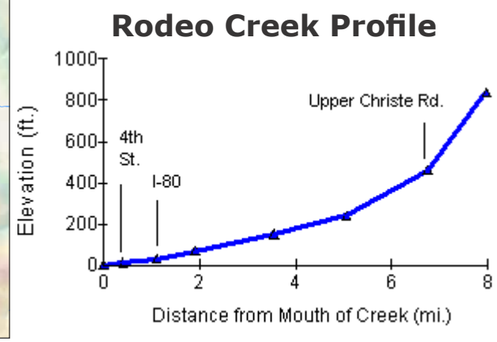




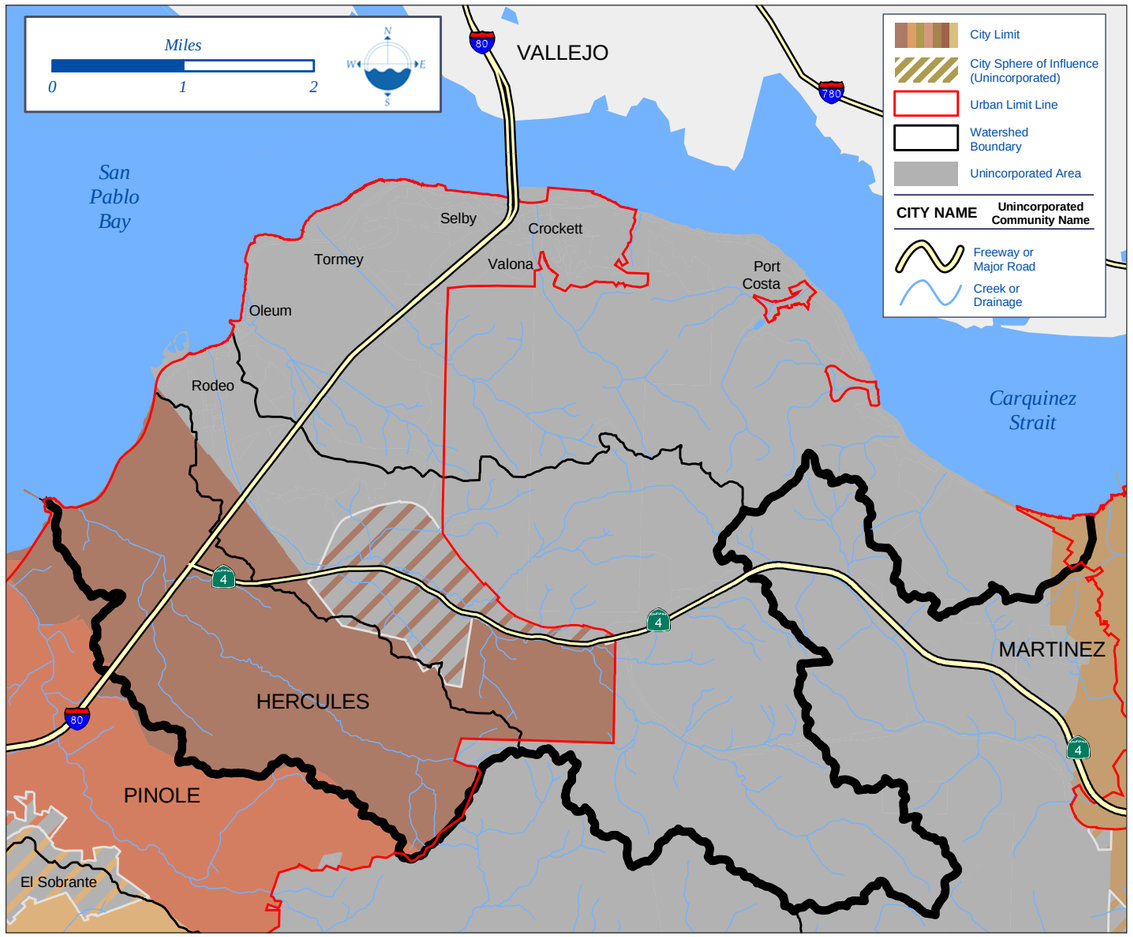
Refugio Creek (4.52 miles), Rodeo Creek (8.35 miles), Canada del Cierbo Creek (2.86 miles) and Edwards Creek (2.0 miles) trend north-west and resemble other West County drainages in that they juxtapose a rural upper watershed with an urbanized and/or industrialized lower watershed. However, these watersheds located at the northwest tip of Contra Costa County do not have flatland areas in their lower reaches characteristic of the watersheds of Pinole, San Pablo, and Wildcat Creeks.

The upper watershed of Rodeo Creek and its tributaries begin in private ranchland and East Bay Regional Park District property. An industrial area and the community of Rodeo are in the lower watershed. Two smaller drainages to the north of Rodeo, including Canada del Cierbo Creek and an unnamed creek, begin in undeveloped land on the east side of Interstate 80 before being diverted underground through refinery properties.

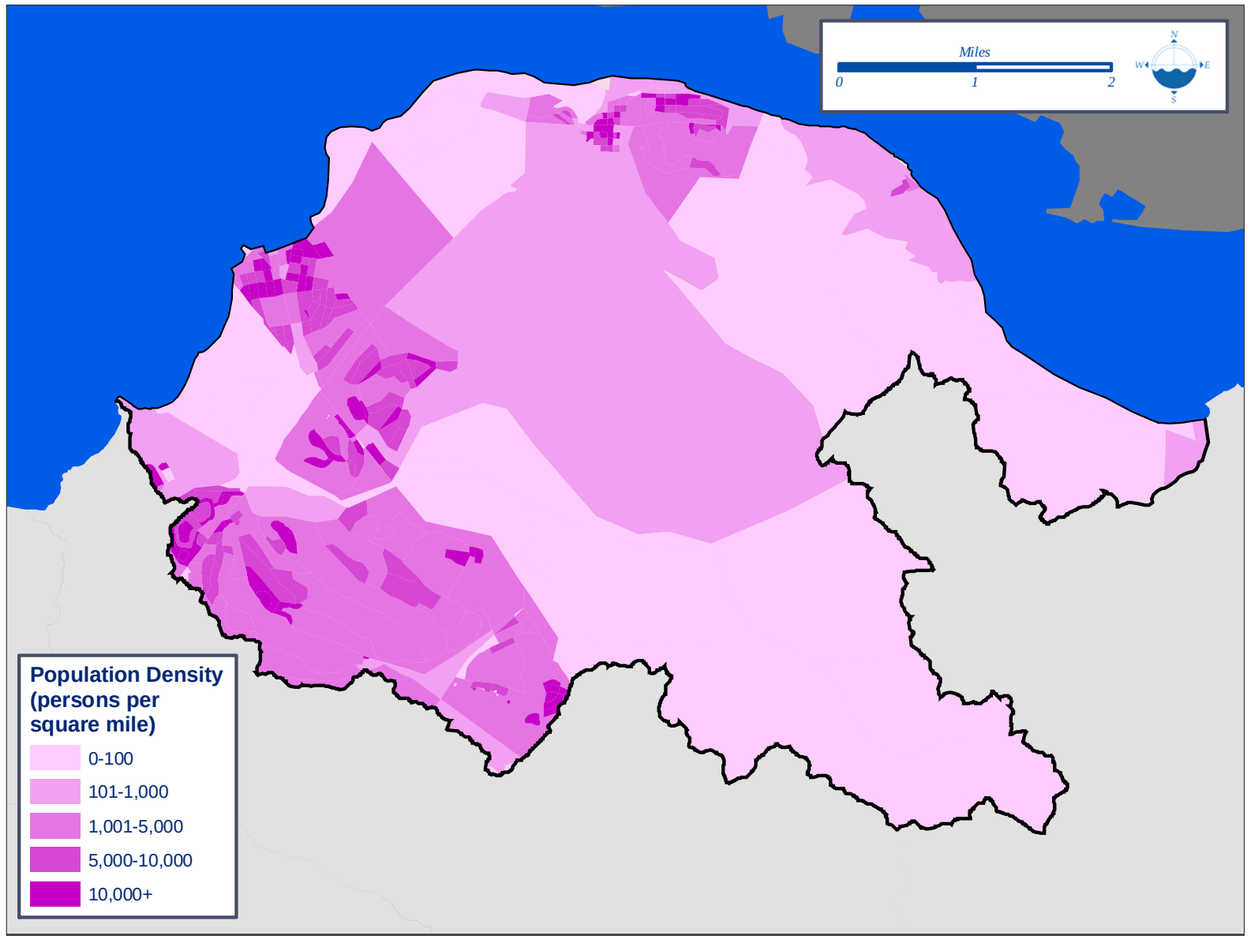
The shorter, steeper Carquinez drainages flow from south-east to north-west following the shape of the land. These drainages are mostly unnamed except for Bull Valley Creek (2 miles), which flows north through the town of Port Costa, first filling the reservoir located just south of town. The upper watersheds of these smaller drainages also begin in East Bay Regional Park land and ranchlands before reaching residential areas and industry located on the shores of the Carquinez Strait.



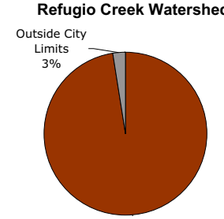
Political Boundaries

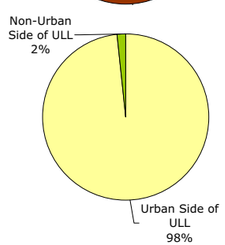


Population Density

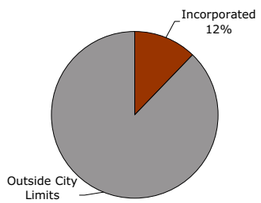


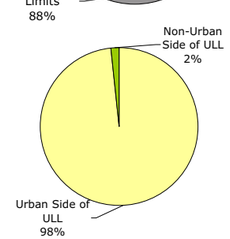
Refugio Creek Watershed



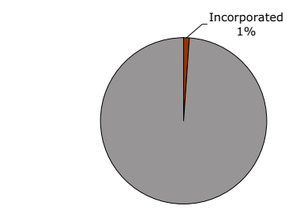


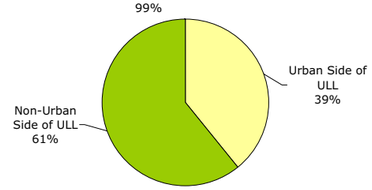
Rodeo Creek Watershed





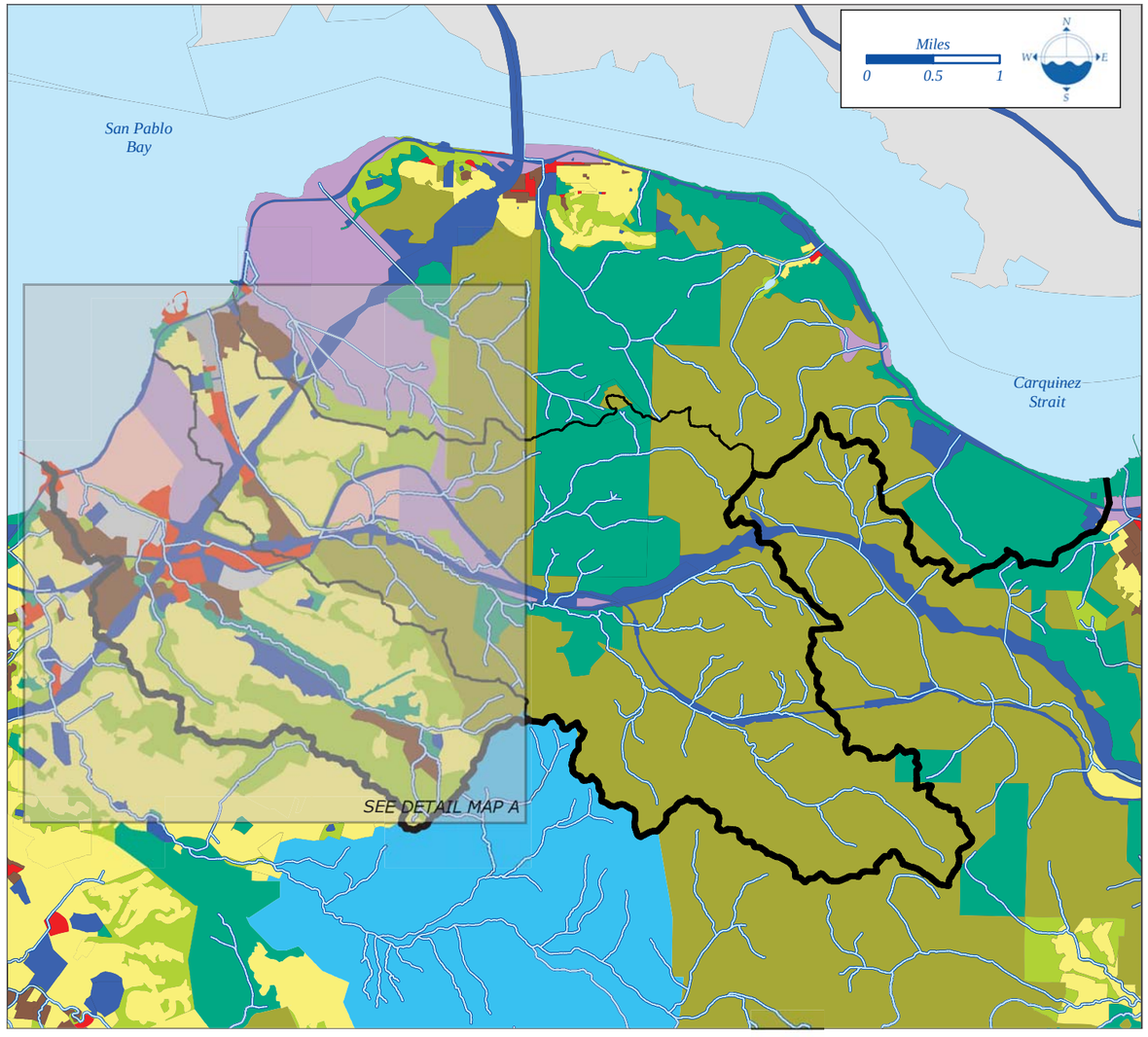
Carquinez Area Watersheds

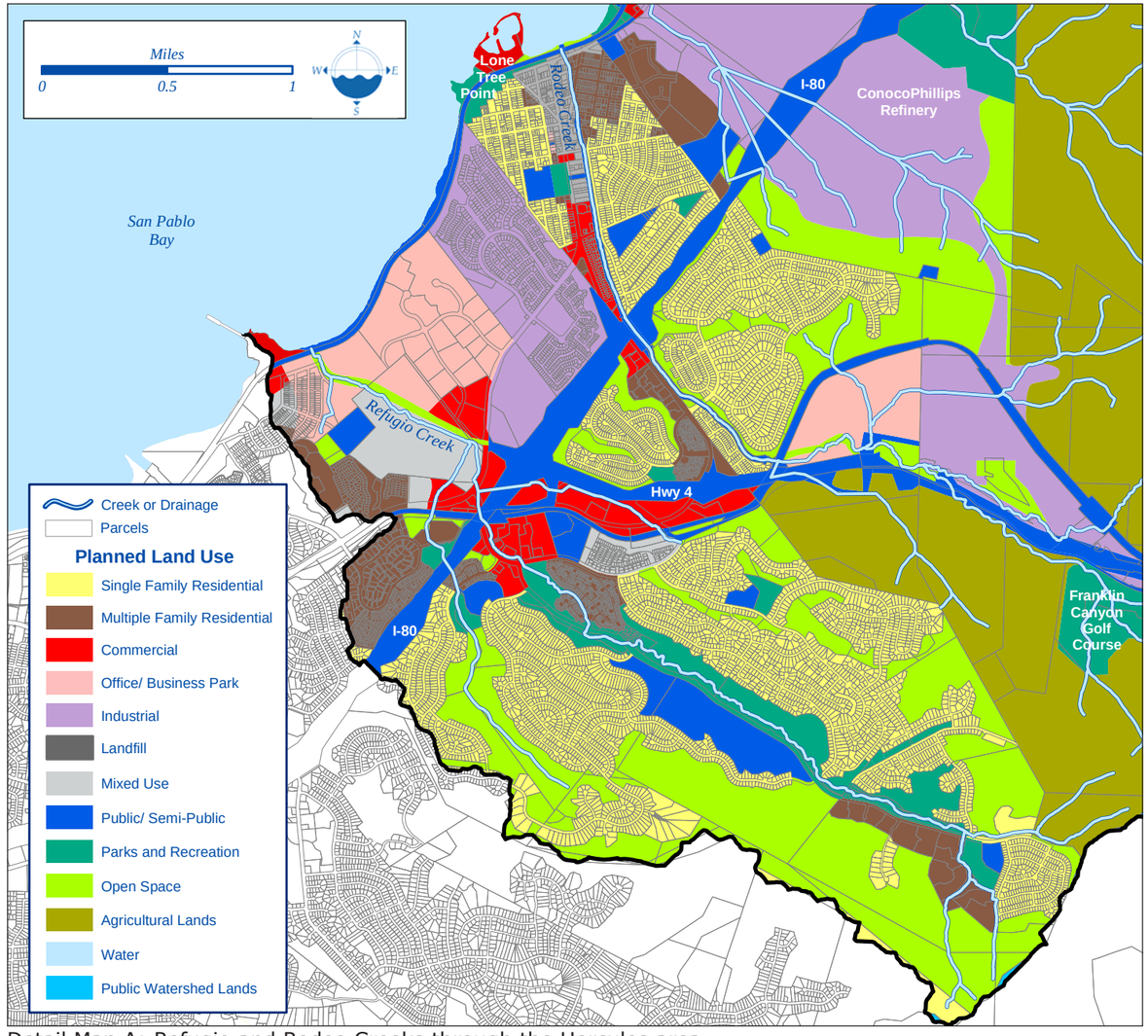




Demographic Profile for Selected Communities In or Near the Refugio, Rodeo and Carquinez Area Watersheds			
Population	**Crockett**	**Hercules**	**Rodeo**
Total Population	3,296	19,299	8,672
Race and Ethnicity	**Crockett**	**Hercules**	**Rodeo**
White	77.0%	23.0%	44.5%
Hispanic or Latino	13.8%	10.8%	16.7%
Black or African American	1.6%	18.4%	13.2%
Asian	3.6%	42.6%	16.2%
Some Other Race	0.8%	1.2%	2.1%
Two or More Races	3.1%	4.0%	7.3%
Education (maximum level attained)	**Crockett**	**Hercules**	**Rodeo**
No High School Diploma	12.3%	9.5%	16.0%
High School Diploma or Equivalent	47.1%	44.0%	55.6%
Associate Degree	12.0%	10.6%	10.1%
Bachelor's Degree	17.9%	27.3%	13.5%
Master's or Professional School Degree	9.7%	8.4%	4.2%
Doctorate Degree	1.1%	0.2%	0.6%
Income	**Crockett**	**Hercules**	**Rodeo**
Median Household Income	$60,359	$75,196	$60,522

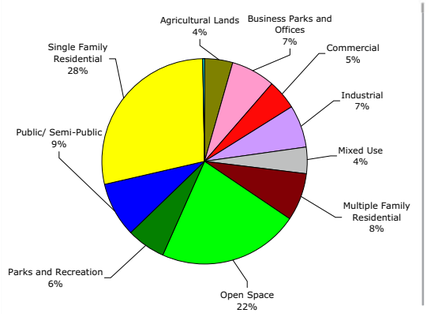
Planned Land Use



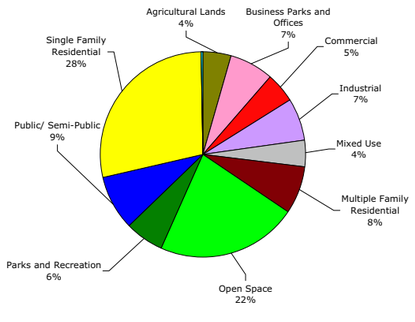


Detail Map A: Refugio and Rodeo Creeks through the Hercules area

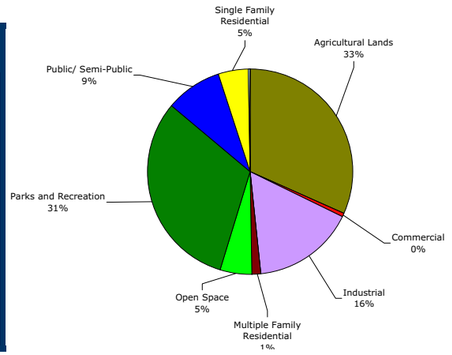
Planned Land Uses *Refugio Creek Watershed*	Acres
Agricultural Lands	140
Business Parks and Offices	218
Commercial	147
Industrial	206
Mixed Use	125
Multiple Family Residential	236
Open Space	693
Parks and Recreation	195
Public/ Semi-Public	265
Single Family Residential	882
Water	2
Watershed (Public)	6
Total	**3,116**

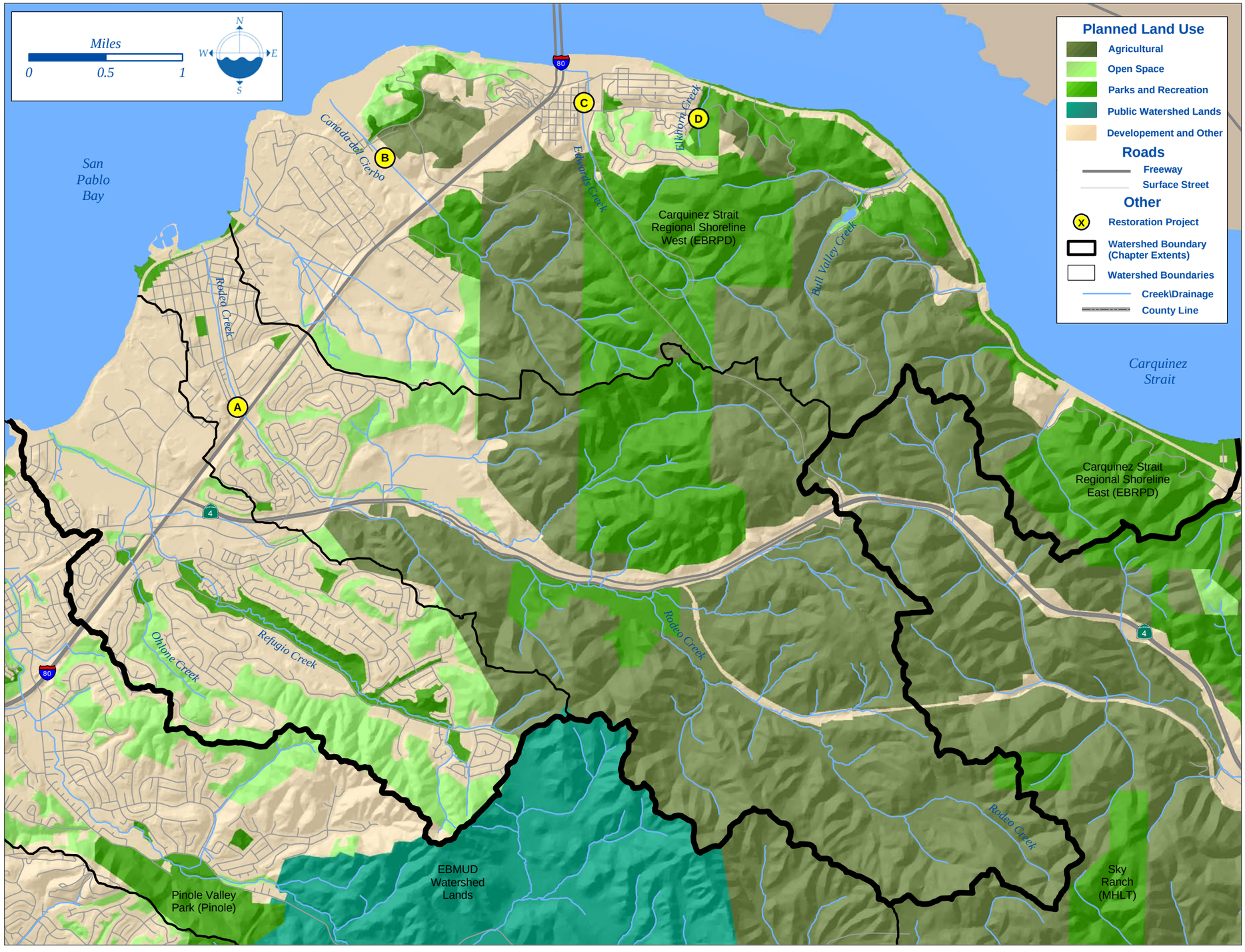


Planned Land Uses *Rodeo Creek Watershed*	Acres
Agricultural Lands	3,905
Business Parks and Offices	97
Commercial	50
Industrial	249
Mixed Use	45
Multiple Family Residential	82
Open Space	224
Parks and Recreation	1,004
Public/ Semi-Public	471
Single Family Residential	526
Water	0
Watershed (Public)	5
Total	**6,657**



Planned Land Uses *Carquinez Area Watersheds*	Acres
Agricultural Lands	2,088
Business Parks and Offices	1
Commercial	27
Industrial	1,072
Mixed Use	0
Multiple Family Residential	88
Open Space	326
Parks and Recreation	2,067
Public/ Semi-Public	578
Single Family Residential	306
Water	23
Watershed (Public)	0
Total	**6,575**





Rodeo Restoration Projects

(A) Rodeo Creek Enhancement: Enhance existing flood control channel by planting native vegetation and creating riparian habitat. Construct a detention basin upstream to offset the loss in capacity created by the riparian vegetation in the channel. This project is seeking funding. Lead Agency: Contra Costa County Flood Control. Anticipated project completion: 2008.

Carquinez Restoration Projects

(B) Canada Del Cierbo: Restore riparian habitat and re-establish creek meander to a creek that was historically rerouted for agricultural purposes. This project was funded by Contra Costa County. Anticipated project completion: 2006.

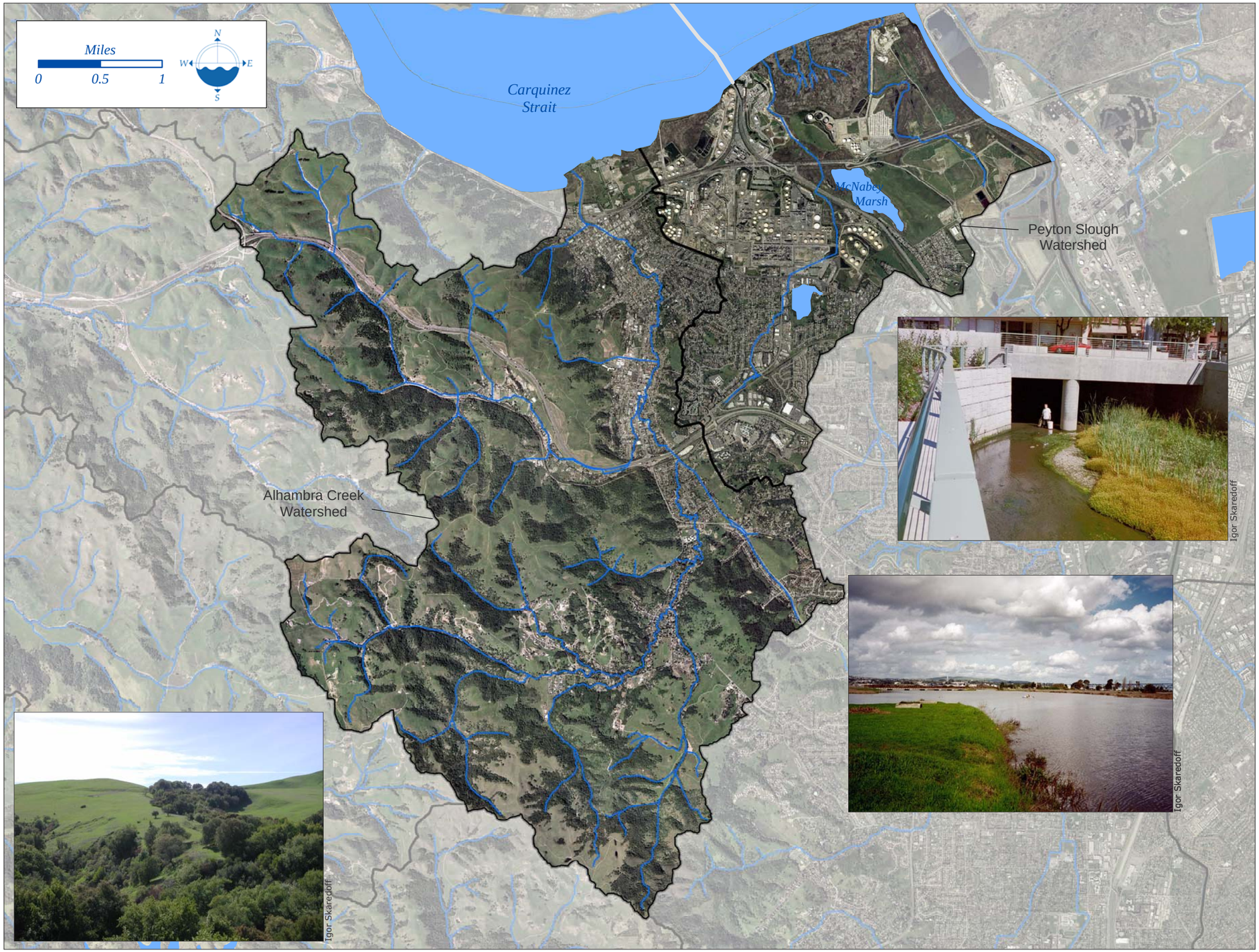
(C) Edwards Creek Native Planting: Removed non-native invasive plants and re-vegetated riparian areas with local native plants. This project was funded by the U.S. Environmental Protection Agency and the California Coastal Conservancy. Lead Agency: Carquinez Regional Environmental Education Center (CREEC) partnered with the Lindsay Wildlife Museum, Diablo Valley College and John Swett Unified School District students. Project completed: 1999.

(D) Elkhorn Creek Phase 1: Restored riparian area with emphasis on butterfly host and nectar plants. Removed non-native blackberries and re-vegetated with locally propagated native plants. This project was funded by the California Coastal Conservancy. Lead Agency: Carquinez Regional Environmental Education Center (CREEC) partnered John Swett Unified School District students. Project completed: 2002.

Organizations Active in the Watershed

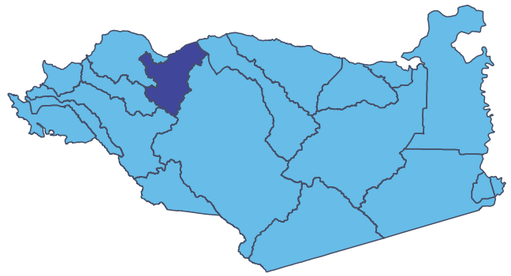
Carquinez Regional Environmental Education Center (CREEC)
Sandra Dare
Phone: (510) 787-2265
Email: mailbox@creecyouth.org
Website: www.creecyouth.org

Friends of Refugio and Rodeo Watersheds
Steven Kirby
P.O. Box 5614
Hercules, CA 94547
Phone: (510) 799-9472
Email:creeks@refugioandrodeowatersheds.com
Website:www.refugioandrodeowatersheds.com



Chapter 8

Alhambra Creek and Peyton Slough Watersheds



Waters from the 10,753-acre watershed of Alhambra Creek wreaked havoc in downtown Martinez, New Years Day 1997, as it had done many times before. The 7.88-mile main stem of Alhambra Creek is joined by two large tributaries (Franklin Creek and Arroyo Del Hambre) before making its way through the residential and commercial areas of downtown Martinez to its mouth in the Carquinez Strait.

Alhambra Creek Watershed Vital Statistics	
Watershed Size	10,735 acres
Length of Longest Branch of Creek	7.99 miles
Total Channel Length in Watershed	48.08 miles
Average Annual Rainfall	22 inches
Estimated Mean Daily Flow	7.2 cfs
Estimated 100-Year Flood Flow	5110 cfs[1]
Highest Elevation in Watershed	1,470 feet
Population (estimated)	14,200 people
Estimated Percent Impervious	15 %
Recognized Pollutants of Concern	N/A[2]

Peyton Slough Watershed Vital Statistics	
Watershed Size	3,914 acres
Length of Longest Branch of Creek	3.64 miles
Total Channel Length in Watershed	8.11 miles
Average Annual Rainfall	17 inches
Estimated Mean Daily Flow	3.7 cfs
Estimated 100-Year Flood Flow	N/A
Highest Elevation in Watershed	400 feet
Population (estimated)	9,500 people
Estimated Percent Impervious[3]	<55 %
Recognized Pollutants of Concern	N/A[2]

[1] At mouth of creek (100% of watershed upstream)

[2] Alhambra Creek and Peyton Slough have not been specifically identified in the State's 303(d) list of Impaired Water Bodies.

[3] Industrial buffer lands could not be tabulated separate from industrial lands--percent impervious is therefore an over-estimate.

Before the City of Martinez incorporated in 1876, the community was a busy trading post and transportation hub. Forty-niners rode Semple's Ferry (1847) from the Martinez waterfront to cross the Delta on their way to the Sierra-Nevada foothills. Tons of sediment, loosened by hydraulic mining practices in the Sierras, washed into the Delta and changed the shape of the waterfront, forcing the mouth of Alhambra Creek to repeatedly advance northward.

CCC Flood Control District

Alhambra Creek floods downtown Martinez, 1955

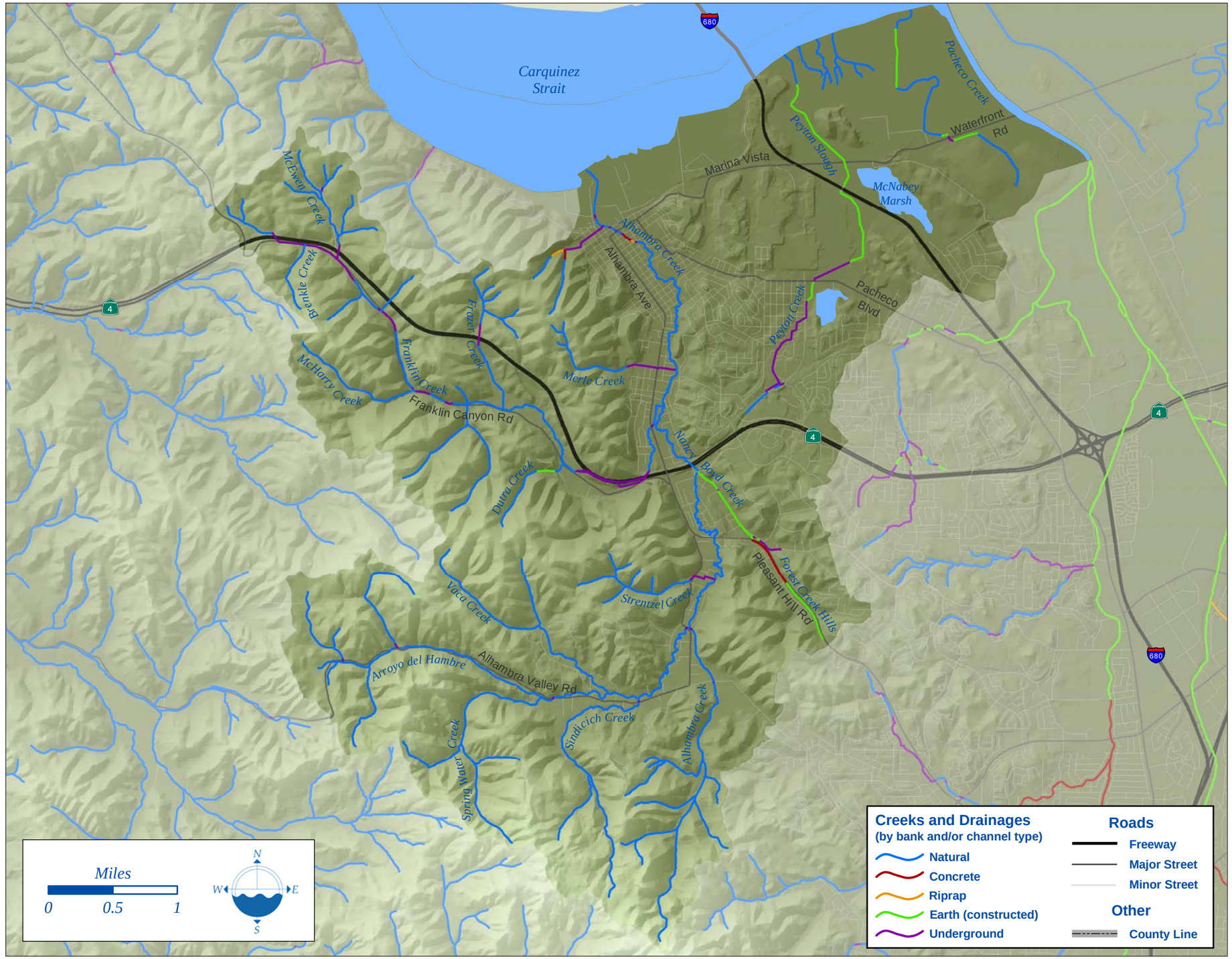
Alhambra Creek Channel Length Statistics*

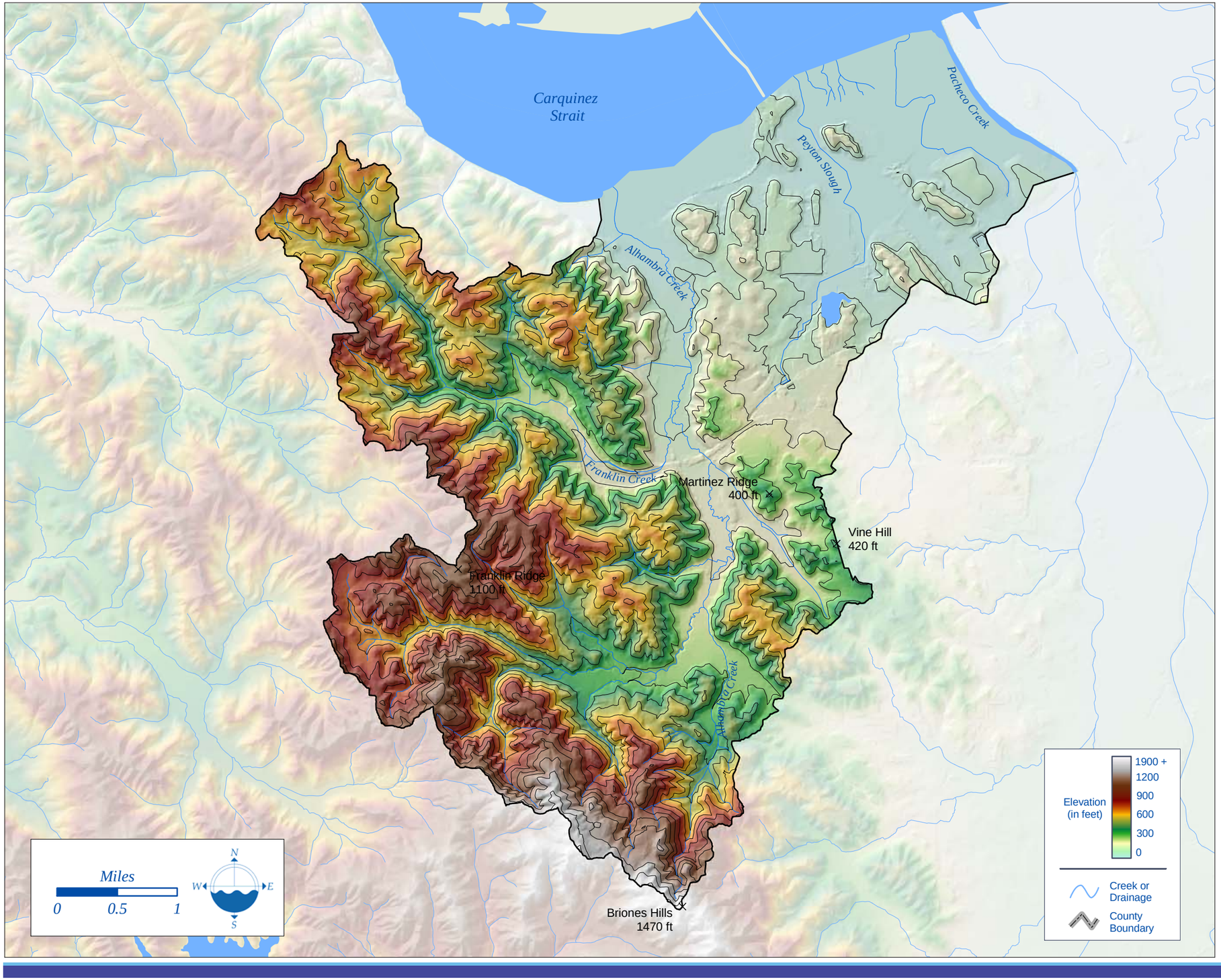
	Miles	Percent
Length of Longest Branch of Creek	7.99	
Total Channel Length in Watershed	48.08	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	41.67	86.7%
Concrete	4.88	10.1%
Earth (constructed)	1.39	2.9%
Riprap	0.14	0.3%
Underground	4.32	9.0%

Peyton Slough Watershed Channel Length Statistics*

	Miles	Percent
Length of Longest Branch of Creek	3.64	
Total Channel Length in Watershed	8.11	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	4.14	51.1%
Concrete	1.39	17.2%
Earth (constructed)	2.57	31.7%
Riprap	0.00	0.0%
Underground	1.39	17.2%

*Data relate to mapped channels only. Does not include storm drains. Bank type for segments shorter than 100 feet was not mapped.



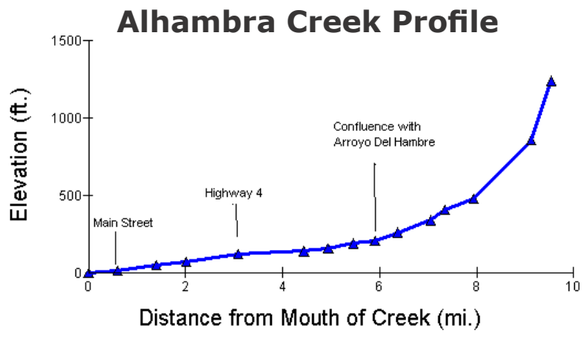


The upper watershed retains much of its rural character. Alhambra Creek's headwaters are located in Briones Regional Park. Other tracts of open space and agricultural lands further protect important habitat in the watershed. Coastal Oak woodlands dominate the north facing slopes of the upper and middle watershed.

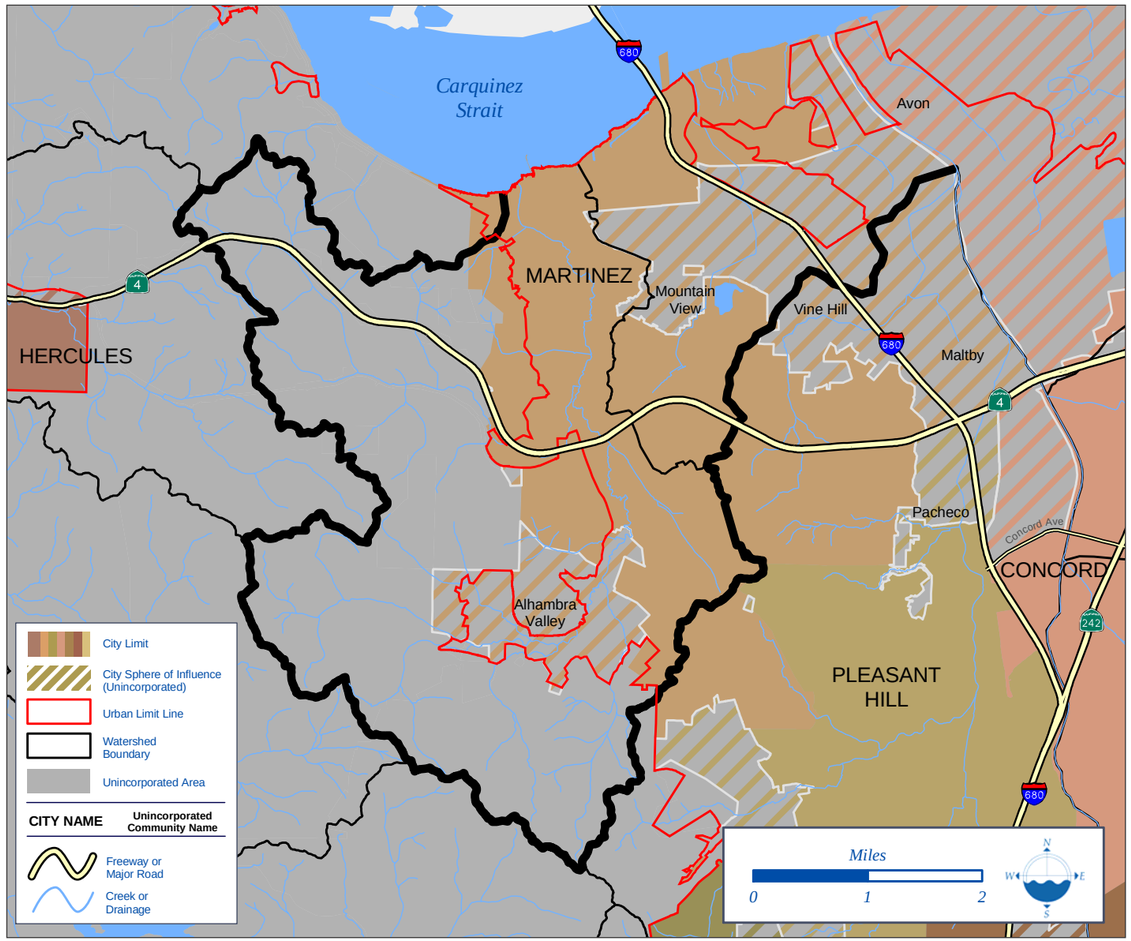
In higher elevations, the lower watershed also retains a rural feeling. Carquinez Strait Regional Shoreline protects the watershed North of Highway 4. The lower elevations, defined by the flood plain of Alhambra Creek, were steadily urbanized through the late 1800's. Shell started operating its first U.S. refinery in Martinez in 1915.

Peyton Slough Watershed (3,914 acres) is located east of the Alhambra Creek Watershed, and has borne the brunt of close to 100 years of industrialization and urbanization. Peyton Creek (3.64 miles) is culverted underground for over a third of its length through residential and industrial areas. Over half of the watershed is urbanized, including all of the upper watershed. Early industry in the lower watershed included oil refining, chemical manufacturing and copper smelting, which brought both jobs and increased environmental concerns to the area.

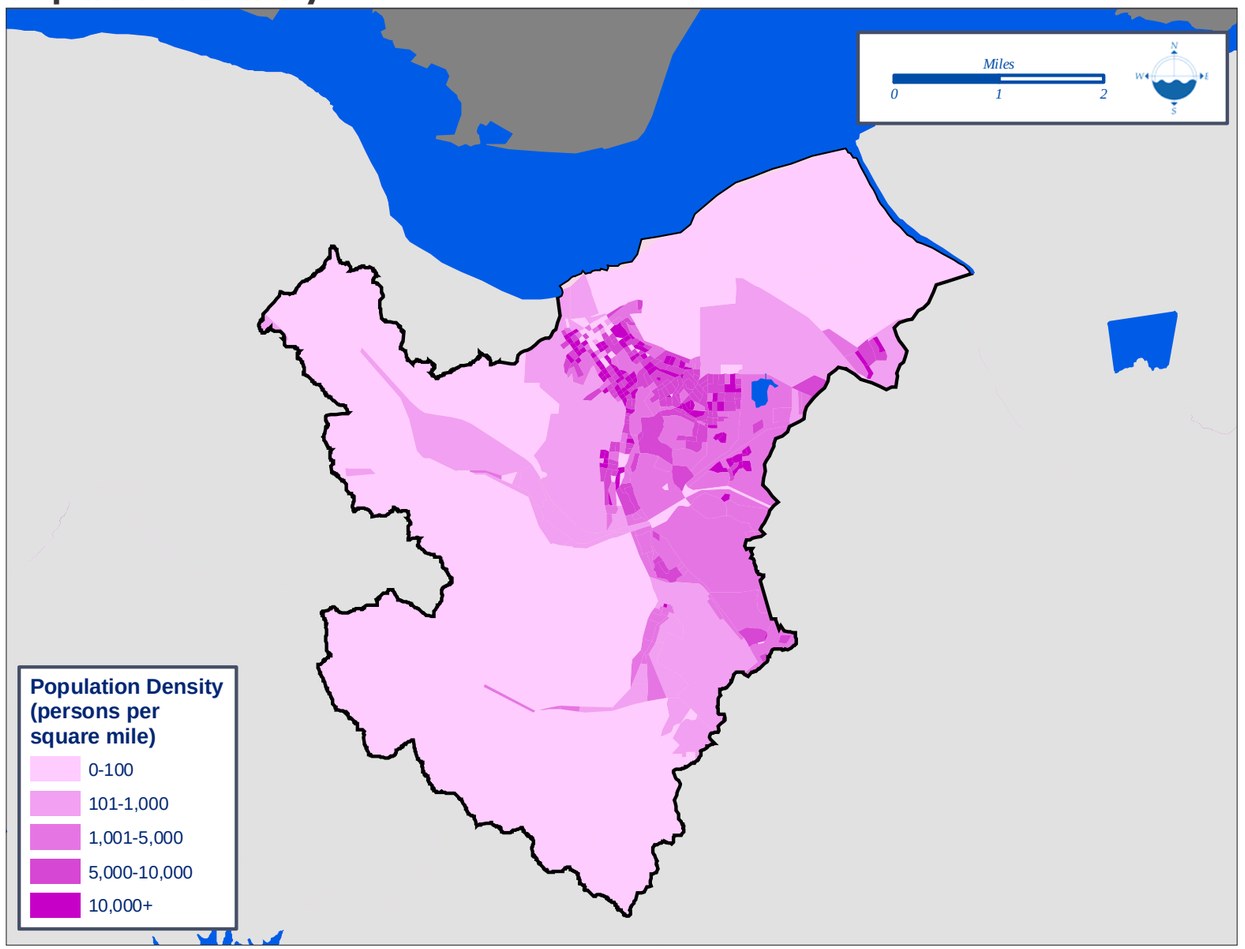
The water in the upper watershed is controlled by storm drain systems throughout this predominantly residential area. The lower watershed retains some of the marshland habitat central to the early history of this area. Native Americans lived in and frequented the local marshes for their abundant food sources. MacNabney Marsh, located in the Pacific Flyway, is home to many species of waterfowl and shorebirds.



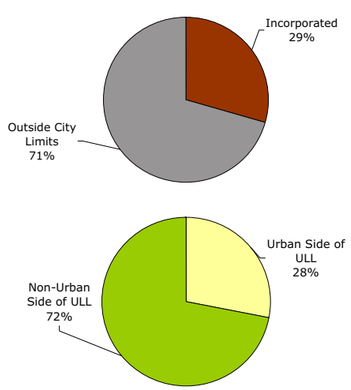
Political Boundaries



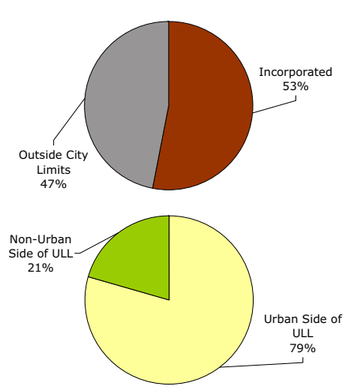
Population Density



Alhambra Creek Watershed

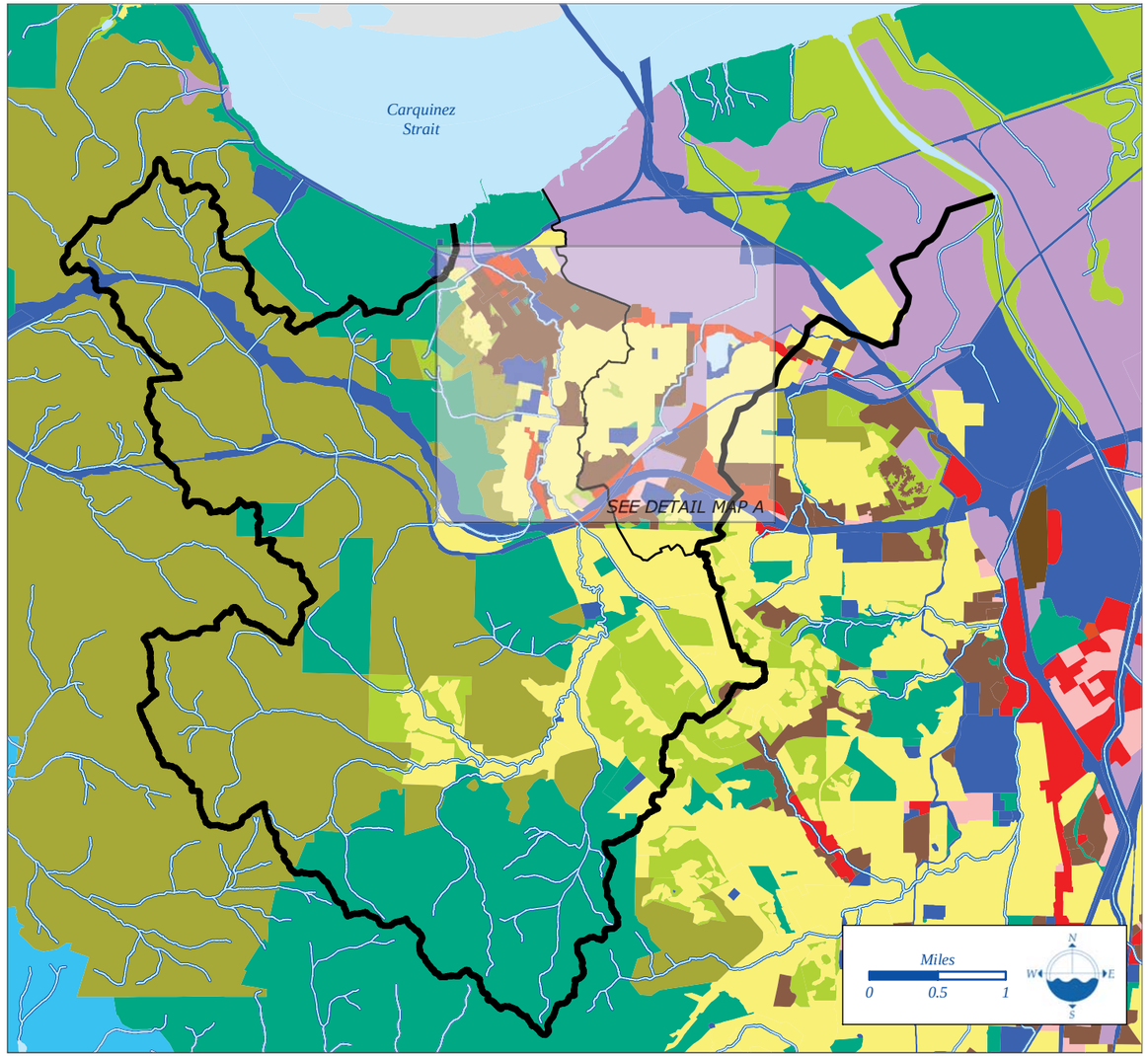


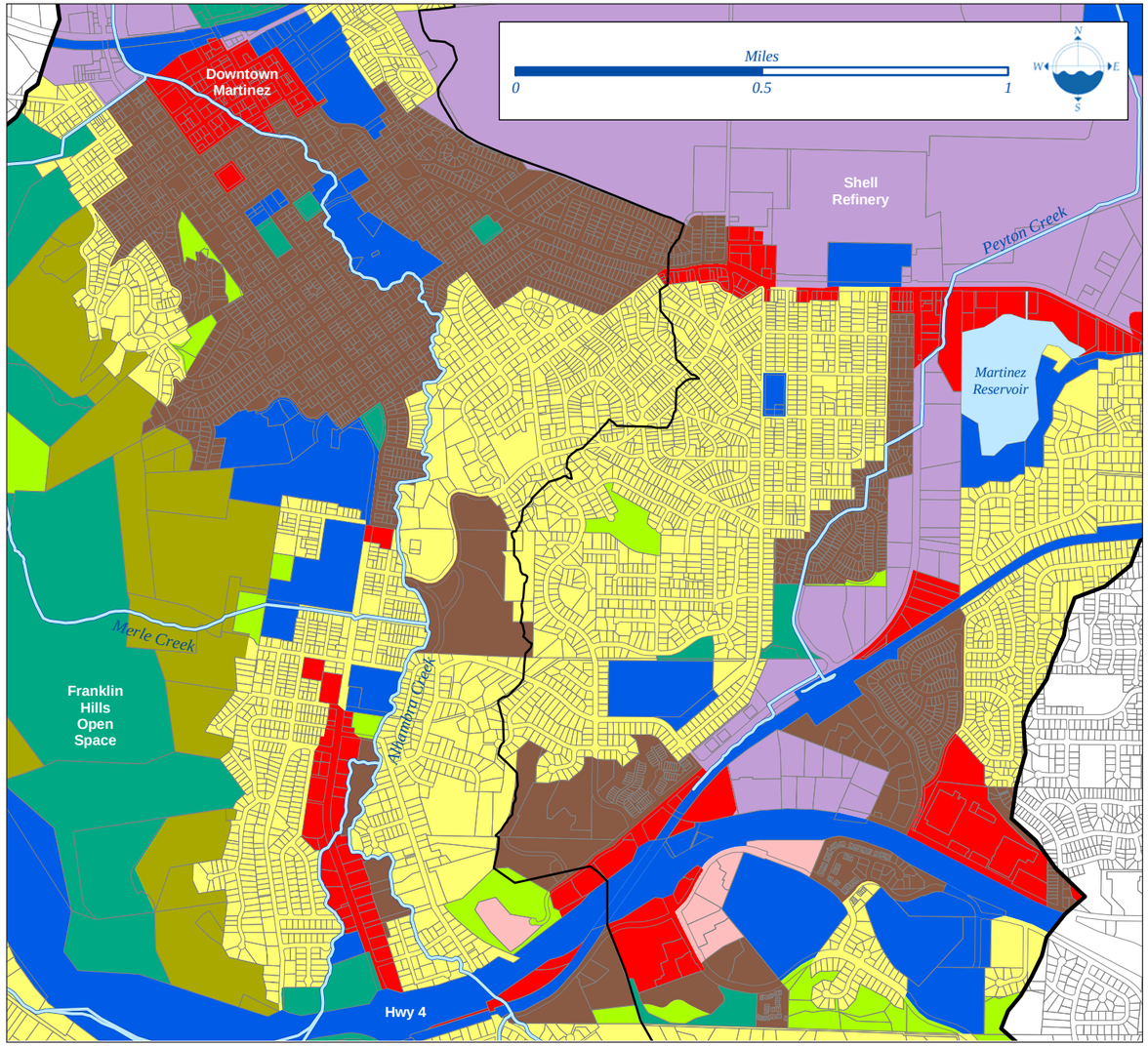
Peyton Slough Watershed



Demographic Profile for Selected Communities In or Near the Alhambra Creek and Peyton Slough Watersheds

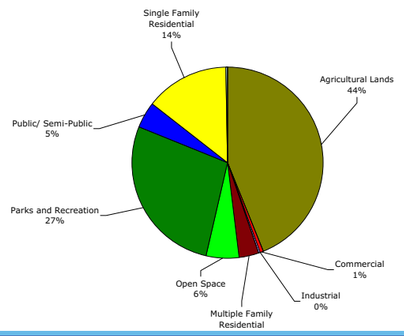
Population	Martinez	Mountain View	Vine Hill
Total Population	36,167	2,362	3,254
Race and Ethnicity	**Martinez**	**Mountain View**	**Vine Hill**
White	75.6%	79.4%	65.1%
Hispanic or Latino	10.6%	9.6%	23.3%
Black or African American	3.2%	1.4%	3.0%
Asian	6.3%	1.7%	3.7%
Some Other Race	0.9%	0.8%	0.4%
Two or More Races	3.5%	7.1%	4.5%
Education (maximum level attained)	**Martinez**	**Mountain View**	**Vine Hill**
No High School Diploma	8.9%	14.8%	21.7%
High School Diploma or Equivalent	49.1%	59.1%	57.8%
Associate Degree	9.9%	8.7%	7.1%
Bachelor's Degree	22.5%	14.5%	10.4%
Master's or Professional School Degree	8.6%	2.8%	3.1%
Doctorate Degree	1.0%	0.0%	0.0%
Income	**Martinez**	**Mountain View**	**Vine Hill**
Median Household Income	$63,010	$51,986	$48,125

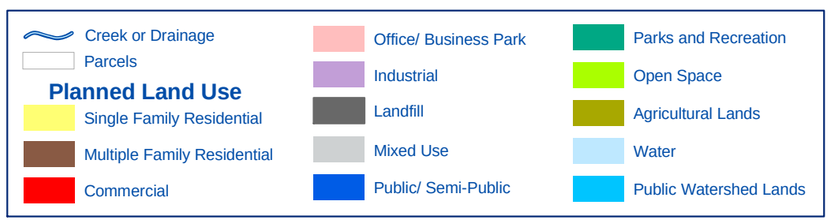


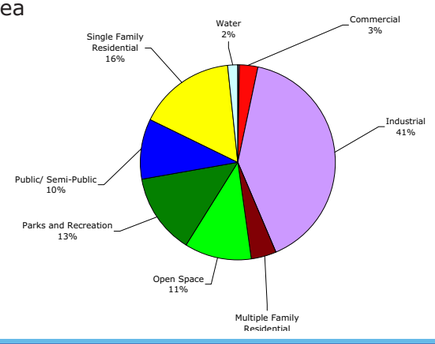


Detail Map A: Downtown Martinez area

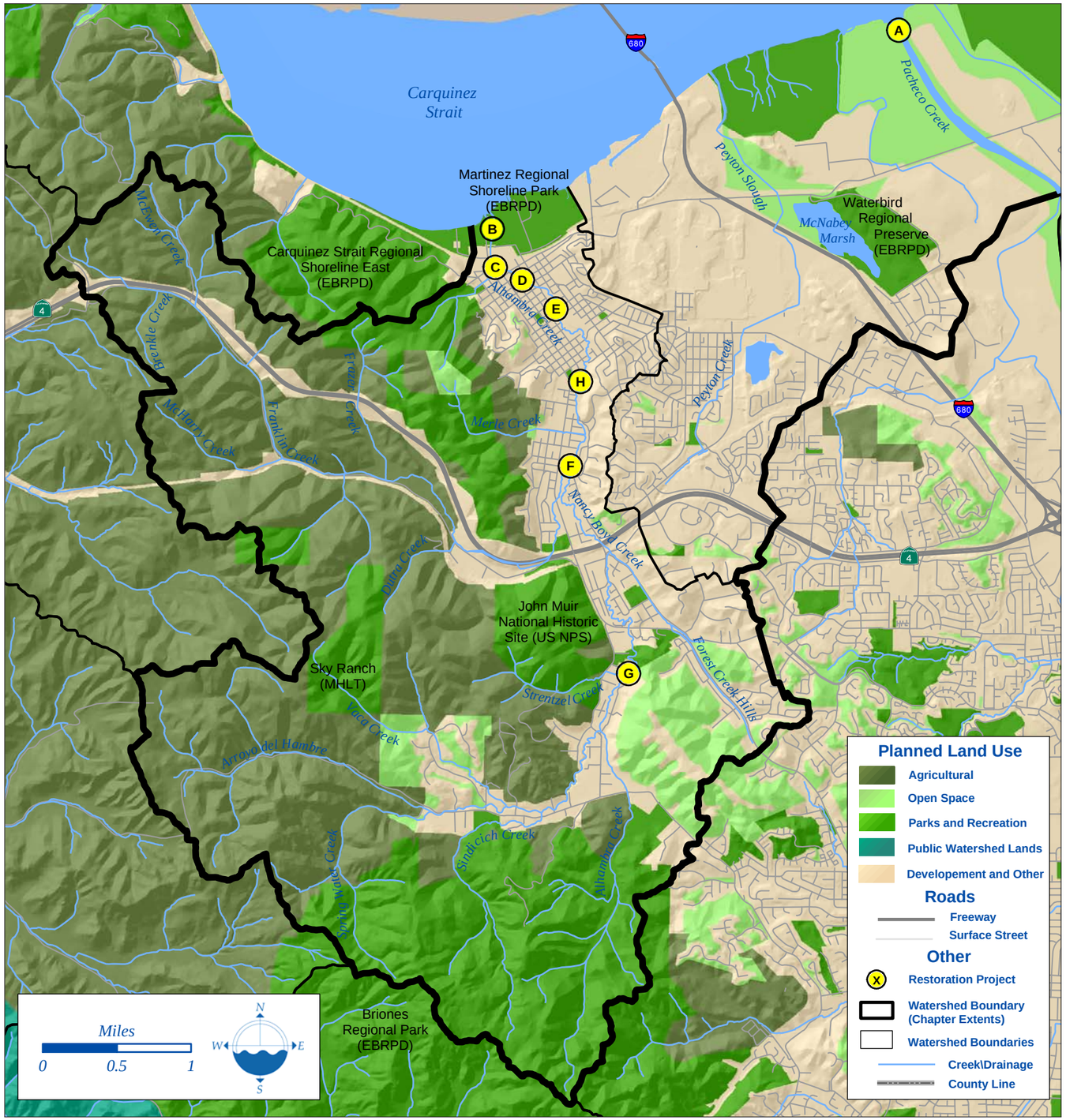
Planned Land Uses *Alhambra Creek Watershed*	Acres
Agricultural Lands	4,702
Business Parks and Offices	4
Commercial	71
Industrial	34
Mixed Use	0
Multiple Family Residential	346
Open Space	598
Parks and Recreation	2,942
Public/ Semi-Public	499
Single Family Residential	1,514
Water	25
Watershed (Public)	0
Total	**10,735**







Planned Land Uses *Peyton Slough Watershed*	Acres
Agricultural Lands	0
Business Parks and Offices	16
Commercial	116
Industrial	1,574
Mixed Use	0
Multiple Family Residential	166
Open Space	433
Parks and Recreation	520
Public/ Semi-Public	387
Single Family Residential	632
Water	70
Watershed (Public)	0
Total	**3,914**



Peyton Slough Restoration Projects

(A) Pacheco Marsh Restoration: Re-establish 126 acres of tidal marsh and upland habitat on a site previously used for dredge spoils. Funding for this project is provided by East Bay Regional Park District and Contra Costa County Flood Control. Lead Agency: East Bay Regional Park District partnered with Contra Costa County Flood Control and Muir Heritage Land Trust. Anticipated project completion: 2005.

Alhambra Restoration Projects

(B) Martinez Wetlands Restoration: Widened the creek channel and established a floodplain in the lower portion of creek near Carquinez Straits. Also excavated a tidally-influenced wetlands bay off the main creek channel for Delta Smelt habitat; constructed erosion prevention structures; and restored marsh. Additionally, paths and a bridge were constructed for recreation purposes. This project was funded by Caltrans Mitigation funds. Lead Agency: East Bay Regional Park District partnered with Caltrans and the City of Martinez. Project completed: 2001.

(C) Alhambra Creek Enhancement and Flood Control Project (Marina Vista to mouth of creek): Restructured the channel and restored sections of the natural flood plain. Removed trash, invasive plants, and structures on the creek bank, as well as re-vegetated riparian areas. This project was part of the City's intermodal transportation project that provided a new train station and incorporated the creek as a design element. Raised the railroad tracks and added two new bridge spans to remove a historical bottleneck to flood flows. This project was funded by the City of Martinez, Caltrans, and Union Pacific Railroad. Lead Agency: City of Martinez and East Bay Regional Park District. Project completion: 2001.

(D) Alhambra Creek Enhancement: Enhanced fish passage and removed non-native invasive plants. By focusing efforts on removing hard structures on creek banks, cleaning up debris in the creek and on the banks, and re-vegetating the riparian corridor with native plants, this project successfully restored a section of Alhambra Creek between Ward and Main Street. This project was later sacrificed and incorporated into a larger downtown creek restoration (B). A large component of the project was to make the creek an amenity to the downtown area. This project was funded by the Martinez Foundation, the Department of Water Resources, downtown property owners and the City of Martinez. Lead Agency: City of Martinez partnered with the Muir Heritage Land Trust. Project completed: 1996**.**

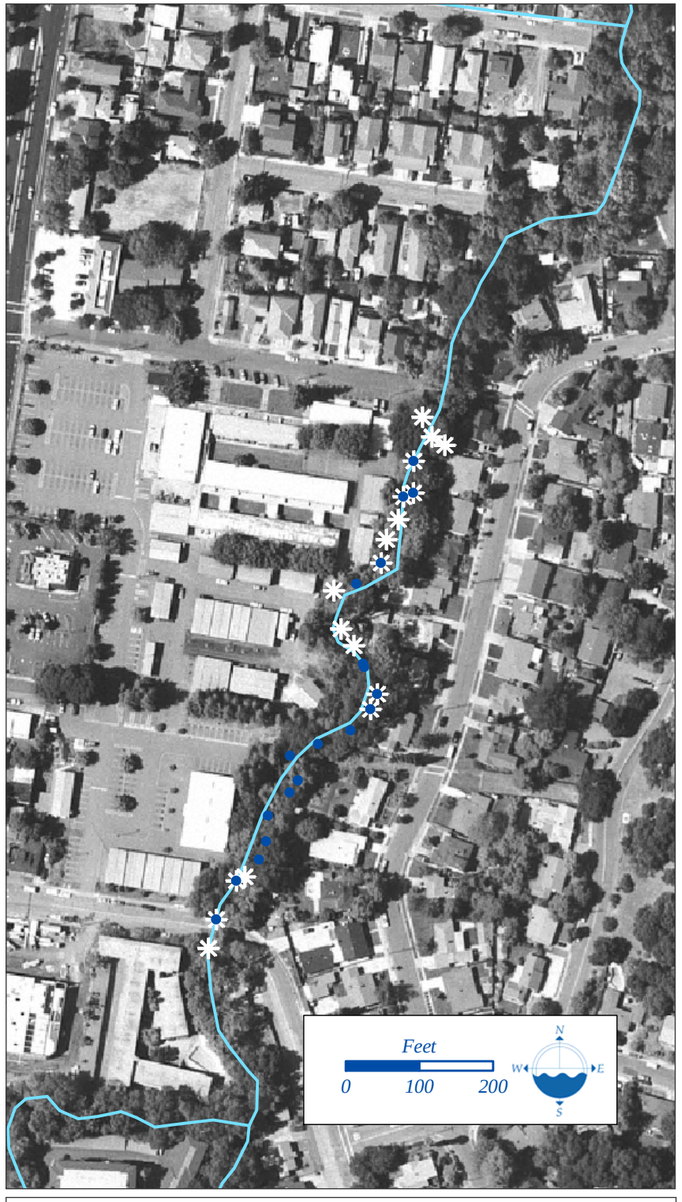
(E) Alhambra Creek Outdoor Classroom: Established an outdoor classroom on the banks of Alhambra Creek for Martinez Jr High School. The area was used to teach students about the creek environment. As part of an experiential education component of the curriculum, students helped remove non-native invasive plants. This project was funded by the Shell CALPIRG Settlement of 1995 and the Martinez Unified School District. Lead Agency: Friends of Alhambra Creek partnered with the Martinez Unified School District and Martinez Junior High. Project Completed: 1998.

(F) Alhambra Creek Restoration and Education Project: Clean up and restore a section of Alhambra Creek. Provide experiential education opportunities to students at the adjacent Alternative Education School. Lead Agency: Muir Heritage Land Trust partnered with the Martinez Unified School District and the Urban Creeks Council. Anticipated project completion: 2005.

(G) Strentzel Lane Erosion and Sediment Reduction Project: Reduced sediment carried into Alhambra Creek while improving the conveyance of floodwaters to the creek. There are plans to use the restored natural channel and seasonal wetland for education. Lead Agency: CCC Public Works partnered with the National Park Service, the Resource Conservation District, the City of Martinez, the SF Bay Regional Water Quality Control Board, CCC Flood Control and the Urban Creeks Council. This project was funded by: the SF Bay Regional Water Quality Control Board, the National Park Service and Contra Costa County. Project completed: 2002.

(H) Spring Clean-up of Alhambra Creek: Remove trash and debris from Alhambra Creek and the surrounding area. This project is funded by the City of Martinez, the Martinez Adult Education School, and the Contra Costa County Clean Water Program. This event has occurred annually since 1990.

Where is Suitable Habitat?



Creek or Drainage

Query of 50-Foot Intervals Data: More than 10% shade cover, Gravel or Cobble Substrate, and Presence of water.

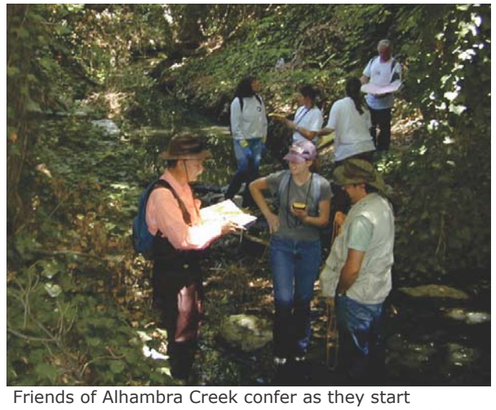
Undercut banks

The potential for restoring and sustaining native fish populations to Alhambra Creek is determined, in part, by the existence of appropriate habitat in and along the creek corridor. A number of factors are important to the survival of fish: water chemistry, substrate, bank characteristics, the presence of food, and water temperature.

GPS Data collected by Contra Costa Watershed Forum volunteers and Friends of Alhambra Creek can be queried for the presence of specific habitat conditions. Data collected at 50-foot intervals along the creek is displayed on the map to the left. White stars on the map to the left indicate that the area of creek has water present, cobble or gravel substrate, and at least 10% shade cover.

Shade cover is important to riparian areas for a number of reasons. Organic debris from trees and other foliage provide important nutrients for aquatic life. The shade provided by creekside vegetation protects the creek from rising daytime temperatures. The native fish in Alhambra Creek prefer to live in and migrate through water less than 65 degrees Fahrenheit.

Resource managers are exploring the potential for restoring sustainable native fish populations in Alhambra Creek. The data can be queried for the presence of specific habitat conditions. Displaying the query creates a visual representation of existing fish habitat locations.



Friends of Alhambra Creek confer as they start collecting data in an incised section of Alhambra Creek.

Organizations Active in the Watershed

Friends of Alhambra Creek
Phone: (925)-229-1371
Email: FriendsofAC@california.com
P.O. Box 2315
Martinez, CA 94553

Contra Costa Resource Conservation District - Alhambra Creek Watershed Action Group
5552 Clayton Road
Concord, CA 94521
Phone: (925) 672-6522 x 4
Website: www.ccrcd.org

Friends of Alhambra Creek pose after wading through the creek collecting GPS data, 2001.

Selected Resources

Alhambra Creek Watershed Action Group, Alhambra Creek Watershed Map, September 2003.

Alhambra Creek Watershed Action Group, Fact Sheet: Alhambra Creek Watershed Flooding and Downtown Revitalization , February 2003.

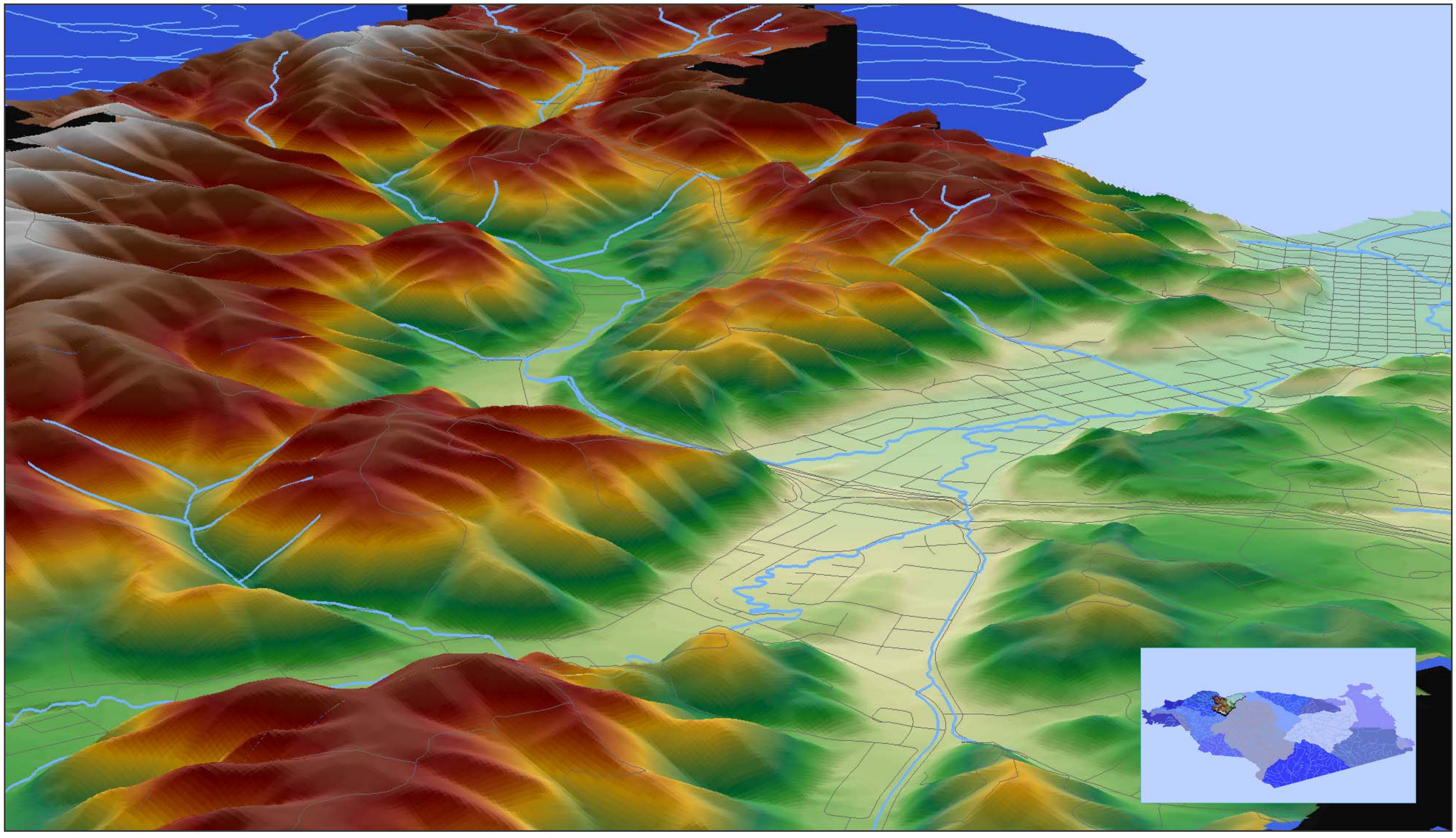
Alhambra Creek Watershed Planning Group, Alhambra Creek Watershed Management Plan, April 2001.

City of Martinez and State Coastal Conservancy, Alhambra Creek Enhancement Plan, May 1992.

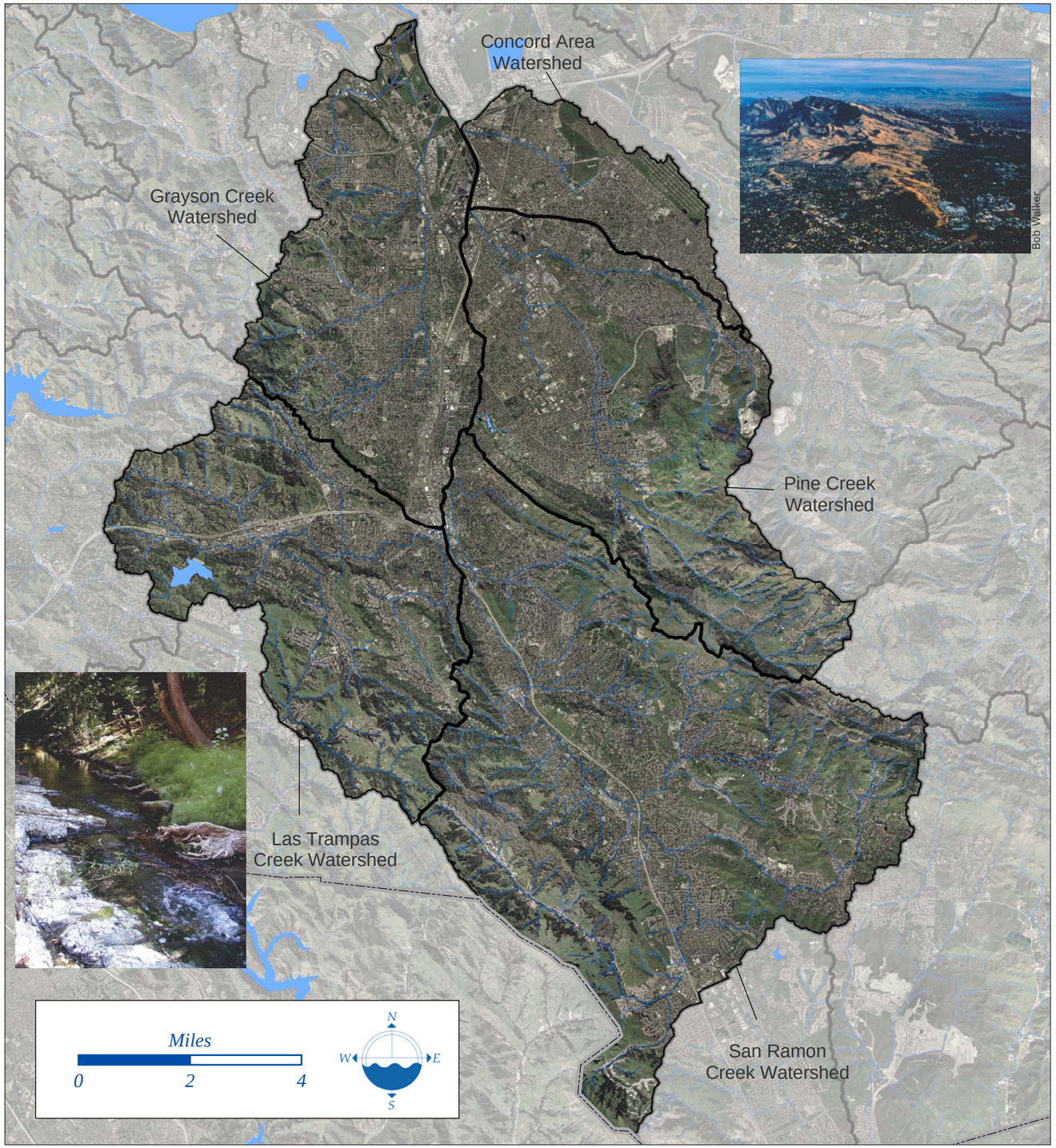
Friends of Alhambra Creek, City of Martinez, Rivers, Trails and Conservation Assistance, National Park Service, Saunter Along Alhambra Creek.

USDA Natural Resources Conservation Service, Alhambra Creek Watershed Resources Inventory, Davis, CA, January 1997.

A rainbow breaks through clouds over the Alhambra Creek Watershed.



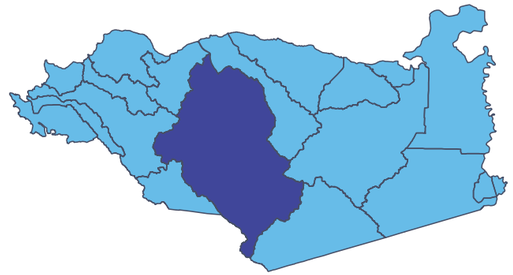
Alhambra Creek and Peyton Slough 3D: Looking west to the headwaters of Franklin Creek from the lower watershed.



Chapter 9

Walnut Creek Watershed

Grayson-Murderers, Concord, Pine-Galindo,
San Ramon and Las Trampas Sub-Watersheds



Walnut Creek Watershed encompasses 93,556 acres in Central Contra Costa County. Draining the west side of Mount Diablo and the east side of the East Bay Hills, Walnut Creek's major tributaries include: San Ramon Creek (18.89 miles), Bollinger Creek (6.72 miles), Las Trampas Creek (12.37 miles), Lafayette Creek (3.78 miles), Grayson Creek (8.87 mile), Murderer's Creek (4.37 miles), Pine Creek (12.65 miles) and Galindo Creek (6.5 miles).

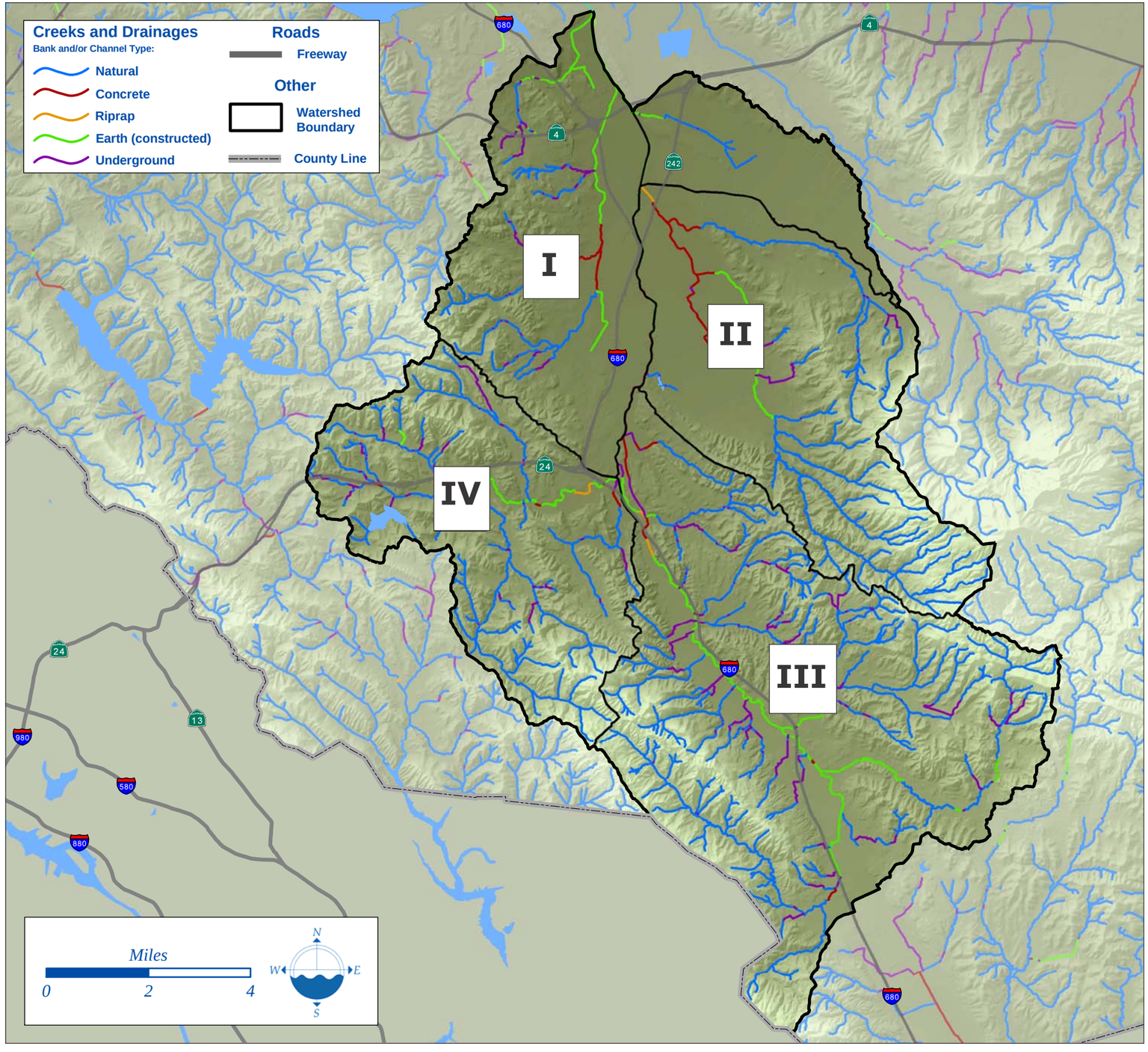
The Cities of Walnut Creek, Lafayette, Pleasant Hill and Danville lie completely within the boundaries of the watershed, while the Cities of Concord, Martinez, and small areas of Moraga and San Ramon are partly within the watershed.

Ranchos established in the watershed in the early 1800's included: Rancho Monte Del Diablo, Rancho Arroyo de las Nueces y Bolbones, Rancho San Ramon, Rancho Las Juntas and Rancho Cañada de Hambre. Agriculture and livestock played an important role for approximately 100 years in the fertile valleys separating Mount Diablo from the East Bay Hills. Grain was the principal crop in the region during the mid-1800's. With the introduction of irrigation technologies, fruit and nut orchards started evolving in the valley.

Walnut Creek Watershed Vital Statistics

	Major Subwatersheds				Walnut Creek (overall)
	Grayson Creek	Las Trampas	Pine/Galindo	San Ramon	
Watershed Size	11,021 acres	17,238 acres	18,525 acres	32,915 acres	93,556 acres
Length of Longest Branch of Creek	8.87 miles	12.37 miles	12.65 miles	18.89 miles	28.74 miles
Total Channel Length in Watershed	25.41 miles	64.10 miles	59.96 miles	136.73 miles	309.75 miles
Average Annual Rainfall	20 inches	26 inches	18 inches	21 inches	21 inches
Estimated Mean Daily Flow	10.6 cfs	15.4 cfs	14.8 cfs	27.1 cfs	81.4 cfs
Estimated 100-Year Flood Flow	N/A	N/A	10000 cfs[1]	13100 cfs[2]	25600 cfs[3]
Highest Elevation in Watershed	1483 feet	2020 feet	3390 feet	2060 feet	3849 feet
Population (estimated)	58,900 people	42,300 people	78,900 people	72,400 people	339,100 people
Estimated Percent Impervious	45 %	25 %	30 %	20 %	30 %
Recognized Pollutants of Concern	Diazinon[4]	Diazinon[4]	Diazinon[4]	Diazinon[4]	Diazinon[4]

[1] At confluence with Walnut (100% of watershed) [2] At Rudgear Rd. (nearly 100% of watershed) [3] Below Grayson (96% of watershed)
[4] Walnut Creek is listed as an Impaired Water Body in the State's 303(d) list. Diazinon is the Pollutant of Concern.



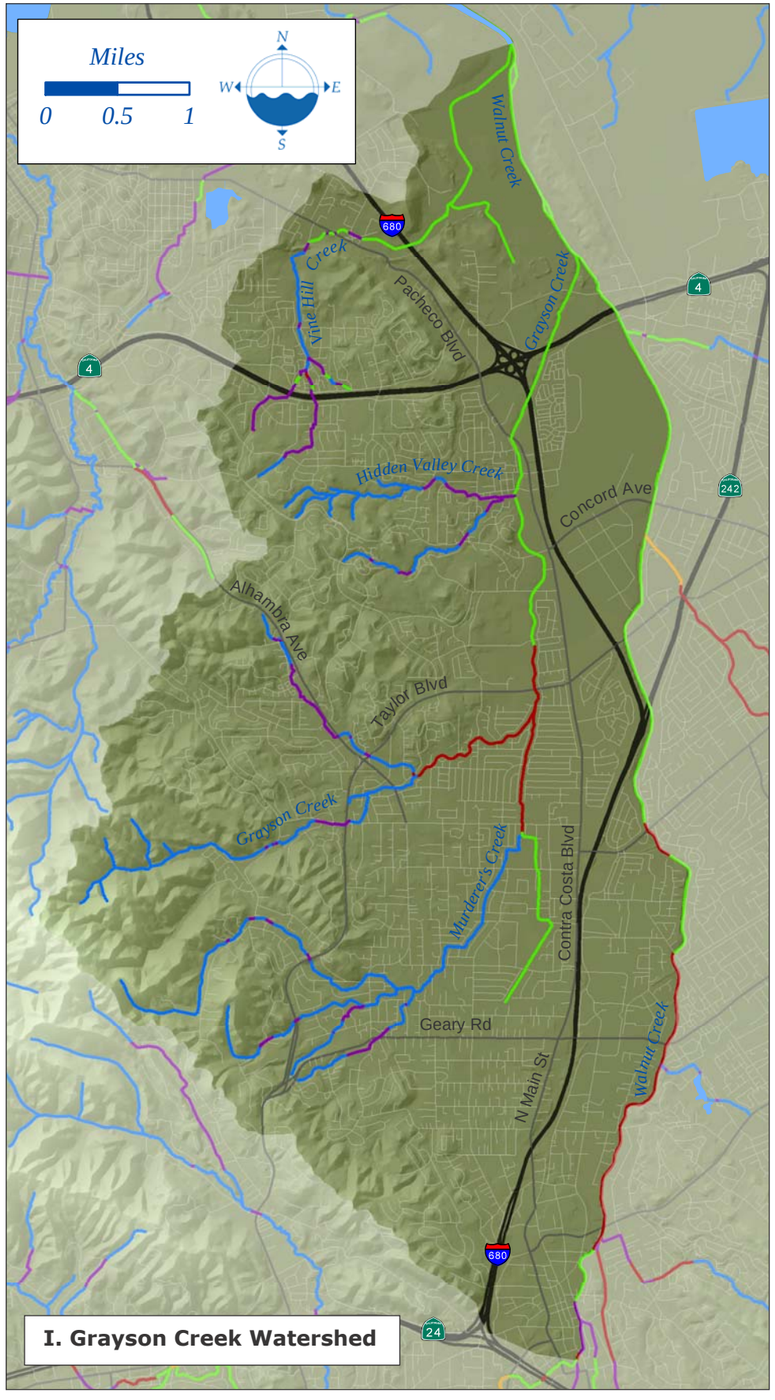
A growing interest in housing and commercial ventures along the Walnut Creek corridor resulted in an increased need for flood control. An extensive stormwater drainage system reroutes surface waters that once meandered across the valley.

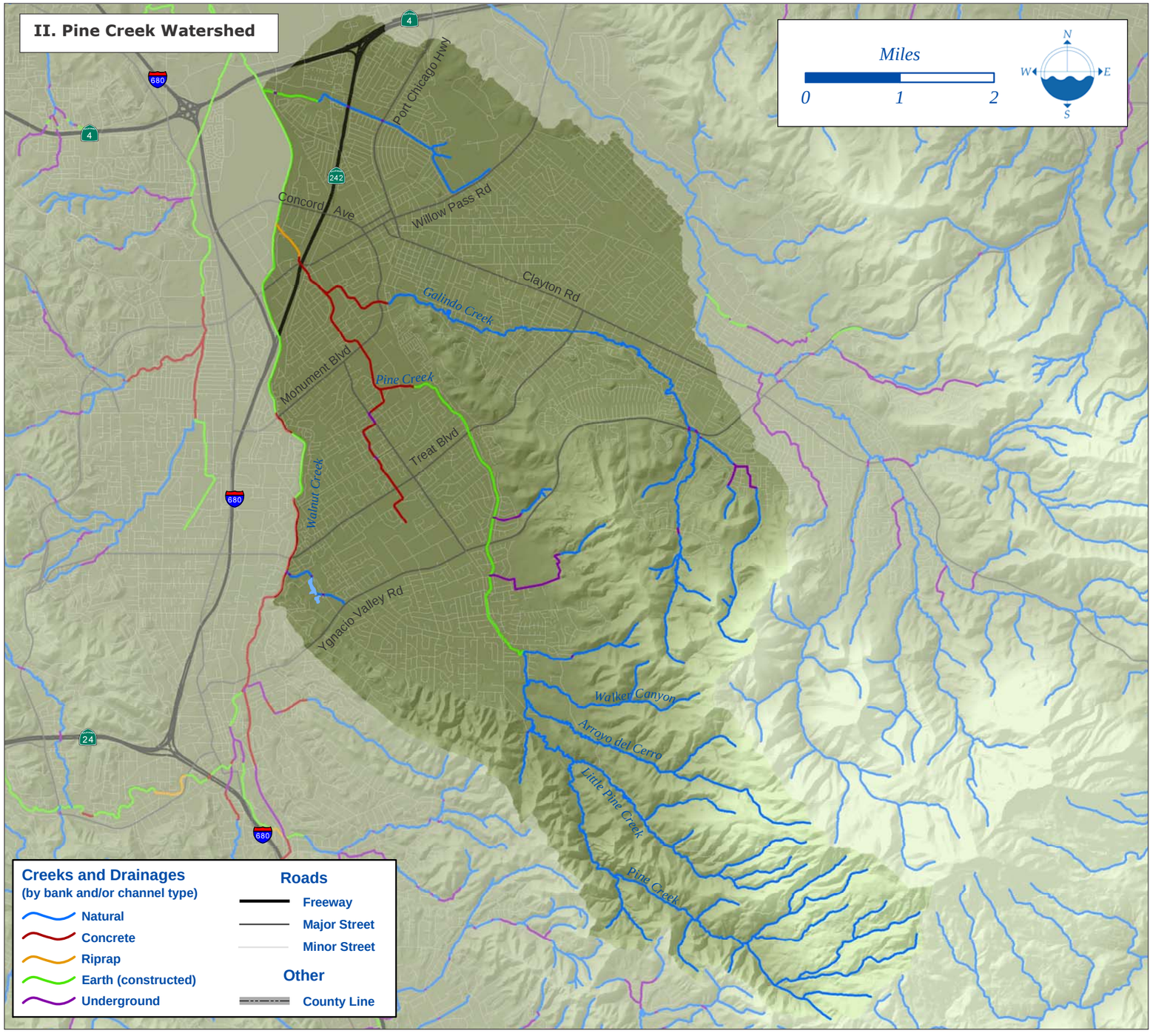
Various physical factors, most importantly landuse, affect the way both surface and groundwater reach the Walnut Creek channel. Rainfall varies throughout the area in part due to the rainshadow effect of the East Bay Hills and the Western slopes of Mount Diablo.

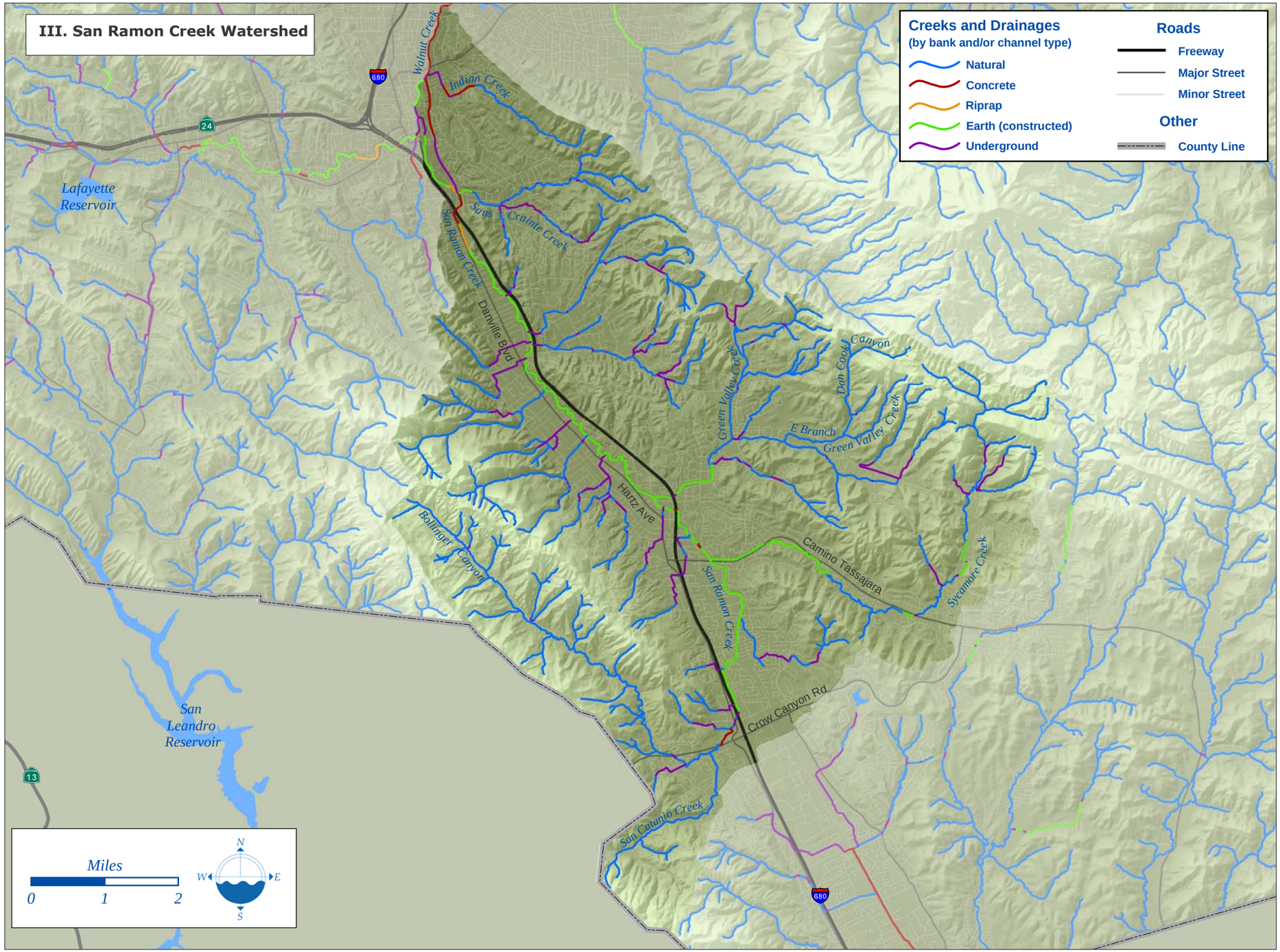
Walnut Creek Watershed Channel Length Statistics*

	Sub-Watersheds (shown on next page)				Walnut Creek (overall)	
	Grayson/Murderers		Pine/Galindo			
	Miles	Percent	Miles	Percent	Miles	Percent
Length of Longest Branch of Creek	8.87		12.65		28.74	
Total Channel Length in Watershed	25.41		59.96		309.75	
Type of Bank or Channel:						
Natural (no obvious reinforcements)	15.13	59.5%	48.58	81.0%	221.56	71.5%
Concrete	5.67	22.3%	7.30	12.2%	49.23	15.9%
Earth (constructed)	4.62	18.2%	3.66	6.1%	37.02	12.0%
Riprap	0.00	0.0%	0.42	0.7%	1.43	0.5%
Underground	3.16	12.5%	2.67	4.5%	36.05	11.6%

*Data relate to mapped channels only. Does not include storm drains. Bank type for segments shorter than 100 feet was not mapped.


Miles
0 0.5 1
N
W E
S
Walnut Creek
Grayson Creek
Vine Hill Creek
Pacheco Blvd
Hidden Valley Creek
Concord Ave
Alhambra Ave
Taylor Blvd
Grayson Creek
Murderer's Creek
Contra Costa Blvd
Geary Rd
N Main St
Walnut Creek
680
4
242
24
I. Grayson Creek Watershed


II. Pine Creek Watershed
Miles
0 1 2
N
W E
S
Port Chicago Hwy
Concord Ave
Willow Pass Rd
Clayton Rd
Galindo Creek
Monument Blvd
Pine Creek
Treat Blvd
Walnut Creek
Ygnacio Valley Rd
Walker Canyon
Arroyo del Cerro
Little Pine Creek
Pine Creek
680
4
242
24
Creeks and Drainages
(by bank and/or channel type)
Natural
Concrete
Riprap
Earth (constructed)
Underground
Roads
Freeway
Major Street
Minor Street
Other
County Line



CCC Flood Control District

Grayson Creek floods Pacheco, 1958

CCC Flood Control District

San Ramon Creek floods the Broadway Shopping Center, 1958

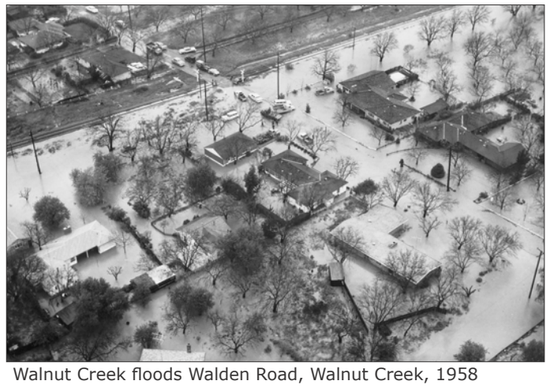
San Ramon Creek Sub-Watershed Channel Length

Statistics*	Miles	Percent
Length of Longest Branch of Creek	18.89	
Total Channel Length in Watershed	136.73	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	100.50	73.5%
Concrete	21.88	16.0%
Earth (constructed)	13.78	10.1%
Riprap	0.43	0.3%
Underground	20.14	14.7%

*Data relate to mapped channels only. Does not include storm drains. Bank type for segments shorter than 100 feet was not mapped.

CCC Flood Control District

Pine Creek floods the Concord Inn, 1962



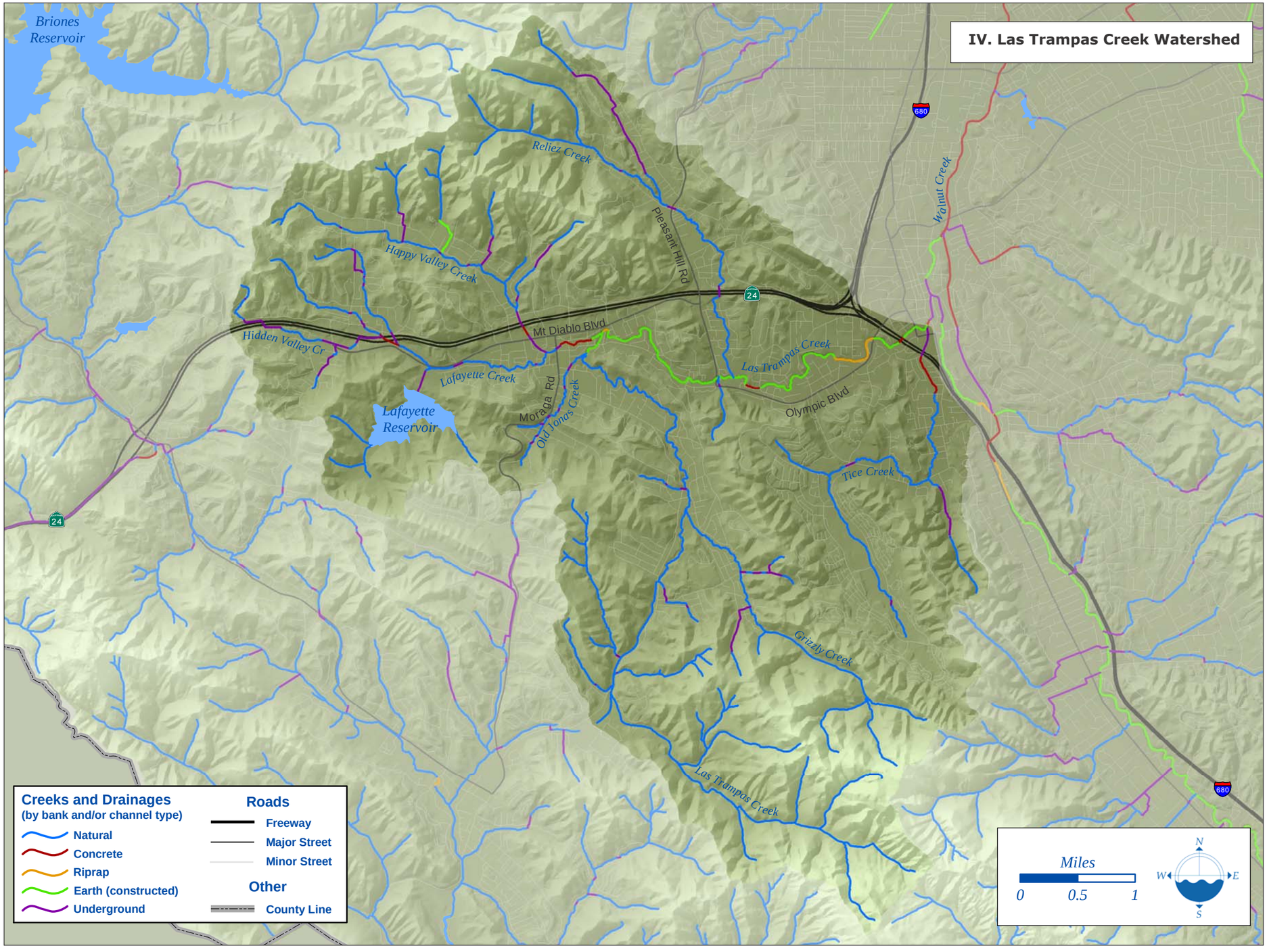
CCC Flood Control District

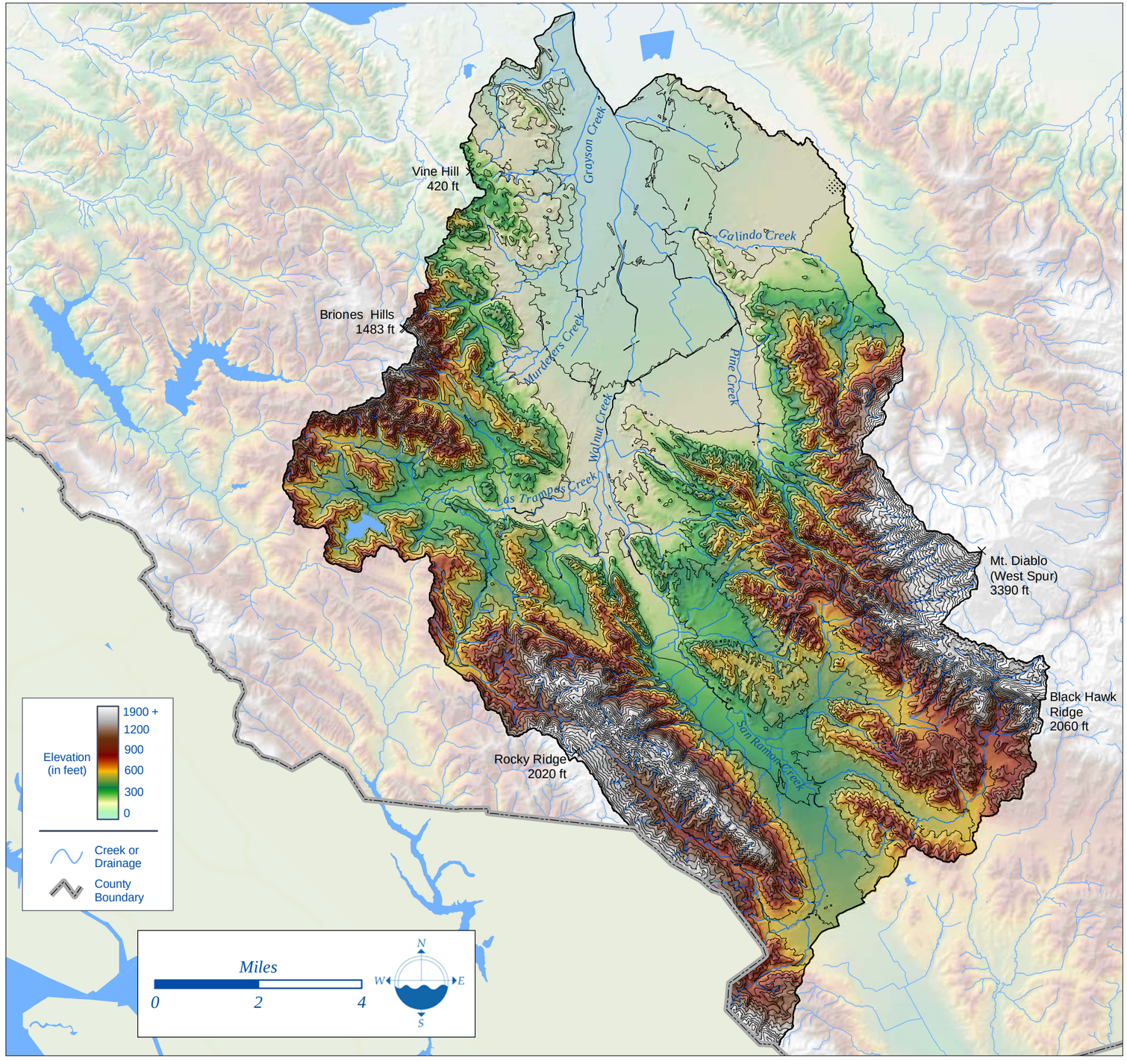
Walnut Creek floods Walden Road, Walnut Creek, 1958

Las Trampas Creek Sub-Watershed Channel Length

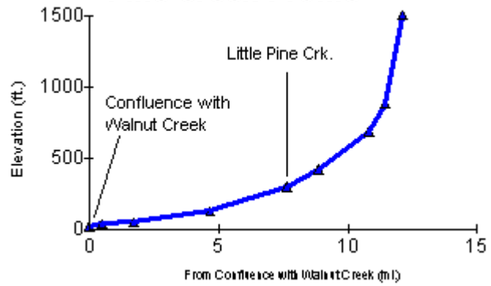
Statistics*	Miles	Percent
Length of Longest Branch of Creek	12.37	
Total Channel Length in Watershed	64.10	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	50.72	79.1%
Concrete	8.68	13.5%
Earth (constructed)	3.76	5.9%
Riprap	0.56	0.9%
Underground	7.49	11.7%

*Data relate to mapped channels only. Does not include storm drains. Bank type for segments shorter than 100 feet was not mapped.

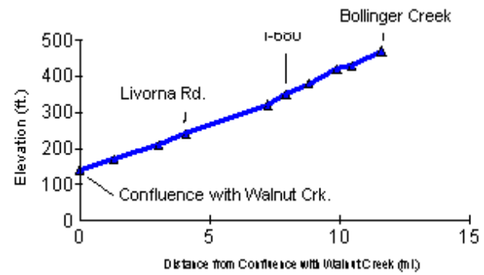




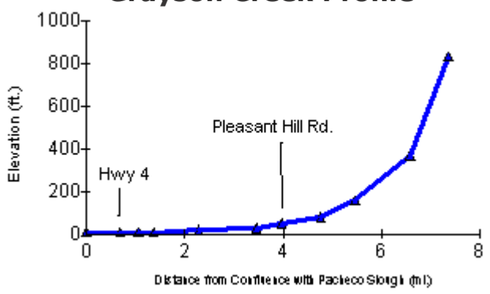
Pine Creek Profile



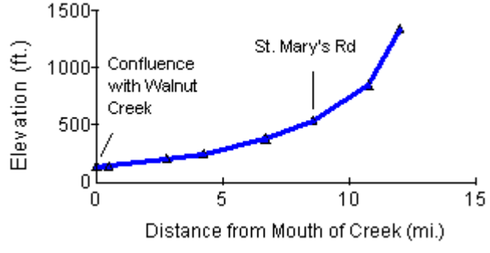
San Ramon Creek Profile



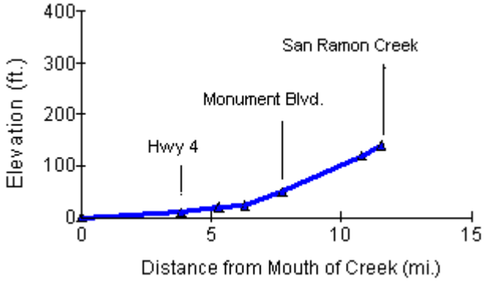
Grayson Creek Profile



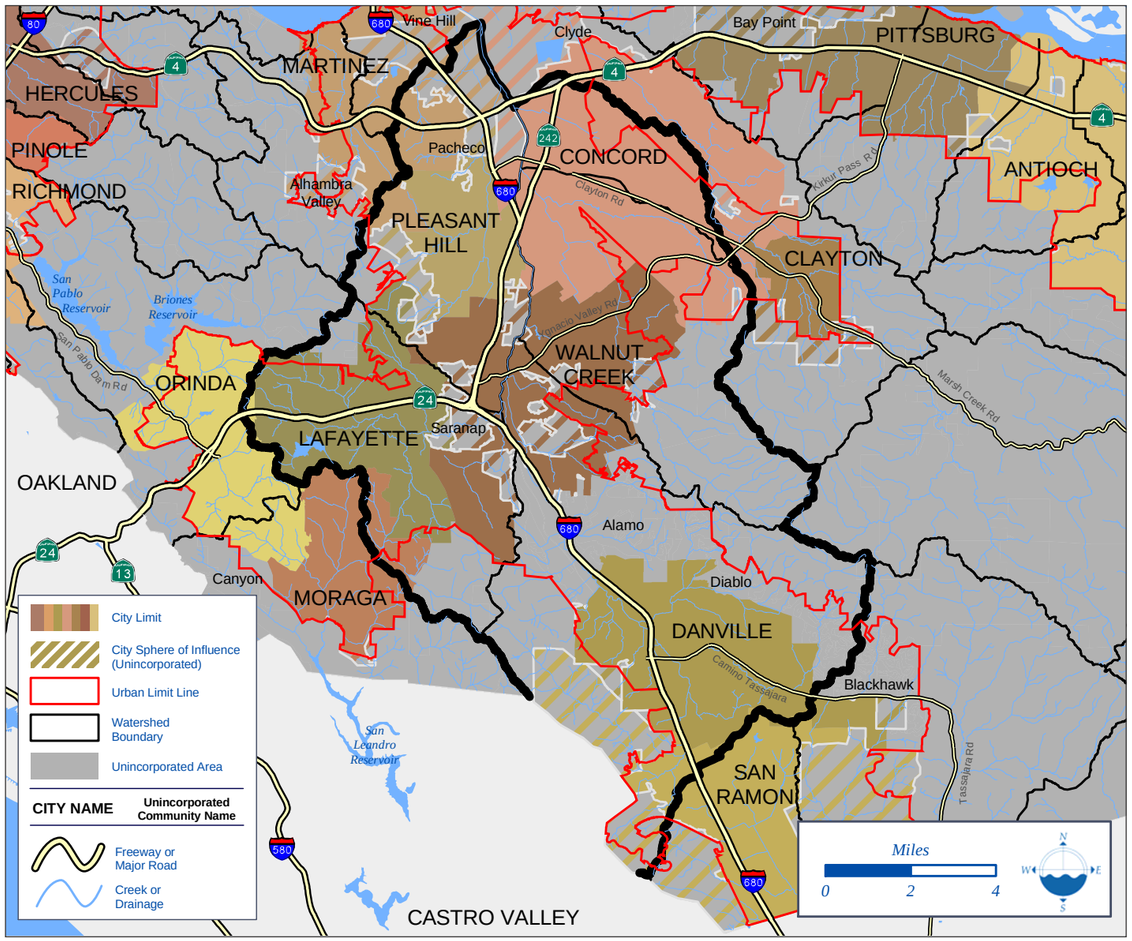
Las Trampas Creek Profile



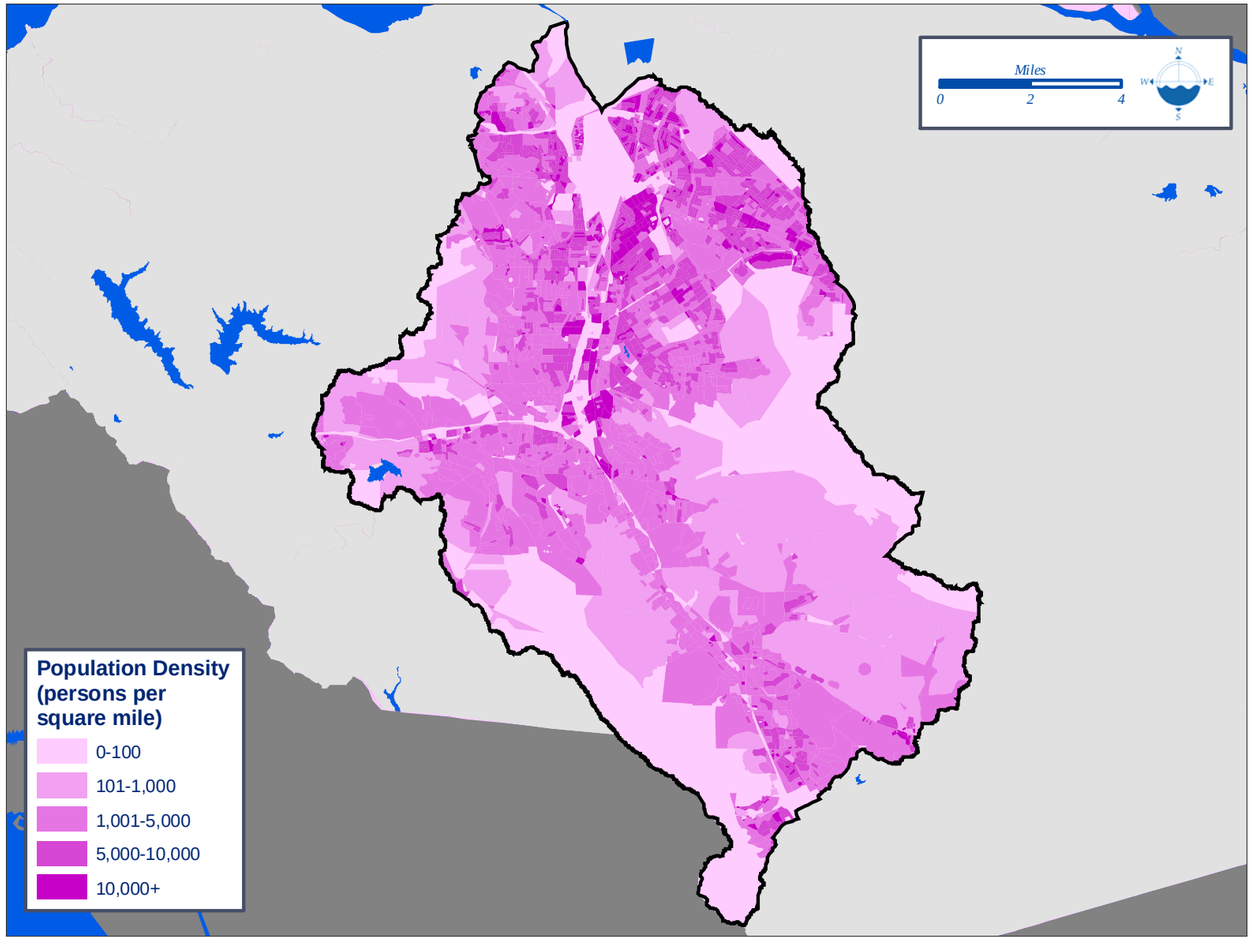
Walnut Creek Profile

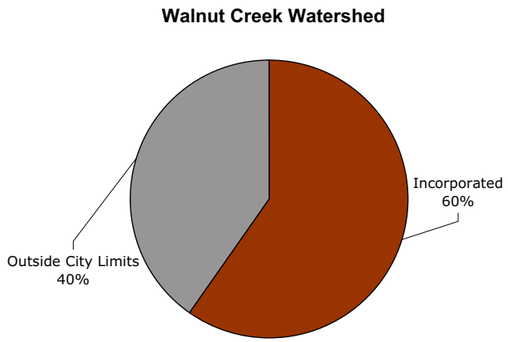


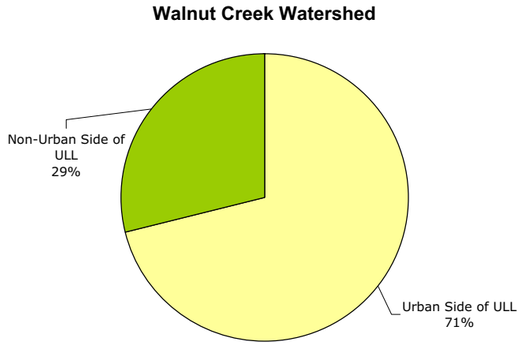
Political Boundaries



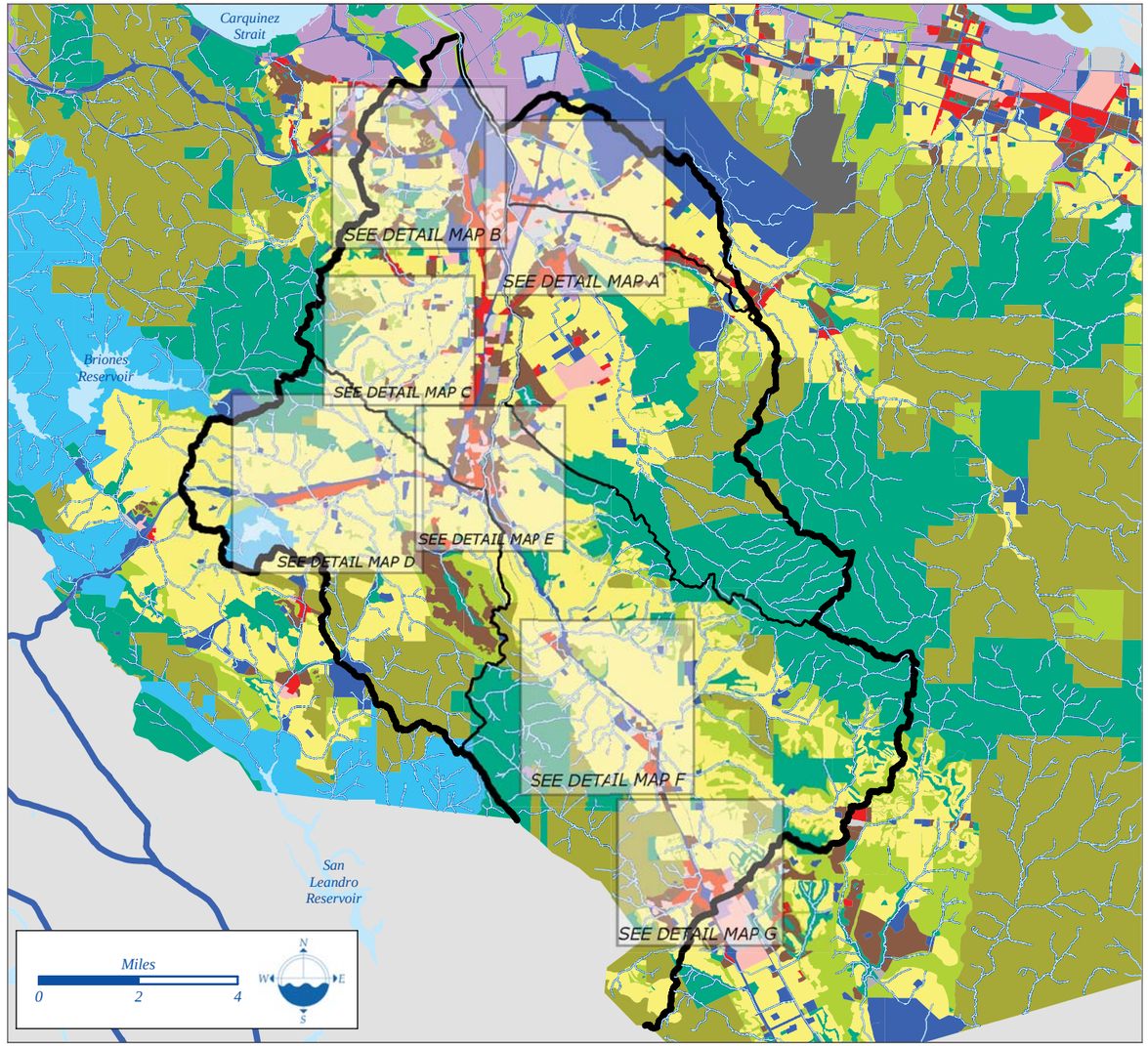
Population Density

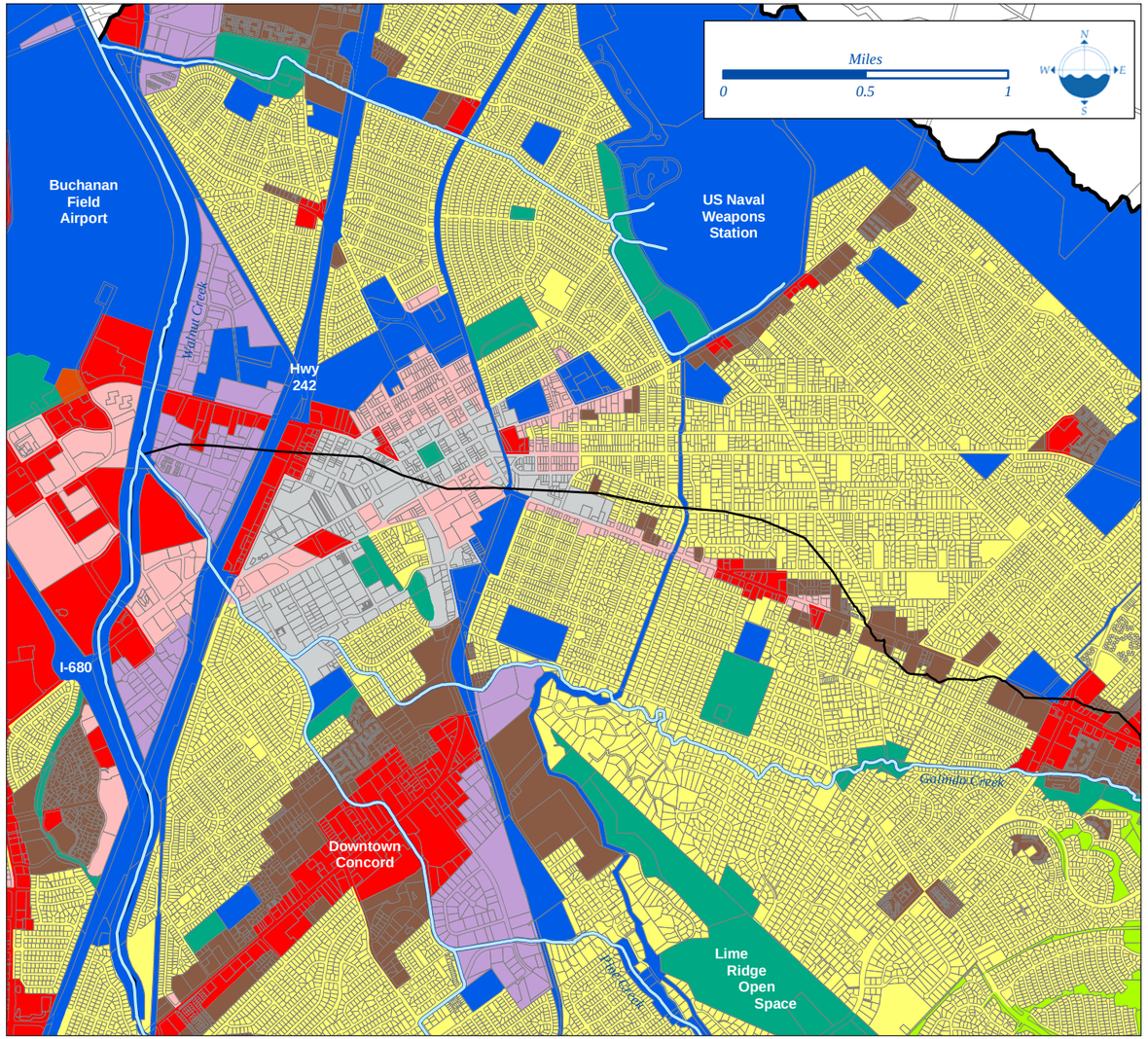






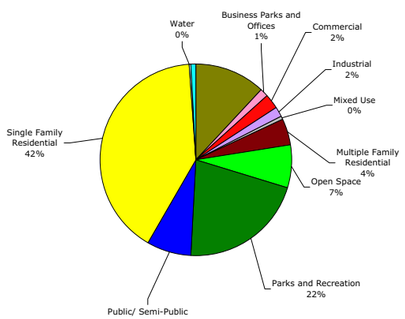
Demographic Profile for Selected Communities In or Near the Walnut Creek Watershed						
Population	Alamo	Concord	Danville	Lafayette	Pleasant Hill	Walnut Creek
Total Population	15,142	121,710	42,127	23,463	32,847	64,583
Race and Ethnicity	Alamo	Concord	Danville	Lafayette	Pleasant Hill	Walnut Creek
White	87.2%	60.5%	83.2%	85.1%	76.5%	80.8%
Hispanic or Latino	4.2%	21.9%	4.9%	4.3%	8.2%	5.8%
Black or African American	1.1%	2.9%	1.0%	0.5%	1.0%	0.9%
Asian	5.7%	9.0%	8.3%	7.0%	9.9%	9.6%
Some Other Race	0.7%	1.1%	0.3%	0.5%	0.9%	0.5%
Two or More Races	1.1%	4.5%	2.3%	2.6%	3.6%	2.4%
Education (maximum level attained)	Alamo	Concord	Danville	Lafayette	Pleasant Hill	Walnut Creek
No High School Diploma	1.6%	15.3%	3.4%	2.3%	6.9%	5.0%
High School Diploma or Equivalent	28.6%	50.1%	30.2%	24.6%	41.6%	33.7%
Associate Degree	6.1%	8.7%	7.0%	5.2%	9.1%	7.3%
Bachelor's Degree	39.3%	18.7%	38.4%	38.2%	29.3%	33.4%
Master's or Professional School Degree	21.8%	6.4%	18.8%	25.4%	11.7%	18.2%
Doctorate Degree	2.5%	0.8%	2.3%	4.4%	1.4%	2.3%
Income	Alamo	Concord	Danville	Lafayette	Pleasant Hill	Walnut Creek
Median Household Income	$137,105	$55,597	$114,064	$102,107	$67,489	$63,238

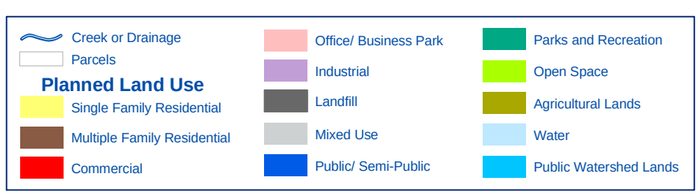


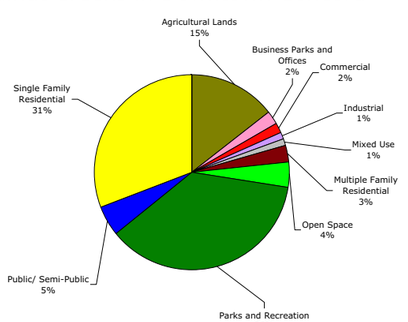


Detail Map A: Pine, Galindo and Walnut Creeks in Downtown Concord

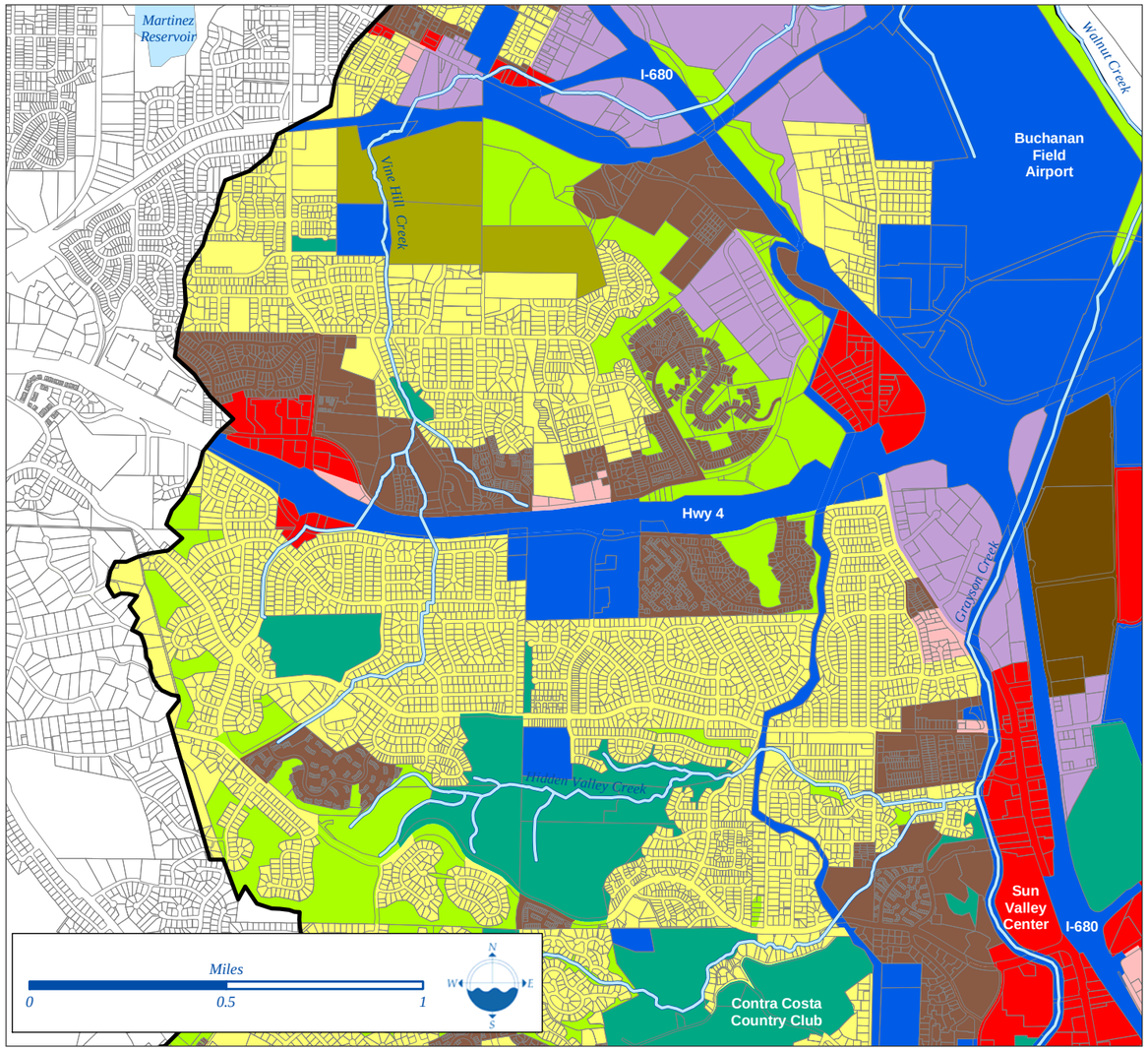
Planned Land Uses *Walnut Creek Watershed*	Acres
Agricultural Lands	11,190
Business Parks and Offices	1,243
Commercial	2,317
Industrial	1,657
Mixed Use	440
Multiple Family Residential	4,135
Open Space	6,833
Parks and Recreation	19,779
Public/ Semi-Public	6,996
Single Family Residential	38,011
Water	134
Watershed (Public)	822
Total	**93,556**



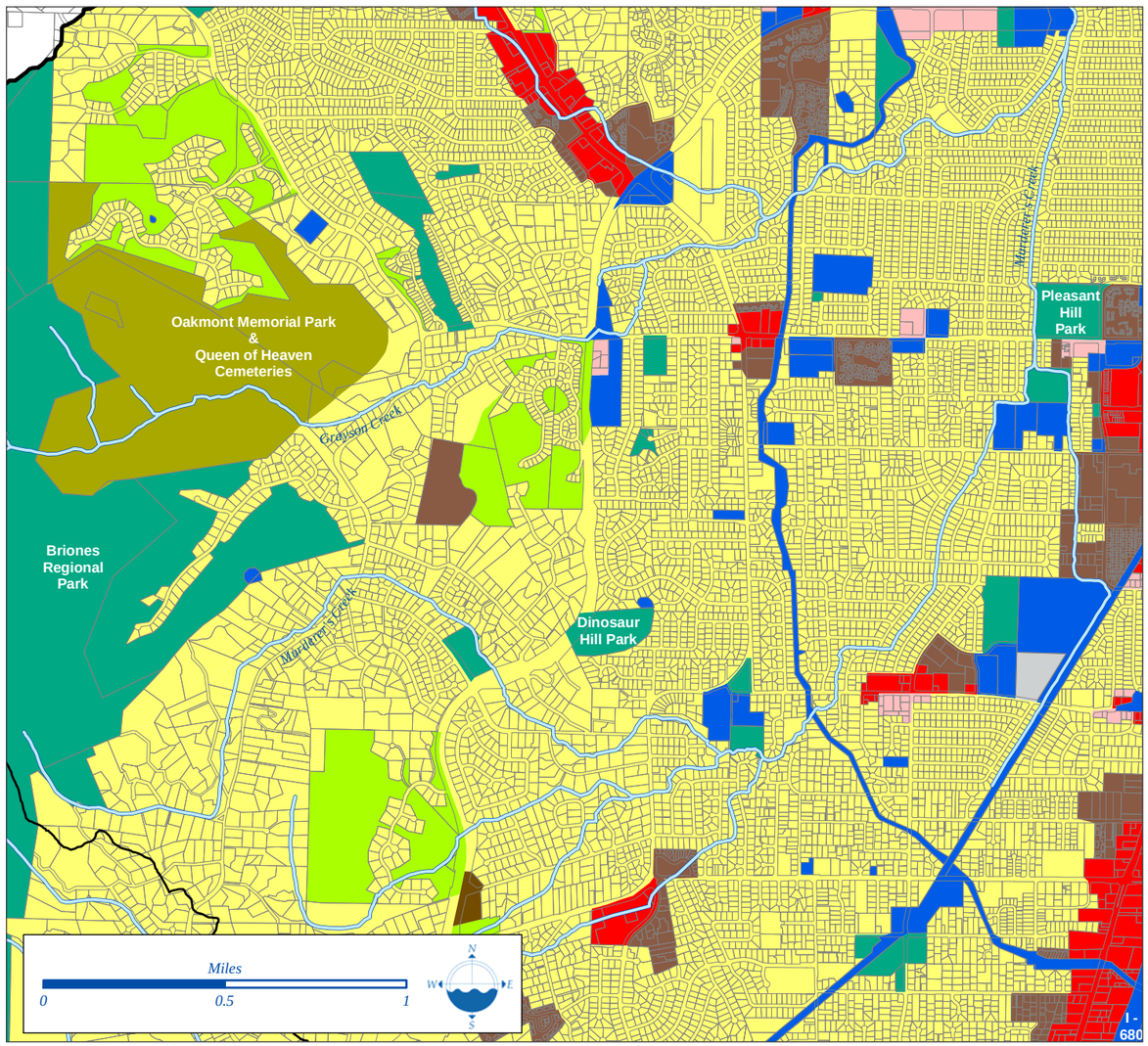




Planned Land Uses *Pine Creek Sub-Watershed*	Acres
Agricultural Lands	2,689
Business Parks and Offices	374
Commercial	356
Industrial	189
Mixed Use	203
Multiple Family Residential	493
Open Space	800
Parks and Recreation	6,765
Public/ Semi-Public	945
Single Family Residential	5,711
Water	0
Watershed (Public)	0
Total	**18,525**

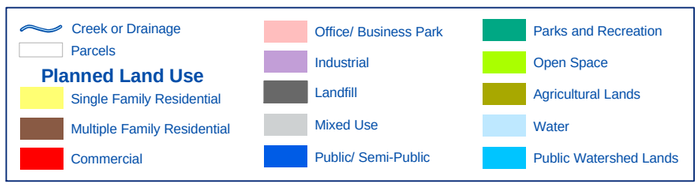


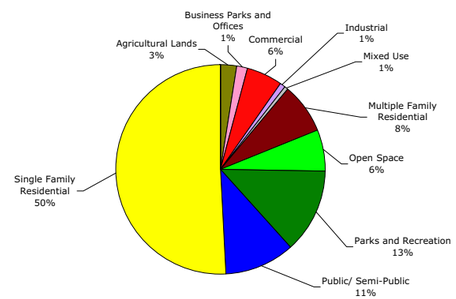
Detail Map B: Grayson Creek: Pacheco, Western Martinez, and the Interstate 80 and Highway 4 interchange.

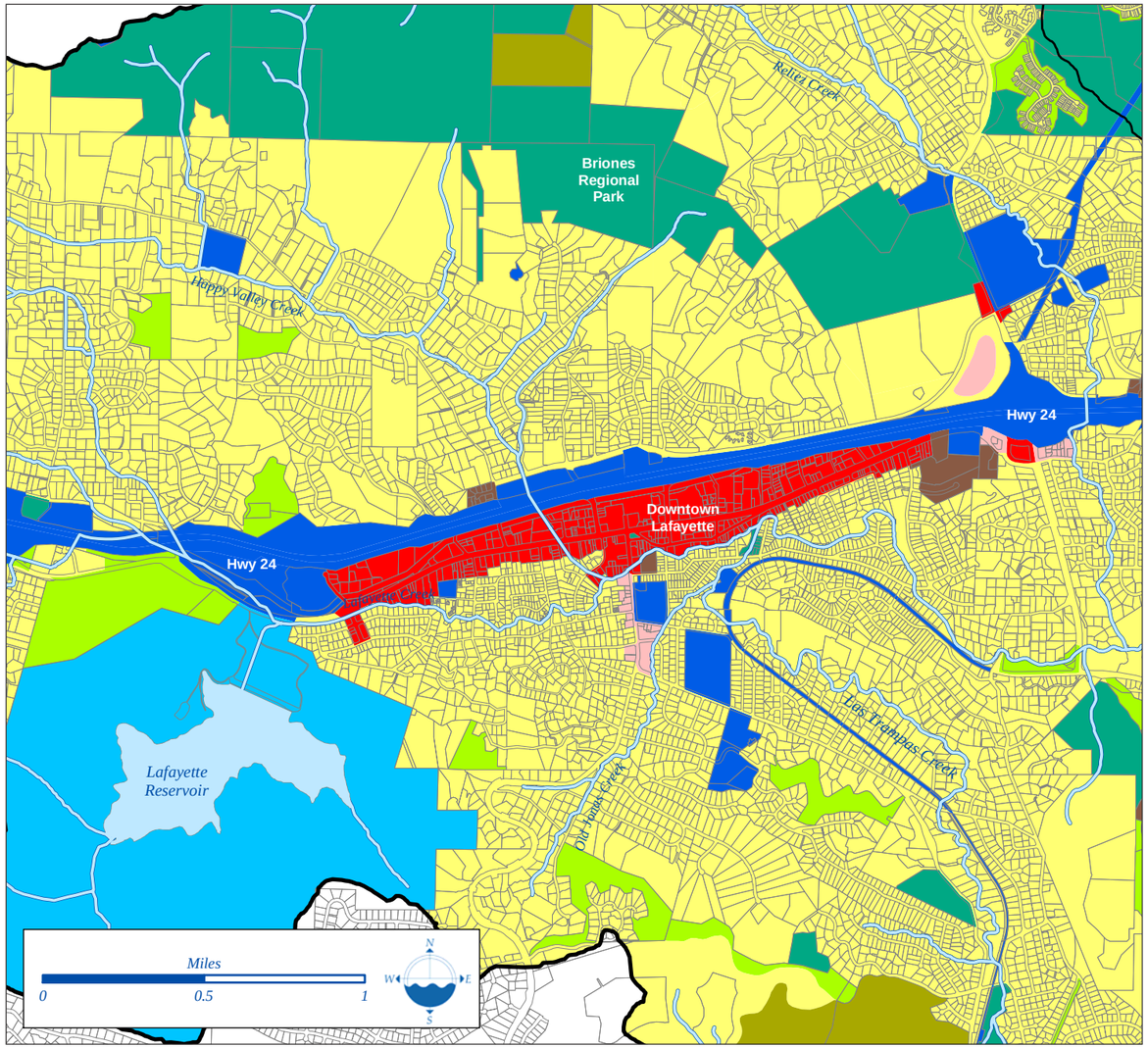


Detail Map C: Grayson and Murderers in Pleasant Hill

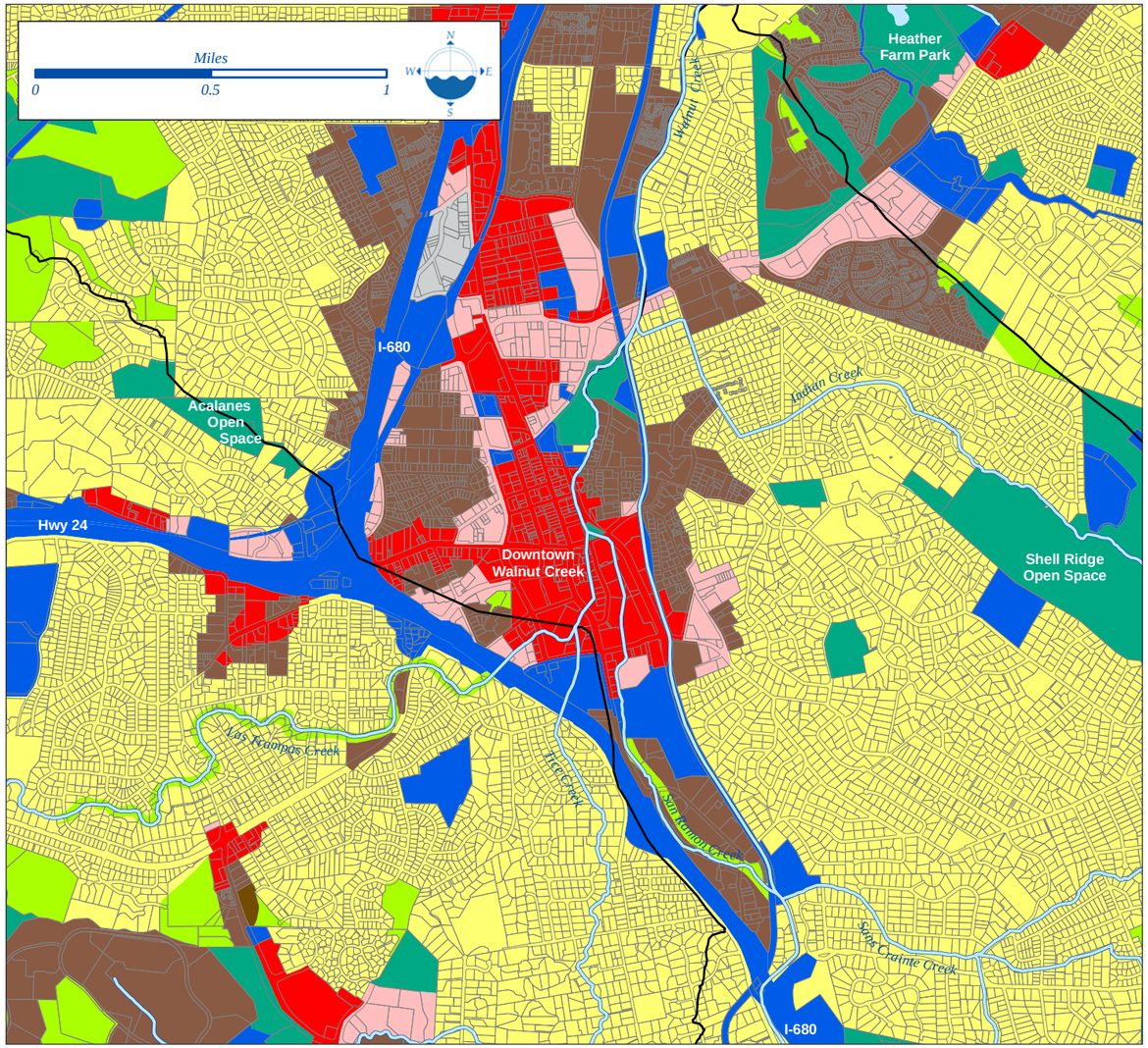
Planned Land Uses *Grayson Creek Sub-Watershed*	Acres
Agricultural Lands	287
Business Parks and Offices	164
Commercial	608
Industrial	94
Mixed Use	81
Multiple Family Residential	848
Open Space	699
Parks and Recreation	1,428
Public/ Semi-Public	1,205
Single Family Residential	5,606
Water	0
Watershed (Public)	0
Total	**11,021**







Detail Map D: Las Trampas Creek and tributaries in Downtown Lafayette



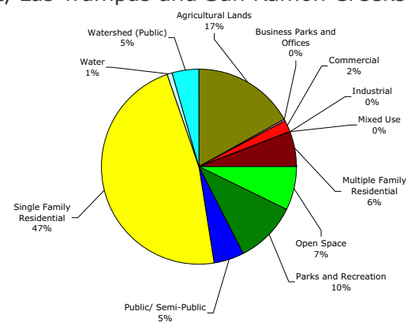
Detail Map E: Confluence of Walnut, Las Trampas and San Ramon Creeks in Downtown Walnut Creek

Planned Land Uses *Las Trampas Creek Sub-Watershed*	Acres
Agricultural Lands	2,922
Business Parks and Offices	68
Commercial	321
Industrial	0
Mixed Use	0
Multiple Family Residential	992
Open Space	1,239
Parks and Recreation	1,776
Public/ Semi-Public	852
Single Family Residential	8,164
Water	121
Watershed (Public)	782
Total	**17,238**

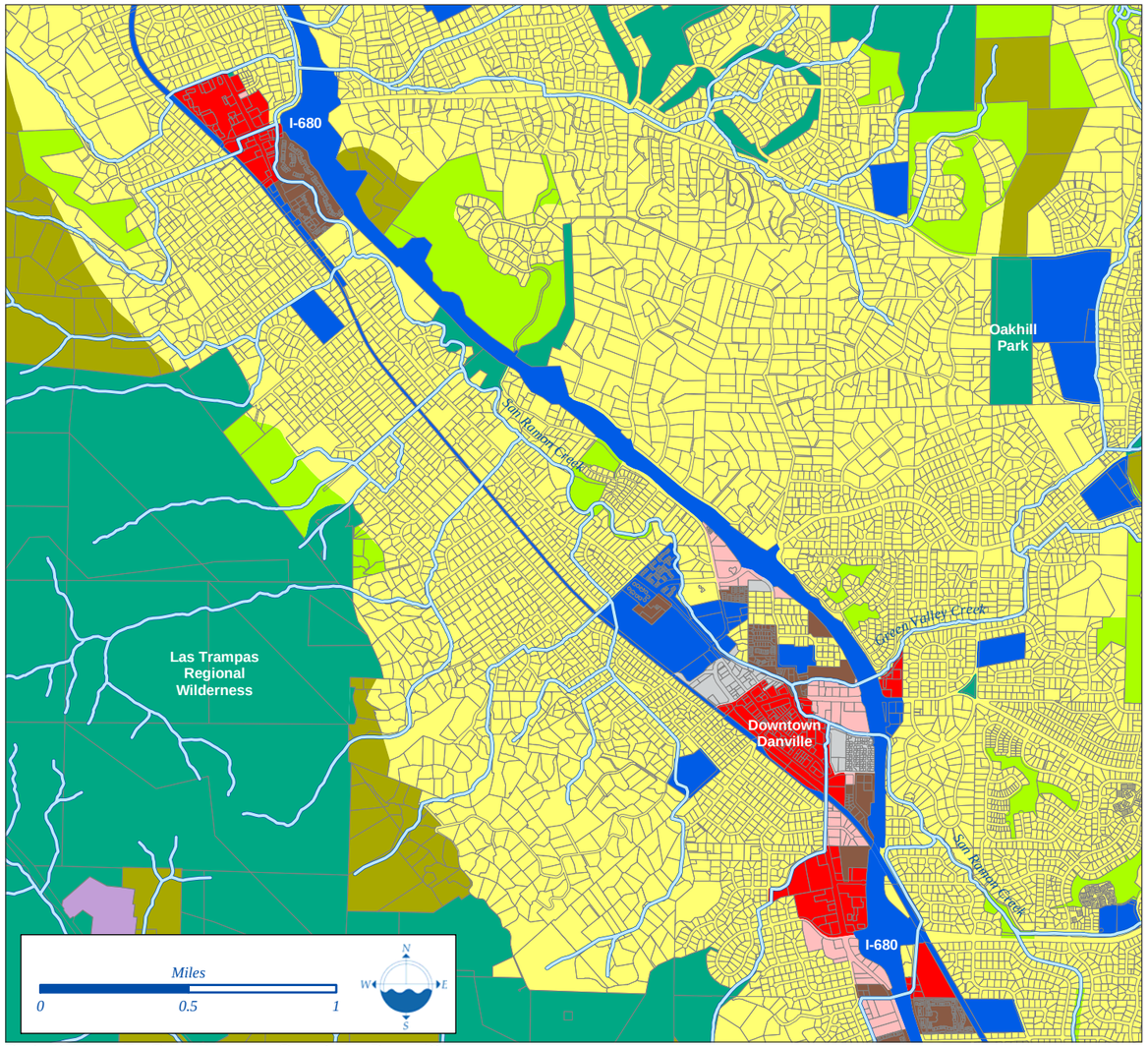
Creek or Drainage
Parcels

Planned Land Use

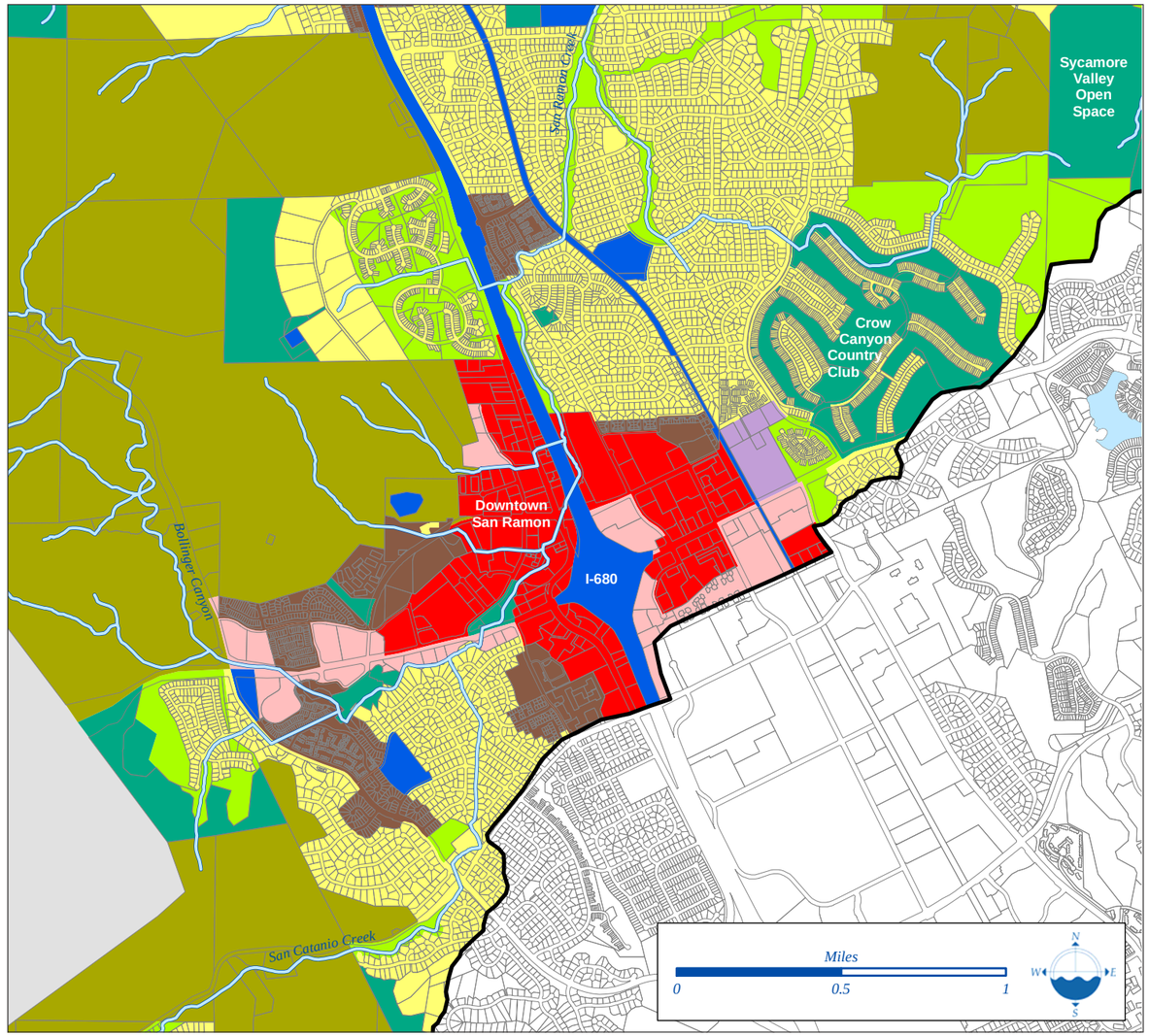
- Single Family Residential
- Multiple Family Residential
- Commercial
- Office/ Business Park
- Industrial
- Landfill
- Mixed Use
- Public/ Semi-Public
- Parks and Recreation
- Open Space
- Agricultural Lands
- Water
- Public Watershed Lands



Planned Land Use

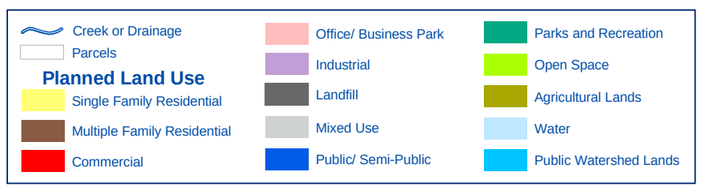


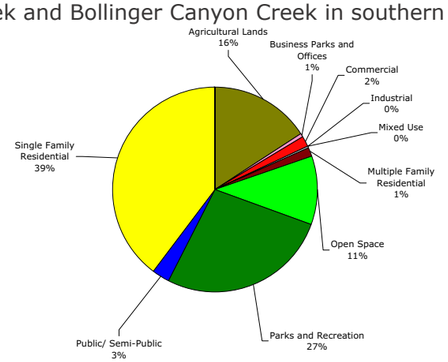
Detail Map F: San Ramon Creek in Danville

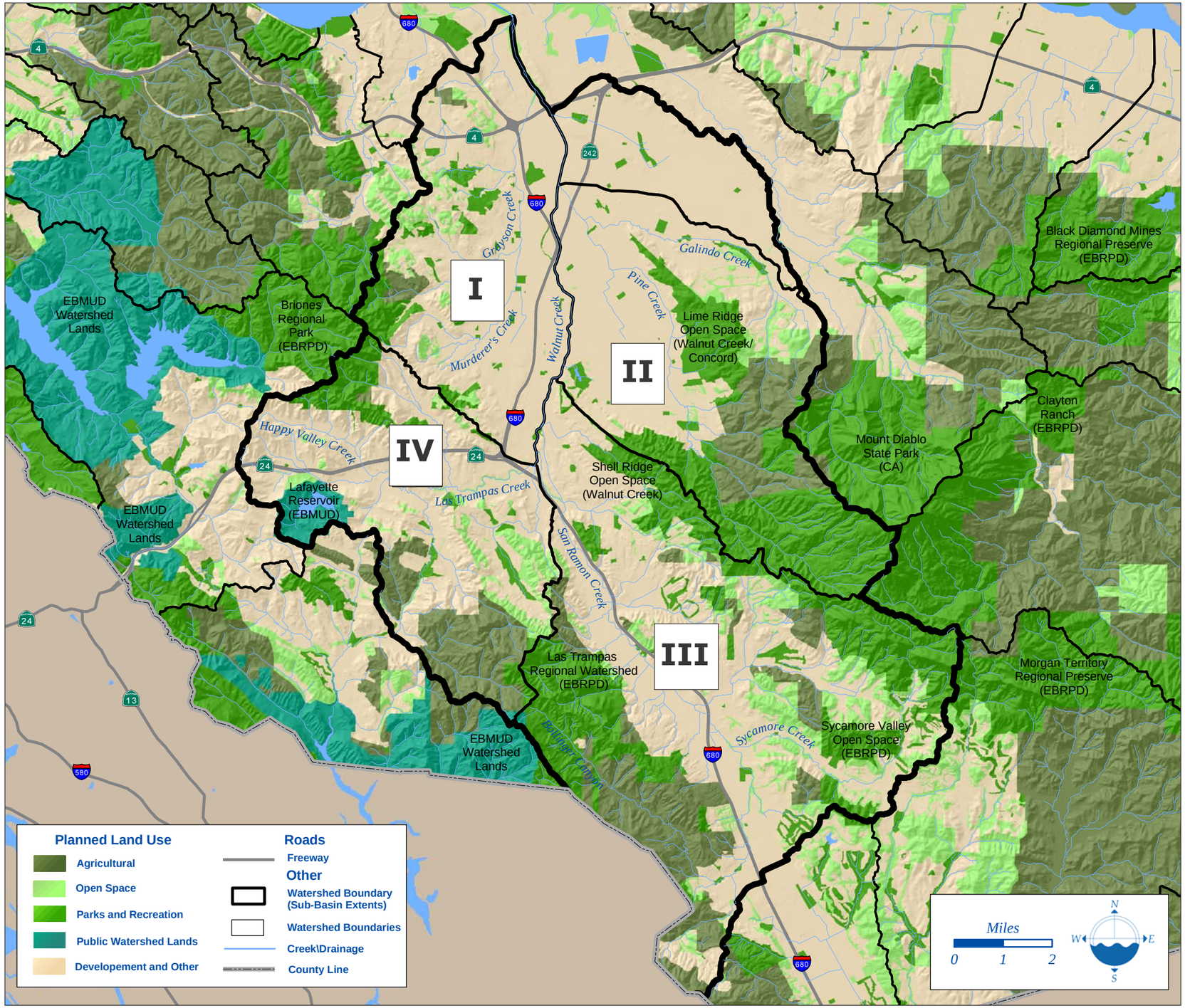


Detail Map G: San Ramon Creek and Bollinger Canyon Creek in southern San Ramon

Planned Land Uses *San Ramon Creek Sub-Watershed*	Acres
Agricultural Lands	5,201
Business Parks and Offices	224
Commercial	506
Industrial	48
Mixed Use	54
Multiple Family Residential	467
Open Space	3,557
Parks and Recreation	8,850
Public/ Semi-Public	945
Single Family Residential	13,024
Water	0
Watershed (Public)	40
Total	**32,915**







The Walnut Creek Watershed is composed of 5 major sub-watersheds. Maps illustrating protected lands, agricultural areas, and restoration projects, for this large watershed, are divided into the sub-basins of: sub-basin for display purposes: Grayson, Concord/Pine, San Ramon, and Las Trampas.

Grayson Restoration Projects

(A) Lower Walnut Creek Channel Restoration and Flood Protection: Move the channel levees back in the lower reaches, to provide additional capacity for floodwaters and create floodplains. This approach will provide the necessary capacity for flooding while creating additional wetlands, riparian habitat and re-vegetation potential. The project will also explore the feasibility of providing fish passage farther upstream, past the first major drop structure, for listed species such as steelhead and Chinook salmon. Funding for this project is provided by: CALFED, U.S. Army Corps of Engineers, and Contra Costa County Flood Control. Lead Agency: Contra Costa County Flood Control. Anticipate Project completion: 2010.

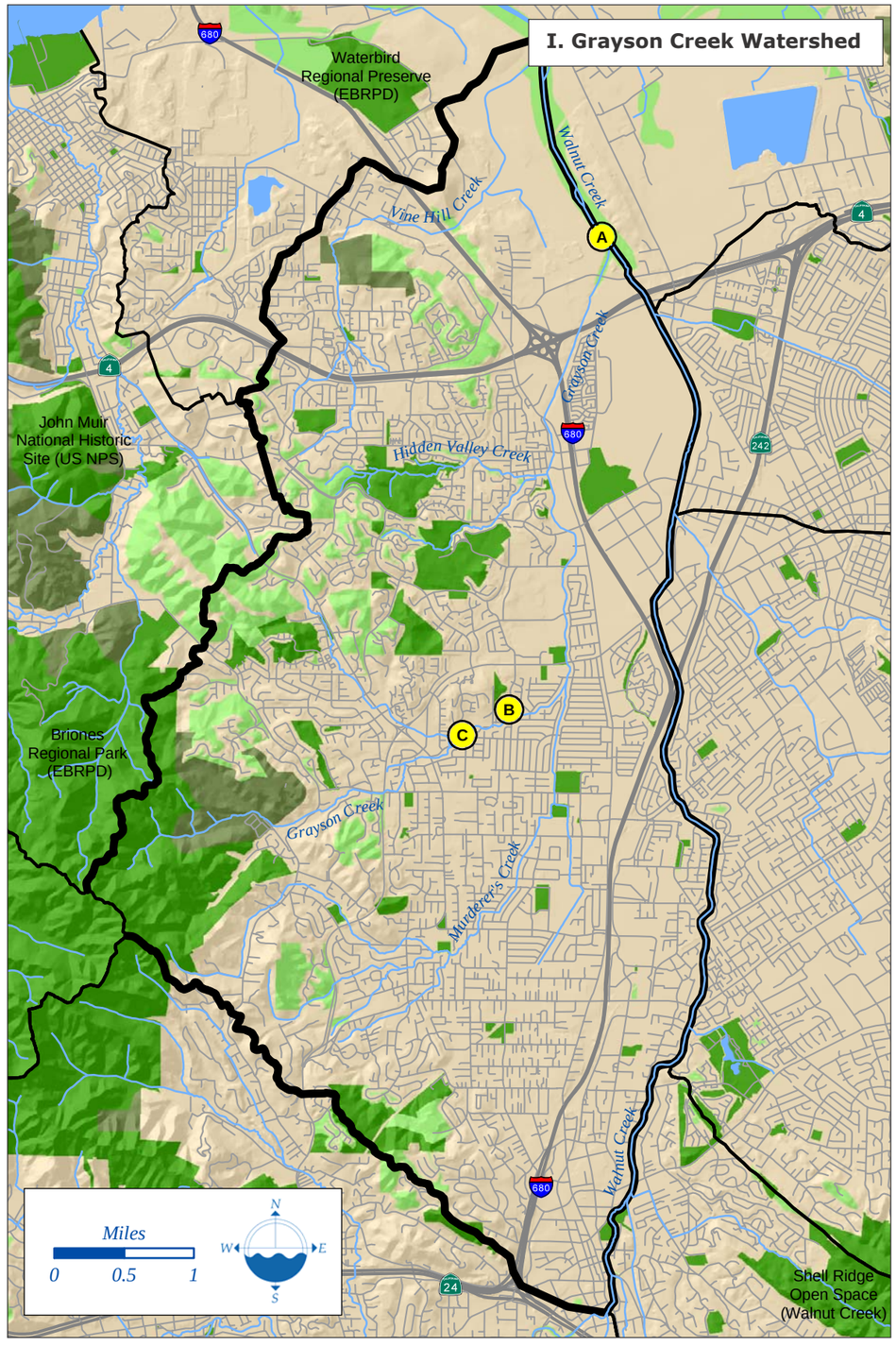
(B) Grayson – Murder's Creek Flood Control: Create a series of bypass pipes and a detention basin facility to protect parts of Pleasant Hill and Walnut Creek from flooding by providing additional runoff storage capacity while leaving the creeks in a natural state. Project detention basins to be used for recreational purposes. Proposed project funding provided by CCC Flood Control, City of Pleasant Hill, Army Corps and City of Walnut Creek. Lead Agency: City of Pleasant Hill. Anticipated project completion: 2012.

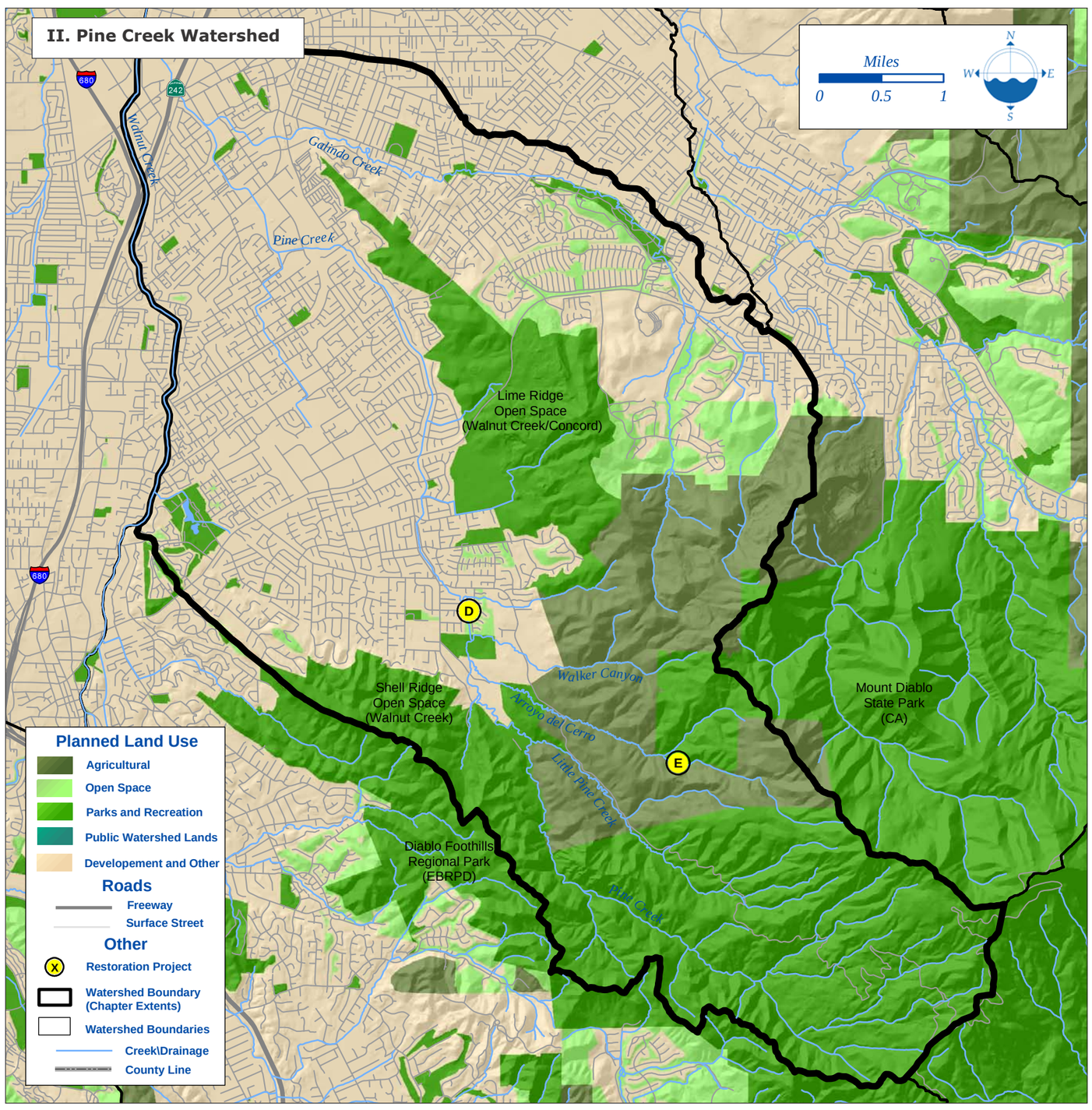
(C) Grayson Creek Reconnaissance: Proposed project seeks to document the current conditions of Grayson Creek. There is currently no active funder for this project. Lead Agency: City of Pleasant Hill. Estimated project completion: Unknown.

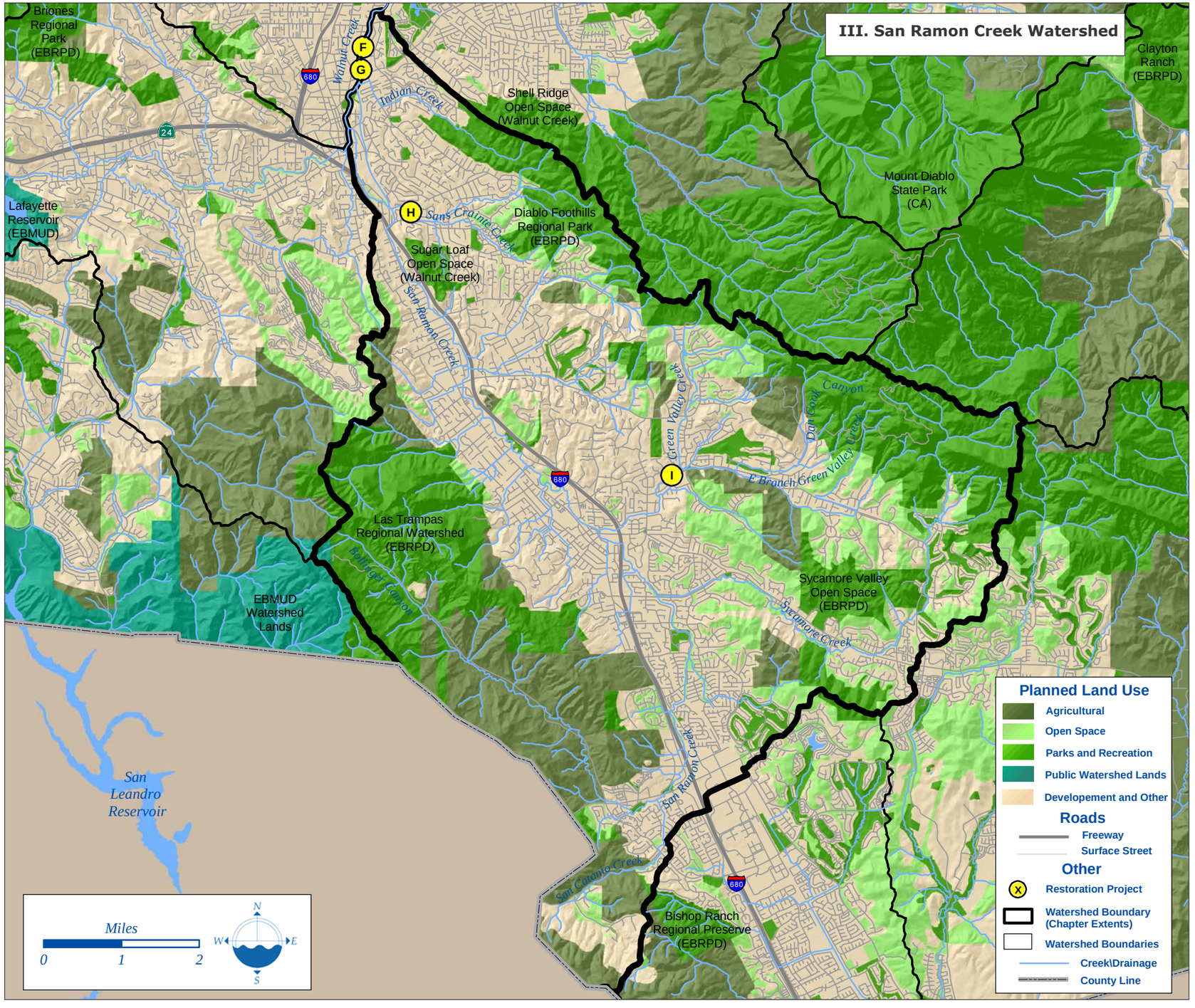
Pine Restoration Projects

(D) Arroyo del Cerro Resource Enhancement: Enhance and create habitat for species in the watershed. In-stream plunge pools for CA red-legged frogs, and other riparian vegetation for birds and deer. Star Thistle control project within the restoration was also established. This project was funded by Lennar Homes mitigation funds. Lead agency: East Bay Regional Parks. Project completed 2002.

(E) Pine Creek Enhancement Project: This portion of Pine Creek has excessive velocities resulting in scouring and loss of property and annual repairs in the area (typically of riprap). Provide natural velocity reduction features such as stepped boulder check dams that would allow the creek to remain natural. This project is seeking funding. Lead Agency: Contra Costa County Flood Control. Anticipated project completion is unknown.


I. Grayson Creek Watershed
Waterbird Regional Preserve (EBRPD)
Walnut Creek
Vine Hill Creek
Grayson Creek
Hidden Valley Creek
John Muir National Historic Site (US NPS)
Briones Regional Park (EBRPD)
Murderer's Creek
Shell Ridge Open Space (Walnut Creek)
A
B
C
680
4
242
24
Miles
0 0.5 1
N
W
E
S


II. Pine Creek Watershed
Miles
0 0.5 1
N
W
E
S
Walnut Creek
Galindo Creek
Pine Creek
Lime Ridge Open Space (Walnut Creek/Concord)
Shell Ridge Open Space (Walnut Creek)
Walker Canyon
Arroyo del Cerro
Little Pine Creek
Mount Diablo State Park (CA)
Diablo Foothills Regional Park (EBRPD)
Pine Creek
D
E
680
242
Planned Land Use
Agricultural
Open Space
Parks and Recreation
Public Watershed Lands
Developement and Other
Roads
Freeway
Surface Street
Other
X Restoration Project
Watershed Boundary (Chapter Extents)
Watershed Boundaries
Creek\Drainage
County Line



San Ramon Restoration Projects

(F) Walnut Creek Annual Clean-up: Remove trash and debris in the downtown Walnut Creek area. Funding for this event is provided by Friends of the Creeks. Lead Agency: Friends of the Creeks. Anticipated project completion: on-going annual event since 1990.

(G) Arundo Removal: Remove non-native invasive plant species Arundo Donax. Lead Agency: Friends of the Creeks. Anticipated project completion: on-going effort since 1999.

(H) Arundo Survey: Document the extent of the non-native invasive Arundo Donax on Sans Criante Creek. Lead Agency: Friends of the Creeks. Anticipated project completion date: On-going, started in 2003.

(I) Green Valley Creek Bypass: The original project called for a concrete lined channel. The second iteration of the project called for an earth channel design, which would obliterate the natural creek. This project would provide a bypass pipe allowing the creek to remain natural. This project is seeking funding. Lead Agency: Contra Costa County Flood Control. Anticipated project completion date is unknown.

Las Trampas Restoration Projects

(J) Tice Creek Bypass: This project is a bypass pipe that will preserve the natural portion of Tice Creek, and eliminate flooding to the adjacent neighborhood. This project is seeking funding. Lead Agency: Contra Costa County Flood Control. Anticipated project completion date is unknown.

(K) Rossmoor Basin: Expand the existing detention basin in the Rossmoor community to reduce flooding in the downstream Tice Creek Watershed. This project is funded by Contra Costa County Flood Control and the City of Walnut Creek. Lead Agency: Contra Costa Flood Control. Project completion date is unknown.

(L) Las Trampas Creek Watershed Plan: Evaluate the current status of Lafayette's creeks and their watersheds, identify problem spots, and create a plan for stabilizing, restoring and managing the creek and watershed ecosystem. Lead Agency: Lafayette Creeks Committee partnered with the Friends of Lafayette Creeks. Anticipated project completion: Unknown.

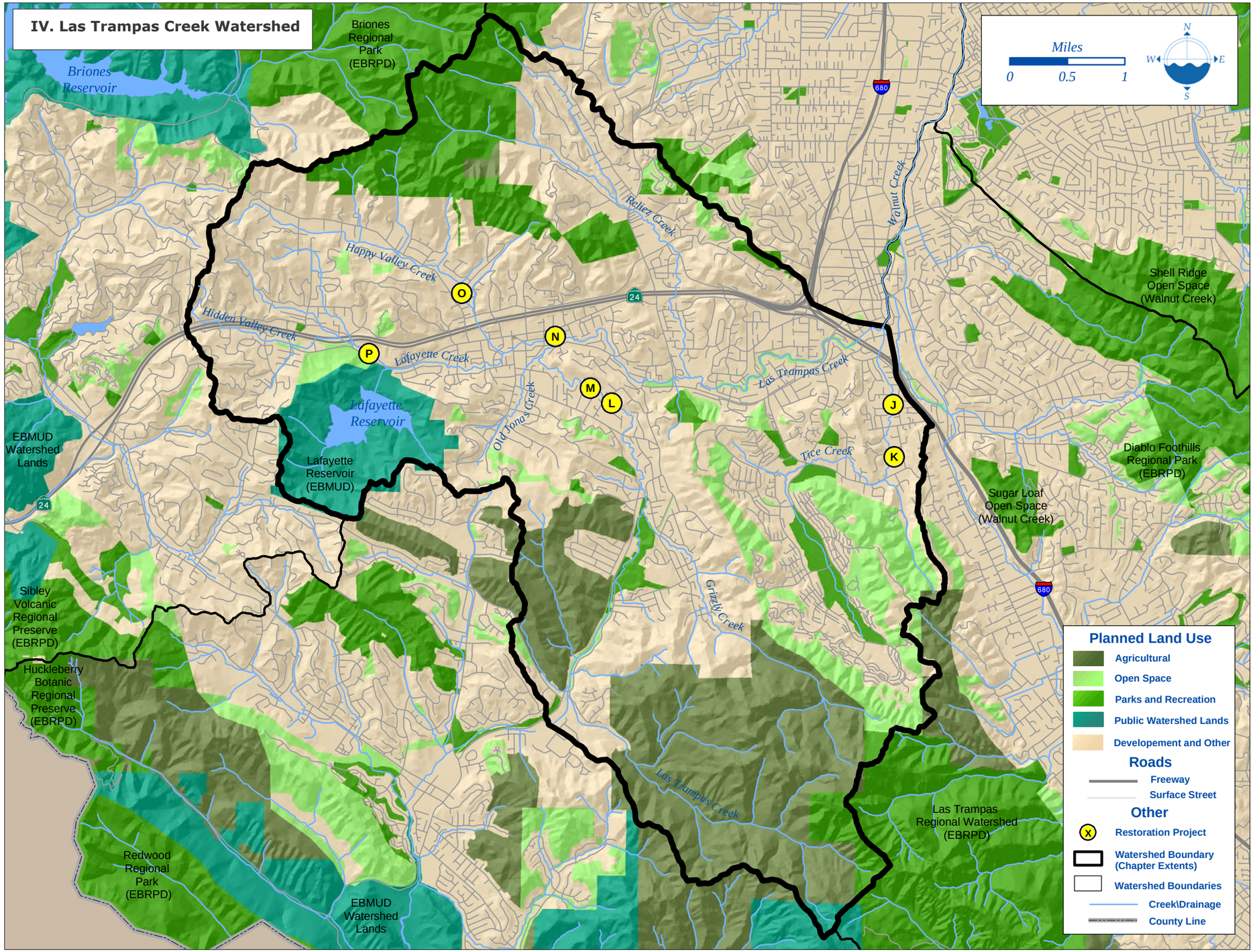
(M) Creek Corridors Master Plan: Develop a "Creek Corridors Master Plan" for the City of Lafayette that will guide the development of creek corridors throughout the city. This project is funded by the City of Lafayette. Lead Agency: City of Lafayette. Anticipated project completion: 2005.

(N) Leigh Creekside Park Demonstration Re-vegetation Project: Improve the functions, values and aesthetics of the creek corridor by removing exotic plants, and re-vegetating area with native riparian species. This project will be funded by grants. Lead Agency: Friends of Lafayette Creeks partnered with the Lafayette Creeks Committee. Anticipated project completion date is unknown.

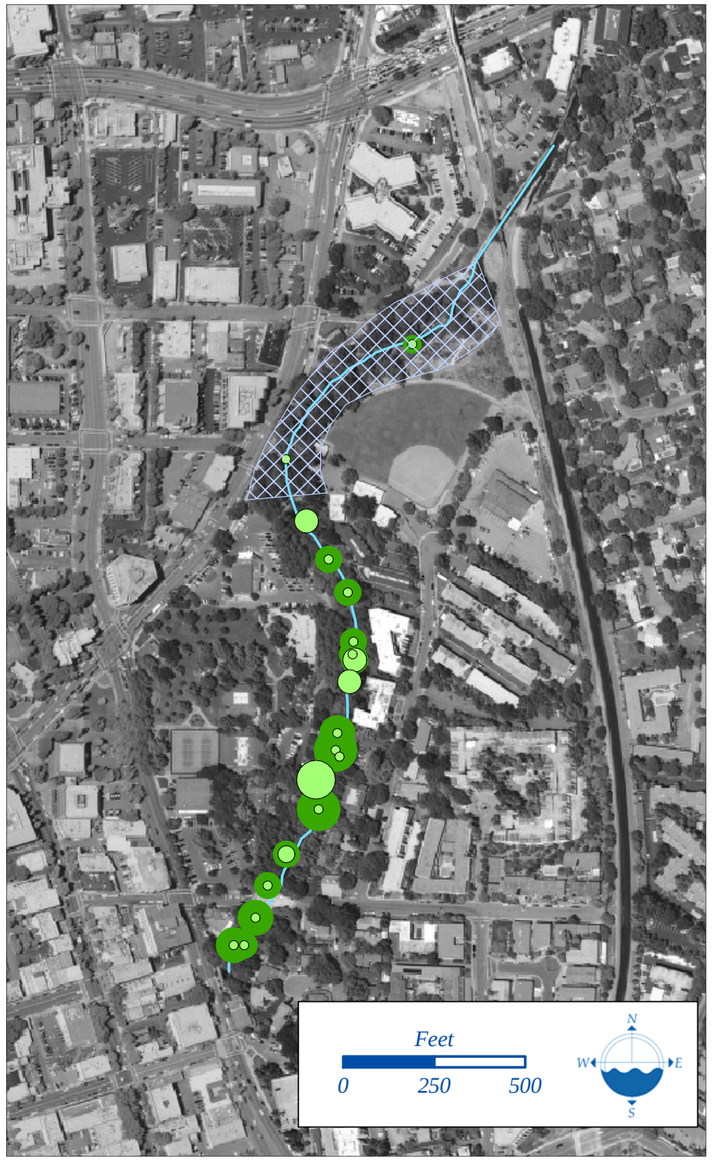
(O) Happy Valley Creek Restoration Project: Enhance public visibility and awareness of creeks in Lafayette by developing a creek-side parkway in a commercial district near the city center. Project includes the removal of trash and debris from the creek as well as re-vegetation of riparian corridor with native plant species. Lead Agency: City of Lafayette. Anticipated project completion date is unknown.

(P) Mount Diablo Blvd Creek Corridor: Enhance awareness of the creek habitat along a popular walking route. Improve the quality of the natural habitat and improve the overall appearance of the area to hikers, bicyclists and motorists. Remove trash and non-native invasive plant species along the riparian corridor. Funding for this project will be provided in part by the City of Lafayette and supplemented with grant funds. Anticipated project completion date: 2004.

City of Lafayette Creeks Committee



Where is the Arundo?



Arundo right bank

Arundo left bank

Arundo removal project

Creek or Drainage

Dots are sized proportionally to the size (length along creek corridor) of the stand of Arundo. Length along the creek corridor was measured from the downstream end of the stand. Size of stands ranges from 2 to 150 feet.

Friends of Five Creeks

Arundo Donax

Arundo Donax (Giant Reed) is a non-native invasive plant that is becoming increasingly common in riparian areas in Contra Costa County. The large reed-like plant reproduces quickly and prevents native plants, important to local ecosystem functions, from flourishing.

Friends of the Creeks has an aggressive Arundo removal program in downtown Walnut Creek (in the blue-hatched area of the map). They are in the process of expanding their efforts to other parts of the watershed that have an Arundo presence.

In 2001, Friends of the Creeks participated in the 2001 pilot project of the GPS data collection survey. Volunteers collected data along a stretch of Walnut Creek that included the area where they had removed Arundo.

Friends of the Creeks gather for a photo after a day of collecting GPS data in Walnut Creek, 2001.

Organizations Active in the Watershed

Walnut Creek Watershed
Friends of the Creeks
Pam Romo
1929 Glenhaven Ave
Walnut Creek, CA 94595
Phone: (925) 939-8979
Email: pmromo@sbcglobal.net

Las Trampas Watershed
City of Lafayette Creeks Committee
Jeff Gilman
City of Lafayette
Public Works Department
3001 Camino Diablo
Lafayette, CA 94549
Phone: (925) 256-1864
Email: Jeff.Gilman@mfgenv.com
Website: www.ci.lafayette.ca.us

Lafayette Area Watershed
Friends of Lafayette Creeks
P.O. Box 311
Lafayette, CA 94549
Phone: (925) 284-4251
Email: cppier1@earthlink.net

Grayson Creek Watershed
Friends of Grayson Creek Watershed
100 Gregory Lane
Pleasant Hill, CA 94523
Phone: (925) 371-5265

Volunteers collect trash and debris during Friends of the Creeks Annual Creek Clean-up event, 2003.

Selected Resources

City of Lafayette, Homeowners Creek Guide to Maintenance, Repair and Planting, revised January 2003.

City of Walnut Creek, A Creek Care Guide for Walnut Creek Residents, (Brochure available online at http://www.ci.walnut-creek.ca.us/CleanWater/), 2001.

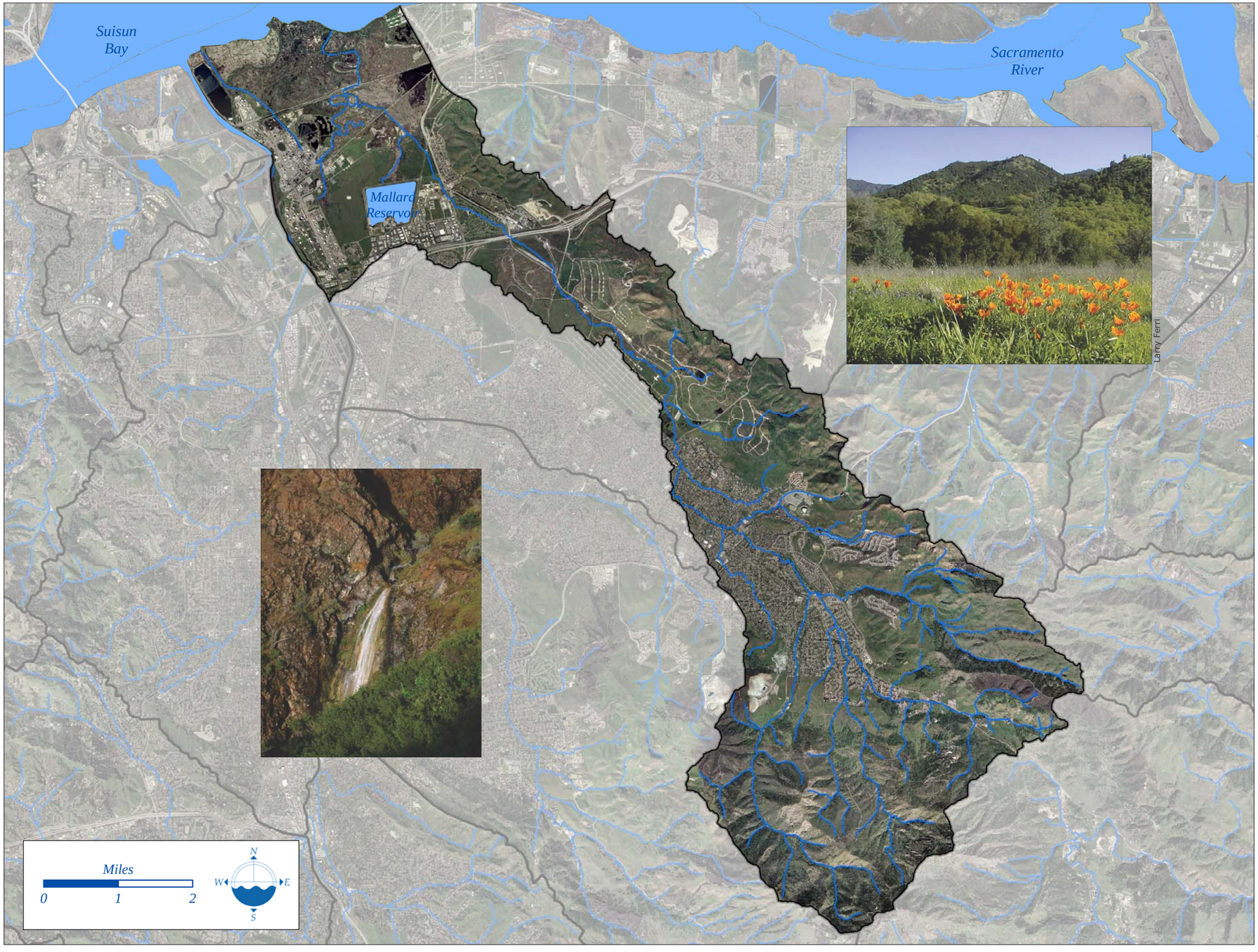
City of Walnut Creek, Creek Restoration & Trails Master Plan, 1992.

City of Walnut Creek, Creek Walk Map, (Map available online at http://www.ci.walnut-creek.ca.us/creeks.html),2001.

U.S. Army Corps of Engineers, Draft EIR Grayson Murderer's Creek Wansho Area and Drainage Improvement Plan D.A 46, April 1984.

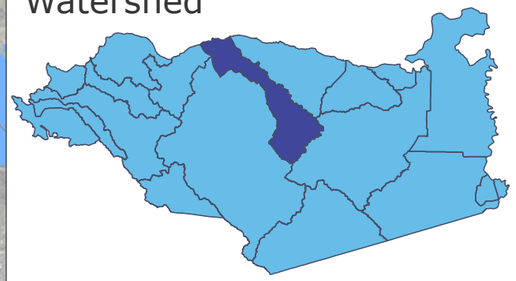
U.S. Army Corps of Engineers, Grayson and Murderer's Creek Feasibility Phase Project Management Plan, March 2003.

U.S. Army Corps of Engineers, Grayson and Murderer's Creek Final Section 905(b) Analysis (Reconnaissance Smog), September 2002.



Chapter 10

Mount Diablo Creek Watershed



Mount Diablo Creek flows off the north slopes of Mount Diablo and travels north-westerly for 17.24 miles before reaching Suisun Bay. The lower third of the watershed is owned and managed by the U.S. Navy. The property referred to as the Naval Weapons Station, Seal Beach (previously called the Concord Naval Weapons Station) occupies approximately 13,000 acres of open, relatively unaltered floodplain. The cities of Clayton and Concord are the two jurisdictions found here, with unincorporated County land accounting for approximately 64% of the watershed.

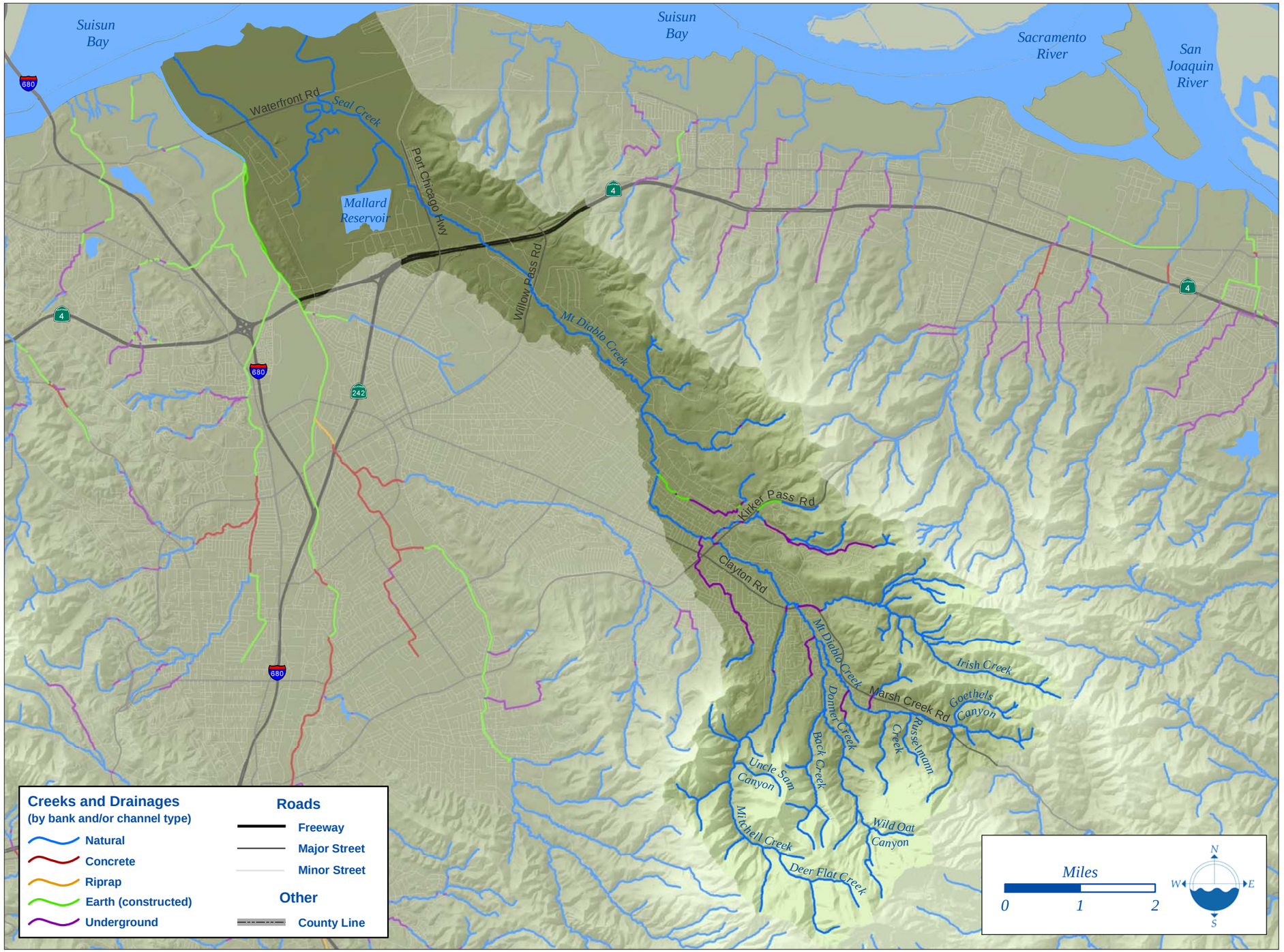
The headwaters of Mount Diablo Creek are in Mount Diablo State Park. Major tributaries, Mitchell Creek, Back Creek and Donner Creek also originate in the state park.

Mount Diablo provides a dramatic backdrop and important open space for Central Contra Costa County. The area was first explored by the Europeans in the late 1700's. By the early 1800's the Spanish started establishing Ranchos and using the area for grazing and farming.

Mount Diablo Creek Watershed Vital Statistics		
Watershed Size	23,846	acres
Length of Longest Branch of Creek	17.24	miles
Total Channel Length in Watershed	79.95	miles
Average Annual Rainfall	18	inches
Estimated Mean Daily Flow	16.5	cfs
Estimated 100-Year Flood Flow	N/A	
Highest Elevation in Watershed	3849	feet
Population (estimated)	24,400	people
Estimated Percent Impervious	20	%
Recognized Pollutants of Concern	Diazinon*	

* Mount Diablo Creek is listed as an Impaired Water Body in the State's 303(d) list. Diazinon is the Pollutant of Concern.

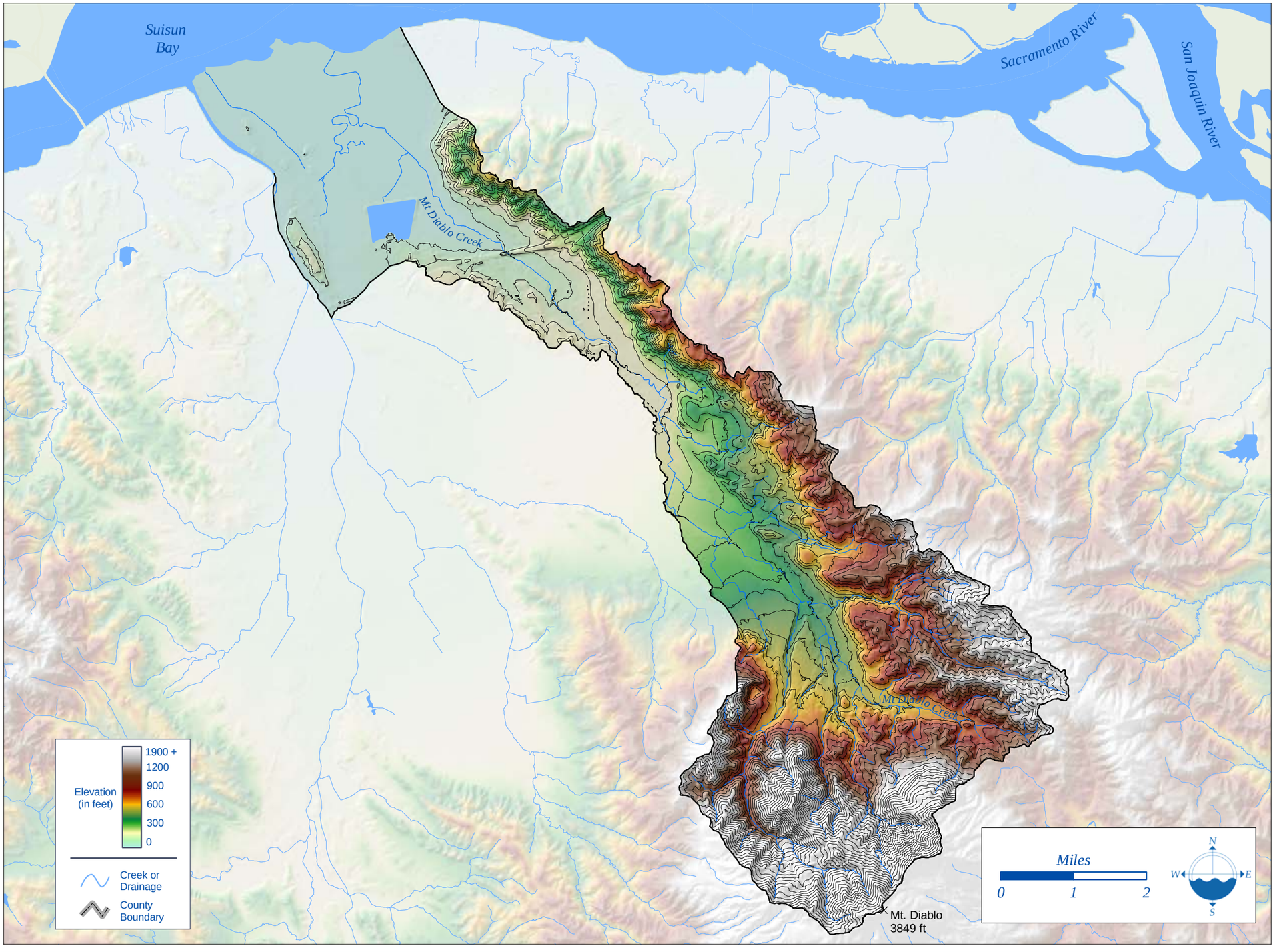
From the creek's headwaters in Mount Diablo State Park to its outlet in Suisun Bay, Mount Diablo Creek and its tributaries flow relatively unencumbered. Through the relatively few areas that are more developed, the creek is channeled underground.



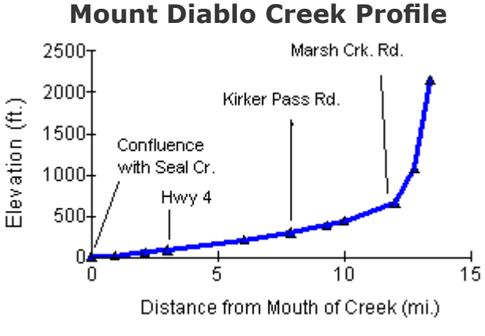
Mount Diablo Creek Channel Length Statistics*

	Miles	Percent
Length of Longest Branch of Creek	17.24	
Total Channel Length in Watershed	79.95	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	72.26	90.4%
Concrete	6.70	8.4%
Earth (constructed)	0.99	1.2%
Riprap	0.00	0.0%
Underground	6.70	8.4%

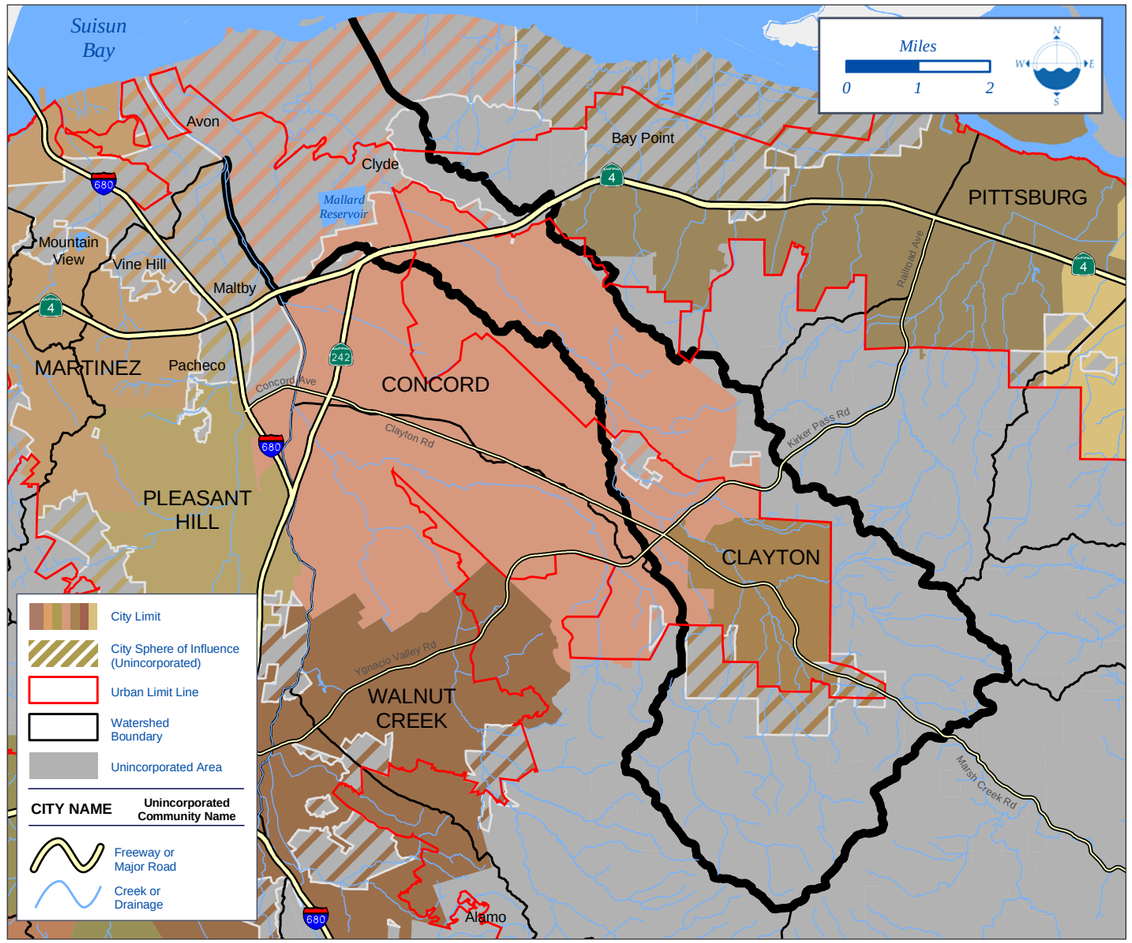
*Data relate to mapped channels only. Does not include storm drains. Bank type for segments shorter than 100 feet was not mapped.



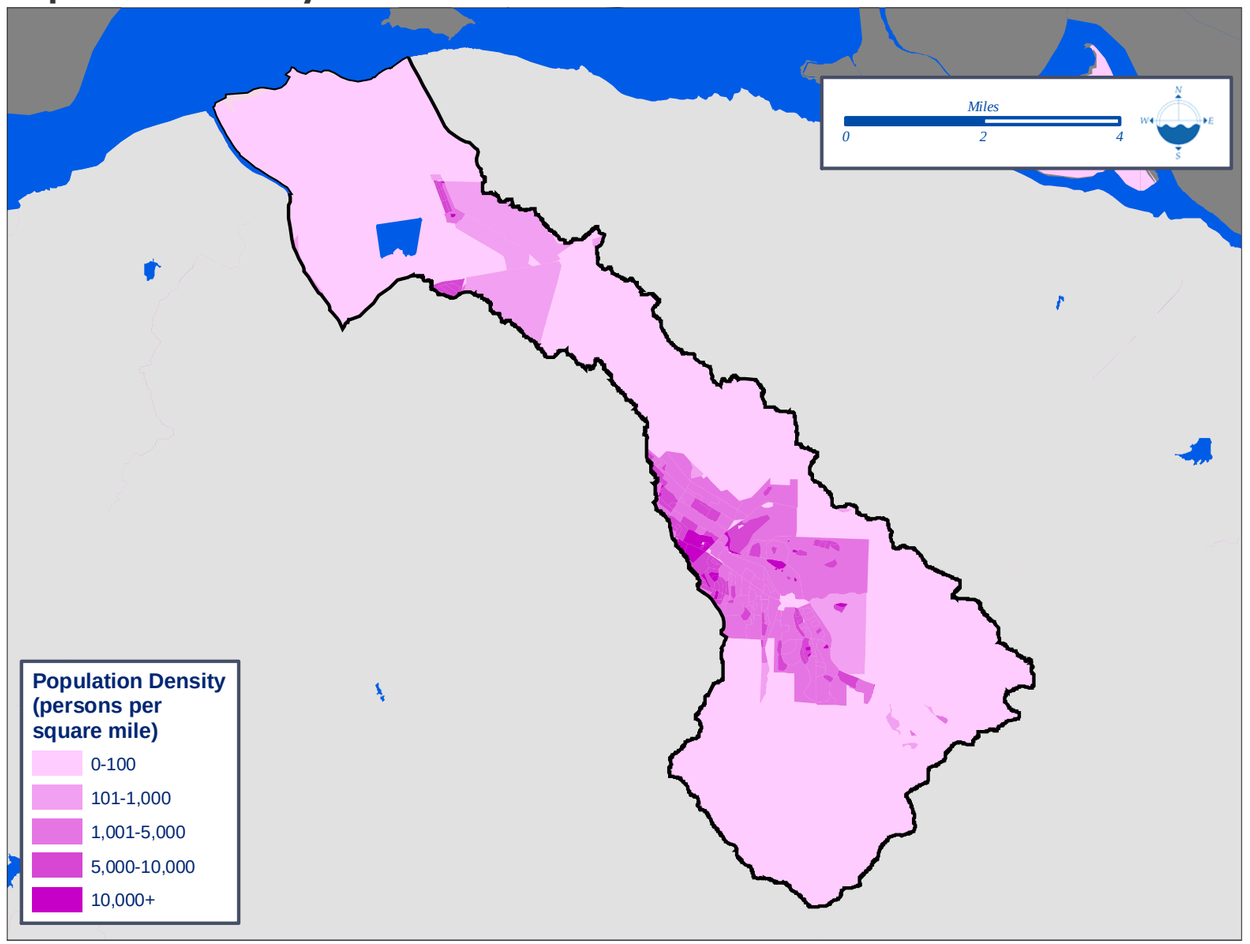
Mount Diablo Creek floods Farm Bureau and Walnut Road, 1952



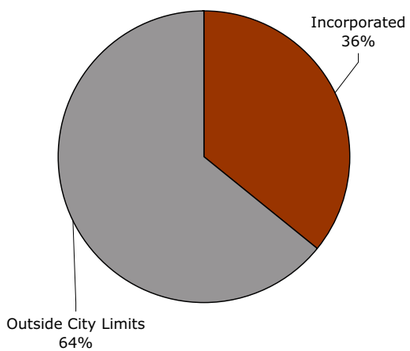
Political Boundaries



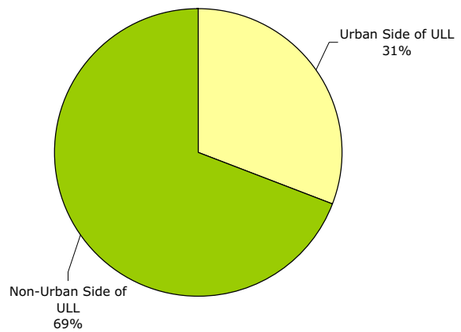
Population Density



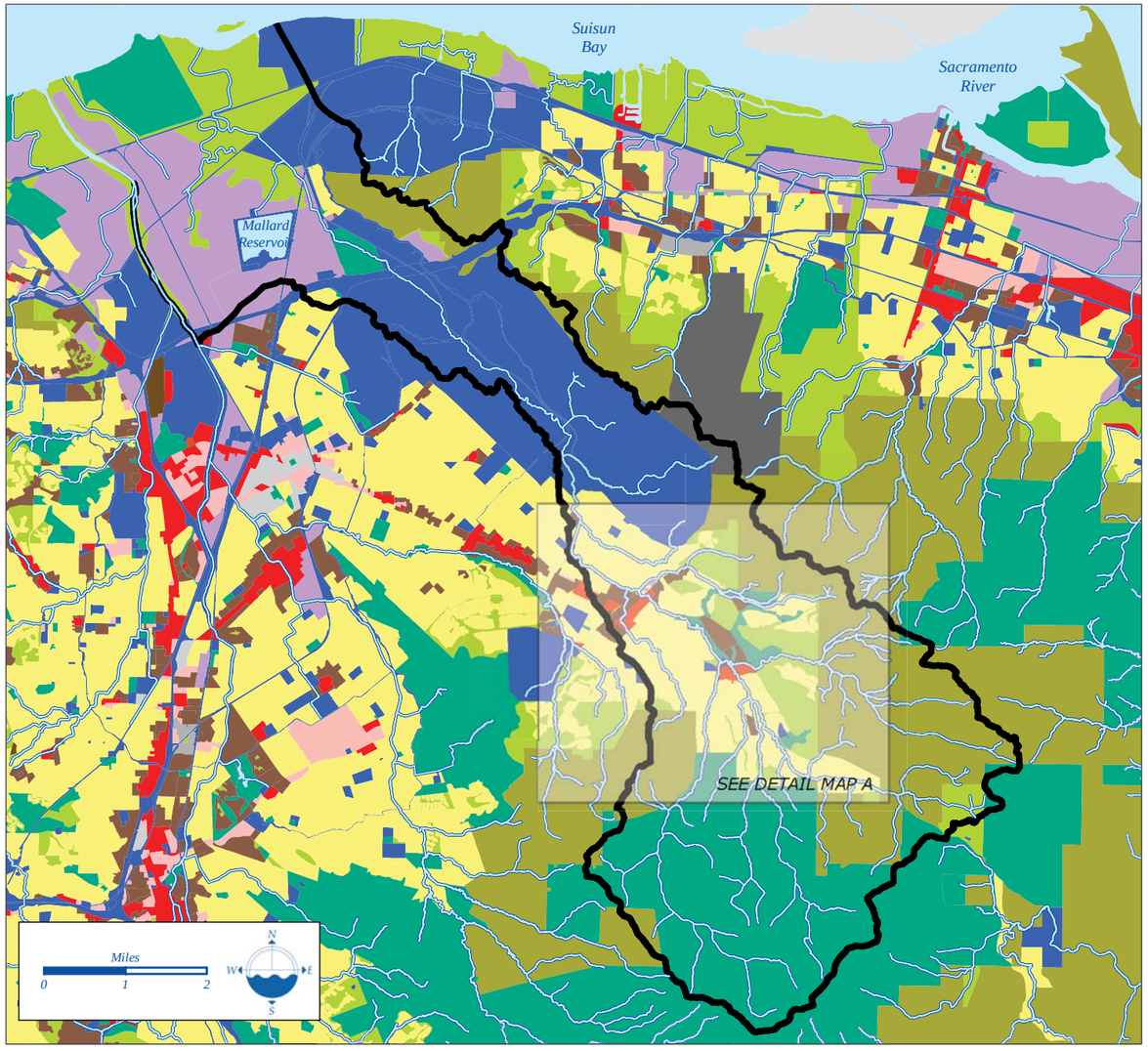
Mount Diablo Creek Watershed

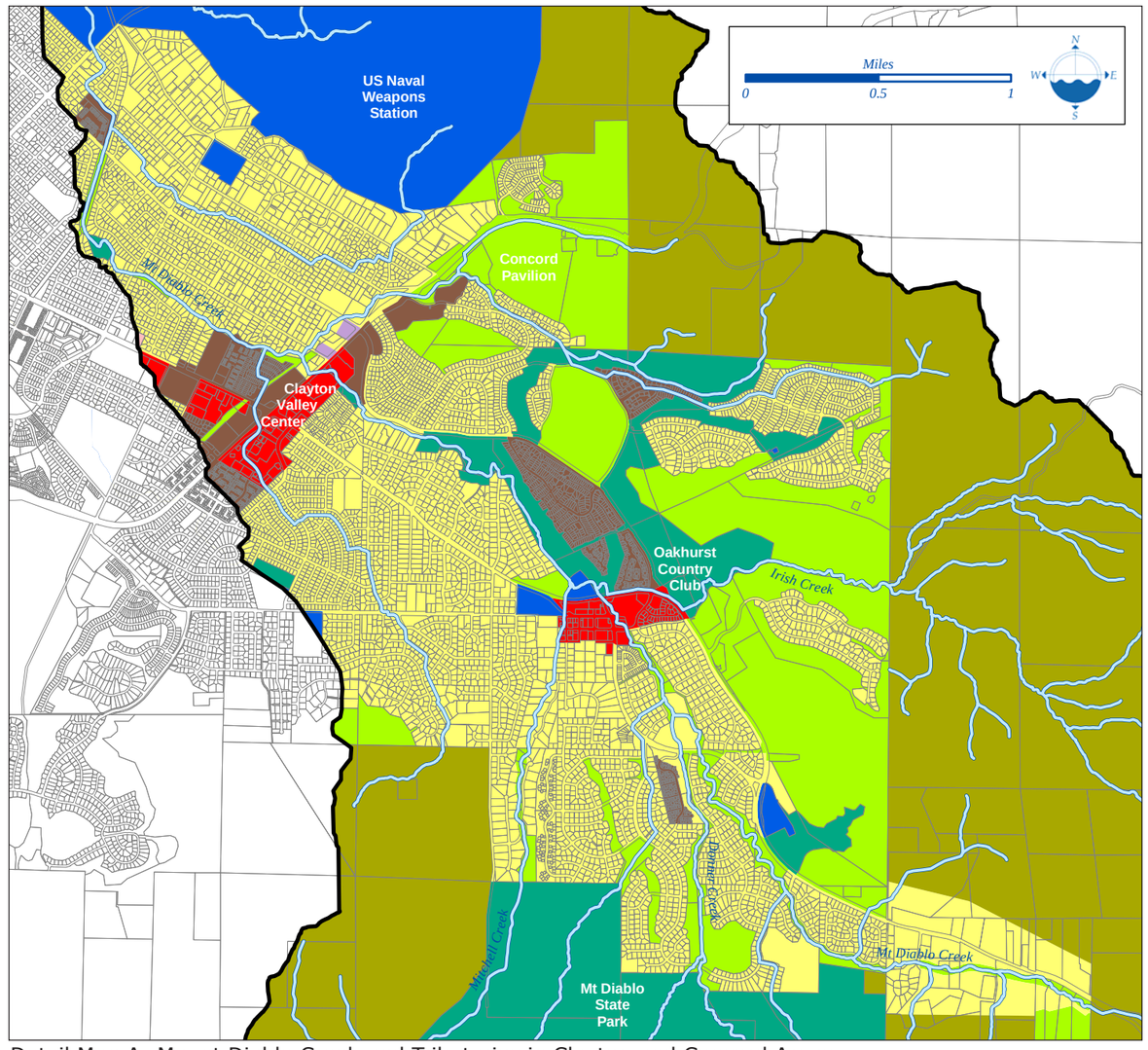


Mount Diablo Creek Watershed



Demographic Profile for Selected Communities In or Near the Mount Diablo Creek Watershed			
Population	Clayton	Clyde	Concord
Total Population	10,792	681	121,710
Race and Ethnicity	Clayton	Clyde	Concord
White	83.3%	84.0%	60.5%
Hispanic or Latino	5.7%	6.8%	21.9%
Black or African American	1.2%	2.6%	2.9%
Asian	5.5%	4.7%	9.0%
Some Other Race	0.7%	1.0%	1.1%
Two or More Races	3.5%	0.9%	4.5%
Education (maximum level attained)	Clayton	Clyde	Concord
No High School Diploma	2.5%	8.7%	15.3%
High School Diploma or Equivalent	38.0%	58.1%	50.1%
Associate Degree	7.8%	12.9%	8.7%
Bachelor's Degree	36.3%	10.6%	18.7%
Master's or Professional School Degree	14.3%	9.6%	6.4%
Doctorate Degree	1.2%	0.0%	0.8%
Income	Clayton	Clyde	Concord
Median Household Income	$101,651	$66,875	$55,597





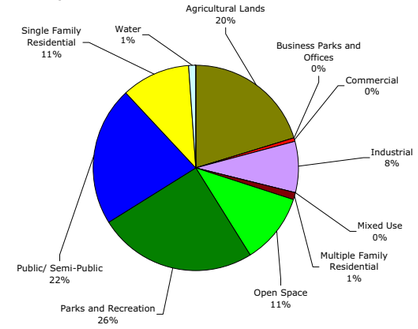
Detail Map A: Mount Diablo Creek and Tributaries in Clayton and Concord Areas

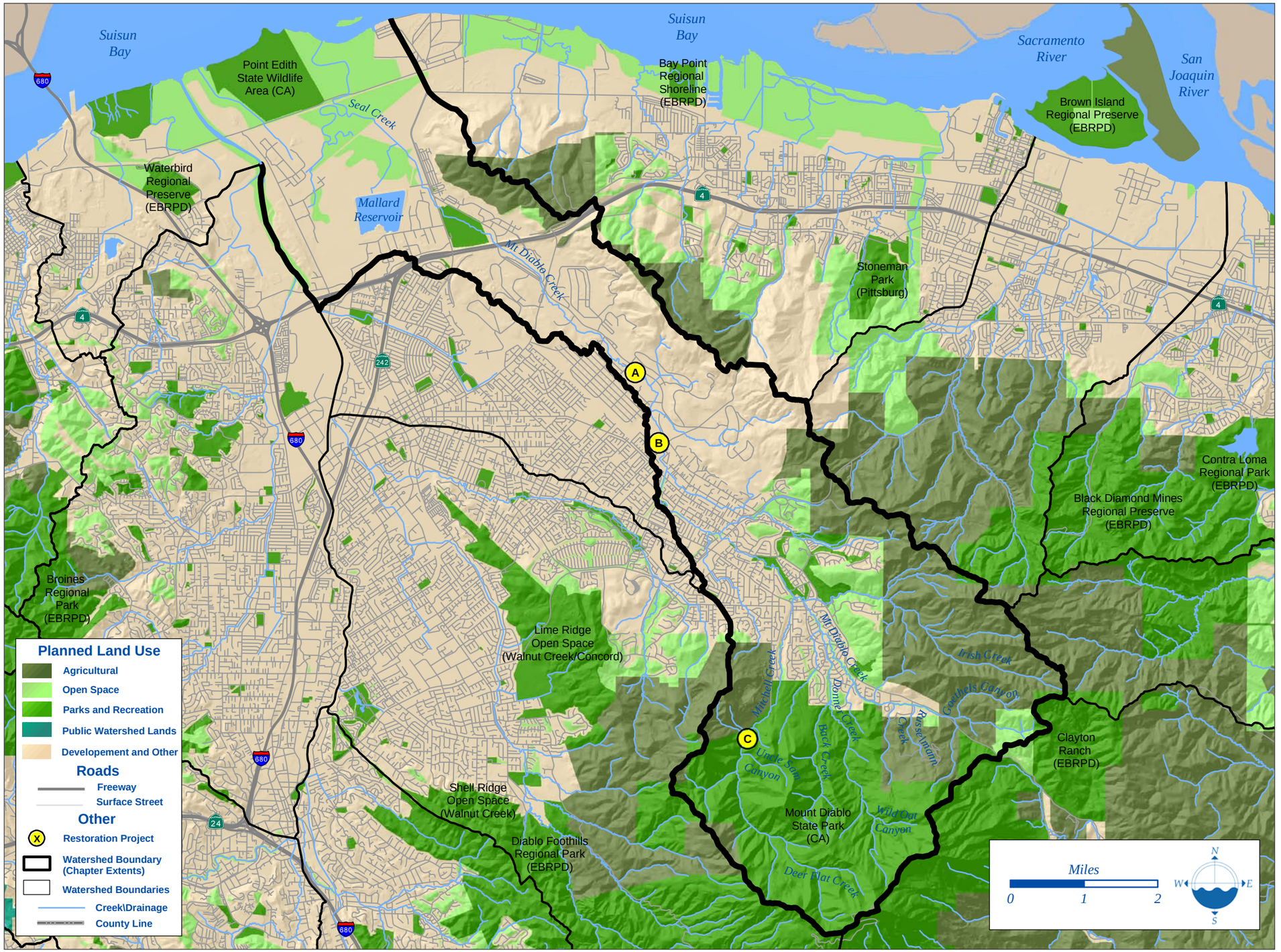
Planned Land Uses *Mount Diablo Creek Watershed*	Acres
Agricultural Lands	4,833
Business Parks and Offices	1
Commercial	117
Industrial	1,951
Mixed Use	0
Multiple Family Residential	235
Open Space	2,674
Parks and Recreation	5,964
Public/ Semi-Public	5,197
Single Family Residential	2,618
Water	256
Watershed (Public)	0
Total	**23,846**

Creek or Drainage
Parcels

Planned Land Use

- Single Family Residential
- Multiple Family Residential
- Commercial
- Office/ Business Park
- Industrial
- Landfill
- Mixed Use
- Public/ Semi-Public
- Parks and Recreation
- Open Space
- Agricultural Lands
- Water
- Public Watershed Lands





Restoration Projects

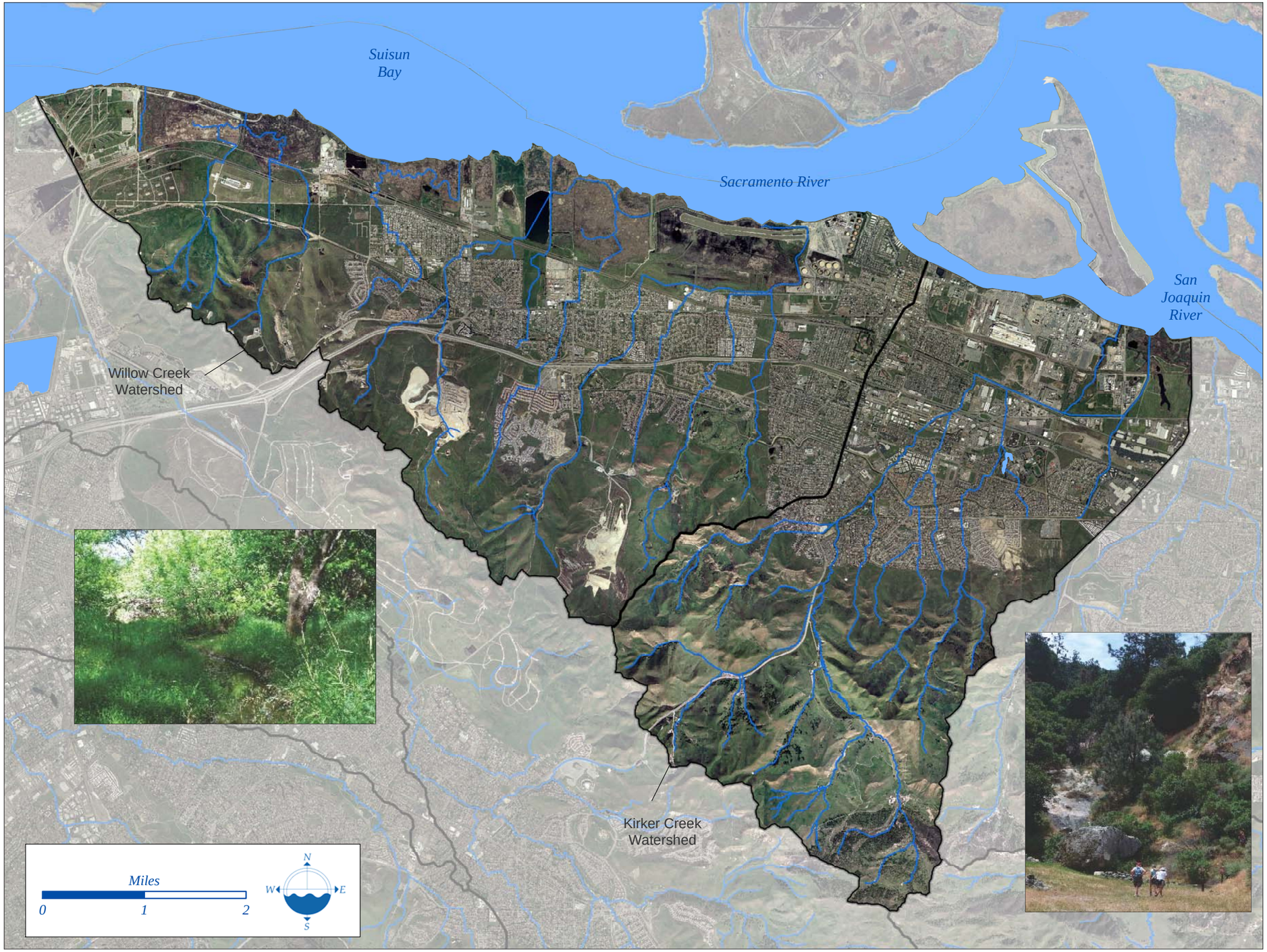
(A) Diablo Creek Restoration: Provide flood protection for the community of Concord and downstream areas, while still maintaining the natural features of the creek. This project is seeking funding. Lead Agency: Contra Costa County Flood Control. Anticipated project completion date is unknown.

(B) Biological Assessment: Inventory natural resources of Mount Diablo Creek watershed emphasizing biological components of uplands, riparian areas, and shorelines, with a special emphasis on wildlife habitats, corridors, and habitat development potential. Funding is provided by a Congressional earmark. Lead agency: the Contra Costa Resource Conservation District partnered with the USDA Natural Resources Conservation Service (NRCS). Anticipated project completion date is unknown.

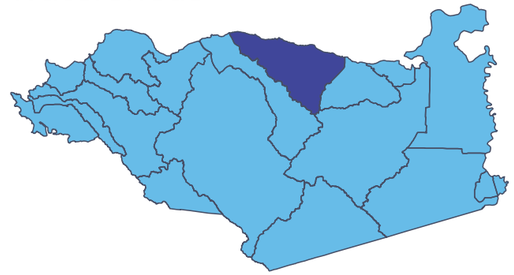
(C) Mitchell Canyon Creek Restoration Project: Monitor creek, remove invasive non-native plants, and remove structures that block fish migration. Funding for this project is provided by Mount Diablo State Park. Lead Agency: Mount Diablo State Park partnered with Save Mount Diablo. Anticipated project completion date is unknown.

Organizations Active in the Watershed

Contra Costa Resource Conservation District
5552 Clayton Road
Concord, CA 94521
Phone: (925) 672-6522 x 4
Website: www.ccrcd.org



Chapter 11
Willow and Kirker Creek Watersheds



The 10,132-acre Kirker Creek Watershed reaches from the foothills of Mount Diablo to the Sacramento-San Joaquin Delta. As Kirker Creek (9.43 miles) flows north from its headwaters, it runs through parkland and ranchland in the upper watershed, and continues through suburban residential neighborhoods and commercial areas in the lower watershed.

Though most of Kirker Creek runs through an open channel, culverts direct the creek underground at road crossings and through some urban areas.

Kirker Creek Watershed Vital Statistics		
Watershed Size	10,132	acres
Length of Longest Branch of Creek	9.43	miles
Total Channel Length in Watershed	43.65	miles
Average Annual Rainfall	16	inches
Estimated Mean Daily Flow	6.5	cfs
Estimated 100-Year Flood Flow	N/A	
Highest Elevation in Watershed	1,900	feet
Population (estimated)	22,900	people
Estimated Percent Impervious	30	%
Recognized Pollutants of Concern	N/A	*

Willow/Neighboring Watersheds Vital Statistics		
Watershed Size	16,063	acres
Length of Longest Branch of Creek	6.16	miles
Total Channel Length in Watershed	44.78	miles
Average Annual Rainfall	14	inches
Estimated Mean Daily Flow	N/A	
Estimated 100-Year Flood Flow	N/A	
Highest Elevation in Watershed	1,438	feet
Population (estimated)	58,800	people
Estimated Percent Impervious	25	%
Recognized Pollutants of Concern	N/A	*

*Kirker and Willow Creeks have not been specifically identified in the State's 303(d) list of Impaired Water Bodies.

Originally, Kirker Creek flowed directly north to the Delta. In the 1940's the creek was diverted to bypass the U.S. Steel property (now USS-POSCO). Kirker Creek now makes a 90-degree turn and flows into Los Medanos Wasteway. Only at high flow does the creek also use Dowest Slough.

Rainfall is the primary source of water for Kirker Creek. The creek flows during the rainy season (November through April) and dries out in the summer. Irrigation and related urban runoff produce some urban dry-weather flow that keeps areas of the creek wet throughout the year, which is characteristic of the entire watershed. Annual rainfall here averages approximately 16.5 inches in the upper reaches.

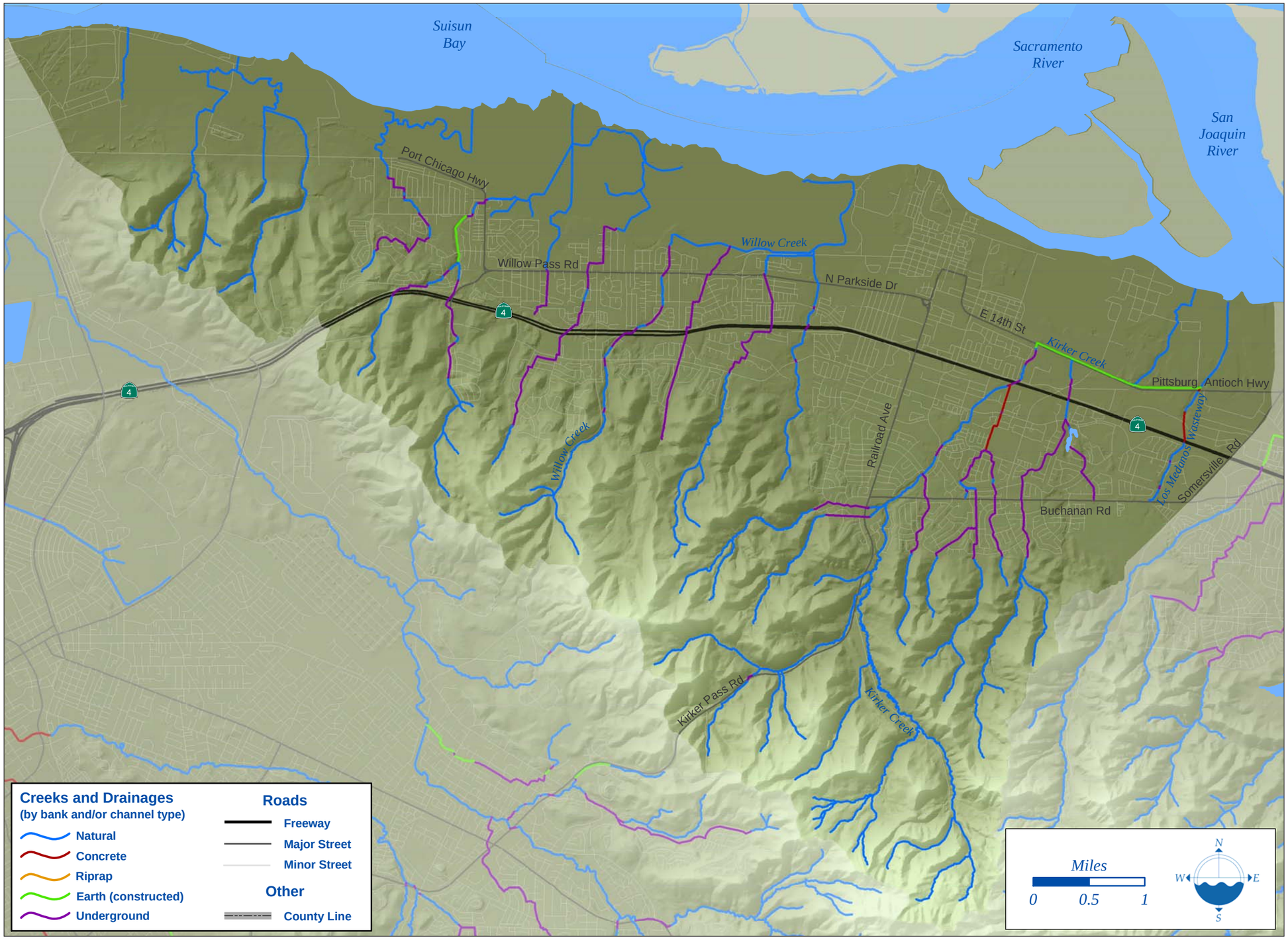
Kirker Creek Channel Length Statistics*

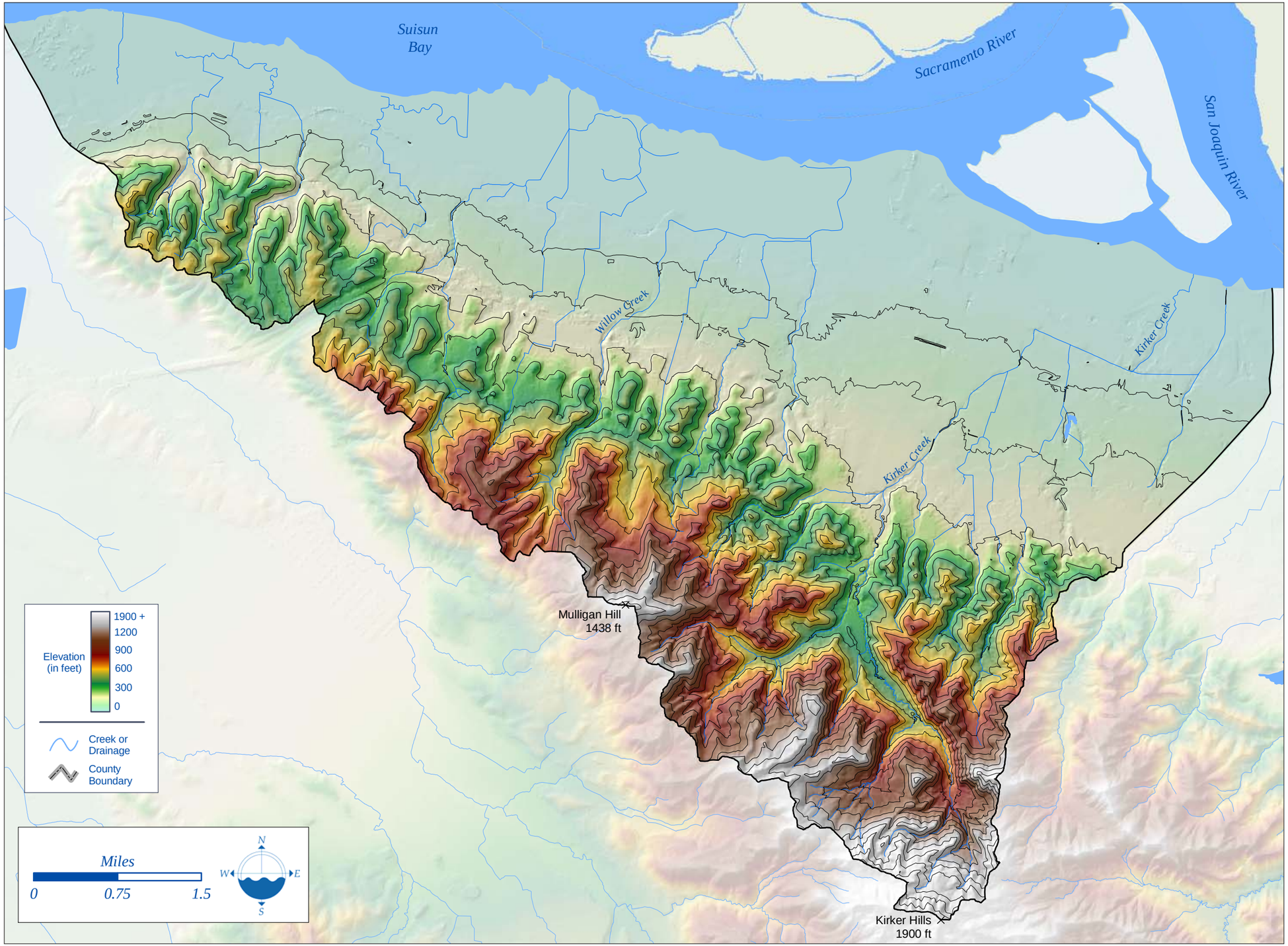
	Miles	Percent
Length of Longest Branch of Creek	9.43	
Total Channel Length in Watershed	43.65	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	33.81	77.5%
Concrete	8.25	18.9%
Earth (constructed)	1.59	3.6%
Riprap	0.00	0.0%
Underground	7.30	16.7%

Willow Creek Channel Length Statistics*

	Miles	Percent
Length of Longest Branch of Creek	6.16	
Total Channel Length in Watershed	44.78	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	34.38	76.8%
Concrete	9.93	22.2%
Earth (constructed)	0.46	1.0%
Riprap	0.00	0.0%
Underground	9.93	22.2%

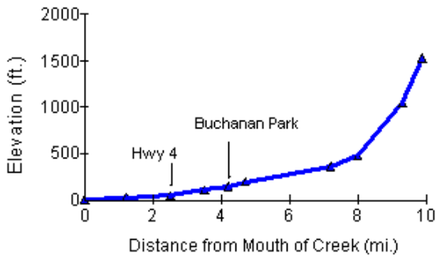
*Data relate to mapped channels only. Does not include storm drains. Bank type for segments shorter than 100 feet was not mapped.



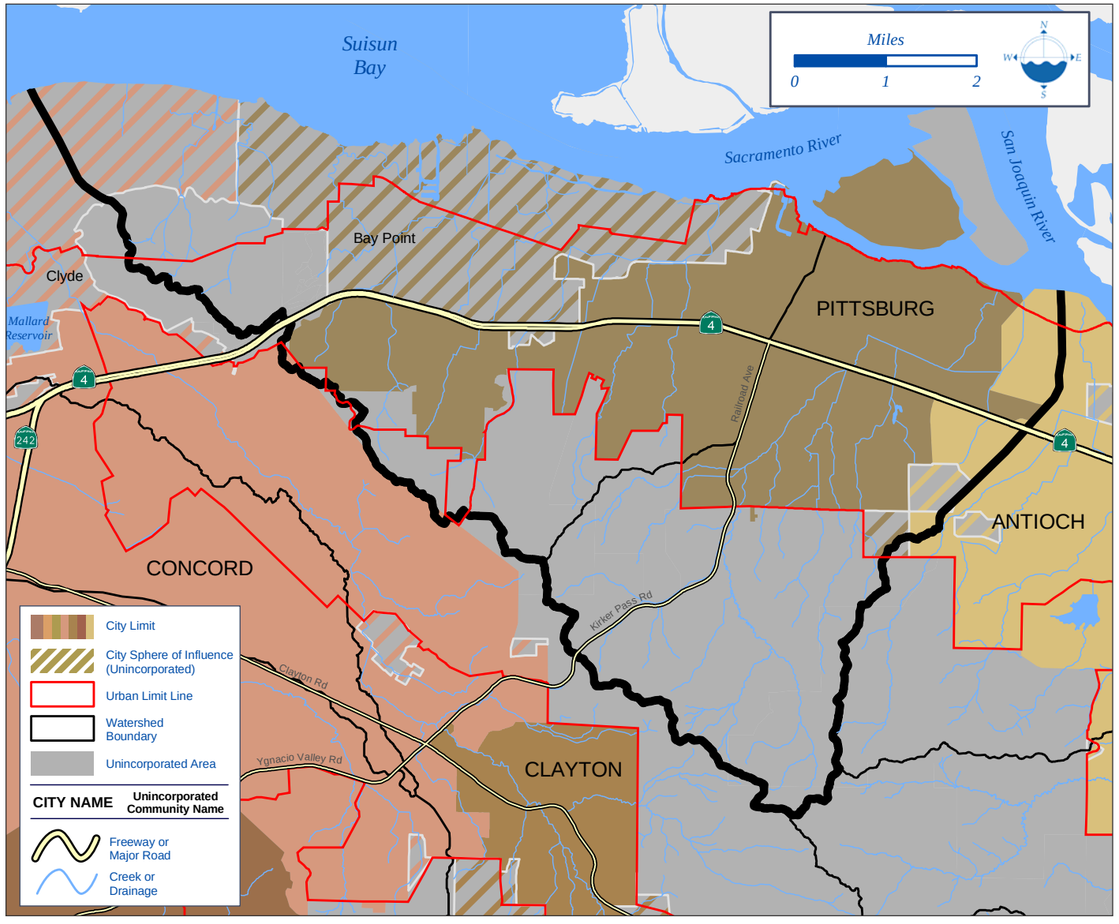


The Willow Creek Watershed encompasses 16,063 acres. Willow Creek (6.16 miles) is located in the middle of the watershed, with approximately 10 miles of unnamed tributaries draining into it in its lower reaches. Most of the lower reaches of these tributaries, including creeks to the east of Willow Creek, are in underground culverts as they flow through the single family residential neighborhoods of Bay Point and Pittsburg.

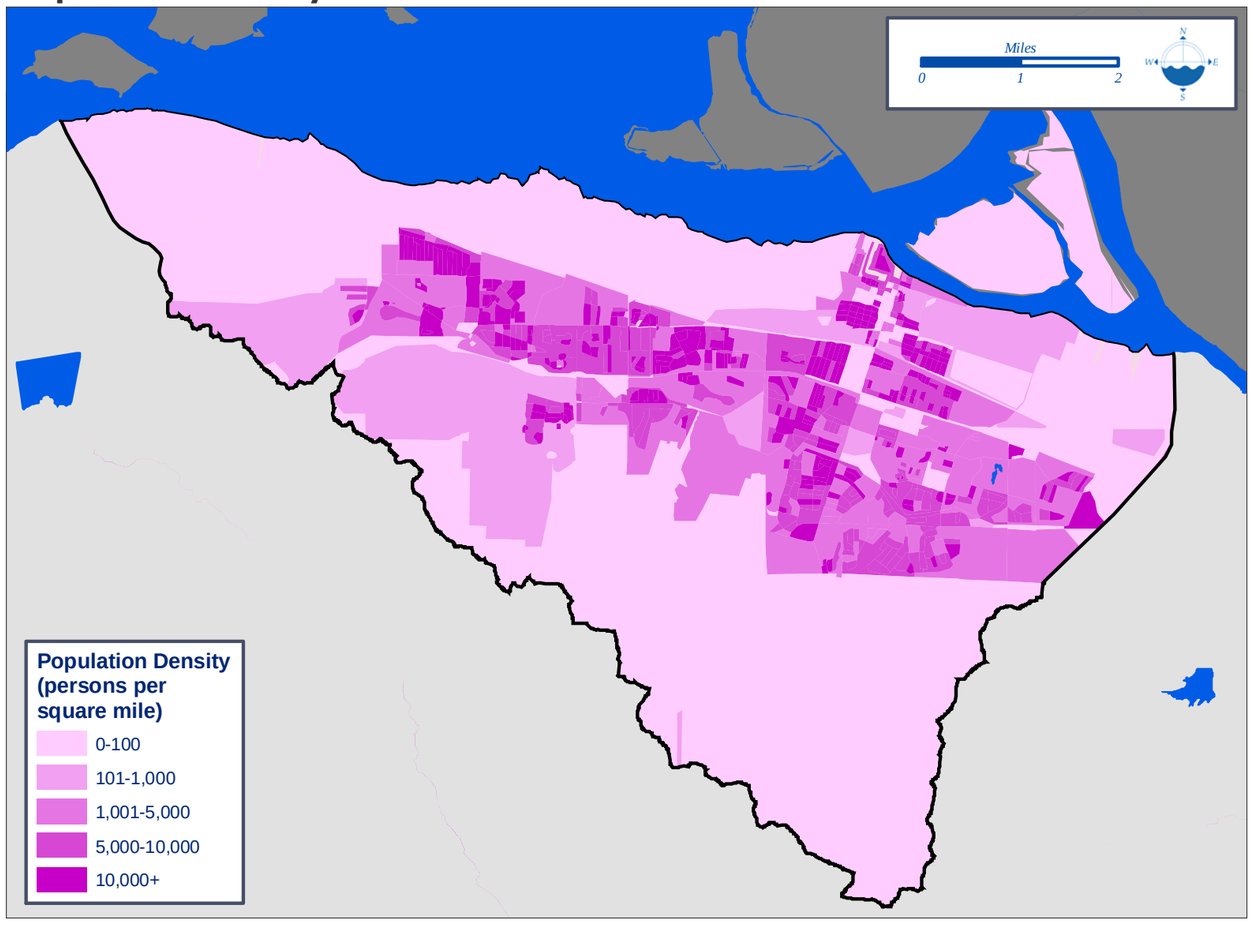
Kirker Creek Profile



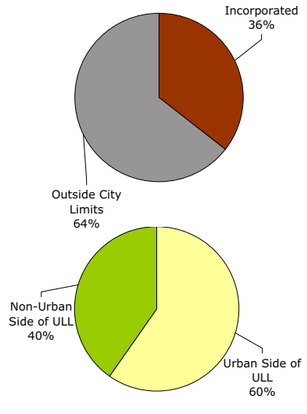
Political Boundaries



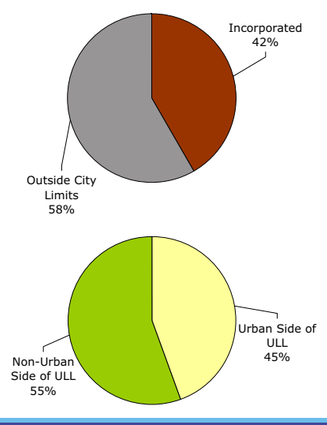
Population Density



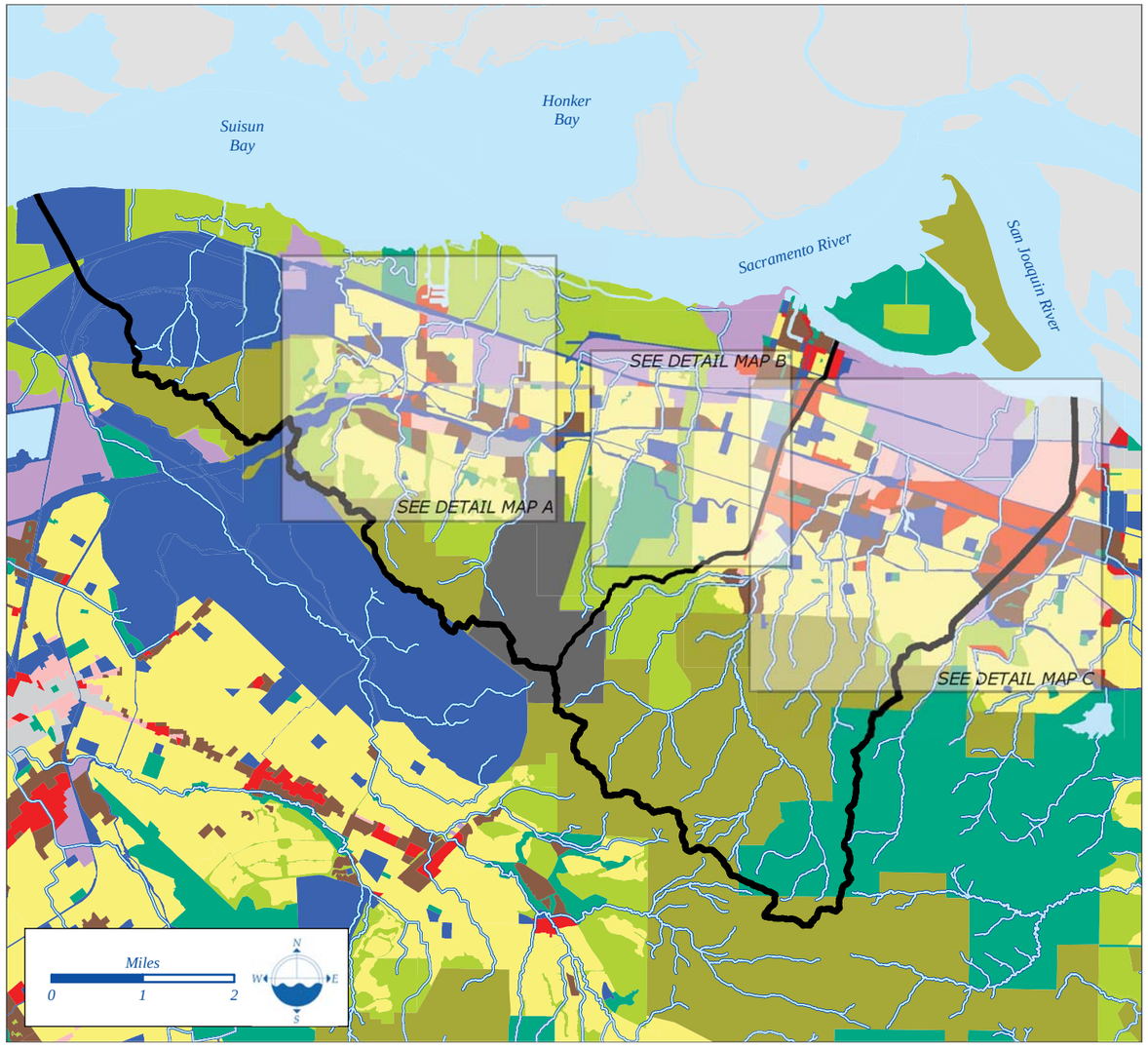
Willow Creek Watersheds

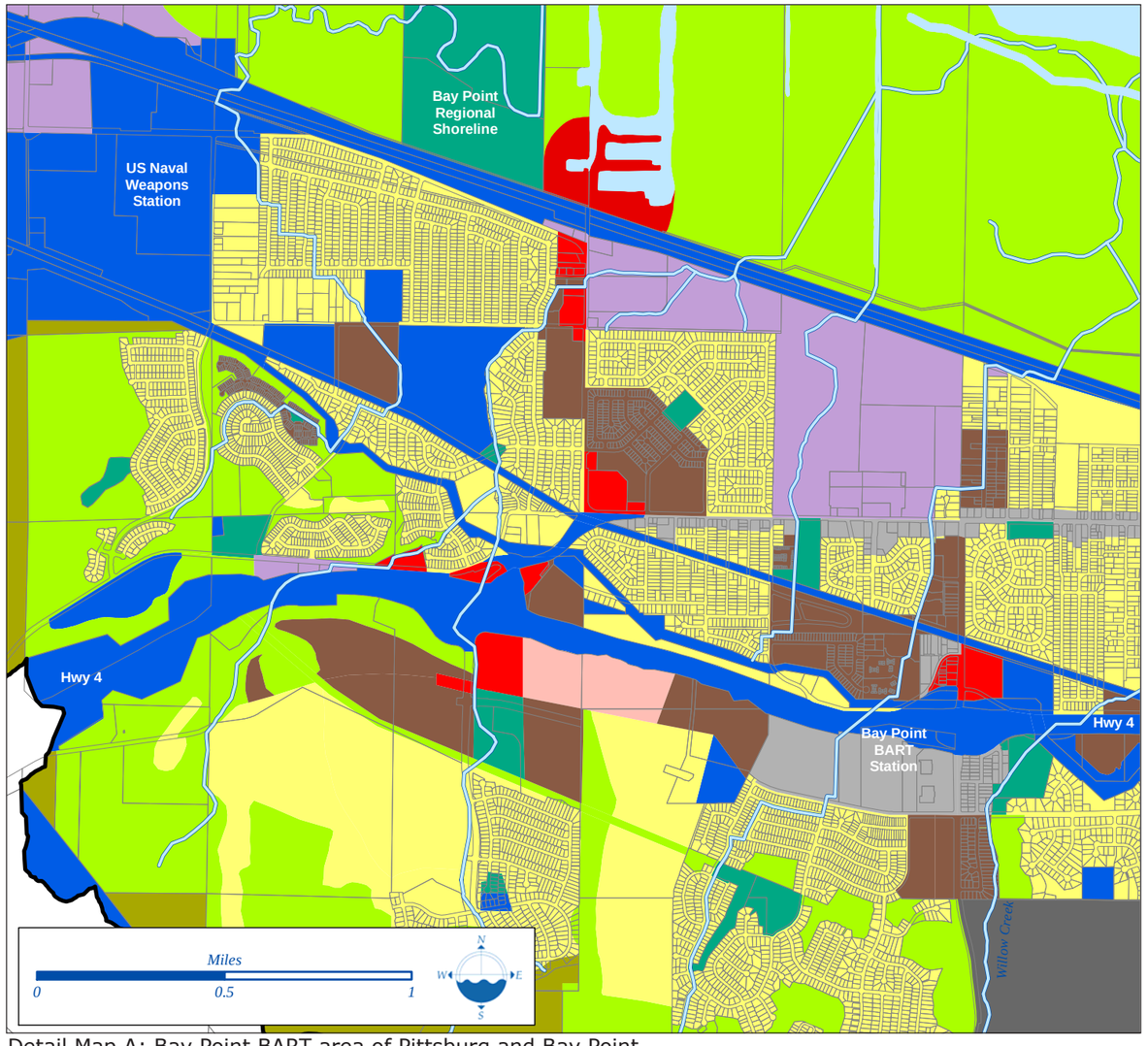


Kirker Creek Watershed



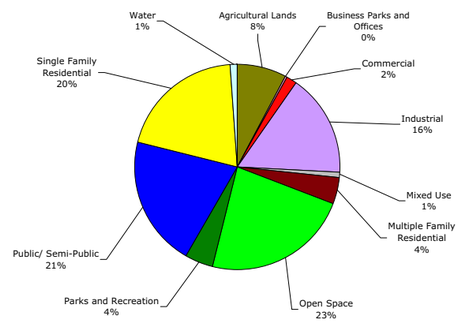
Demographic Profile for Selected Communities In or Near the Kirker and Willow Creek Watersheds			
Population	Antioch	Bay Point	Pittsburg
Total Population	90,814	21,415	56,820
Race and Ethnicity	Antioch	Bay Point	Pittsburg
White	55.8%	30.6%	31.3%
Hispanic or Latino	22.0%	39.3%	32.0%
Black or African American	9.3%	12.3%	17.7%
Asian	7.1%	11.2%	12.6%
Some Other Race	1.2%	2.1%	1.8%
Two or More Races	4.5%	4.4%	4.6%
Education (maximum level attained)	Antioch	Bay Point	Pittsburg
No High School Diploma	14.3%	28.2%	24.3%
High School Diploma or Equivalent	58.6%	52.3%	53.6%
Associate Degree	8.9%	7.4%	7.3%
Bachelor's Degree	13.5%	8.8%	11.4%
Master's or Professional School Degree	4.2%	2.9%	3.0%
Doctorate Degree	0.4%	0.4%	0.3%
Income	Antioch	Bay Point	Pittsburg
Median Household Income	$60,359	$44,951	$50,557





Detail Map A: Bay Point BART area of Pittsburg and Bay Point

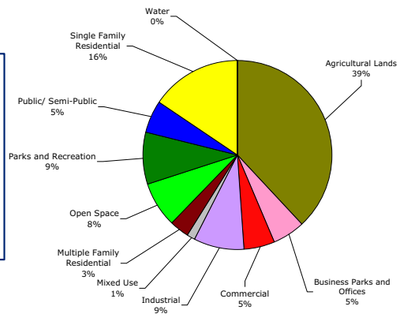
Planned Land Uses *Willow Creek Area Watersheds*	Acres
Agricultural Lands	1,271
Business Parks and Offices	36
Commercial	273
Industrial	2,584
Mixed Use	134
Multiple Family Residential	636
Open Space	3,706
Parks and Recreation	711
Public/ Semi-Public	3,330
Single Family Residential	3,202
Water	178
Watershed (Public)	0
Total	**16,063**



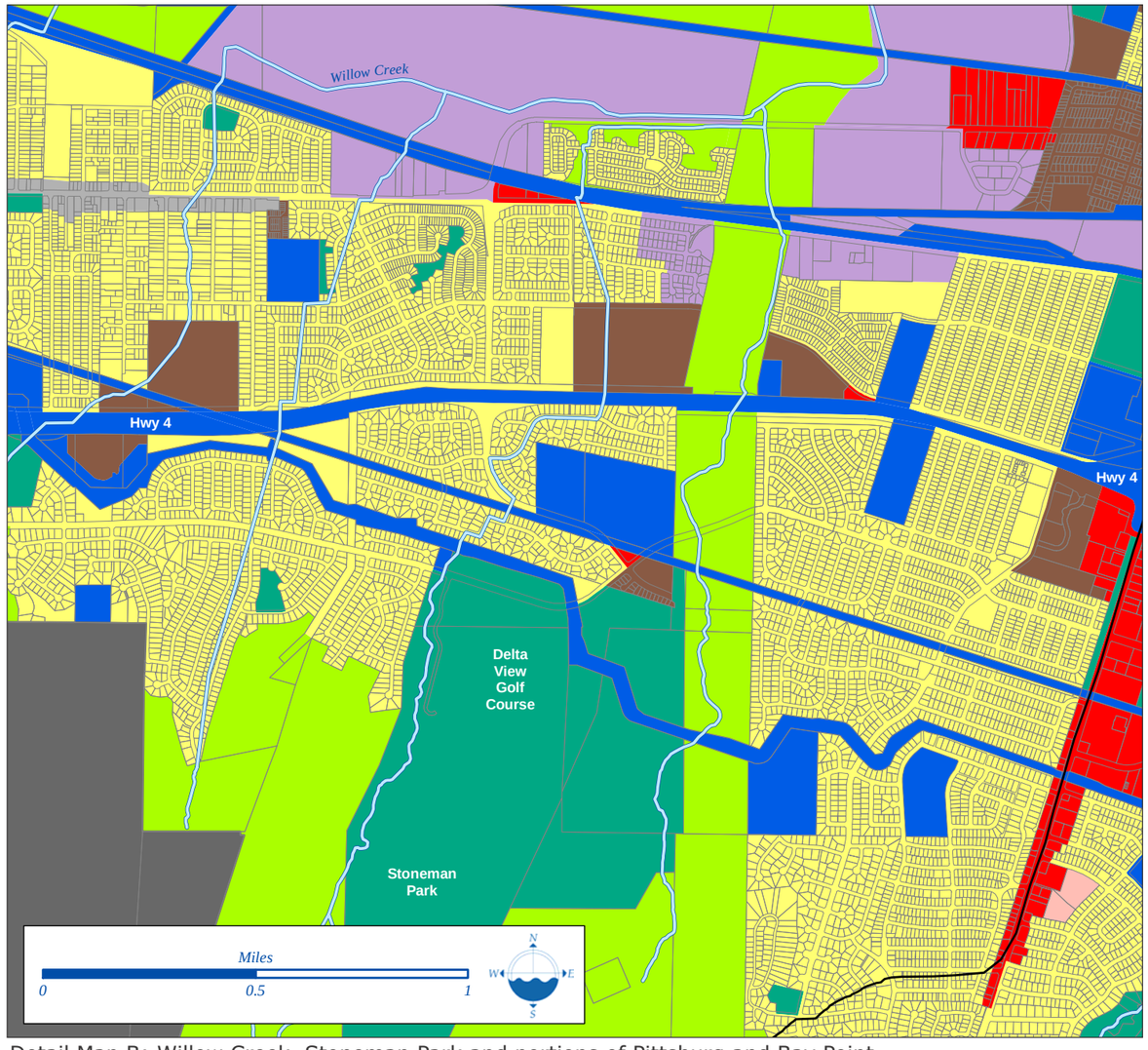
Creek or Drainage
Parcels

Planned Land Use

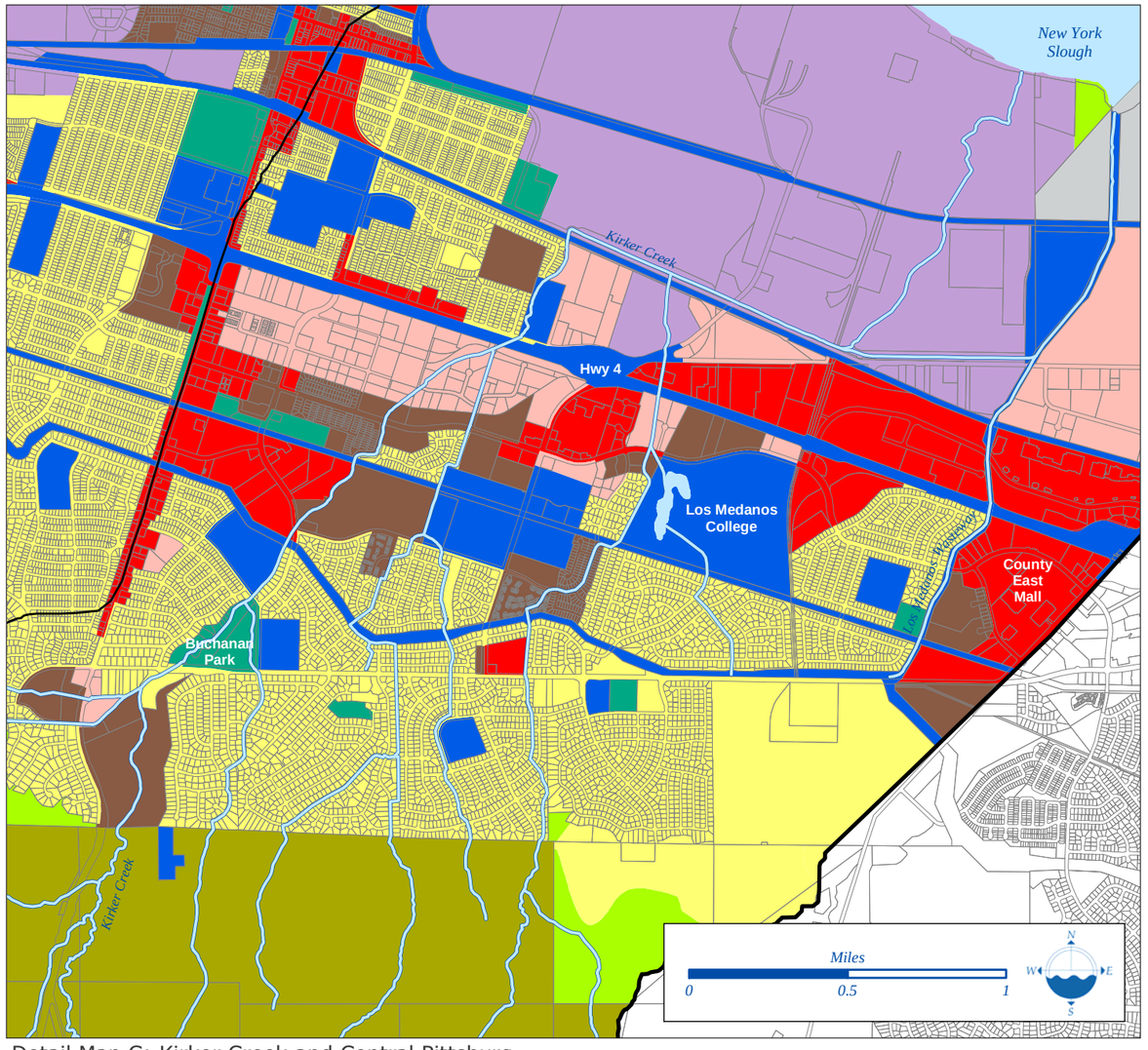
- Single Family Residential
- Multiple Family Residential
- Commercial
- Office/ Business Park
- Industrial
- Landfill
- Mixed Use
- Public/ Semi-Public
- Parks and Recreation
- Open Space
- Agricultural Lands
- Water
- Public Watershed Lands



Planned Land Uses *Kirker Creek Watershed*	Acres
Agricultural Lands	3,857
Business Parks and Offices	554
Commercial	551
Industrial	870
Mixed Use	124
Multiple Family Residential	348
Open Space	796
Parks and Recreation	901
Public/ Semi-Public	549
Single Family Residential	1,576
Water	6
Watershed (Public)	0
Total	**10,132**



Detail Map B: Willow Creek, Stoneman Park and portions of Pittsburg and Bay Point

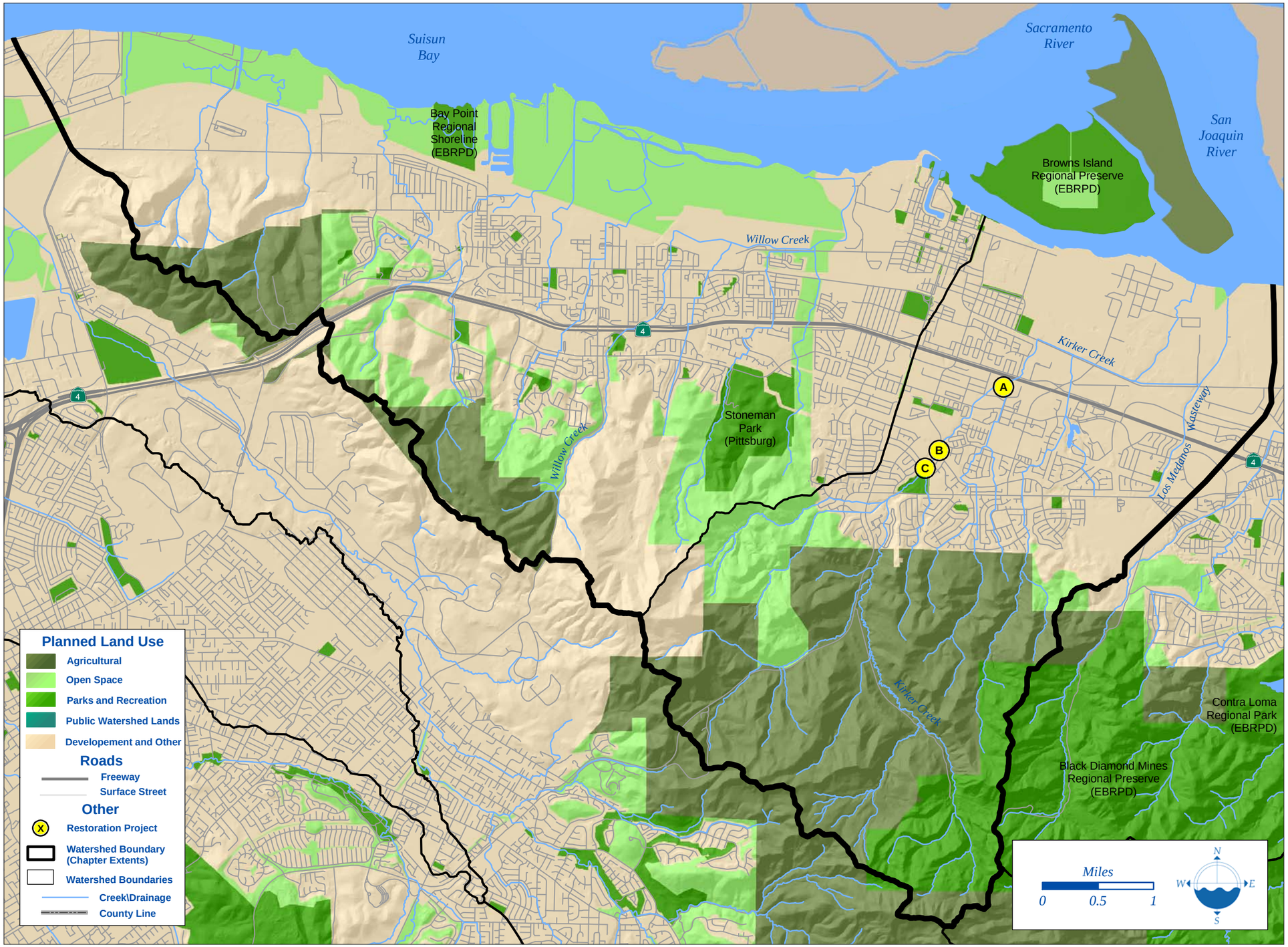


Detail Map C: Kirker Creek and Central Pittsburg

Creek or Drainage
Parcels

Planned Land Use

- Single Family Residential
- Multiple Family Residential
- Commercial
- Office/ Business Park
- Industrial
- Landfill
- Mixed Use
- Public/ Semi-Public
- Parks and Recreation
- Open Space
- Agricultural Lands
- Water
- Public Watershed Lands



Restoration Projects

(A) Daylighting of Kirker Creek: Restore above ground channel of 150 feet of Kirker Creek. Re-shape channel, re-vegetate riparian area. Funding for this project provided by State Transportation Infrastructure Program, East Contra Costa County Regional Fee and Finance Authority, and the Redevelopment Agency. Lead Agency: City of Pittsburg. Anticipated project completion: 2005.

(B) Erosion Control on Kirker Creek: Install landscaping and retaining walls to prevent erosion. Lead Agency: Private landowner. Anticipated project completion: project is on-going since 1998.

(C) Kirker Creek Watershed Management Plan: Local stakeholders have developed a consensus-based management plan for the Kirker Creek Watershed using the Coordinated Resource Management Planning process (CRMP). A spin-off of the planning group, Partners for the Watershed have led on-the-ground efforts to monitor water quality (Los Medanos College), remove invasive plants, propagate native plants (Pittsburg Environmental Center), and remove trash form the creek. This project is funded by the CALFED Ecosystem Restoration Program Grant. Lead Agency (and other collaborators): Contra Costa Resource Conservation District. Anticipated project completion date: Spring 2004.

Stephen Joseph

Getting Garbage out of Creeks

Illegally Dumped Garbage

Creek or Drainage

Volunteers in Kirker Creek Watershed pose with some of the debris they removed from the creek.

Trash and debris can be deposited in creeks by high winds or heavy rains. Unfortunately, people also leave difficult-to-dispose-of items in creeks. It is not unusual to come across tires, car batteries, old bicycles, shopping carts and garden debris in the county creeks.

Volunteer activities often revolve around cleaning up the creek. Many creek groups organize annual creek clean-up days. Such events are appropriate for all ages and skill-levels. Additionally, creek groups work to educate neighbors along the creek.

GPS data collected by the Kirker Creek Watershed Planning Group during the Summer of 2002 documented areas where large items were dumped. This information is important for organizing clean-up days as well as focusing outreach and education efforts.

The data displayed indicates areas were trash has been dumped along the creek. This information can be queried in conjunction with Contra Costa County address data to produce mailing lists for educational brochures.

Organizations Active in the Watershed

Contra Costa Resource Conservation District and Kirker Creek Watershed Planning Group
5552 Clayton Road
Concord, CA 94521
Phone: (925) 672-6522 x 4
Website: www.ccrcd.org

Pittsburg Environmental Center/ Rubicon Programs, Inc.
Tina Soewardie
2551 Harbor Ave.
Pittsburg CA 94565
(925) 473-2251
tinas@rubiconpgms.org

Partners for the Watershed (CCRCD)
Website: www.alldownstream.org

Pittsburg High Club Power/ EarthTeam
Dan Hanel
Phone: (925) 473-4100 x1012
dhandel@pittsburg.k12.ca.us

Los Medanos College Chemistry Department
Mitch Schweickert
Phone: (925) 439-2181 x3230
Email: mschweickert@losmedanos.edu

Bob Walker

Selected Resources

Alvarez, Jeff, Wildlife Inventory along Kirker Creek at Buchanan Park, Pittsburg, California. Environmental Impact Services, Hayward, CA. 1994.

Boysen, Sue, Some Historical Highlights of the History of Pittsburg. Pittsburg, CA. *1*964.

Contra Costa Resource Conservation District. Kirker Creek Watershed Management Plan, Concord, CA. 2003.

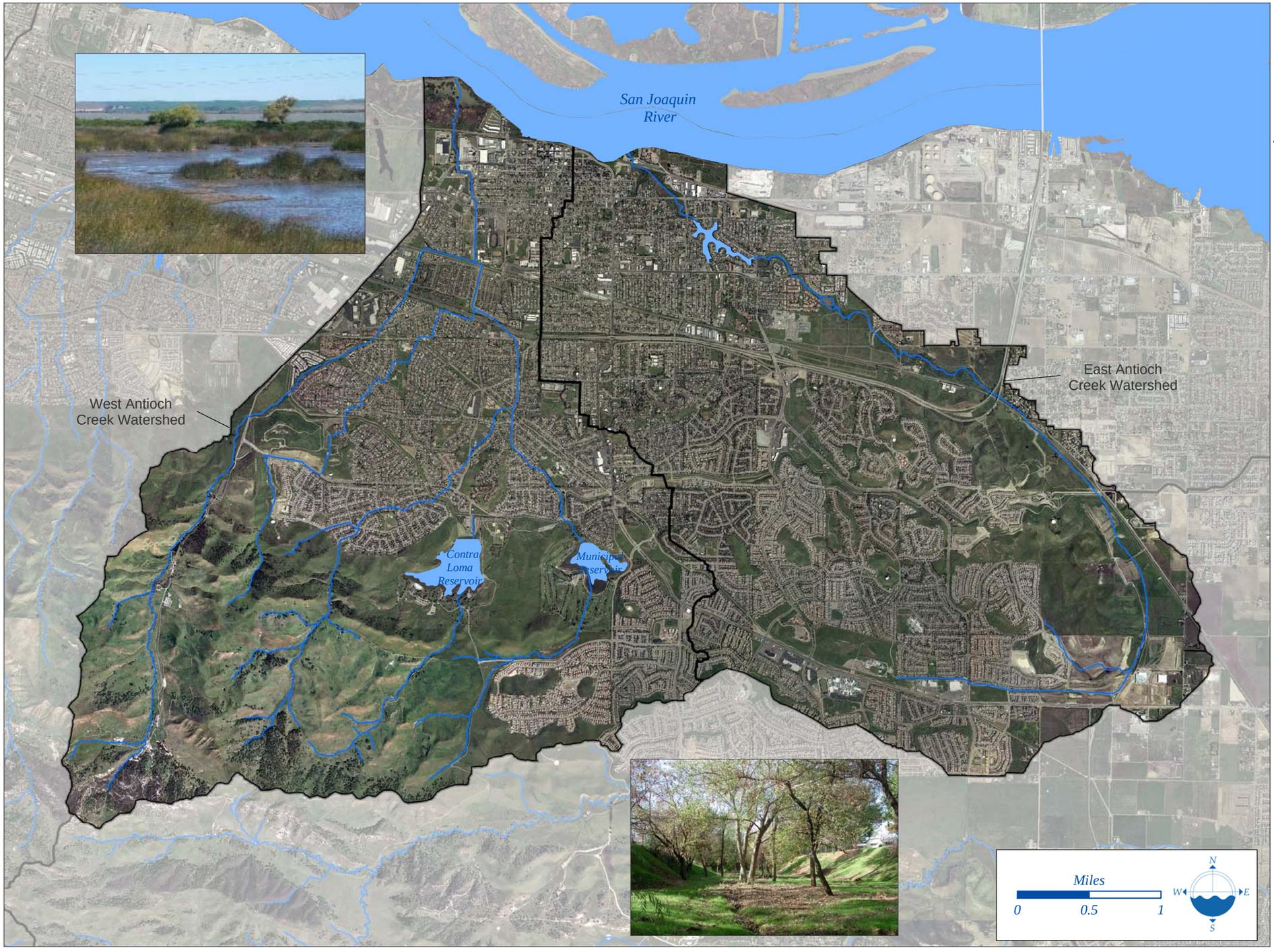
Contra Costa Resource Conservation District, Creekside Resident Survey – Kirker Creek, Contra Costa County, CA, 2002.

East Bay Regional Park District, Black Diamond Mines Regional Preserve Coal Mine Waste Pile pH Investigation Technical Report. 1999.

Lake, Dianne, Plant Survey of Quercos (Kirker) Creek, Buchanan Park, Pittsburg, CA. Hercules, CA. 1994.

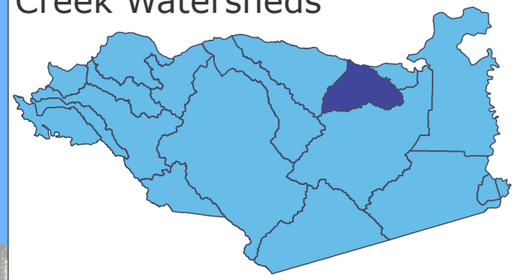
Lake, Dianne, Plant Survey to Determine Native vs. Exotic Plants. Kirker Creek, Buchanan Park, Pittsburg, CA. Hercules, CA. 1995.

USDA Natural Resources Conservation Service (NRCS) and Contra Costa Resource Conservation District (CCRCD). Kirker Creek Watershed Resources Inventory. Concord, CA. 2002.



Chapter 12

East and West Antioch Creek Watersheds



The watersheds of East and West Antioch Creeks are located in the north-eastern part of Contra Costa County. They are part of the creek system in this region that drains from the hills south of Antioch to the Sacramento-San Joaquin River Delta.

Two reservoirs located in the watersheds, Contra Loma Reservoir (CCWD) and the Antioch Municipal Reservoir provide drinking water storage.

West Antioch Creek Watershed Vital Statistics		
Watershed Size	8,182	acres
Length of Longest Branch of Creek	6.24	miles
Total Channel Length in Watershed	26.53	miles
Average Annual Rainfall	15	inches
Estimated Mean Daily Flow	5.2	cfs
Estimated 100-Year Flood Flow	N/A	
Highest Elevation in Watershed	1,535	feet
Population (estimated)	35,500	people
Estimated Percent Impervious	35	%
Recognized Pollutants of Concern	N/A	*

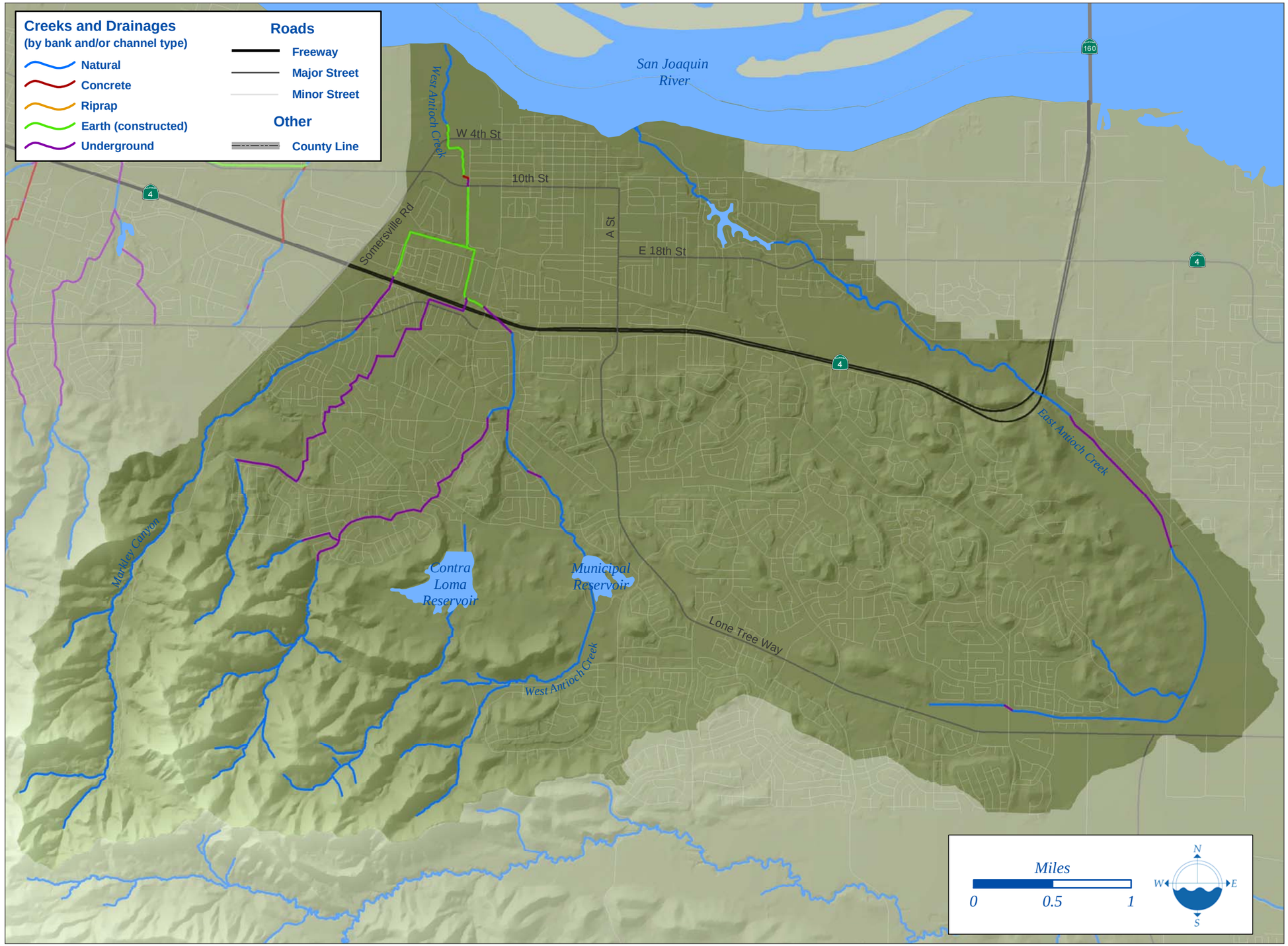
East Antioch Creek Watershed Vital Statistics		
Watershed Size	7,261	acres
Length of Longest Branch of Creek	7.87	miles
Total Channel Length in Watershed	8.70	miles
Average Annual Rainfall	13	inches
Estimated Mean Daily Flow	6.5	cfs
Estimated 100-Year Flood Flow	N/A	
Highest Elevation in Watershed	327	feet
Population (estimated)	46,000	people
Estimated Percent Impervious	60	%
Recognized Pollutants of Concern	N/A	*

*East & West Antioch Creeks have not been specifically identified in the State's 303(d) list of Impaired Water Bodies.

The headwaters of Markley Canyon Creek (part of the longest creek branch in the watershed) are found at 1,535 feet in Black Diamond Mine Regional Preserve (EBRPD). The confluence of Markley Canyon Creek and West Antioch is north of Highway 4 where both creeks are channelized.

The main stem of West Antioch Creek also flows from its headwaters in land managed by EBRPD. The creek flows through a valley that was at one time proposed for a major landfill facility. After a different location was selected for the landfill, the valley was purchased by EBRPD and added to Black Diamond Mine Preserve.

West Antioch Creek (6.24 miles) is joined by Markley Canyon Creek (5.3 miles) and a few unnamed tributaries, before passing near the Dow Wetlands Preserve and discharging into the San Joaquin River.



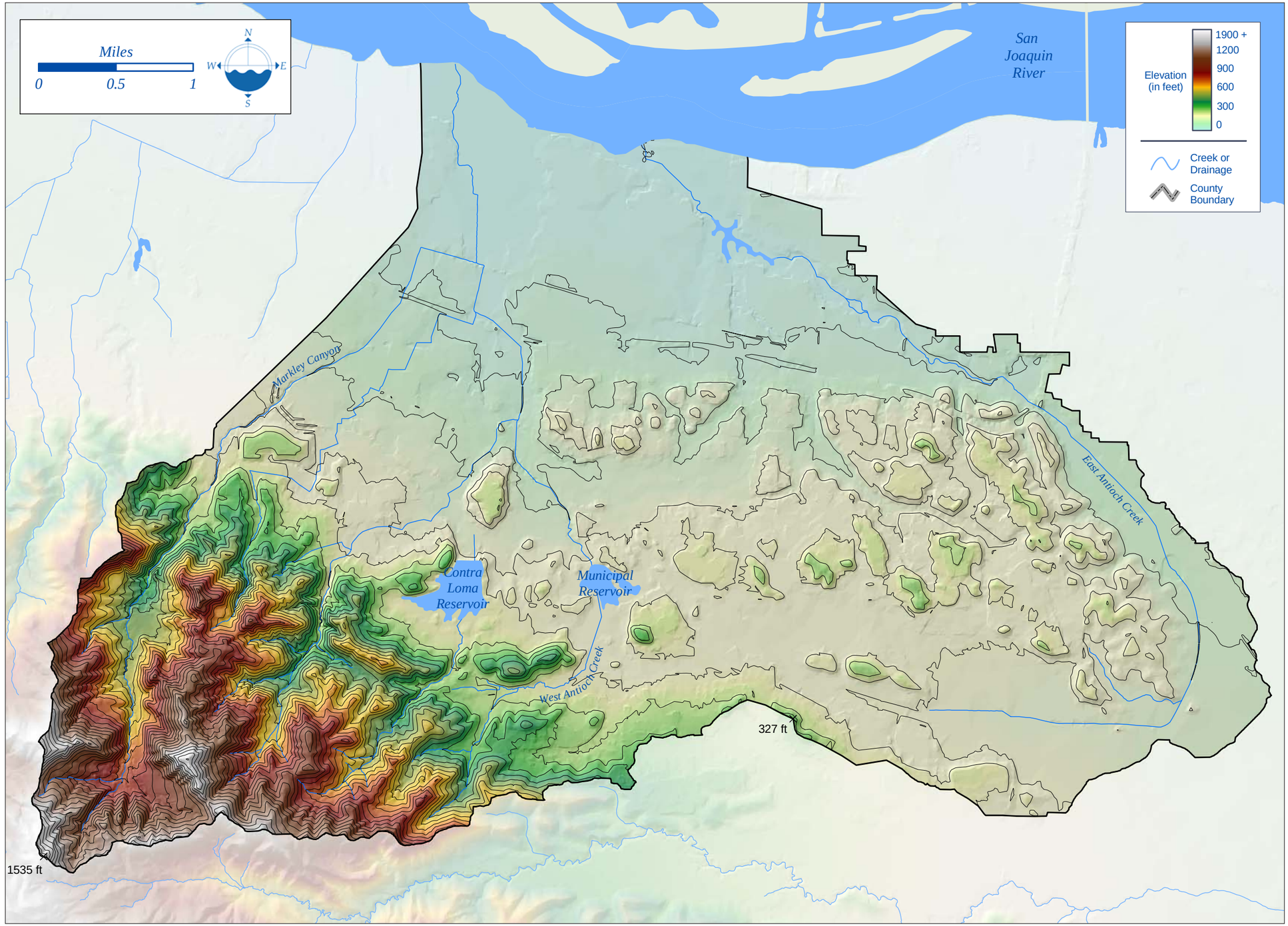
West Antioch Creek Channel Length Statistics*

	Miles	Percent
Length of Longest Branch of Creek	6.24	
Total Channel Length in Watershed	26.53	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	21.17	79.8%
Concrete	5.35	20.2%
Earth (constructed)	0.00	0.0%
Riprap	0.00	0.0%
Underground	5.35	20.2%

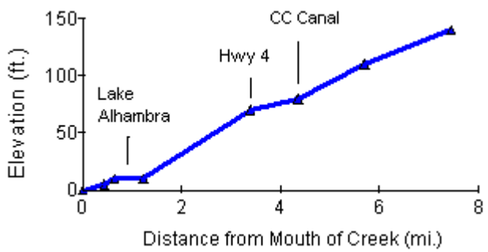
East Antioch Creek Channel Length Statistics*

	Miles	Percent
Length of Longest Branch of Creek	7.87	
Total Channel Length in Watershed	8.70	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	7.57	86.9%
Concrete	1.14	13.1%
Earth (constructed)	0.00	0.0%
Riprap	0.00	0.0%
Underground	1.14	13.1%

*Data relate to mapped channels only. Does not include storm drains. Bank type for segments shorter than 100 feet was not mapped.



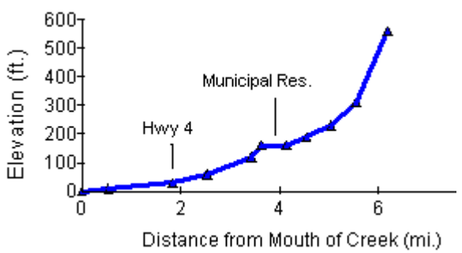
East Antioch Creek Profile



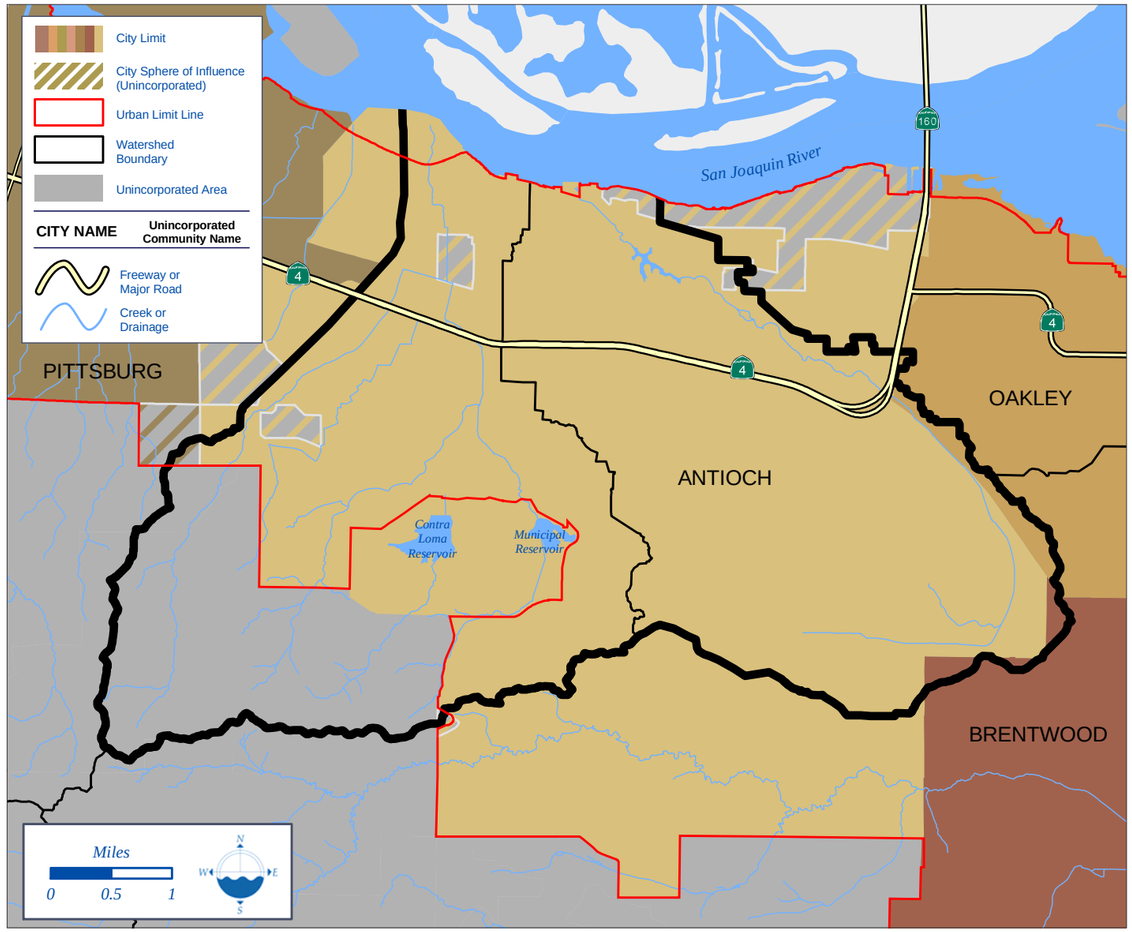
Although channelized in its lower half, the main stem of West Antioch Creek remains above ground for most of its length. Large sections of tributaries, however, are routed underground to provide flood protection and drainage through more developed areas.

East Antioch Creek flows from its low elevation headwaters near Lone Tree Way in Antioch. Various detention basins and levees are located along the length of the creek to a prevent storm water from moving into the Marsh Creek drainage area, which it has done historically during flood events.

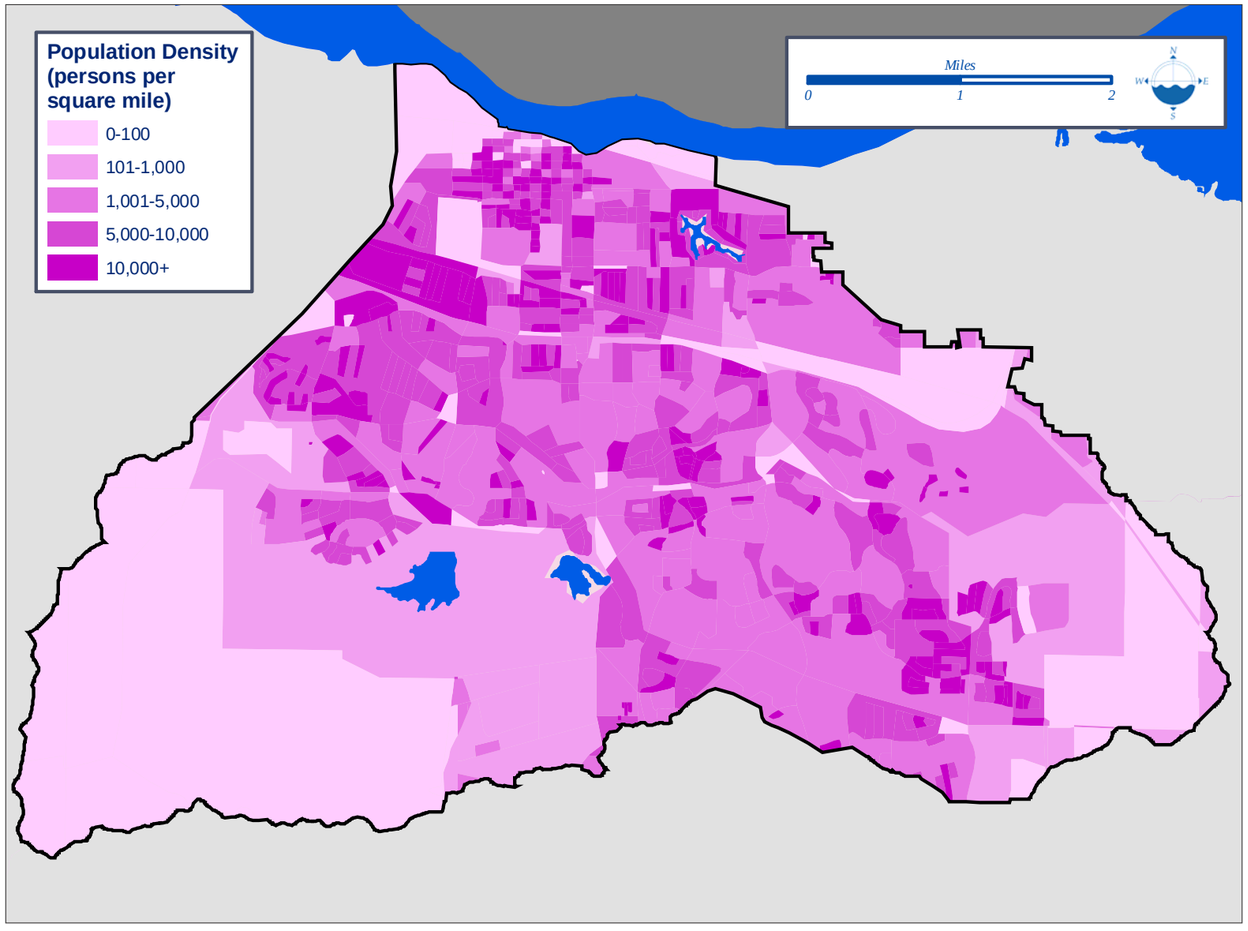
West Antioch Creek Profile



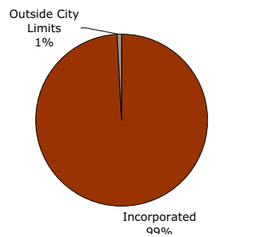
Political Boundaries

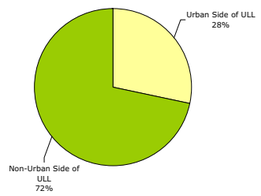


Population Density

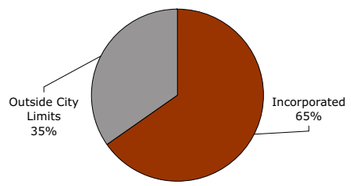


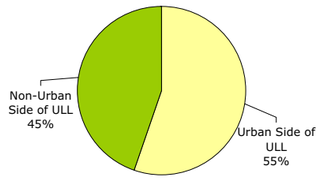
East Antioch Creek Watershed





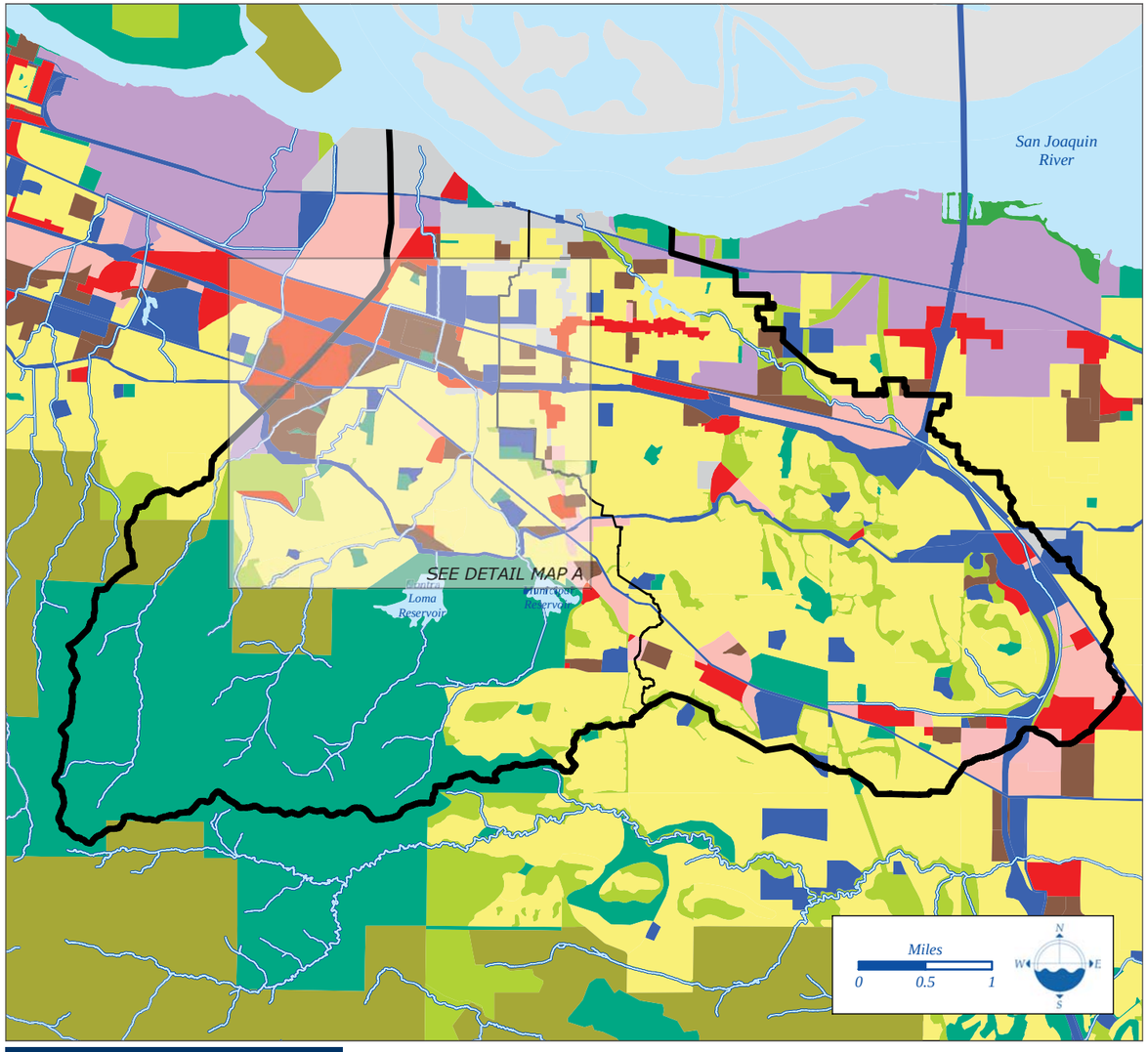
West Antioch Creek Watershed

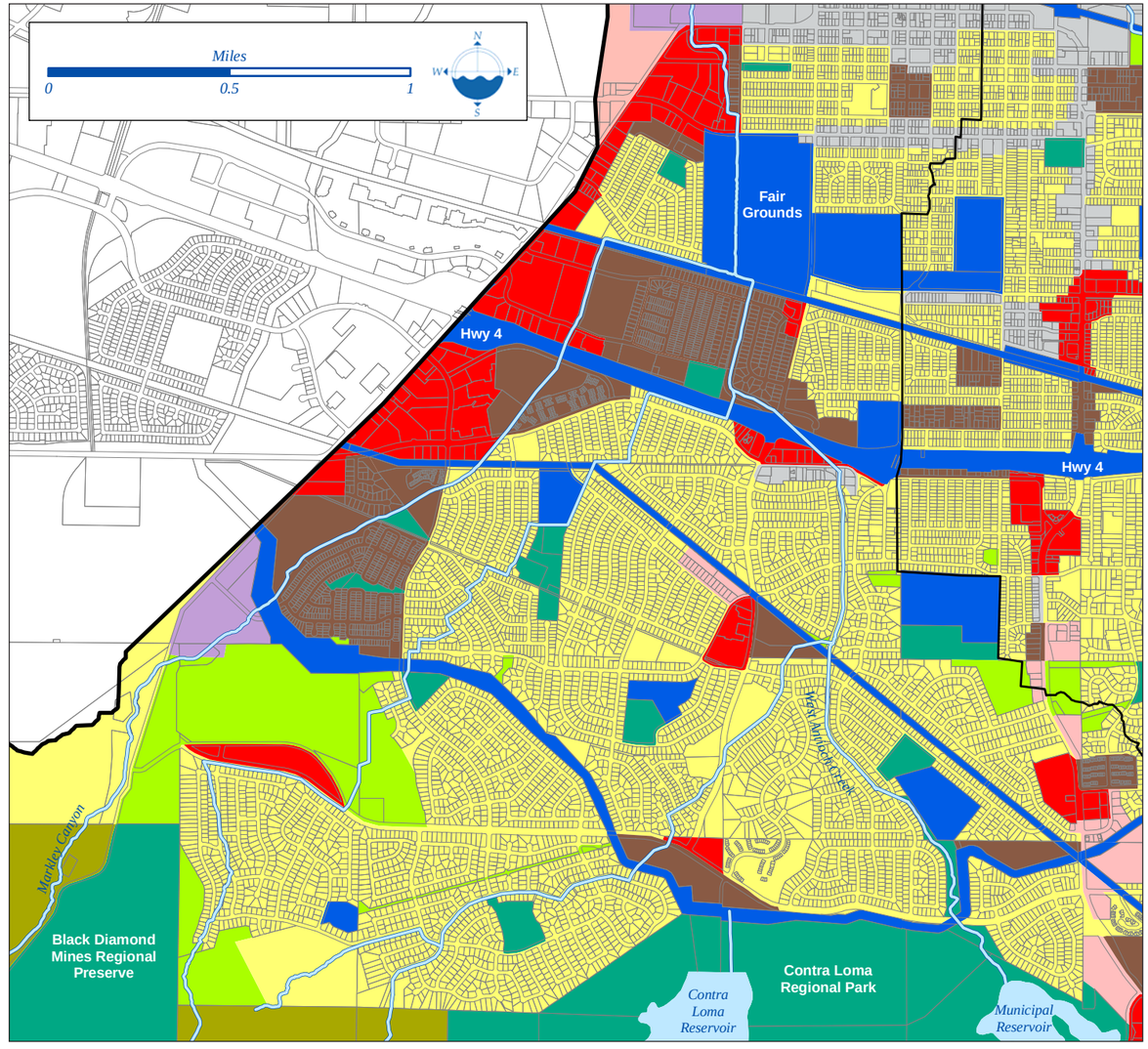




Demographic Profile for Selected Communities In or Near the East and West Antioch Creek Watersheds			
Population	Antioch	Oakley	Pittsburg
Total Population	90,814	25,465	56,820
Race and Ethnicity	Antioch	Oakley	Pittsburg
White	55.8%	64.6%	31.3%
Hispanic or Latino	22.0%	24.6%	32.0%
Black or African American	9.3%	2.6%	17.7%
Asian	7.1%	2.9%	12.6%
Some Other Race	1.2%	0.7%	1.8%
Two or More Races	4.5%	4.6%	4.6%
Education (maximum level attained)	Antioch	Oakley	Pittsburg
No High School Diploma	14.3%	15.2%	24.3%
High School Diploma or Equivalent	58.6%	62.8%	53.6%
Associate Degree	8.9%	8.3%	7.3%
Bachelor's Degree	13.5%	10.6%	11.4%
Master's or Professional School Degree	4.2%	2.8%	3.0%
Doctorate Degree	0.4%	0.3%	0.3%
Income	Antioch	Oakley	Pittsburg
Median Household Income	$60,359	$65,589	$50,557

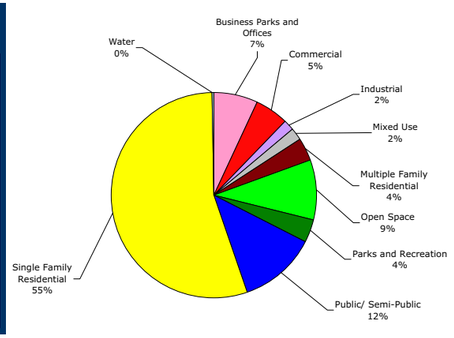
Planned Land Use

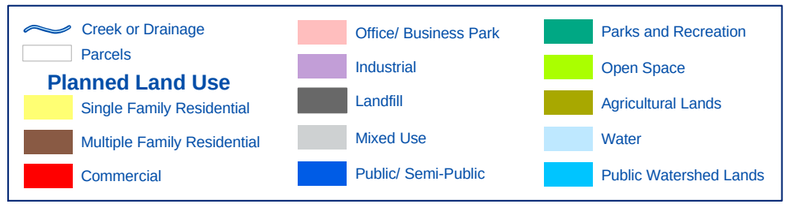


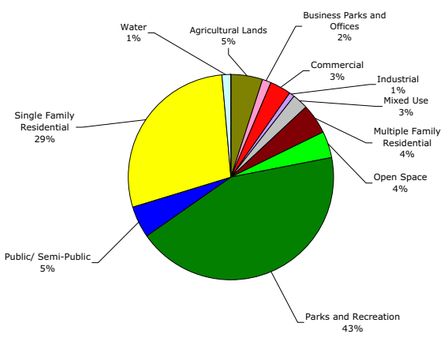


Detail Map A: Downtown Antioch

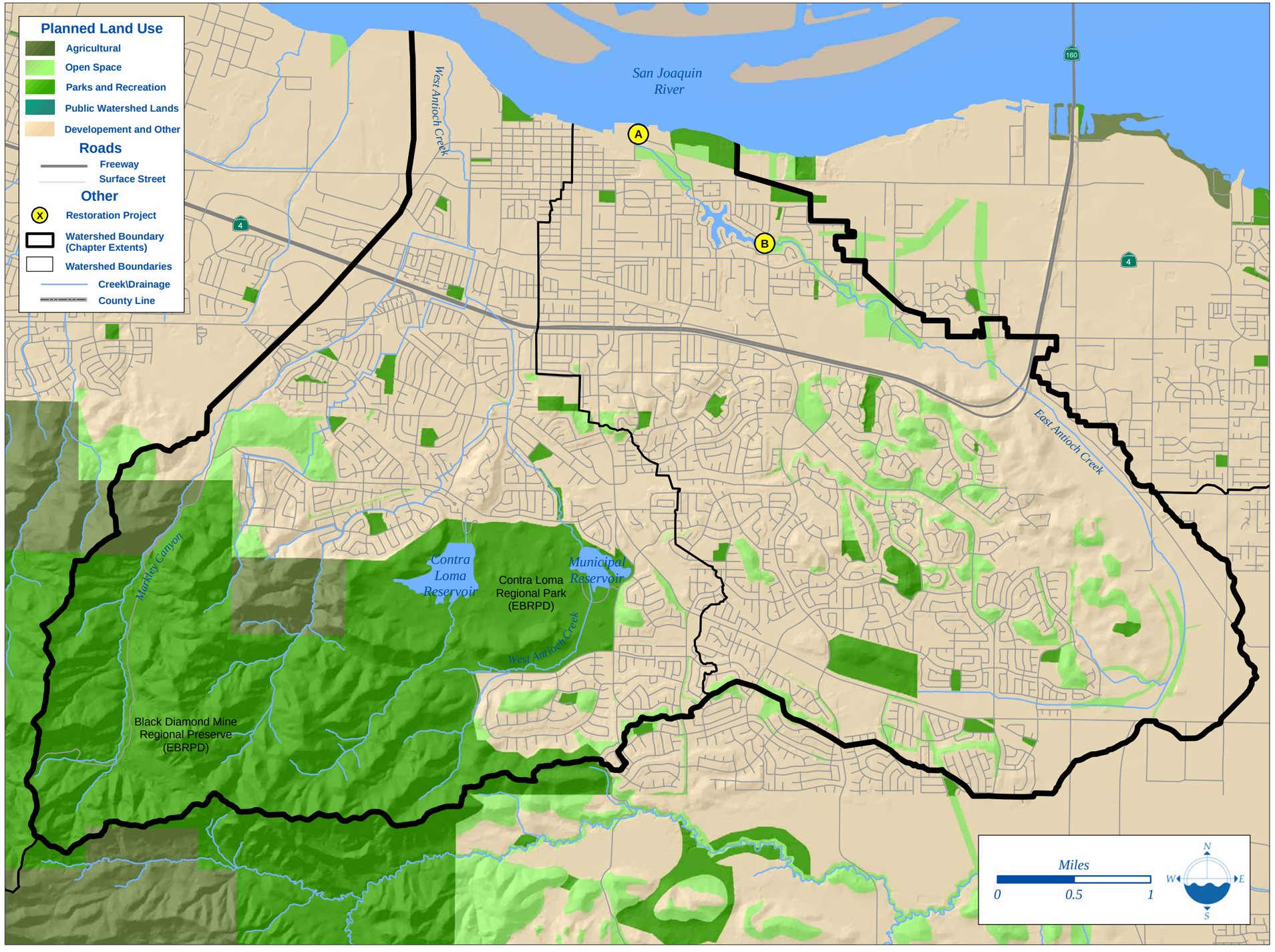
Planned Land Uses *East Antioch Creek Watershed*	Acres
Agricultural Lands	0
Business Parks and Offices	506
Commercial	387
Industrial	115
Mixed Use	133
Multiple Family Residential	271
Open Space	680
Parks and Recreation	274
Public/ Semi-Public	882
Single Family Residential	3,995
Water	19
Watershed (Public)	0
Total	**7,261**







Planned Land Uses *West Antioch Creek Watershed*	Acres
Agricultural Lands	402
Business Parks and Offices	130
Commercial	260
Industrial	78
Mixed Use	209
Multiple Family Residential	368
Open Space	340
Parks and Recreation	3,558
Public/ Semi-Public	401
Single Family Residential	2,334
Water	102
Watershed (Public)	0
Total	**8,182**

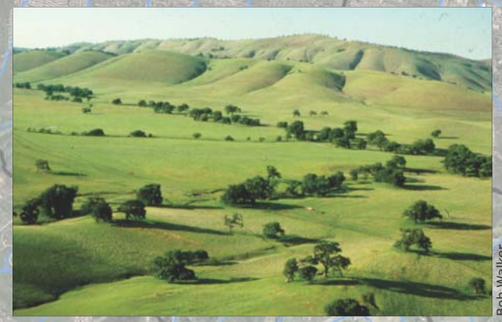


Restoration Projects

(A) Dow Beaver Pond Restoration: Establish riparian habitat of native plants along the Beaver Point shoreline. Funding for this project provided by: the U.S. EPA and USS-POSCO. Lead Agency: Dow Wetland Preserve partnered with CA Department of Fish and Game, and UC Berkeley Environmental Outreach. This project is on going and started in 1999.

(B) East Antioch Creek Floodplain Restoration: Re-establish historical floodplain and wetland areas adjacent to the downstream end of East Antioch Creek where it discharges into the San Joaquin River. Provide remediation to a toxic site. This project is seeking funding. Lead Agency: Contra Costa County Flood Control District. Anticipated project completion: 2008.

Walter Knight @CA Academy of Sciences



Bob Walker

Big Break

Lower Marsh Creek Watershed

Upper Marsh Creek Watershed

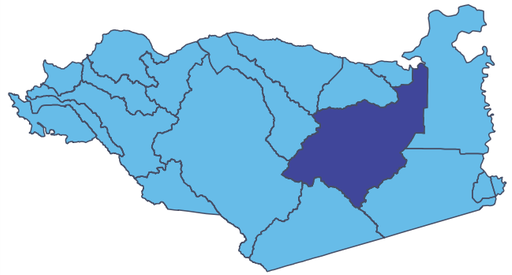
Los Vaqueros Reservoir

Stephen Joseph

Miles
0 1 2

N W E S

Chapter 13
Marsh Creek Watershed



With its headwaters in the Morgan Territory (Mount Diablo foothills) on the eastern and flanks of Mount Diablo, Marsh Creek flows 34.57 miles before exiting into the San Joaquin River Delta at Big Break. The second largest watershed in the County, it encompasses 60,066 acres in eastern Contra Costa County. Tributaries in the upper watershed include Curry Canyon Creek (5.8 miles) and Sycamore Creek (4 miles) and lastly, Briones Creek (13 miles), which flows into the Marsh Creek Reservoir. Tributaries entering the middle portion of the main stem near and in the City of Brentwood include, Dry Creek (5.8 miles), Sand Creek (18.74 miles) and Dear Creek (9 miles).

Marsh Creek Watershed Vital Statistics		
Watershed Size	60,066	acres
Length of Longest Branch of Creek	34.57	miles
Total Channel Length in Watershed	167.18	miles
Average Annual Rainfall	17	inches
Estimated Mean Daily Flow	28.3	cfs
Estimated 100-Year Flood Flow	5,740	cfs*
Highest Elevation in Watershed	3849	feet
Population (estimated)	38,500	people
Estimated Percent Impervious	15	%
Recognized Pollutants of Concern	Mercury & Metals**	

*Above Marsh Creek Reservoir (34,900 acres upstream, or 77% of watershed). Downstream, 100yr flow is: 1,490 cfs below dam; and 2,720 cfs at mouth.

**Marsh Creek Reservoir, Dunn Creek and portions of Marsh Creek are listed as an Impaired Water Bodies in the State's 303(d) list. Pollutants of Concern are the following: Mercury (Reservoir, Dunn Creek and Marsh Creek below Reservoir) and Metals (Dunn Creek and Marsh Creek below Dunn).

North of the Marsh Creek Reservoir, the creek runs through the Cities of Brentwood and Oakley. In these cities, Marsh Creek runs through urban and agricultural areas. Much of the undeveloped area north of Marsh Creek Reservoir is planned for development. Another area planned for significant development lies along Sand Creek within the city limits of Antioch.

Eastern Contra Costa County has been an important agricultural center since the mid-1800's. Early settlers planted orchards in the flat, alluvial plain where the availability of water from Marsh Creek, Old River and the Sacramento River made the area a perfect choice for growing and shipping fruit and produce. Railroad lines passing through both Brentwood and Oakley secured this region as a major supplier.

Natural Heritage Institute

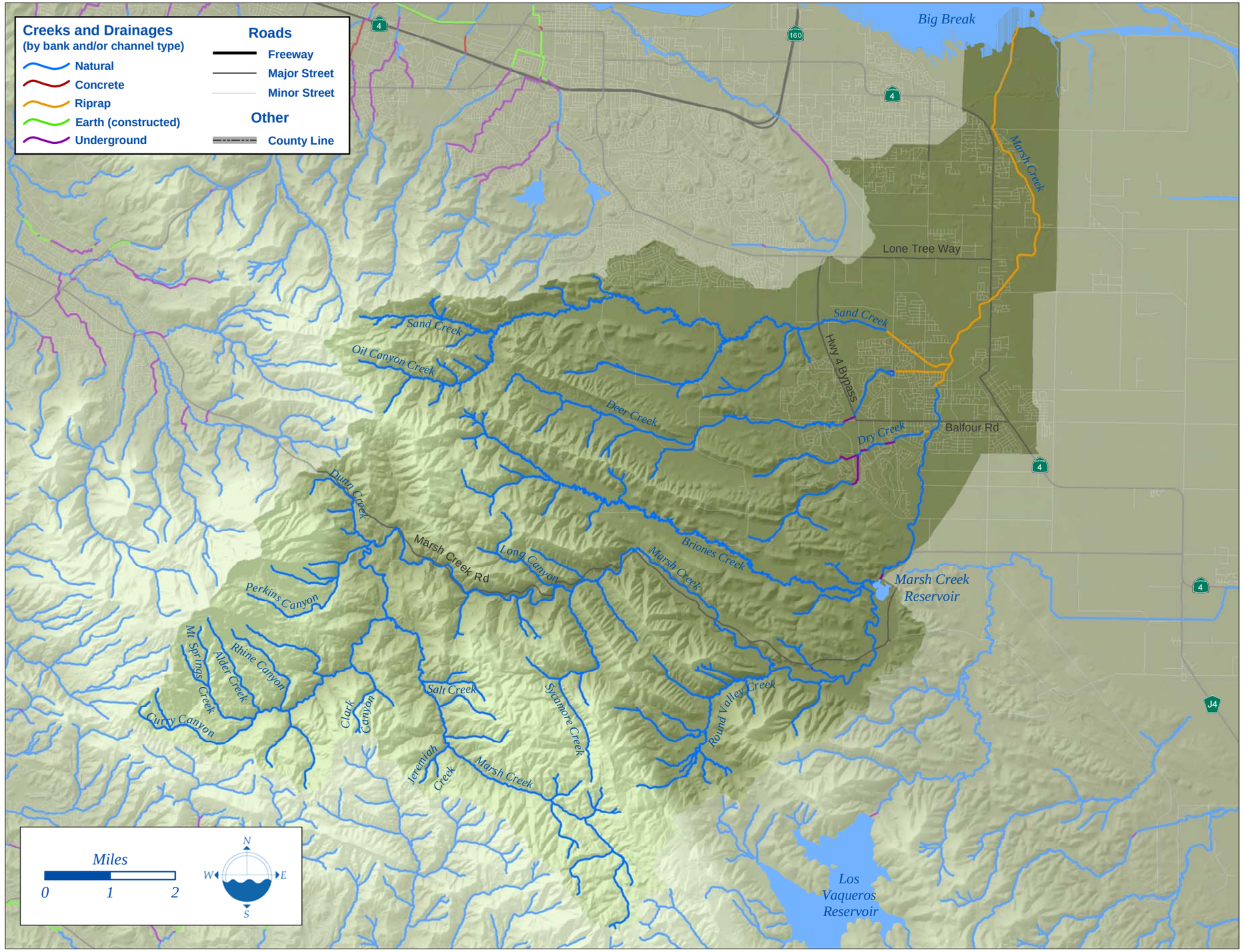
CCC Flood Control District

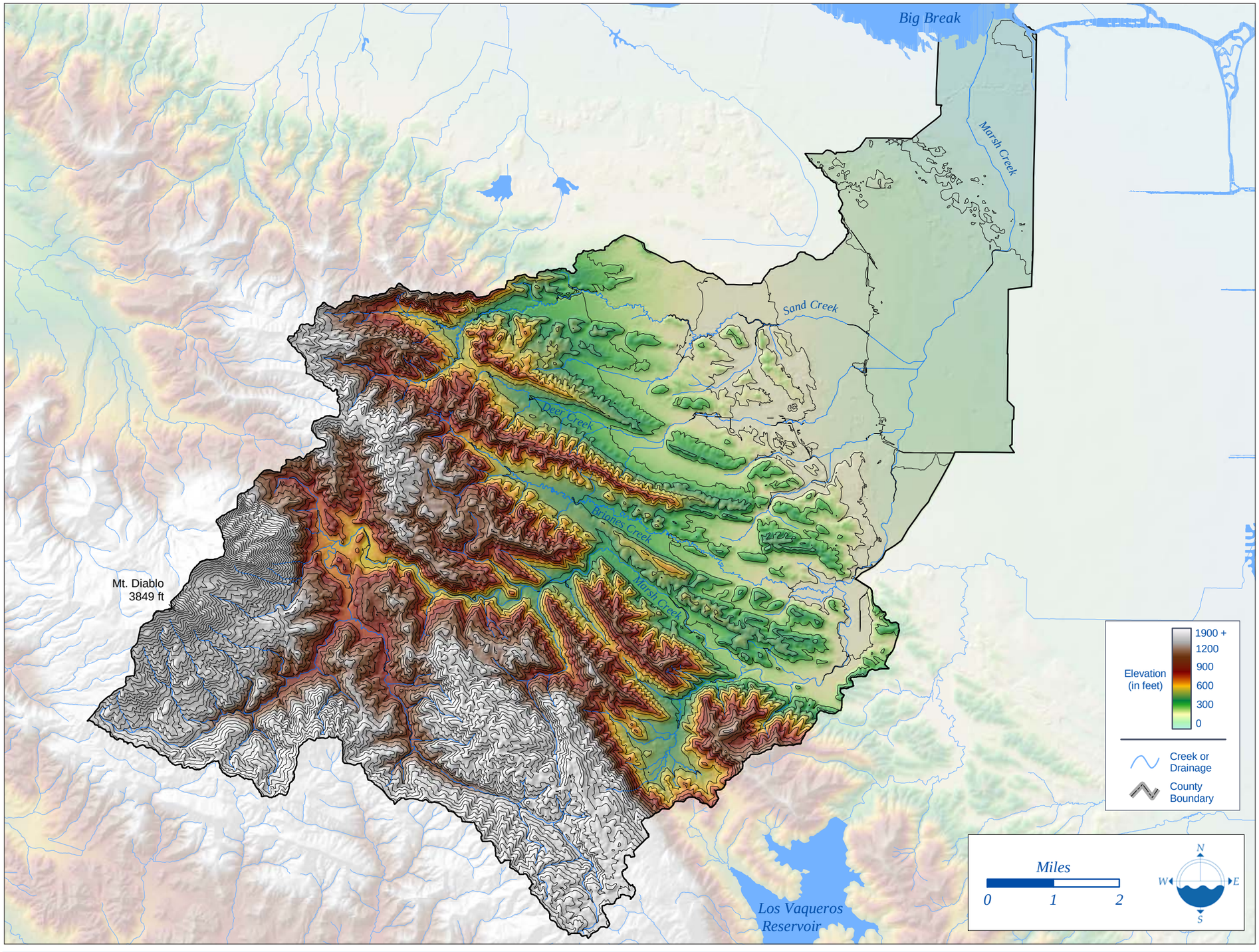
Marsh Creek floods Delta Road, 1952

Marsh Creek Channel Length Statistics*

	Miles	Percent
Length of Longest Branch of Creek	34.57	
Total Channel Length in Watershed	167.18	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	156.94	93.9%
Concrete	1.36	0.8%
Earth (constructed)	0.00	0.0%
Riprap	8.88	5.3%
Underground	1.36	0.8%

*Data relate to mapped channels only. Does not include storm drains. Bank type for segments shorter than 100 feet was not mapped.



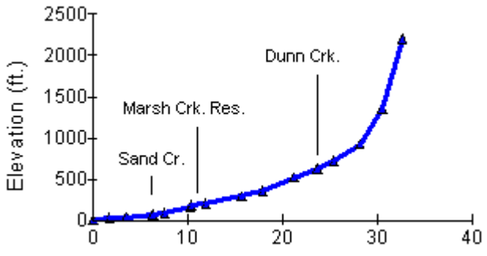


Marsh Creek goes through hydrologic, geologic and topographic changes as it leaves its steep, rocky headwaters and enters the alluvial plain north of the Marsh Creek Reservoir. Historically, Marsh Creek meandered through this alluvial area. However, since 1856 and the establishment of Rancho Los Meganos, and more drastically after the turn of the century, farmers and flood control authorities have altered the channel and the surrounding landscape dramatically to protect agricultural resources. The building of levees, detention basins, dams, and reservoirs, as well as the culverting, straightening, and creation of concrete-lined channels, led to a severe reduction in riparian habitat and vegetation, as well as the intended alteration of flow.

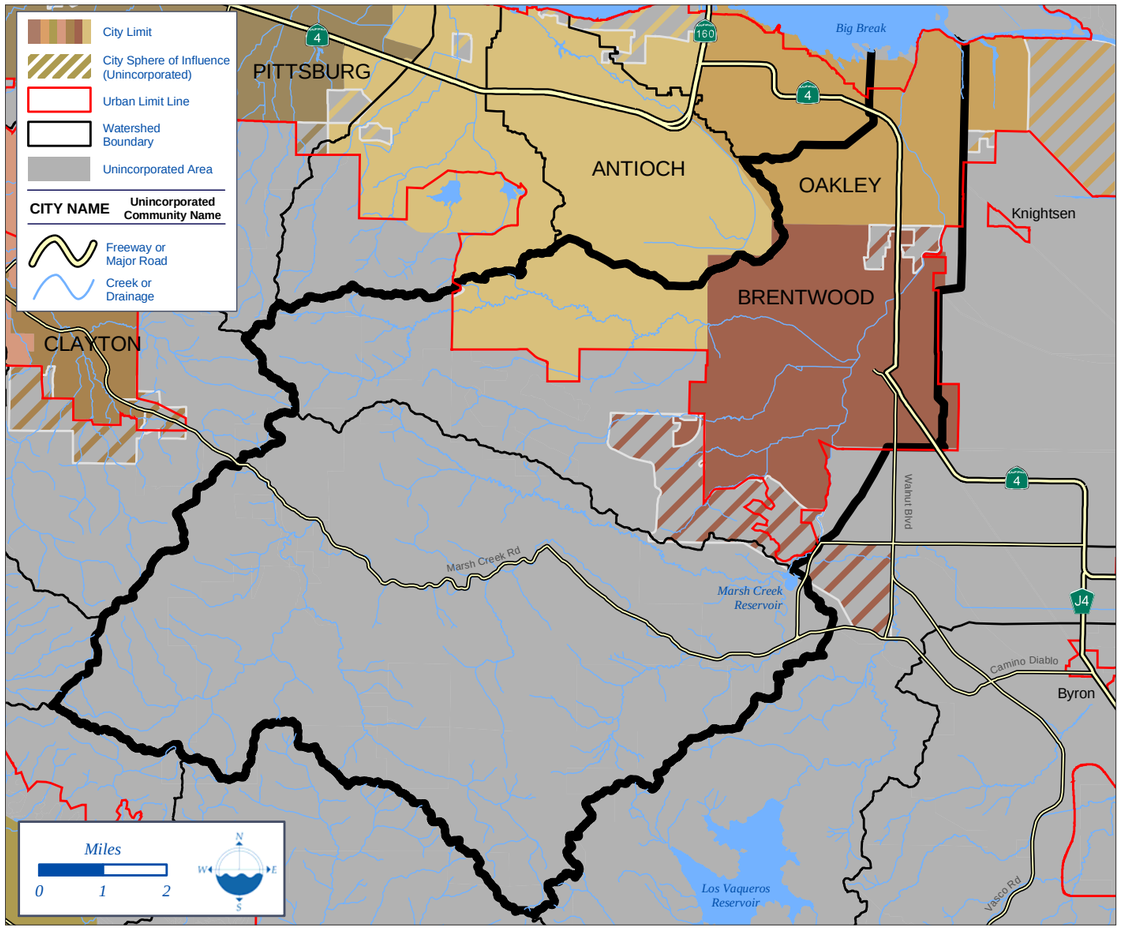
Hydrology in the eastern portion of the watershed is complex due to the number of irrigation canals and diversions. The eastern watershed boundary for the Marsh Creek watershed was generated using CCC Flood Control drainage inventory and topographical information only.

Natural Heritage Institute

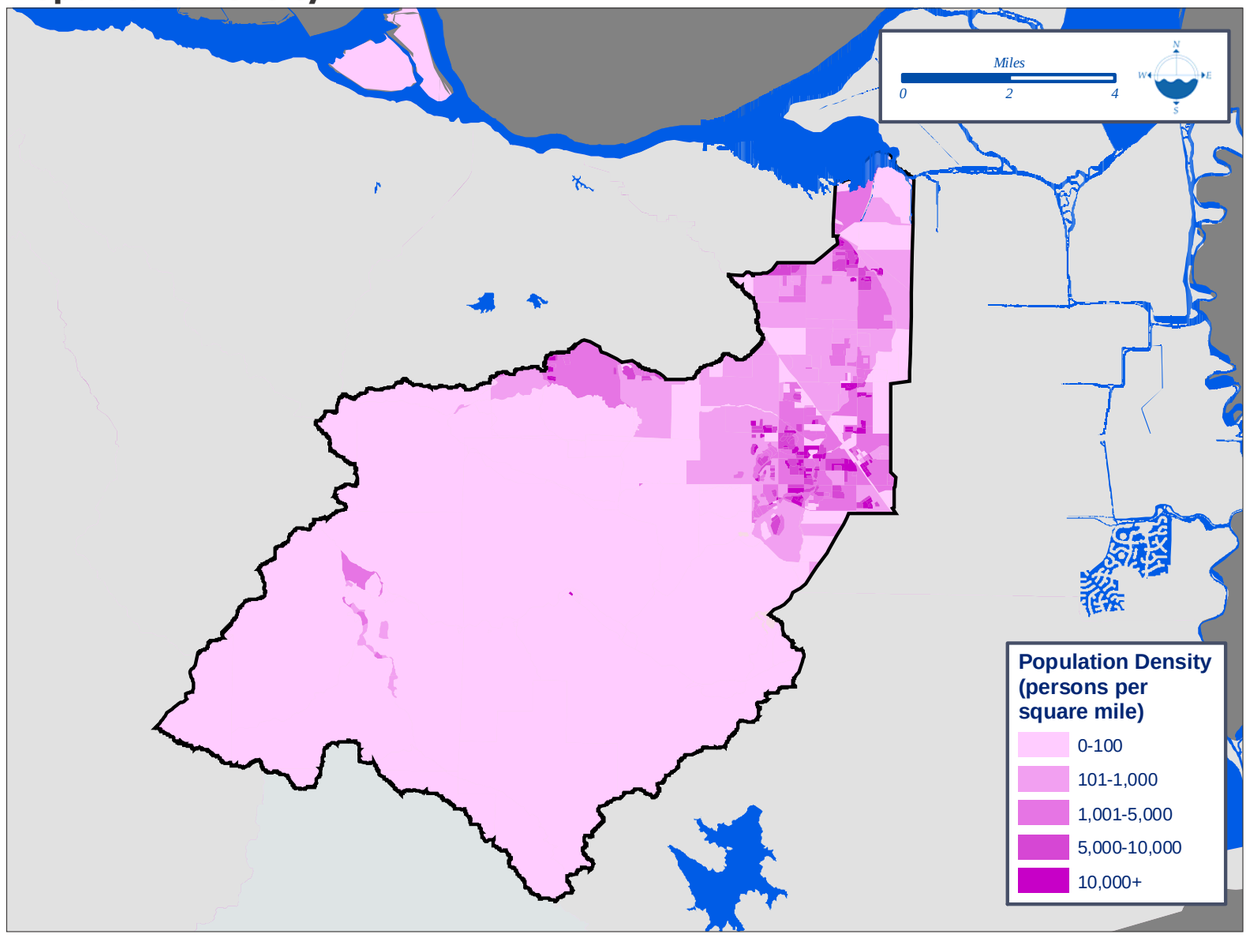
Marsh Creek Profile

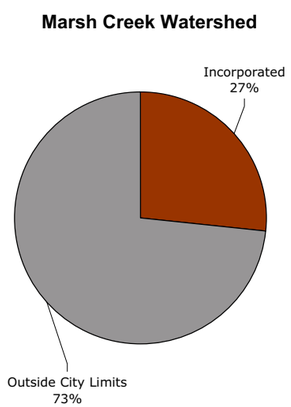


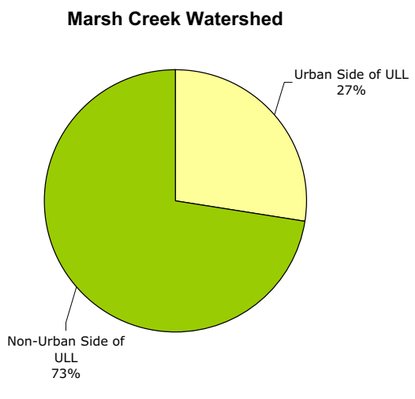
Political Boundaries



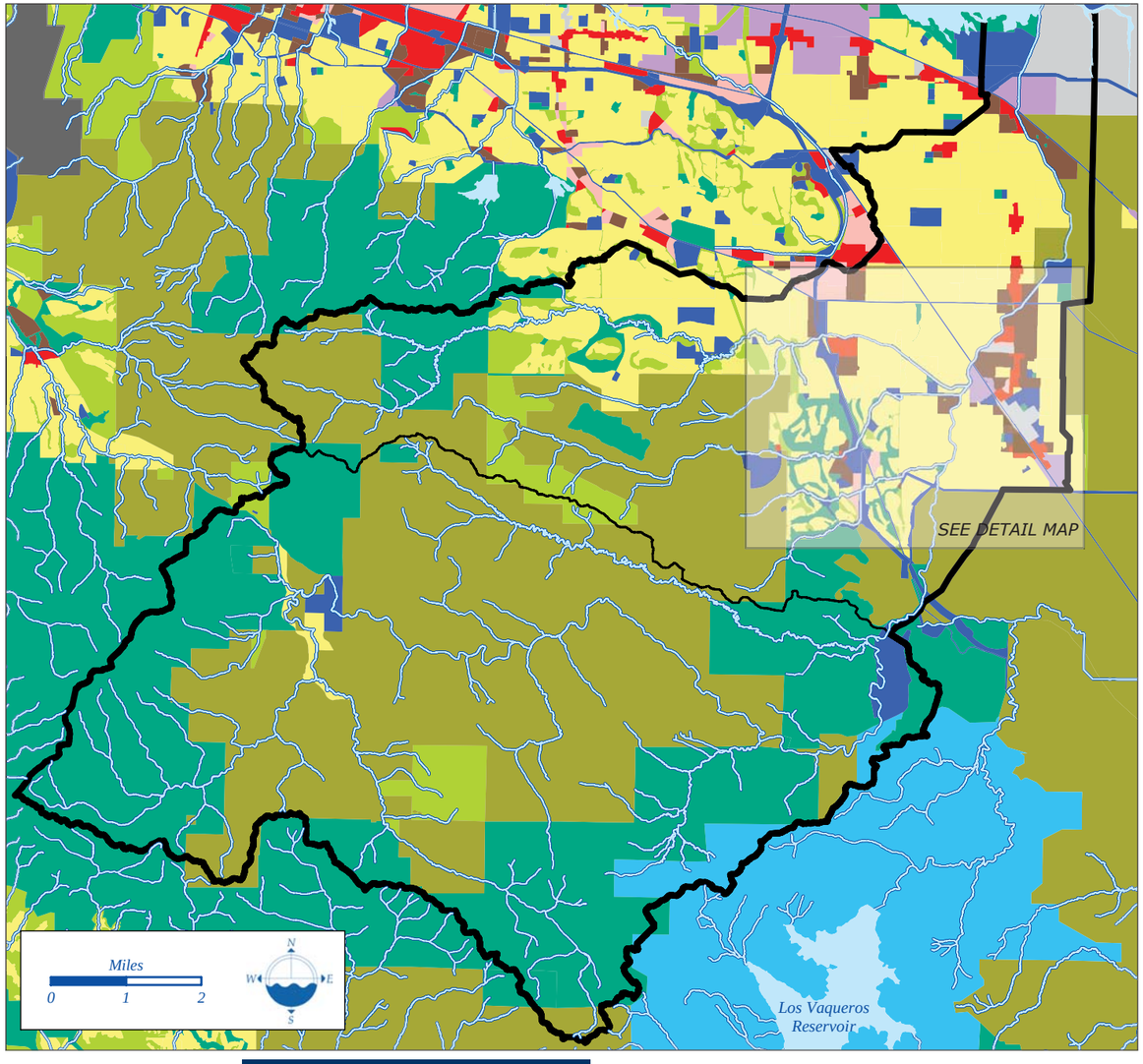
Population Density

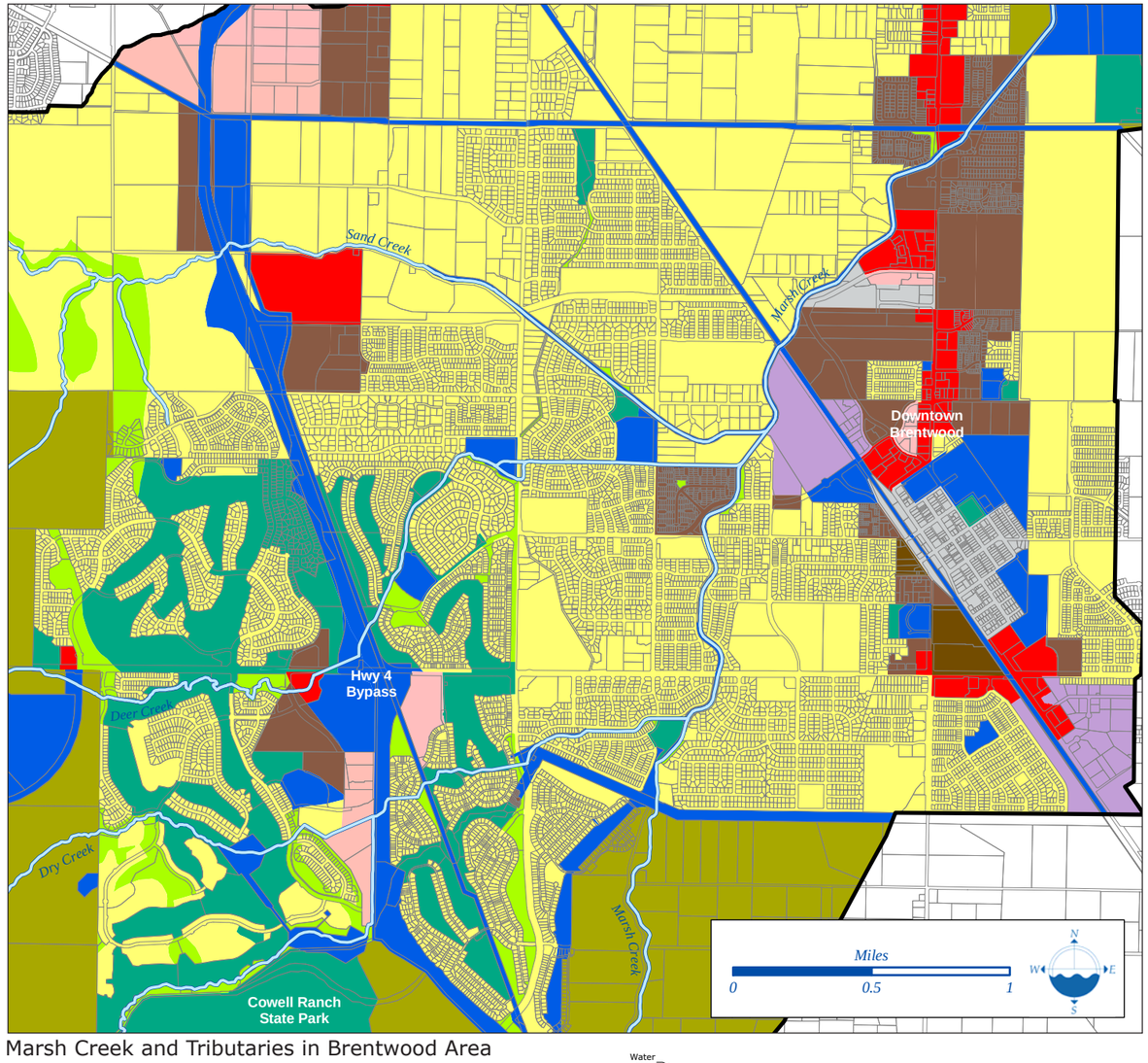






Demographic Profile for Selected Communities In or Near the Marsh Creek Watershed			
Population	Antioch	Brentwood	Oakley
Total Population	90,814	23,284	25,465
Race and Ethnicity	Antioch	Brentwood	Oakley
White	55.8%	63.0%	64.6%
Hispanic or Latino	22.0%	28.9%	24.6%
Black or African American	9.3%	1.2%	2.6%
Asian	7.1%	3.1%	2.9%
Some Other Race	1.2%	0.5%	0.7%
Two or More Races	4.5%	3.3%	4.6%
Education (maximum level attained)	Antioch	Brentwood	Oakley
No High School Diploma	14.3%	17.1%	15.2%
High School Diploma or Equivalent	58.6%	54.1%	62.8%
Associate Degree	8.9%	7.9%	8.3%
Bachelor's Degree	13.5%	15.2%	10.6%
Master's or Professional School Degree	4.2%	5.3%	2.8%
Doctorate Degree	0.4%	0.4%	0.3%
Income	Antioch	Brentwood	Oakley
Median Household Income	$60,359	$69,198	$65,589





Marsh Creek and Tributaries in Brentwood Area

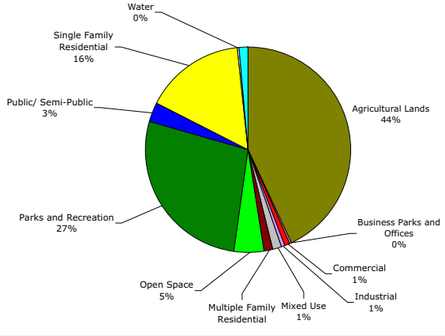
Planned Land Uses *Marsh Creek Watershed*	Acres
Agricultural Lands	25,890
Business Parks and Offices	217
Commercial	416
Industrial	355
Mixed Use	765
Multiple Family Residential	847
Open Space	2,823
Parks and Recreation	16,387
Public/ Semi-Public	1,837
Single Family Residential	9,560
Water	201
Watershed (Public)	769
Total	**60,066**

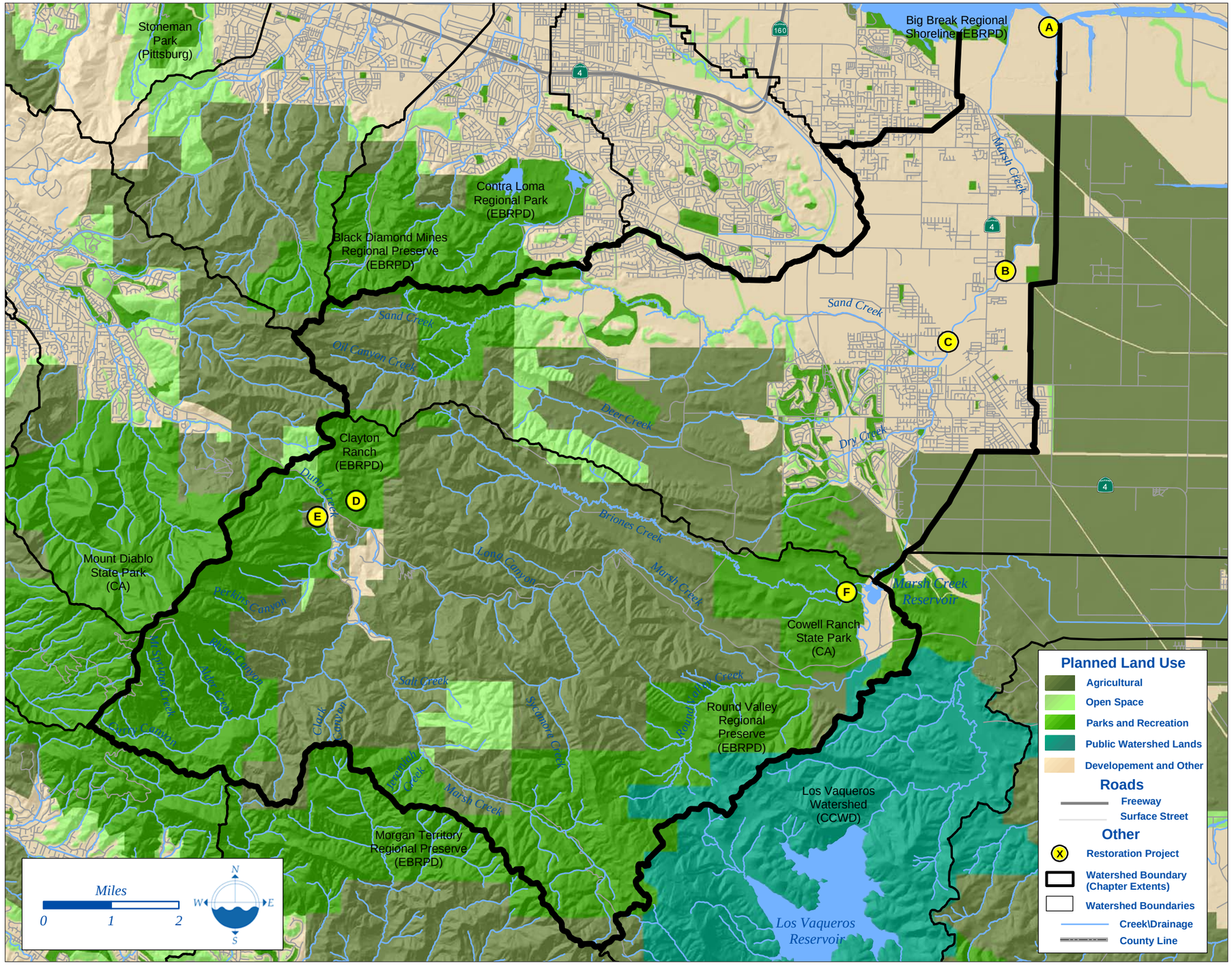
Creek or Drainage

Parcels

Planned Land Use

- Single Family Residential
- Multiple Family Residential
- Commercial
- Office/ Business Park
- Industrial
- Landfill
- Mixed Use
- Public/ Semi-Public
- Parks and Recreation
- Open Space
- Agricultural Lands
- Water
- Public Watershed Lands





Restoration Projects

(A) Dutch Slough Restoration Project: Restore a variety of tidal wetlands and other habitats in an 1,200-acre area that has historically been used for dairy farms. Funding is provided by the CALFED Bay-Delta Program and the California Coastal Conservancy. Lead Agency: CA Department of Water Resources, CA Coastal Conservancy, the Conservation Fund, Natural Heritage Institute, and the CALFED Bay-Delta Program. Project is currently in design phase. It is expected to be a multi-year project.

(B) Fish Passage Barrier Removal: Modification of a drop structure in Marsh creek to allow fish to pass. Lead Agency: Natural Heritage Institute partnered with CCC Flood Control and Water Conservation District. Anticipated Project Completion: 2005.

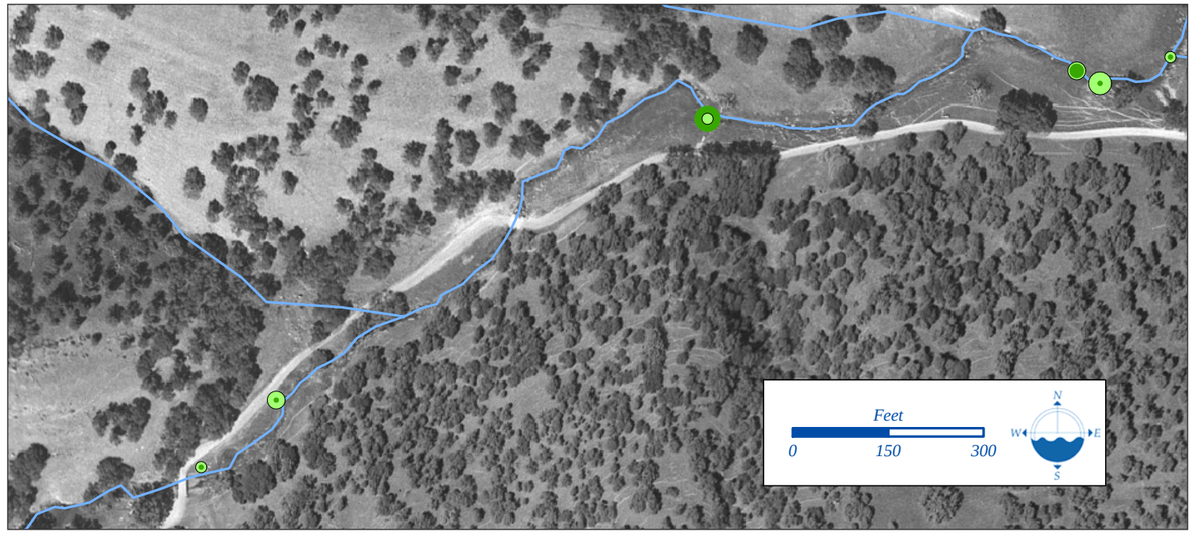
(C) Lower Marsh Creek Habitat Enhancement (proposed): Acquisition and restoration of riparian corridors on Marsh, Sand and Deer Creeks. Funding for this project is provided by the CA State Parks Riparian and Riverine Program, the Department of Water Resources Urban Streams Restoration Program, and the City of Brentwood. Lead Agency: City of Brentwood partnered with the Natural Heritage Institute and Contra Costa County Flood Control District. Anticipated Project Completion: 2006.

(D) Clayton Ranch Resource Enhancement: Restore creek bed from stock pond, improve local spring, and clean up trash and debris. This project was funded by West Coast Home Builders mitigation funds. Lead Agency: East Bay Regional Park District. Project completion: 2001.

(E) Marsh Creek Mercury Mine Remediation: Remediate mercury leaching from old mercury mine in upper watershed. This project is seeking funding. Anticipated completion date is unknown.

(F) Marsh Creek Reservoir Capacity and Habitat Restoration Project: Increase the capacity of Marsh Creek reservoir to prevent downstream flooding. Restore adjacent habitat. This project is seeking funding. Lead Agency: Contra Costa Flood Control District. Anticipate project completion date is unknown.

Baseline Invasive Plants



Yellow Star Thistle on right bank

Yellow Star Thistle on left bank

Creek or Drainage

Dots are sized proportionally to the size (length along creek corridor) of the stand of yellow star thistle. Length along the creek corridor was measured from the downstream end of the stand. Stands of thistle range from 2 to 10020 feet along the channel.

Jo-Ann Ordano @ CA Academy of Sciences

Yellow Star Thistle

Volunteers pause to record a data point in a dry section of Marsh Creek, 2001.

Introduced to the California landscape as early as the 1900's, yellow star thistle has become common throughout the state. A prodigious seed producer, star thistle quickly spreads and dominates areas. It can be found in grasslands, grazing areas, roadsides, agricultural areas and vacant lots.

Volunteers from Marsh Creek watershed collected data in the upper watershed through Round Valley. One of the many parameters they documented was the prevalence of yellow star thistle along the creek bank. Data indicated that yellow star thistle was not the dominant vegetation. However, the existing conditions, banks with minimal vegetation, make the area susceptible for further invasion of star thistle.

The data provides some baseline data to guide eradication efforts, and future studies of the thistle.

Organizations Active in the Watershed

Contra Costa Resource Conservation District
5552 Clayton Road
Concord, CA 94521
Phone: (925) 672-6522 x 4
Website: www.ccrcd.org

Natural Heritage Institute
Rich Walkling, Sarah Beamish
2140 Shattuck Ave, 5th Floor
Berkeley, CA 94704
Phone: (510) 644-2900
Website: www.n-h-i.org

Delta Science Center
Steve Barbata
Phone: (925) 947-1473
Email: dscatbb@aol.com

Volunteers gather before collecting GPS data on a tributary of Marsh Creek in Round Valley, 2001.

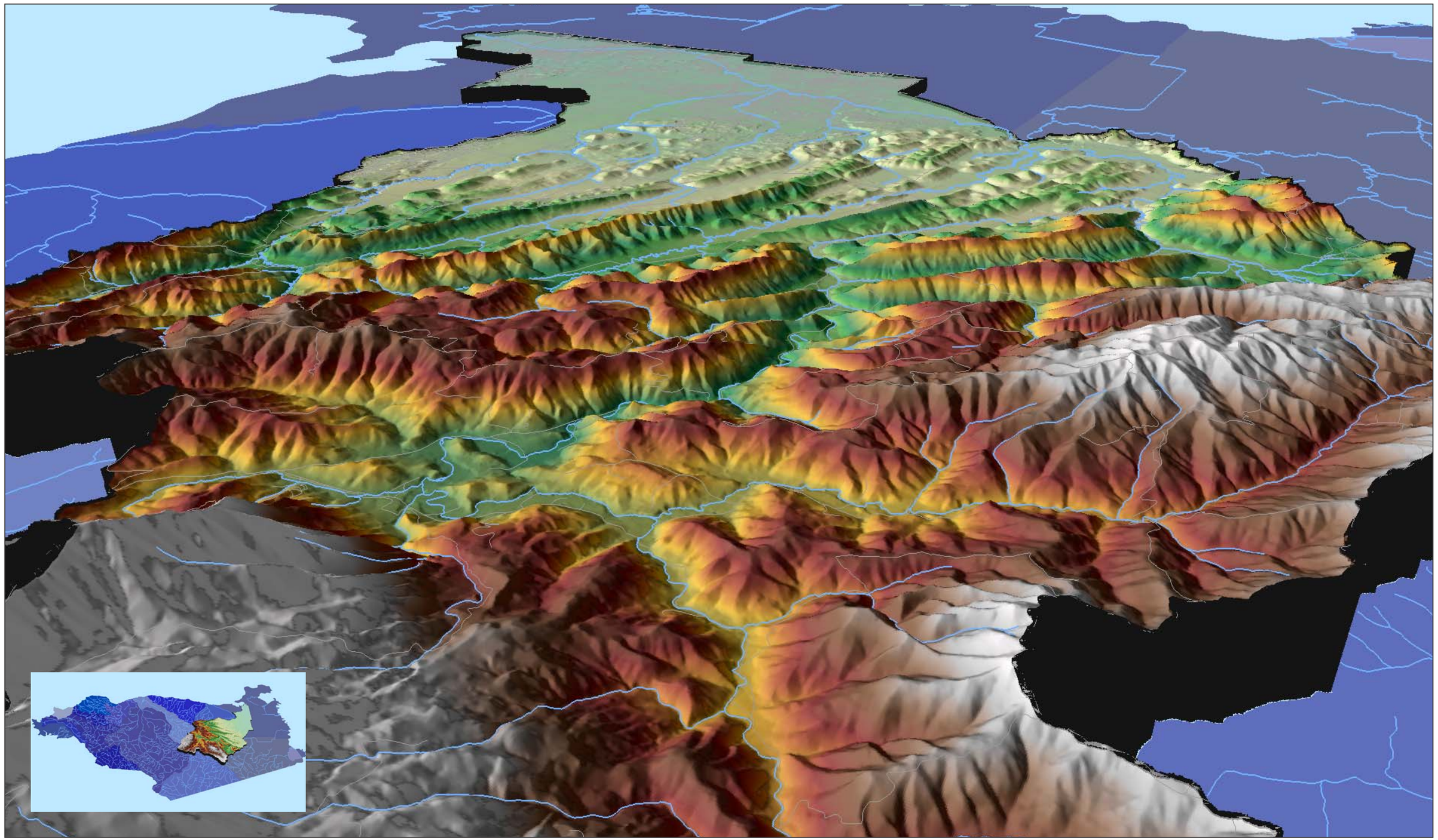
Selected Resources

Natural Heritage Institute, Corridor Width Report, Parcel Inventory and Conceptual Stream Corridor Master Plan for Marsh, Sand and Deer Creeks in Brentwood, CA. Berkeley, CA. 2002.

University of California at Berkeley Department of Landscape Architecture and the Natural Heritage Institute, Envisioning Brentwood's Creeks: A Green Resource for the Future. Berkeley, CA. 2002.

Natural Heritage Institute and the Delta Science Center, The Past and Present Condition of the Marsh Creek Watershed, 3rd edition. Berkeley, CA. 2003.

Contra Costa Resource Conservation District, Marsh Creek Watershed Issues Catalog. Concord, CA. 2003



Marsh Creek Watershed 3D: Looking Northeast to Big Break from the upper watershed.

Contra Costa County Department of Agriculture

Contra Costa County Department of Agriculture

San Joaquin River

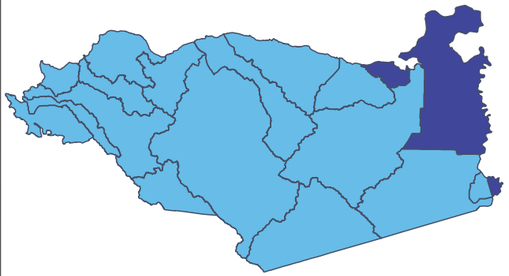
Big Break

Franks Tract

Miles
0 1 2

N W E S

Chapter 14
East County Delta Drainages

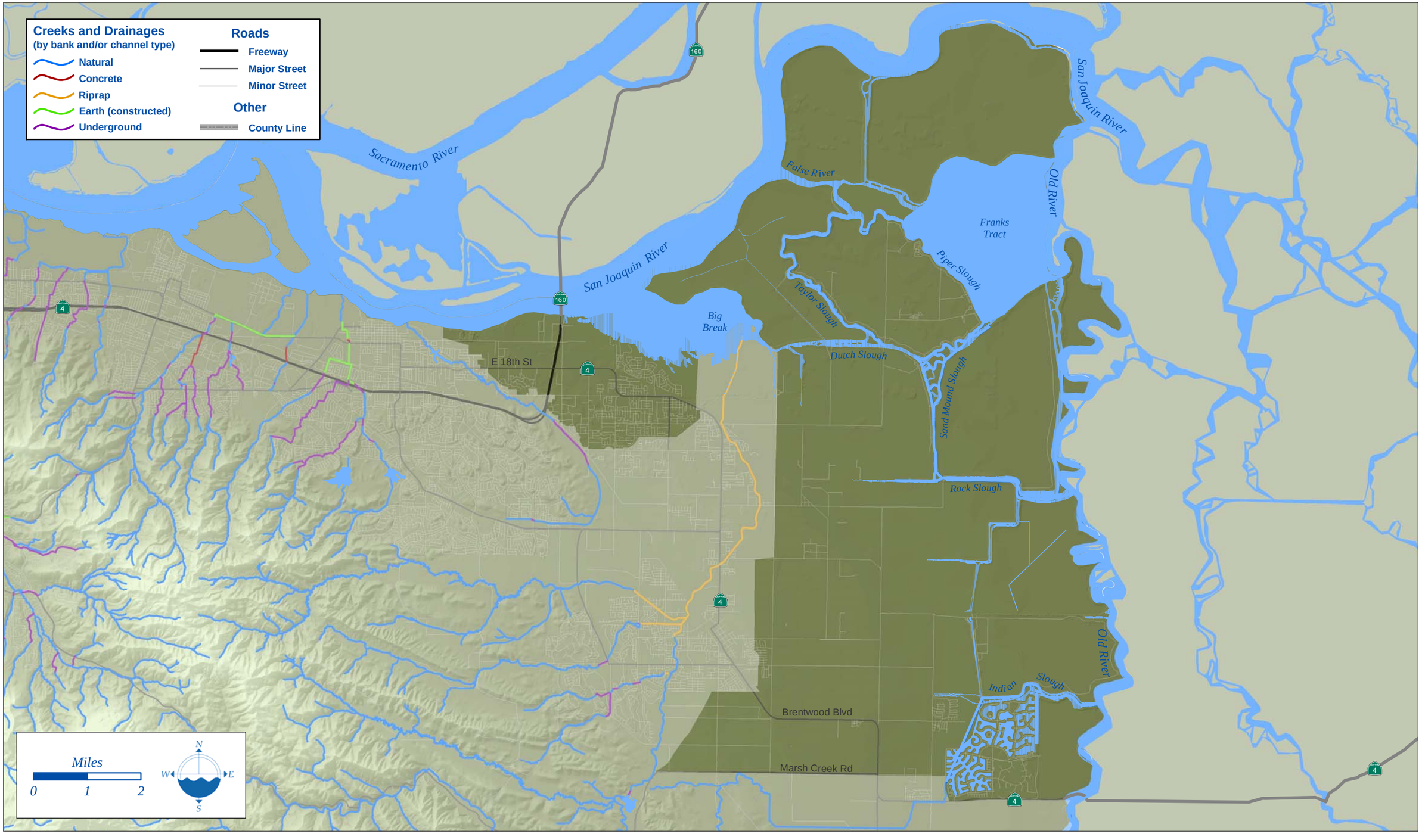


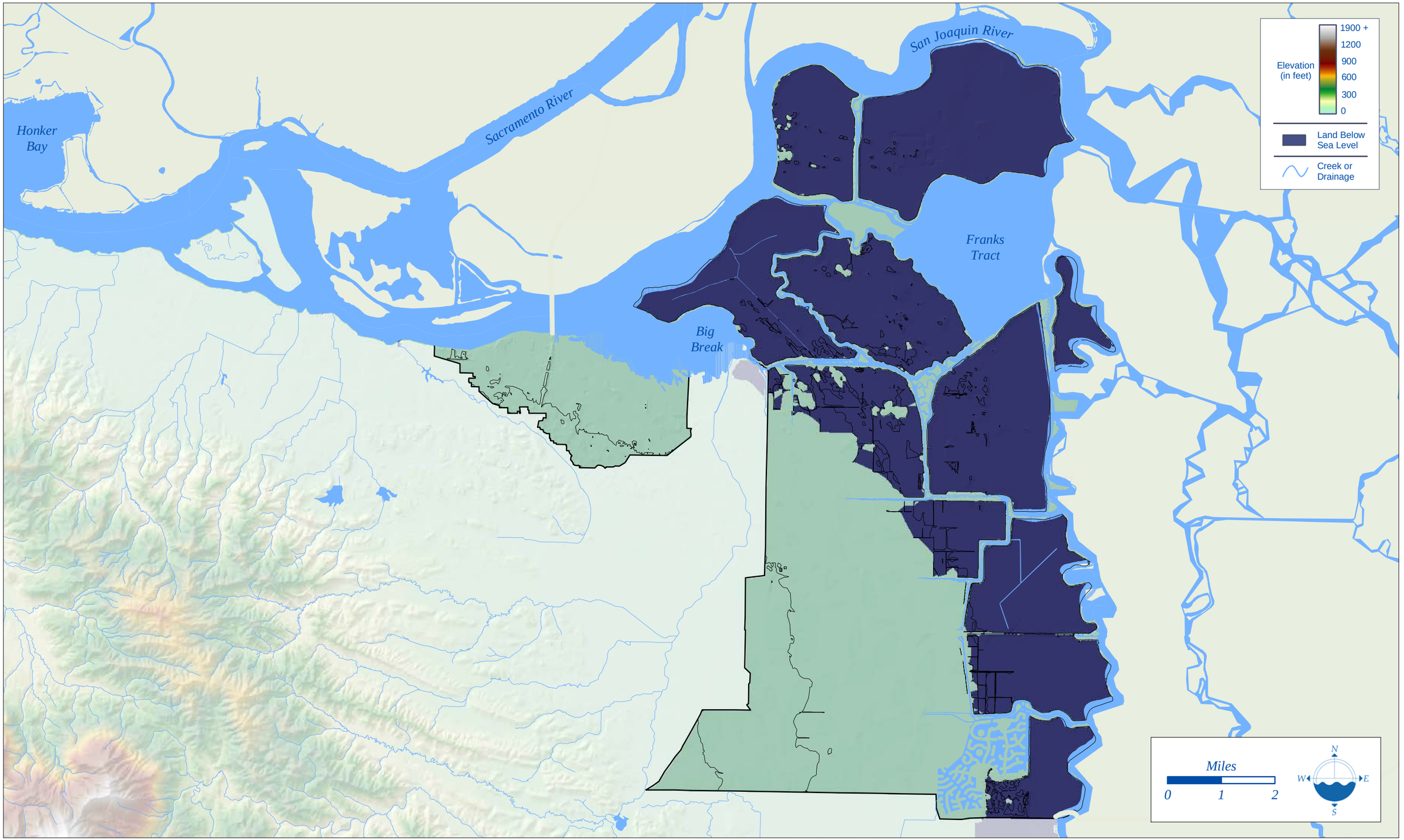
Water that falls in the Great Central Valley of California and in most of the Sierra Nevada Mountains ultimately flows to the Pacific Ocean through the Sacramento-San Joaquin Delta and along the shorelines of Contra Costa County. More than half of California's water needs (and a large portion of the County's) are met with water pumped from the Delta in Eastern Contra Costa County (Clifton Court Forebay in Brushy Creek Watershed is the primary diversion point). All of these Bays and much of the Delta is tidally influenced. Delta islands are kept dry by peripheral levees—the interiors of these islands have subsided below sea level as soils reclaimed from marsh have oxidized. Major levee breaks have created new water bodies such as Franks Tract and the aptly named Big Break.

Naturally-occuring, rich soil in the area has attracted the agricultural industry to this region. Sediment deposited in the low lands by repeated flooding from the delta created this fertile environment.

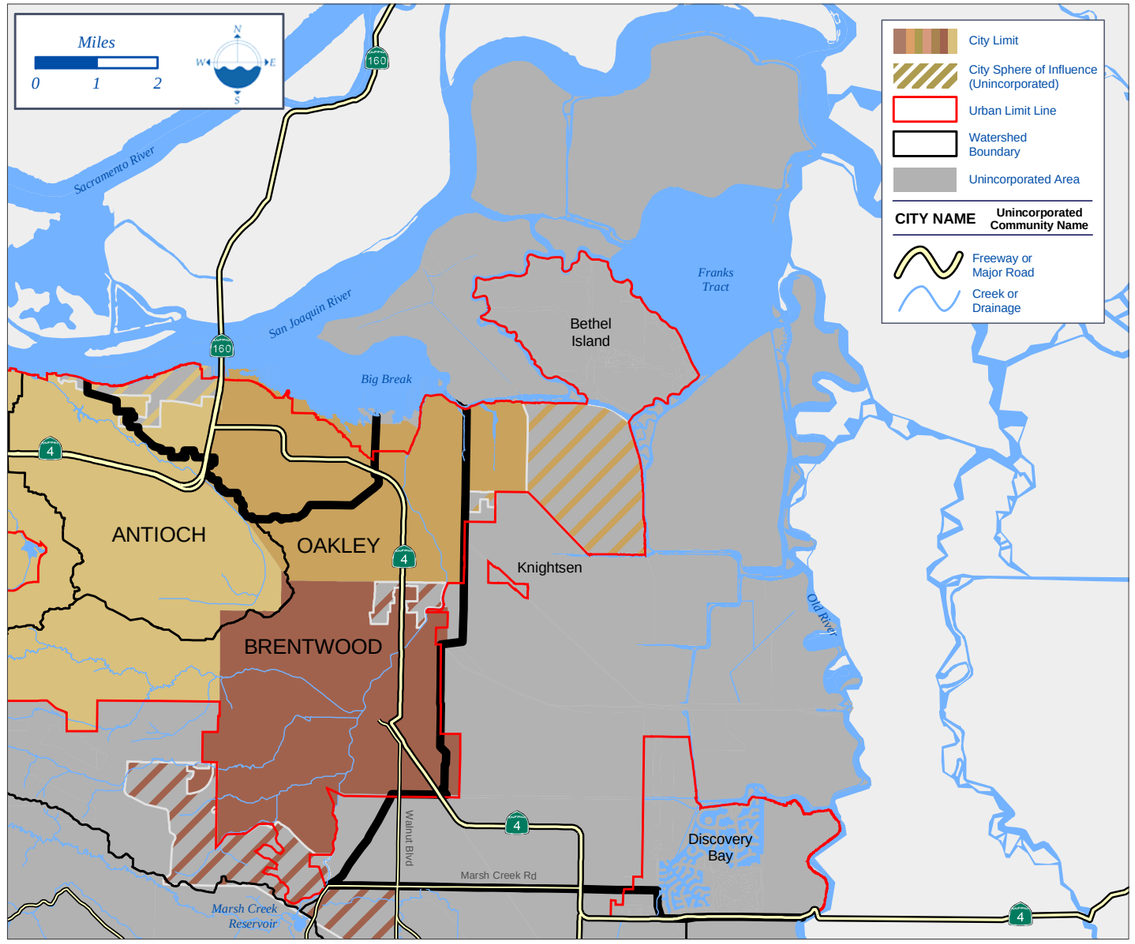
Flood control infrastructure was constructed to protect farmland, and irrigation canals crisscross the land to channel water through the region. Agriculture is and historically has been the economic mainstay of this part of eastern Contra Costa County.

East County Delta Drainages Vital Statistics	
Watershed Size	56,223 acres
Average Annual Rainfall	11 inches
Highest Elevation in Watershed	100 feet
Lowest Elevation in Watershed	-20 feet
Population (estimated)	33,100 people
Estimated Percent Impervious	10 %

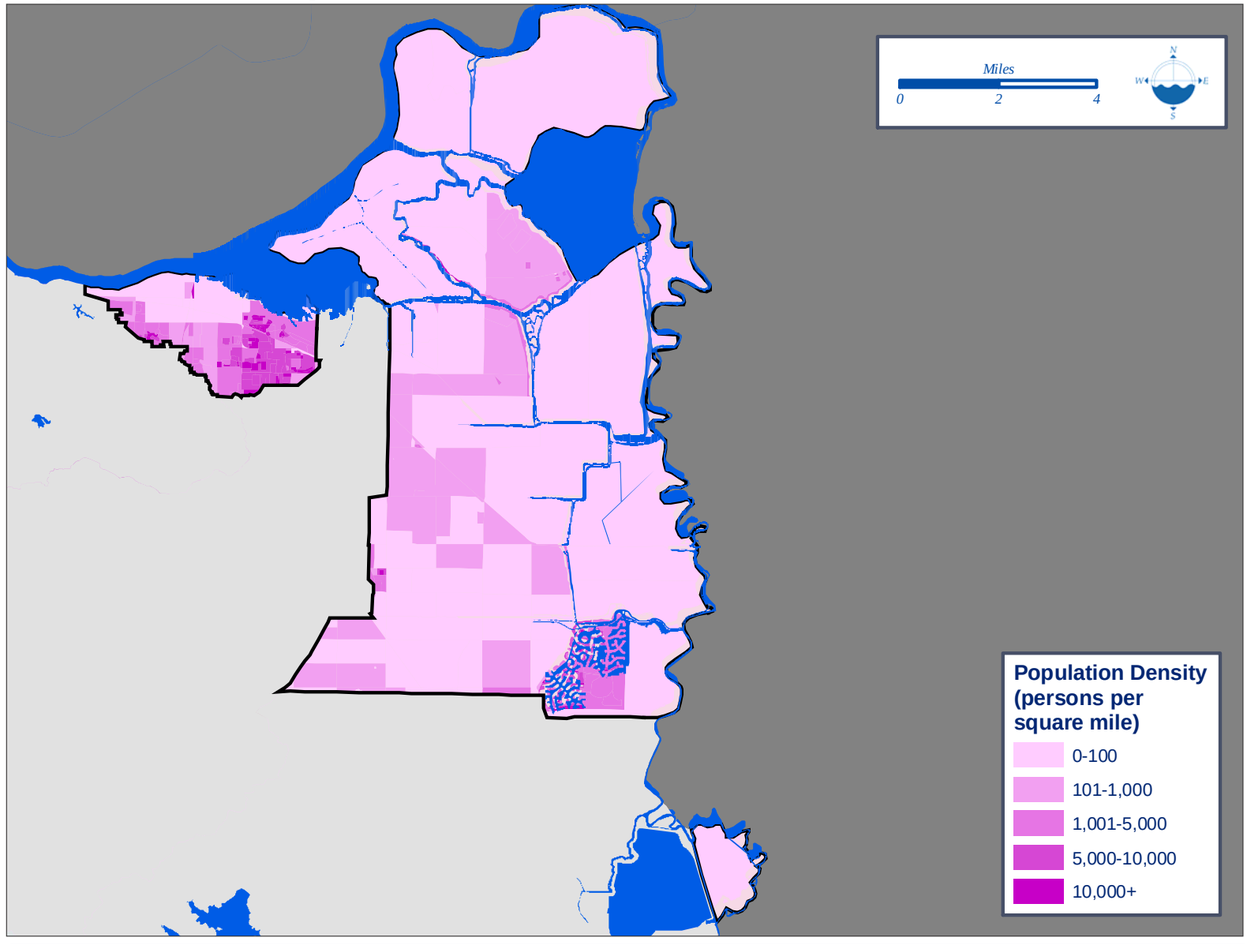

Creeks and Drainages
(by bank and/or channel type)
Natural
Concrete
Riprap
Earth (constructed)
Underground
Roads
Freeway
Major Street
Minor Street
Other
County Line
Sacramento River
San Joaquin River
False River
San Joaquin River
Old River
Franks Tract
Piper Slough
Taylor Slough
Big Break
Dutch Slough
Sand Mound Slough
Rock Slough
Old River
Indian Slough
E 18th St
Brentwood Blvd
Marsh Creek Rd
160
4
Miles
0
1
2
N
W
E
S


Honker Bay
Sacramento River
San Joaquin River
Big Break
Franks Tract
Elevation (in feet)
1900 +
1200
900
600
300
0
Land Below Sea Level
Creek or Drainage
Miles
0
1
2
N
W
E
S

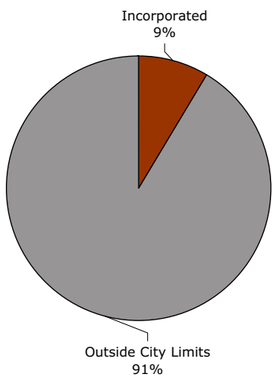
Political Boundaries



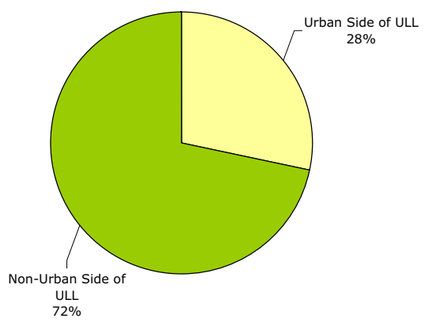
Population Density



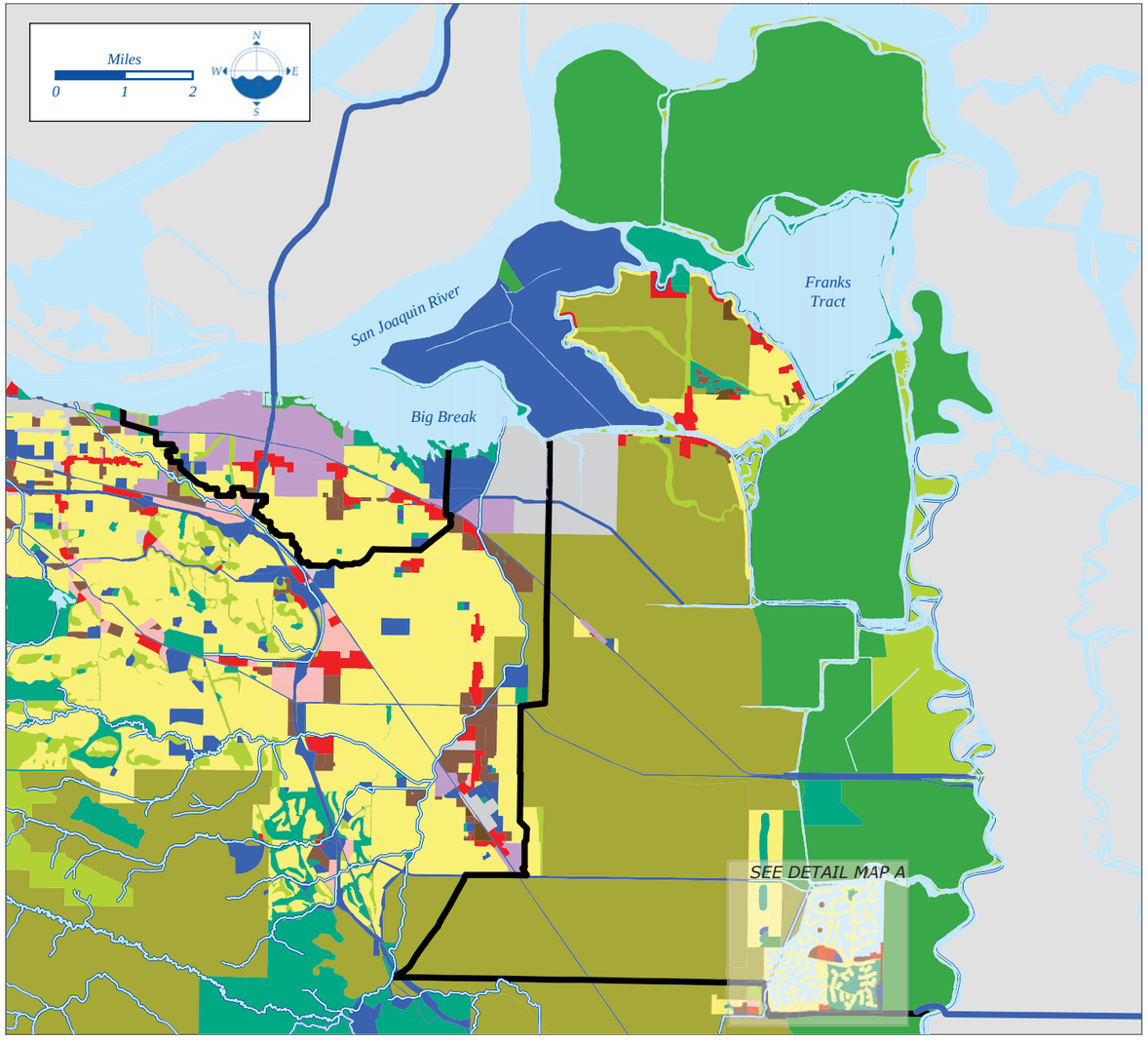
East County Delta Drainages

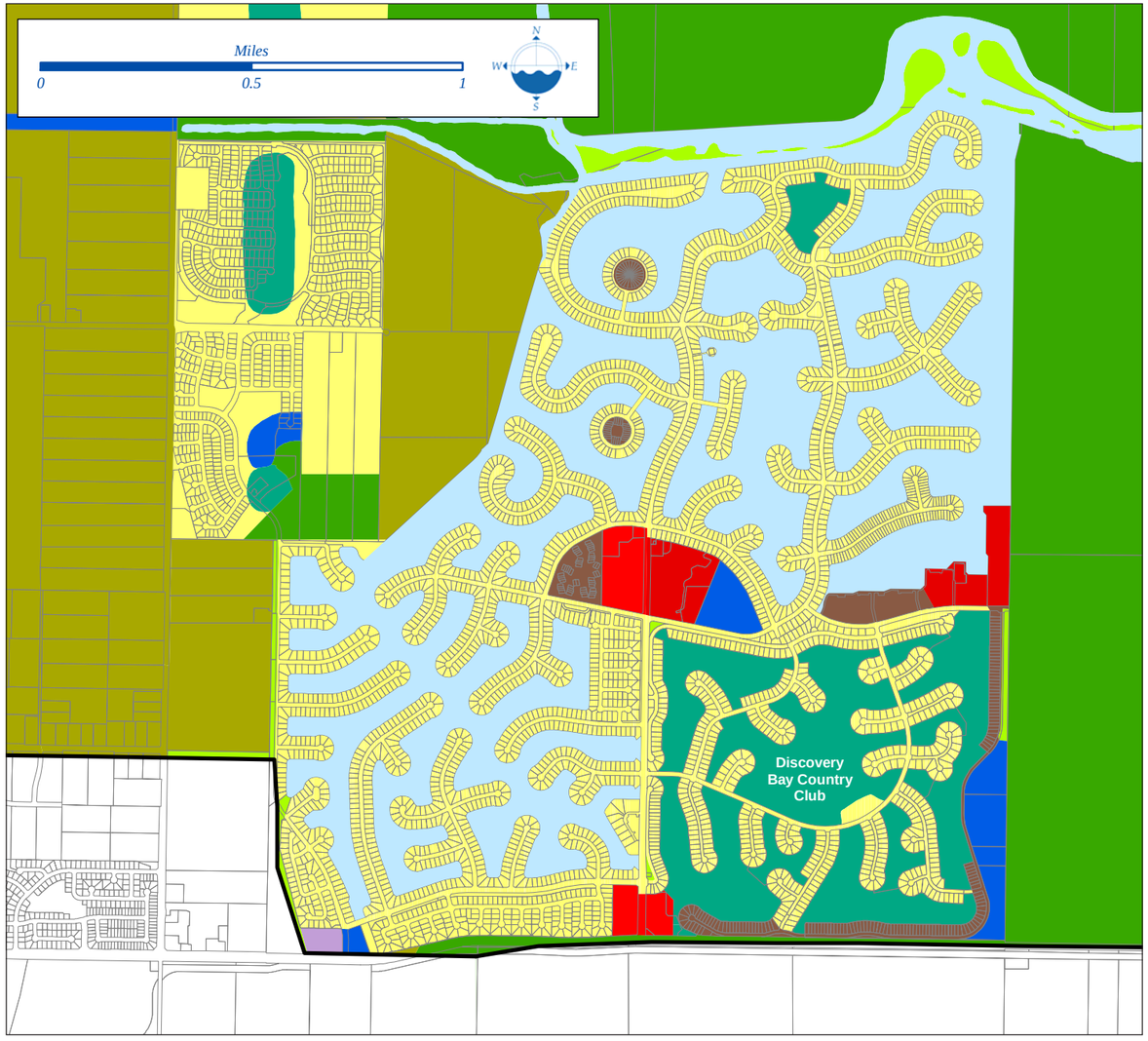


East County Delta Drainages



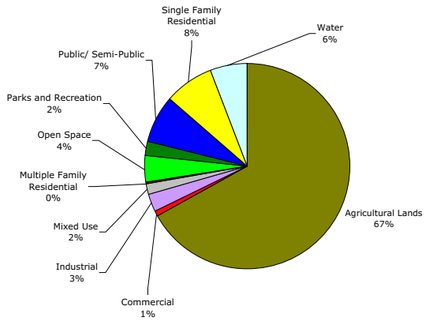
Demographic Profile for Selected Communities In or Near the Kellogg and Brushy Creek Watersheds			
Population	Brentwood	Byron	Discovery Bay
Total Population	23,284	884	8,847
Race and Ethnicity	Brentwood	Byron	Discovery Bay
White	63.0%	59.3%	81.8%
Hispanic or Latino	28.9%	26.1%	10.7%
Black or African American	1.2%	6.6%	1.8%
Asian	3.1%	1.0%	1.4%
Some Other Race	0.5%	0.9%	1.2%
Two or More Races	3.3%	6.1%	3.1%
Education (maximum level attained)	Brentwood	Byron	Discovery Bay
No High School Diploma	17.1%	25.7%	7.1%
High School Diploma or Equivalent	54.1%	55.5%	53.4%
Associate Degree	7.9%	8.2%	11.6%
Bachelor's Degree	15.2%	6.0%	22.3%
Master's or Professional School Degree	5.3%	4.6%	5.4%
Doctorate Degree	0.4%	0.0%	0.3%
Income	Brentwood	Byron	Discovery Bay
Median Household Income	$69,198	$35,938	$89,915





Detail Map A: Discovery Bay area

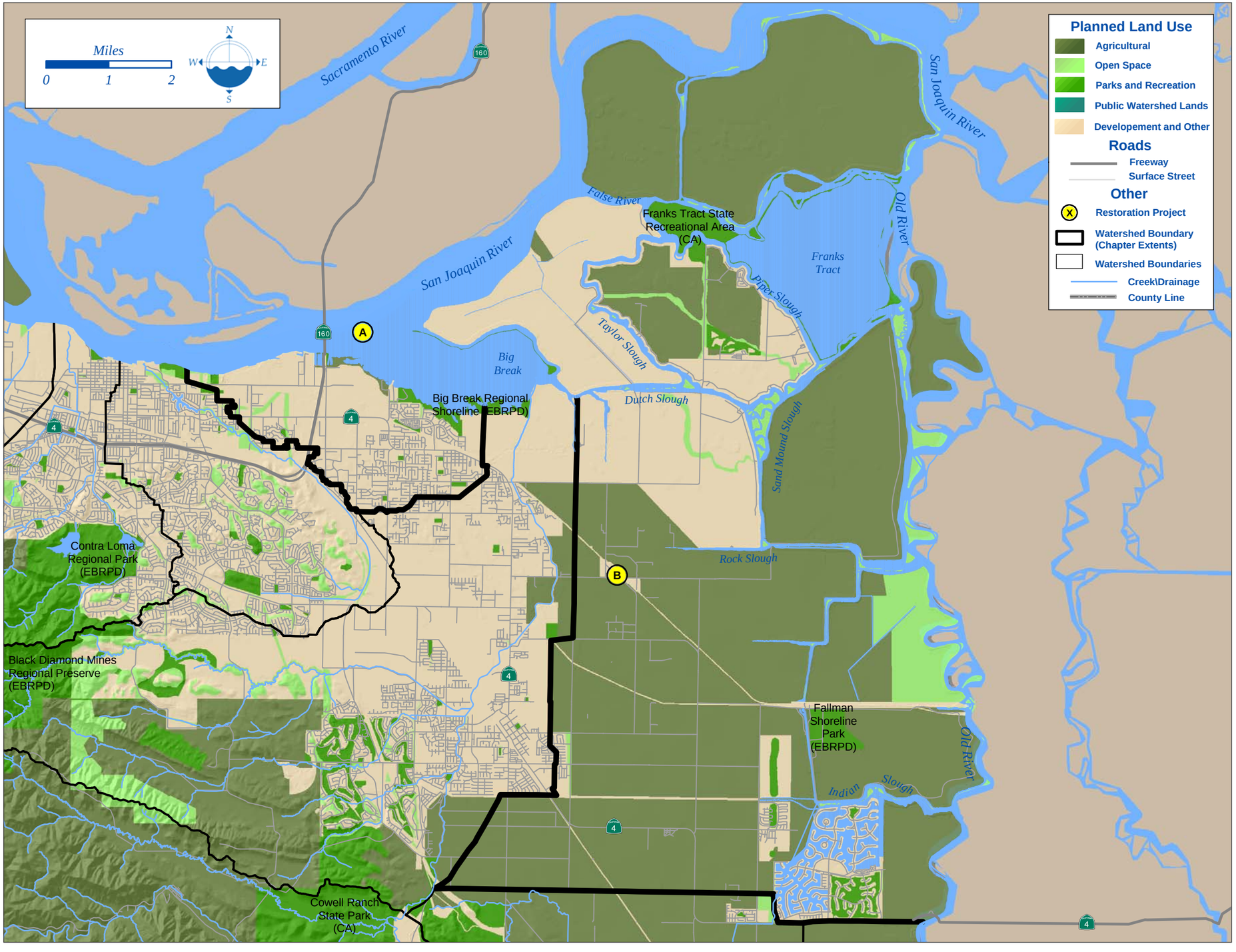
Planned Land Uses *East County Delta Drainages*	Acres
Agricultural Lands	37,589
Business Parks and Offices	0
Commercial	578
Industrial	1,491
Mixed Use	882
Multiple Family Residential	278
Open Space	2,255
Parks and Recreation	1,315
Public/ Semi-Public	4,210
Single Family Residential	4,291
Water	3,334
Watershed (Public)	0
Total	**56,223**



Creek or Drainage
Parcels

Planned Land Use

- Single Family Residential
- Multiple Family Residential
- Commercial
- Office/ Business Park
- Industrial
- Landfill
- Mixed Use
- Public/ Semi-Public
- Parks and Recreation
- Open Space
- Agricultural Lands
- Water
- Public Watershed Lands



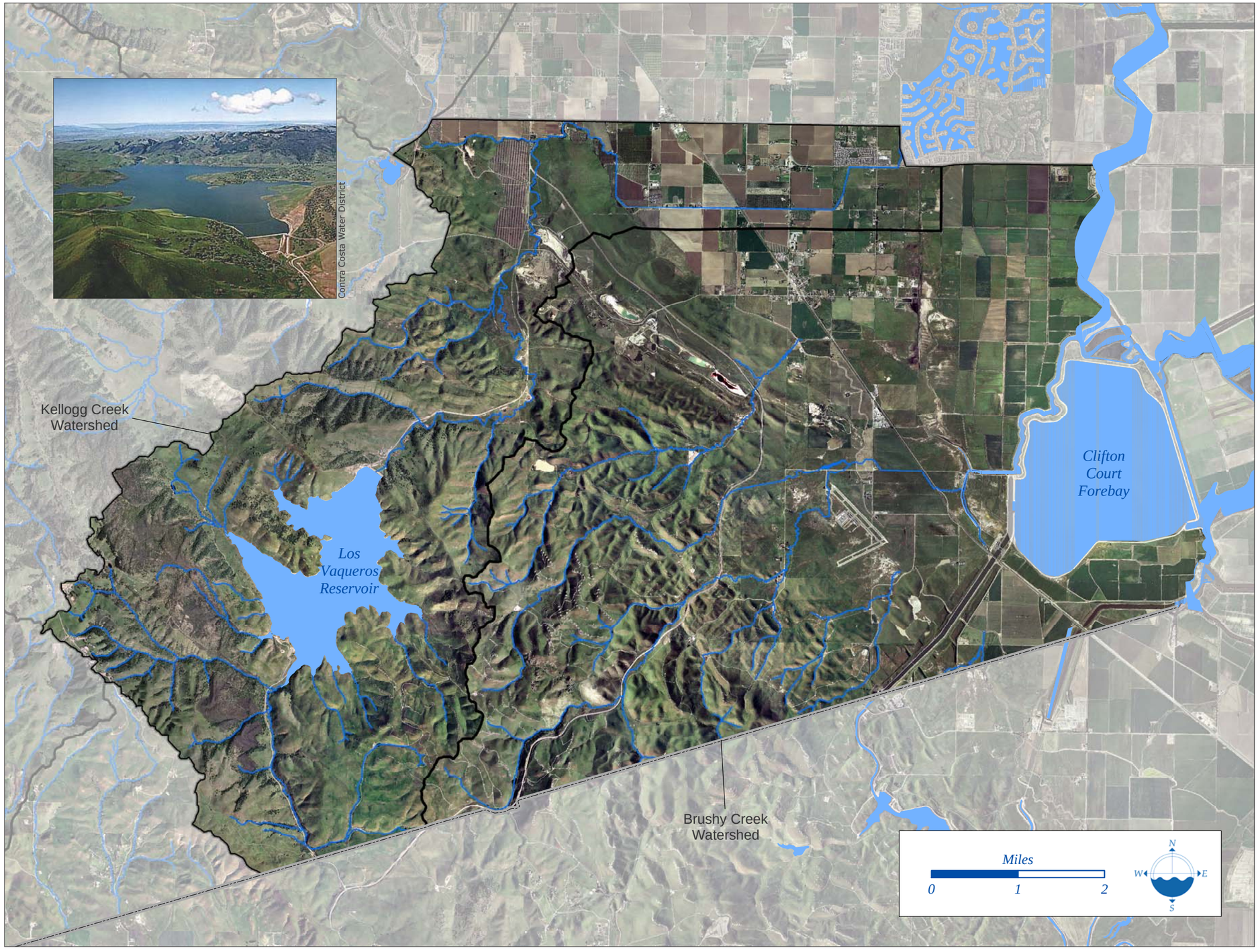
Restoration Projects

(A) "The Water You Play In Is The Water You Drink" (Program): Study and implement actions to target the cumulative impacts of pollutants on Delta water quality. Pollutants such as pathogens (overboard sewage discharge and pet waste), petroleum hydrocarbons (MTBE containing fuel, oil, contaminated bilge water, and solvents), and other liquid wastes (engine and hull maintenance and general marina activities) can be generated and inadvertently discharged into the Delta during recreational boating, waterfront residential occupancy and marina activities. The program will use education and infrastructure to preserve and protect drinking water quality, recreational uses and environmental health in the Delta. This project is funded by CALFED and the State Water Resources Control Board. Lead Agency: Contra Costa County Public Works Department in cooperation with the Contra Costa Water District, California Coastal Commission, Department of Boating and Waterways, and the Environmental Health Investigations Branch of the California Department of Health Services. Anticipated completion date: 2006.

(B) Knightsen Wetlands Biofilter Feasibility Study: Study a wetlands biofilter to provide flood protection and water quality to the Town of Knightsen, which floods on a regular basis. The town is on well systems that are threatened by septic contamination during flooding events. This project is seeking grant funds. Lead Agency: Contra Costa County and Knightsen community. Anticipated completion is unknown.

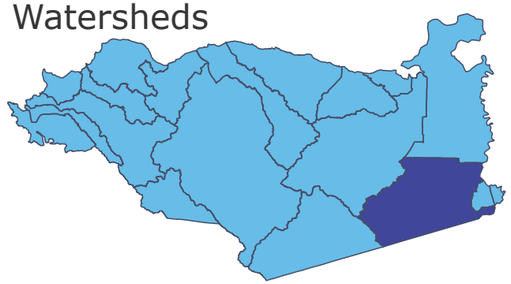
CCC Flood Control District

Flooding near Knightsen, 1952



Chapter 15

Kellogg and Brushy Creek Watersheds



Kellogg Creek and Brushy Creek watersheds are located in the south-eastern portion of Contra Costa County, bordering Alameda and San Joaquin Counties. Due to the rainshadow effect of Mount Diablo, average rainfall in the upper watershed averages approximately 20 inches per year, and falls to 10 inches or less in the lower parts of the watershed. Developed areas remain at a minimum here, with all of the land part of Unincorporated Contra Costa County.

Kellogg Creek Watershed Vital Statistics*		
Watershed Size	20,863	acres
Length of Longest Branch of Creek	25.34	miles
Total Channel Length in Watershed	67.64	miles
Average Annual Rainfall	16	inches
Estimated Mean Daily Flow	N/A	
Estimated 100-Year Flood Flow	4020	
Highest Elevation in Watershed	2,280	feet
Population (estimated)	1,400	people
Estimated Percent Impervious	<5	%
Recognized Pollutants of Concern	N/A	**

Brushy Creek Watershed Vital Statistics*		
Watershed Size	24,422	acres
Length of Longest Branch of Creek	12.46	miles
Total Channel Length in Watershed	45.94	miles
Average Annual Rainfall	13	inches
Estimated Mean Daily Flow	N/A	
Estimated 100-Year Flood Flow	N/A	
Highest Elevation in Watershed	1,220	feet
Population (estimated)	900	people
Estimated Percent Impervious	5	%
Recognized Pollutants of Concern	N/A	**

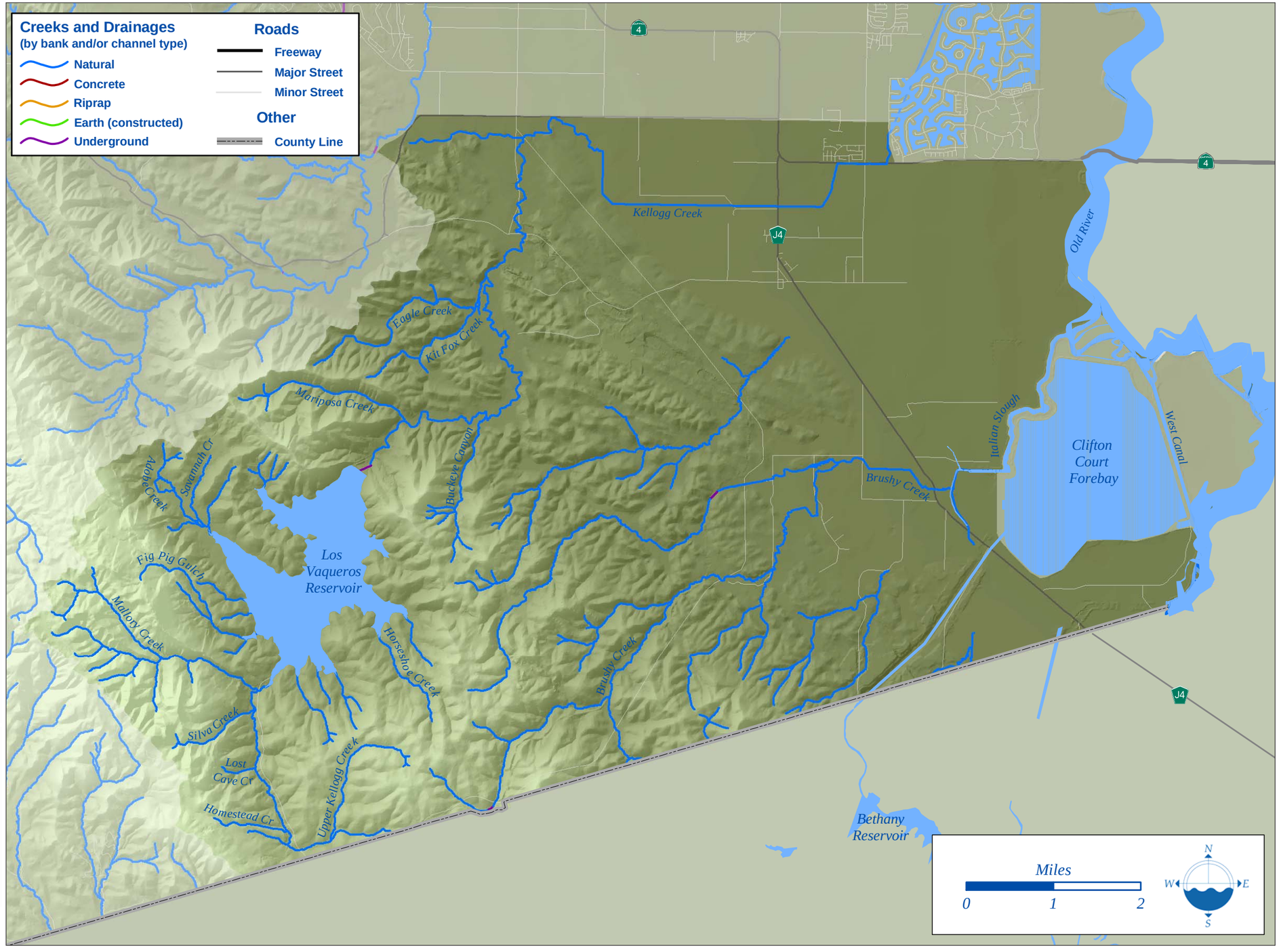
*Statistics reflect Contra Costa County portion of watershed only

**Kellogg and Brushy Creeks have not been specifically identified in the State's 303(d) list of Impaired Water Bodies.

The 20,863-acre Kellogg Creek watershed encompasses Los Vaqueros Reservoir, a facility owned and operated by the Contra Costa Water District. The reservoir can store up to 100,000 acre-feet of water, pumped to the facility from an intake at Old River near Discovery Bay. Water from Los Vaqueros serves 450,000 customers in Contra Costa County during the summer months.

Originally known as Arroyo de los Posos the 25.34-mile Kellogg Creek barely resembles its original course through the area referred to as Poso de los Vaqueros or Cowboy's Spring, during the time of the Mission San Jose. During Mexican rule, the area (and part of Brushy Creek Watershed) was known as Los Vaqueros as it's called today..

Archeological studies during the pre-construction phase of the reservoir found that native peoples had inhabited this area before European settlement, but had left the valley 300 years prior to the arrival of the Europeans.



Kellogg Creek Channel Length Statistics* **

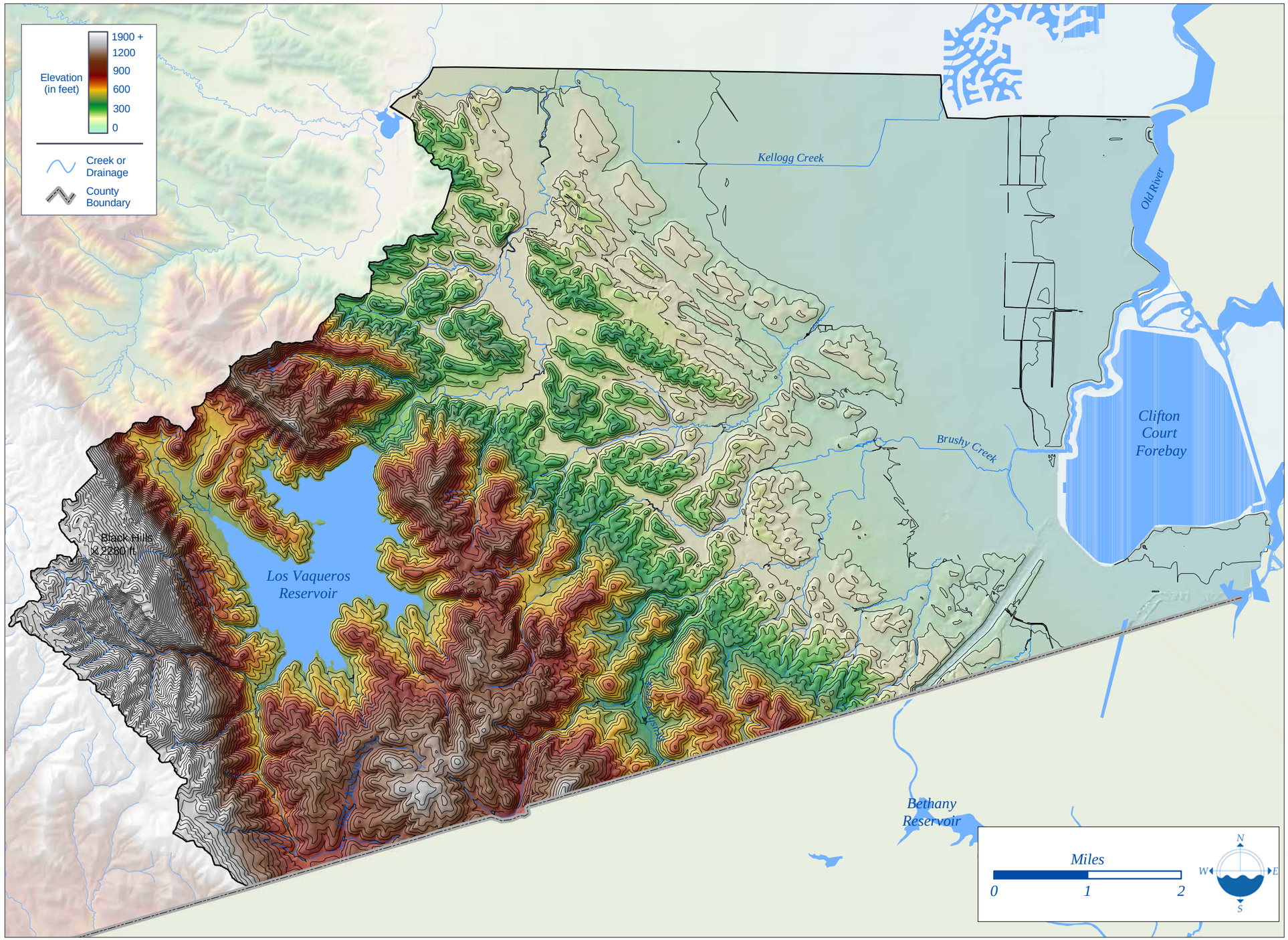
	Miles	Percent
Length of Longest Branch of Creek	25.34	
Total Channel Length in Watershed	67.64	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	67.50	99.8%
Concrete	0.14	0.2%
Earth (constructed)	0.00	0.0%
Riprap	0.00	0.0%
Underground	0.14	0.2%

Brushy Creek Channel Length Statistics* **

	Miles	Percent
Length of Longest Branch of Creek	12.46	
Total Channel Length in Watershed	45.94	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	45.82	99.7%
Concrete	0.12	0.3%
Earth (constructed)	0.00	0.0%
Riprap	0.00	0.0%
Underground	0.12	0.3%

*Data relate to mapped channels only. Does not include storm drains. Bank type for segments shorter than 100 feet was not mapped.
**Statistics reflect Contra Costa County portion of watershed only.

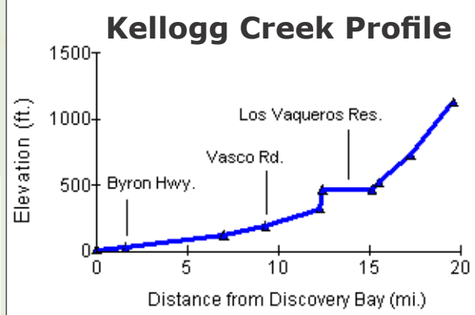
Topography and Hydrology



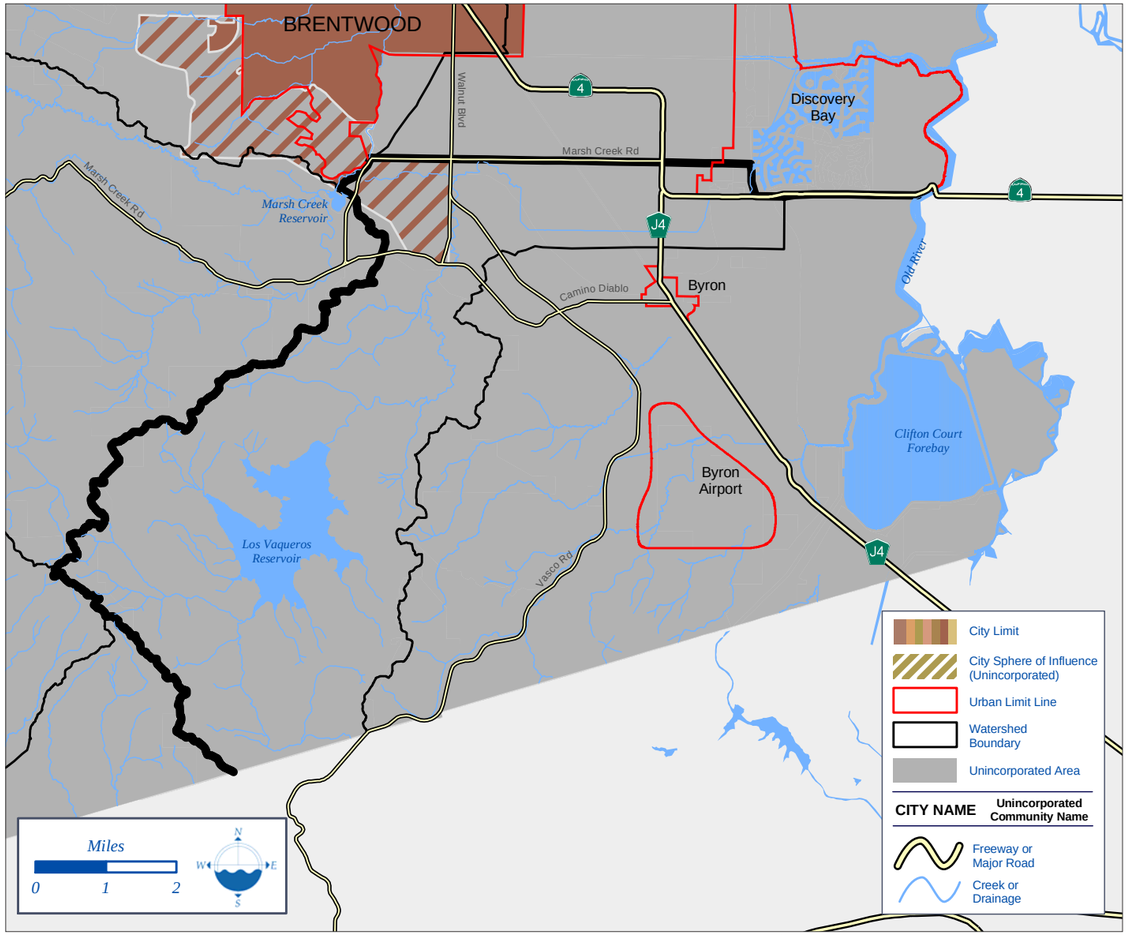
Both Kellogg and Brushy Creek were diverted and altered by farmers in the north and eastern parts of the watershed, where Marsh, Kellogg and Brushy Creeks enter the alluvial plain.

The protected open space at Los Vaqueros Reservoir is now home to a variety of animal and bird species. The Contra Costa Water District runs educational programs for school groups from their interpretive center at the reservoir that highlights water issues, plants, wildlife and the history of the area.

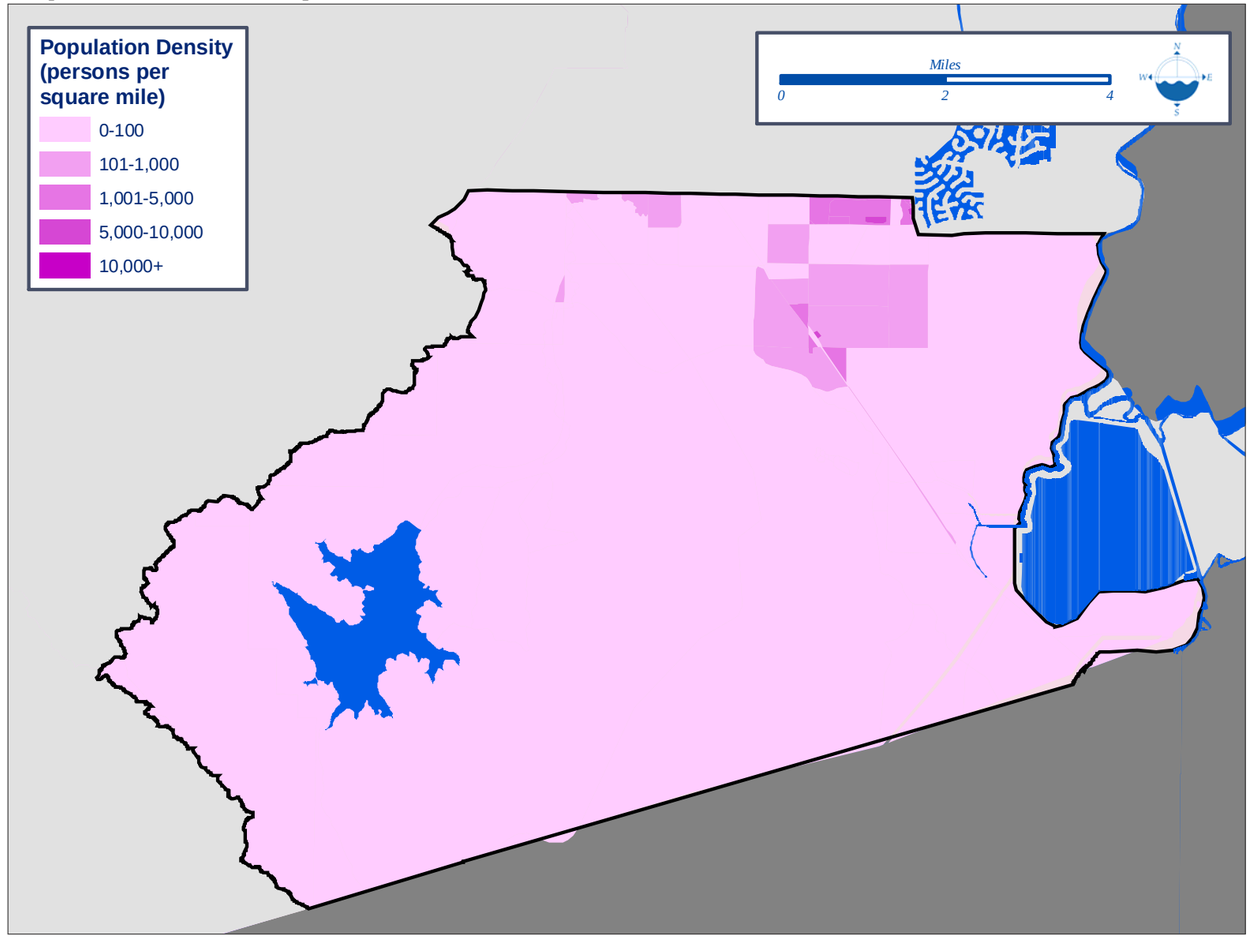
Contra Costa Water District



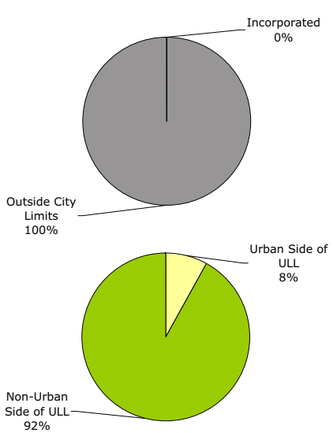
Political Boundaries



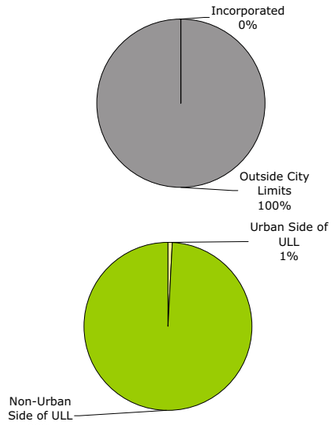
Population Density



Brushy Creek Watershed

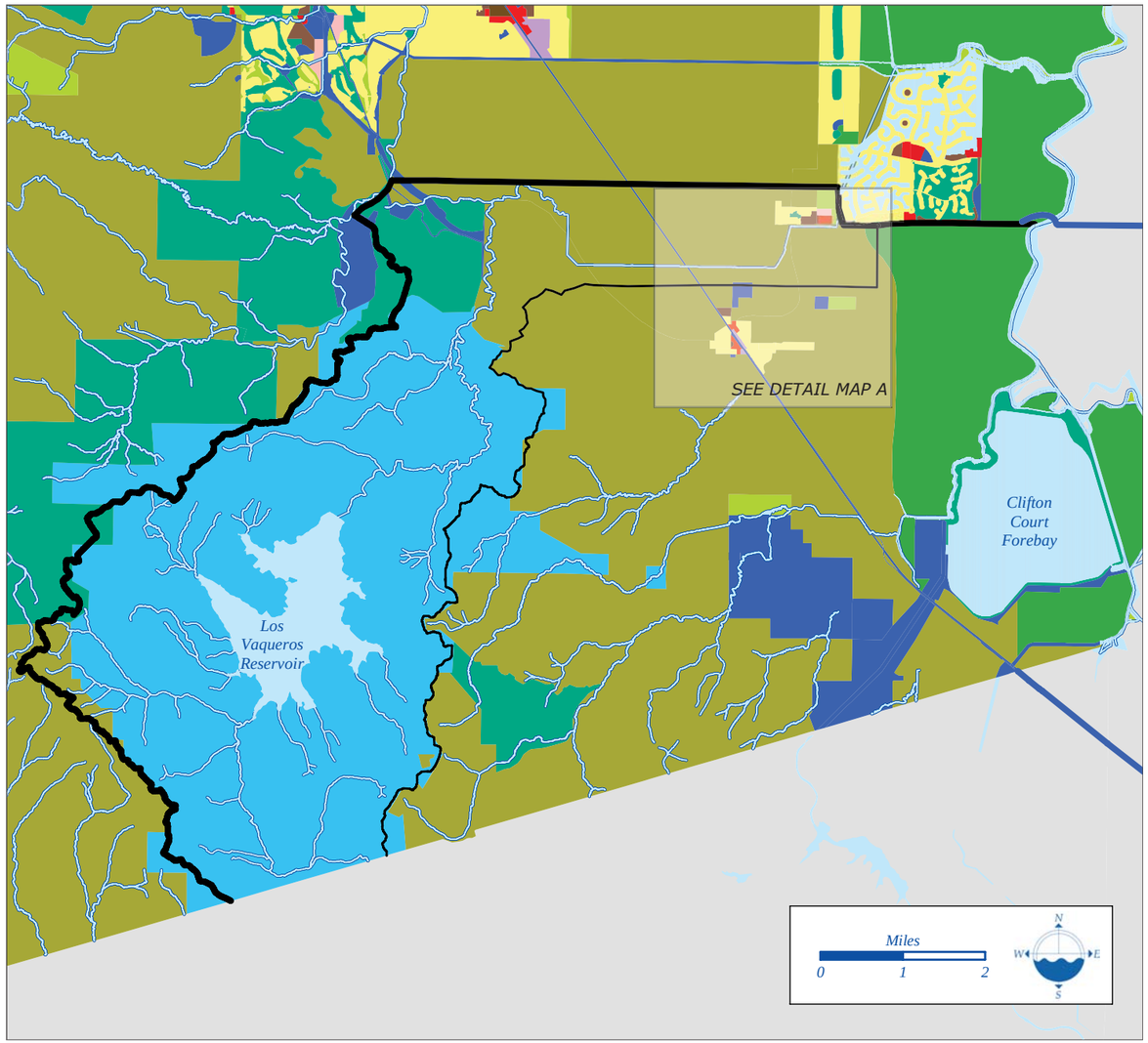


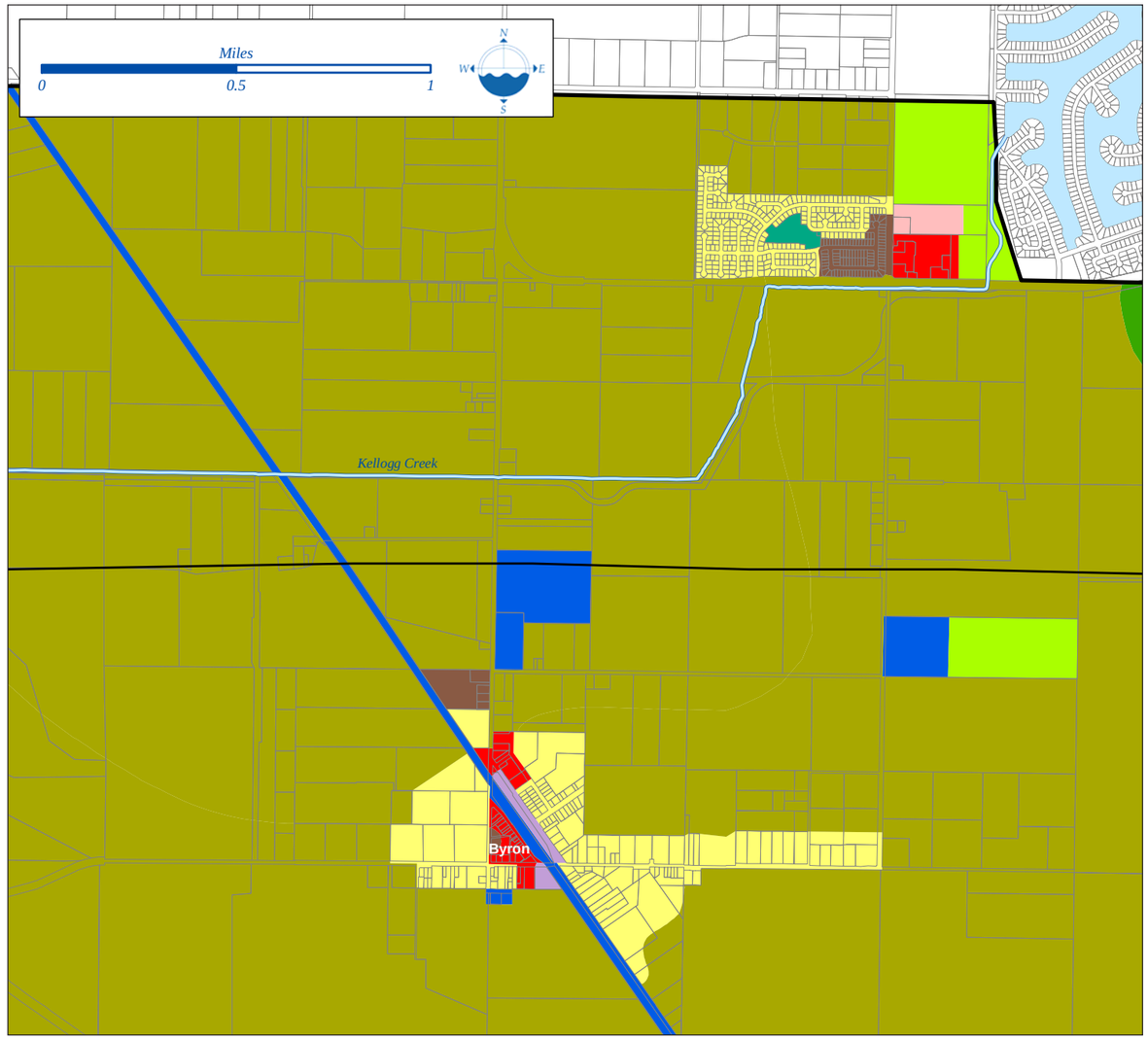
Kellogg Creek Watershed



Demographic Profile for Selected Communities In or Near the Kellogg and Brushy Creek Watersheds

Population	Brentwood	Byron	Discovery Bay
Total Population	23,284	884	8,847
Race and Ethnicity	**Brentwood**	**Byron**	**Discovery Bay**
White	63.0%	59.3%	81.8%
Hispanic or Latino	28.9%	26.1%	10.7%
Black or African American	1.2%	6.6%	1.8%
Asian	3.1%	1.0%	1.4%
Some Other Race	0.5%	0.9%	1.2%
Two or More Races	3.3%	6.1%	3.1%
Education (maximum level attained)	**Brentwood**	**Byron**	**Discovery Bay**
No High School Diploma	17.1%	25.7%	7.1%
High School Diploma or Equivalent	54.1%	55.5%	53.4%
Associate Degree	7.9%	8.2%	11.6%
Bachelor's Degree	15.2%	6.0%	22.3%
Master's or Professional School Degree	5.3%	4.6%	5.4%
Doctorate Degree	0.4%	0.0%	0.3%
Income	**Brentwood**	**Byron**	**Discovery Bay**
Median Household Income	$69,198	$35,938	$89,915

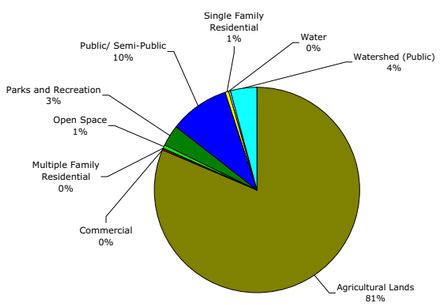


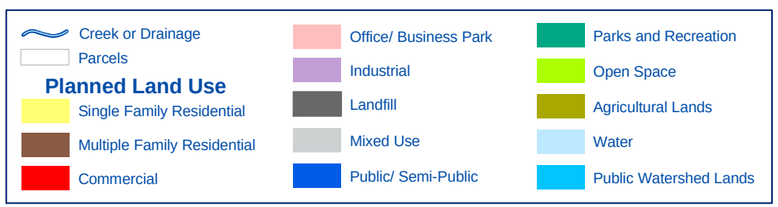


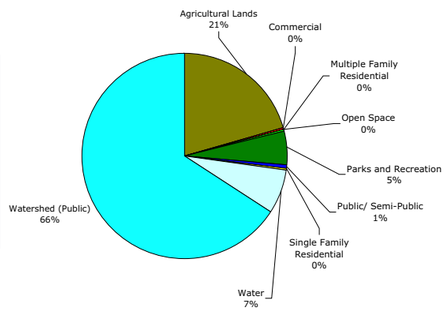
Detail Map A: Byron area

Planned Land Uses *Brushy Creek Watershed**	Acres
Agricultural Lands	19,903
Business Parks and Offices	0
Commercial	15
Industrial	7
Mixed Use	0
Multiple Family Residential	11
Open Space	154
Parks and Recreation	791
Public/ Semi-Public	2,327
Single Family Residential	156
Water	20
Watershed (Public)	1,040
Total	**24,422**

*Contra Costa County portion of watershed only.

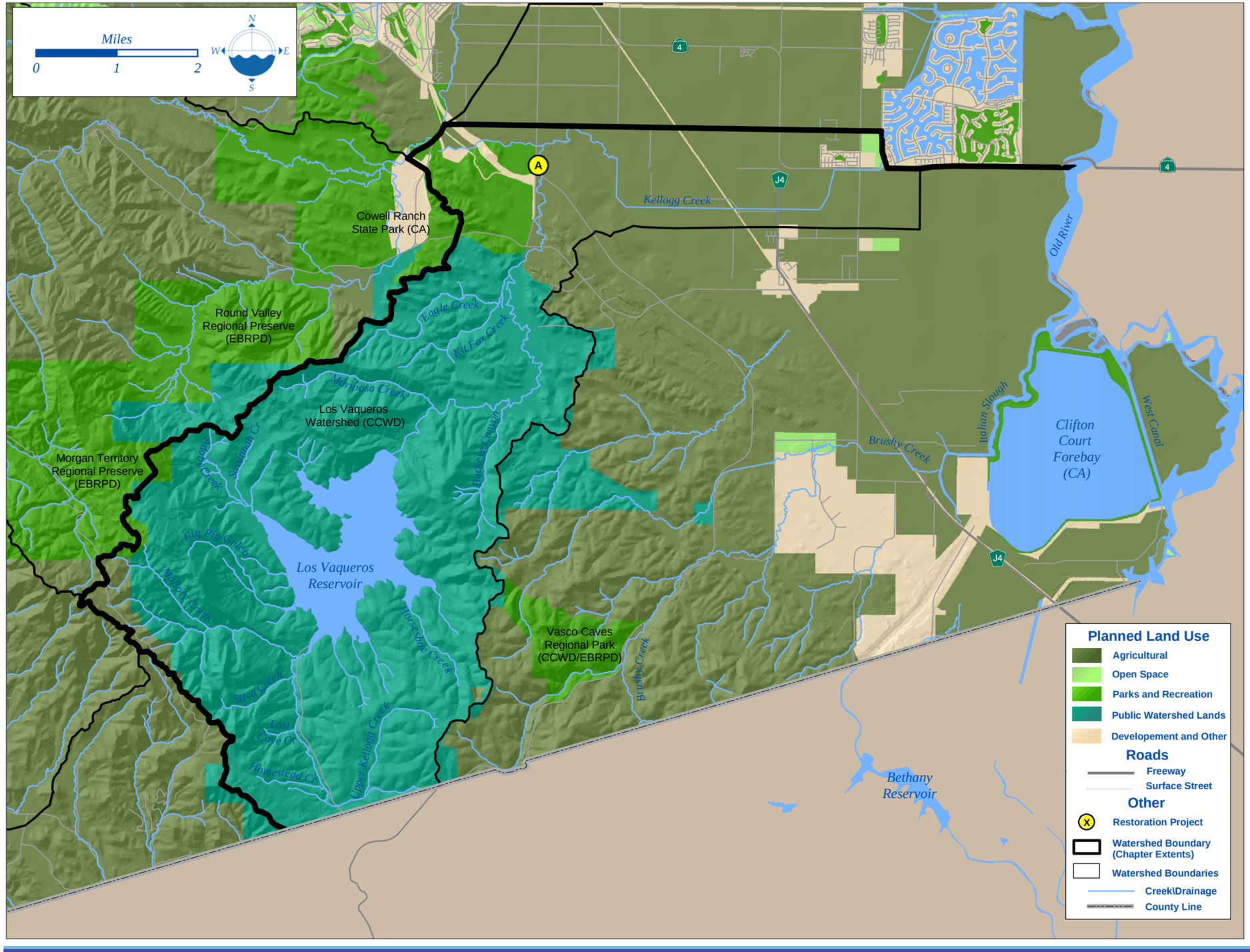






Planned Land Uses *Kellogg Creek Watershed**	Acres
Agricultural Lands	4,303
Business Parks and Offices	9
Commercial	12
Industrial	0
Mixed Use	0
Multiple Family Residential	14
Open Space	60
Parks and Recreation	1,119
Public/ Semi-Public	114
Single Family Residential	53
Water	1,427
Watershed (Public)	13,752
Total	**20,863**

*Contra Costa County portion of watershed only.



Restoration Projects

(A) Kellogg Creek Regional Sedimentation Basin: Identify and construct a regional sediment basin to improve the water quality of Kellogg Creek. The basin would significantly reduce the silt load entering Discovery Bay and Dutch Slough. This project is seeking grant funds. Lead Agency: Contra Costa County Flood Control and Recreation District 800. Anticipated project completion: 2006.

Organizations Active in the Watershed

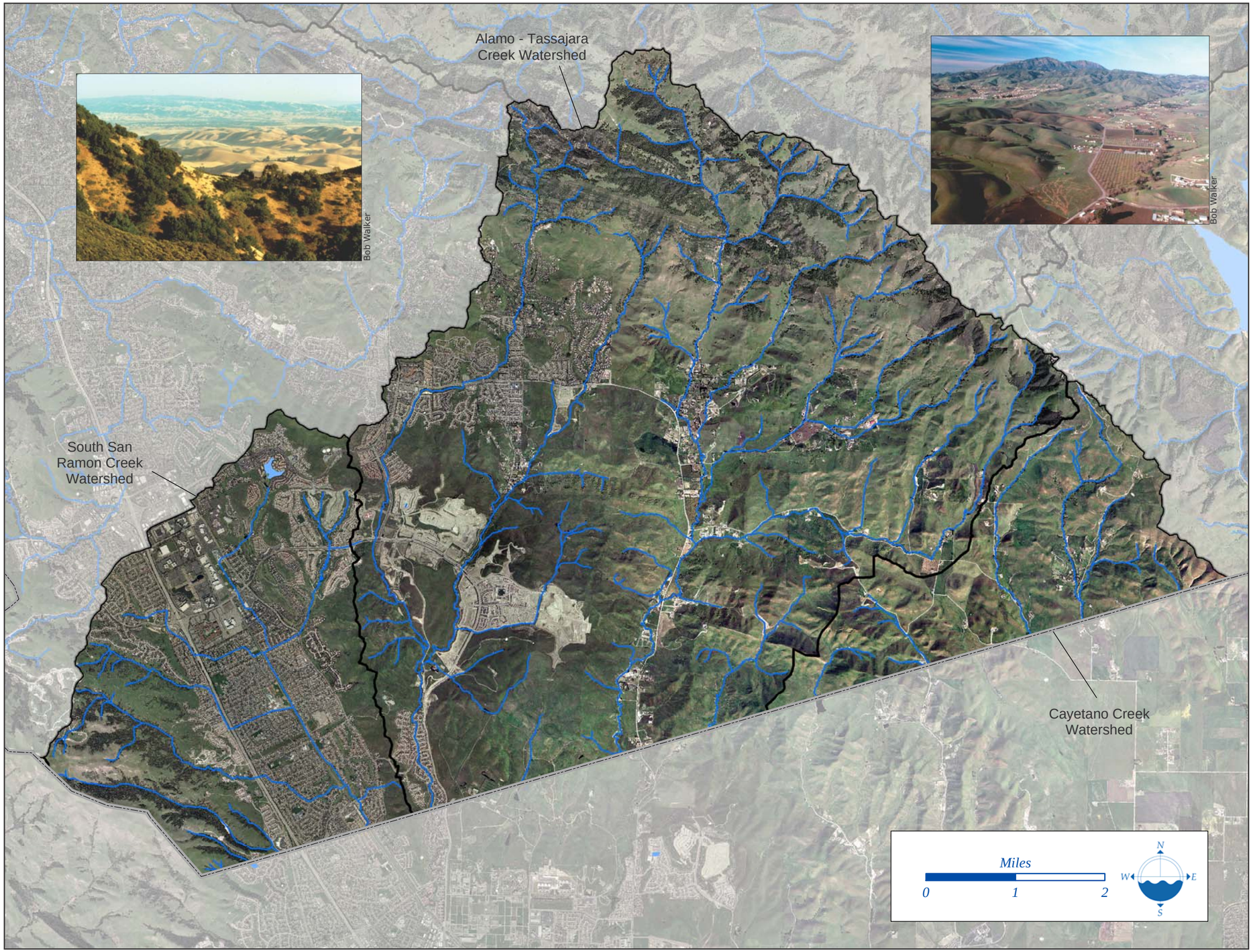
Contra Costa Water District
P.O. Box H20
Concord, CA 94524-2099
(925) 688-8000
Website: www.ccwater.com

Selected Resources

Ziesing, Grace, Anthropological Studio Center, Sonoma State University, From Rancho to Reservoir: History and Archaeology of the Los Vaqueros Watershed, 1997.

Scott Hein

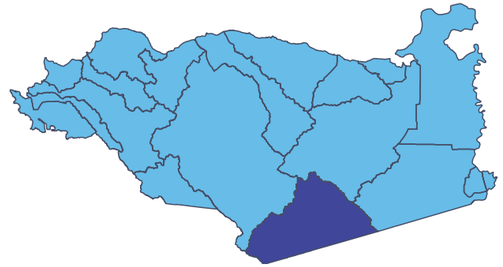
Stephen Joseph



Chapter 16

Upper Alameda Creek Watershed

Cayetano, Alamo-Tassajara, and South San Ramon Sub-Watersheds



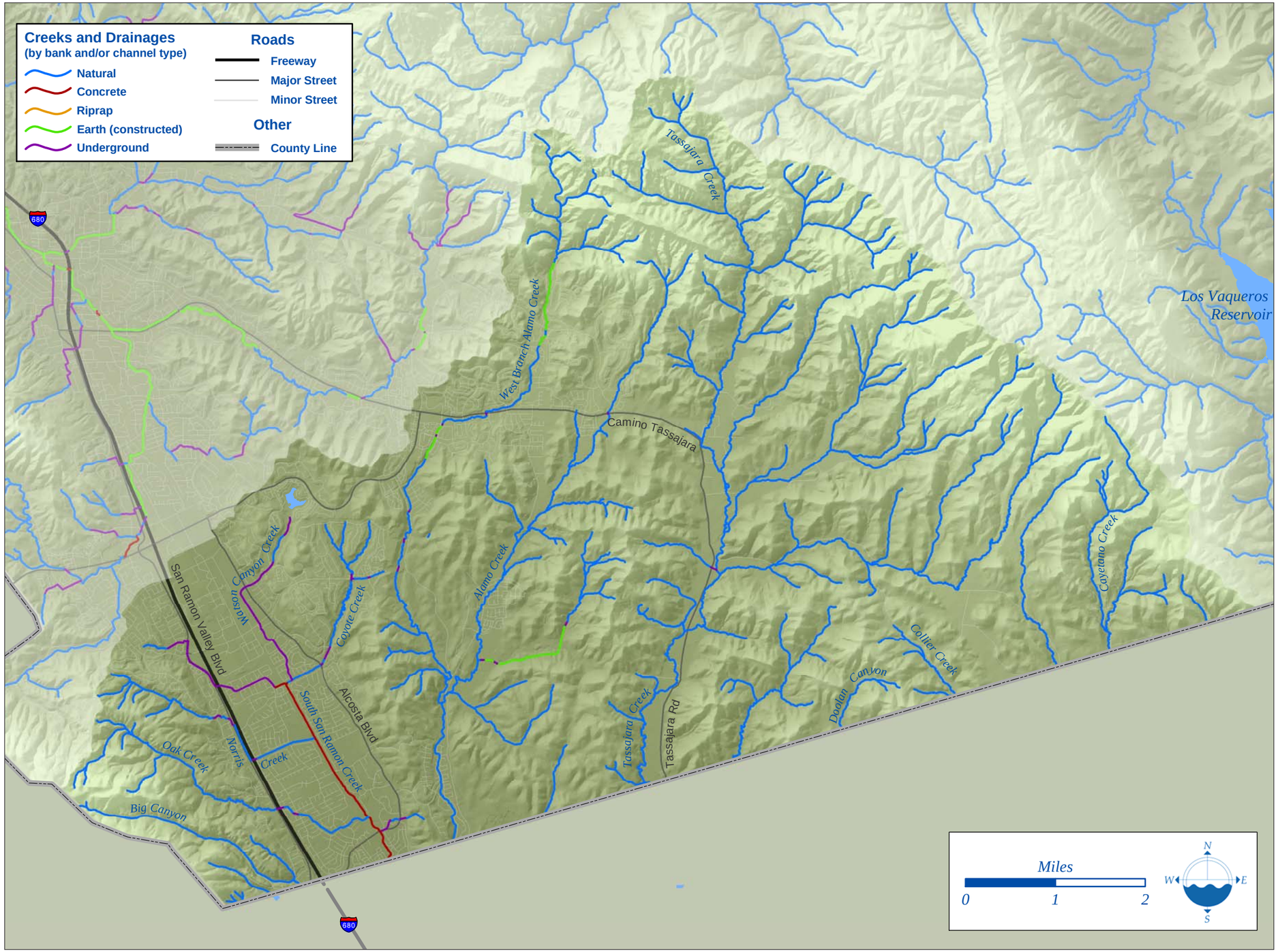
One of the largest watersheds in the Bay Area, the Alameda Creek Watershed stretches from the Mount Diablo foothills in the north, to Mount Hamilton in the south. A little less than a tenth of the entire Watershed is in Contra Costa County. An approximate map of the entire 405,120-acre Alameda Creek Watershed can be found on Page 6 of this Atlas.

Cayetano Creek Watershed Vital Statistics*		
Watershed Size	4,395	acres
Length of Longest Branch of Creek	3.44	miles
Total Channel Length in Watershed	14.14	miles
Average Annual Rainfall	17	inches
Highest Elevation in Watershed	2,060	feet
Population (estimated)	100	people
Estimated Percent Impervious	<5	%

Alamo/Tassajara Watershed Vital Statistics*		
Watershed Size	26,390	acres
Length of Longest Branch of Creek	10.27	miles
Total Channel Length in Watershed	100.99	miles
Average Annual Rainfall	19	inches
Highest Elevation in Watershed	2,581	feet
Population (estimated)	14,800	people
Estimated Percent Impervious	10	%

South San Ramon Creek Watershed Vital Statistics*		
Watershed Size	8,357	acres
Length of Longest Branch of Creek	4.67	miles
Total Channel Length in Watershed	26.24	miles
Average Annual Rainfall	21	inches
Highest Elevation in Watershed	1,739	feet
Population (estimated)	35,100	people
Estimated Percent Impervious	35	%

*Statistics reflect Contra Costa County portion of watershed only.



The 39,142-acre area in southern Contra Costa County is only part of the headwaters of the massive Alameda Creek Watershed. The Creek's outlet is in Alameda County in the City of Fremont near the Coyote Hill Regional Park (EBRPD) and the San Francisco Bay National Wildlife Refuge.

Other creeks in Contra Costa County portion of this watershed include South San Ramon, Alamo, Tassajara, and Cayetano Creeks. San Ramon and a small area of Danville are located in the western-most part of the area. The majority of land to the east is unincorporated.

The City of San Ramon's Environmental Affairs Advisory Committee is active on Creek and Watershed issues in this areas.

Cayetano Creek Channel Length Statistics* **

	Miles	Percent
Length of Longest Branch of Creek	3.44	
Total Channel Length in Watershed	14.14	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	14.14	100.0%
Concrete	0.00	0.0%
Earth (constructed)	0.00	0.0%
Riprap	0.00	0.0%
Underground	0.00	0.0%

Alamo/Tassajara Creeks Channel Length Statistics* **

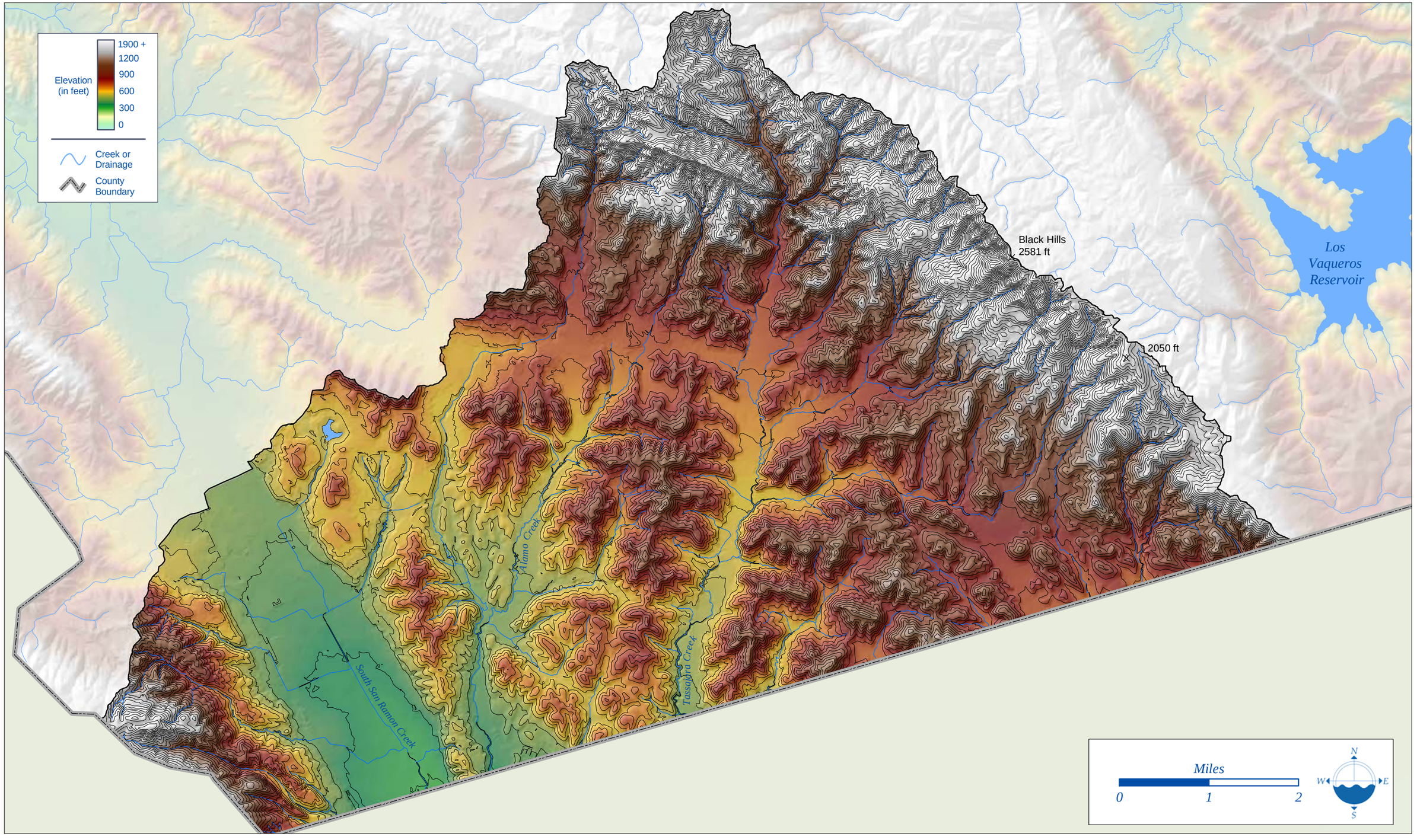
	Miles	Percent
Length of Longest Branch of Creek	10.27	
Total Channel Length in Watershed	100.99	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	98.01	97.1%
Concrete	0.52	0.5%
Earth (constructed)	2.45	2.4%
Riprap	0.00	0.0%
Underground	0.52	0.5%

South San Ramon Creek Channel Length Statistics* **

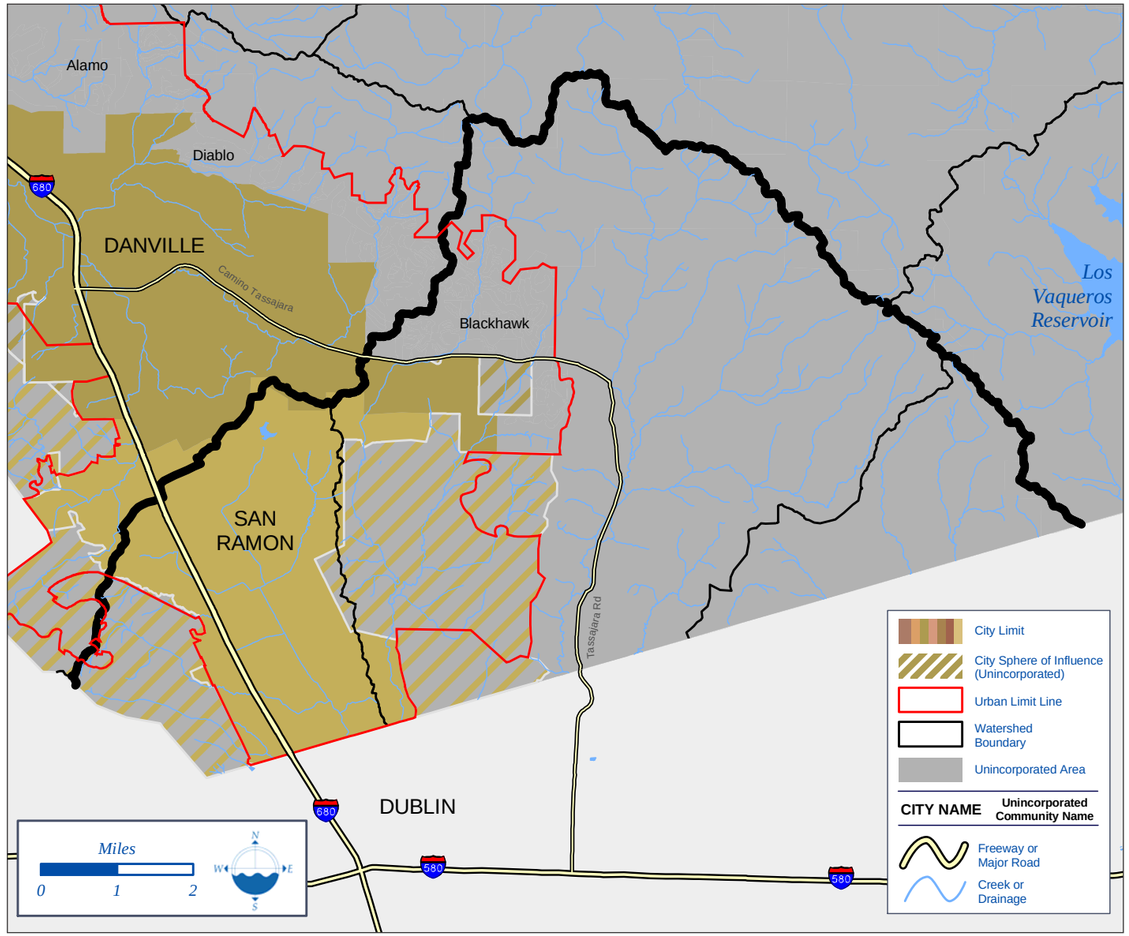
	Miles	Percent
Length of Longest Branch of Creek	4.67	
Total Channel Length in Watershed	26.24	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	19.14	73.0%
Concrete	7.09	27.0%
Earth (constructed)	0.00	0.0%
Riprap	0.00	0.0%
Underground	4.61	17.6%

*Data relate to mapped channels only. Does not include storm drains. Bank type for segments shorter than 100 feet was not mapped.

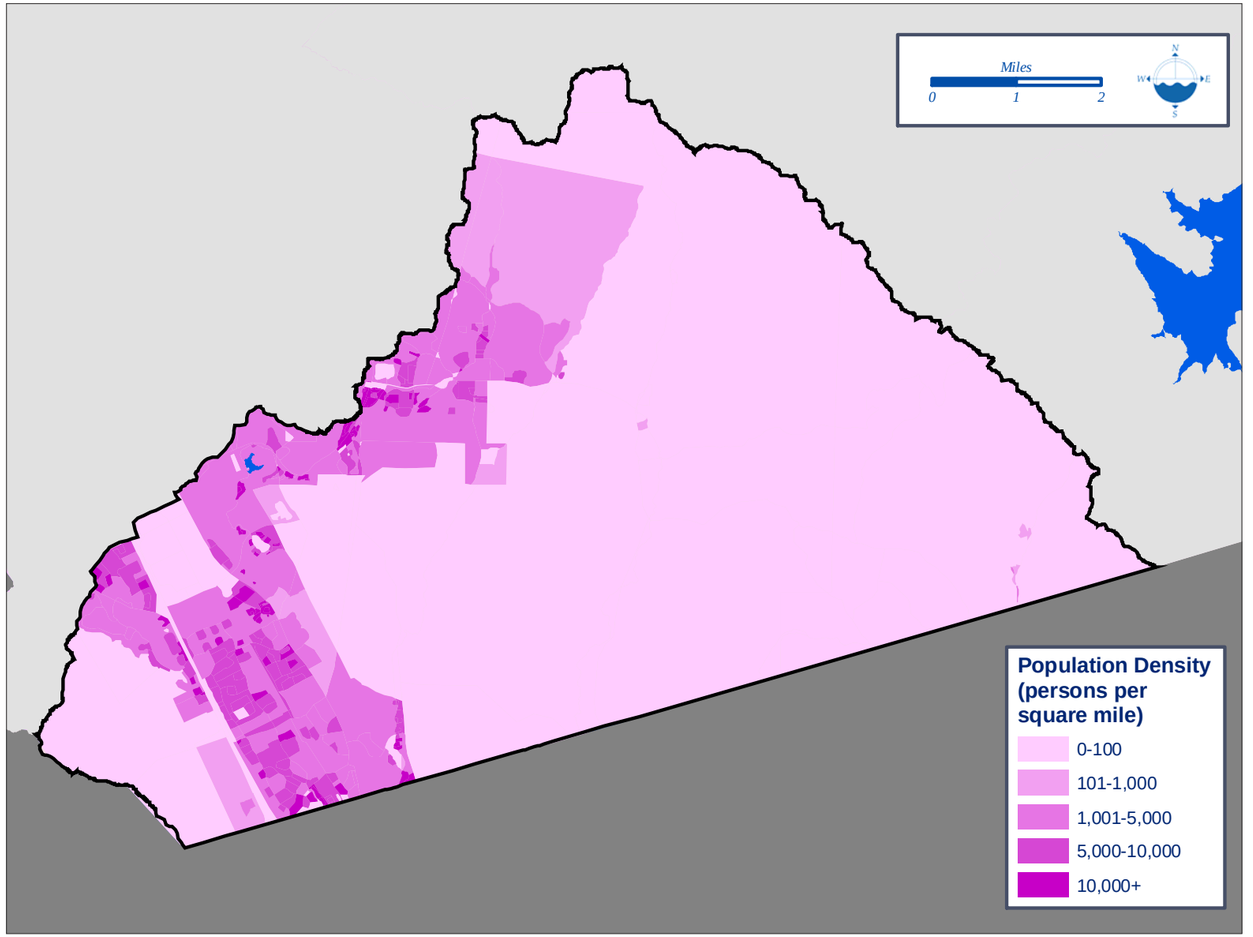
**Statistics reflect Contra Costa County portion of watershed only.


Elevation (in feet)
1900 +
1200
900
600
300
0
Creek or Drainage
County Boundary
Black Hills
2581 ft
2050 ft
Los Vaqueros Reservoir
Alamo Creek
South San Ramon Creek
Tassajara Creek
Miles
0
1
2
N
W
E
S

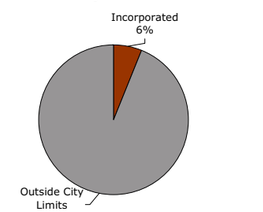
Political Boundaries

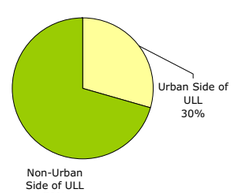


Population Density

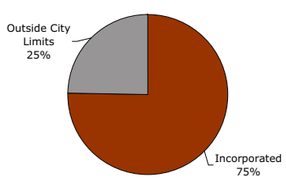


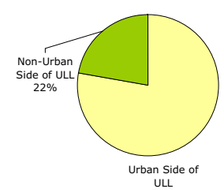
Alamo-Tassajara Creek Watershed



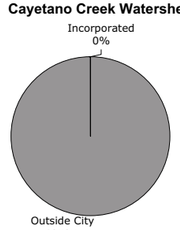


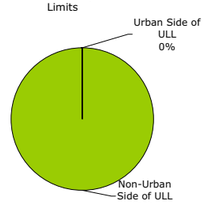
South San Ramon Creek Watershed





Cayetano Creek Watershed

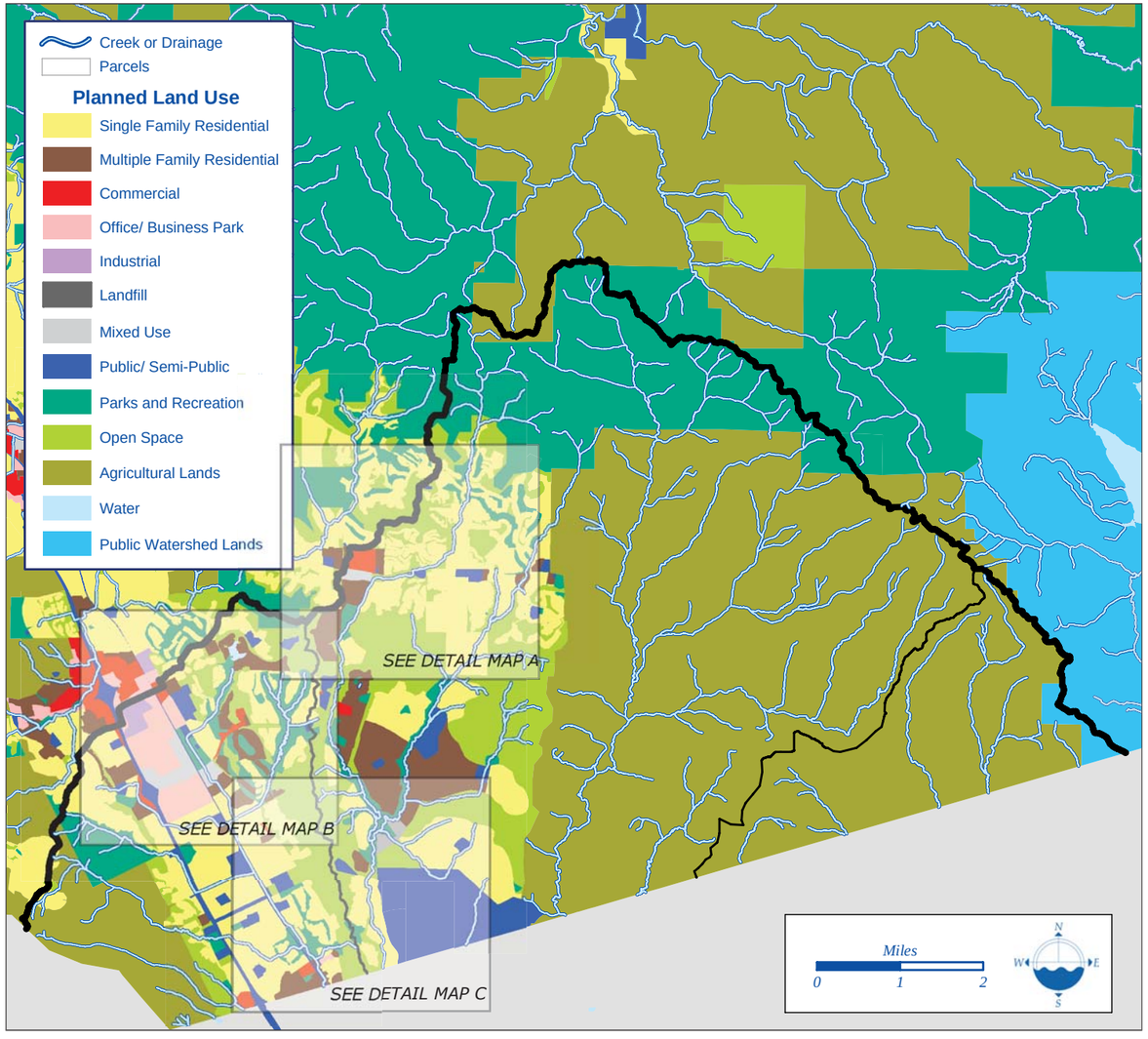


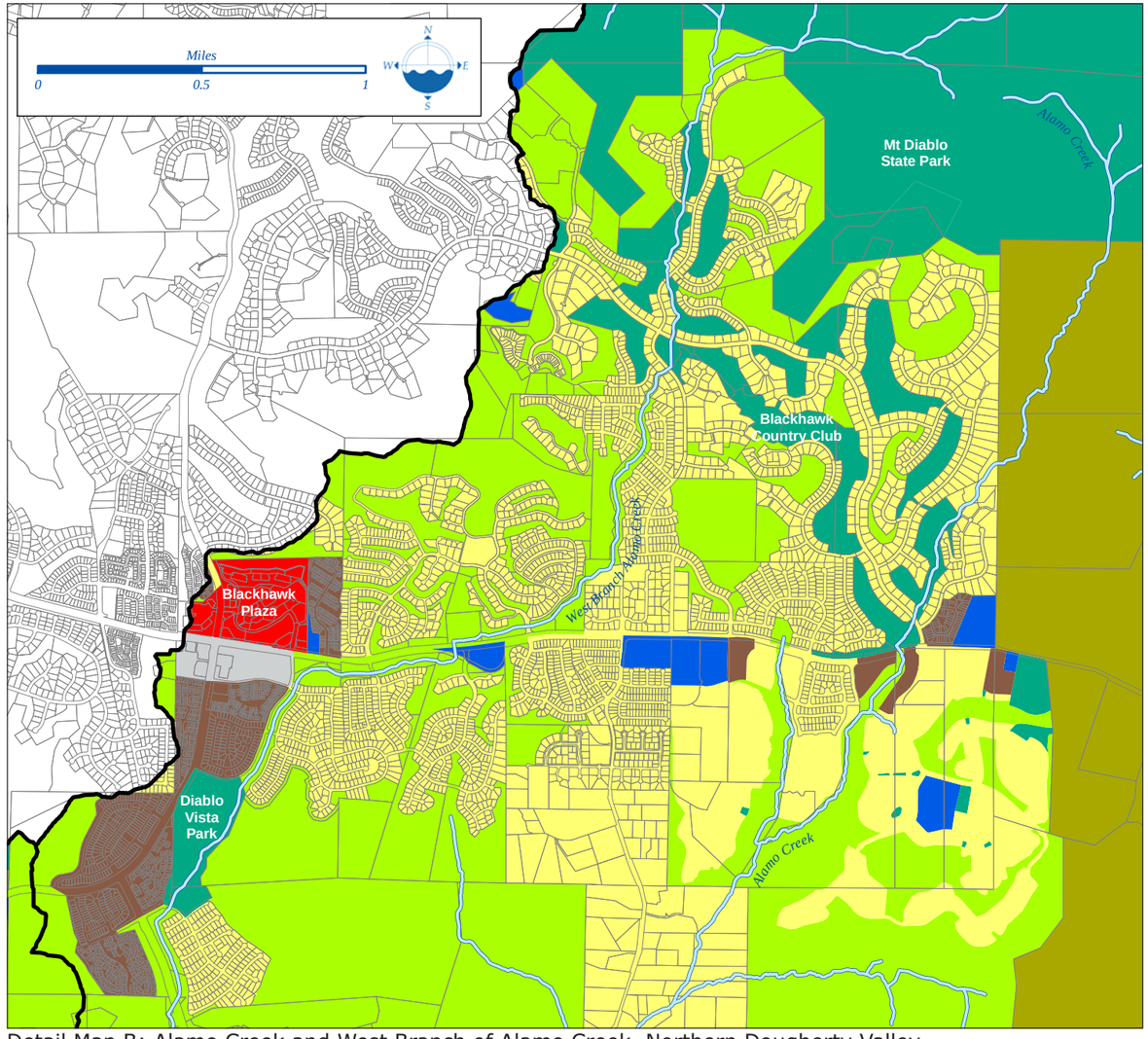


Demographic Profile for Selected Communities In or Near the Cayetano, Alamo/Tassajara and South Ramon Creek Watersheds

Population	Blackhawk-Camino Tassajara	Danville	San Ramon
Total Population	9,966	42,127	44,477
Race and Ethnicity	**Blackhawk-Camino Tassajara**	**Danville**	**San Ramon**
White	72.8%	83.2%	71.8%
Hispanic or Latino	3.9%	4.9%	7.2%
Black or African American	2.4%	1.0%	2.1%
Asian	16.9%	8.3%	15.1%
Some Other Race	1.2%	0.3%	0.9%
Two or More Races	2.8%	2.3%	2.8%
Education (maximum level attained)	**Blackhawk-Camino Tassajara**	**Danville**	**San Ramon**
No High School Diploma	3.0%	3.4%	3.5%
High School Diploma or Equivalent	24.3%	30.2%	35.6%
Associate Degree	8.4%	7.0%	8.2%
Bachelor's Degree	41.1%	38.4%	35.9%
Master's or Professional School Degree	19.9%	18.8%	14.8%
Doctorate Degree	3.5%	2.3%	2.0%
Income	**Blackhawk-Camino Tassajara**	**Danville**	**San Ramon**
Median Household Income	$154,598	$114,064	$95,856

Planned Land Use

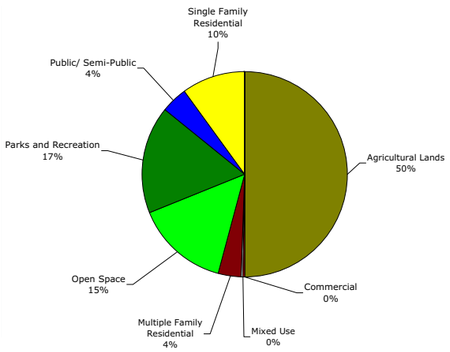




Detail Map B: Alamo Creek and West Branch of Alamo Creek, Northern Dougherty Valley

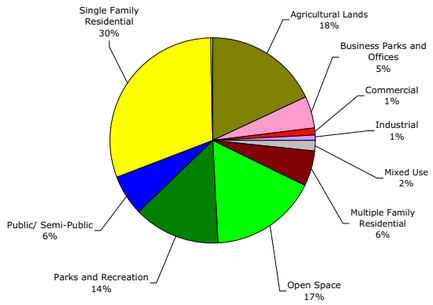
Planned Land Uses *Alamo/Tassajara Creek Watershed**	Acres
Agricultural Lands	13,196
Business Parks and Offices	0
Commercial	69
Industrial	0
Mixed Use	68
Multiple Family Residential	975
Open Space	3,887
Parks and Recreation	4,422
Public/ Semi-Public	1,152
Single Family Residential	2,617
Water	0
Watershed (Public)	0
Total	**26,390**

*Contra Costa County portion of watershed only.



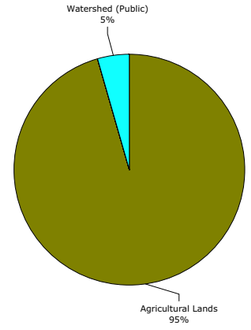
Planned Land Uses *South San Ramon Creek Watershed**	Acres
Agricultural Lands	1,506
Business Parks and Offices	416
Commercial	101
Industrial	68
Mixed Use	127
Multiple Family Residential	483
Open Space	1,412
Parks and Recreation	1,142
Public/ Semi-Public	516
Single Family Residential	2,573
Water	14
Watershed (Public)	0
Total	**8,357**

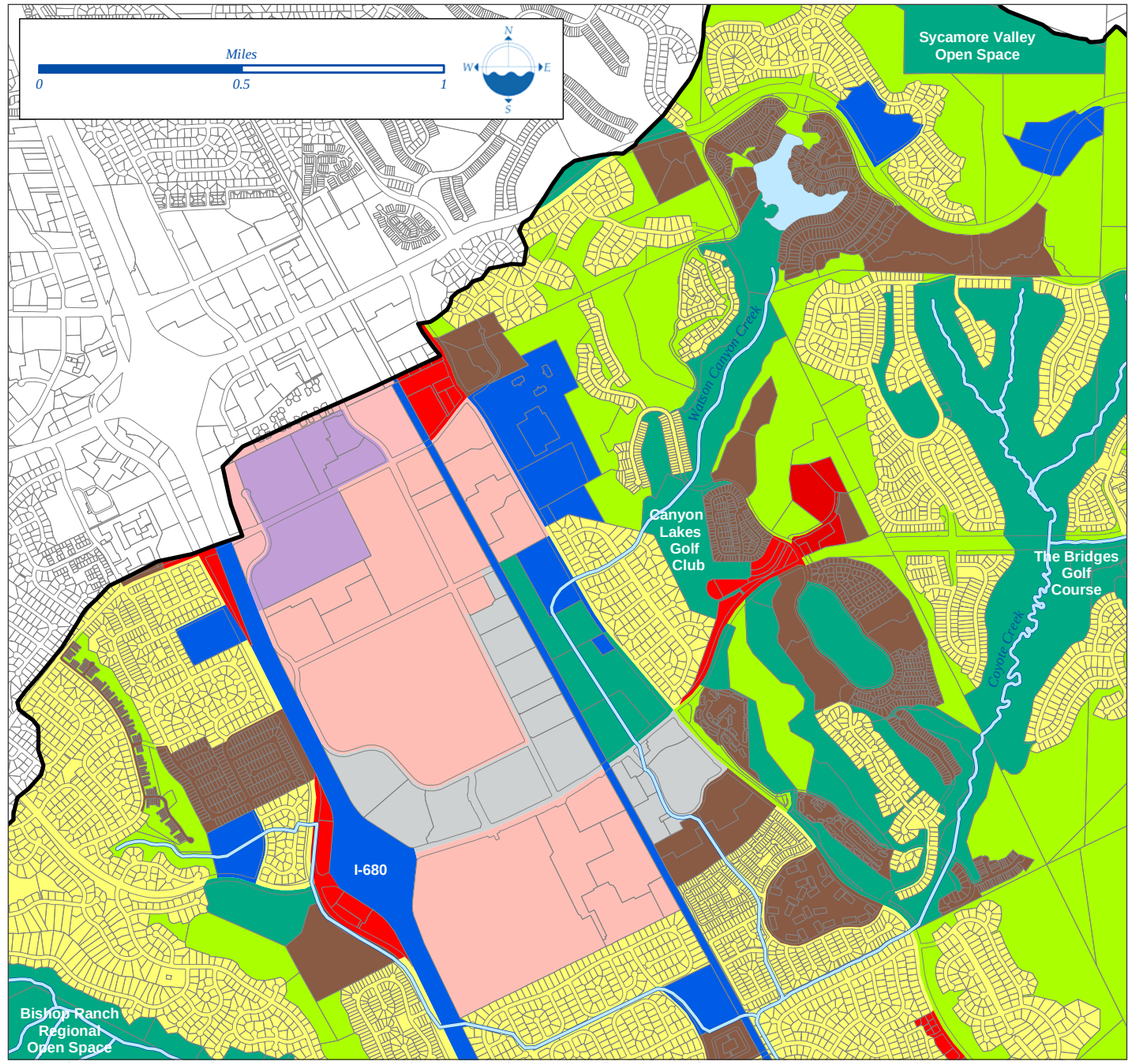
*Contra Costa County portion of watershed only.



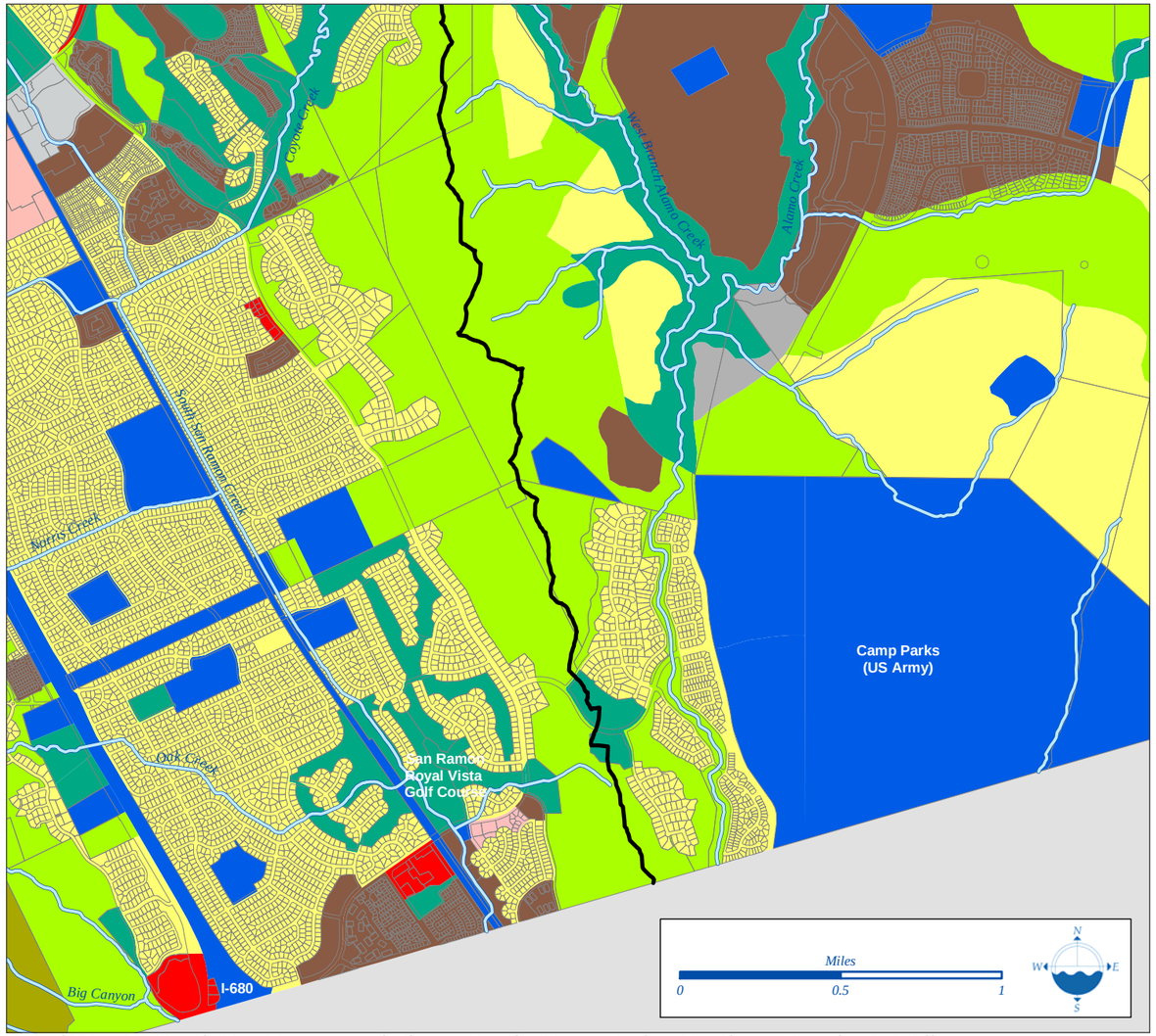
Planned Land Uses *Alamo/Tassajara Creek Watershed**	Acres
Agricultural Lands	13,196
Business Parks and Offices	0
Commercial	69
Industrial	0
Mixed Use	68
Multiple Family Residential	975
Open Space	3,887
Parks and Recreation	4,422
Public/ Semi-Public	1,152
Single Family Residential	2,617
Water	0
Watershed (Public)	0
Total	**26,390**

*Contra Costa County portion of watershed only.





Detail Map B: South San Ramon Creek and Bishop Ranch Area of San Ramon

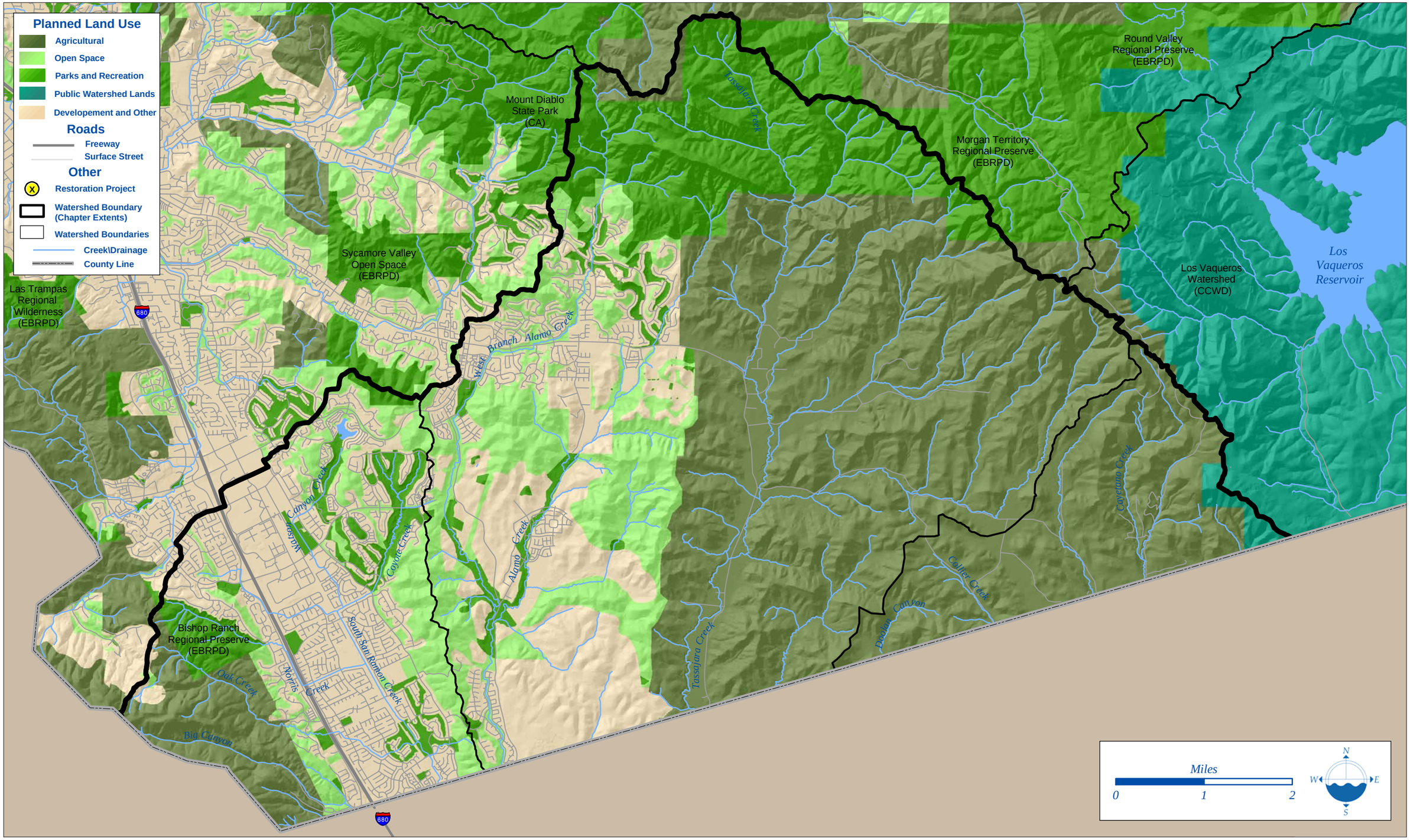


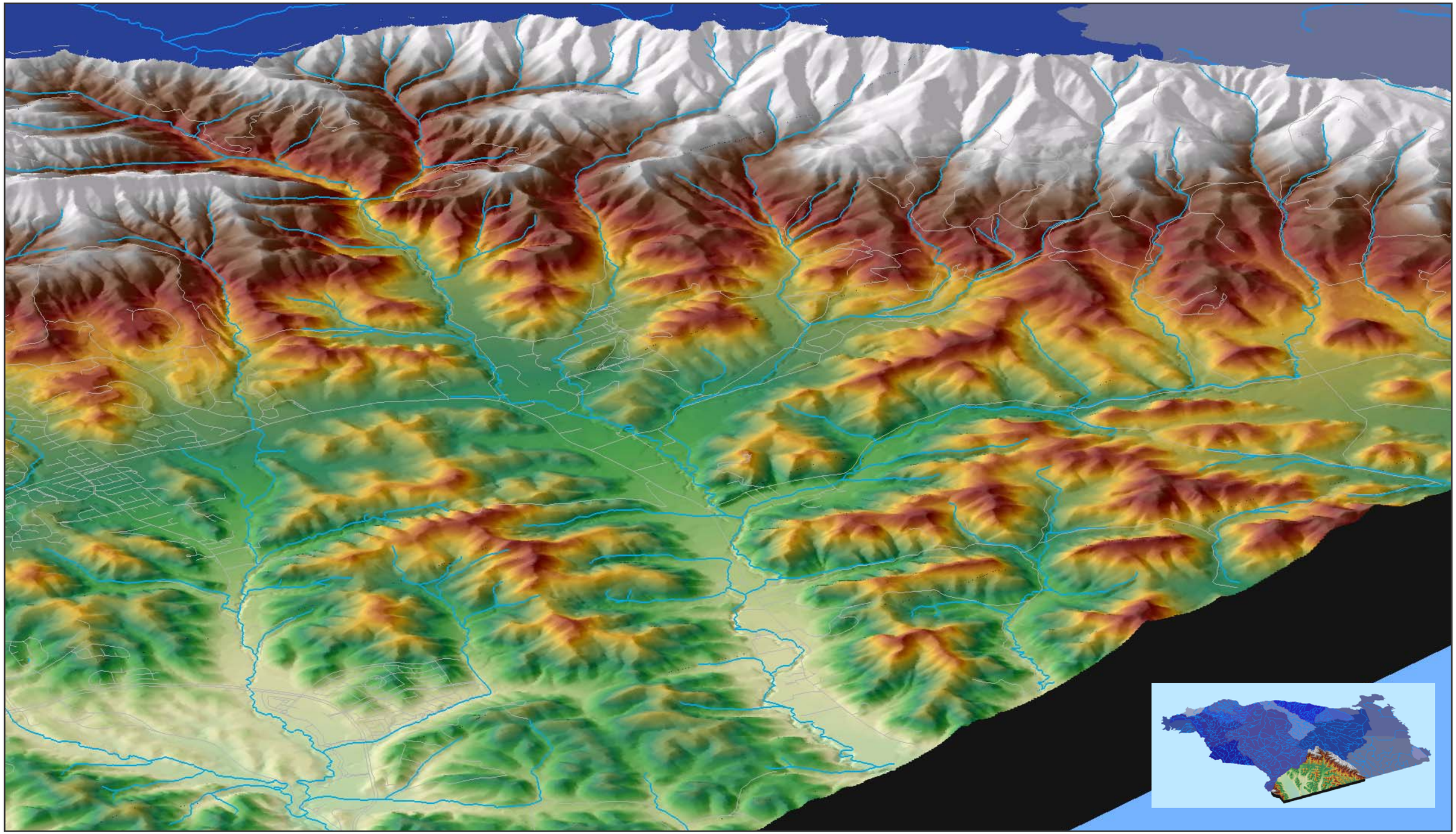
Detail Map C: South San Ramon and Alamo Creek: Camp Parks, Southern Dougherty Valley

Creek or Drainage
Parcels

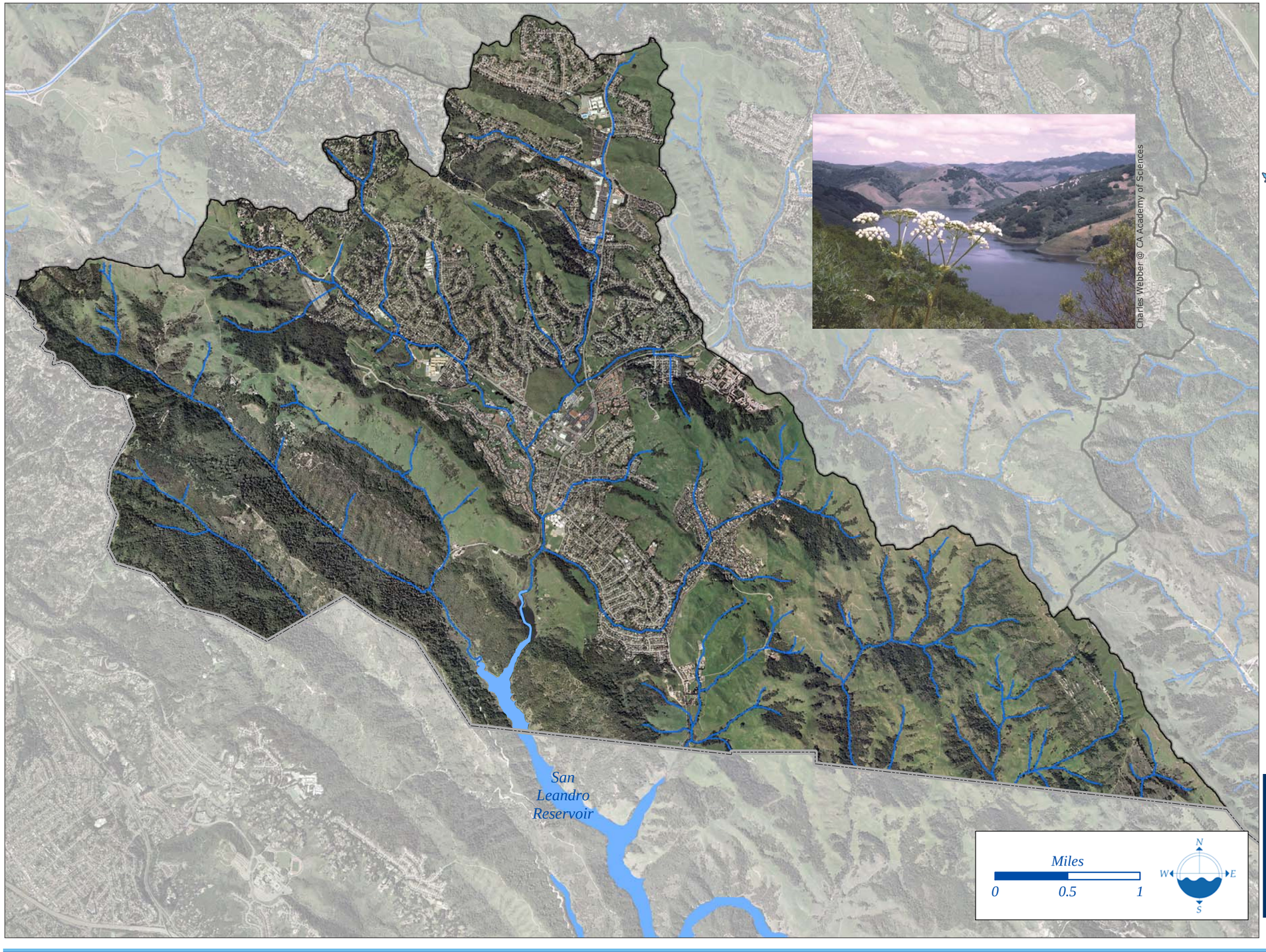
Planned Land Use

- Single Family Residential
- Multiple Family Residential
- Commercial
- Office/ Business Park
- Industrial
- Landfill
- Mixed Use
- Public/ Semi-Public
- Parks and Recreation
- Open Space
- Agricultural Lands
- Water
- Public Watershed Lands


Planned Land Use
Agricultural
Open Space
Parks and Recreation
Public Watershed Lands
Developement and Other
Roads
Freeway
Surface Street
Other
Restoration Project
Watershed Boundary (Chapter Extents)
Watershed Boundaries
Creek\Drainage
County Line
Mount Diablo State Park (CA)
Round Valley Regional Preserve (EBRPD)
Morgan Territory Regional Preserve (EBRPD)
Sycamore Valley Open Space (EBRPD)
Las Trampas Regional Wilderness (EBRPD)
Los Vaqueros Watershed (CCWD)
Los Vaqueros Reservoir
Bishop Ranch Regional Preserve (EBRPD)
680
Miles
0
1
2
N
W
E
S

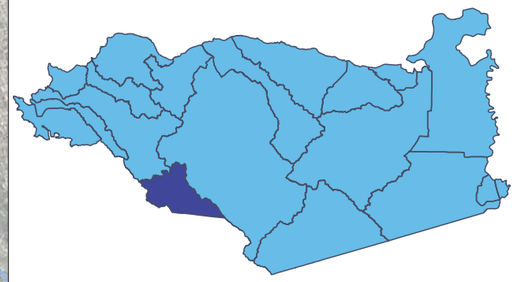


Upper Alameda Creek Watershed 3D: Looking north to the headwaters.



Charles Webber @ CA Academy of Sciences

Chapter 17
Upper San Leandro and Moraga Creek Watersheds



13,059 acres of the Upper San Leandro and Moraga Creek Watersheds are located within Contra Costa County. These creeks flow into the Upper San Leandro Reservoir, managed by the East Bay Municpal Utility District. The reservoirspans the county line, and its outlet is in Alameda County. Water then flow through Alameda county to the San Francisco Bay.

The creeks in this area include Moraga Creek (4.7 miles), San Leandro Creek (4.76 miles), Laguna Creek (3.2 miles), Redwood Creek (1.8 mi.), Indian Creek (1.8 miles), Rimer Creek (3.14 miles), Buckhorn Creek (2.1 miles), and Callahan Creek (1.3 miles).

The southern extent of Orinda and a major portion of Moraga are the local jurisdictions in the region. The remaining property in the area is Unincorporated County lands, including areas managed by East Bay Regional Park District and East Bay Municipal Utility District.

San Leandro/Moraga Creek Watershed Vital Statistics*		
Watershed Size	13,059	acres
Length of Longest Branch of Creek	4.76	miles
Total Channel Length in Watershed	53.81	miles
Average Annual Rainfall	28	inches
Highest Elevation in Watershed	2,024	feet
Population (estimated)	18,300	people
Estimated Percent Impervious	15	%

*Statistics reflect Contra Costa County portion of watershed only.

The channels of the creeks throughout the area are relatively unmodified. Large flood control channels have not been built in this region. Moraga Creek has been routed underground in short reaches to accommodate urbanization and infrastructure development.

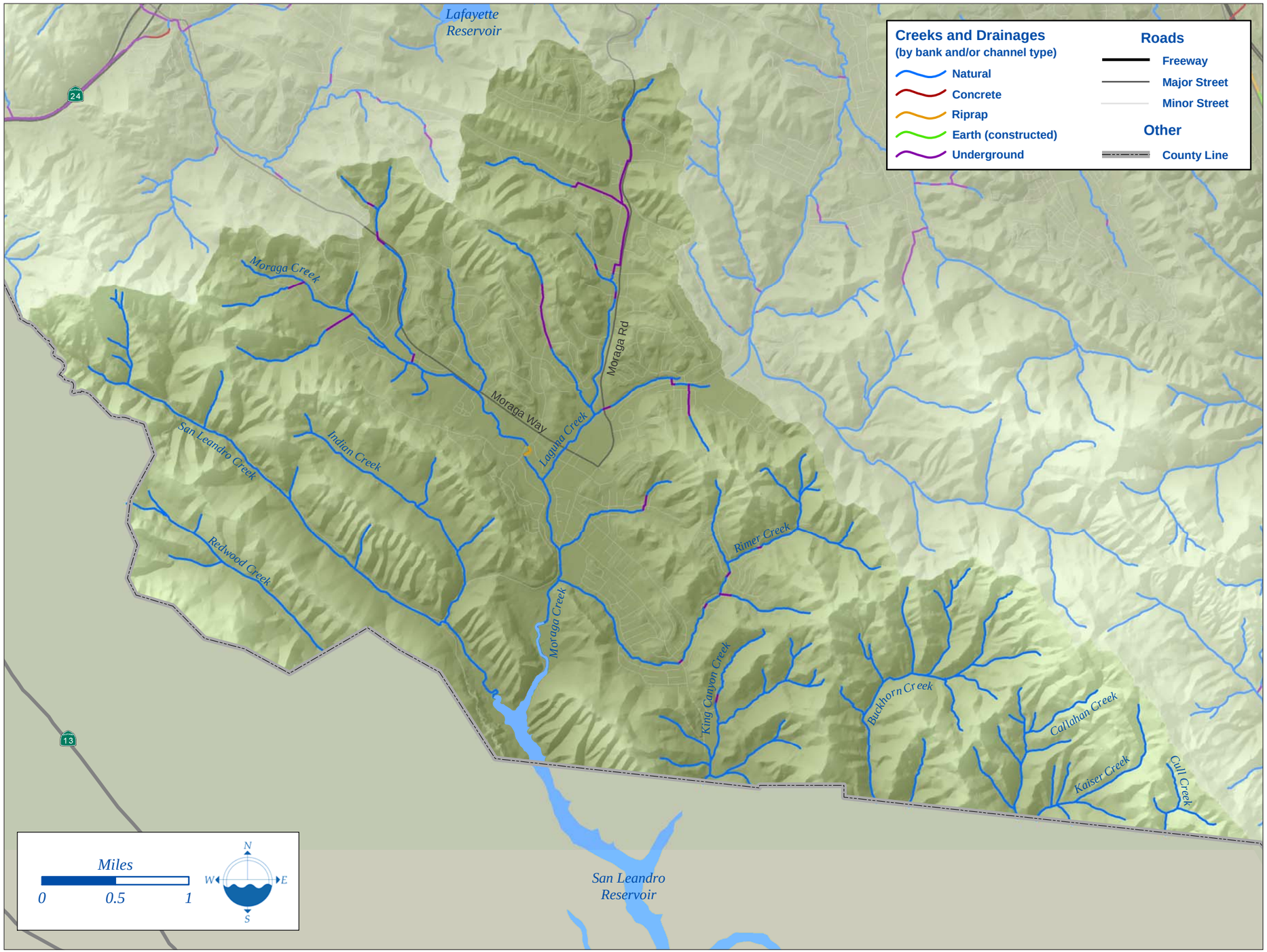
Canyon Elementary School District

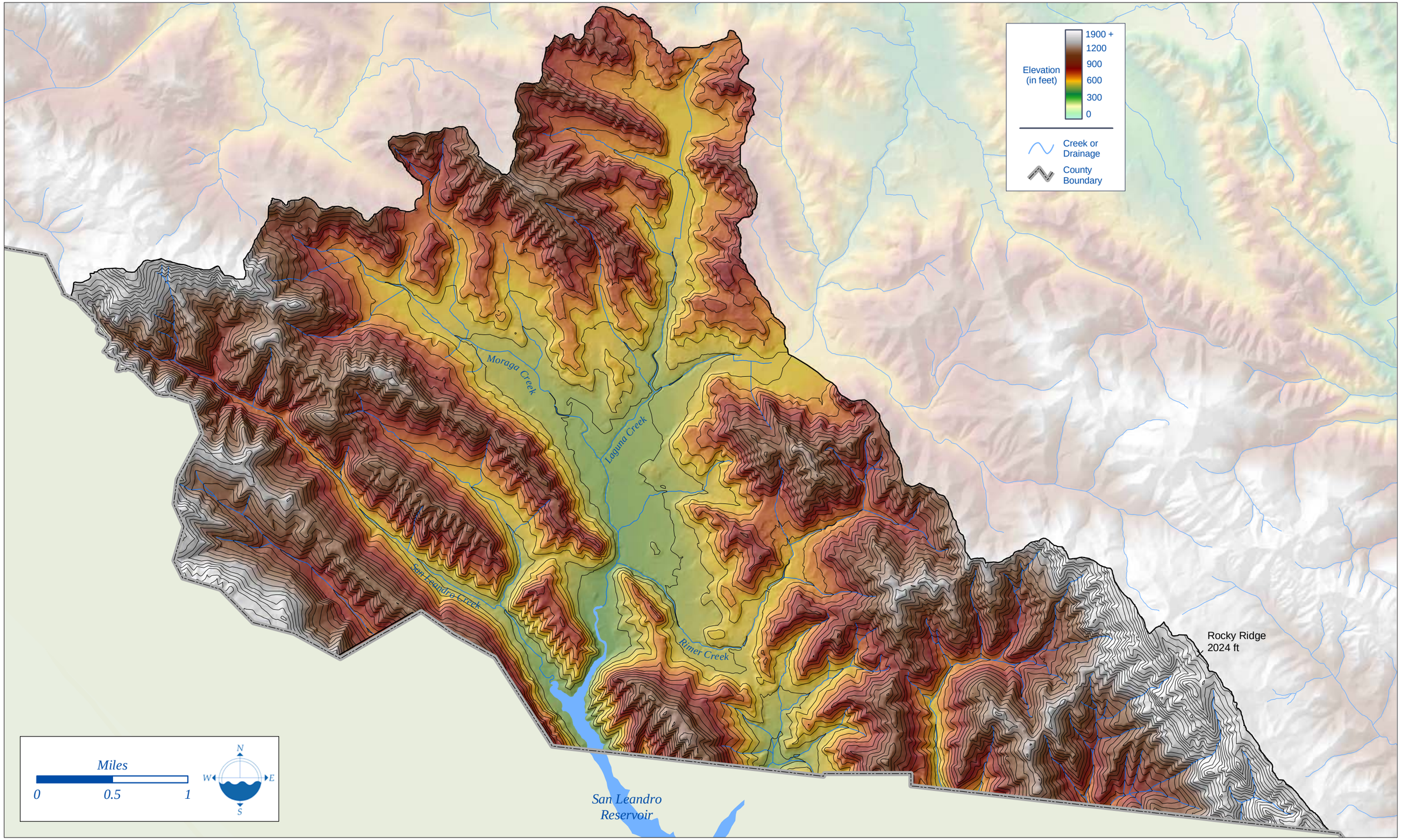
Charles Webber @ CA Academy of Sciences

San Leandro/Moraga Creek Channel Length Statistics*

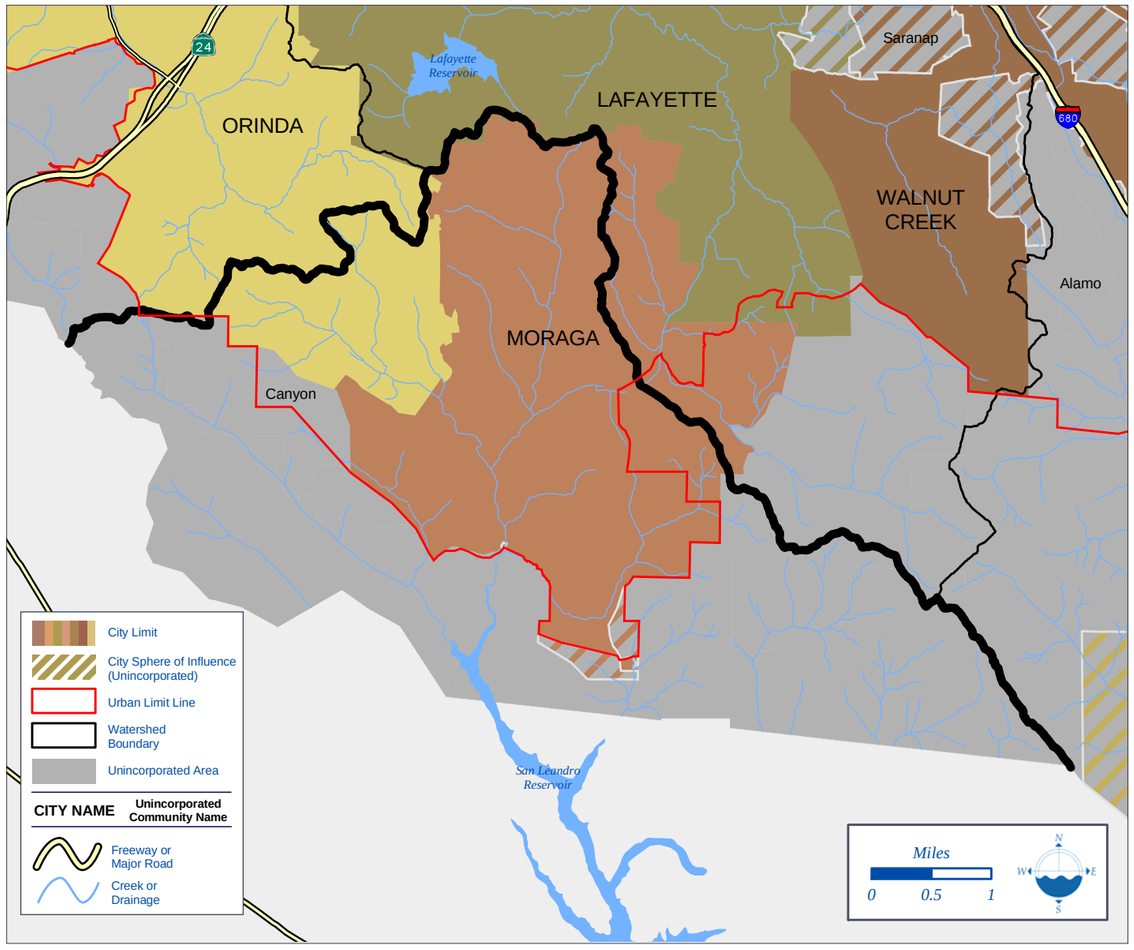
	Miles	Percent
Length of Longest Branch of Creek	4.76	
Total Channel Length in Watershed	53.81	
Type of Bank or Channel:		
Natural (no obvious reinforcements)	50.47	93.8%
Concrete	3.26	6.1%
Earth (constructed)	0.00	0.0%
Riprap	0.08	0.2%
Underground	3.26	6.1%

*Data relate to mapped channels only. Does not include storm drains. Bank type for segments shorter than 100 feet was not mapped.

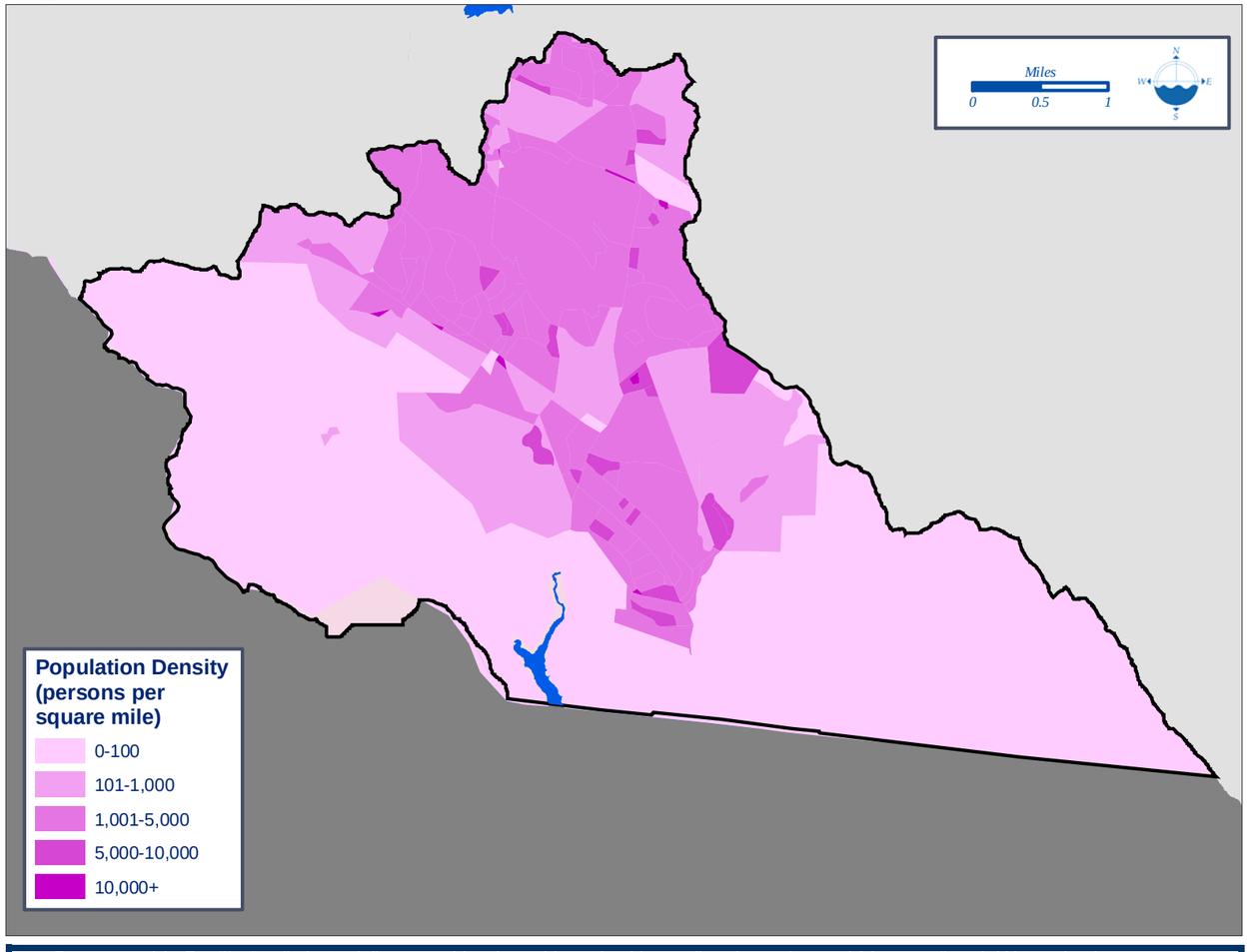



Elevation
(in feet)
1900 +
1200
900
600
300
0
Creek or
Drainage
County
Boundary
Moraga Creek
Laguna Creek
San Leandro Creek
Rimer Creek
Rocky Ridge
2024 ft
San Leandro
Reservoir
Miles
0
0.5
1
N
W
E
S

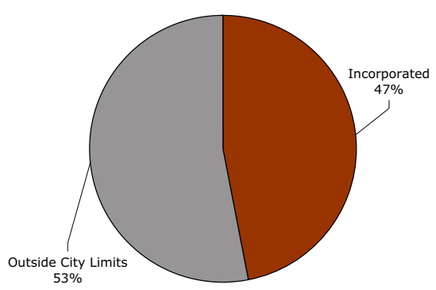
Political Boundaries



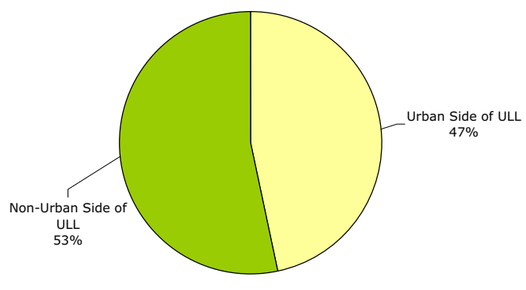
Population Density



Upper San Leandro-Moraga Creek Watershed



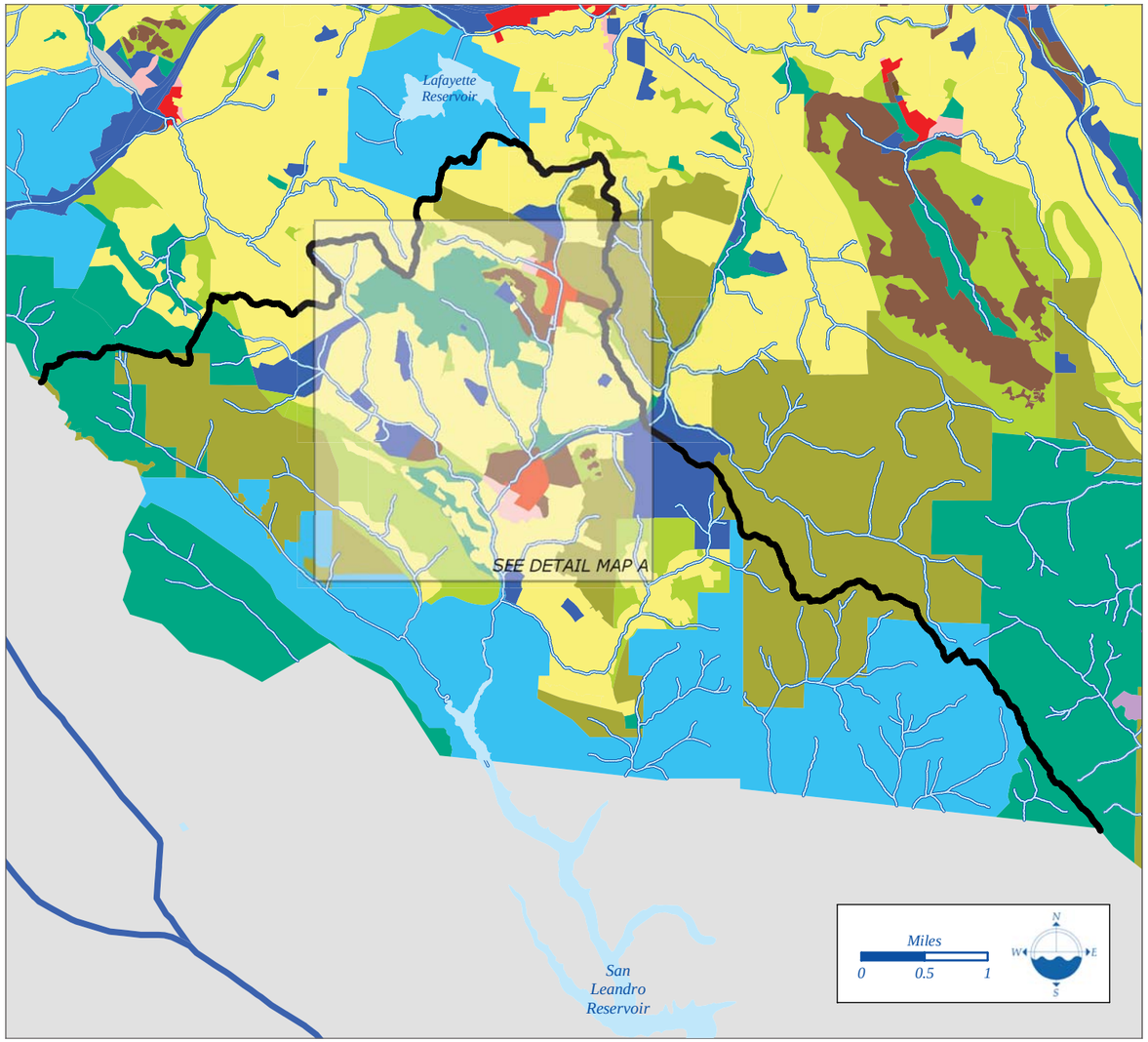
Upper San Leandro-Moraga Creek Watershed

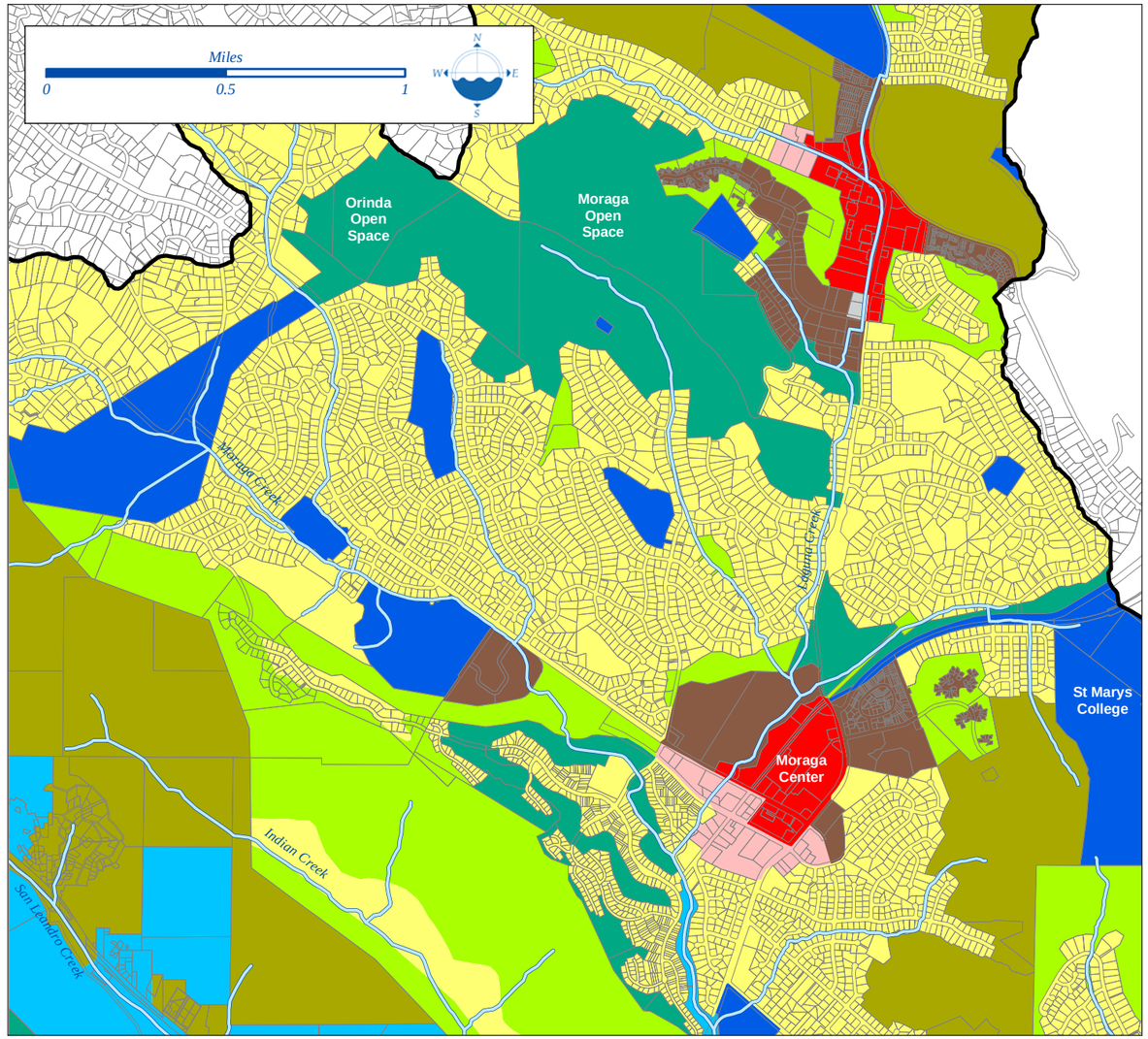


Demographic Profile for Selected Communities In or Near the Upper San Leandro and Moraga Creek Watersheds

Population	Lafayette	Moraga	Orinda
Total Population	23,463	16,642	17,446
Race and Ethnicity	**Lafayette**	**Moraga**	**Orinda**
White	85.1%	77.0%	84.1%
Hispanic or Latino	4.3%	4.6%	3.5%
Black or African American	0.5%	1.3%	0.3%
Asian	7.0%	12.9%	8.7%
Some Other Race	0.5%	0.8%	0.7%
Two or More Races	2.6%	3.5%	2.7%
Education (maximum level attained)	**Lafayette**	**Moraga**	**Orinda**
No High School Diploma	2.3%	2.9%	2.2%
High School Diploma or Equivalent	24.6%	24.6%	18.2%
Associate Degree	5.2%	4.9%	5.7%
Bachelor's Degree	38.2%	37.0%	39.6%
Master's or Professional School Degree	25.4%	26.3%	29.2%
Doctorate Degree	4.4%	4.3%	5.1%
Income	**Lafayette**	**Moraga**	**Orinda**
Median Household Income	$102,107	$98,080	$117,637

Planned Land Use





Detail Map A: Moraga Creek through downtown Moraga

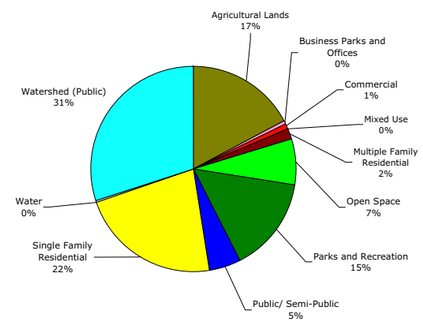
Planned Land Uses *San Leandro/Moraga Creek Watershed**	Acres
Agricultural Lands	2,262
Business Parks and Offices	50
Commercial	104
Industrial	0
Mixed Use	2
Multiple Family Residential	218
Open Space	948
Parks and Recreation	1,984
Public/ Semi-Public	637
Single Family Residential	2,892
Water	46
Watershed (Public)	3,917
Total	**13,059**

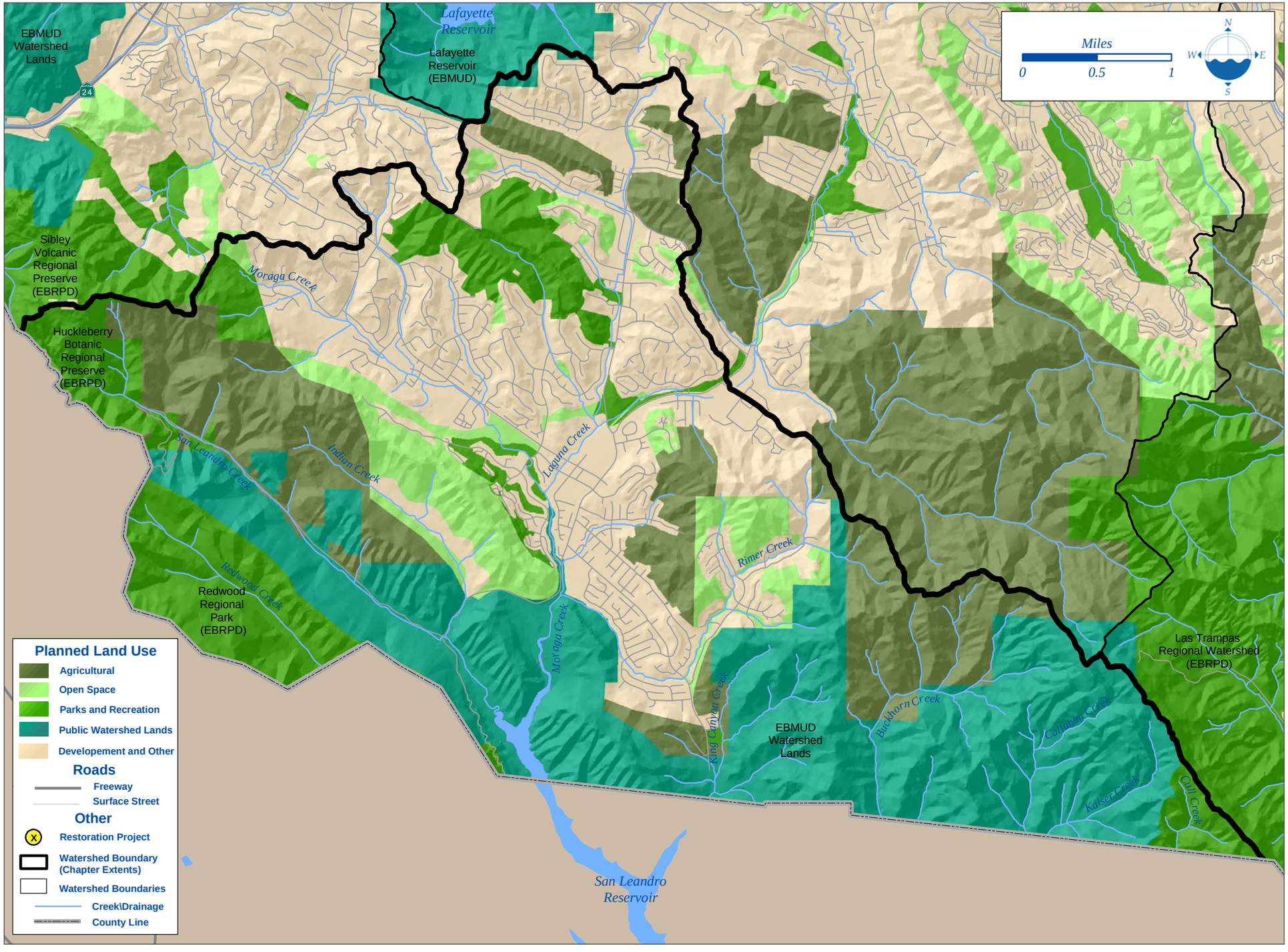
*Contra Costa County portion of watershed only.

Creek or Drainage
Parcels

Planned Land Use

- Single Family Residential
- Multiple Family Residential
- Commercial
- Office/ Business Park
- Industrial
- Landfill
- Mixed Use
- Public/ Semi-Public
- Parks and Recreation
- Open Space
- Agricultural Lands
- Water
- Public Watershed Lands





Organizations Active in the Watershed

Friends of San Leandro Creek
T. W. "Rick" Richards
Phone: (510) 577-6069
Website: www.fslc.org

East Bay Municipal Utility District
375 11th Street
Oakland, CA 94607
Phone: (510) 287-1380
Website: www.EBMUD.com

East Bay Regional Park District
2950 Peralta Oaks Court
P.O. Box 5381
Oakland, CA 94605
Phone: (510) 635-0135
Email: volunteers@ebparks.org
Website: www.ebparks.org

Canyon Elementary School District

Glossary and Acronyms

Many terms are explained in the Guide to the Data Layers (pages 7-11) and the County Overview (pages 13-28). Additional terms used throughout the Atlas are described here.

Alluvial: Relating to deposits made by flowing water. An alluvial fan is a geologic feature characterized be a fan shaped, flat/gently sloping area below a steep drainage and composed of rocks and other materials deposited by that drainage.

Anadromous: Describes fish that live in the ocean and return to fresh water to spawn.

Concrete Channel: See Page 11.

Constructed Earth Channel: See Page 11.

DEM (Digital Elevation Model): See Page 7.

Drop Structure: A drop structure is a constructed feature designed to dissipate the energy of a stream in a controlled manner to prevent undesirable erosion. Drop structures can take the form of a long slough with a drop or "waterfall" and constructed pool at the downstream end. It can also be just be a drop without other elements.

GIS: Geographic Information System is a general term used to describe a type of database. It may be colloquially explained as a computerized mapping system. GIS and related software are designed to store, manipulate and analyze geographic data. There are different types of software that can be used. The most common way to view GIS data is in map form.

GPS: Geographic Positioning System is a term used to describe the network of orbiting satellites that provide time and positional information. Historically, 24 satellites operated by the U.S. Department of Defense have been available to communicate with GPS units.

GPS Unit: The GPS unit is a device that receives signals from satellites and can use the signals to determine coordinates on Earth (latitude, longitude and altitude).

Hydrograph: A chart that plots the rate of water runoff against time. Additional information is provided on Page 24.

Hydrology: The science of the properties, distribution and impact of water.

Invasive plants: Plant species that crowd out other plant species. Invasive plants often spread rapidly and can dramatically change the ecosystem and habitat. Frequently, invasive plants are not native to the area and therefore thrive due to a lack of predators.

Natural Channel: See Page 11.

Orographic Rain: Refers to precipitation that occurs as a result of moist air traveling over increased elevation and cooler temperatures. As moist air rises on the windward side of a mountain, it cools. If the temperature drops to the dew point, condensation occurs, clouds form, and moisture is released.

Orthographic: Is used in the Atlas to qualify the aerial photographs (also called ortho-photos). It refers to the adjustment of photos to correct for the curvature of the earth. Both the color and the black and white photos used in this publication were orthographically corrected.

Parcel: Units of land that may be bought and sold.

Perennial: Used in the Atlas to refer to the type of water flow in a creek. A perennial creek normally flows year round. Most small creeks in Contra Costa County are seasonal, and have consistent flow only in the rainy season.

Projection: A mathematical model that transforms the locations of features on the earth's curved surface to locations on a two-dimensional surface. It can be visualized as a transparent globe with a light bulb at its center casting lines of latitude and longitude onto a sheet of paper. Every map projection distorts distance, area, shape, direction, or some combination thereof. All maps in this Atlas are projected using NAD 83 California State Plane III, Feet.

Rainshadow Effect: The phenomenon of more rain falling on the windward side of a hill or mountain and less falling on the leeward side. The leeward side is in the rainshadow.

Rancho: Ranch. A Large farm that includes grazing for livestock.

Raster: A GIS data structure that represents geographic features with a grid: rows and columns of square cells. Each cell contains an attribute value and location coordinates.

Riparian: Refers to the riverside environment. Riparian areas provide a link between the aquatic and terrestrial habitats and often have distinctly different vegetation than adjacent areas.

Riprap: See page 11.

Runoff: Water that is not absorbed into the ground and flows overland to a drainage.

Shapefile: A file format used to store geographic and attribute data in a Geographic Information System (GIS).

Sphere of Influence: See Page 15.

Substrate: Describes the material that composes the streambed (e.g. sand, gravel, cobble).

TIN (Triangulated Irregular Network): A technique for representing topography in a GIS. The land surface is represented with a series of contiguous, non-overlapping triangles. The vertices of each triangle are data points with x, y, and z values; elevation values at these points are interpolated to create a continuous surface.

Topography: The graphic representation of the surface features of a region on a map, indicating their relative positions and elevations.

Underground Channel: See Page 11.

Urban Limit Line (ULL): See Page 15

Vector: A data structure that uses points. lines and polygons to represent geographic features. Attributes are associated with each feature (as opposed to a raster data structure, which associates attributes with grid cells).

Watershed: The simplest definition of a watershed is an area of land that drains precipitated waters to a given reference point, typically a confluence with another major creek or large water body.

Acronyms

ACOE - U.S. Army Corps of Engineers
CA DFG - California Department of Fish and Game
CCC - Contra Costa County
CCRCD - Contra Costa Resource Conservation District
CCWD - Contra Costa Water District
CCWF - Contra Costa Watershed Forum
CEMAR - Center for Ecosystem Management and Research
EBMUD - East Bay Municipal Utility District
EBRPD - East Bay Regional Park District
FEMA - Federal Emergency Management Agency
HCP – East Contra Costa County Habitat Conservation Plan
MHLT – Muir Heritage Land Trust
SWRQCB – State Water Resources Quality Control Board
U.S. EPA - U.S. Environmental Protection Agency
UCC – Urban Creeks Council
USGS - U.S. Geological Survey

Watershed Size in Acres

93,556	Walnut Creek
60,066	Marsh Creek
56,223	East County Delta Drainages
32,915	San Ramon Creek (tributary to Walnut Creek)
27,640	San Pablo Creek
26,390	Alamo/Tassajara Creek (CCC portion only)
24,422	Brushy Creek (CCC portion only)
23,846	Mount Diablo Creek
20,863	Kellogg Creek (CCC portion only)
18,525	Pine / Galindo Creek (tributary to Walnut Creek)
17,238	Las Trampas Creek (tributary to Walnut Creek)
16,063	Willow Creek and Coastal Drainages
13,059	San Leandro / Moraga Creek (CCC portion only)
11,021	Grayson / Murderers Creek (tributary to Walnut Creek)
10,735	Alhambra Creek
10,132	Kirker Creek
9,705	Pinole Creek
8,357	South San Ramon Creek (CCC portion only)
8,182	West Antioch Creek
7,261	East Antioch Creek
6,848	Wildcat Creek
6,657	Rodeo Creek
6,575	Carquinez Area Drainages
5,530	Baxter Creek
4,976	West Richmond Drainages
4,395	Cayetano Creek (CCC portion only)
3,914	Peyton Slough
3,850	Garrity Creek
3,116	Refugio Creek
1,790	Rheem Creek
1,322	Cerrito Creek (CCC portion only)

Total Channel Length Within Watershed in Miles

309.75	Walnut Creek
167.18	Marsh Creek
136.73	San Ramon Creek (tributary to Walnut Creek)
108.60	San Pablo Creek
100.99	Alamo/Tassajara Creek (CCC portion only)
79.95	Mount Diablo Creek
67.64	Kellogg Creek (CCC portion only)
64.10	Las Trampas Creek (tributary to Walnut Creek)
59.96	Pine / Galindo Creek (tributary to Walnut Creek)
53.81	San Leandro / Moraga Creek (CCC portion only)
48.08	Alhambra Creek
46.64	Pinole Creek
45.94	Brushy Creek (CCC portion only)
44.78	Willow Creek and Coastal Drainages
43.65	Kirker Creek
31.64	Rodeo Creek
26.95	Carquinez Area Drainages
26.53	West Antioch Creek
26.24	South San Ramon Creek (CCC portion only)
25.41	Grayson / Murderers Creek (tributary to Walnut Creek)
22.22	Wildcat Creek
14.44	Baxter Creek
14.14	Cayetano Creek (CCC portion only)
9.17	Refugio Creek
8.70	East Antioch Creek
8.11	Peyton Slough
5.82	Cerrito Creek (CCC portion only)
4.10	Garrity Creek
3.36	Rheem Creek
1,350	Countywide

Miles of Underground Channel (not including storm drains)

36.05	Walnut Creek
20.14	San Ramon Creek (tributary to Walnut Creek)
9.93	Willow Creek and Coastal Drainages
8.15	Baxter Creek
7.80	San Pablo Creek
7.49	Las Trampas Creek (tributary to Walnut Creek)
7.30	Kirker Creek
6.70	Mount Diablo Creek
5.35	West Antioch Creek
4.61	South San Ramon Creek (CCC portion only)
4.56	Carquinez Area Drainages
4.32	Alhambra Creek
3.26	San Leandro / Moraga Creek (CCC portion only)
3.16	Grayson / Murderers Creek (tributary to Walnut Creek)
3.12	Cerrito Creek (CCC portion only)
2.67	Pine / Galindo Creek (tributary to Walnut Creek)
1.93	Pinole Creek
1.39	Peyton Slough
1.36	Marsh Creek
1.33	Refugio Creek
1.24	Garrity Creek
1.14	East Antioch Creek
1.07	Rheem Creek
0.88	Rodeo Creek
0.52	Alamo/Tassajara Creek (CCC portion only)
0.28	Wildcat Creek
0.14	Kellogg Creek (CCC portion only)
0.12	Brushy Creek (CCC portion only)
0.00	Cayetano Creek (CCC portion only)
112.56	Countywide

Length of Longest Branch of Creek in Miles

34.57	Marsh Creek
28.74	Walnut Creek
25.34	Kellogg Creek (CCC portion only)
19.65	San Pablo Creek
18.89	San Ramon Creek (tributary to Walnut Creek)
17.24	Mount Diablo Creek
13.43	Wildcat Creek
12.65	Pine / Galindo Creek (tributary to Walnut Creek)
12.46	Brushy Creek (CCC portion only)
12.37	Las Trampas Creek (tributary to Walnut Creek)
10.95	Pinole Creek
10.27	Alamo/Tassajara Creek (CCC portion only)
9.43	Kirker Creek
8.87	Grayson / Murderers Creek (tributary to Walnut Creek)
8.35	Rodeo Creek
7.99	Alhambra Creek
7.87	East Antioch Creek
6.24	West Antioch Creek
6.16	Willow Creek and Coastal Drainages
4.76	San Leandro / Moraga Creek (CCC portion only)
4.67	South San Ramon Creek (CCC portion only)
4.52	Refugio Creek
3.67	Garrity Creek
3.64	Peyton Slough
3.44	Cayetano Creek (CCC portion only)
3.36	Rheem Creek
2.87	Baxter Creek
2.86	Carquinez Area Drainages
2.44	Cerrito Creek (CCC portion only)

Average Annual Rainfall in Inches

28	San Leandro / Moraga Creek (CCC portion only)
27	San Pablo Creek
26	Las Trampas Creek (tributary to Walnut Creek)
24	Wildcat Creek
23	Pinole Creek
22	Cerrito Creek (CCC portion only)
22	Alhambra Creek
22	Baxter Creek
22	Rheem Creek
21	San Ramon Creek (tributary to Walnut Creek)
21	South San Ramon Creek (CCC portion only)
21	Rodeo Creek
21	Walnut Creek
20	West Richmond Drainages
20	Garrity Creek
20	Grayson / Murderers Creek (tributary to Walnut Creek)
20	Carquinez Area Drainages
19	Refugio Creek
19	Alamo/Tassajara Creek (CCC portion only)
18	Pine / Galindo Creek (tributary to Walnut Creek)
18	Mount Diablo Creek
17	Cayetano Creek (CCC portion only)
17	Peyton Slough
17	Marsh Creek
16	Kirker Creek
16	Kellogg Creek (CCC portion only)
15	West Antioch Creek
14	Willow Creek and Coastal Drainages
13	East Antioch Creek
13	Brushy Creek (CCC portion only)
11	East County Delta Drainages
18	Countywide average

Estimated Mean Daily Flow at Mouth in cfs

81.4	Walnut Creek
32.1	San Pablo Creek
28.3	Marsh Creek
27.1	San Ramon Creek (tributary to Walnut Creek)
23.4	East County Delta Drainages
16.5	Mount Diablo Creek
15.4	Las Trampas Creek (tributary to Walnut Creek)
14.8	Pine / Galindo Creek (tributary to Walnut Creek)
11.2	Willow Creek and Coastal Drainages
10.6	Grayson / Murderers Creek (tributary to Walnut Creek)
10.4	Pinole Creek
8.2	Baxter Creek
7.9	Carquinez Area Drainages
7.7	Wildcat Creek
7.2	Alhambra Creek
7.0	Rodeo Creek
6.8	West Richmond Drainages
6.5	Kirker Creek
6.5	East Antioch Creek
5.4	Garrity Creek
5.2	West Antioch Creek
4.2	Refugio Creek
3.7	Peyton Slough

Estimated 100-Year Flood Flow in cfs

25,600	Walnut Creek (downstream of confluence w/ Grayson)
13,100	San Ramon Creek (near Rudgear Road)
10,000	Pine / Galindo Creek (at confluence with Walnut Creek)
5,740	Marsh Creek (above Marsh Creek Reservoir)
5,110	Alhambra Creek (at Escobar)
4,170	Pinole Creek (at mouth)
2,280	Wildcat Creek (at 23rd Street)
1,060	Rheem Creek (at BNSF railroad tracks)

Estimated Population by Watershed

339,100	Walnut Creek
78,900	Pine / Galindo Creek (tributary to Walnut Creek)
72,400	San Ramon Creek (tributary to Walnut Creek)
58,900	Grayson / Murderers Creek (tributary to Walnut Creek)
58,800	Willow Creek and Coastal Drainages
58,400	Baxter Creek
47,100	San Pablo Creek
46,000	East Antioch Creek
42,300	Las Trampas Creek (tributary to Walnut Creek)
38,500	Marsh Creek
35,500	West Antioch Creek
35,100	South San Ramon Creek (CCC portion only)
33,100	East County Delta Drainages
29,900	West Richmond Drainages
24,400	Mount Diablo Creek
24,000	Wildcat Creek
23,900	Garrity Creek
22,900	Kirker Creek
18,300	San Leandro / Moraga Creek (CCC portion only)
15,700	Pinole Creek
15,400	Refugio Creek
14,800	Alamo/Tassajara Creek (CCC portion only)
14,200	Alhambra Creek
13,900	Rheem Creek
13,300	Cerrito Creek (CCC portion only)
9,500	Peyton Slough
8,900	Rodeo Creek
5,100	Carquinez Area Drainages
1,400	Kellogg Creek (CCC portion only)
900	Brushy Creek (CCC portion only)
100	Cayetano Creek (CCC portion only)
948,816	Population of Contra Costa County

Estimated Percent Impervious

65%	Baxter Creek
65%	Cerrito Creek (CCC portion only)
60%	East Antioch Creek
60%	Garrity Creek
60%	West Richmond Drainages
<55%	Peyton Slough
50%	Refugio Creek
50%	Rheem Creek
45%	Grayson / Murderers Creek (tributary to Walnut Creek)
35%	South San Ramon Creek (CCC portion only)
35%	West Antioch Creek
30%	Kirker Creek
30%	Pine / Galindo Creek (tributary to Walnut Creek)
30%	Walnut Creek
25%	Carquinez Area Drainages
25%	Las Trampas Creek (tributary to Walnut Creek)
25%	Willow Creek and Coastal Drainages
20%	Mount Diablo Creek
20%	Rodeo Creek
20%	San Pablo Creek
20%	San Ramon Creek (tributary to Walnut Creek)
20%	Wildcat Creek
15%	Alhambra Creek
15%	Marsh Creek
15%	Pinole Creek
15%	San Leandro / Moraga Creek (CCC portion only)
10%	Alamo/Tassajara Creek (CCC portion only)
10%	East County Delta Drainages
5%	Brushy Creek (CCC portion only)
<5%	Cayetano Creek (CCC portion only)
<5%	Kellogg Creek (CCC portion only)
35%	Countywide average

Percent of Watershed on Urban Side of Urban Limit Line

100.0%	East Antioch Creek
100.0%	Baxter Creek
100.0%	Cerrito Creek (CCC portion only)
99.6%	West Richmond Drainages
98.3%	Refugio Creek
93.8%	Grayson / Murderers Creek (tributary to Walnut Creek)
90.6%	Garrity Creek
85.4%	Rheem Creek
79.4%	Peyton Slough
77.6%	South San Ramon Creek (CCC portion only)
75.5%	Las Trampas Creek (tributary to Walnut Creek)
71.1%	Walnut Creek
68.0%	San Ramon Creek (tributary to Walnut Creek)
59.8%	Willow Creek and Coastal Drainages
55.4%	West Antioch Creek
47.9%	Pine / Galindo Creek (tributary to Walnut Creek)
46.5%	San Leandro / Moraga Creek (CCC portion only)
44.5%	Kirker Creek
41.1%	San Pablo Creek
39.1%	Carquinez Area Drainages
37.3%	Rodeo Creek
33.2%	Wildcat Creek
30.9%	Mount Diablo Creek
29.5%	Alamo/Tassajara Creek (CCC portion only)
28.9%	Pinole Creek
28.3%	East County Delta Drainages
28.1%	Alhambra Creek
27.4%	Marsh Creek
8.0%	Brushy Creek (CCC portion only)
1.0%	Kellogg Creek (CCC portion only)
0.0%	Cayetano Creek (CCC portion only)
43.4%	Countywide ave. (not including tidal areas & Delta islands)

Percent of Watershed Planned for Parks and Open Space (including Public Watershed)

71.6%	Kellogg Creek (CCC portion only)
67.0%	Wildcat Creek
56.9%	San Pablo Creek
52.4%	San Leandro / Moraga Creek (CCC portion only)
49.3%	Pinole Creek
47.6%	West Antioch Creek
40.8%	Pine / Galindo Creek (tributary to Walnut Creek)
37.8%	San Ramon Creek (tributary to Walnut Creek)
36.4%	Carquinez Area Drainages
36.2%	Mount Diablo Creek
33.3%	Marsh Creek
33.0%	Alhambra Creek
31.5%	Alamo/Tassajara Creek (CCC portion only)
30.6%	South San Ramon Creek (CCC portion only)
29.3%	Walnut Creek
28.7%	Refugio Creek
27.5%	Willow Creek and Coastal Drainages
24.4%	Peyton Slough
22.2%	Rheem Creek
22.0%	Las Trampas Creek (tributary to Walnut Creek)
19.3%	Grayson / Murderers Creek (tributary to Walnut Creek)
19.2%	Garrity Creek
19.0%	West Richmond Drainages
18.5%	Rodeo Creek
16.8%	Kirker Creek
13.1%	East Antioch Creek
9.8%	Baxter Creek
8.9%	Cerrito Creek (CCC portion only)
8.1%	Brushy Creek (CCC portion only)
6.3%	East County Delta Drainages
4.6%	Cayetano Creek (CCC portion only)
30.6%	Countywide average

303(d) List of Impaired Water Bodies with Associated Pollutants of Concern (POC) (2002 SWRCB).

Waterbody Name	Pollutant/Stressor
San Pablo Reservoir	Mercury
Mt. Diablo Creek	Diazinon
Pinole Creek	Diazinon
Pine Creek	Diazinon
Rodeo Creek	Diazinon
San Pablo Creek	Diazinon
Wildcat Creek	Diazinon
Walnut Creek	Diazinon
Marsh Creek Reservoir	Mercury
Dunn Creek	Mercury & Metals
Marsh Creek- Dunn Creek to Reservoir	Metals
Marsh Creek- Reservoir to San Joaquin River	Mercury & Metals

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